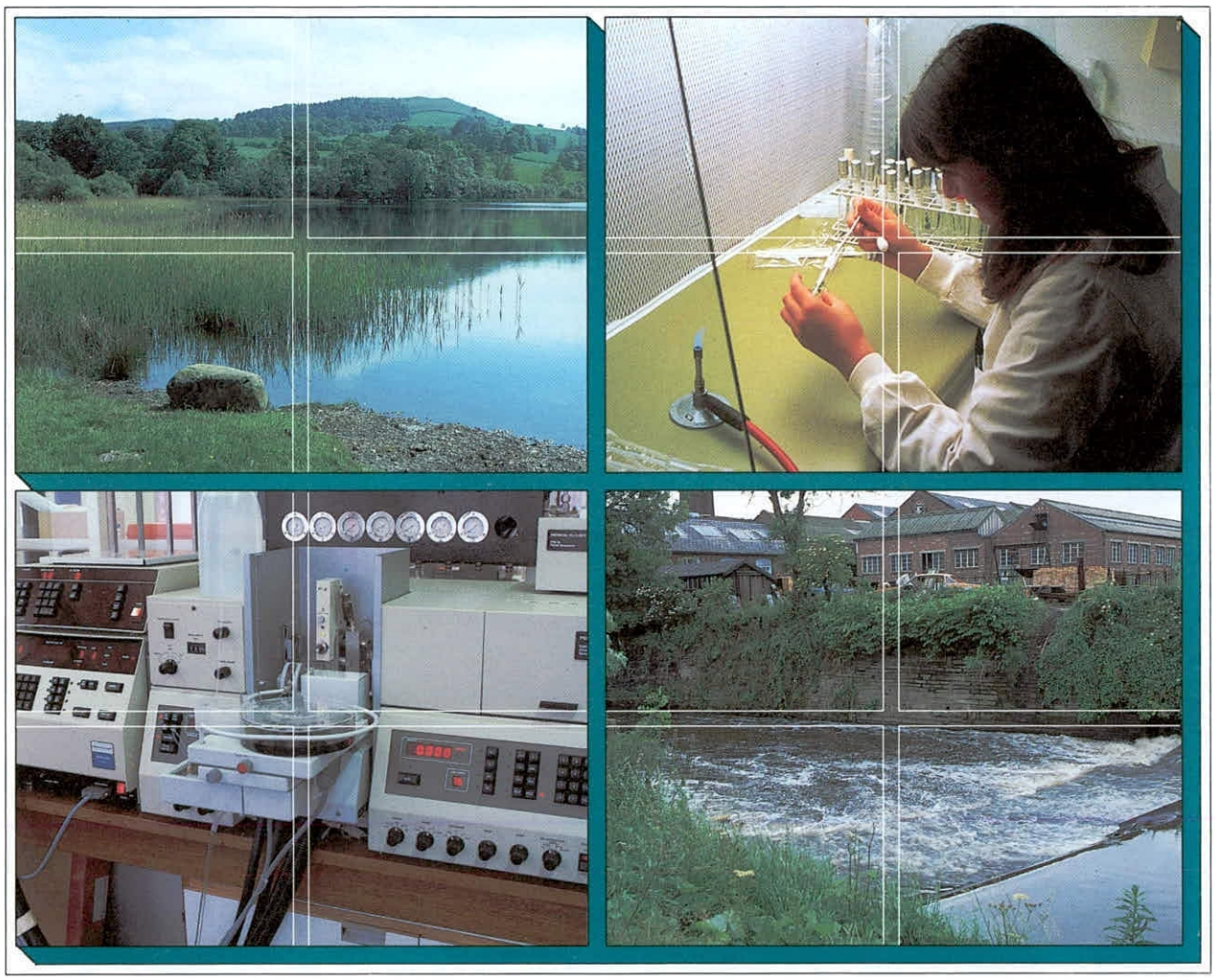
Institute of Freshwater Ecology

1994 SURVEY OF THE COARSE FISH OF THE RIVER TEES BEFORE CONSTRUCTION OF THE BARRAGE

Interim Report

J S Welton; B E Dear; W R C Beaumont; A C Pinder; M Ladle; D T Crisp; S C Clough; I J Winfield

Report To: National Rivers Authority, Northumbria & Yorkshire Region
TFS Project No: T11064f1
IFE Report Ref.No: RL/T11064f1/2



Natural Environment Research Council

Institute of Freshwater Ecology

River Laboratory
East Stoke
Wareham
Dorset BH20 6BB

1994 SURVEY OF THE COARSE FISH OF THE RIVER TEES BEFORE CONSTRUCTION OF THE BARRAGE

Interim Report

J S Welton, BSc, PhD, CBiol, MIBiol
B E Dear
W R C Beaumont, LMIFM
A C Pinder
M Ladle, BSc, PhD
D T Crisp, BSc, PhD, DSc, CBiol, FIBiol
S C Clough, BSc
I J Winfield, BSc, PhD

Sub Project Leader:	J S Welton
Report Date:	February 1995
Report To:	National Rivers Authority, Northumbria & Yorkshire Region
TFS Project:	T11064f1
IFE Report Ref.No:	RL/T11064f1/2

INTELLECTUAL PROPERTY RIGHTS

CONFIDENTIALITY STATEMENT

'In accordance with our normal practice, this report is for the use only of the person to whom it is addressed, and no responsibility is accepted to any third party for the whole or any part of its contents. Neither the whole nor any part of this report or any reference thereto may be included in any published document, circular or statement, nor published or referred to in any way without our written approval of the form and context in which it may appear.'

CONTENTS

REVIEW OF PROGRESS

This is a progress report for the period April 1994-February 1995. The main objectives of this year's work were

1. To conduct a survey of the fry of coarse fish to identify spawning sites and species composition and to compare this with the previous year's results.

   This was successfully carried out in June and was the fourth annual survey. Over 5000 fry were sampled by micromesh seine and point sampling electrofishing gear.

2. To conduct a survey of the coarse fish of the R. Tees in the area that is expected to be affected by the barrage. Collect data to add to previous years on the species composition, size distribution and age structure of each species prior to the construction of the barrage.

   This was successfully carried out in September. Water levels were higher than in 1993 but in general conditions were good for electrofishing. Over 5000 fish were caught mainly by boom boat electrofishing. The length of each fish was recorded, a representative sample of each species was weighed and scales were taken for age determination.

   597 fish have been aged from scale samples.

3. To collect information from angling matches.

   The system put into effect last year has worked well and the database from angling matches has been updated. The distribution of fish as determined from angling data has been analysed.

4. To continue data collection from temperature loggers.

   All four temperature loggers have operated for the full year although equipment failure caused the loss of some data from Ingleby Barwick and Stockton.

1. FRY SURVEY 1994

1.1 Introduction

The survey was designed to collect information on the fry of all species of angling importance and in particular to concentrate again on determining the main spawning areas of dace. For this reason the survey was brought forward to early June when dace fry may still be in the vicinity of where they were spawned. This was the last opportunity to assess dace spawning sites before the closure of the barrage and as this is central to the anglers claim that the main dace spawning site will be flooded out by the increase in water level, it was felt that, although the survey may not be comparable with previous years, its timing was justified. As the survey was conducted earlier than usual, the species composition in each site cannot be compared with previous year's results.

1.2 Methods

The survey was conducted in early June and covered most of the length of the river to be affected by the barrage and areas above this for comparison. Sections known to contain adult fish (from previous surveys) between Preston Park (Section 4) and Low Dinsdale (Section 25) were sampled. In addition to this, at the NRA project leader's request, effort was concentrated on the lower sections of the river where few adult fish have been found in the past.

A description of each sampling site and its position relative to the sections is given in Appendix 1.

1.2.1 Electrofishing

Electrofishing apparatus designed for fry sampling was used. This is battery powered with the anode ring mounted on a telescopic pole so that it can be extended in front of the boat to sample fry before they are disturbed. The shape and size of the anode allow point sampling, producing a high intensity field that stuns fry in a small area. At each sampling site, up to 10 point samples were taken over an area of 25 m^2. The number of point samples depended on the number of fry caught. Point samples were either targeted at concentrations of fry or taken at random.

1.2.2 Netting

In addition to the electrofishing, a micromesh seine was used in areas where large congregations of fry were expected and where no snags were present. Seines were set and hauled in shallow marginal areas of the river, especially from beach gravel shoals. Fry were also often observed to be in shallow water (<5 cm) and hand netting was often found to be a more effective sampling technique.

1.3 Results

Over 5000 fry were sampled and identified (Table 1). In most cases, all individuals from a sample were measured but where large numbers were caught, a proportion was measured (never less than 50 individuals). Over 4000 of the fry caught were dace. Several hundred chub and roach were also caught. The fry of these species were very small and were considered to be still hatching. The large number of dace caught signifies that the fry were sampled whilst they were still inhabiting the margins of the river. By July, the usual sampling time for fry, dace are large enough to have moved into deeper water making sampling more difficult. This is also true for grayling, another species which hatches early. The number of grayling fry was large compared with previous years. No barbel fry were found possibly because of the early sampling date. The only unusual fry was one specimen of perch found in Section 11. Over 50 stone loach fry were caught which is similar to the number found in 1993 (Table 2). A number of older fish were caught during the survey and details of these are given in Appendix 2.

Table 1. Number of fry of each species of angling interest sampled in the R.Tees in June 1994.

Species	Total
Barbel *Barbus barbus* (L.)	0
Chub *Leuciscus cephalus* (L.)	448
Dace *Leuciscus leuciscus* (L.)	4216
Grayling *Thymallus thymallus* (L.)	83
Gudgeon *Gobio gobio* (L.)	2
Roach *Rutilus rutilus* (L.)	306
Perch *Perca fluviatilis* L.	1

Table 2. Number of fry of minor species sampled in the R.Tees in July 1994.

Species	Total
Bullhead *Cottus gobio* L.	3
Flounder *Platichthys flesus* (L.)	5
Minnow *Phoxinus phoxinus* (L.)	0
Stone loach *Barbatula barbatula* (L.)	55
Three spined stickleback *Gasterosteus aculeatus* L.	2

Table 3. Number of fry of each species found in each section in the R.Tees in June 1994.

Section	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	25	ORSU1
Barbel																							
Chub	3	2			162	9	18		2	4			22		23						188		15
Dace	1	66	2	56	108	89	170	186	83	311	13	36	138	254	27	173	832	549	184	356	140	299	143
Gudgeon																							2
Roach	1	1		1	8	13	16	1	24	96	43	10	14					19	9	49	1		
Grayling																			76			7	
Salmon																							
Rudd																							
Stickleback																							2
Flounder	1	2		1				1															
Minnow																							
Stone loach																		4	25	2	1	14	2
Bullhead																							

1.3.1 Distribution of fry

The number of fry of each species in each section is given in Table 3 and length frequency histograms for each section for dace, chub and roach are given in Appendix 3-5.

As in the previous year, fry were found in the lower sections (1-3) with individuals of dace, roach and chub being found in Section 1 along with one flounder fry. Many dead dace fry were found in the new ORSU in this section. Presumably they had entered the ORSU on an ebbing tide and had been killed by incoming salt water as the tide turned. Fry are probably passively carried by the current and drift both upstream and downstream depending on the state of the tide. Dace were present in large numbers in Section 2, more than in previous years, although numbers caught depend on effort and this is not standard either between sections or between years.

The number of fry found in ORSU 1 was low (Table 3). Five species were found although due to the early timing of the sampling, many fry may not have found their way into this area. As expected for the time of year, dace fry comprised >90% of the fry present.

A comparison of the distribution of dace in relation to spawning sites will be given in the Annual report in March.

1.3.2 Length frequency distribution

Length frequency histograms are shown for each species (Fig 1). The early time of sampling is reflected in the small sizes of fry of all species. Grayling fry were the largest being on average 2 cm longer than dace. It is likely that in a year when sampling is conducted in July, grayling fry will have moved away from the margins.

The size distribution of dace fry in each section is similar. The modal length is 13 or 14 mm showing no differences along the length of the river. In ORSU 1 however, the modal length is 16 mm indicating that there may be a higher growth rate in this refuge (Appendix 3).

Unlike the previous year, no shift in size distribution of chub fry can be seen along the length of the river (Appendix 4). The size distribution in ORSU 1 is similar to those in other sections. It is likely that the chub fry have only just hatched and there has been no time for differential growth.

Roach were also still hatching with fry as small as 4 mm being found (Appendix 5).

2. SURVEY OF COARSE FISH SEPTEMBER 1994

2.1 Introduction

This is the fourth year that a survey of the coarse fish has been undertaken at this time of the year. It is aimed at increasing the data base of fish populations before the completion of the barrage. It will also be possible to compare the distributions of fish along the length of the river in each year. Last year, there was a trial batch marking of dace from the areas upstream of the tidal influence. This was to determine whether dace from these areas migrated to the lower tidal stretches where the main angling effort is concentrated. This year, few dace were caught from these upstream sites and as it was thought that a significant increase in marked fish could not be attained, no fish were marked. There have been no further sightings of previously marked fish.

It is known that electrofishing in deep water is at best inefficient and fishings have thus been concentrated along each bank. With the increase in water level expected after closure of the barrage it has become more necessary to find a method of sampling deep water. To this end echo-sounding was tested. However, this is only for vertical rather than horizontal deployment and is at its limit of deployment in a relatively shallow watercourse such as the River Tees. While no comparable data exists for this or any other river, this initial survey should produce results which could be compared with future, post-barrage data collected in 1995 and beyond.

2.2 Methods

2.2.1 Electrofishing

All sites sampled were electrofished in 1994. Sites 19 and 25 were waded (twin anode 200 V, 1.9 kVA), the ORSU was electrofished from a dinghy with the same gear and all other sites were electrofished with the boom boat. Due to the water depth, Section 21 was fished in part by twin anode wading and in part with the boom boat.

The boom boat used 200 V at 10 A from a 7.5 kVA generator. Pulse rate was 100 Htz. Due to generator problems, many sites were fished with a 5 kVA generator at the same voltage and amperage. In certain circumstances especially in shallower reaches, the fishing was operated at 5-8 amps. Each section was fished once along each bank, moving with the flow of the river. Fish from both runs were retained in an oxygenated holding tank and processed as one catch. Fish were released at a distance sufficient to prevent their migration into the next study section before fishing commenced.

2.2.2 Processing

Length measurements were taken from each fish (fork length to the nearest mm) and weight measurements (to the nearest gram). Scales for ageing were taken from a representative sample of fish.

2.2.3 Echo-sounding

Echo sounding was carried out using a Simrad EY 200P portable echo sounder with a 200 kHz single beam transducer of beam angle 7 ° (Simrad Subsea A/S, Horten, Norway). Throughout the surveys, gain and attenuation settings were maintained at 3 and -15 dB respectively, pulse duration was set at 1.0 ms, and a 40 log R time-varied-gain employed. In addition to the real-time production of an echogram through a colour printer, data were also recorded to digital audio tape using a SONY Digital Audio Tape-corder TCD-D7. The system was deployed from the boom boat moving at a speed of approximately 2 m s^{-1}. The transducer was deployed in the vertical plane and positioned approximately 0.5 m below the surface of the water.

The above system was deployed on a series of transects along the River Tees during the daylight high tide on 6 September 1994. The transects generally followed the middle of the river channel, deviating only to avoid areas of extremely shallow water or to examine known deep areas, and covered all of the sections defined elsewhere in this report. In addition, the transects were extended downstream to the limit of navigation near the barrage.

2.2.4 Echo-sounding data analysis

Data on the audio tapes were processed using version 4.02 of the hardware and software Hydro Acoustic Data Acquisition System (HADAS) (Lindem Data Acquisition Systems, University of Oslo, Norway). Using this system, analogue signals from the audio tape were digitised and transferred to an IBM-compatible personal computer where they were further processed to examine patterns of spatial distribution, abundance and target strength, the latter by the indirect statistical algorithm of Craig & Forbes (1969). Prior to such data processing, the system was calibrated using a sphere of target strength -39.2 dB.

Following exploratory data analysis, default software settings were used for all parameters with the exceptions of the following. The bottom level was set at 4000 mV, the bottom duration to 8 samples, the bottom backstep to 0 m to allow the recognition of fish echoes close to the bottom, and the single fish recognition to 14 samples. While in parts of some transects the bottom had to be redefined manually, close inspection of the HADAS echograms showed no evidence of any complications arising from false fish echoes near the bottom or sides of the river channel.

Much of the river was too shallow to facilitate quantitative vertical echo sounding and so analysis was restricted to those parts of the transects covering relatively deep areas. The latter were defined as locations where the water depth increased from 2 m or less to 5 m or greater. During the analysis, the water column of each transect was divided into strata of depth 2 m from 2 m below the transducer to the river bottom.

Estimates of target strengths produced by HADAS were converted to fish lengths using a rearrangement of the relationship recommended for physoclists by Foote (1987) of

$$TS = (20 \log L) - 67.4$$

where TS is target strength in dB and L is fish length in cm. Targets were then pooled into three length classes of small (4 to 10 cm), medium (10 to 25 cm) and large (greater than 25 cm) fish.

2.3 Results

The total number of fish caught in the September survey was 5343. This is two thousand more than in 1993, and 2500 more than in 1992 (Table 4). The vast majority were young of the year dace. The number of fish >8 cm caught this year was 1180. This figure is about 1000 less than the previous year but still more than was caught in 1992. Numbers of gudgeon were substantially lower and roach numbers were only two thirds of the previous year's total. Flounder numbers increased for the second successive year. Two fish species were recorded for the first time in the study. One perch, 35 cm in length, was found in Section 10 and three pike, all around 23 cm were found in Section 21.

Four adult salmon were caught and two others seen. They came from Sections 5, 11, 13 and 25 and ranged in length from 68-98 cm. Two had sea lice and one fish had net marks. Three were identified as males and the fourth was probably a female. A pre-smolt was found in Section 3, and parr in Sections 10, 12, 13 and 25.

Last year, one sea trout was recorded in Section 14 and there was anecdotal evidence from an angler suggesting sea trout were caught around Section 4 only in early summer. This year three sea trout, 35-49 cm were recorded in Section 3.

Table 4. Species list for the R. Tees and number of each species caught - September 1994.

Species	Totals
Barbel *Barbus barbus* (L.)	14
Bullhead *Cottus gobio* L.	2
Chub *Leuciscus cephalus* (L.)	566
Dace *Leuciscus leuciscus* (L.)	2362
Eel *Anguilla anguilla* (L.)	>>100
Flounder *Platichthys flesus* (L.)	410
Grayling *Thymallus thymallus* (L.)	6
Gudgeon *Gobio gobio* (L.)	92
Minnow *Phoxinus phoxinus* (L.)	391
Perch *Perca fluviatilis* L.	1
Pike *Esox lucius* L.	3
River Lamprey *Lampetra fluviatilis* (L.)	0
Roach *Rutilus rutilus* (L.)	447
Salmon *Salmo salar* L.	10
Stone loach *Barbatula barbatula* (L.)	10
Three spined stickleback *Gasterosteus aculeatus* L.	8
Trout (brown) *Salmo trutta* L.	18
Trout (sea) *Salmo trutta* L.	3

2.3.1 Distribution of fish

Site descriptions, fishing methods, date, state of the tide, species and number of fish caught in each section are given in Appendix 6.

Species compositions at each site are summarised in Fig 2. Pie charts for each section are shown in Appendix 7.

Quasi-quantitative information on number of fish per 100 m of river for each section is given in Table 5. Comparisons between sections and between years may be made only after giving due regard to the different efficiencies with which each section is fished. Factors such as the state of the tide, depth and turbidity all have a marked effect on fishing efficiency.

Table 5. Number of fish per 100 m found in each section in September 1994.

Section	Dace	Roach	Chub
3	27.25	7.13	1.75
4	17.28	5.92	0.88
5	0.38	0.16	0.11
6	11.77	0.16	1.37
7	26.05	0.88	1.23
8	160.00	17.50	3.75
10	36.96	3.57	10.36
11	9.76	2.74	4.52
12	71.14	9.32	2.27
13	35.83	3.33	6.50
14	26.92	2.12	7.88
15	34.66	5.69	12.07
16	34.00	2.00	11.75
19	59.50	0.00	11.00
21	35.38	3.85	13.08
25	16.29	4.29	5.71

As in previous years, dace were found in all sections. In general, densities are much higher than in 1993 due mainly to the high numbers of 0+ fish present. Extremely high densities were apparent in Section 8 (between the bridges at Yarm) and in all reaches from Section 12 upstream (Table 5). Unlike 1993, the most downstream section electrofished (Section 3) had a high density of dace, again mainly due to young of the year. Section 5 had few dace compared with other sections and compared with the same section in the previous year.

The distribution of roach was very variable. The largest density was found in Section 8 (the same as for dace) but in the previous year this section had a very low density of roach. No roach were found in Section 19, although the whole section was not fished due to excessive water depth. Densities were also very low in Sections 5-7 and most roach in the lower reaches were found in Sections 3 and 4 (Table 5).

As usual, chub densities were low in the bottom sections and apart from a high density in Section 10, they were concentrated in the upper sections (13 and above). As in the case of roach, the density of chub in Section 11 may have been affected by the inability to fish the whole reach.

2.3.2 Length frequency distribution

The length frequency distribution of each of the major species is given in Fig 3 and for dace, chub, roach and gudgeon this is also given by section fished (Appendices 8-11).

The length frequency distribution showed that young of the year dace were mostly <8 cm and these fish have been excluded from the graph as they occurred in such large numbers that the length frequency of older fish could not be readily discerned. The high numbers of young of the year suggest that the 1994 year class will be strong. The 1993 year class was poor and is represented by low numbers of fish with a modal length of 9 cm in this year's catch. Last year's modal length class at 9 cm is now seen at 14 cm and similarly last year's 19 cm class can be seen this year at 21 cm (Appendix 8).

In 1993, young of the year were present in low numbers with a maximum of 50 in Section 5 and only three other sections having >10 specimens in the modal length class. Many sections were devoid of these fish. This year young of the year were found in high numbers in almost every section fished.

Chub young of the year were found in very low numbers in the lower sections (below Yarm). They were found in greater numbers in Sections 10, 11, 14 and 15 with ORSU 1 having the greatest number (although it must be remembered that this was fished by a different method and the volume of water was minimal compared with the main river. Numbers of young of the year were greater than those of 1993. The strong 7-8 cm class of 1993 can be seen as modal class 12 cm this year and the larger 27 cm class in 1994 probably corresponds to the strong 23 cm modal class of 1993. Few large chub were found in the lower sections being most abundant in Sections 14 and above (Appendix 9).

Around twice as many young of the year roach were caught this year compared to last year. They were particularly abundant in Sections 3, 4 and 12 and in ORSU 1. Numbers of older fish were significantly lower than last year and were totally absent in sections 7, 19 and 21. Last year Section 7 was one of the best sections for roach especially for fish of 11-16 cm in length (Appendix 10).

Three distinct length groups can be seen in the length frequency histogram for gudgeon. As in the previous year, most young of the year were found in ORSU 1 although this probably suggests that the boom boat is not an efficient method for this age class or that their habitat in the main river is not fished. Numbers were lower than last year but in general follow the same distributional pattern between sections (Appendix 11).

2.3.3 Length weight relationship

Regression analysis of length on weight was carried out for each species occurring in large numbers. The regression equation is

$\log W = a + b \log L$

where W = weight (g), a = intercept constant, b = slope and L = length (cm). The values of a and b and r^2 (an indication of the goodness of fit) for each species are given in Table 6.

Table 6. Values of the length weight regressions for major species in the R. Tees, 1994.

Species	a	b	r^2(%)
Chub	-2.05	3.13	99.7
Dace	-2.51	3.52	96.0
Flounder	-1.95	3.03	97.6
Gudgeon	-2.27	3.31	83.9
Roach	-2.26	3.39	97.9

Values are similar to previous years. Data for all years pre-barrage will be collated next year.

2.3.4 Year class strengths

The length frequency histograms for each age group of dace, chub, roach and gudgeon are shown in Figs 4-7. Although the same proportion of each age group was not necessarily aged, high numbers of a particular age group can be interpreted as an indication of a strong year class. As the lengths of all fish were recorded it may be better to determine the relative year class strengths from lengths of fish after due consideration of the length age relationship. This will be investigated next year when all pre-barrage data is collated and discussed.

Very large numbers of young of the year dace were caught in the September fishings which indicates a good year class (Fig 4). Low numbers of 1+ correspond with the low numbers of 0+ found in the previous year. The 2+ and 5+ year classes were strong corresponding to those of 1+ and 4+ in the previous year.

Chub were caught up to 15 years of age as was the case in the two previous years. Fish of the strong year class seen as 2+ in 1991 and as 3+ and 4+ in 1992 and 1993 respectively are now seen as 5+ (Fig 5). There appears to be a poor 1+ year class. This corresponds to the low number of young of the year caught in 1993 when water temperatures in the summer were low. This year numbers of young of the year were high and it is expected that a good year class will be apparent in future years unless affected by the closure of the barrage.

As with dace and chub, numbers of young of the year roach were high (Fig 6). No scale samples were taken from the 1+ age class. This was not deliberate but a function of the very low numbers in the river corresponding to the low numbers of 0+ found in the previous year's fishings. The 5+ year class was strong corresponding to previous years but the large number of the 2+ year class which was expected to be well represented following large numbers of 1+ the previous year, was not evident. The oldest roach sampled were 5+ whereas in previous years fish up to 7+ had been found.

In general, numbers of gudgeon were down in comparison with last year (Fig 7). The high relative proportion of young of the year indicates good recruitment although actual numbers sampled are similar to 1993 which was considered a poor year class. The length distribution (2-5cm) of young of the year in 1994 is similar to the previous year which resulted in a poor year class. In 1992, when large numbers of young of the year were caught, the length distribution was 4-7 cm. This may indicate that this year is likely to result in a poor year class. Numbers of 1+ gudgeon were low which corresponds to the few 0+ caught in 1993.

Four adult salmon were caught, three of which were grilse. One smolted at 1+, one at 2+ and the other scale was scarred. The fourth adult was 2SW having smolted at 1+. One pre-smolt was found in Section 3 of age 1+ and four other parr of the same age were found.

2.3.5 Echo-sounding results

Ten areas, A to J (Appendix 12) were subjected to quantitative analysis. Areas A to G were within parts of the river previously sampled by electrofishing, while areas H, I and J were all further downstream (National Grid References of NZ 447 179, 449 192 and 469 194 respectively).

The numbers of small, medium and large single fish echoes recorded in each area are given in Table 7. The total numbers of echoes recorded were relatively low and so their division into the three size groups, through the indirect statistical algorithm of Craig & Forbes (1969) must be viewed with due caution although the large breadth of the size groups decreases this source of error. Single fish echoes were only

numerous in the three sites C, D and J, although evidence presented below suggests that those recorded at the latter site may not have originated from fish.

Table 8 presents the above data expressed as the number of fish individuals per square metre of river surface area and incorporates allowances made by the data processing of HADAS for both the spread of the insonifying beam and for the depth of the examined stratum. The figures are thus comparable between sites.

Although not presented in this report, the vertical distributions of fish echoes were examined for all areas where they were recorded. Fish tended to be concentrated towards the river bottom in all areas with the exception of area J, where they were uniformally distributed throughout the water column. However, it is possible that the majority of these echoes arose not from fish but from crustaceans, or were even artifacts produced by drastic changes in salinity which may have occurred in this stretch of the river. Given their questionable origins, the echoes from area J are not considered further in these results.

Among areas A to I, total fish densities ranged from 0 to 4.375 individuals m^{-2}, with only areas C, D, F and I containing densities above 1 individual m^{-2}. With the exception of area H, where medium fish were relatively most abundant, small fish dominated at all areas where fish were recorded.

Table 7. Numbers of single fish echoes of small, medium and large fish recorded by echo sounding in ten areas of the River Tees on 6 September 1994.

	Number of single fish echoes			
Area	Small (5 to 10 cm)	Medium (10 to 25 cm)	Large (> 25 cm)	Total
A	6	0	0	6
B	0	0	0	0
C	29	1	0	30
D	38	2	0	40
E	3	0	0	3
F	8	2	2	12
G	0	0	0	0
H	4	1	0	5
I	9	0	0	9
J	82	0	1	83

Table 8. Densities of small, medium and large fish recorded by echo sounding in ten areas of the River Tees on 6 September 1994.

	Density (individuals m^{-2})			
Area	Small (4 to 10 cm)	Medium (10 to 25 cm)	Large (> 25 cm)	Total
A	0.478	0.000	0.000	0.478
B	0.000	0.000	0.000	0.000
C	1.385	0.082	0.000	1.467
D	1.048	0.023	0.000	1.070
E	0.371	0.000	0.000	0.371
F	4.207	0.030	0.137	4.375
G	0.000	0.000	0.000	0.000
H	0.098	0.429	0.000	0.528
I	1.861	0.000	0.000	1.861
J	11.876	0.000	0.278	12.154

3. TEMPERATURE

3.1 Introduction

The logger at Low Moor recorded for the full year without interruption. At Ingleby Barwick and Stockton Quay however, logger problems caused the loss of data. It is apparent that these machines are now subject to breakdown and it may be worth considering changing the machines.

The logger at Stockton Quay is still in the marina. It is unclear when it will be moved or where it will be moved to. It had been expected that the marina would move before the barrage was closed but this has not been the case.

3.2 Results

Monthly means and monthly mean of daily ranges are given in Table 9 with values from the R. Frome in Dorset for comparison.

In 1994 the river was noticeably colder in February than in the preceding year. Summer and autumn temperatures were however higher than in 1993 which should have resulted in good growth of fry. This will be investigated next year when the whole data set for pre-barrage conditions is analysed.

As in 1993, the monthly mean temperature of ORSU1 was very close to that of the main river although the mean daily ranges were again very much higher. It is expected that these high mean monthly ranges will be damped when there is no tidal effect after the closure of the barrage. The extreme high and low temperatures will be associated with low tides when the water is very shallow.

Table 9. Monthly means (^{0}C) and means of daily ranges in the River Tees at a) Low Moor, b) Ingleby Barwick, c) Stockton, d) ORSU1.

	Low Moor		Ingleby Barwick		Stockton		ORSU1		Frome
	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Dec 93	3.4	0.81	3.7	0.74	-	-	3.0	3.75	6.7
Jan 94	3.0	0.76	3.1	0.63	4.4	2.70	2.6	4.02	6.5
Feb	2.1	0.80	2.3	0.58	3.8	2.68	0.2	3.73	6.8
Mar	5.4	1.22	-	-	-	-	6.2	8.51	7.4
Apr	8.0	1.34	7.7	0.95	-	-	7.5	13.02	10.6
May	12.3	1.85	-	-	-	-	10.5	10.32	13.3
Jun	16.4	2.20	-	-	-	-	16.1	8.58	16.7
Jul	19.4	2.09	-	-	-	-	19.9	9.77	17.4
Aug	16.6	1.51	-	-	-	-	16.8	6.96	17.0
Sep	12.5	1.06	12.4	0.59	-	-	12.8	3.96	14.6
Oct	9.4	0.84	9.3	0.57	7.7	2.11	9.5	3.48	11.9
Nov	8.1	0.74	7.9	0.58	6.0	2.15	8.2	1.12	8.3

4. ANGLING DATA

4.1 Methods

The system set up for anglers to record data from matches has been very successful this year. Data is now being collected on individual angler's catches. The total weight of each catch is recorded along with the composition in terms of numbers of each species of fish. Dace, roach and chub are split into large and small fish, large dace and roach being >6 oz and large chub being >1 lb. Also recorded are the position on the river (peg number), the state of the tide and subjective assessments of the river and weather conditions. A map of the position of each peg is shown in Appendix 13.

Interpretation of the data is difficult because of many uncontrollable variables. These include:

Variable number of anglers in matches
Different pegs fished
Variable angling techniques used
Variability in angler ability
Variable river and weather conditions
Catch weight is affected by distance between anglers which varies with the number of anglers
Variability in feeding behaviour of the fish

The anglers also complain about compensation water from Cow Green Reservoir which "causes causing fish to cease feeding", and predators such as cormorants and seals "decimating the fish population".

As the catch weight from any particular peg will be greatly affected by the ability of the angler, it was felt that it was more appropriate to look at differences between reaches. It is assumed that the there is a normal distribution of angling ability and that the distribution of these anglers between sections fished is random. In the majority of occasions, over the years when records are available, the number of angler weights per peg is large compared to the number of anglers.

Anglers have pre-conceptions as to where the fish will be at different times of the year and as a result, different pegs are fished in matches over the season. In order to assess the distribution of fish over the whole length of river, the data was split into four unequal periods depending on the pegs fished and the number of matches in each period. Some care was taken in choosing these periods to consider water temperature also. The four periods chosen were:

June 16 - August 31
September 1 - October 31
November 1 - February 14
February 15 - March 14

Due to the fluctuations in numbers of anglers fishing each competition, and in particular due to the poor attendances in recent years, the anglers felt that the mean catch per angler was giving a result which was artificially high as the few anglers fishing were given what were expected to be the best pegs and comparisons with previous matches, where many anglers failed to catch anything, may not be valid. In order to address this, the top ten catches in each match were used to calculate the mean catch per angler.

4.2 Results

4.2.1 Mean catch per angler

The mean catch per angler was calculated and appended to those of previous years (Appendix 14). There appears to have been a dramatic decrease in the mean weight per angler with the weight significantly less than occurred prior to the Hargreave's pollution on 24 October 1983 (Fig 8).

The pattern of mean catch per angler using only the top ten weights in each match is similar to the mean catch per angler (Fig 9). Current catch weights are of the same order as those seen in the recovery period after the pollution. The maximum mean catch per angler which occurred in the 91/92 season shows a value from the top ten anglers which is significantly higher than pre-pollution values whereas the value from all data is approximately the same as pre-pollution values. Corresponding values in the seasons 89/90 to 92/93 show similar results. It is possible that conditions for recruitment were good in the years after the pollution and that the high biomass is a result of this. A study of the year class strengths and growth rates following the pollution may verify this. It is also possible that the early match angling records were not as accurate as at present. It is often the case that anglers failing to catch or catching poorly, fail to wait for the weigh-in and this would have the effect of artificially enhancing the mean catch per angler.

The data show that the mean catch in the 93/94 season is the lowest recorded using either method of analysis (excluding years affected by the pollution). The scale of the decrease is however different. Using all data the 93/94 mean catch per angler per match is approximately half the value of the worst pre-pollution catch (season 80/81). The 93/94 value is 84% of the 80/81 value using the data from the top ten anglers.

4.2.2 Distribution of catch weights along the river (Fig 10)

Period 1. June 16 - August 31.

Catches are quite evenly distributed on the top shallows (pegs 1-9) and a similar biomass is present in the top deeps (pegs 10-19). Catch weights increase downstream over the shallows from pegs 20-40. Little is caught in the deeps downstream of this (pegs 41-67). The river at pegs 68-80 is shallow and catch weights are similar to those on the top shallows. Pegs 81-115 are not fished in this period. There are sporadic high weights in pegs 116-130. Pegs 137-156 show low weights in this deep section and correspond to low catches by the boom boat in this area.

Period 2. September 1 - October 31.

The deep section (pegs 41-67) which previously produced low catches has improved, the weights now being similar to those in the sections upstream but without the extreme high catches. The upstream pegs produce similar mean weights to those made during Period 1 although they are more variable with some higher catches than previously. Weights from pegs 41-88K generally decrease downstream. More pegs in the lower half of the river were fished and catches are generally more consistent and heavier than in Period 1.

Period 3. November 1 - February 14.

The top sections (pegs 1-67) both shallows and deeps produced (with a few exceptions), low catch weights compared with the two previous periods. Fish appear to have congregated in pegs 75-88. There is a peak mean catch of over 280 oz from peg 75 and catches decrease downstream from this peg to peg 80. Catches then steadily increase to peg 88E. Catches are approximately four times higher than in the preceding period. Catches fall rapidly from downstream pegs and pegs 88J and K are blank. No pegs in the lower sections were fished in this period.

Period 4. February 15 - March 14.

Mean catches over the top 36 pegs are similar to the previous period and fish are still shoaled in the middle reaches (opposite the church at Yarm). They are slightly more tightly shoaled and mean catches are heavier than in Period 3. The peg which produced the heaviest mean weight in period 3 (peg 75) blanked in Period 4 even though it is only slightly upstream of the pegs producing heavy weights.

4.2.3 Distribution of fish along the river (Fig 11)

These data are a result of the angling questionnaire filled in at each match. The results are split into the same four periods.

Period 1. June 16 - August 31

The top pegs (1-5) all contained only small fish in the deep water. On the shallows (6-9) large chub and dace were also caught. Large roach appeared in the next deep section (pegs 10-18). Pegs 19-40 contained small roach and dace on all pegs and widespread distributions of small chub and large dace and chub. There was one pocket of large roach associated with a sewage outfall (pegs 26-31).

Small fish were widely distributed in the deep section (pegs 56-69) as were large dace. Very few large chub were caught and no large roach. In the deep section (pegs 80-88) there were only small dace and roach. There were no small chub or other large fish. The section 89-98 contained small roach and small and large dace only. A similar distribution was seen in the deeps (pegs 99-115) except that the large dace were confined to the upper pegs. Pegs 116-122 were not fished in this period and in the deeps downstream (pegs 122-131) small and large roach and dace were present over the whole section. Small chub appeared at the bottom of the section but no large chub were caught. In the furthest downstream deep section (pegs 136-156) small dace and roach were widespread, small chub were mainly confined to the middle of the section and large roach and dace were distributed in all but the bottom pegs.

In summary, large chub occurred only above peg 35. large roach were mainly in the lower sections with a few being caught in the upper pegs but none in the middle reaches. Large dace were evenly distributed except for pegs 80-88 and 110-115.

Period 2. September 1 - October 31.

As in the previous period, small dace and roach were present in all sections and at nearly all pegs. Small chub were also widely distributed having appeared in pegs 105-118 unlike Period 1. Large chub were again caught in the upper sections but now also in the lower sections. They were still absent from the middle reaches. Large roach were more widespread and had appeared in the middle sections 32-115. Large dace were also more widespread than in the previous period having appeared at pegs 110-115 and 85-88. They were still absent from the alphabet pegs (88A-H).

Period 3. November 1 - February 14.

No pegs below 88 were fished. Few fish were caught in the top sections except for chub and large dace at pegs 23-26. All fish except large chub were present in most of pegs 75-88I. Pegs 54-68 contained large and small dace and large roach.

Period 4. February 15 - March 14.

Large chub only were caught in the top 37 pegs. Most of pegs 55-79, both on the shallows and in the deeps blanked but in the deeps in most of the 80s pegs there were roach and dace of all sizes. Below peg 90 virtually nothing was caught. During this period the fish are tightly shoaled on the alphabet pegs.

5. COST OF WORK DURING THE REPORTING PERIOD (APRIL 1994 - FEBRUARY 1995)

Costs of the work are in accordance with the tender document accepted by the Authority namely £30825 (this price has been adjusted for inflation from the original 1990/91 financial year).

6. ANTICIPATED COSTS OF THE WORK IN THE PERIOD UP TO FEBRUARY 1996

As agreed with the NRA Project Officer, there will not be a double fishing next year to coincide with the first post-barrage year but the project will run for an extra year. To this end the cost of next year's work will be £30825 (at 1994/95 prices).

7. PROGRAMME FOR THE NEXT REPORTING PERIOD

Fry will be sampled in the summer. The date of the sampling will give due regard to all species expected to be present. Ideally, the sampling time would be different for some species but this is not possible under the present contract requirements.

The adults will be surveyed in September as normal. In previous years all of the tidal section regularly fished by anglers has been sampled along with other areas above the

tidal influence for comparison and areas lower down the river where salt water intrusion was a regular occurrence. The time spent on the adult sampling had been maximised and is in excess of the current contract requirements. The data base produced in the pre-barrage period is excellent and ideally the sampling regime should be maintained. However, it is unlikely, given the present funding, that this can be done. There will be a greater area for the fish to disperse in which will need to be sampled. There is also a need to add an echo sounding, sampling method to each section in addition to the electrofishing survey. The requirement to do more lab based work and discussion of results is also causing time constraints.

Collection of temperature data will continue in ORSU1 and at the three sites on the main river. It is still not clear whether the logger at Stockton will have to be moved or where it may go. There is still a requirement for new loggers to monitor the additional ORSUs. Some discussion is urgently needed over this and the extra work required.

Angling match data collection will be continued providing there is co-operation from the anglers. There will be no staff on site to supervise the recording by anglers.

All data collected in the pre-barrage period will be collated and analysed to give an estimate of between year variation to compare with the post-barrage period.

8. FACTORS LIKELY TO AFFECT THE COMPLETION OF FUTURE WORK

1993 saw the start of water sports in the lower river with speed boats and water skiing taking place. Electrofishing had to be suspended each time water skiers passed and speed boat wakes caused disturbance of the water in the electrofishing area. Efficiencies of operating will fall under this constant disruption.

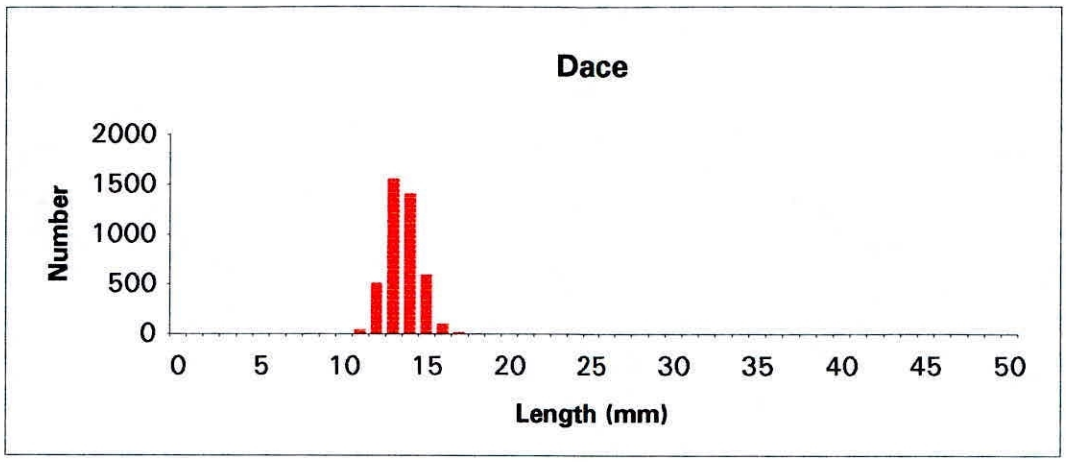
This year, Section 9 was not fished because of constant angler presence. Electrofishing is normally suspended on approaching an angler's swim and the boom boat passes by on the opposite bank. Even this procedure did not prevent one angler hurling abuse at the team. It would be helpful if advance notice could be given to anglers through clubs and tackle shops apologising for any inconvenience and pointing out that the survey is being done for their benefit.

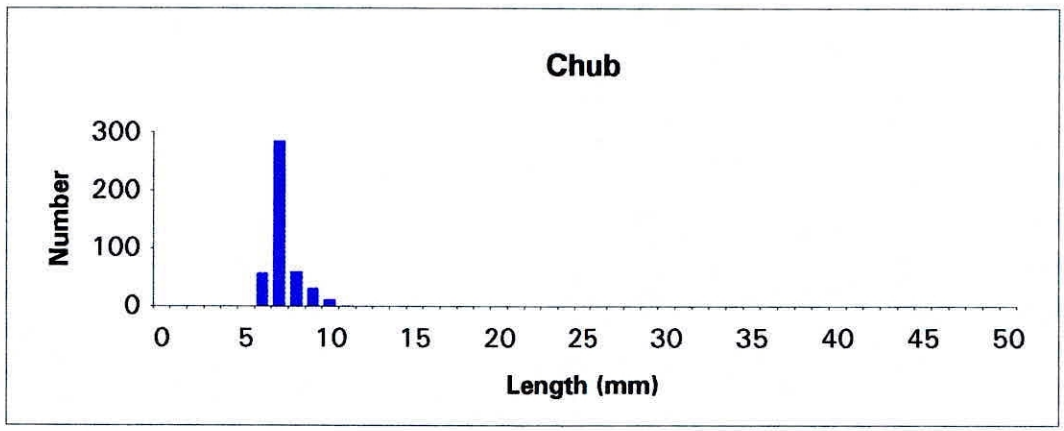
It is possible that adverse weather conditions may delay the sampling programme in the short term but it is unlikely that the completion date of the project will be affected.

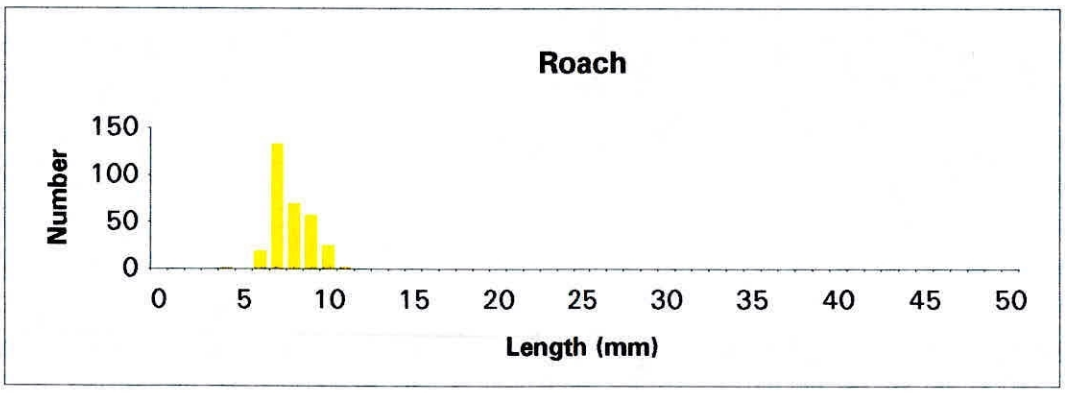
9. ACKNOWLEDGEMENTS

The authors wish to thank Diana Morton for production of the text and Daniel Ladle for his general help.

Fig 1 Length frequency histograms for each species of fry in the R.Tees in June 1994







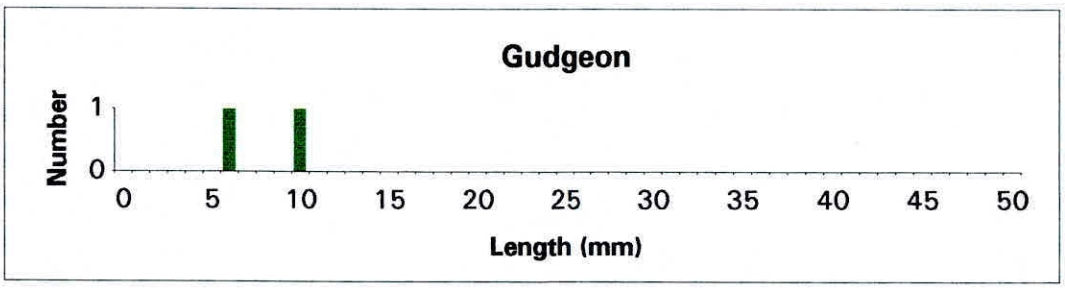
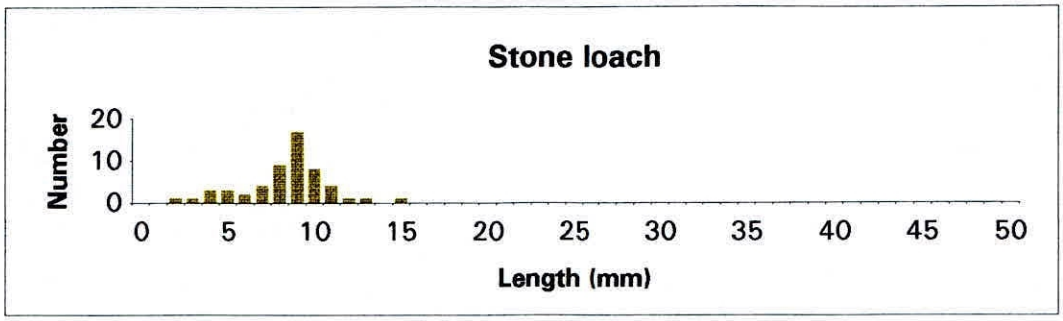
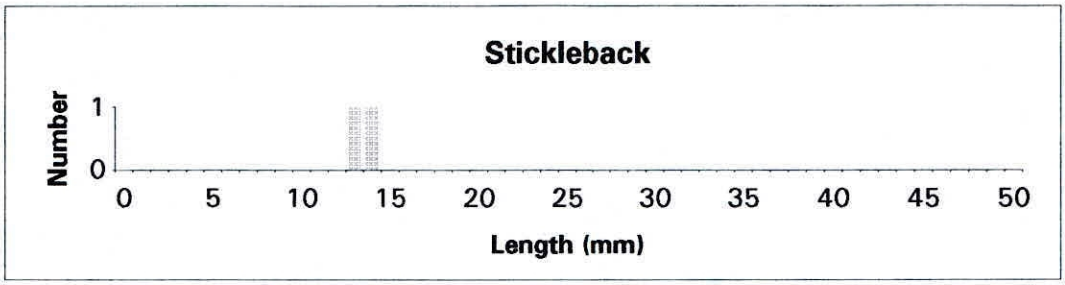
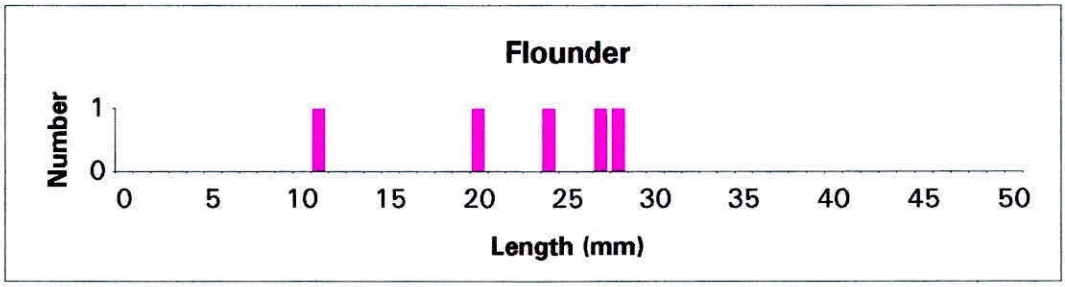
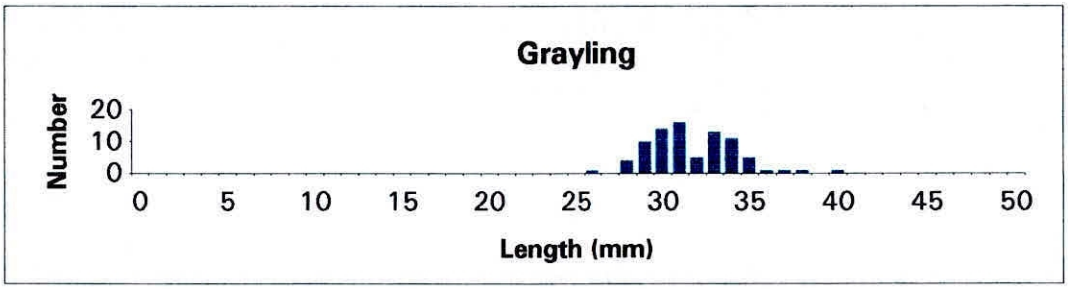


Fig 1 continued









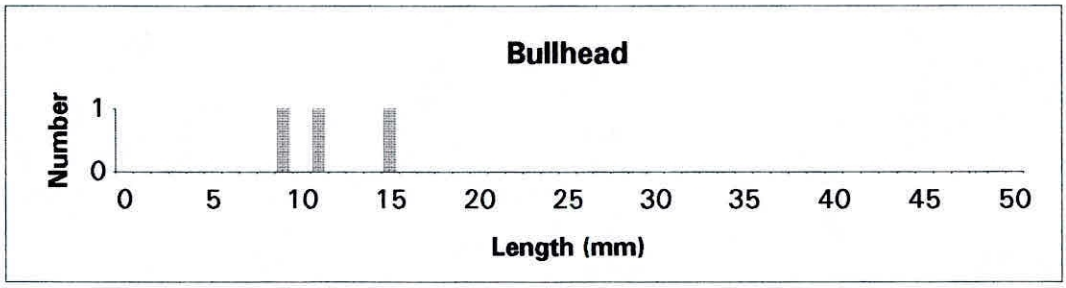


Fig 1 continued

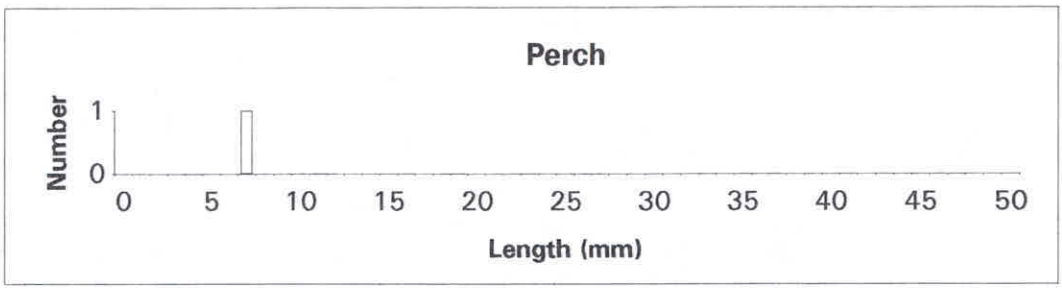


Fig 2 Species composition of fish in the R.Tees in September 1994 at various sites.

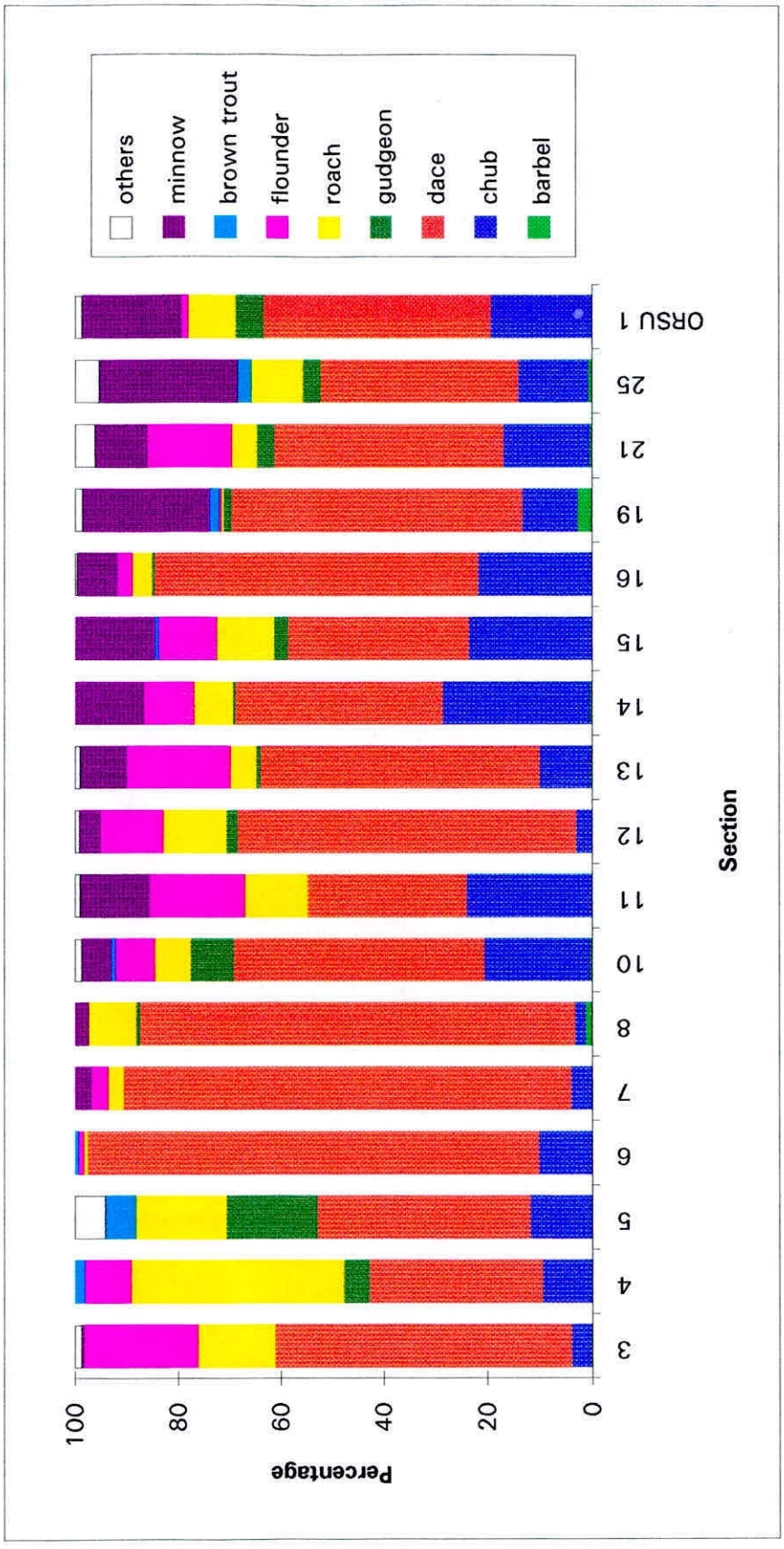
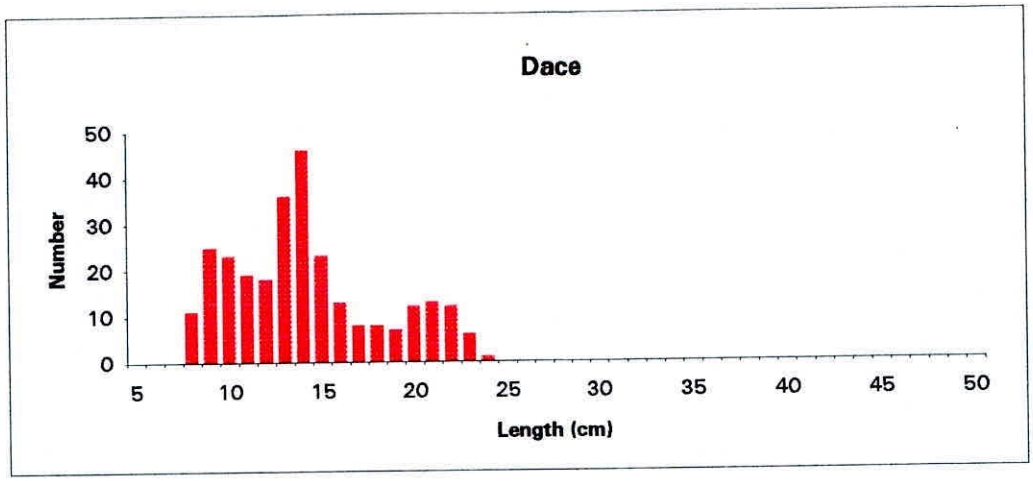
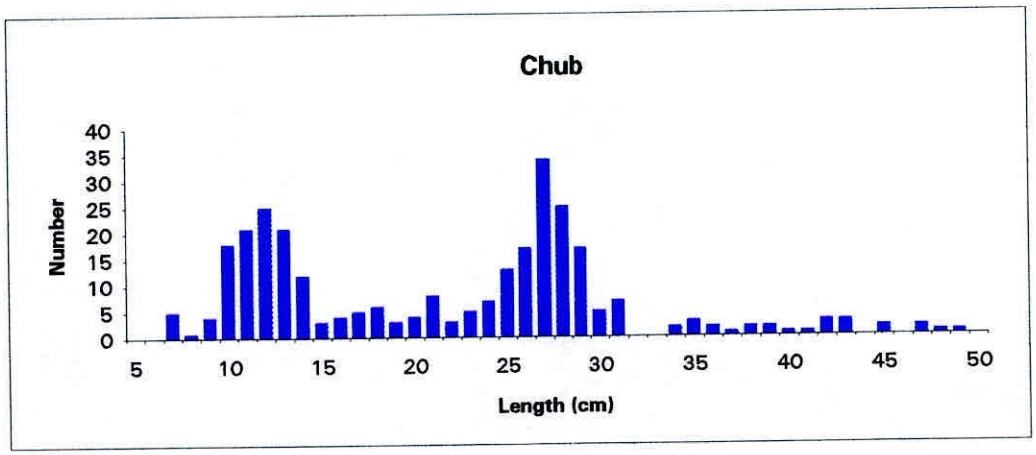


Fig 3 Length frequency histograms for each species of adult fish in the R.Tees in September 1994





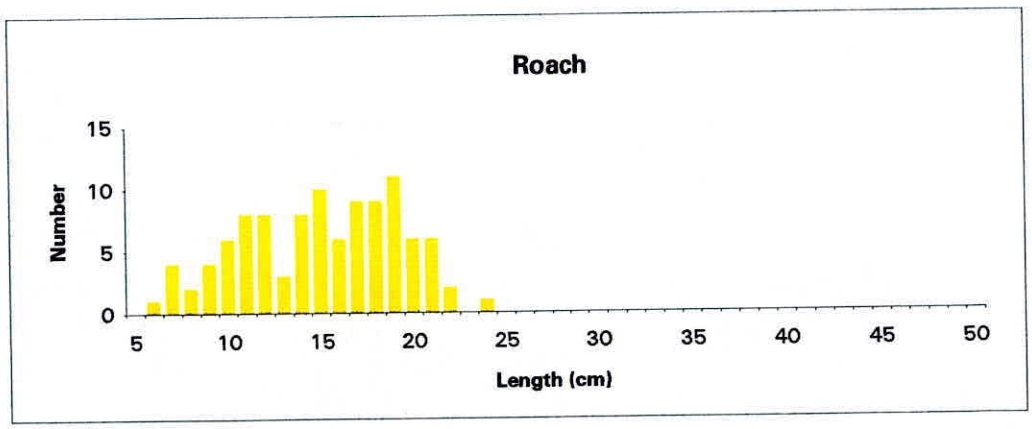
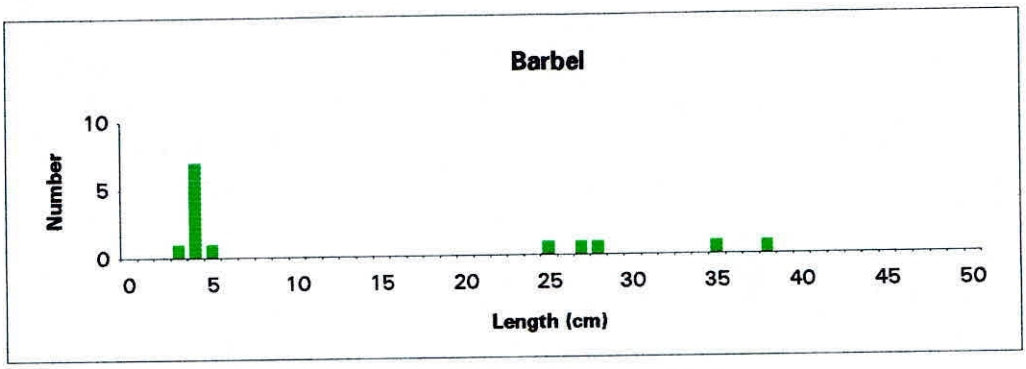
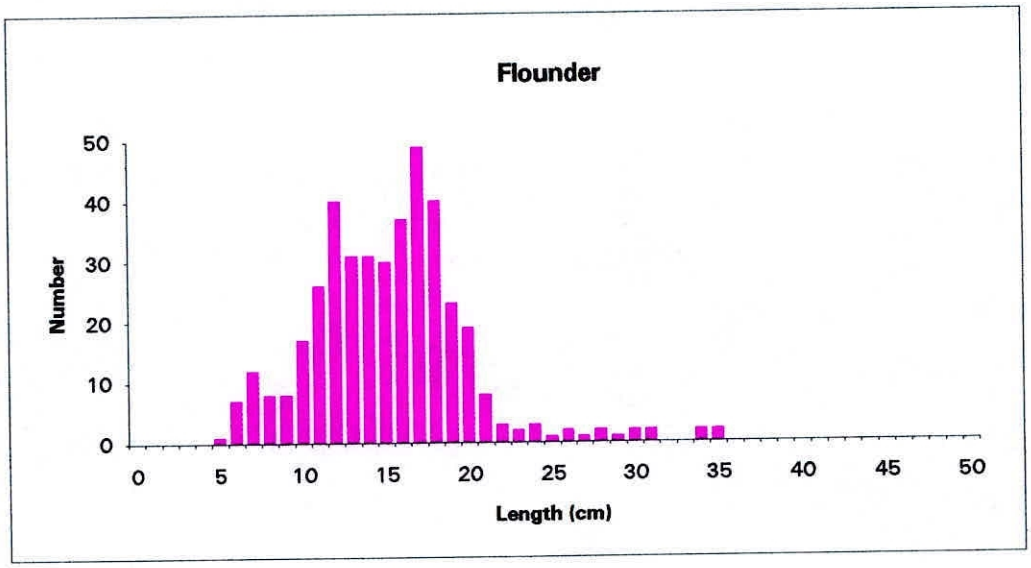


Fig 3 Continued





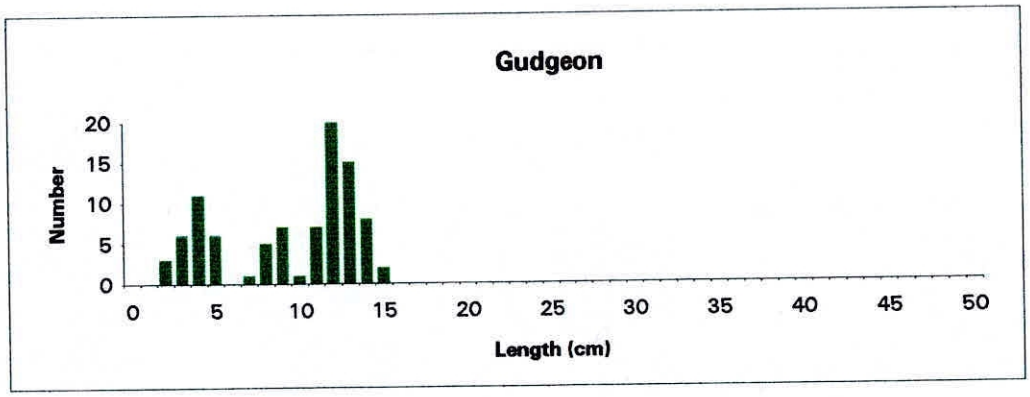


Fig 4 Length by age for dace in the R. Tees in September 1994.

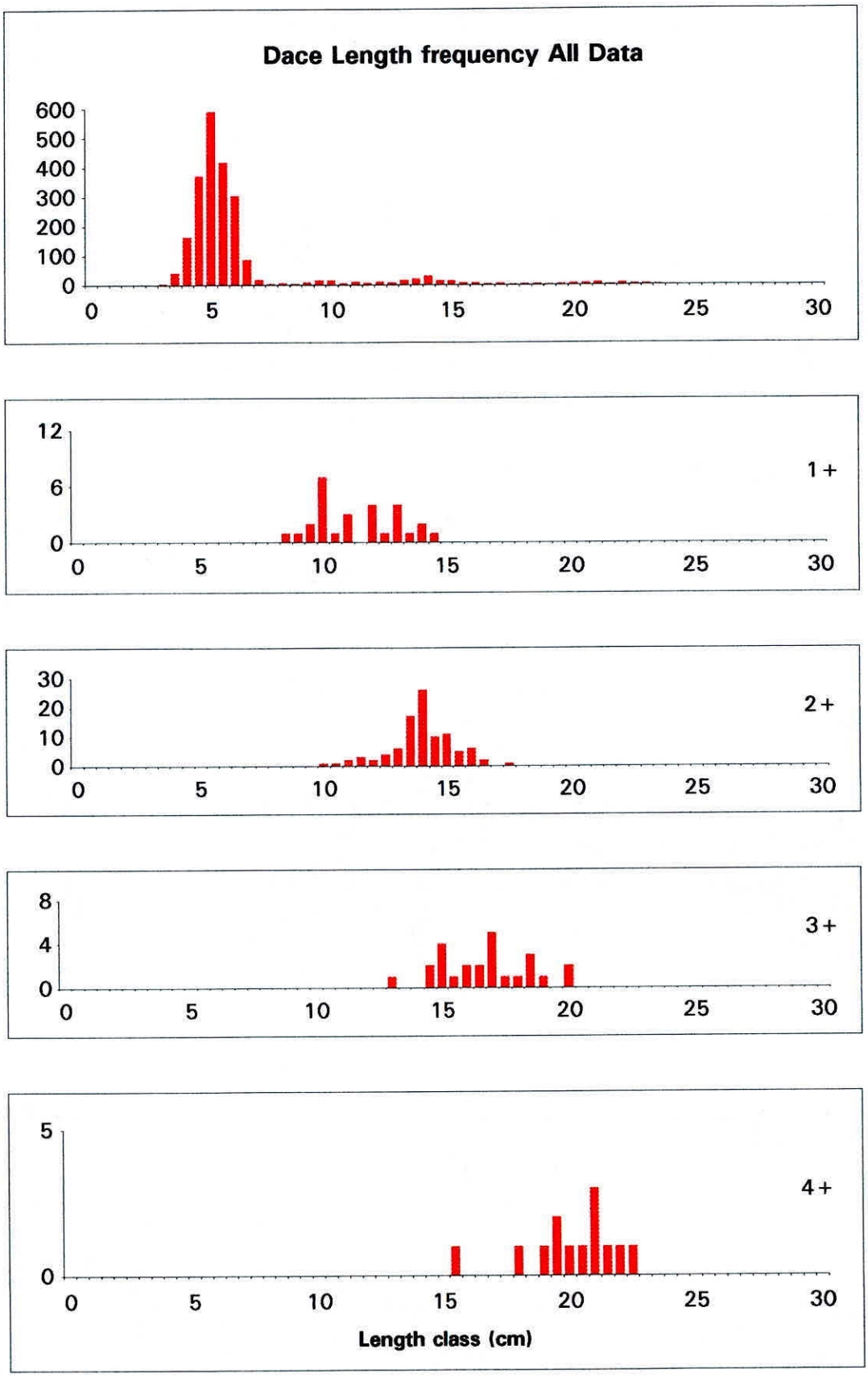


Fig 4 continued

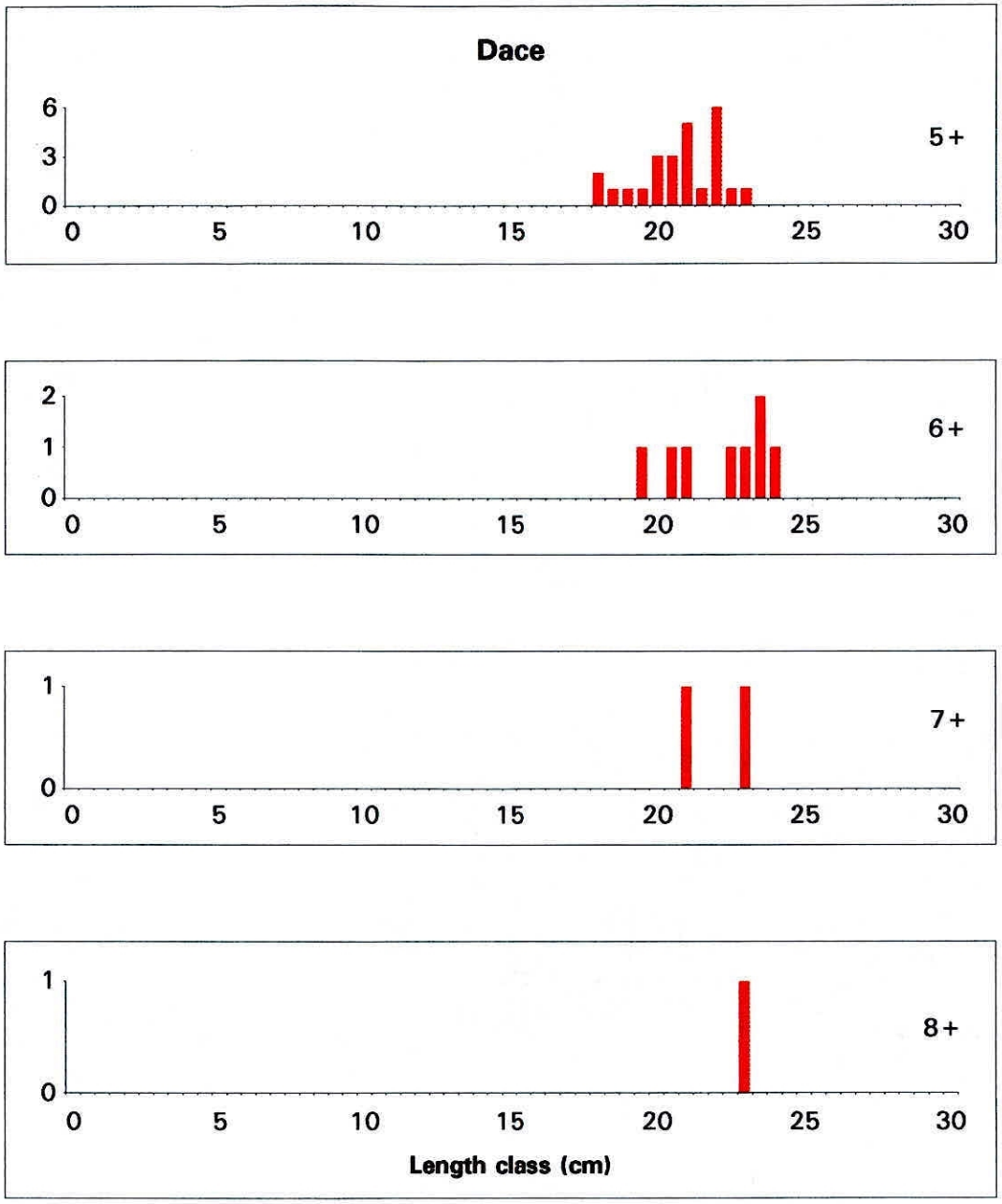


Fig 5 Length by age for chub in the R.Tees in September 1994.

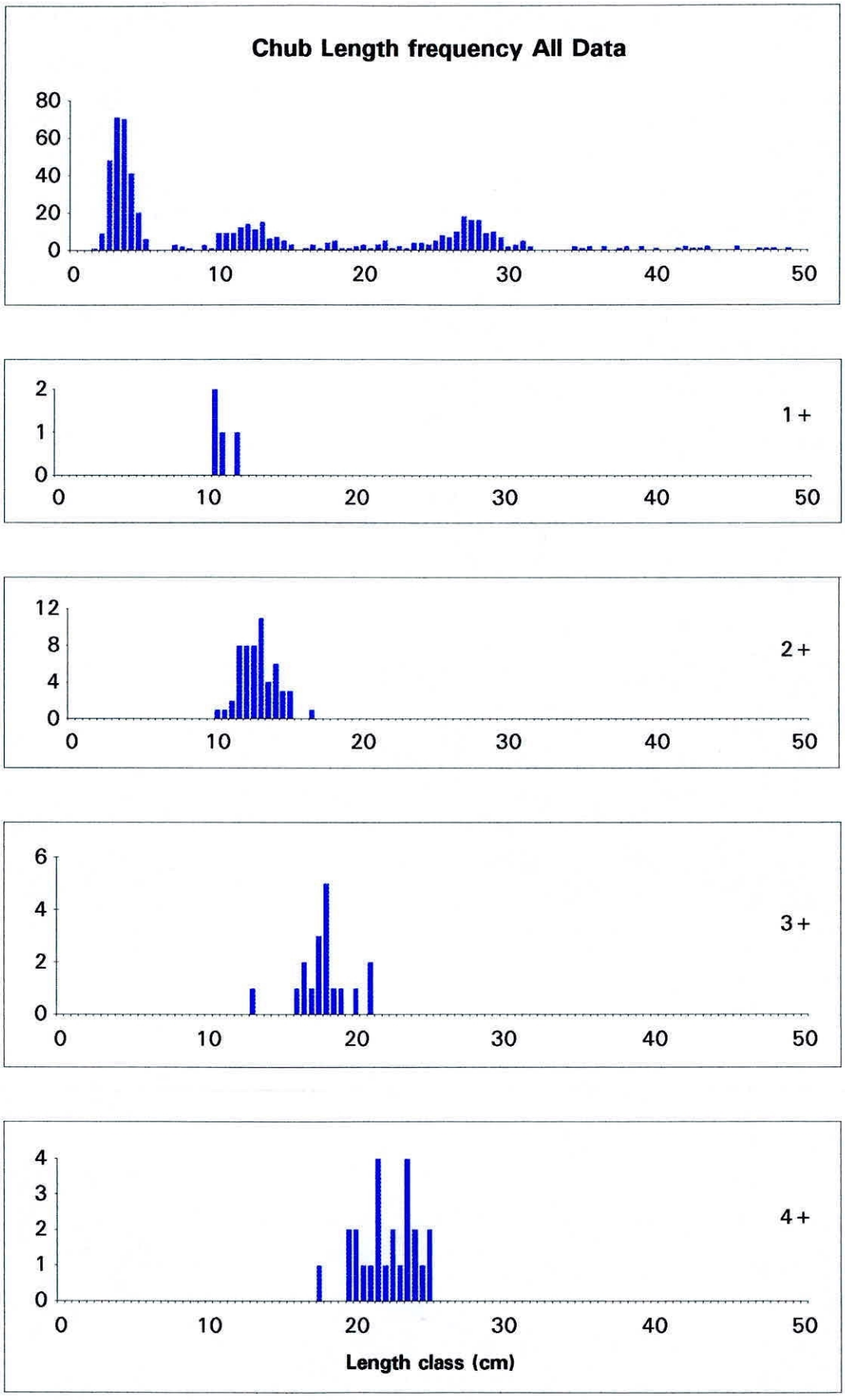


Fig 5 continued

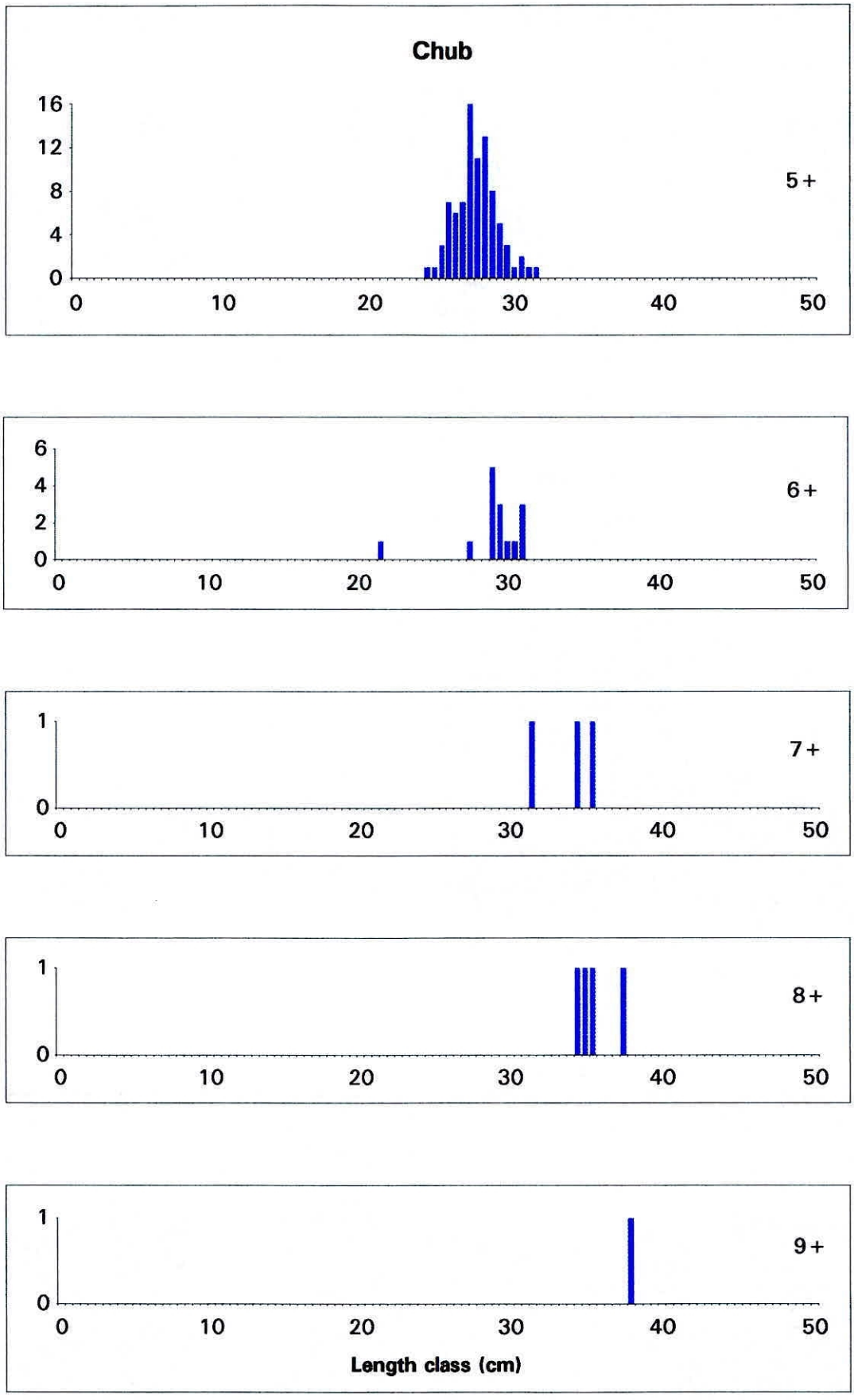


Fig 5 continued

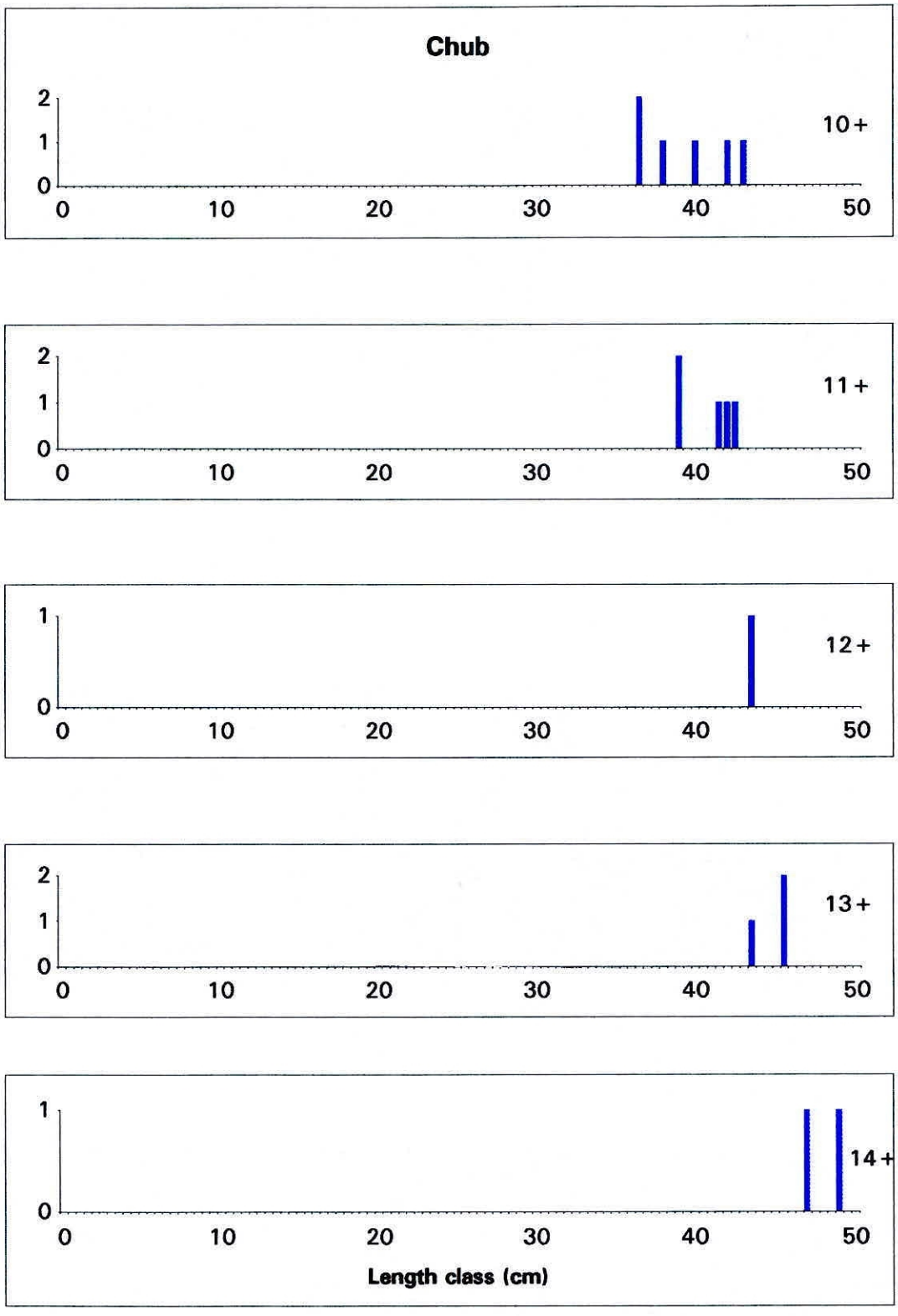


Fig 5 continued

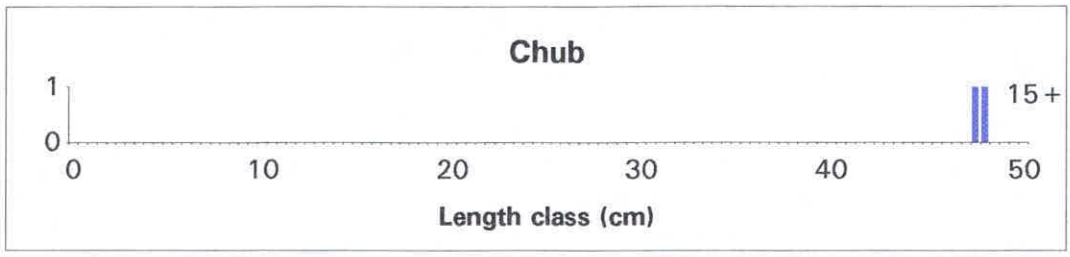


Fig 6 Length by age for roach in the R.Tees in September 1994

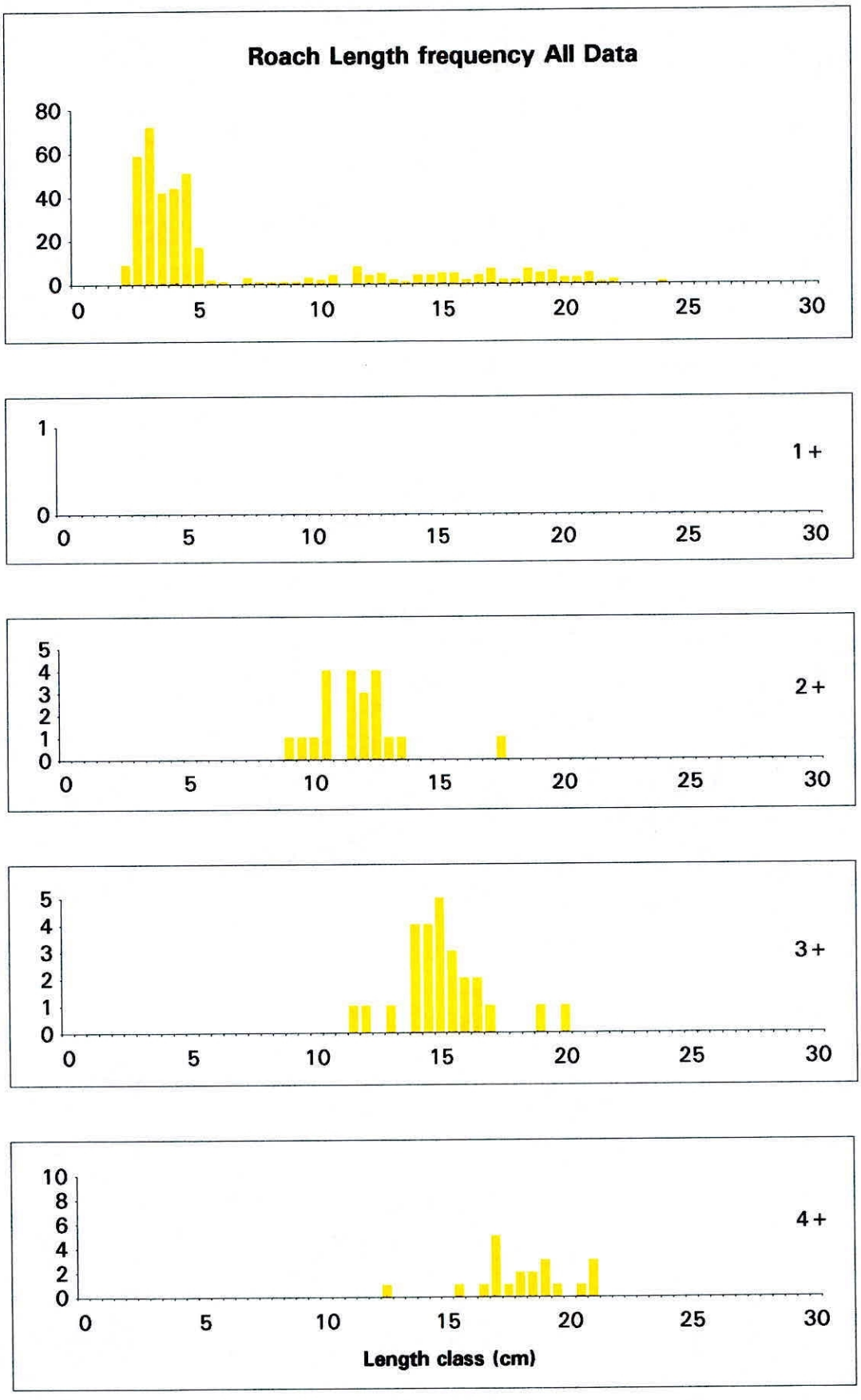


Fig 6 continued

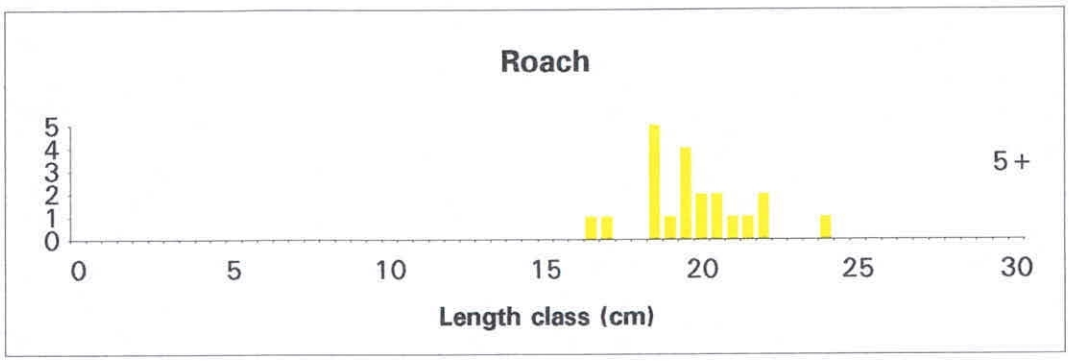


Fig 7 Length by age for gudgeon in the R. Tees in September 1994

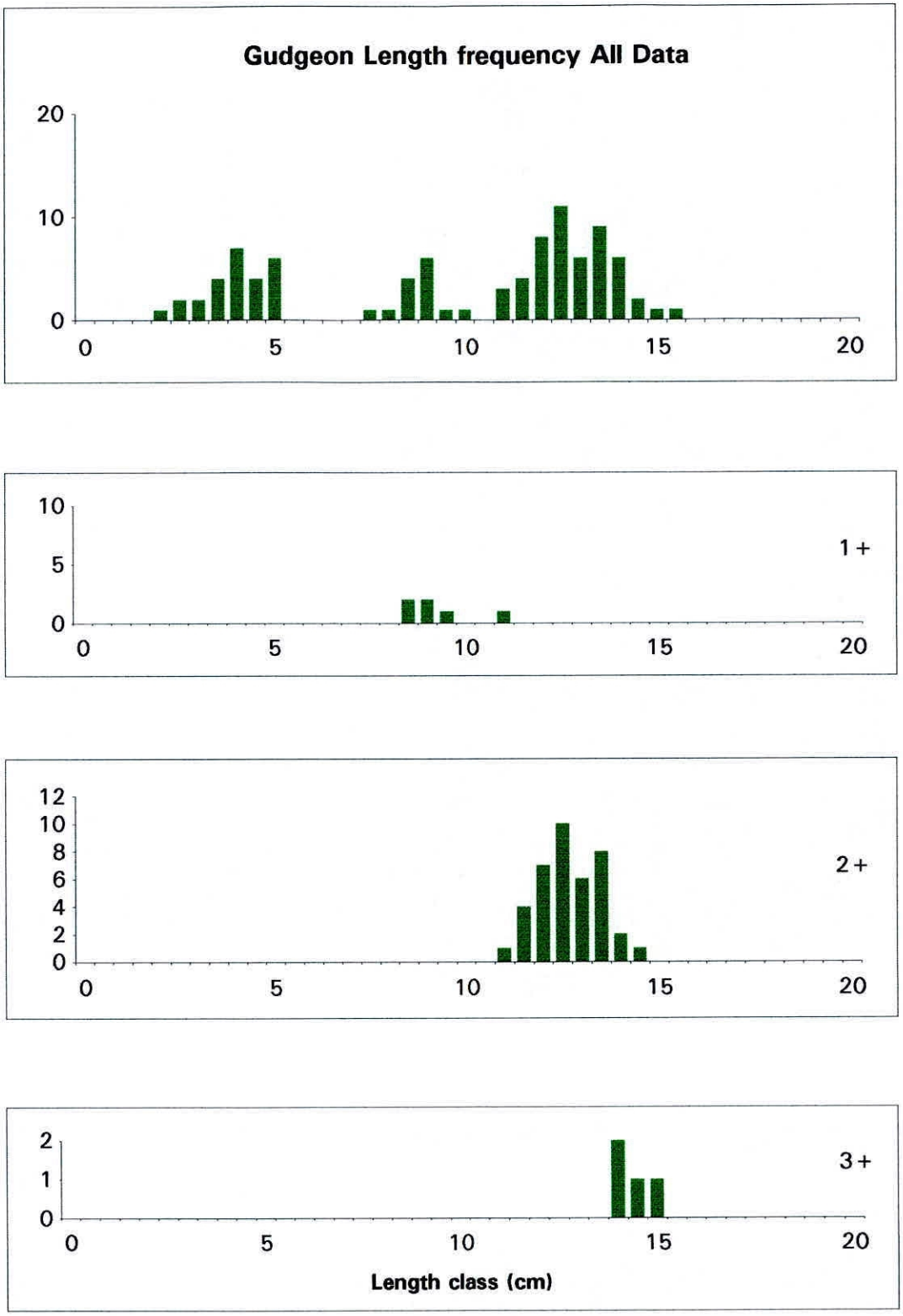


Fig 8 Mean (+ - 95 % C. L.) catch weight per angler per match for each season in the study period

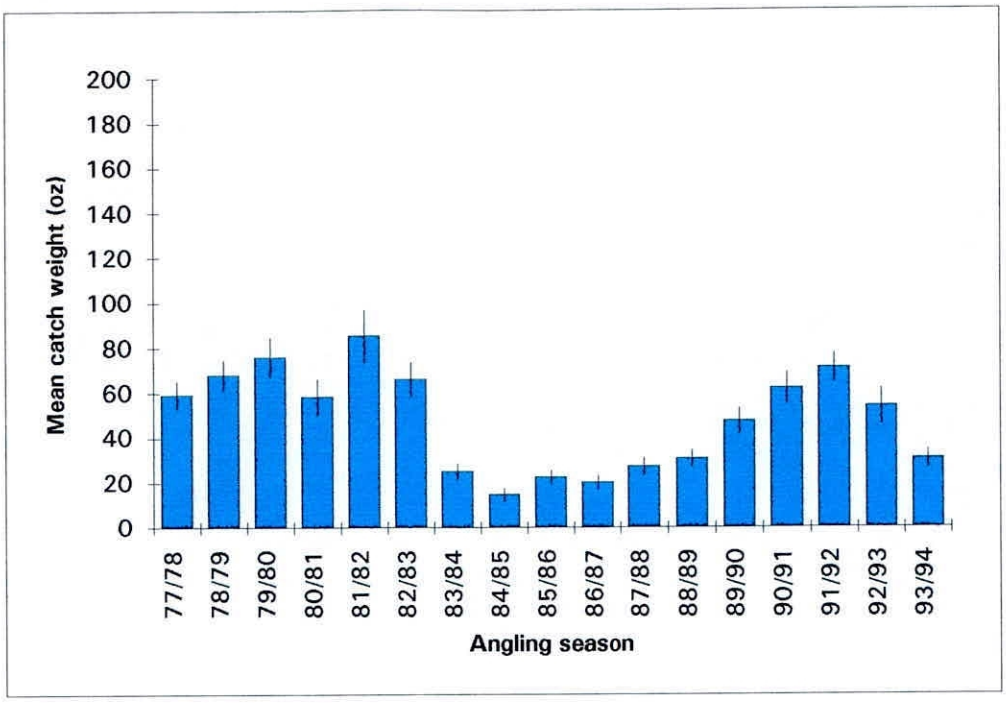


Fig 9 Mean (+/- 95% CL) catch weight per top ten angler per match for each season in the study period

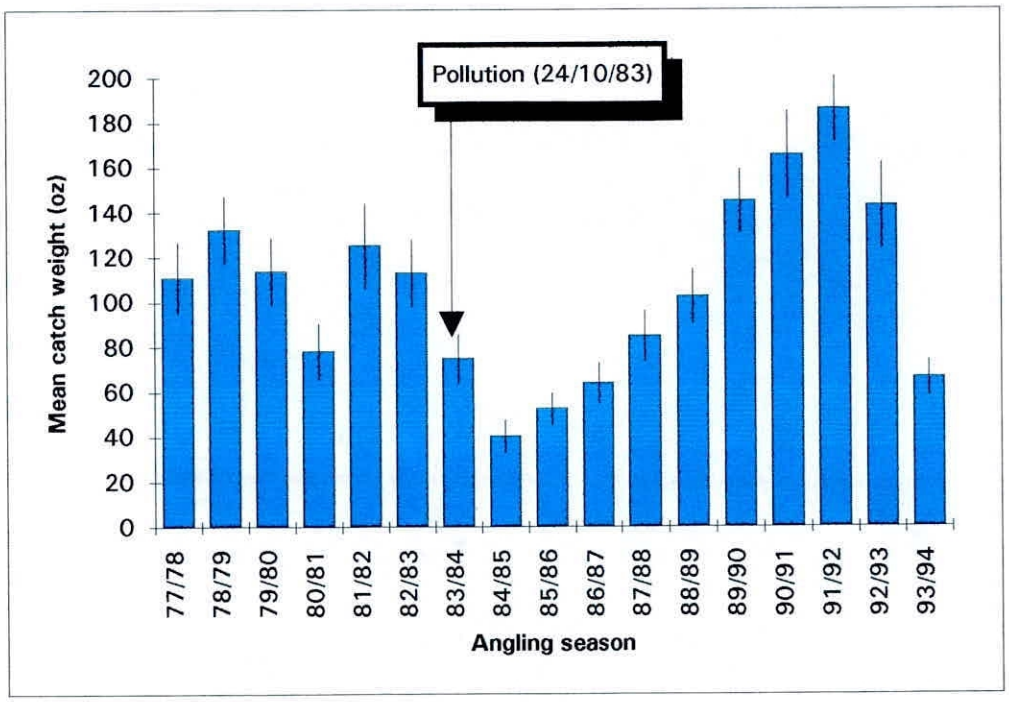
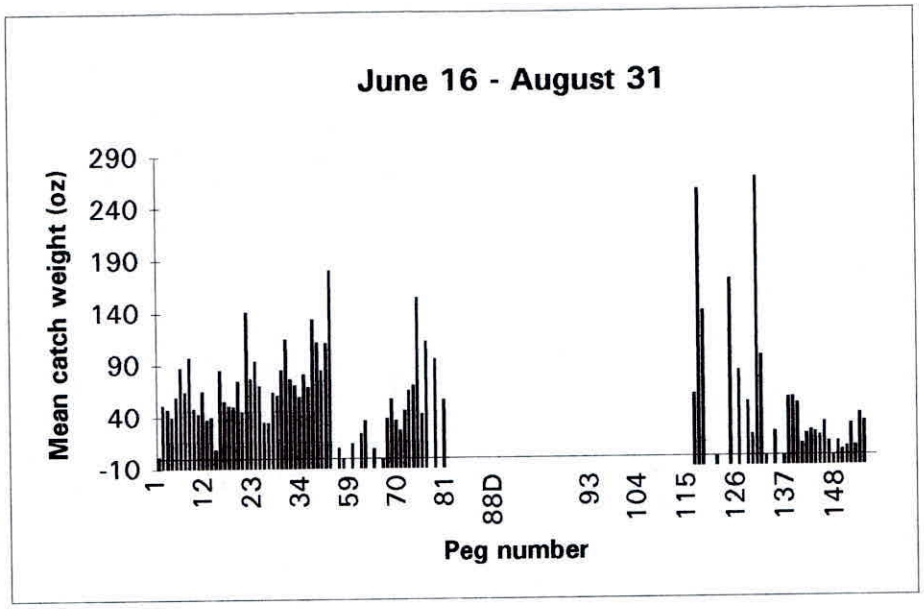


Fig 10 Distribution of catch weights in R. Tees
(from angling data 1991-1994) | = Pegs fished



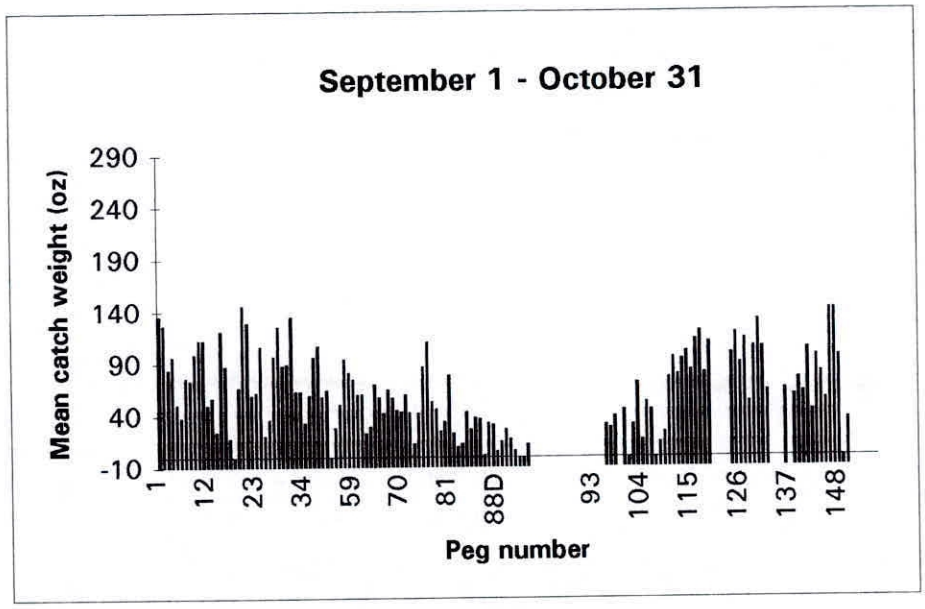
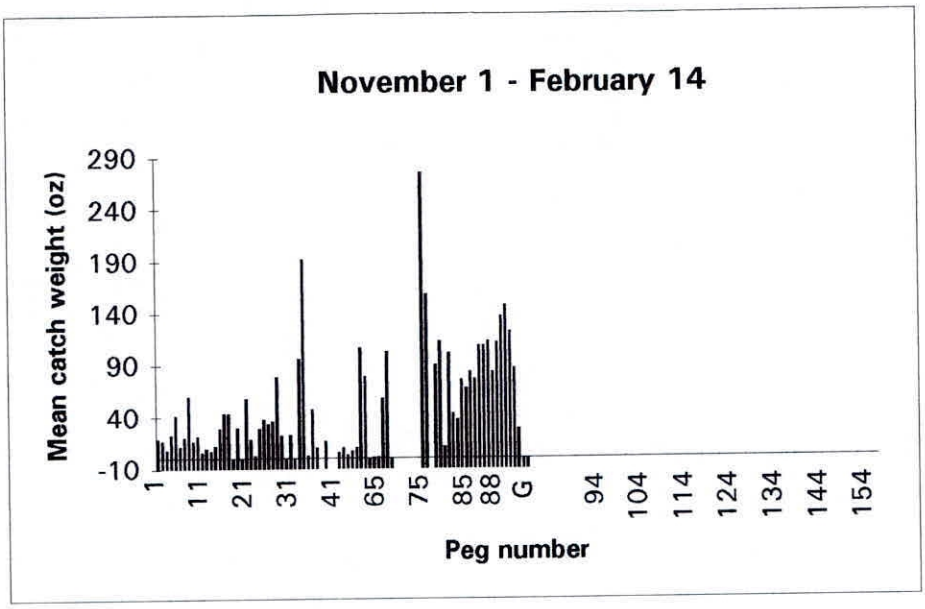


Fig 10 continued



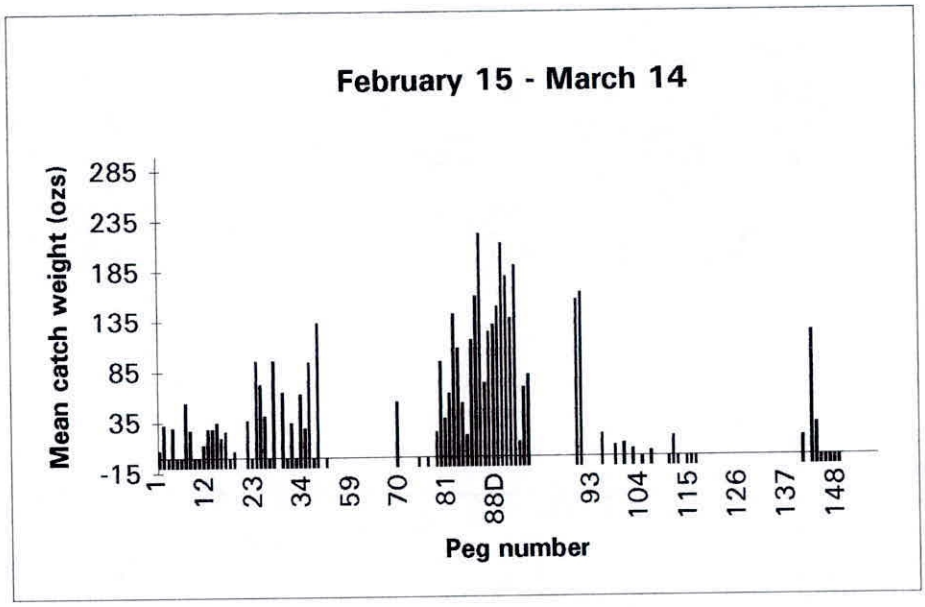
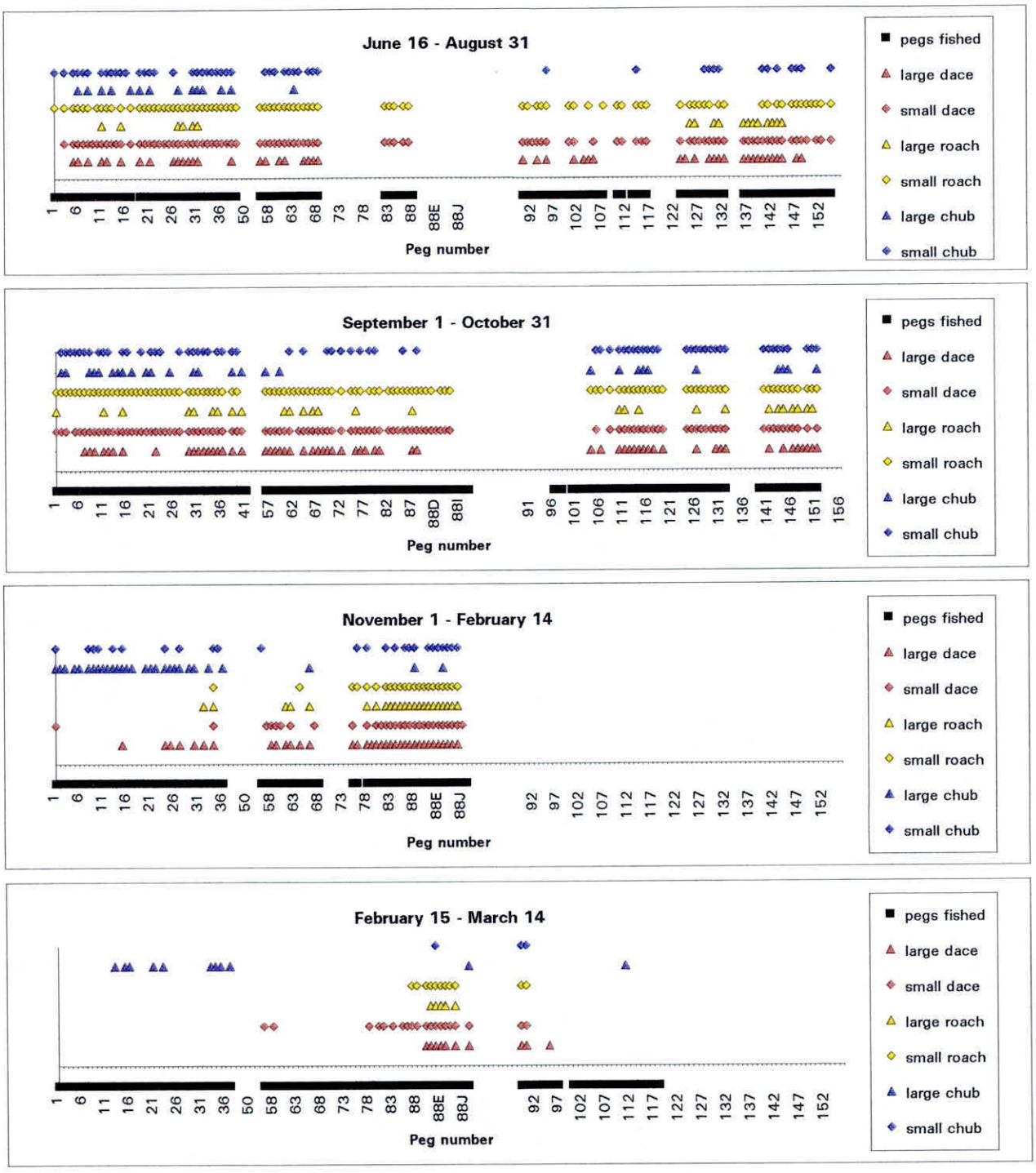


Fig 11 Distribution of fish in R. Tees (from angling data 1991-94).
■ Pegs fished



Appendix 1. Description of sampling sites for fry and distribution of these within sections.

Designations used in the following site descriptions are as follows: S(n)= Micromesh seine sample; P(n)= Point sample; N(n)= Hand net sample; E(n)= Area visually examined.

Section 1 10 June 1994. Tide low slack/flooding.

S1 Sandy backwater with branches. Very shallow (0.0-0.3 m). Conductivity 760µS cm^{-1}, tide flooding fast.
E1 Examined c.50 m of bank. Sandy slope. No fry seen.
E2 Examined c.50 m of bank downstream from Thornaby ORSU. Substrate large cobble/small boulder. No fry seen.
N1 Targeted handnet sweep in backwater isolated by low tide. Conductivity 1150µS cm^{-1}, substrate mud and boulders (conductivity in some pools >2000 µS cm^{-1}).
N2 Single targeted sweep in backwater.

Section 2 10 June 1994. Tide low slack.

S1 3m seine where creek enters the river. Substrate mud/sand and boulders, tide just flooding.
N1 Single targeted sweep over coarse sand downstream of tree roots and branches. Conductivity 600 µS cm^{-1}.
N2 Targeted hand net sweeps in the same general area as the seine, conductivity 1700 µS cm^{-1}.
N3 4 targeted handnet sweeps by creek, tide low slack, substrate mud, sand & boulders, conductivity 580 µS cm^{-1}.

Section 3 10 June 1994. Tide ebbing to low slack. Conductivity 580µS cm^{-1}.

S1 5m seine on sand/mud slope.
N1 150m of bank examined. Shallow water over hard mud and rock.

Section 4 9 June 1994 Tide just flooding from low slack.

S1 15m seine on shelving sandy beach.
S2 10m seine on shelving sandy beach downstream of S1. No fry caught.

Section 4 10 June 1994. Tide ebbing. Conductivity 600µS cm^{-1}.

S3 8m seine on shelving gravel bank. Slow flow on edge of main current, depth 1.25m.
N1 5 hand net sweeps along shallow margin. 30 cm water over sandy substrate.
N2 5 hand net sweeps along shallow margin. Substrate cobbles/sand.

Section 5 9 June 1994. Tide flooding.

S1 8m seine over bedrock. Water depth 1 m.
N1 Single targeted hand net sweep in scalloped edge over bedrock.
P1 10 targeted point samples in backwater (lee of fallen tree). Water depth 1m.
P2 6 targeted point samples in slack water area with trailing vegetation over silt/sand substrate.

Section 6 9 June 1994. Tide just ebbing.

N1 5 targeted point samples in bedrock pools and bays.
P1 4 targeted point samples in scalloped edges of bank with overhanging willows. Tide rising, conductivity 450 µS cm^{-1}.
P2 10 targeted point samples in bedrock pools and bays. Tide still ebbing.

Section 7 9 June 1994. Low water.

S1 Approx 10 seine on gravel beach in slow flowing backwater, depth 0.5 m. Only seinable area in section 7.
N1 5 targeted point samples in area of scalloped bank (mud substrate) and sparse emergent vegetation. Depth >0.5 m.

Section 8 9 June 1994.

S1 Gravel beach between bridges. Edge of flow plus backwater area. Depth 0.5 m.
N1 1 handnet sweep in backwater area too shallow to seine.

Section 9 9 June 1994.

N1 3 targeted point samples. Mud slope plus some emergent vegetation.
N2 1 targeted point sample. Edge of river in emergent vegetation.

Section 10 9 June 1994.

S1 Approx 10 m seines on gravel beach, depth 1 m.
N1 2 handnet sweeps in same area as S1 to catch very small fry.
N2 5 targeted point samples in backwater area of emergent vegetation.

Section 11 9 June 1994.
Note: No suitable areas for seine net sampling.

P1 4 targeted point samples in area of slow flow/backwater. Tide ebbing. Conductivity 460 µS cm^{-1}.
P2 4 targeted point samples in deep water area of scalloped bank. Mud substrate.

Section 12 9 June 1994

P1 5 targeted point samples in bank scallops. Bank steeply sloping mud, depth 0.3m. Ebb tide.
N1 2 handnet sweeps to catch very small fry in shallows, gravel substrate.
S1 30 m sweep with seine on gravel beach. Water flowing depth 0.5 m. Only beach in reach.

Section 13 8 June 1994

S1 Approx 8-10 m seine on gravel/silt shelving beach, depth <0.5 m. Tide flooding.
P1 4 random point samples. Deep water, substrate mud and overhanging vegetation. Flood tide

Section 14 8 June 1994

S1 10 m seine on silty gravel beach, depth <0.5 m.
P1 6 random point samples on shallow (<0.3 m) area of cobble and silt. Overhanging vegetation present. Tide just starting to flood.

Section 15 8 June 1994

P1 5 random point samples in scallops in steep bank, mud substrate.
S1 Silty gravel shelving beach, depth <0.5 m. Tide slack/flooding. First suitable site from downstream boundary of section 16.

Section 16 8 June 1994

S1 Area of gravel/silt beach approx. 20 m length of edge seined, <0.5 m depth.

Section 17 8 June 1994

S1 Gravel/silt beach, depth 1.0 m. Approximately 20 m of beach netted.
S2 Shallow backwater embayment, substrate silty gravel. Depth 0.4 m.

Low Worsall ORSU 8 June 1994

S1 Shallow bay at top of ORSU, soft mud substrate.
P1 5 targeted point samples in 0.02 m-0.03 m depth of water, soft mud substrate.

Note: No large fish seen in ORSU, connection to main river very thin and shallow, depth ranging between 0.1 m to 0.02 m.

Section 18 7 June 1994

S1 Area of gravel/detritus in backwater on edge of flow. Depth >0.5 m

Section 18 8 June 1994

S2 Gravel shallows on edge of flow/backwater, 10 m sweep on edge of river. First seinable area downstream of section 19.
P1 3 random point samples in silt substrate backwater, depth 0.3 m-0.4 m.

Section 19 7 June 1994

S1 In slack water area behind upstream island. One full net sweep, substrate gravel / silt, depth >0.3 m.
S2 In area of slack water on edge of flow behind downstream island. One full net sweep. substrate gravel/silt.
N1 One net sweep in 0.03 m water downstream of island. Substrate detritus/silt.

Section 20 7 June 1994

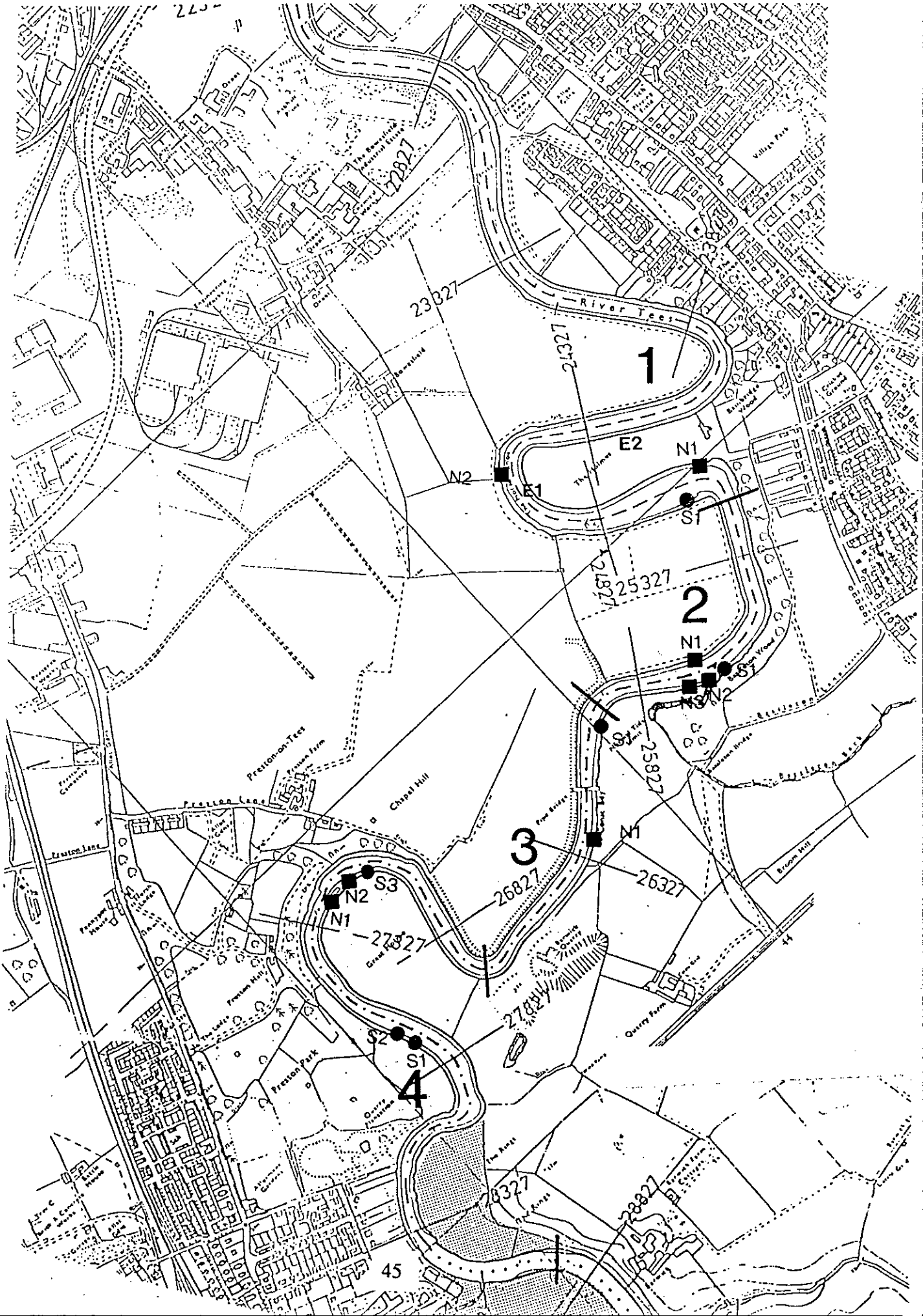
S1 Backwater on edge of flow, one full net sweep, substrate coarse gravel with some *Ranunculus*. Depth >0.5 m.
P1 4 targeted point samples in silt/gravel backwater, depth >0.5 m.
N2 1 net sweep along sandy shelving bank, many thousands of fry seen.

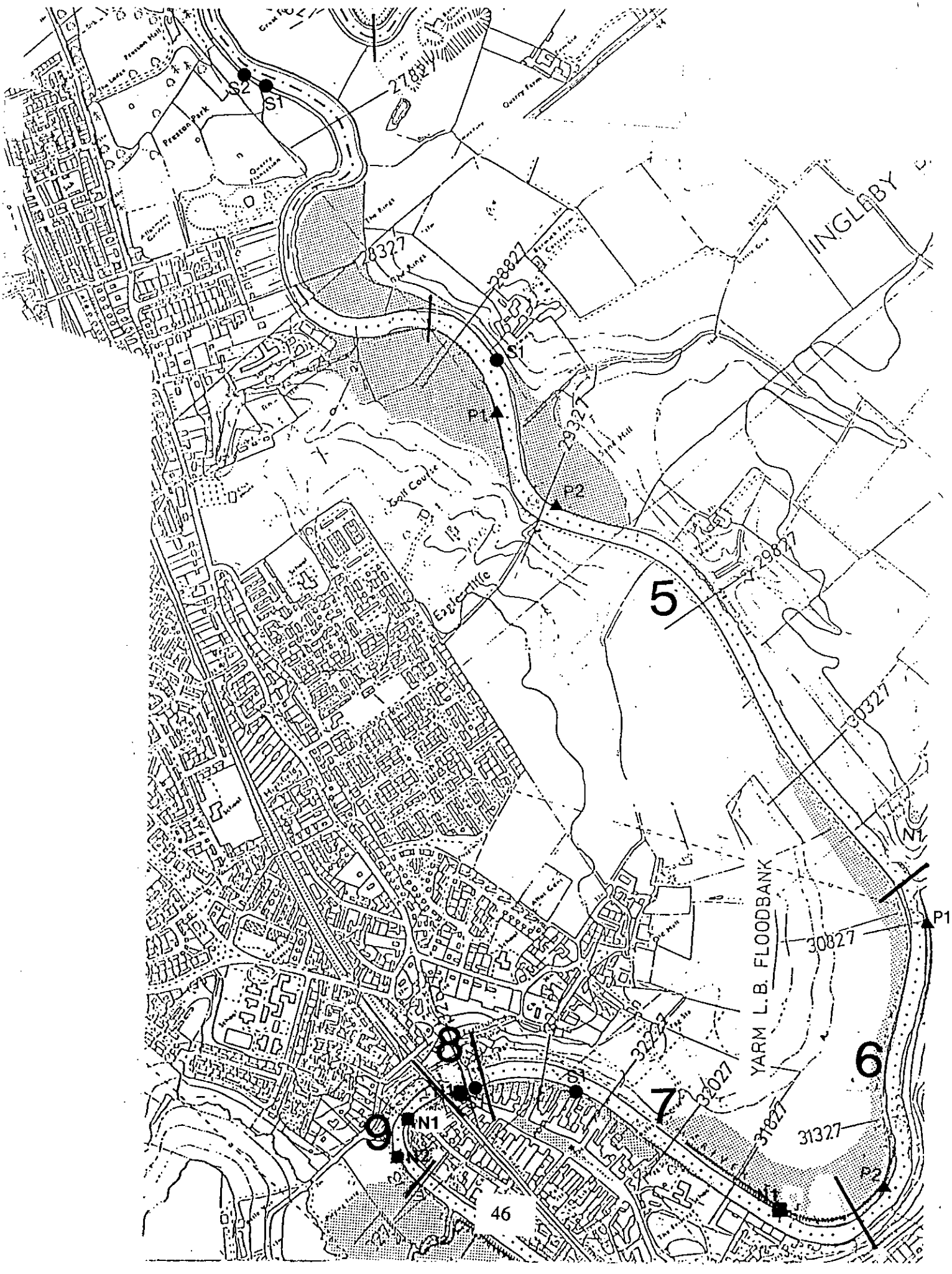
Section 21 Low Moor 7 June 1994

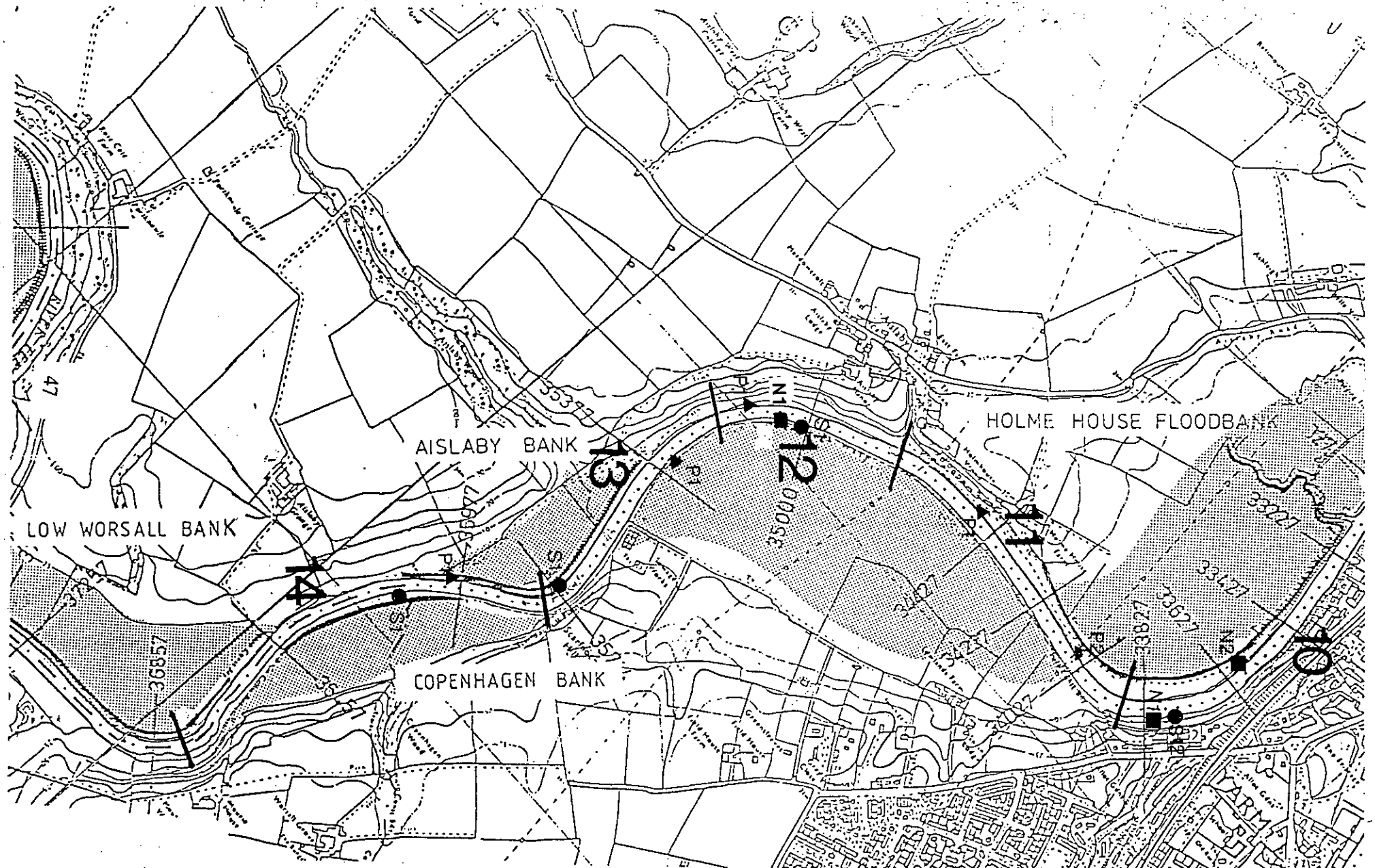
S1 Approx 20 m length of gravel downstream of the ford netted, flowing water, depth <0.1 m
P1 5 targeted point samples in silt backwater, depth 0.3 m.
P2 4 targeted point samples in slack areas in *Ranunculus* beds (gravel substrate). Depth 0.3 m.
P3 2 targeted point samples in slack water area, silt/detritus substrate, depth 0.3 m.
P4 3 targeted point samples upstream of weir in slack water areas in marginal and in-river vegetation, depth 0.75 m.

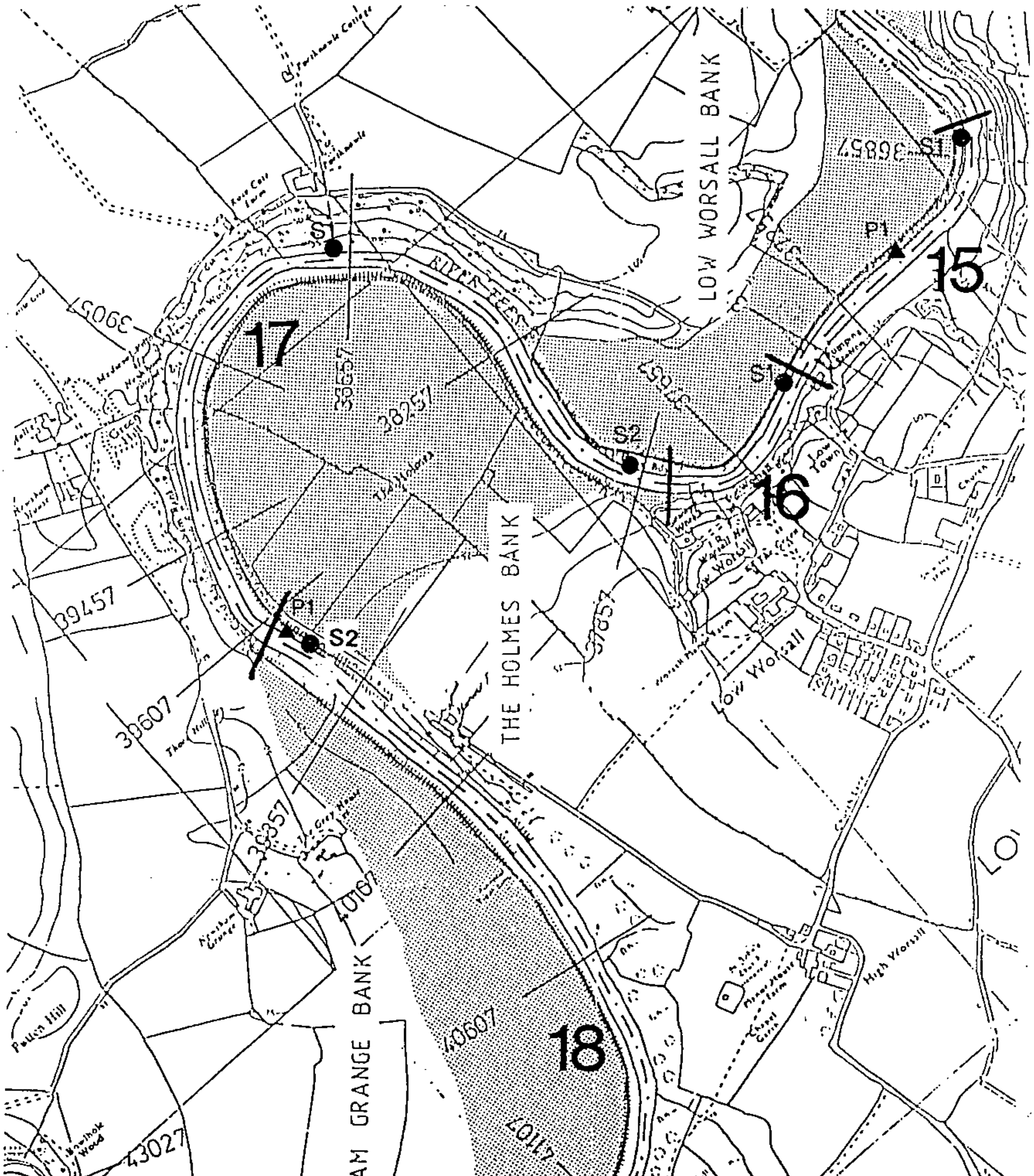
Section 25 Low Dinsdale 7 June 1994

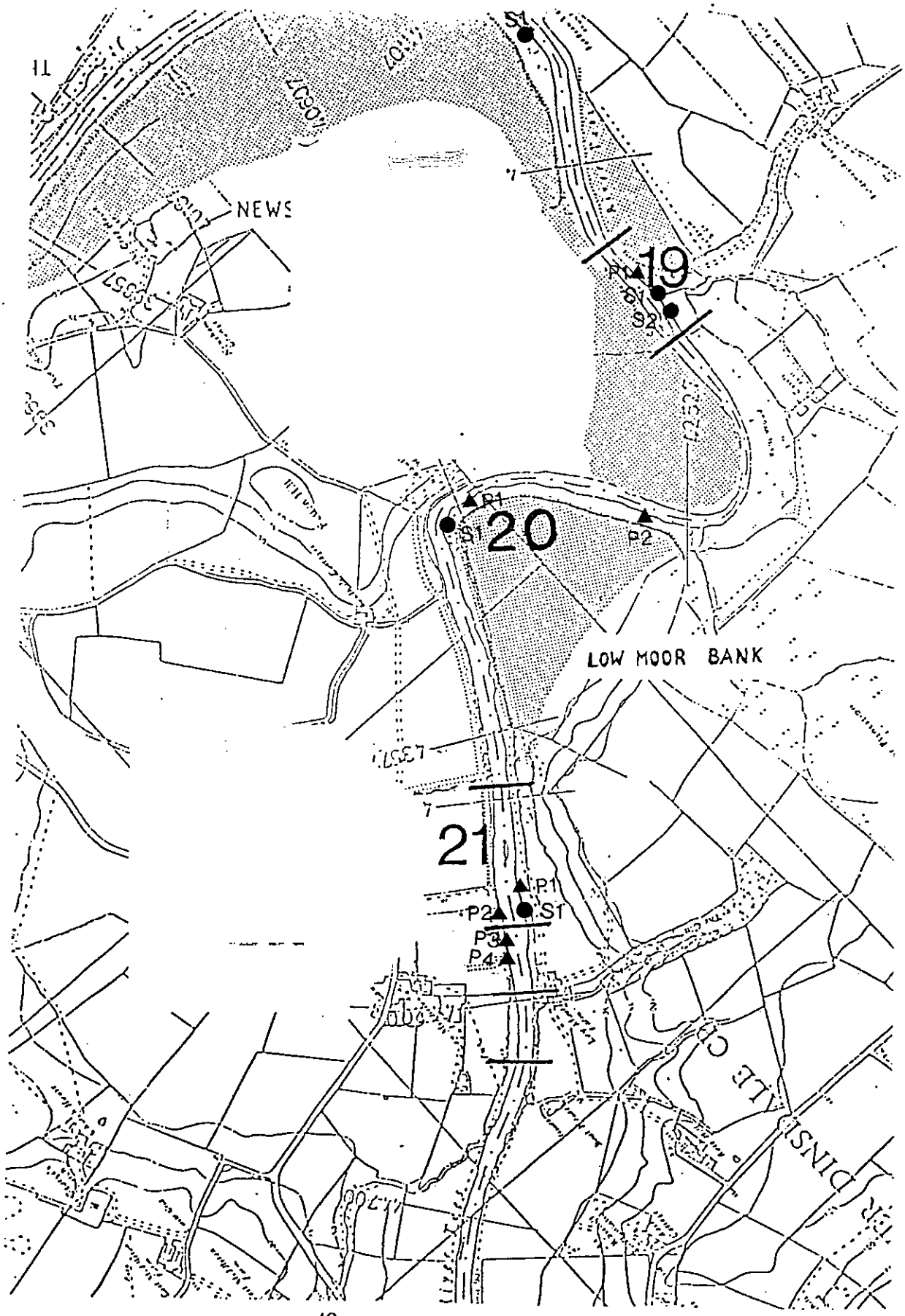
S1 Approximately 15 m length of beach under bridge netted, gravel/cobble substrate, flowing water, depth <0.35 m.
S2 One full net sweep in gravel/silt backwater on edge of flow, depth <0.3 m.

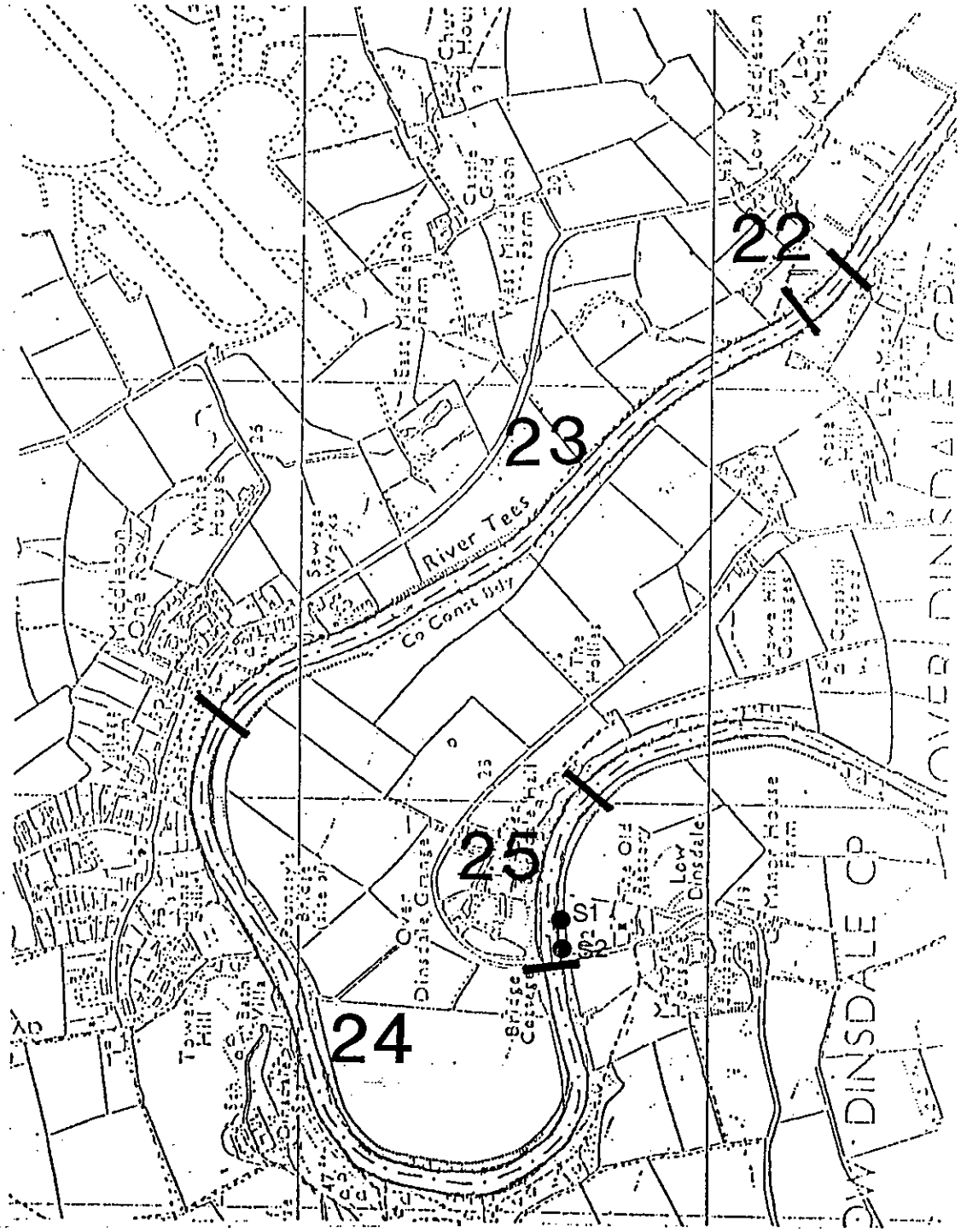

River Tees
1
2
3
4
E1
E2
N1
N2
S1
N3
S2
S3
Preston-on-Tees
Chapel Hill
Preston Park
Broom Hill
23327
22827
25327
25827
26327
26827
27327
27827
28327
28827
45


S2
S1
Preston Park
27827
28327
28827
INGLEBY
S1
P1
29327
P2
Spital Hill
Spital Cottage
Eppleville
29827
5
30327
N1
P1
30827
YARM L.B. FLOODBANK
32327
32827
8
7
6
9
N1
N2
31827
31327
P2
46


LOW WORSALL BANK
AISLABY BANK
COPENHAGEN BANK
HOLME HOUSE FLOODBANK
N1
N2
35000
33857
33427
33627
33827


LOW WORSALL BANK
THE HOLMES BANK
NEWSHAM GRANGE BANK
15
16
17
18
S1
S2
P1
RIVER TEES
Low Worsall
High Worsall
Potto Hill
36857
38257
39457
39607
40167
40607
41107
41607
43027

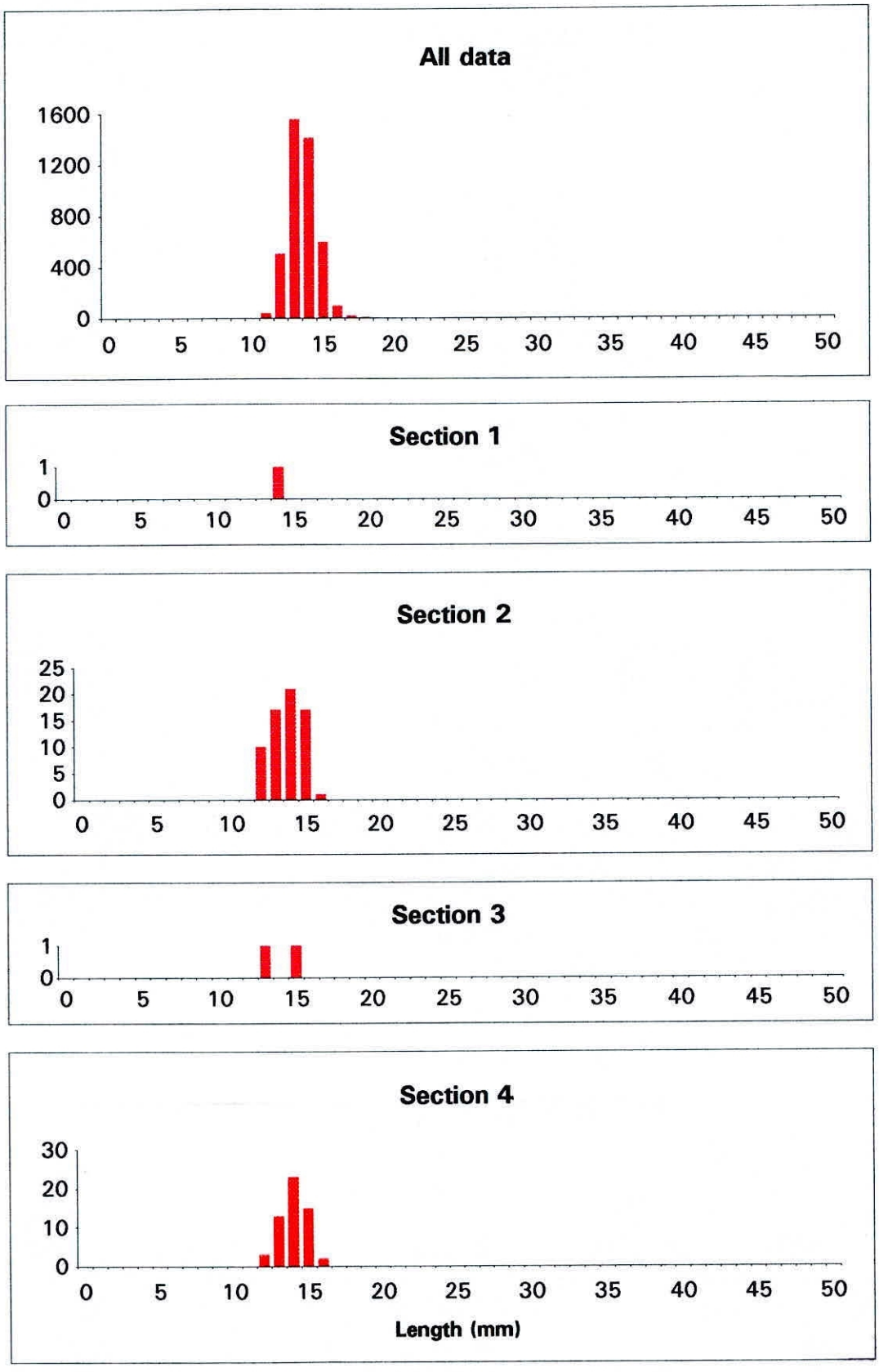

S1
19
P1
S1
S2
NEWS
P1
20
S1
P2
LOW MOOR BANK
21
P1
P2
S1
P3
P4


22
23
25
24
S1
S2
River Tees
Co Const Duly
Sewage Works
Low Dinsdale
Manor House
DINSDALE

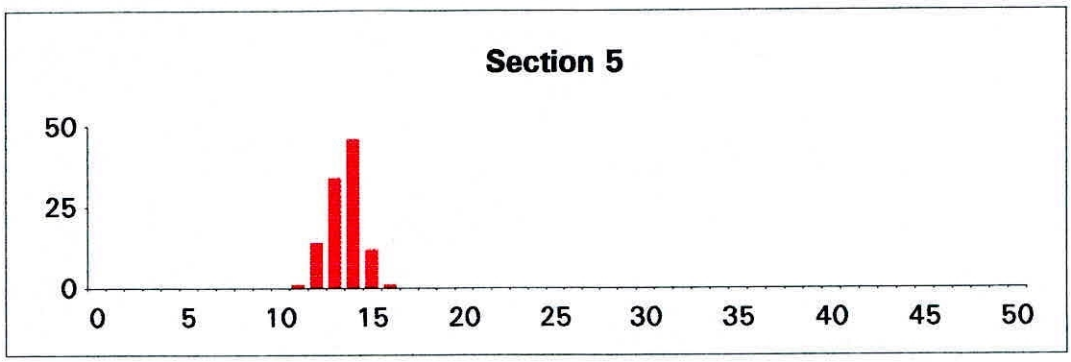
Appendix 2. Number of older fish of each species caught during the fry survey in 1994.

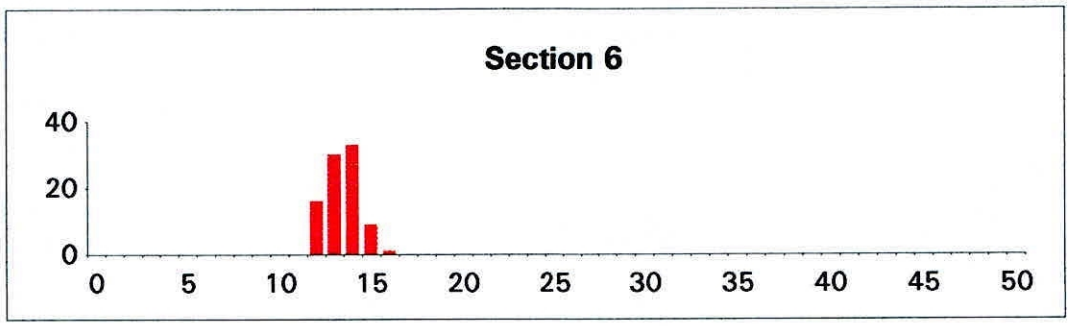
Section	Chub	Roach	Minnow	Gudgeon	Flounder	Dace	Barbel	Stone loach	3 spined stickleback
2									
4						1			
5									
6			2						
7									
8									
9									
10									
12			16			3			
14			1						
15	1		11			1			
16			4	4					
18			1					1	
19			5						3
20			52					1	
21			2					1	
ORSU1									
Total	1	0	94	4	0	5	0	3	3

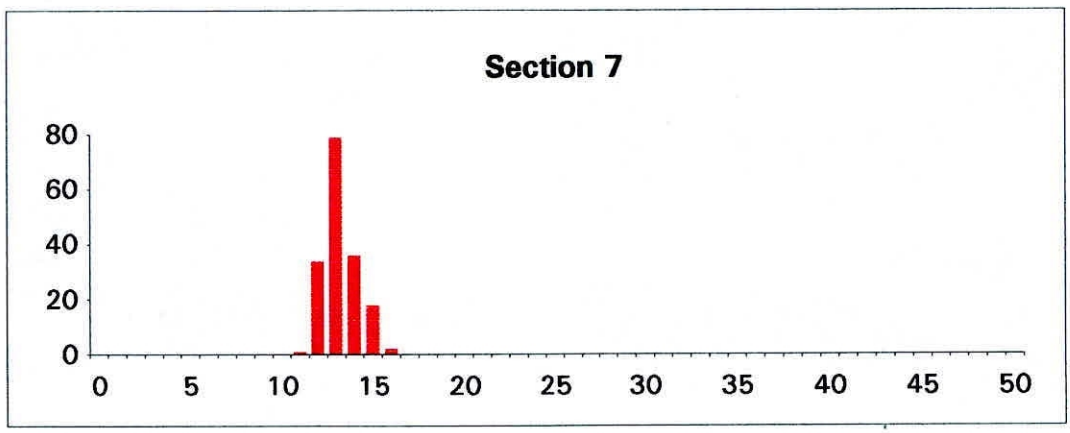
Appendix 3 Length frequency distribution of dace fry in each section of the R.Tees in June 1994.

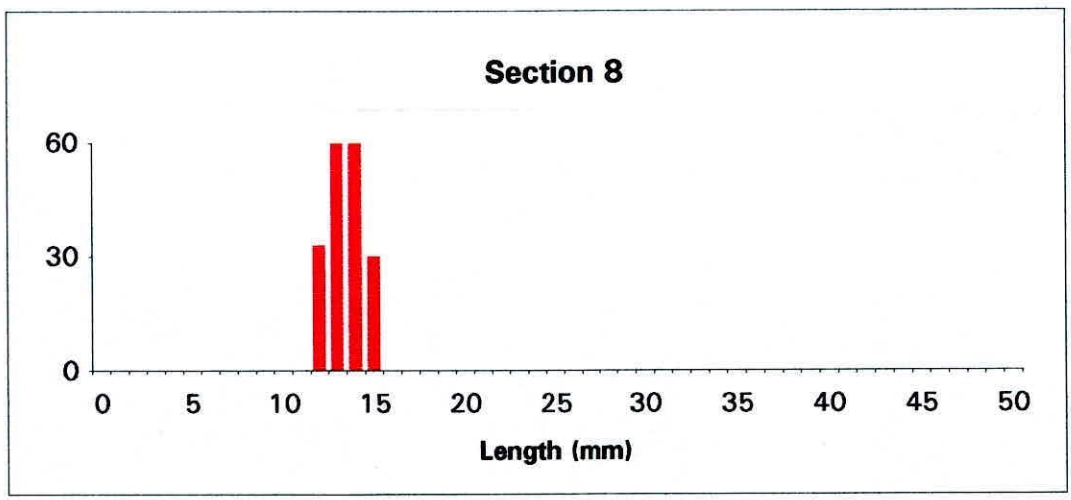


Appendix 3 Continued.

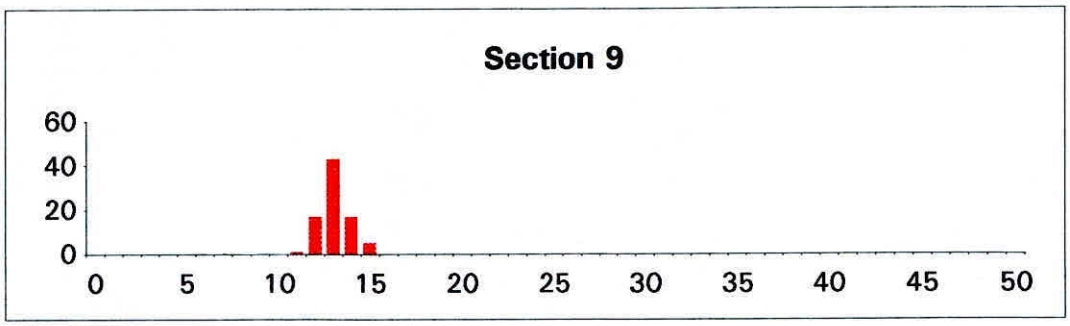


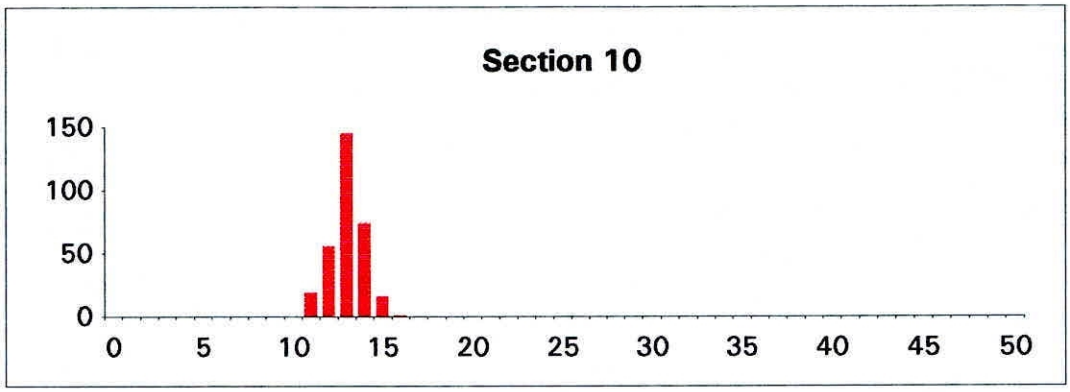


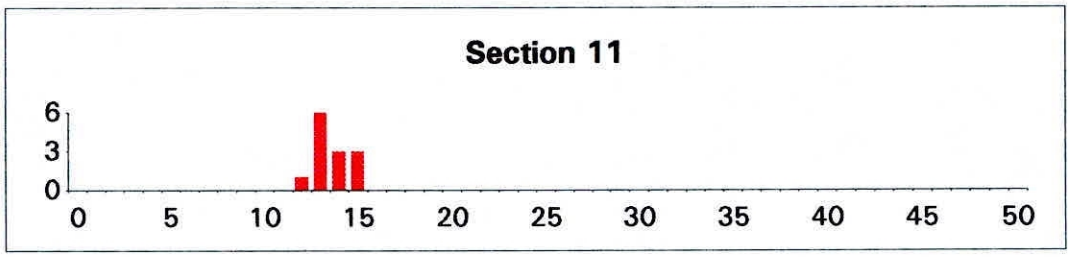


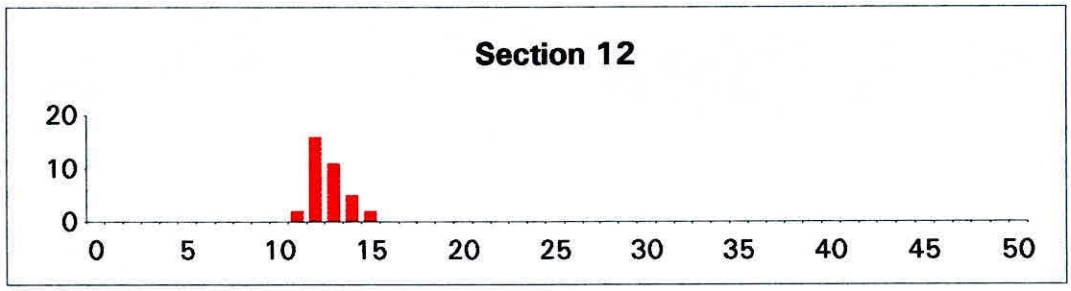


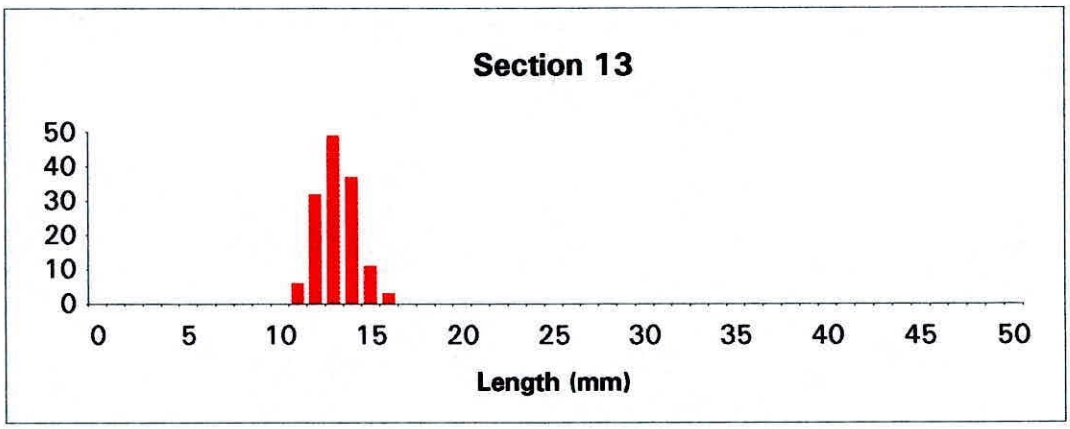
Appendix 3 Continued.



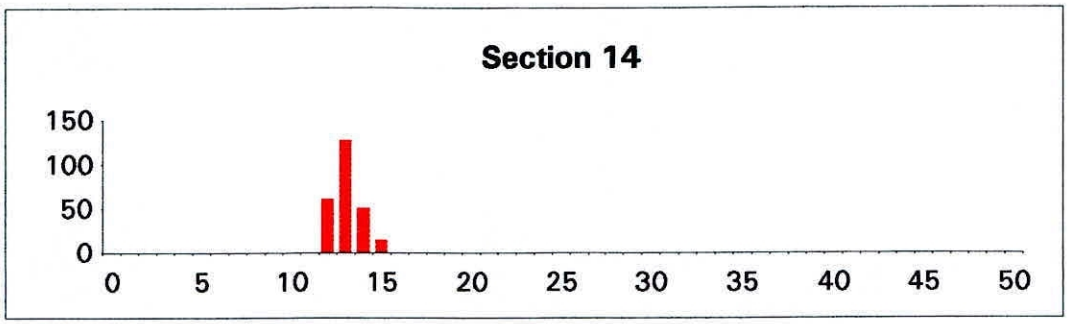


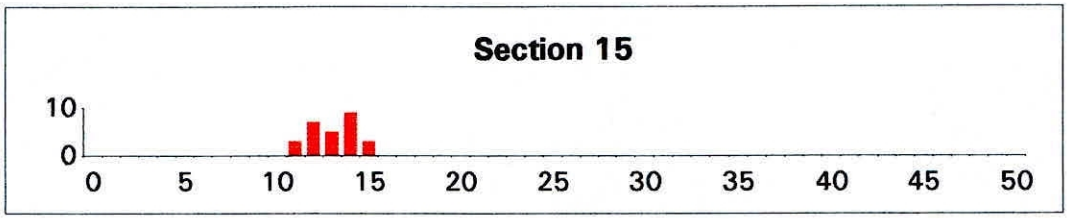


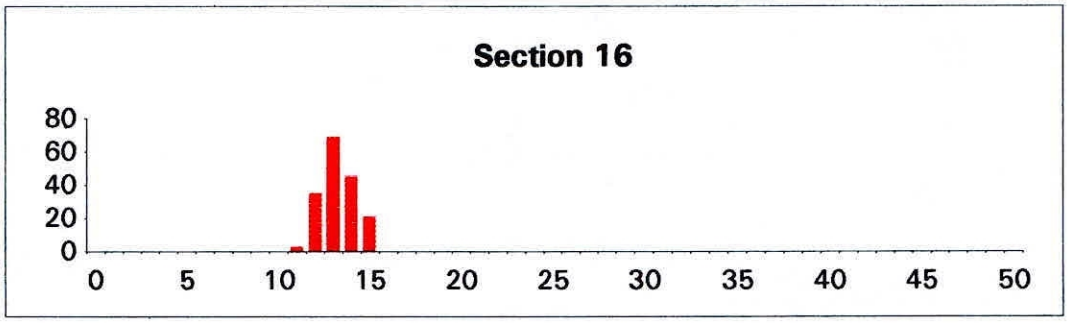


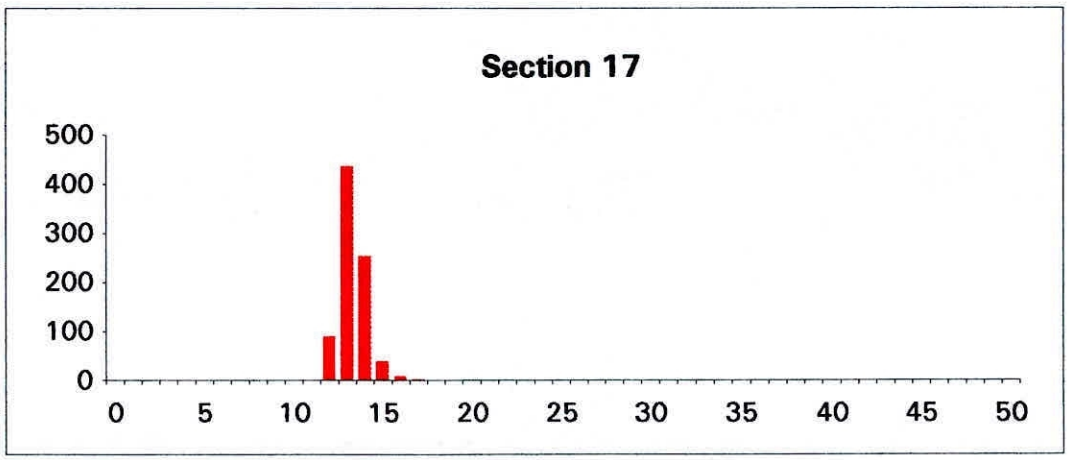


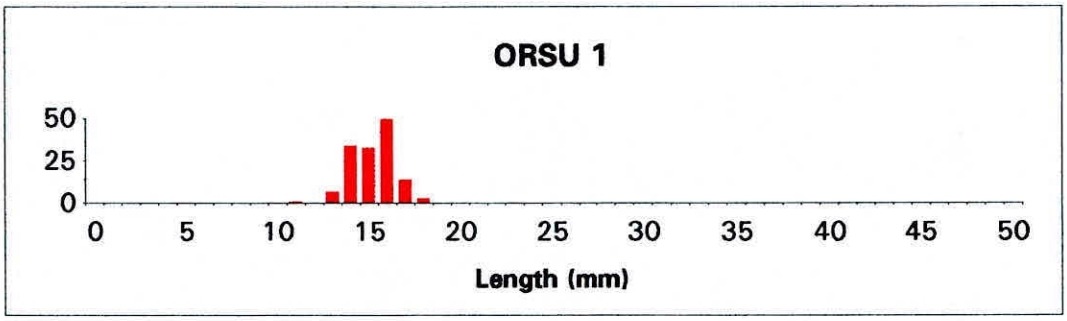
Appendix 3 Continued.



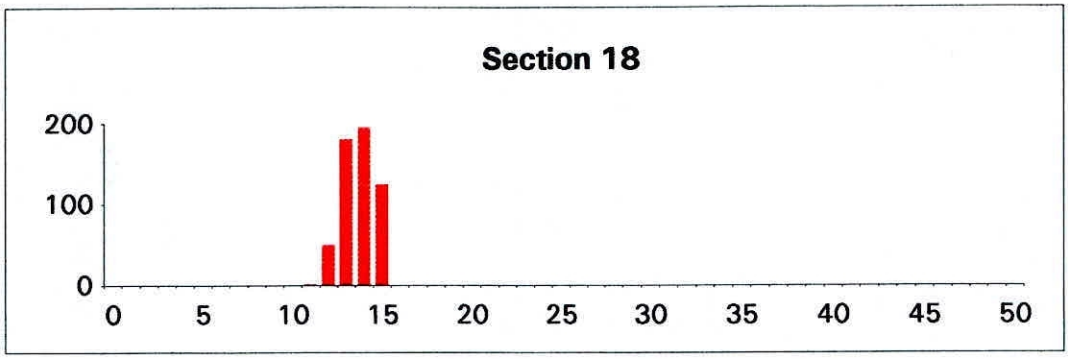


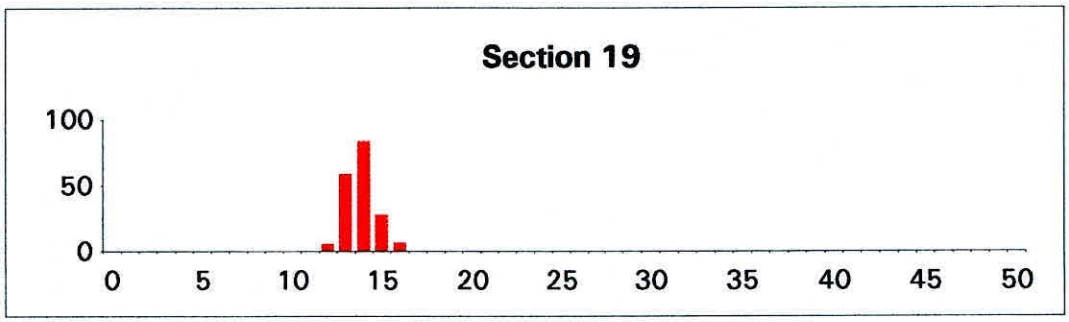


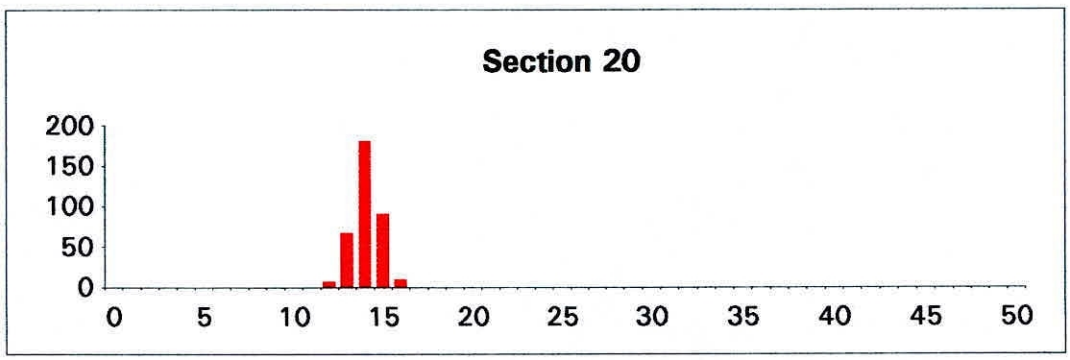


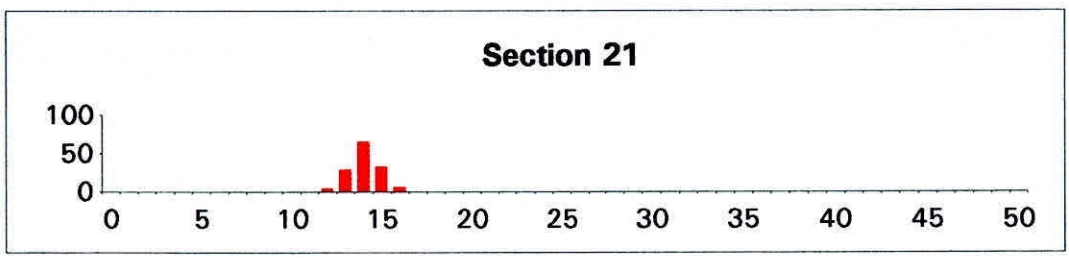


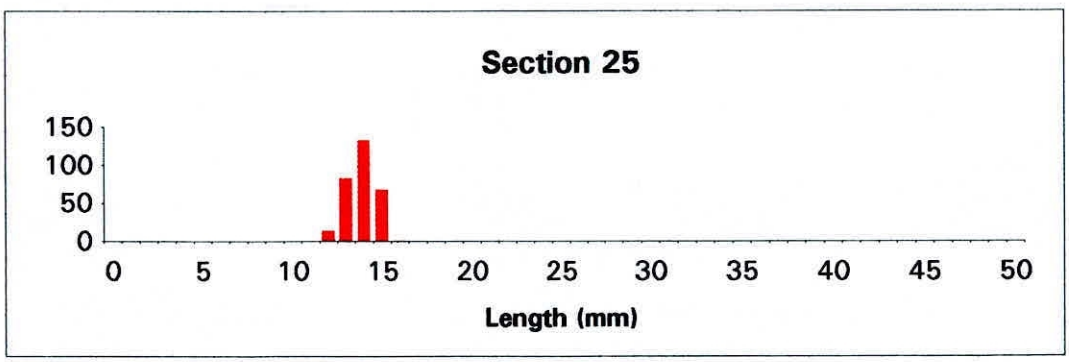
Appendix 3 Continued.



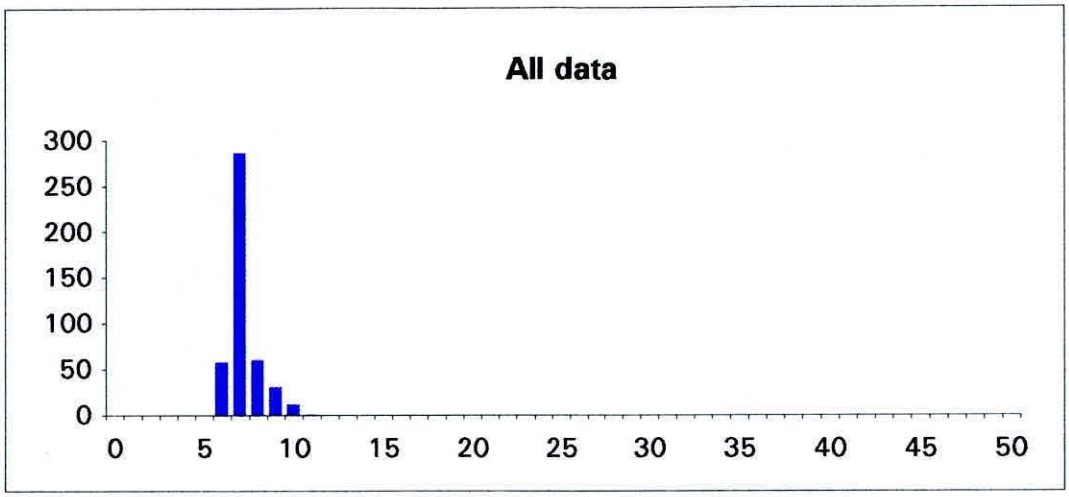


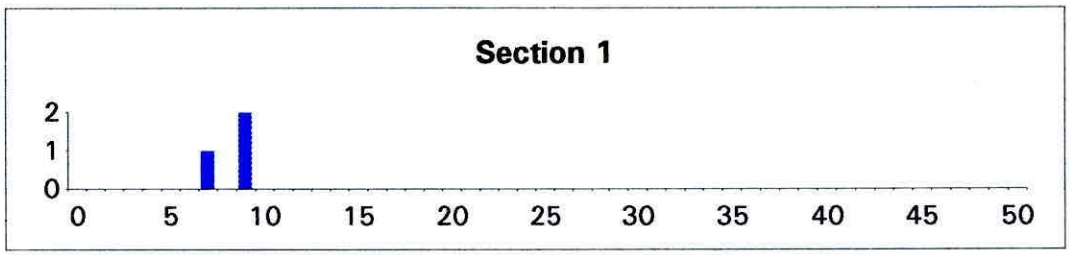


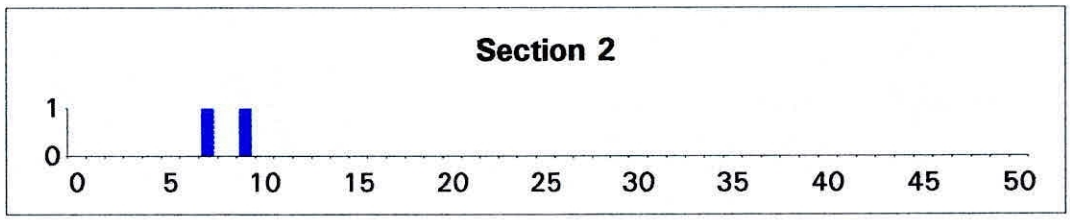


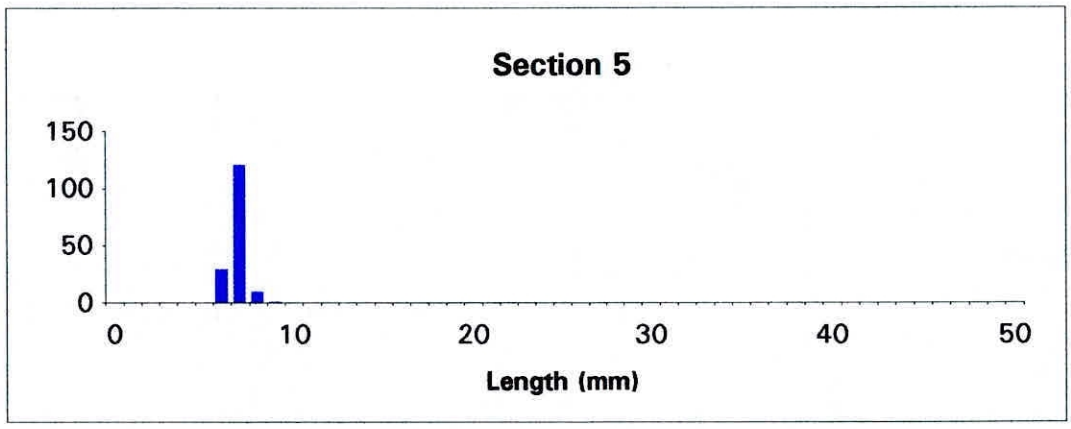


Appendix 4 Length frequency distribution of chub fry in each section of the R. Tees in June 1994.

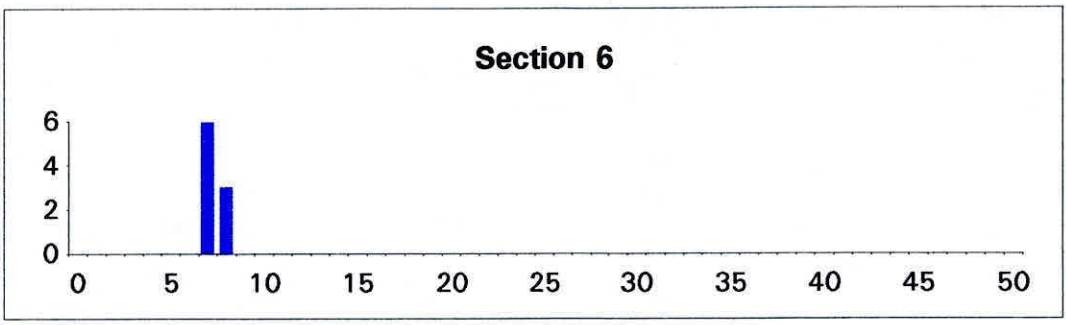


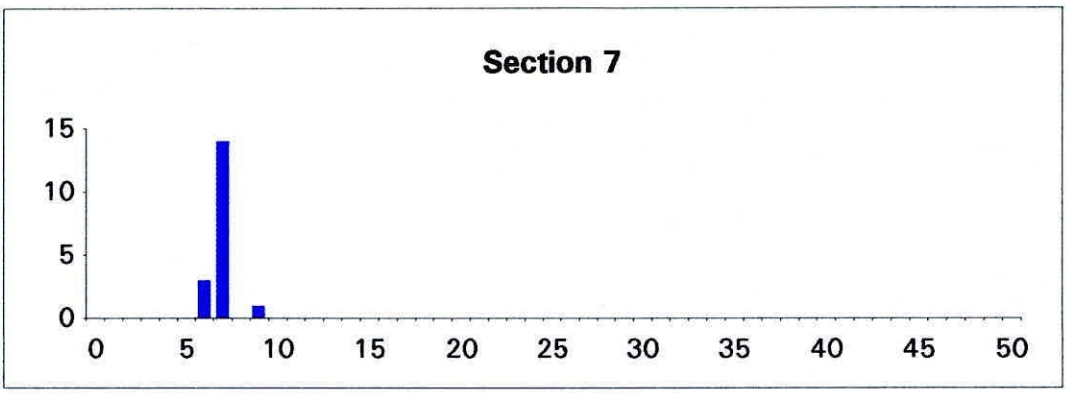


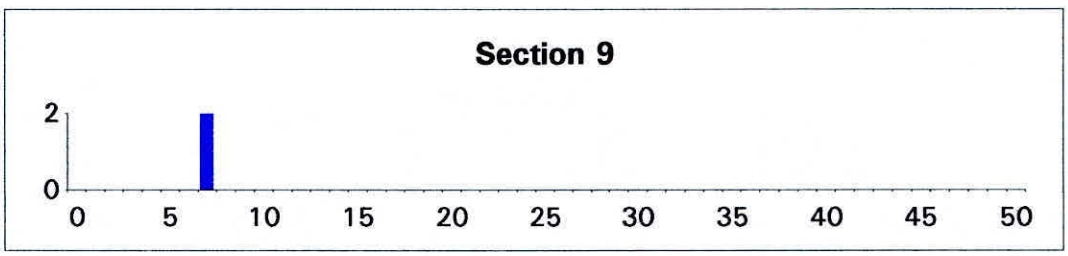


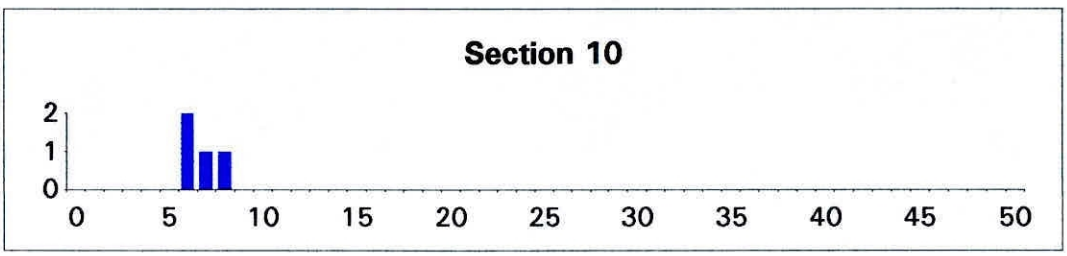


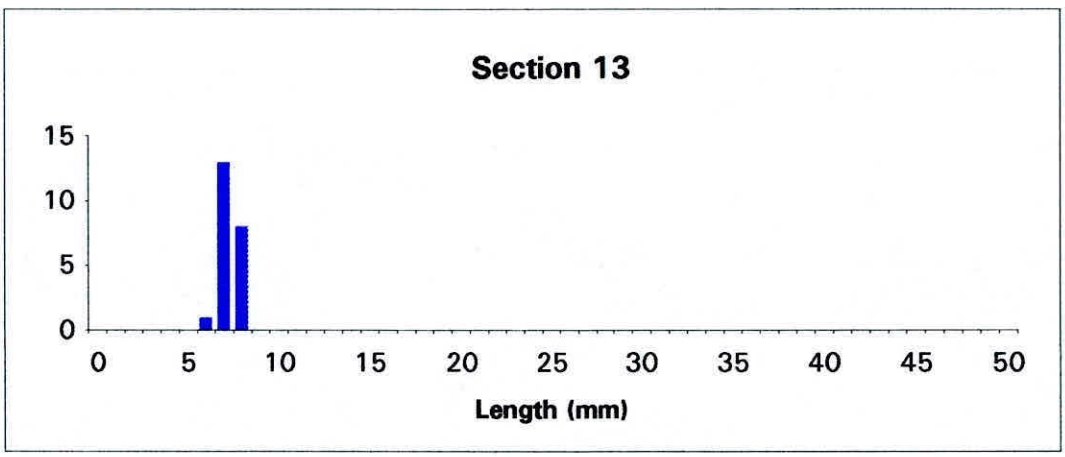
Appendix 4 Continued.



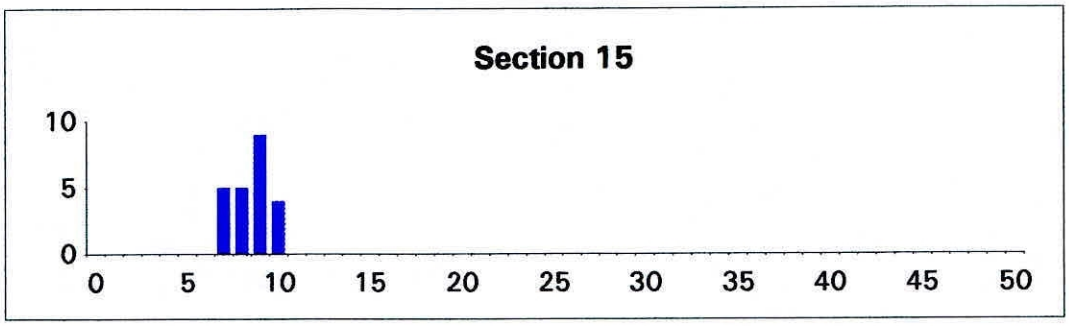


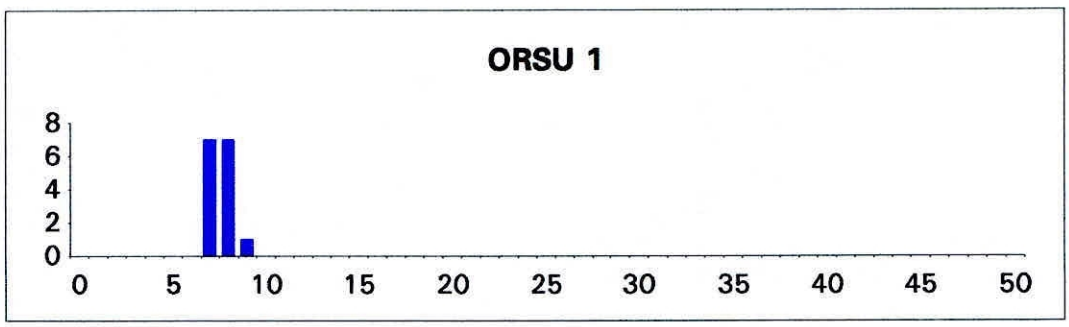


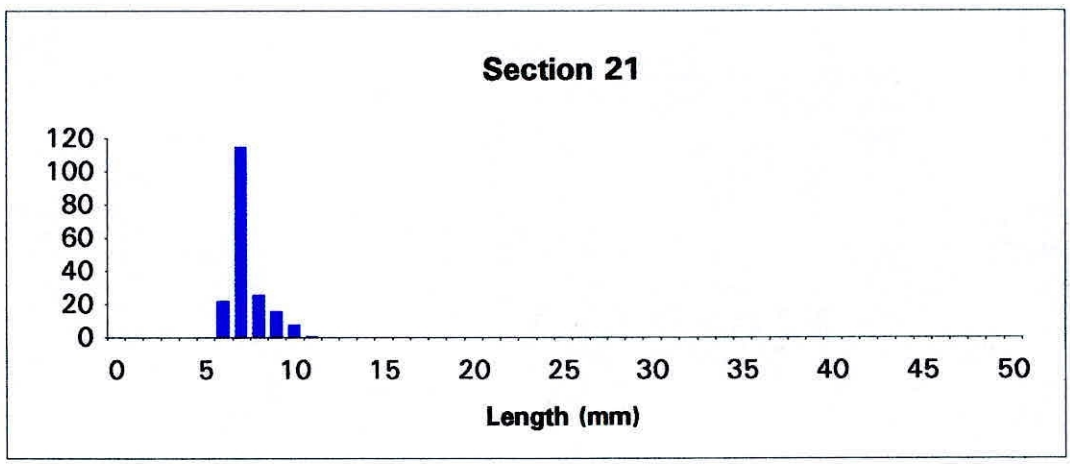




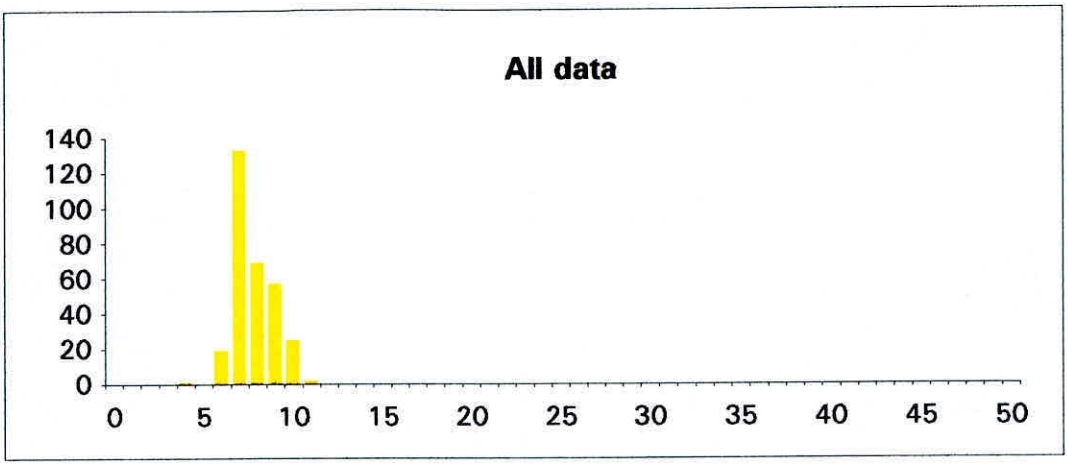
Appendix 4 Continued.

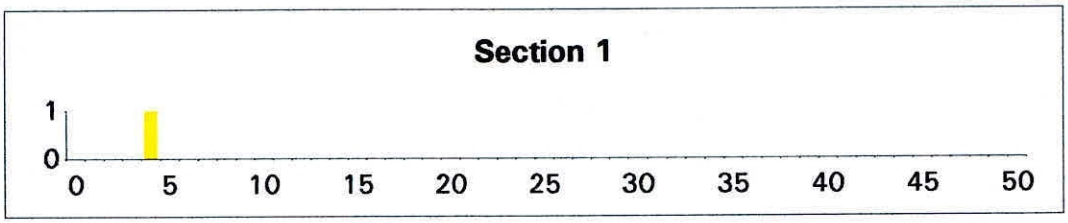


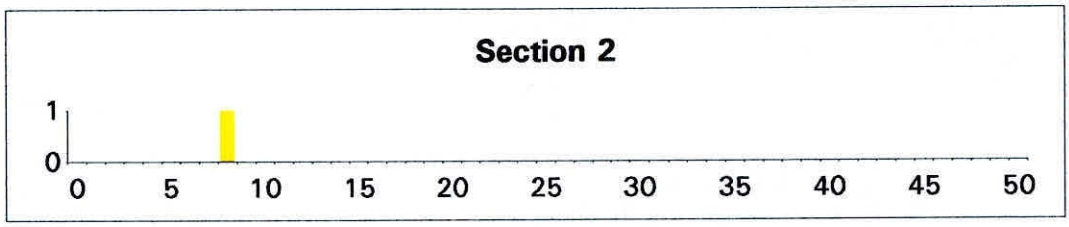


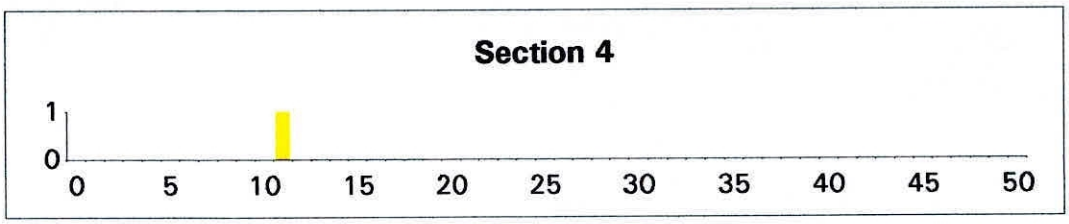


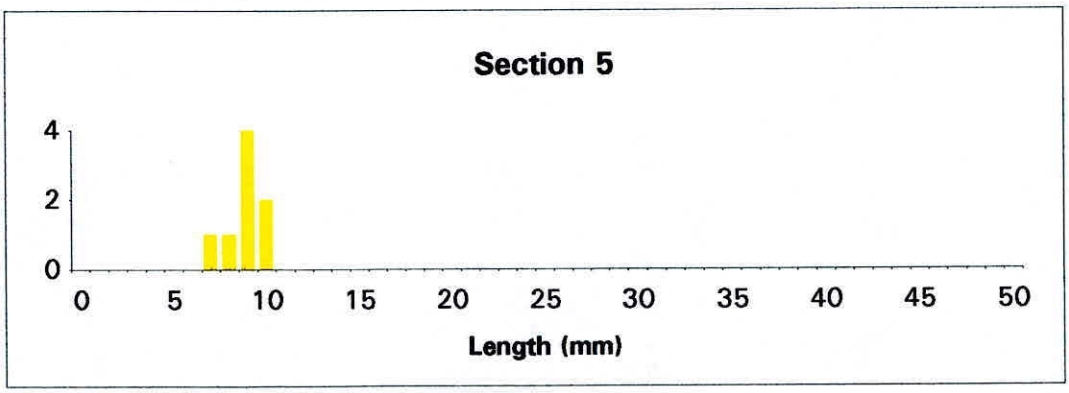
Appendix 5 Length frequency distribution of roach fry in each section of the R. Tees in June 1994.



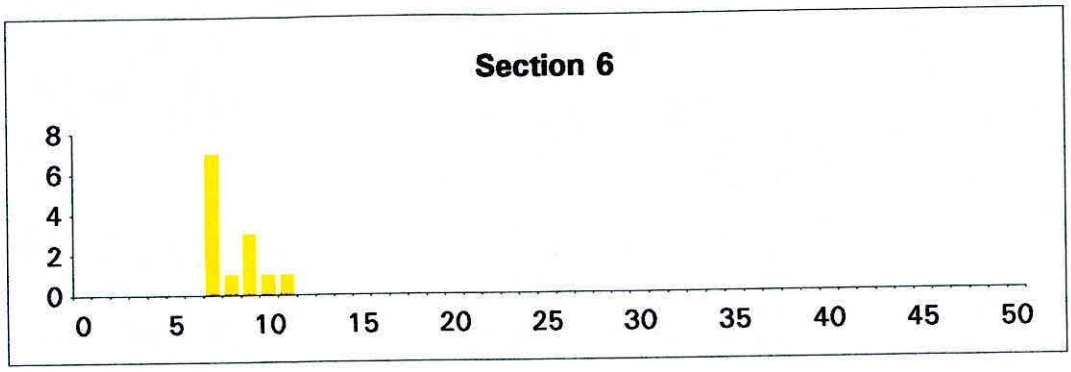


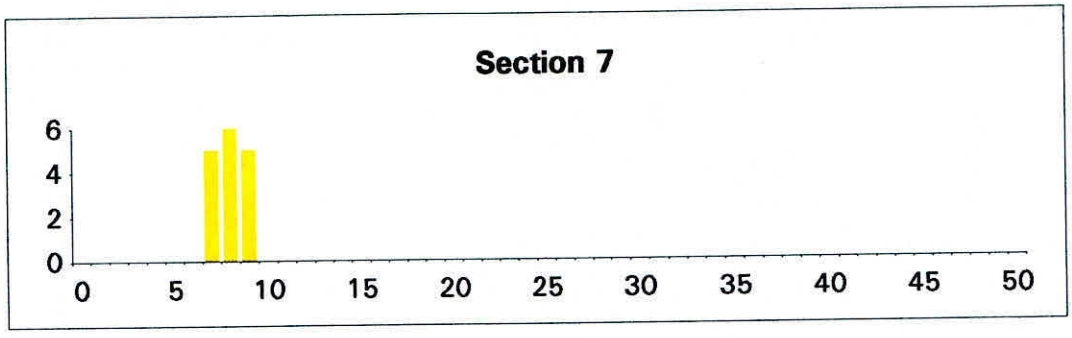


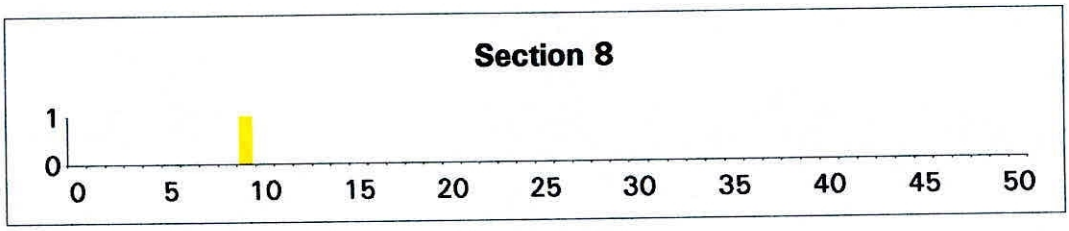


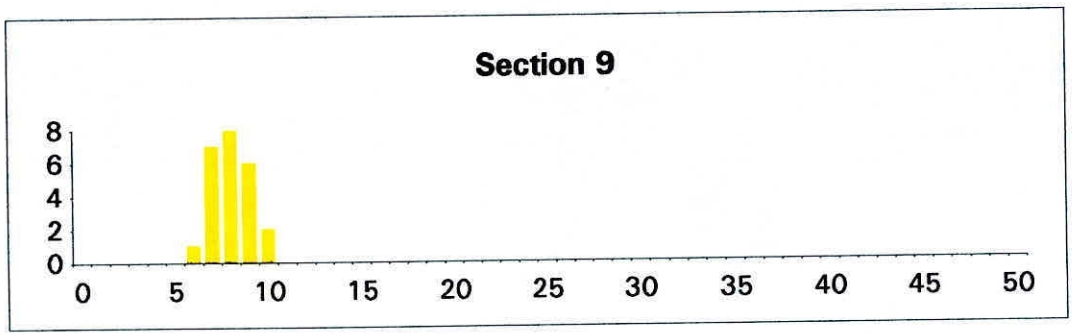


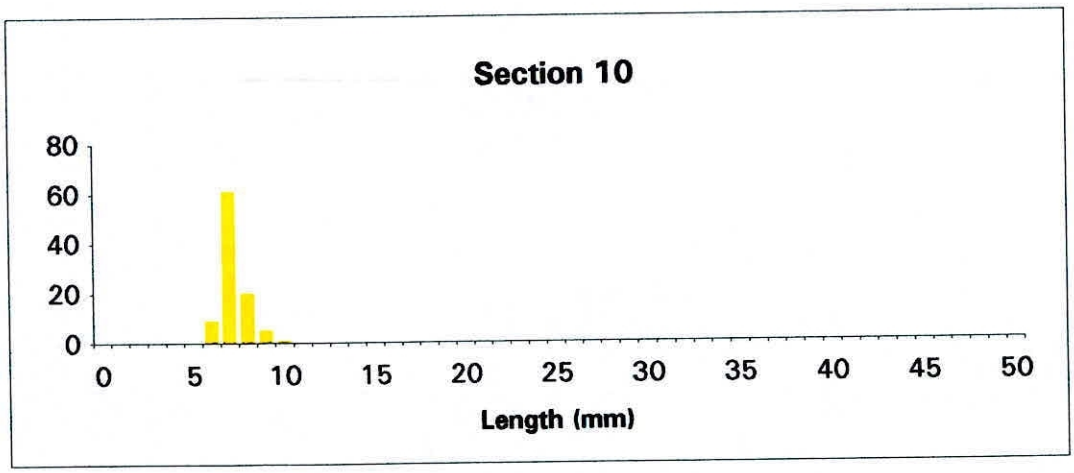
Appendix 5 Continued.



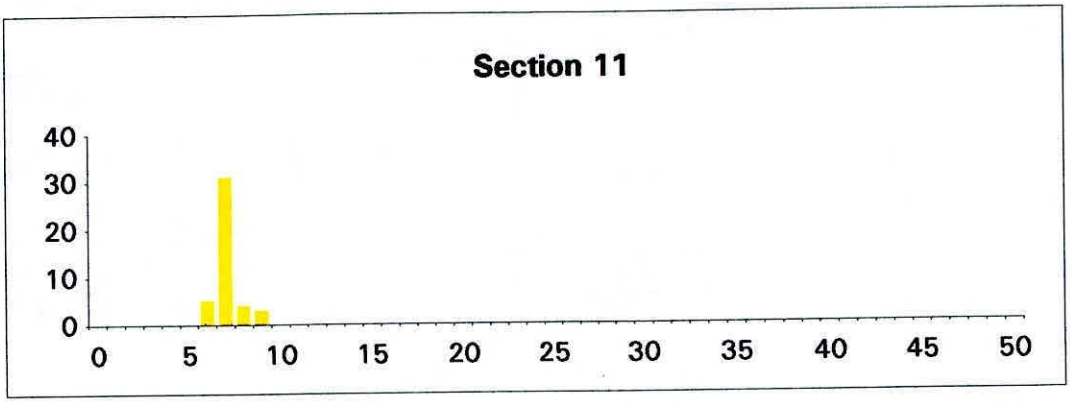


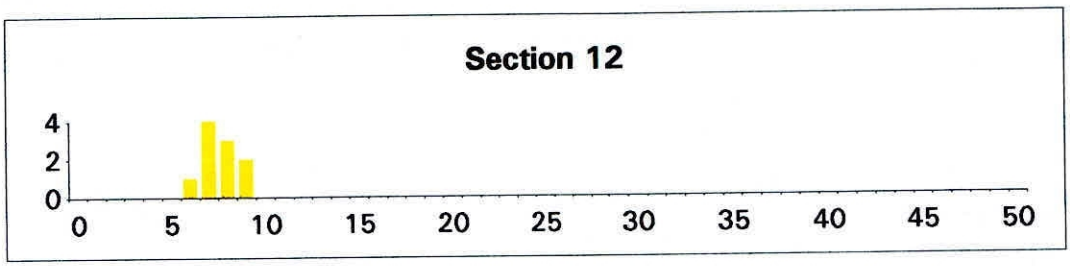


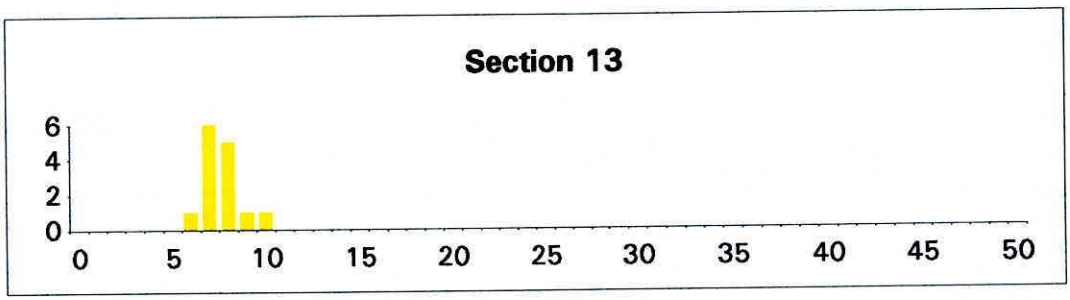


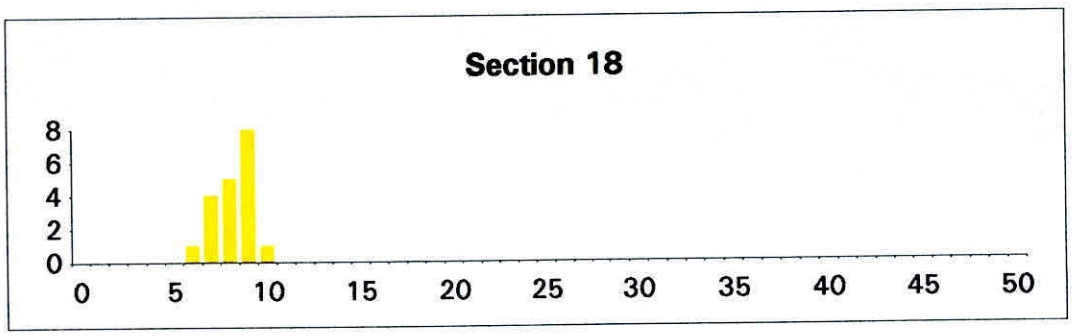


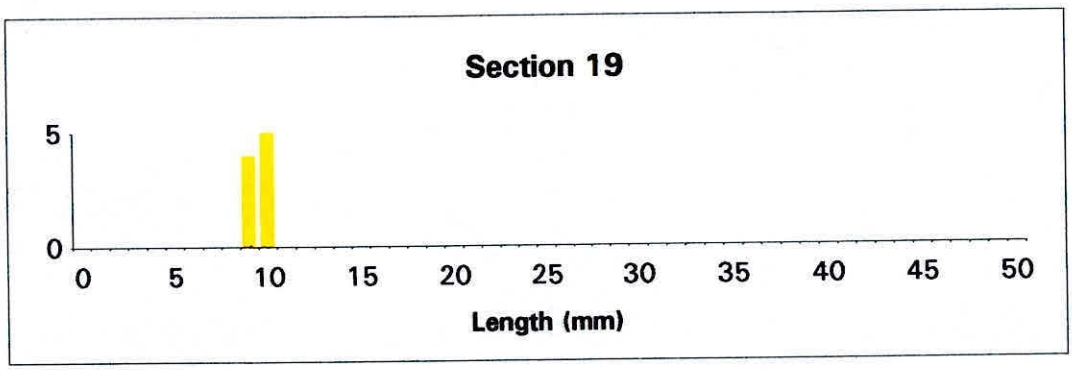
Appendix 5 Continued.



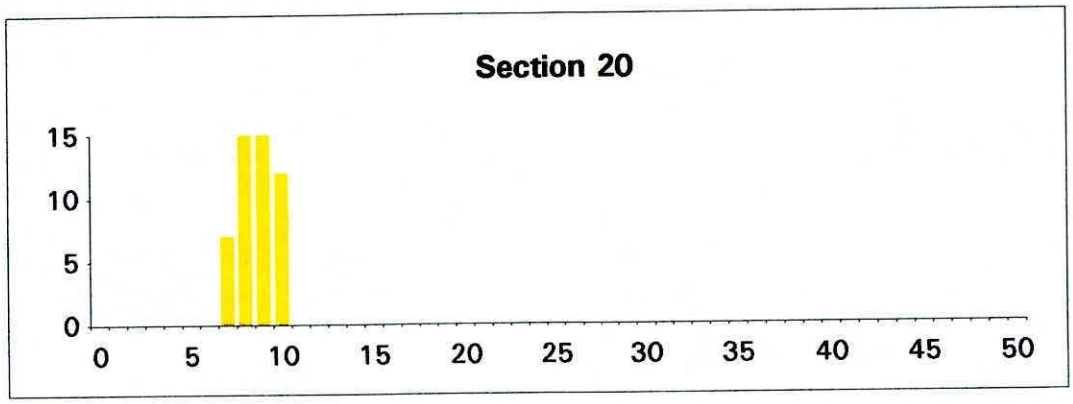


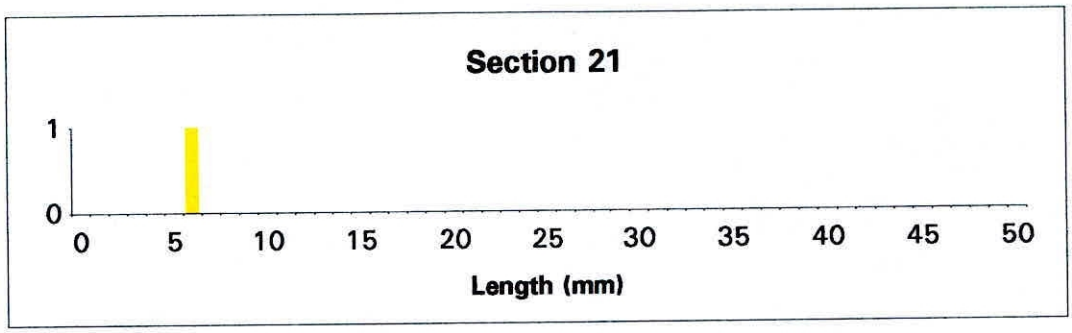






Appendix 5 Continued.





Appendix 6. Site descriptions and details of fish caught.

SECTION 3

Date fished	4 September 1994
Area	Bend below Great Holme to bend below pipe bridge
Length	800 m
NGR	NZ434154 - NZ441157
State of tide	Ebbing to low water and flooding
Time	10.45-13.00
Fishing method	Boom boat
Site description	River lined with reeds. Meadows, few trees.

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)	1	3.2
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	14	4.1-31.9
Dace *Leuciscus leuciscus* (L.)	218	3.8-24.2
Flounder *Platichthys flesus* (L.)	84	10.0-35.5
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)		
Minnow *Phoxinus phoxinus* (L.)	2	4.7-6.3
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	57	3.5-21.2
Salmon *Salmo salar* L.	1	18.3
Stone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.	12	4.6
Trout (brown) *Salmo trutta* L.		
Eel *Anguilla anguilla* L.	4	
Sea trout *Salmo trutta* L.	3	35.2-48.5

SECTION 4

Date fished	4 September 1994
Area	The Rings and Great Holmes
Length	2280 m
NGR	NZ431147 - NZ434154
State of tide	Flooding to high springs and then ebbing
Time	14.30-17.30
Fishing method	Boom boat
Site description	High banks with meadows and few trees. River lined with reeds.

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)		
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	20	3.0-28.9
Dace *Leuciscus leuciscus* (L.)	394	4.6-21.5
Flounder *Platichthys flesus* (L.)	19	11.7-34.5
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)	10	12.0-15.3
Minnow *Phoxinus phoxinus* (L.)		
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	135	2.5-20.6
Salmon *Salmo salar* L.		
Stone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.	4	17.5-33.0
Eel *Anguilla anguilla* L.	5	

SECTION 5

Date fished	1 September 1994
Area	Downstream of R. Leven - start of The Rings
Length	1840 m
NGR	NZ365105 - NZ431147
State of tide	Flooding
Time	12.00-13.00
Fishing method	Boom boat
Site description	High banks with meadows. Some trees and shrubs on the banks, very few overhanging the water. High wooded banks at the bottom of the section.

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)		
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	2	14.1-16.0
Dace *Leuciscus leuciscus* (L.)	7	11.0-22.4
Flounder *Platichthys flesus* (L.)		
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)	3	12.5-14.2
Minnow *Phoxinus phoxinus* (L.)		
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)		15.8-19.3
Salmon *Salmo salar* L.	1	97.5
Stone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.	1	19.8
Eel *Anguilla anguilla* L.	<10	

SECTION 6

Date fished	1 September 1994
Area	River Leven - large bend upstream
Length	1240 m
NGR	NZ423122 - NZ430130
State of tide	Flooding to high water and ebbing
Time	13.30-14.10 and 14.20-14.30
Fishing method	Boom boat
Site description	High banks. Overhanging trees on south bank. Open land on north bank.

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)		
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	17	3.9-28.4
Dace *Leuciscus leuciscus* (L.)	146	4.3-21.0
Flounder *Platichthys flesus* (L.)	2	15.0-21.4
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)		
Minnow *Phoxinus phoxinus* (L.)		
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	2	3.2-11.5
Salmon *Salmo salar* L.		
Stone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.	1	39.5
Eel *Anguilla anguilla* L.	<10	

SECTION 7

Date fished	1 September 1994
Area	Upstream of Section 6 - Yarm road bridge
Length	1140 m
NGR	NZ418132 - NZ423122
State of tide	Slow ebb - low water and low slack - flooding
Time	09.45-10.30 and 10.45-11.40
Fishing method	Boom boat
Site description	High banks. Yarm on south bank. Open meadows on north bank.

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)		
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	14	3.1-27.1
Dace *Leuciscus leuciscus* (L.)	297	4.1-21.2
Flounder *Platichthys flesus* (L.)	11	7.5-27.1
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)		
Minnow *Phoxinus phoxinus* (L.)	11	3.8-6.8
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	10	2.9-4.4
Salmon *Salmo salar* L.		
Sone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.		
Eel *Anguilla anguilla* L.	21	

SECTION 8

Date fished	1 September 1994
Area	Yarm road bridge - Yarm railway bridge
Length	80 m
NGR	NZ417132 - NZ418132
State of tide	Ebbing
Time	15.30-15.45
Fishing method	Boom boat
Site description	High banks. Gravel bar on south bank. Water otherwise deep.

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)	2	27.5-28.9
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	3	3.6-8.0
Dace *Leuciscus leuciscus* (L.)	128	4.2-23.7
Flounder *Platichthys flesus* (L.)		
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)	1	9.2
Minnow *Phoxinus phoxinus* (L.)	4	3.4-7.2
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	14	3.9-22.2
Salmon *Salmo salar* L.		
Stone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.		
Eel *Anguilla anguilla* L.	1	

SECTION 9

Date fished	Not fished - too many anglers on each occasion in the vicinity
Area	Yarm railway bridge - upstream to outfall on north bank
Length	300 m
NGR	NZ415131 - NZ417132
State of tide	
Time	
Fishing method	
Site description	Flood defence construction on south bank. On north, high bank with bushes and herbaceous vegetation.

SECTION 10

Date fished	1 September 1994 and 5 September 1994
Area	Upstream of section 9 - downstream of section 11
Length	560 m
NGR	NZ415122 - NZ415131
State of tide	Ebbing on both occasions
Time	16.15-16.45 and 09.15-9.50
Fishing method	Boom boat
Site description	High banks. Thin line of trees and shrubs on the north bank, more open on the south bank.

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)	1	25.2
Bullhead *Cottus gobio* L.	1	7.2
Chub *Leuciscus cephalus* (L.)	58	3.0-35.8
Dace *Leuciscus leuciscus* (L.)	207	4.4-23.1
Flounder *Platichthys flesus* (L.)	22	11.8-24.3
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)	24	8.8-15.5
Minnow *Phoxinus phoxinus* (L.)	16	3.3-6.3
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	20	2.6-17.4
Salmon *Salmo salar* L.	1	12.9
Stone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.	1	3.7
Trout (brown) *Salmo trutta* L.	2	17.5-26.7
Eel *Anguilla anguilla* L.	8	
Perch *Perca fluviatilis* L.	1	35.2

SECTION 11

Date fished	5 September 1994
Area	Aislaby at The Cabins - bend downstream
Length	840 m
NGR	NZ407123 - NZ415122
State of tide	Ebbing
Time	10.45-11.30
Fishing method	Boom boat
Site description	High banks. Wooded area

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)		
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	45	2.5-45.7
Dace *Leuciscus leuciscus* (L.)	82	3.5-10.0
Flounder *Platichthys flesus* (L.)	35	7.2-20.0
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)		
Minnow *Phoxinus phoxinus* (L.)	25	2.8-5.9
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	23	2.8-19.0
Salmon *Salmo salar* L.	1	68.5
Stone loach *Barbatula barbatula* (L.)	1	10.0
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.		
Eel *Anguilla anguilla* L.	14	

SECTION 12

Date fished	3 September 1994
Area	Aislaby at The Cabins - middle of 1st bend upstream
Length	440 m
NGR	NZ405120 - NZ407123
State of tide	Ebbing towards low water springs
Time	09.55-10.45
Fishing method	Boom boat
Site description	High banks, meadows with few overhanging trees

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)		
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	10	3.1-28.0
Dace *Leuciscus leuciscus* (L.)	313	4.2-20.0
Flounder *Platichthys flesus* (L.)	41	6.7-21.1
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)	7	12.0-13.6
Minnow *Phoxinus phoxinus* (L.)	13	3.2-6.8
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	41	2.4-14.1
Salmon *Salmo salar* L.	2	12.5-13.1
Stone loach *Barbatula barbatula* (L.)	1	7.7
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.		
Eel *Anguilla anguilla* L.	46	

SECTION 13

Date fished	3 September 1994
Area	Upstream of Aislaby, end of Section 12 - next bend upstream
Length	600 m
NGR	NZ404114 - NZ405120
State of tide	Low water springs
Time	11.30-13.00
Fishing method	Boom boat
Site description	High banks, meadows with few overhanging trees

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)	1	4.5
Bullhead *Cottus gobio* L.	1	6.5
Chub *Leuciscus cephalus* (L.)	39	2.4-47.2
Dace *Leuciscus leuciscus* (L.)	215	3.6-23.1
Flounder *Platichthys flesus* (L.)	80	14.5-30.0
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)	3	8.8-14.2
Minnow *Phoxinus phoxinus* (L.)	36	3.1-6.9
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	20	2.5-21.4
Salmon *Salmo salar* L.	2	13.2-69.0
Stone loach *Barbatula barbatula* (L.)	1	8.2
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.		
Eel *Anguilla anguilla* L.	73	

SECTION 14

Date fished	3 September 1994
Area	End of Section 13 - next bend upstream
Length	1040 m
NGR	NZ401105 - NZ404114
State of tide	Flooding from low water springs
Time	14.15-15.45
Fishing method	Boom boat
Site description	High banks, more wooded than sections 12 and 13. Deep water

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)	1	5.0
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	82	2.7-38.0
Dace *Leuciscus leuciscus* (L.)	280	3.4-19.6
Flounder *Platichthys flesus* (L.)	28	8.1-29.5
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)	1	5.0
Minnow *Phoxinus phoxinus* (L.)	39	2.7-6.8
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	22	2.6-18.7
Salmon *Salmo salar* L.		
Stone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.		
Sea Trout *Salmo trutta* L.		
Eel *Anguilla anguilla* L.	22	

SECTION 15

Date fished	5 September 1994
Area	Pumping station - bend downstream. Lower limit opposite upstream limit of section 14.
Length	580 m
NGR	NZ395103 - NZ401105
State of tide	Ebbing
Time	13.20-13.50
Fishing method	Boom boat
Site description	High banks, wooded section. Shallow water with gravel banks

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)		
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	70	2.5-29.8
Dace *Leuciscus leuciscus* (L.)	207	3.7-16.7
Flounder *Platichthys flesus* (L.)	34	11.9-31.3
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)	8	3.3-13.9
Minnow *Phoxinus phoxinus* (L.)	46	2.5-6.8
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	33	2.6-20.7
Salmon *Salmo salar* L.		
Stone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.	2	19.1-22.2
Eel *Anguilla anguilla* L.	20	

SECTION 16

Date fished	3 September 1994
Area	Lower Worsall - pumping station
Length	400 m
NGR	NZ392103 - NZ395103
State of tide	Ebbing from high water
Time	16.40-17.15
Fishing method	Boom boat
Site description	Banks less steep. Open meadows upstream with tree cover increasing downstream. Shallow water.

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)		
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	47	2.5-49.4
Dace *Leuciscus leuciscus* (L.)	136	3.6-21.4
Flounder *Platichthys flesus* (L.)	6	14.4-20.1
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)	1	14.6
Minnow *Phoxinus phoxinus* (L.)	17	2.4-6.5
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	8	11.5-24.1
Salmon *Salmo salar* L.	1	71.5
Stone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.		
Eel *Anguilla anguilla* L.	10	

SECTION 19

Date fished	2 September 1994
Area	Fardeneside Farm to top of second island upstream.
Length	200 m
NGR	NZ371095 - NZ373095
State of tide	Not affected by the tide.
Time	09.30-11.30
Fishing method	Twin anode wading
Site description	Very high, steep, wooded banks. Uniform area downstream with little macrophyte cover but dense bushes on the bank overhanging the water.

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)	6	4.0-4.8
Chub *Leuciscus cephalus* (L.)	22	3.0-27.5
Dace *Leuciscus leuciscus* (L.)	119	4.4-19.9
Flounder *Platichthys flesus* (L.)	1	15.4
Grayling *Thymallus thymallus* (L.)		
Gudgeon *Gobio gobio* (L.)	3	4.2-5.0
Minnow *Phoxinus phoxinus* (L.)	52	2.4-9.0
Roach *Rutilus rutilus* (L.)	1	3.2
Rudd *Scardinius erythrophthalmus* (L.)		
Salmon *Salmo salar* L.		
Sea lamprey *Petromyzon marinus* L.		
Stone loach *Barbatula barbatula* (L.)	3	5.4-6.4
Trout (brown) *Salmo trutta* L.	4	20.0-28.8
Bullhead *Cottus gobio* (L.)		
Eel *Anguilla anguilla* L.	<10	

SECTION 21

Date fished	31 August 1994
Area	Downstream of ford below Low Moor weir
Length	260 m
NGR	NZ365106 - NZ376104
State of tide	Not affected by the tide
Time	15.00-16.30
Fishing method	Boom boat and twin anode wading
Site description	High banks with some trees on the south bank. Open meadows. A small number of willows overhanging the water on the north bank. Water generally up to 80 cm with deeper pools under overhanging trees. Substratum cobbles/gravel with fine organic sediment in areas of low flow.

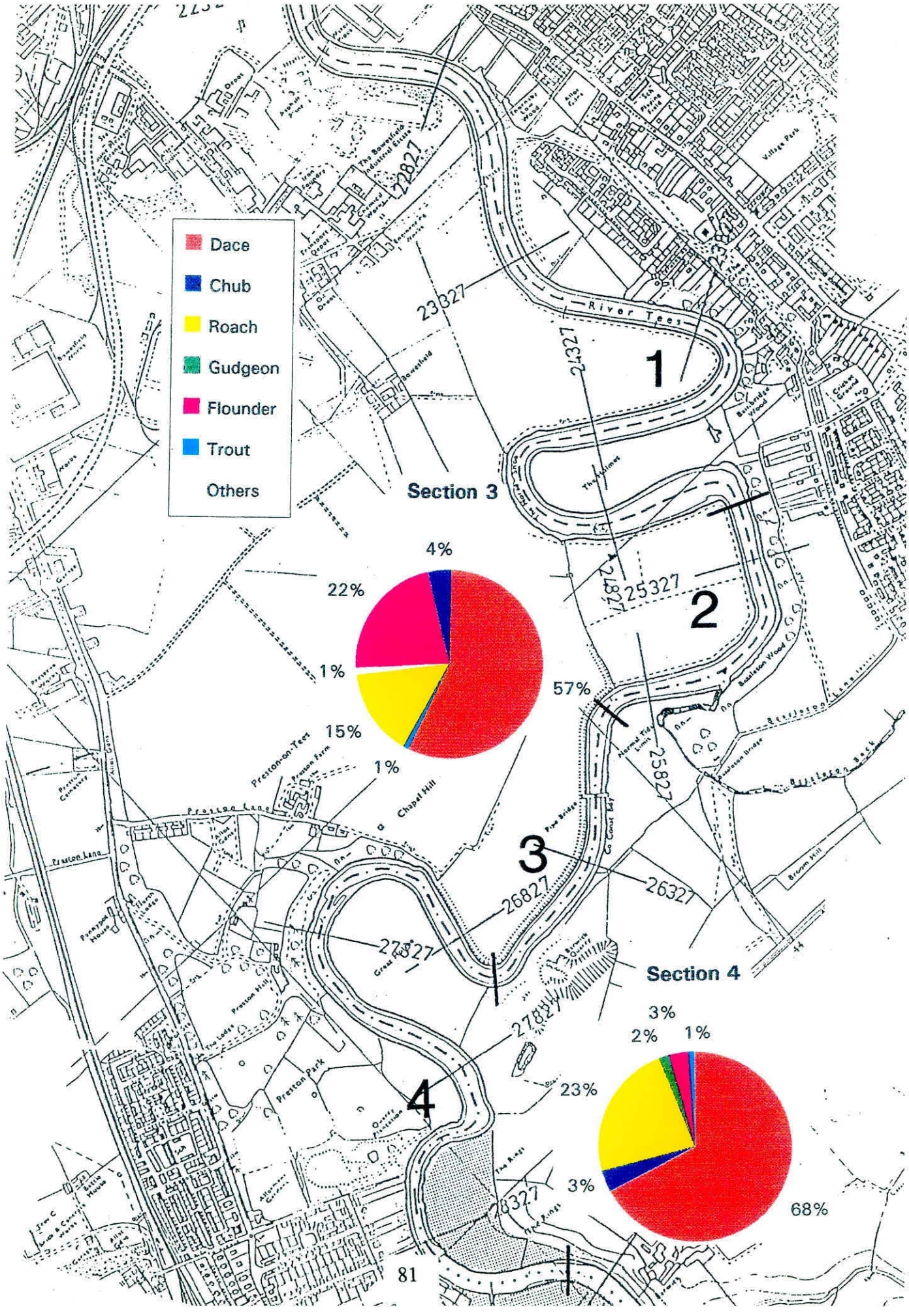
Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)	1	35.0
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	34	2.2-42.6
Dace *Leuciscus leuciscus* (L.)	92	3.1-22.3
Flounder *Platichthys flesus* (L.)	34	9.1-35.0
Grayling *Thymallus thymallus* (L.)	5	19.3-31.3
Gudgeon *Gobio gobio* (L.)	7	8.1-15.0
Minnow *Phoxinus phoxinus* (L.)	21	2.1-7.0
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	10	2.3-3.5
Salmon *Salmo salar* L.		
Stone loach *Barbatula barbatula* (L.)		
Three spined stickleback *Gasterosteus aculeatus* L.		
Trout (brown) *Salmo trutta* L.		
Eel *Anguilla anguilla* L.	25	
Pike *Esox lucius* L.	3	22.9-24.1

SECTION 25

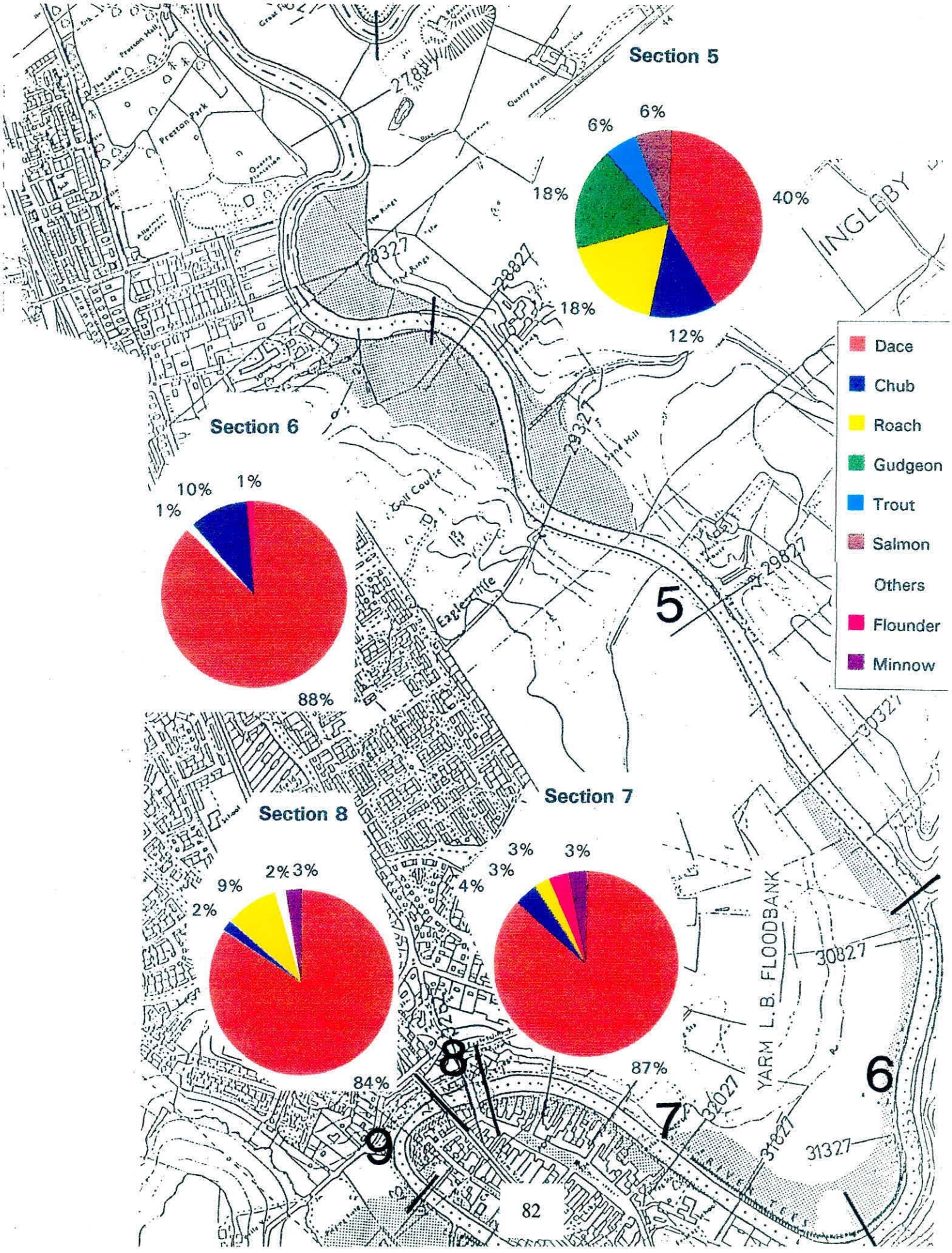
Date fished	31 August 1994
Area	Low Dinsdale toll bridge - first bend upstream
Length	350 m
NGR	NZ350113 - NZ345114
State of tide	Not influenced by the tide
Time	09.30-10.10 and 10.45-11.05
Fishing method	Twin anode wading
Site description	Fast flowing over bedrock. Gravel banks present in places usually near the bank. Very high wooded banks. Fallen trees in the water often with associated macrophyte debris.

Species	No. of individuals	Size range (cm)
Barbel *Barbus barbus* (L.)	1	38.5
Bullhead *Cottus gobio* L.		
Chub *Leuciscus cephalus* (L.)	20	1.6-38.2
Dace *Leuciscus leuciscus* (L.)	57	4.7-23.0
Flounder *Platichthys flesus* (L.)		
Grayling *Thymallus thymallus* (L.)	1	12.4
Gudgeon *Gobio gobio* (L.)	5	2.9-7.7
Minnow *Phoxinus phoxinus* (L.)	40	2.4-7.5
River Lamprey *Lampetra fluviatilis* (L.)		
Roach *Rutilus rutilus* (L.)	15	2.9-21.5
Salmon *Salmo salar* L.	1	16.6
Stone loach *Barbatula barbatula* (L.)	4	4.8-5.6
Three spined stickleback *Gasterosteus aculeatus* L.	1	3.7
Trout (brown) *Salmo trutta* L.	4	15.5-24.1
Eel *Anguilla anguilla* L.	21	

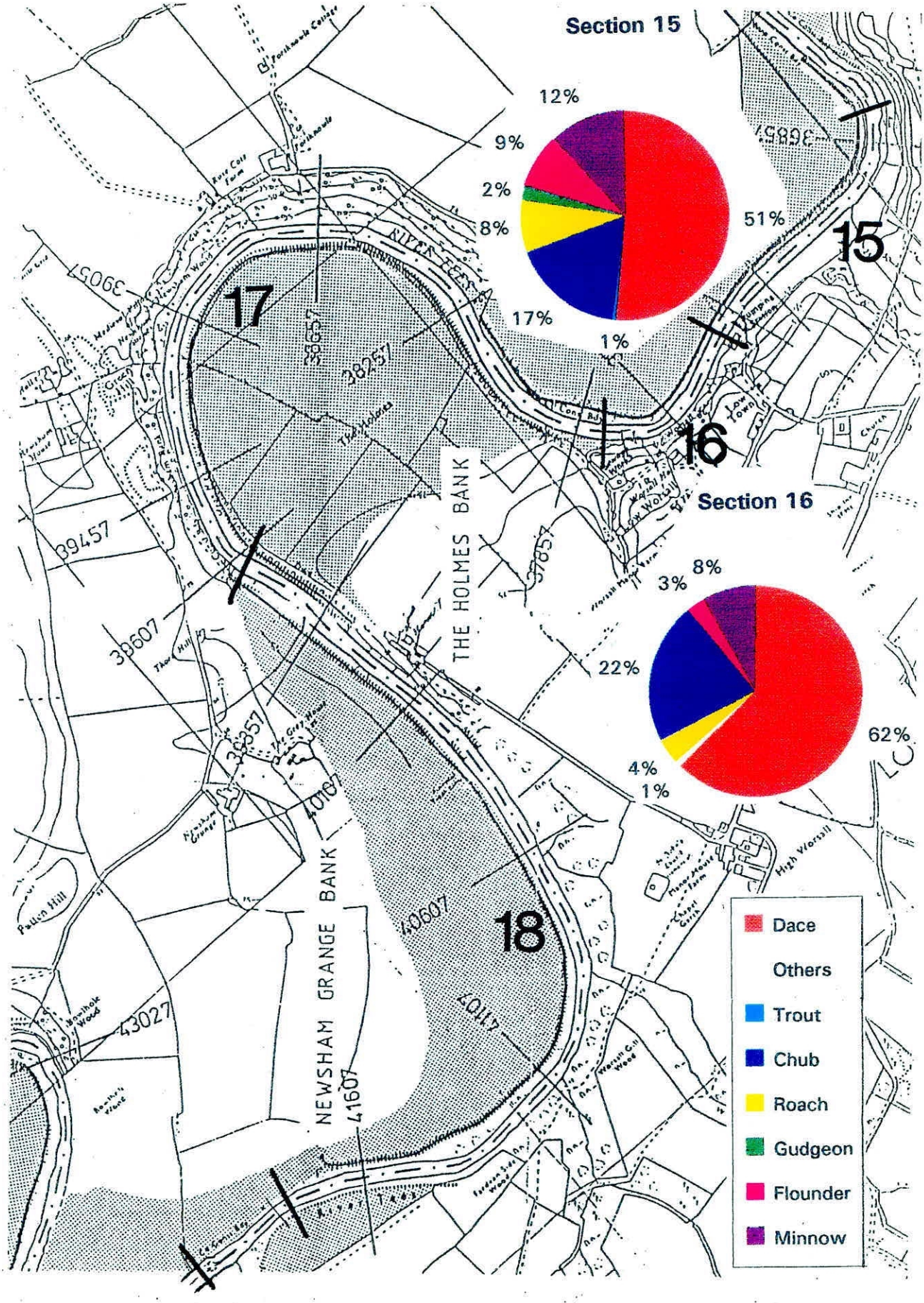
Appendix 7. Species composition of fish in each section in September 1994.



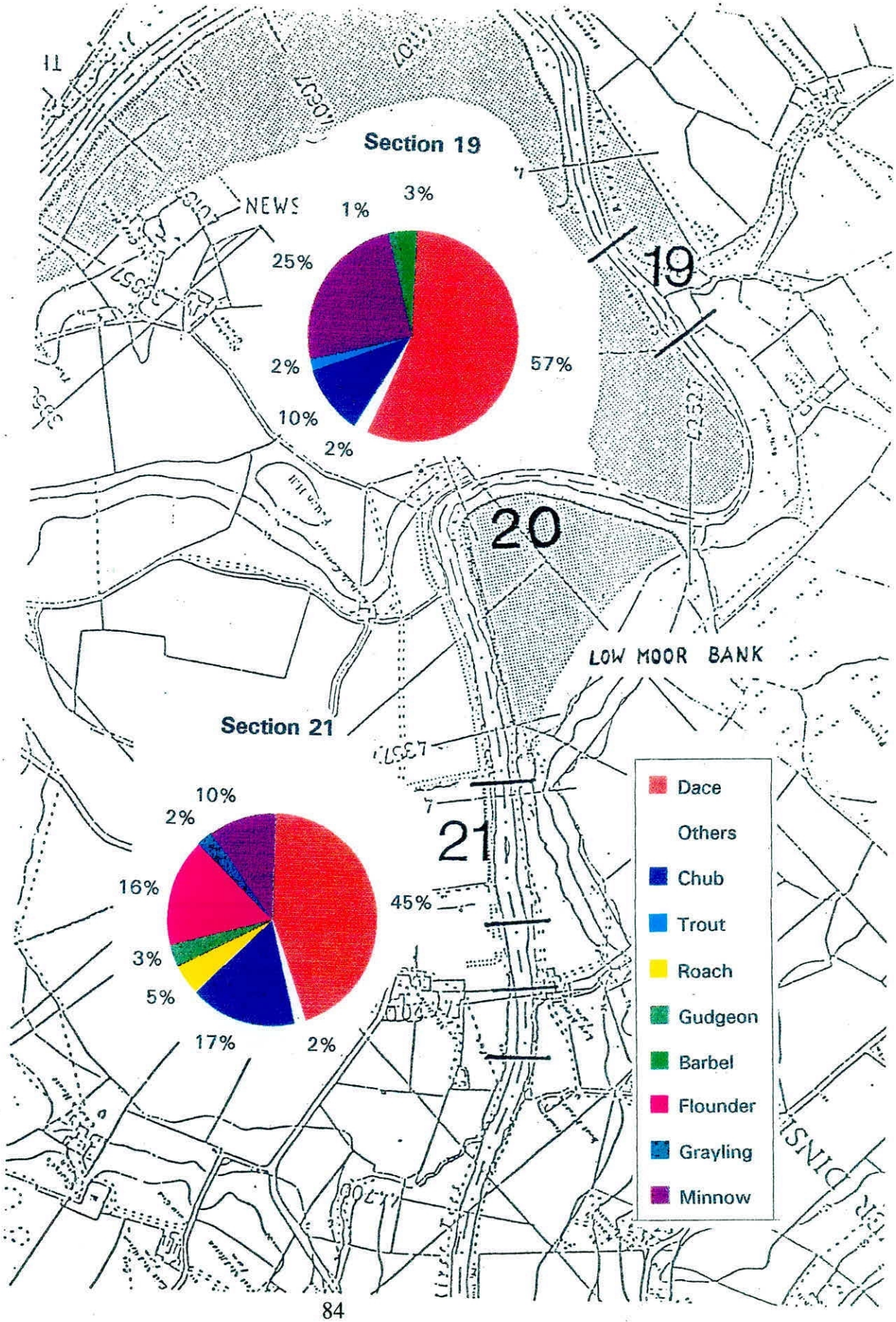
Appendix 7 continued



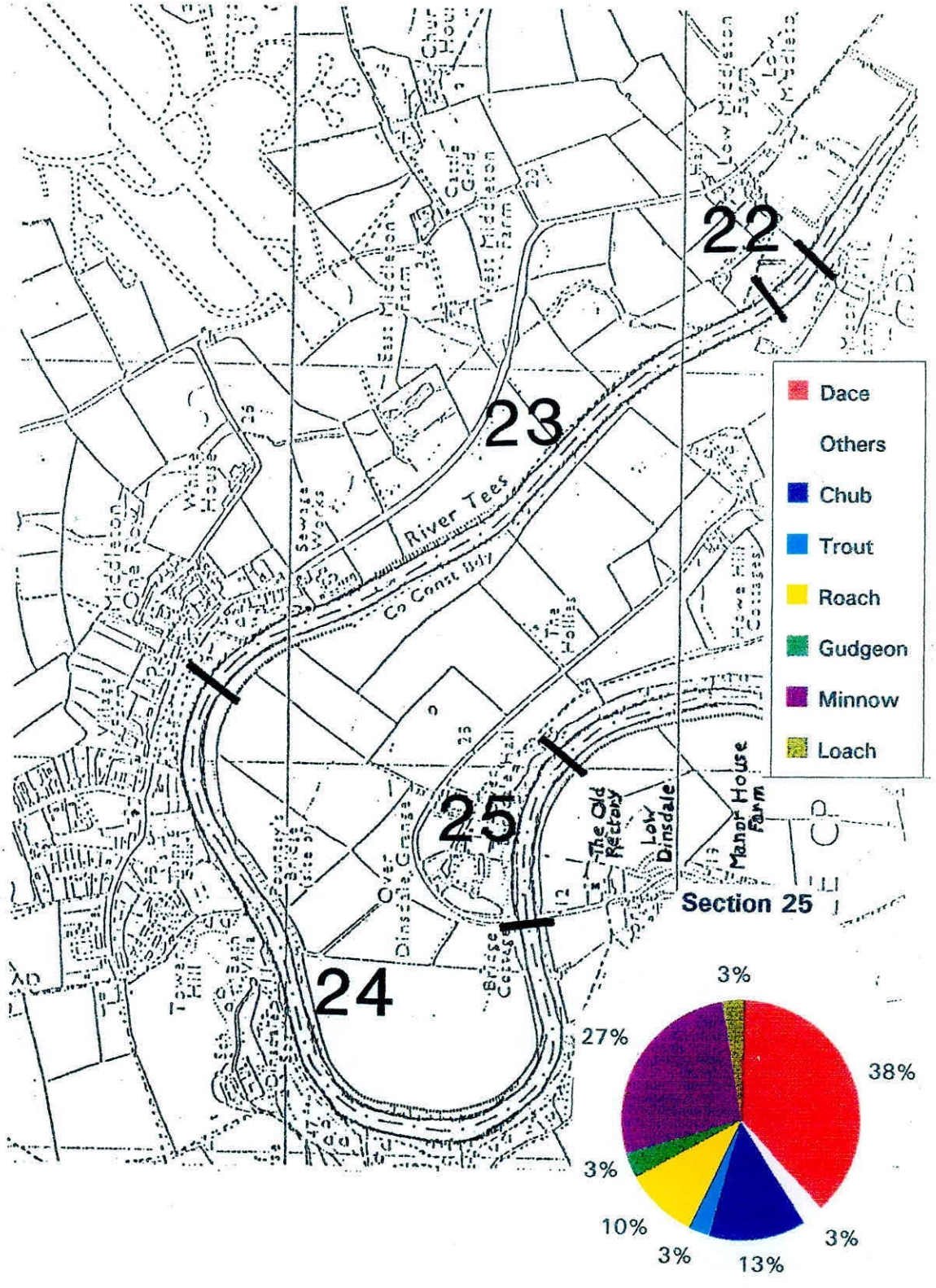
Appendix 7 continued



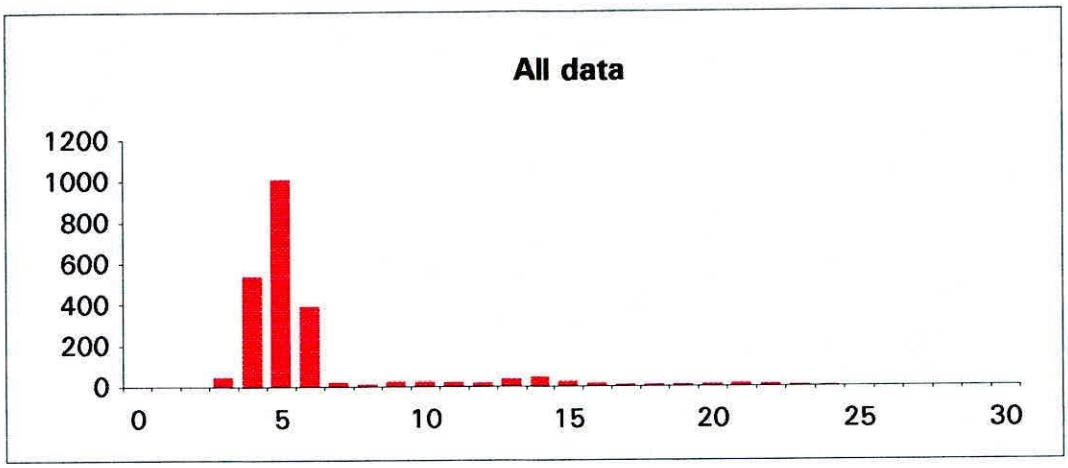
Appendix 7 continued

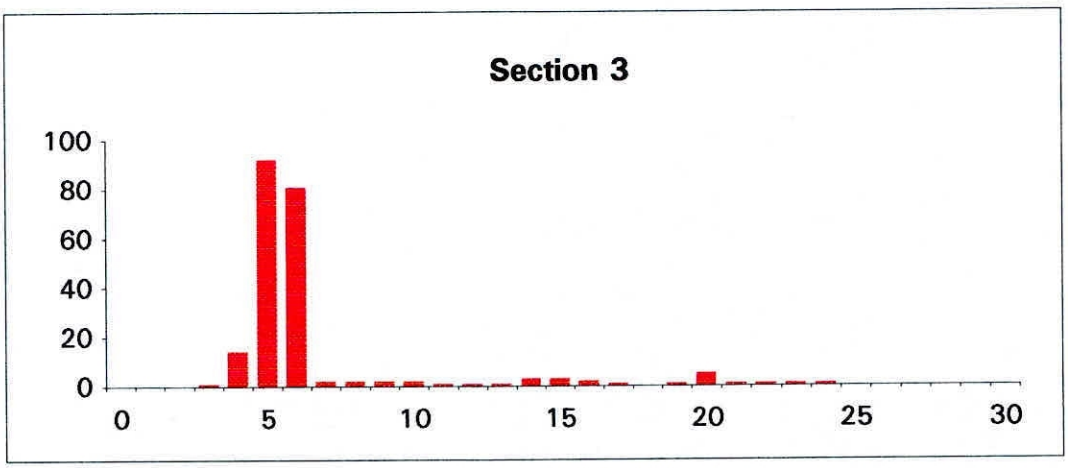


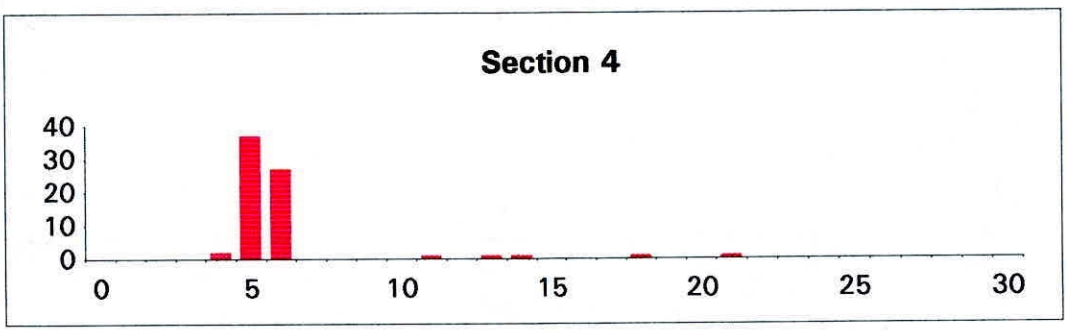
Appendix 7 continued

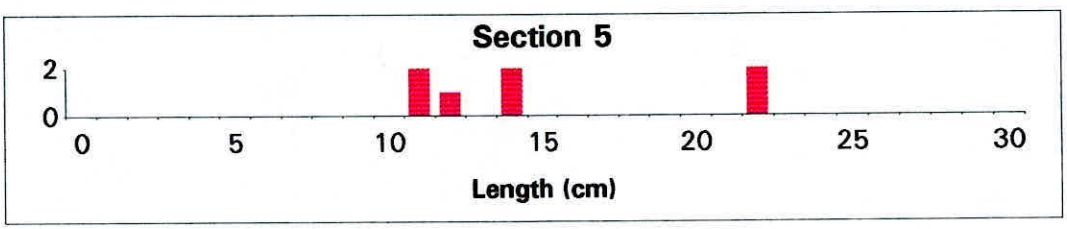


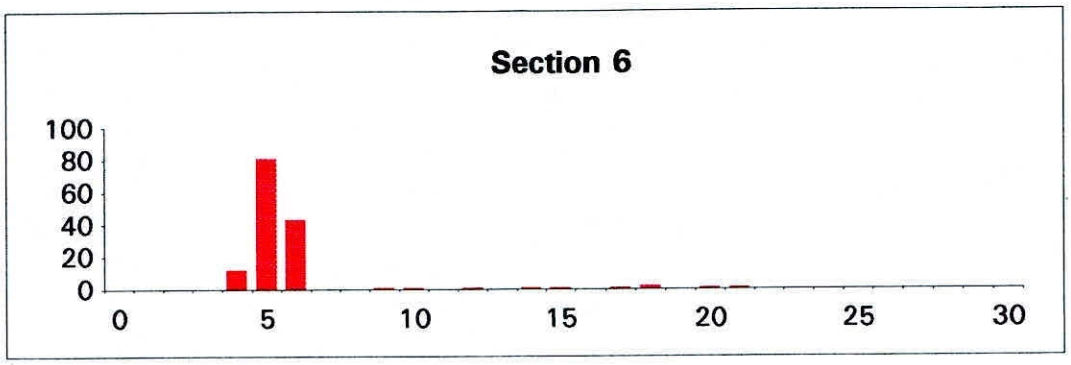
Appendix 8 Length frequency distribution of dace in the R.Tees in September 1994.

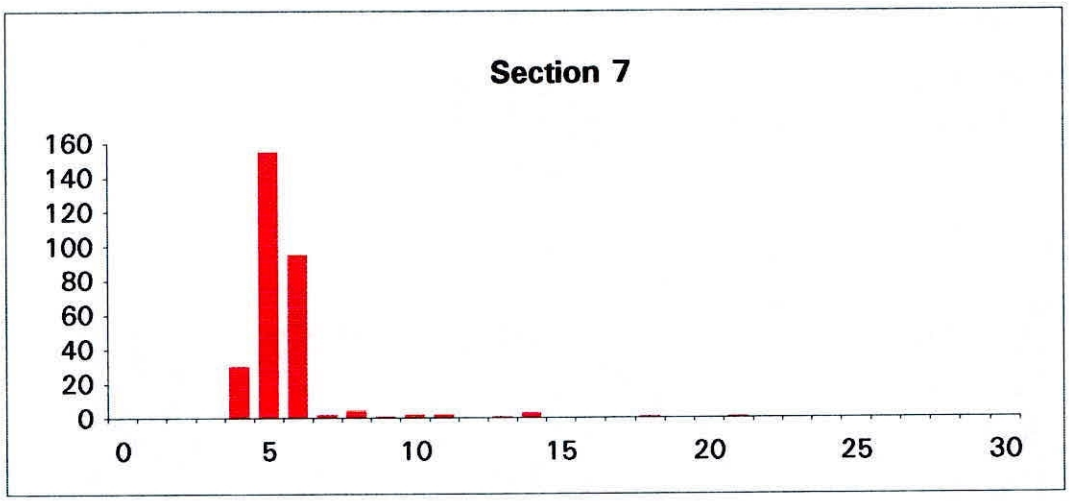


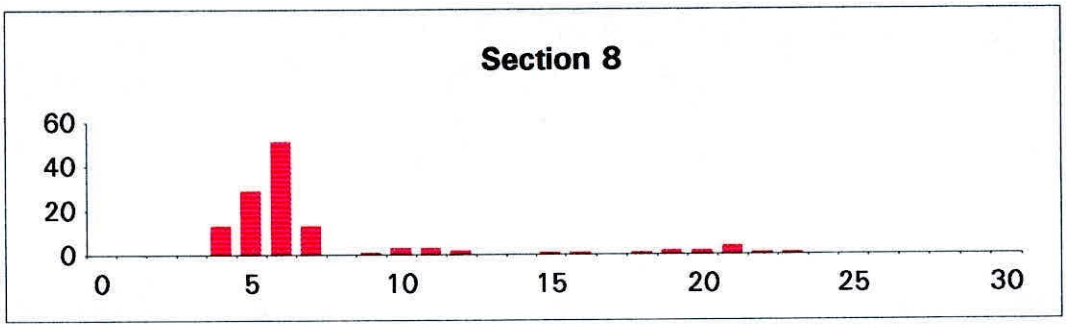


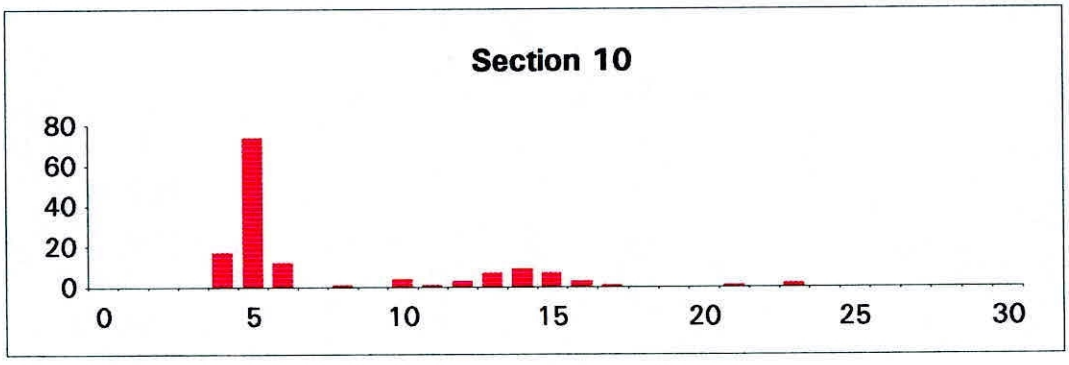




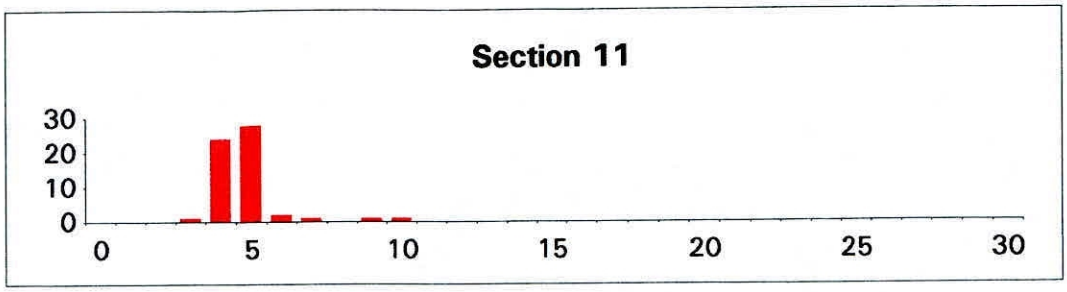

Section 6
100
80
60
40
20
0
0
5
10
15
20
25
30

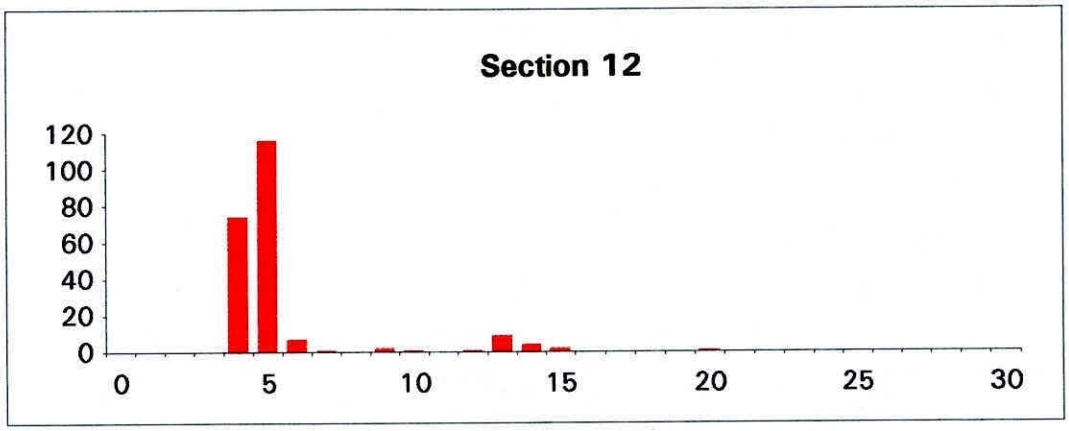

Section 7
160
140
120
100
80
60
40
20
0
0
5
10
15
20
25
30

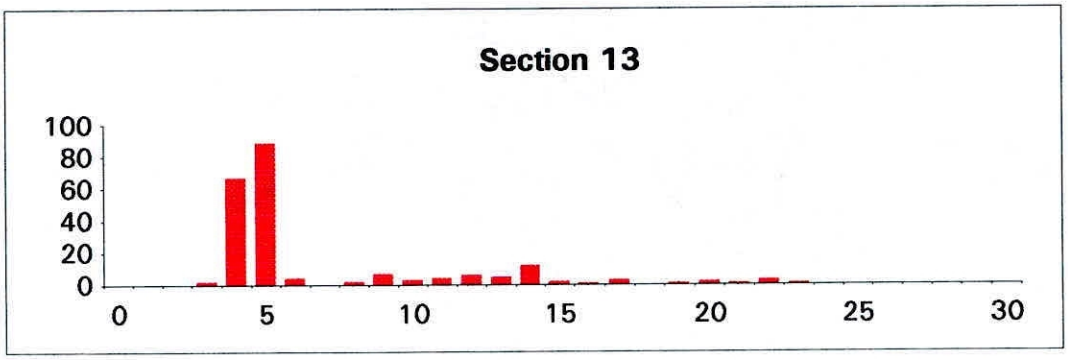

Section 8
60
40
20
0
0
5
10
15
20
25
30

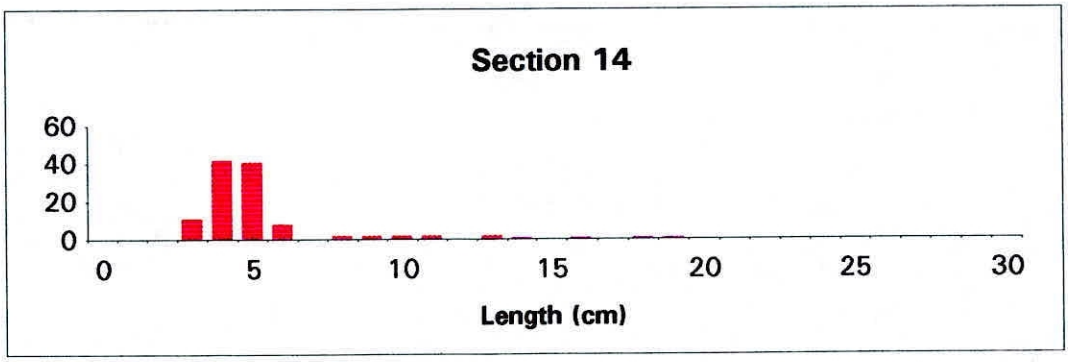

Section 10
80
60
40
20
0
0
5
10
15
20
25
30

Appendix 8 continued

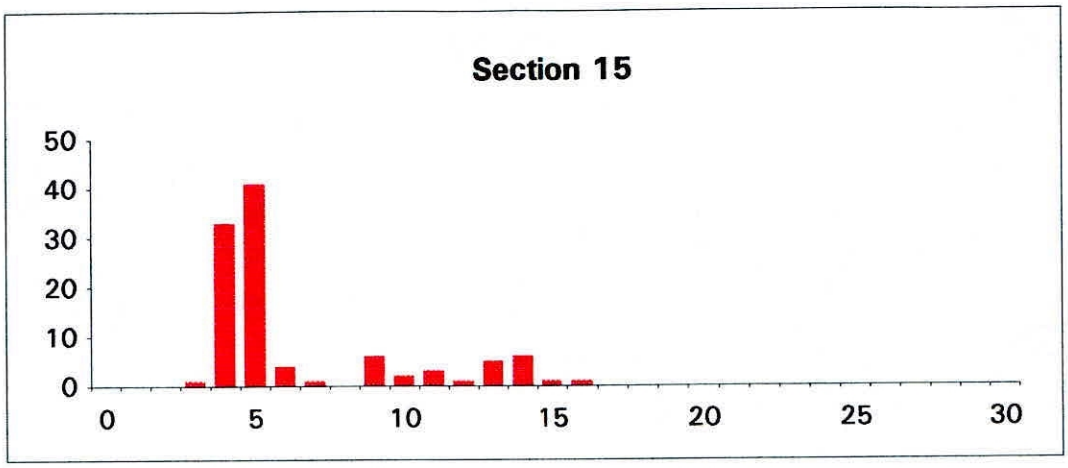


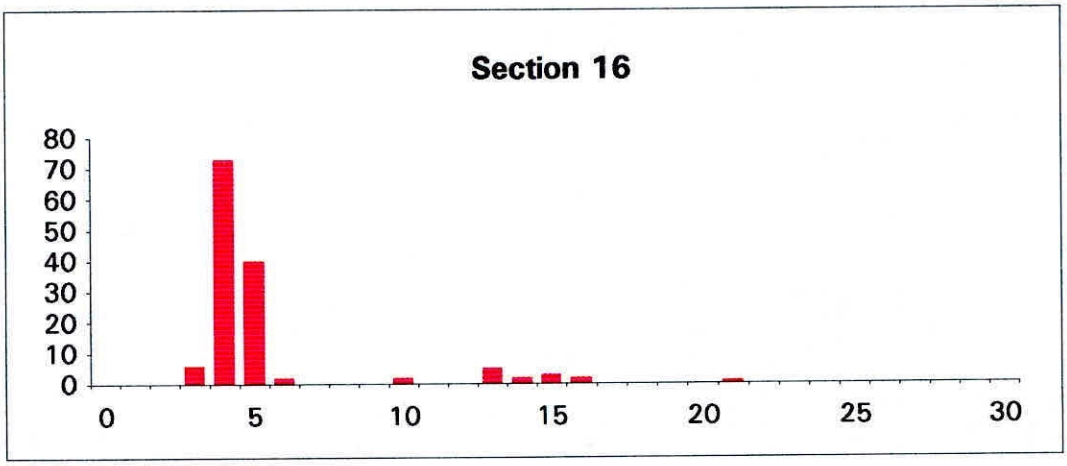


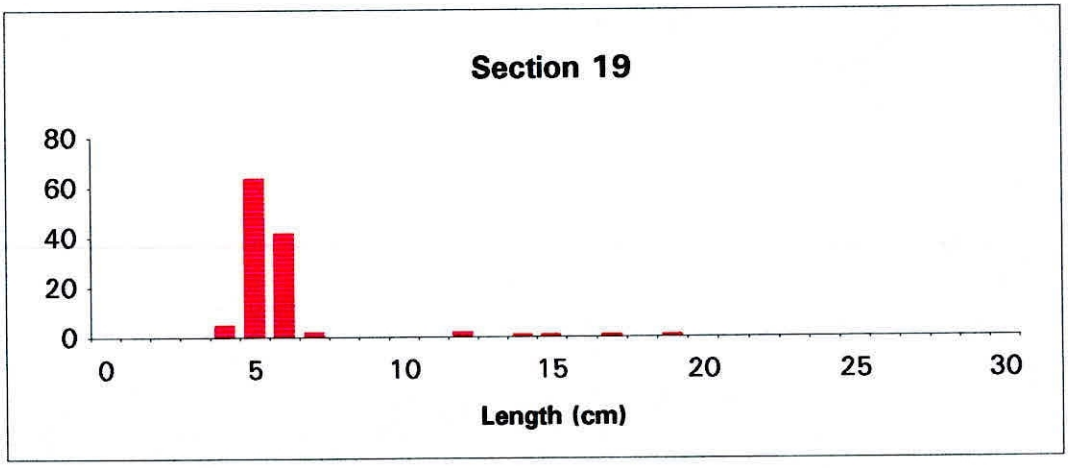


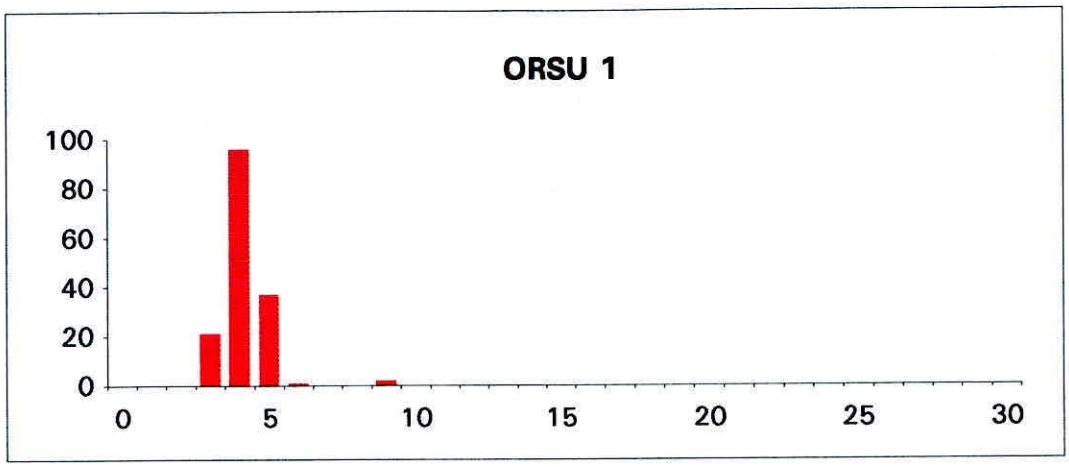


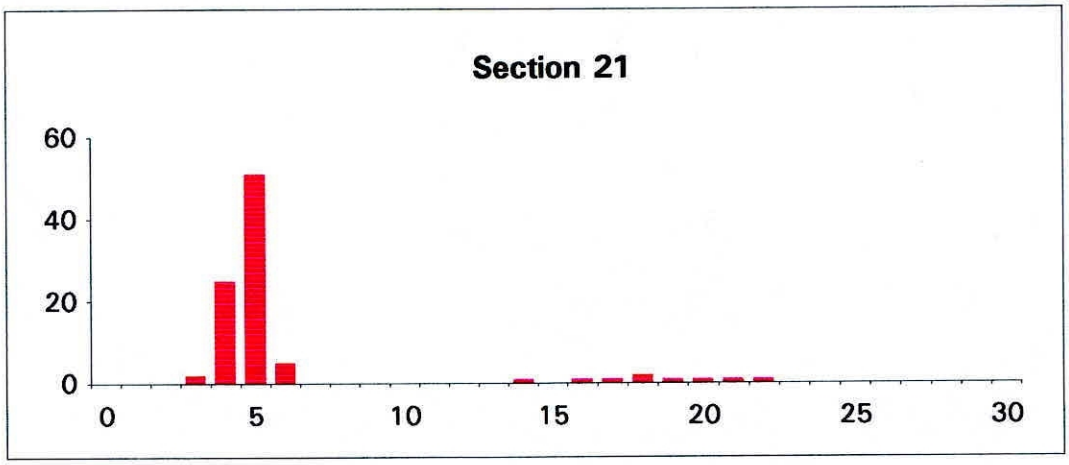
Appendix 8 continued

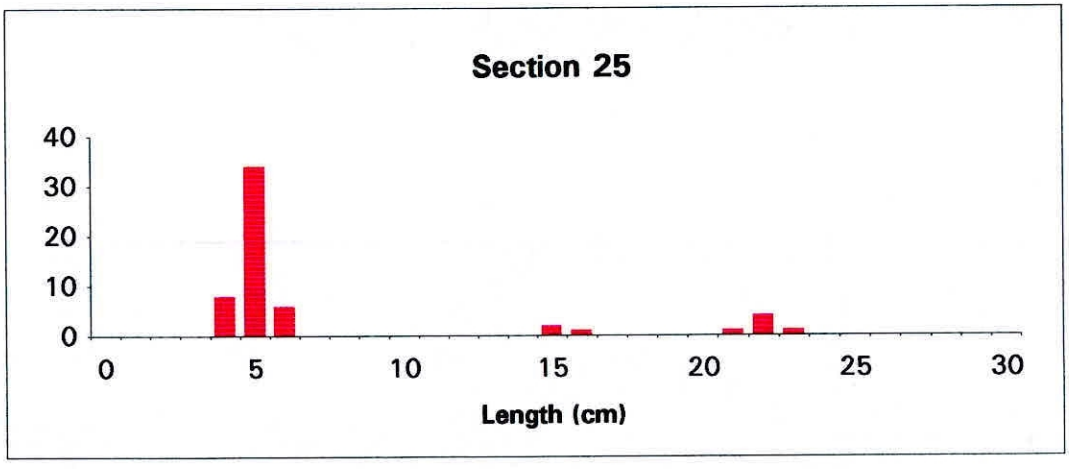




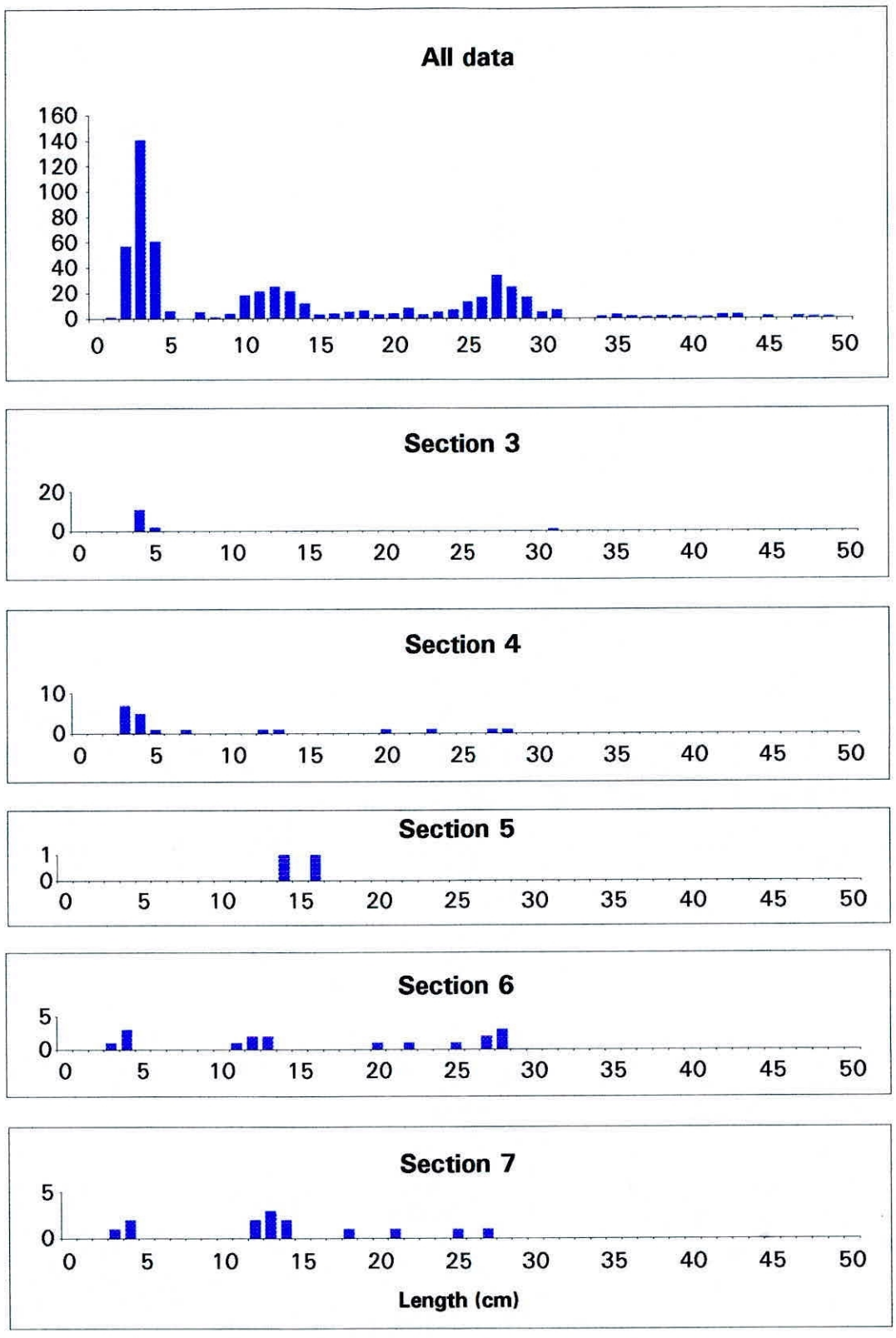



ORSU 1
100
80
60
40
20
0
0
5
10
15
20
25
30

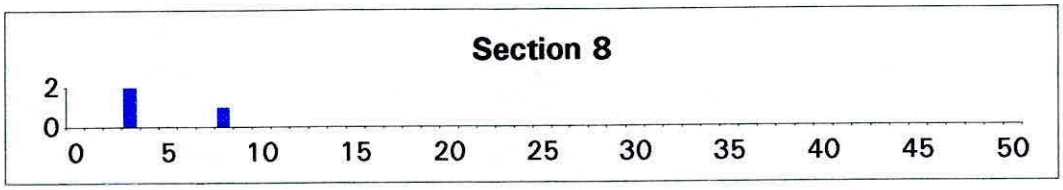

Section 21
60
40
20
0
0
5
10
15
20
25
30

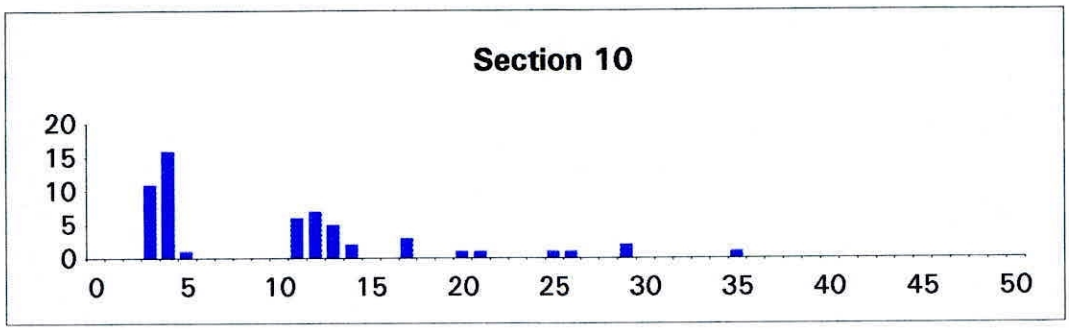

Section 25
40
30
20
10
0
0
5
10
15
20
25
30
Length (cm)

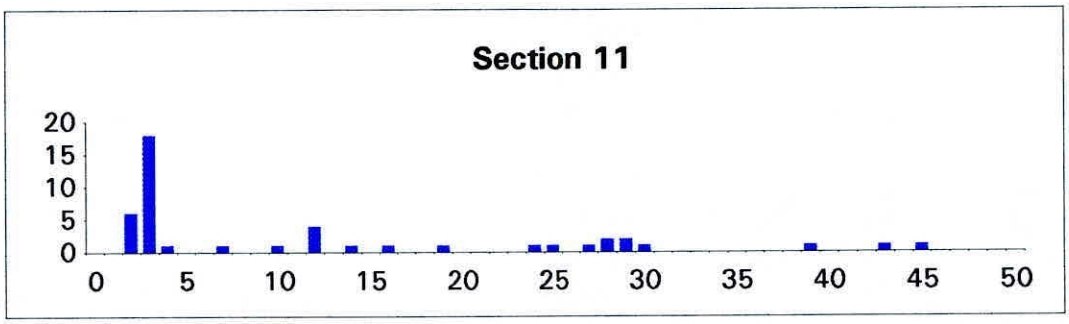
Appendix 9 Length frequency distribution of chub in each section of the R.Tees in September 1994.

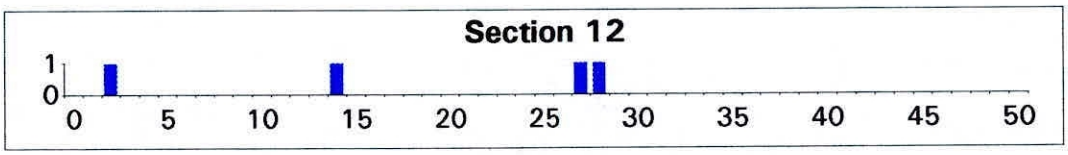


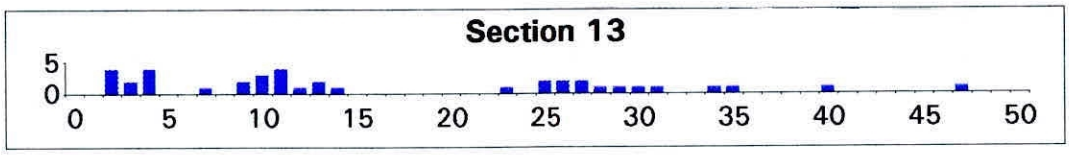
Appendix 9 continued

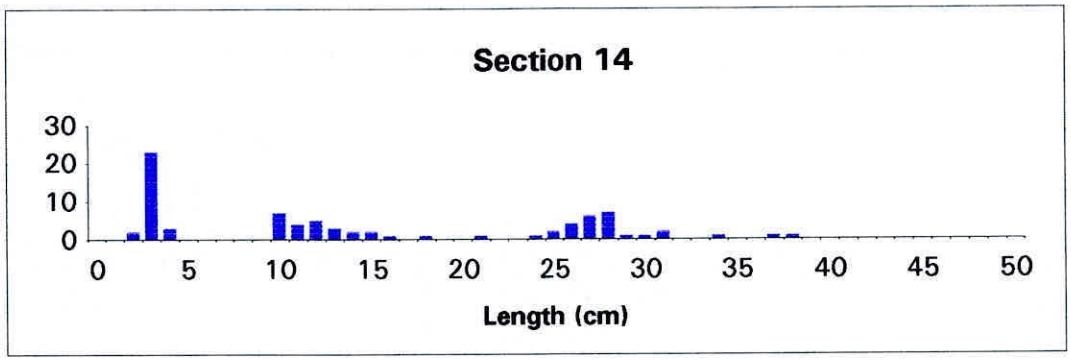




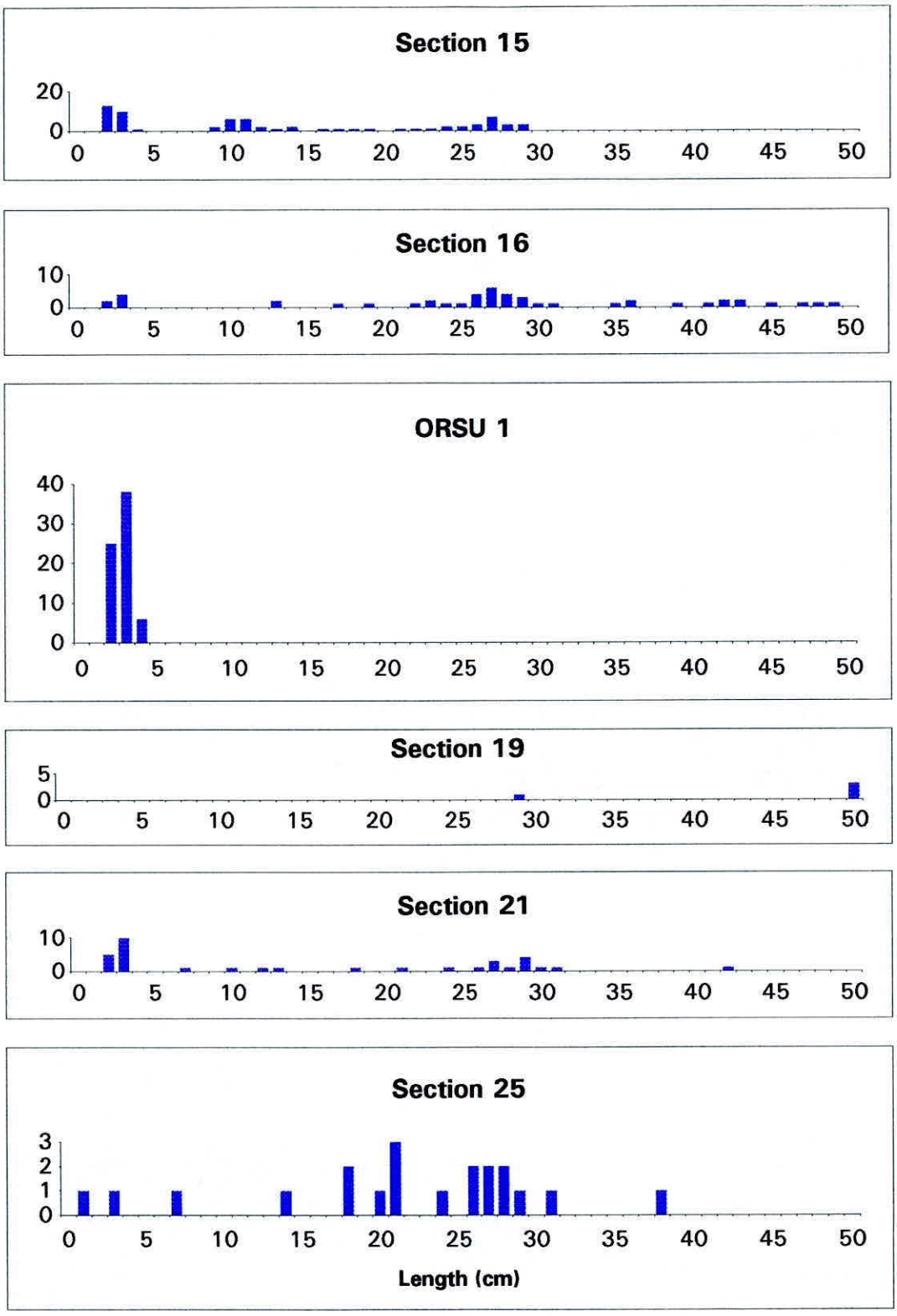




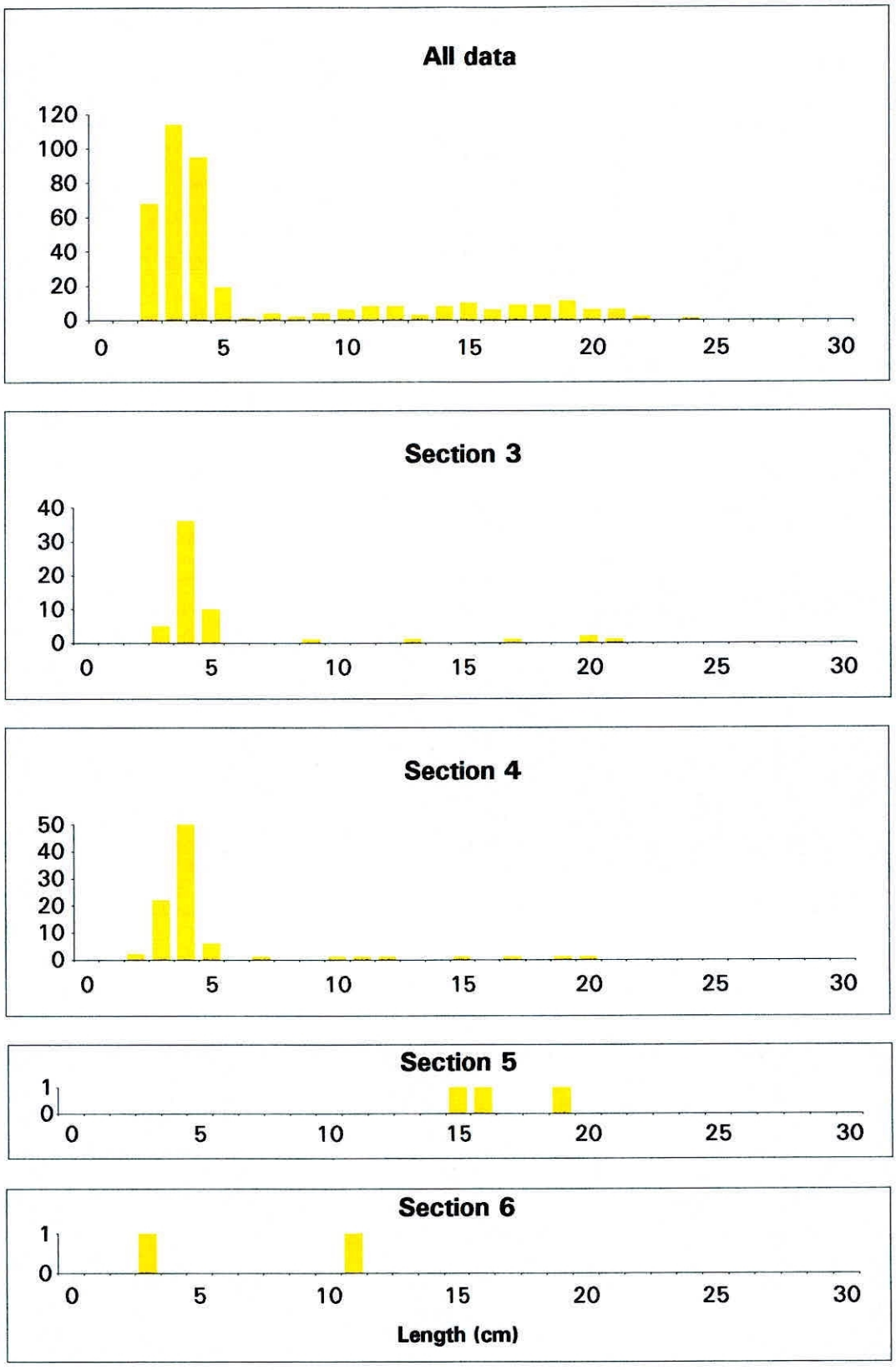




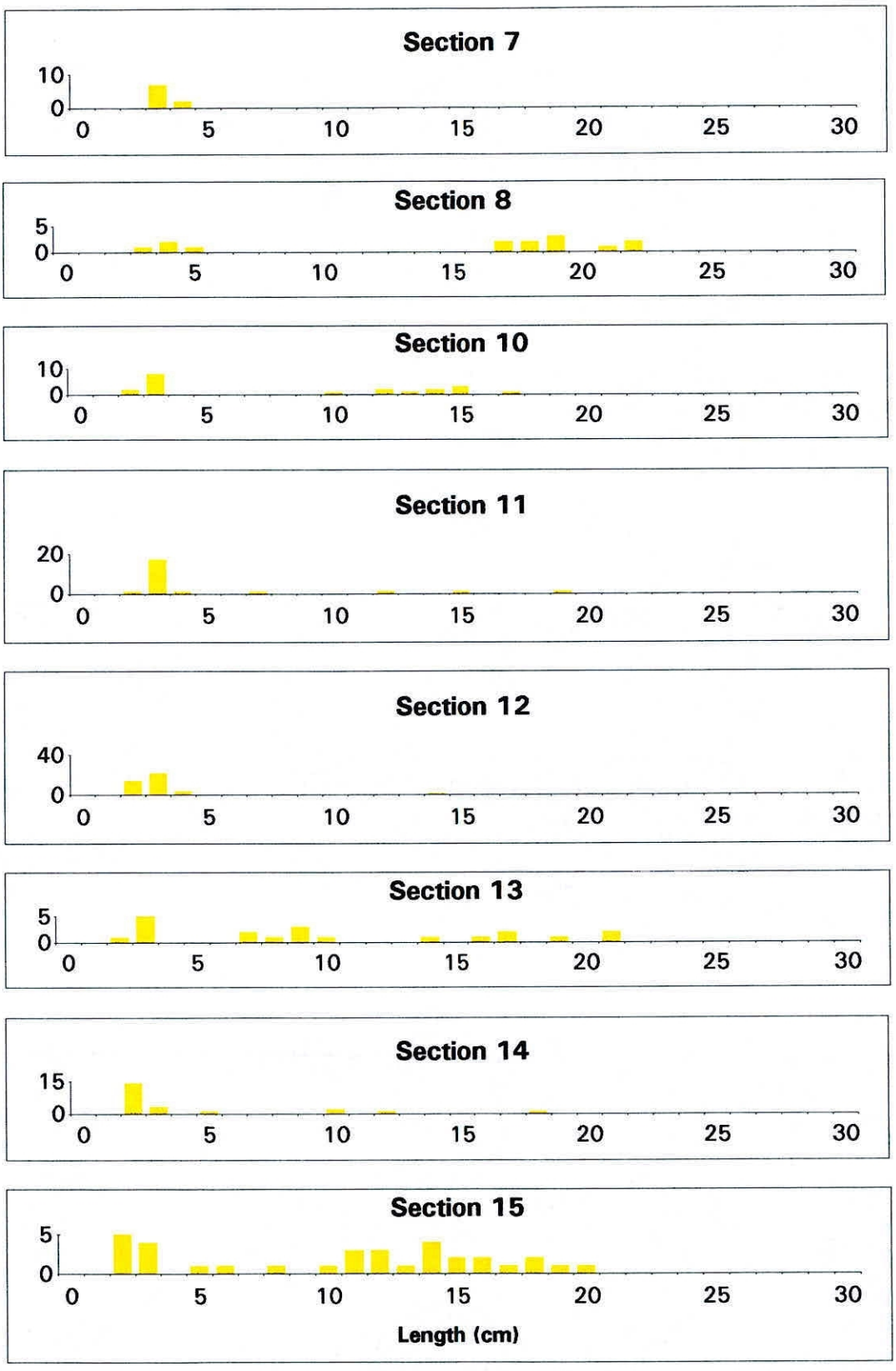
Appendix 9 continued



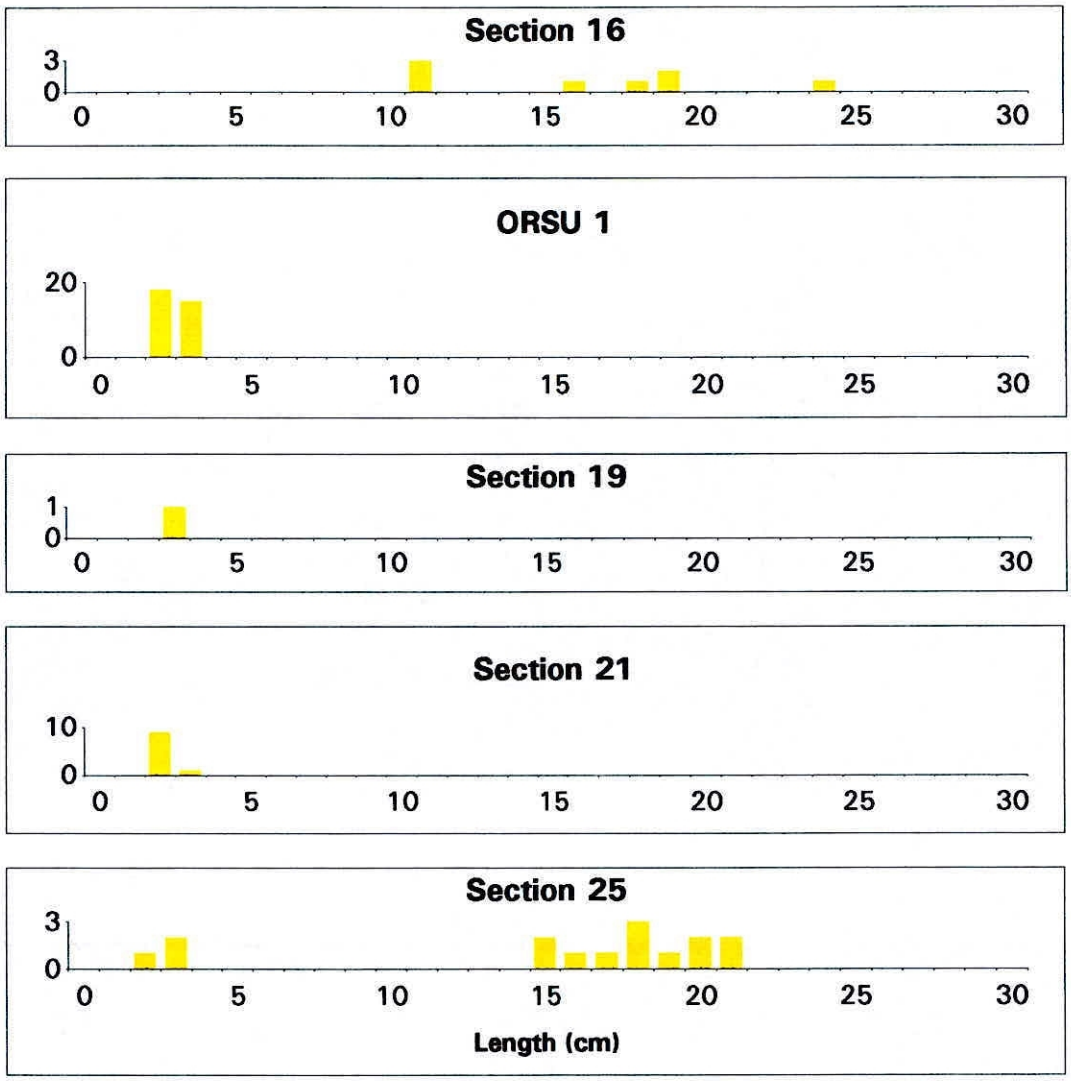
Appendix 10 Length frequency distribution of roach in each section of the R.Tees in September 1994.



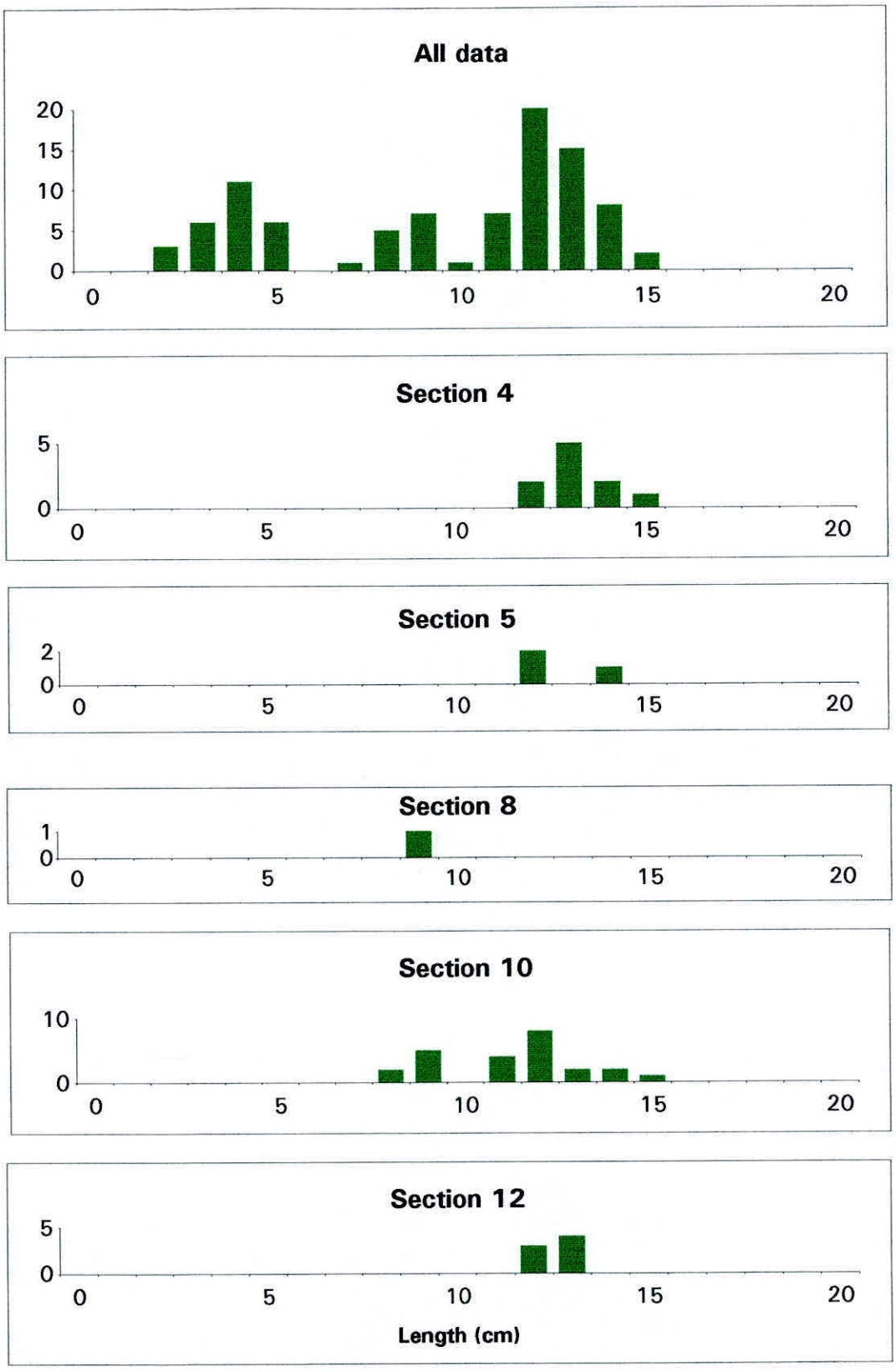
Appendix 10 continued



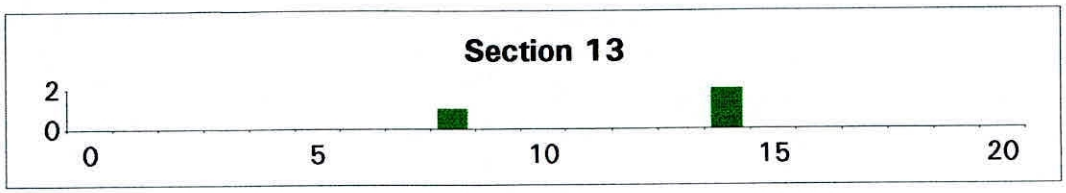
Appendix 10 continued

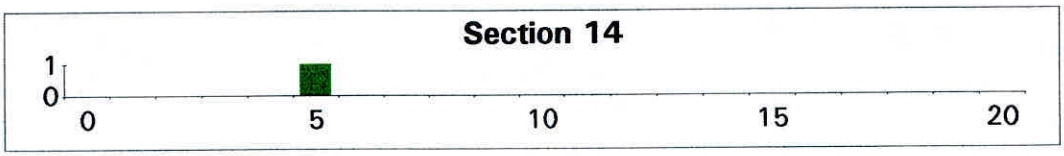


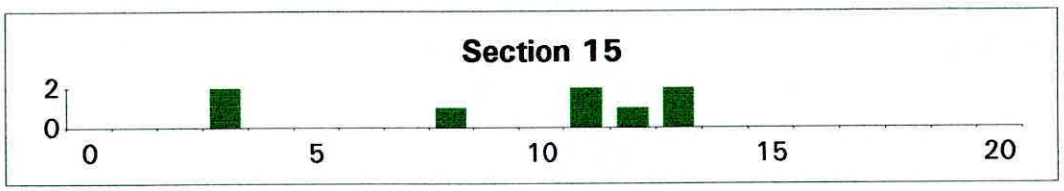
Appendix 11 Length frequency distribution of gudgeon in each section of the R.Tees in September 1994.

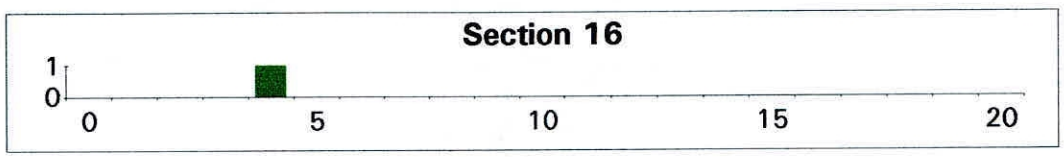


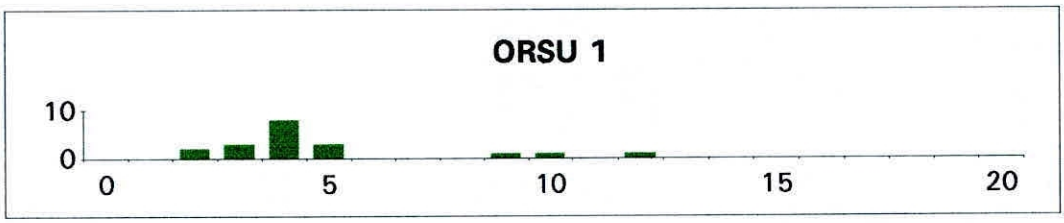
Appendix 11 continued

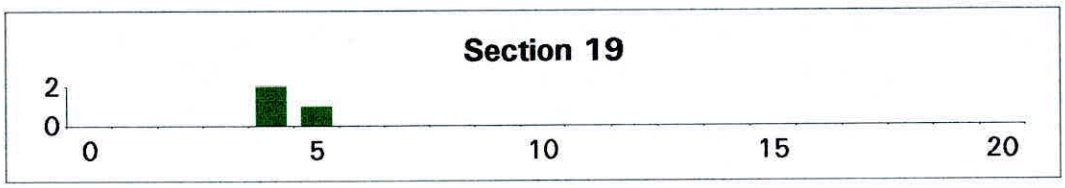


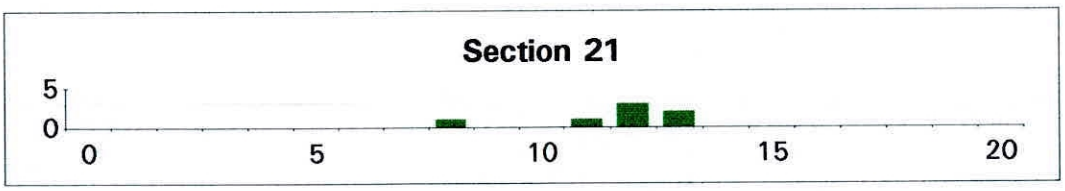


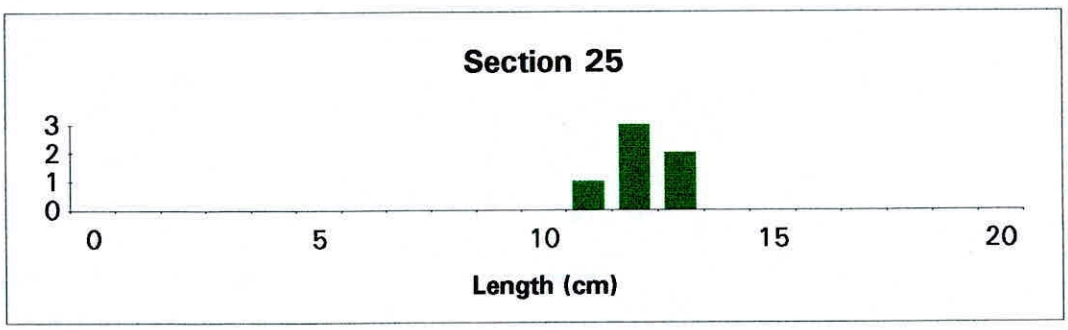


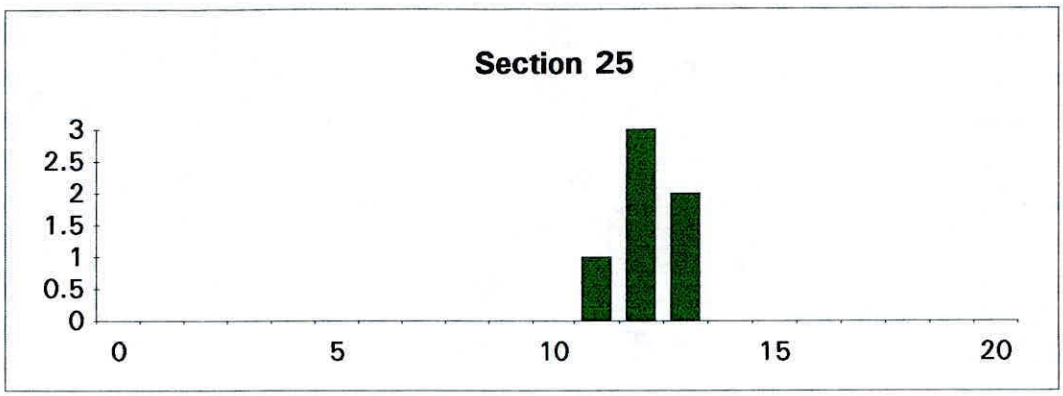




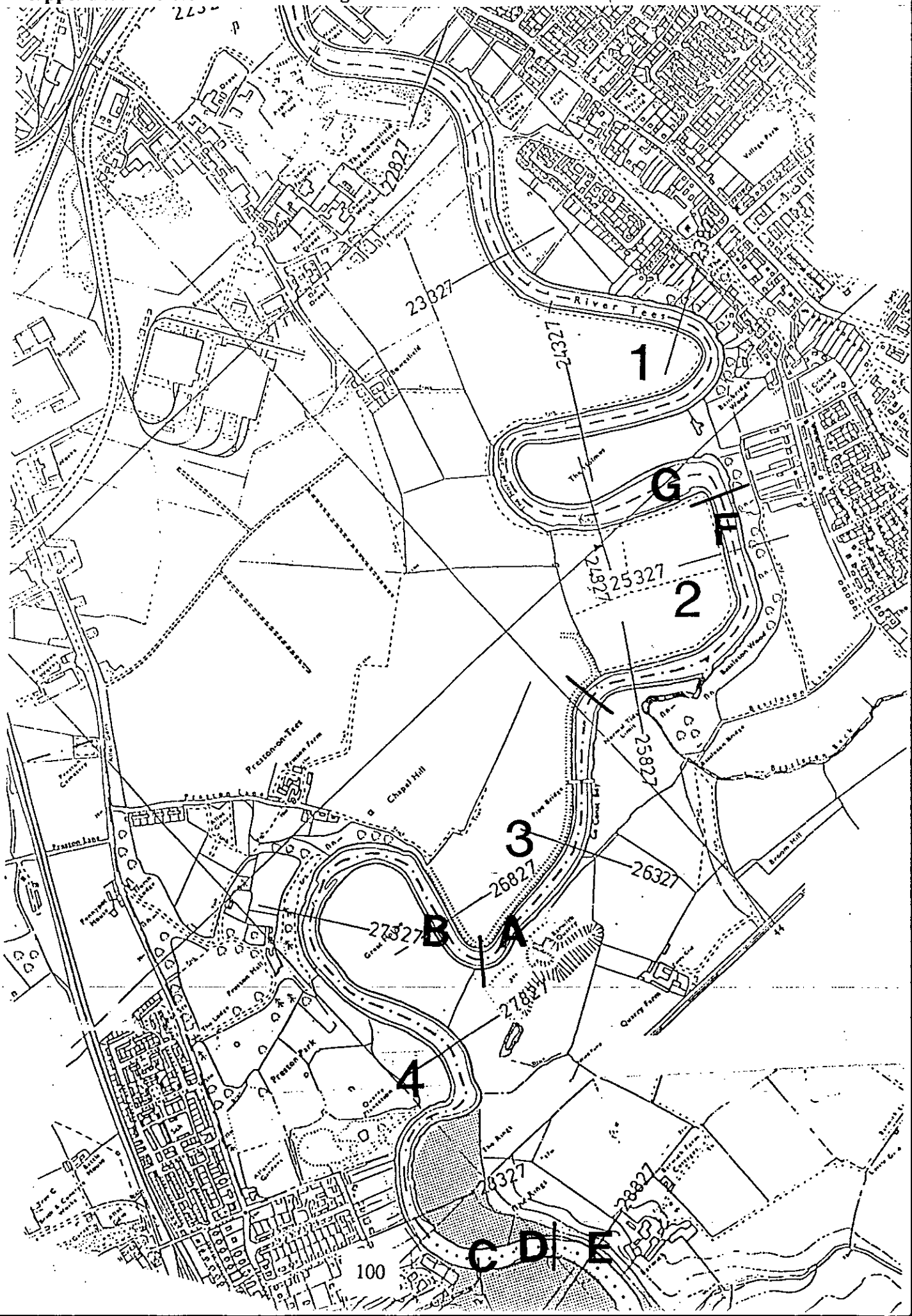




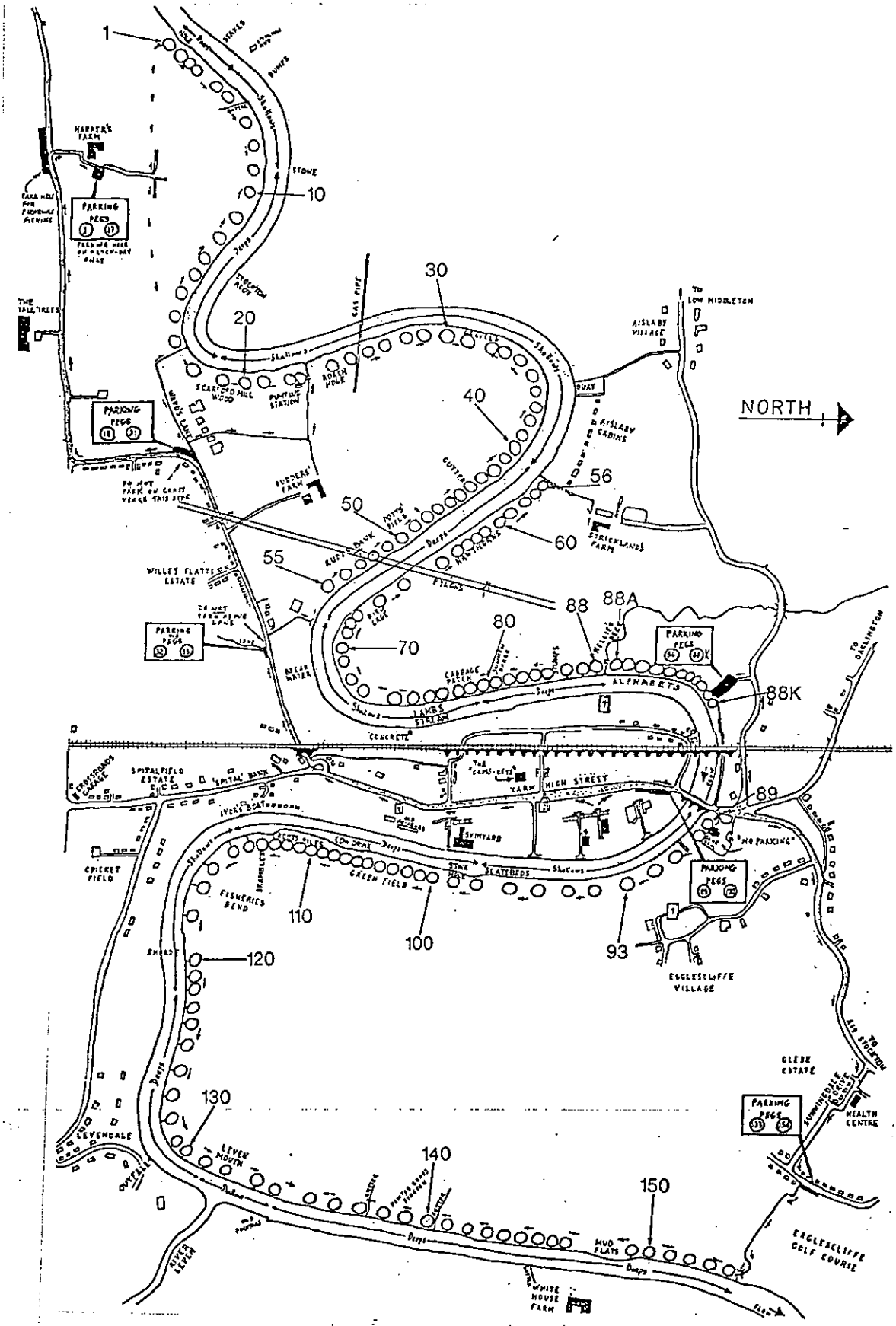



Section 25
3
2.5
2
1.5
1
0.5
0
0
5
10
15
20

Appendix 12 Sites of echo soundings



Appendix 13 Yarm Angling Club water showing pegs 1-154



Appendix 14 Results of angling matches 1977-1993. $\bar{x}$ = mean catch per angler per match (ounces) ± 95% confidence limits; $\bar{y}$ = mean catch per angler per match (ounces) ± 95% confidence limits for the top 10 anglers in each match.

Year	$\bar{x}$	$\bar{y}$
1977/78	59.4 ± 6.0	111.2 ± 15.7
1978/79	68.3 ± 6.6	132.5 ± 15.0
1979/80	76.2 ± 8.6	113.9 ± 15.0
1980/81	58.3 ± 8.2	78.3 ± 12.5
1981/82	85.5 ± 11.7	125.5 ± 18.9
1982/83	66.1 ± 7.7	113.3 ± 15.1
1983/84	25.1 ± 3.6	75.2 ± 10.9
1984/85	14.8 ± 2.9	40.5 ± 7.6
1985/86	22.6 ± 3.0	52.6 ± 7.1
1986/87	20.4 ± 3.1	64.2 ± 9.0
1987/88	27.4 ± 4.0	85.2 ± 11.5
1988/89	30.9 ± 4.0	102.7 ± 12.2
1989/90	47.5 ± 5.7	145.3 ± 14.2
1990/91	62.1 ± 7.1	165.8 ± 19.4
1991/92	85.4 ± 10.0	186.1 ± 14.6
1992/93	54.0 ± 8.0	143.1 ± 19.1
1993/94	30.7 ± 4.0	66.3 ± 8.2