



The effect of a barrage on the coarse fish of the River Tees

Interim report

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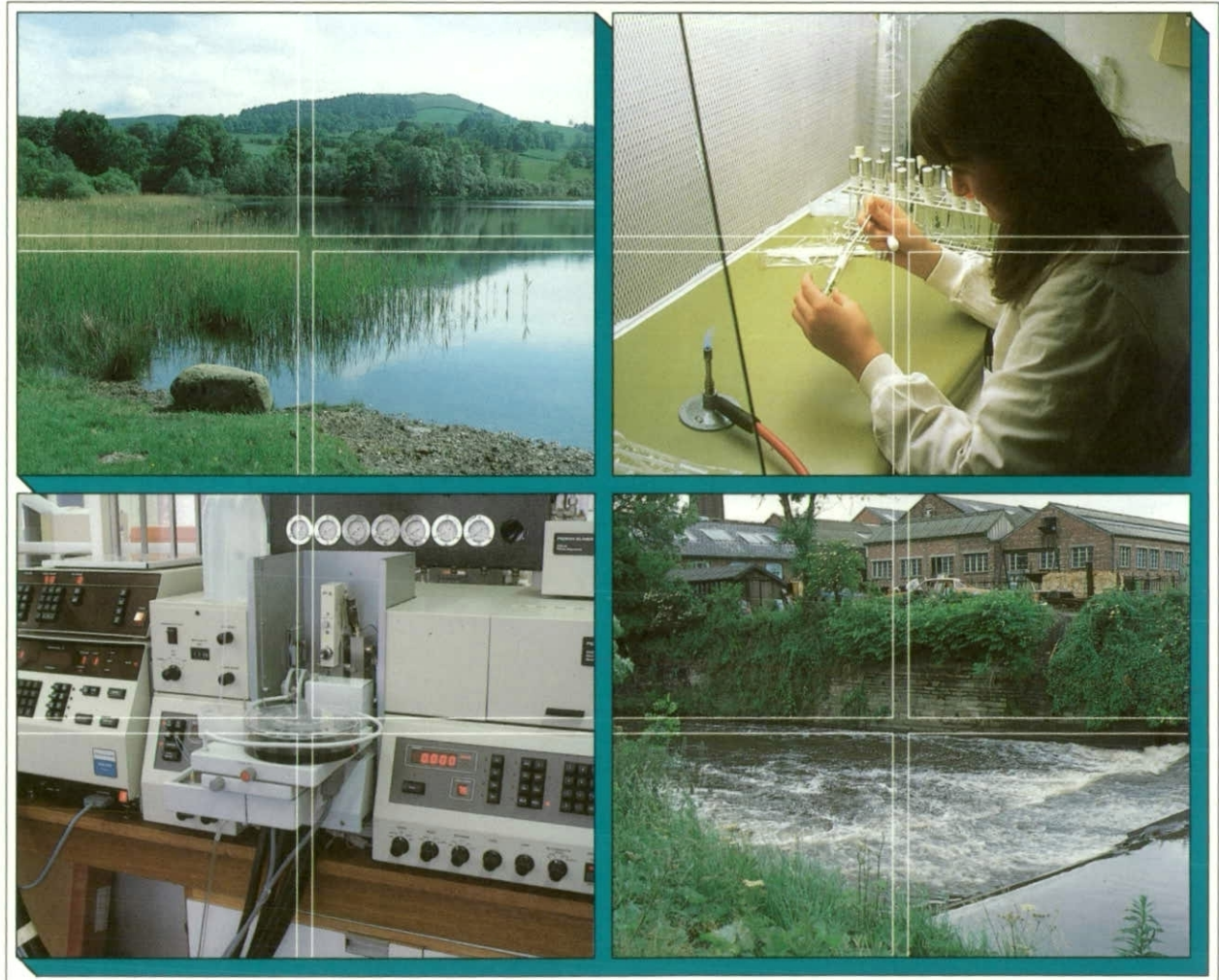
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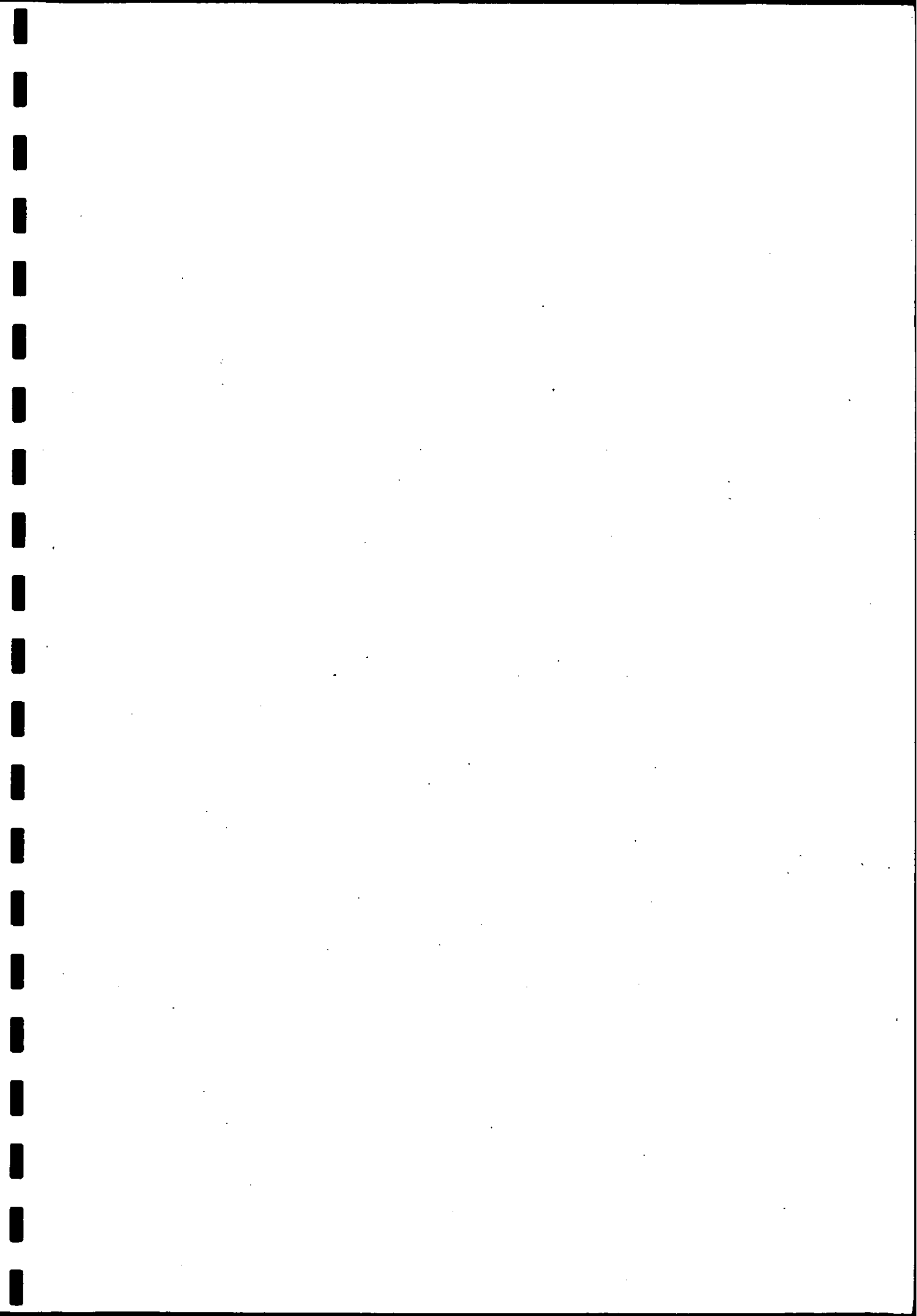
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REVIEW OF PROGRESS

The main objectives of this reporting period were to

1. Conduct a survey of the coarse fish in the area of the R. Tees which is expected to be affected by the construction of the barrage at Stockton. This base line survey would identify the relative abundance of each species of angling importance.

This survey was carried out in June before the opening of the coarse fishing season. All planned areas were fished successfully except for lower areas of the river where high conductivity caused equipment failure even though the timing was planned to coincide with low tide when saline water was expected to have been absent. The fishing team returned in early July and completed the work.

2. Carry out further surveys in areas identified from the initial survey to collect information for age, growth and condition factor determination.

These surveys were carried out in September. Length and weight measurements of each fish were recorded and scales were taken for age determination.

3. Conduct a survey of fry to identify areas favoured and species composition.

This was successfully completed in September.

4. Install temperature loggers.

This was completed in July. Loggers are operational at Stockton where the river is affected by saline intrusion, at The Rings where the river is tidal but unaffected by saline intrusion except at very high spring tides and at Low Moor where there is no tidal influence.

5. Collect and collate data from angling clubs on past matches and liaise with anglers on methods of collecting data from future matches.

A good relationship has been developed with anglers. Past match data has been made available and a recording system for anglers has been set up.

1. BASE LINE SURVEY OF COARSE FISH JUNE 1991

1.1 Introduction

This survey was designed to determine the species of fish present and their relative abundances in the area of the R. Tees affected by the proposed barrage. Emphasis was placed on fishing as much of the river as possible to give the best estimate for the whole river as well as for different reaches. The length of each reach electro-fished depended on the number of fish caught and a physical feature to identify the end of each reach in future surveys. When large numbers of fish were present, the need to stop and process determined the end of a reach.

Where possible, broad assessments of the habitat characteristics were made.

The state of the tide for each fishing was also noted.

1.2 Methods

Fish were caught by electrofishing using methods appropriate to the conditions. In the main, the multi-anode, boom mounted, electrofishing system (boom boat) fishing at 200v, 7.5KvA was used. Most fishings were carried out moving with the tide at a speed which was slightly faster than the speed of the water. Fishing against the tide was considered less efficient as the netting time is too short to capture all fish except when fishing near slack tide.

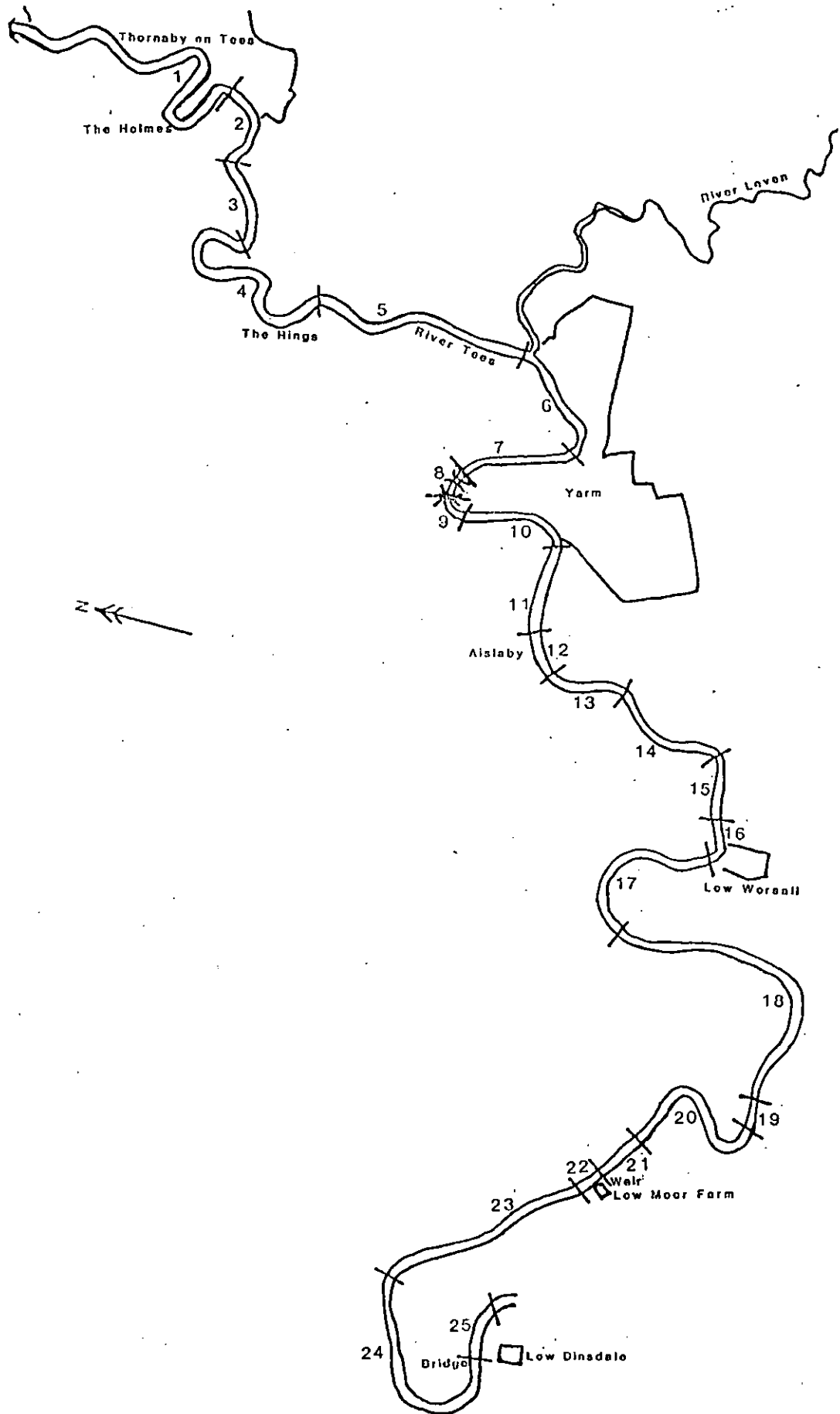
Careful timing allowed some shallow sites to be fished by boom boat at high tide.

Further upstream, electrofishing by wading using a twin anode system (200v 1.9KvA) was used to sample the fish.

All fish of angling interest were caught but minor species (minnow and stone loach) were caught on an occasional basis.

Sections of the river fished are shown in Fig. 1. Electrofishing concentrated mainly on the river margins (one boom width from the bank). The right hand bank looking upstream is designated .1 (usually the north bank) and the left hand bank looking upstream is designated .2 (usually the south bank). The centre of the river was often too deep for effective electrofishing resulting in inability to see stunned fish deep in the turbid conditions.

Fig. 1. Map of the R. Tees showing sampling sections.



1.3 Results

During the initial survey, 1606 fish were caught and measured. Thirteen species were recorded from 28 km of river between Low Dinsdale in the non-tidal area to Thornaby which is affected by saline intrusion. Dace accounted for two thirds of the fish caught, roach, chub and minnows being the only other common species (Table 1). Numbers caught in each section are given in Table 2 and species composition at each site are given in Figs 2-7 and synthesized in Fig. 7a.

Site descriptions, fishing method, date, state of tide, species and number of fish caught in each section are given in Appendix 1.

Table 1. Species lists for the R. Tees and number of each species caught - June 1991.

Species	Totals
Barbel <i>Barbus barbus</i> (L.)	13
Chub <i>Leuciscus cephalus</i> (L.)	149
Dace <i>Leuciscus leuciscus</i> (L.)	1007
Eel <i>Anguilla anguilla</i> (L.)	>>100
Flounder <i>Platichthys flesus</i> (L.)	20
Grayling <i>Thymallus thymallus</i> (L.)	3
Gudgeon <i>Gobio gobio</i> (L.)	55
Minnow <i>Phoxinus phoxinus</i> (L.)	113
Roach <i>Rutilus rutilus</i> (L.)	203
Rudd <i>Scardinius erythrophthalmus</i> (L.)	1
Salmon parr <i>Salmo salar</i> L.	5
Salmon smolt <i>Salmo salar</i> L.	2
Sea lamprey <i>Petromyzon marinus</i> L.	1
Stone loach <i>Noemacheilus barbatulus</i> (L.)	7
Trout (brown) <i>Salmo trutta</i> L.	27

Table 2. Numbers of fish present in each section.

Section	1	2	3	4	5	6	7	8.2
Dace	1	11	10	19	2	56	221	95
Roach		1	2	5			17	3
Chub							9	3
Trout				1		3	2	1
Salmon						3		
Gudgeon						2	3	1
Minnow								
Stone loach								
Flounder	3	1				1		1
Barbel								1
Grayling								
Sea lamprey								
Rudd								
Section	9.1	10	11.1	12.1	12.2	13.1	13.2	14.1
Dace	85	65	2	88	22	34	108	1
Roach	24	1		7	13		34	
Chub	2	1		3		7	5	1
Trout		1		2	2	4	1	2
Salmon		1			1	1		1
Gudgeon		1			1	1	2	
Minnow								
Stone loach							2	
Flounder					4			
Barbel								
Grayling								
Sea lamprey								
Rudd								
Section	14.2	15.2	16.2	19	21.1	22	25.1	25.2
Dace	9	56	25	2	3	2	87	3
Roach		2		2			92	
Chub		38	5	11	1	10	42	11
Trout	1	1	1	2	3			
Salmon								
Gudgeon	1	1	3	6		3	30	
Minnow		1	3	14	24		67	4
Stone loach				1	2	2		
Flounder				6	4			
Barbel				5			2	5
Grayling				1	1		1	
Sea lamprey				1				
Rudd						1		

Key to Figs 2-7

B = barbel

C = chub

D = dace

F = flounder

Gu = gudgeon

Gr = grayling

R = roach

Ru = rudd

T = trout

Fig. 2. Species composition in Sections 1 to 4 of the R. Tees.

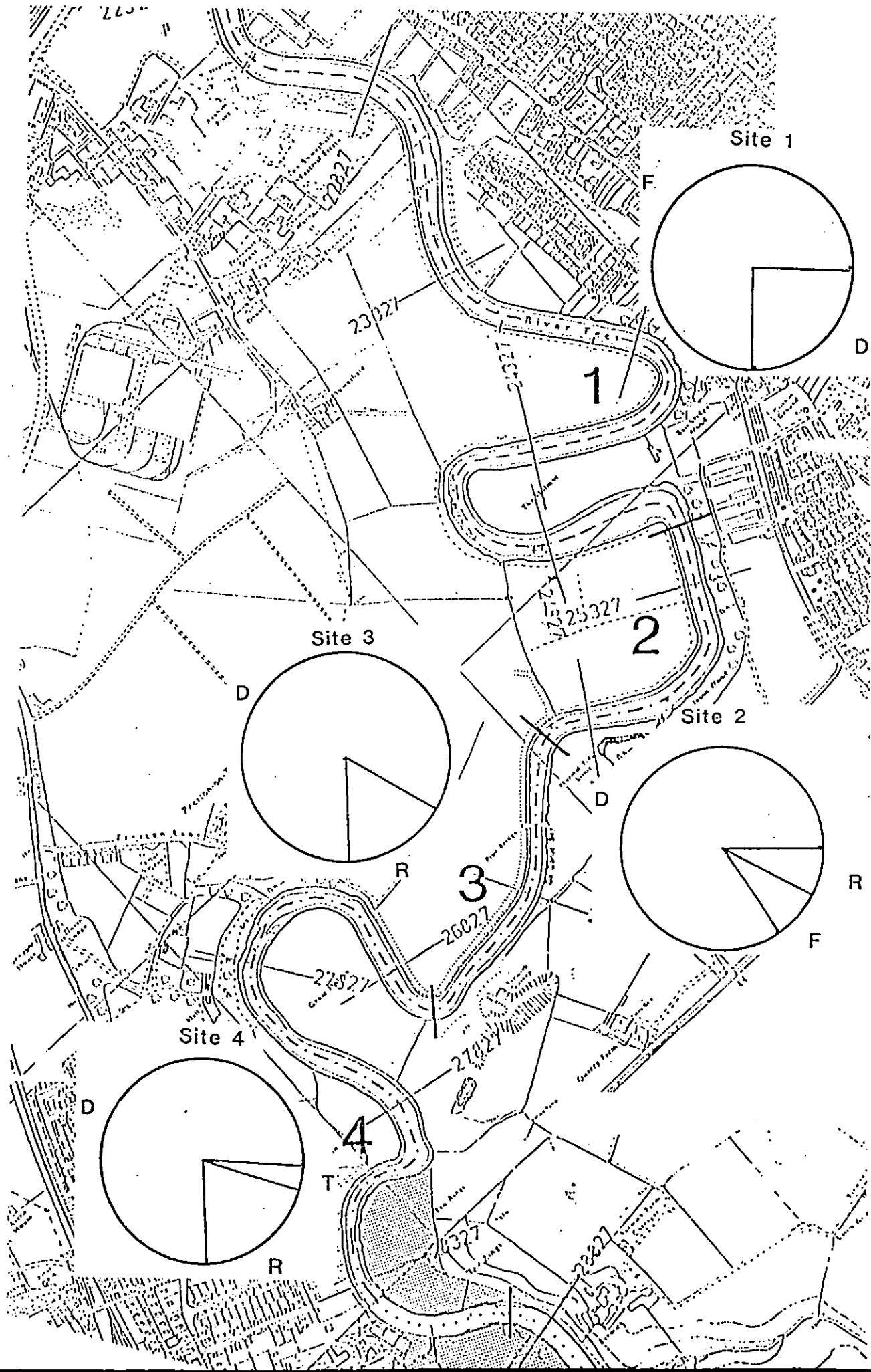


Fig. 3. Species composition in Sections 5 to 9 of the R. Tecs.

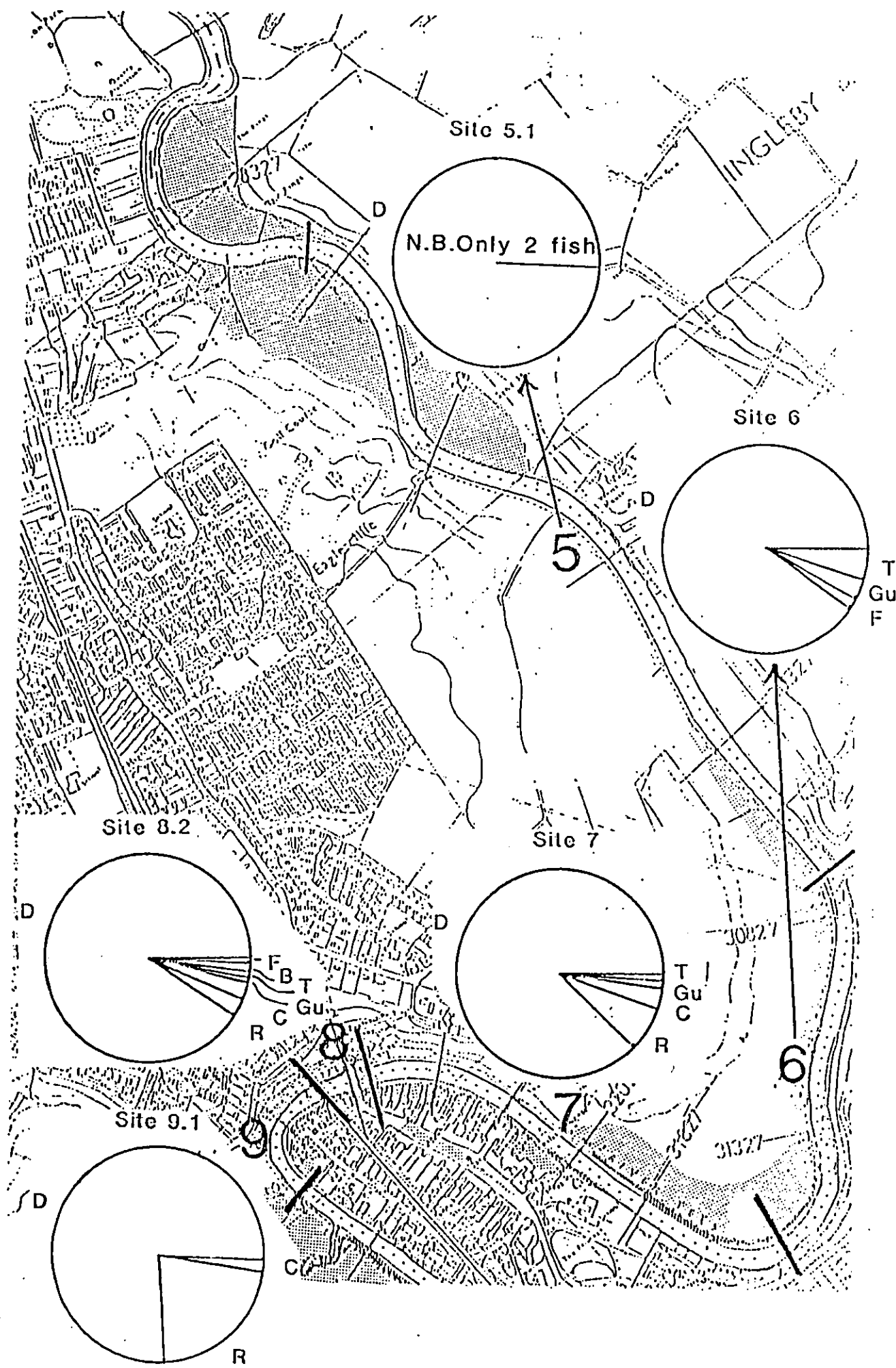


Fig. 4. Species composition in Sections 10 to 14 of the R. Tecs.

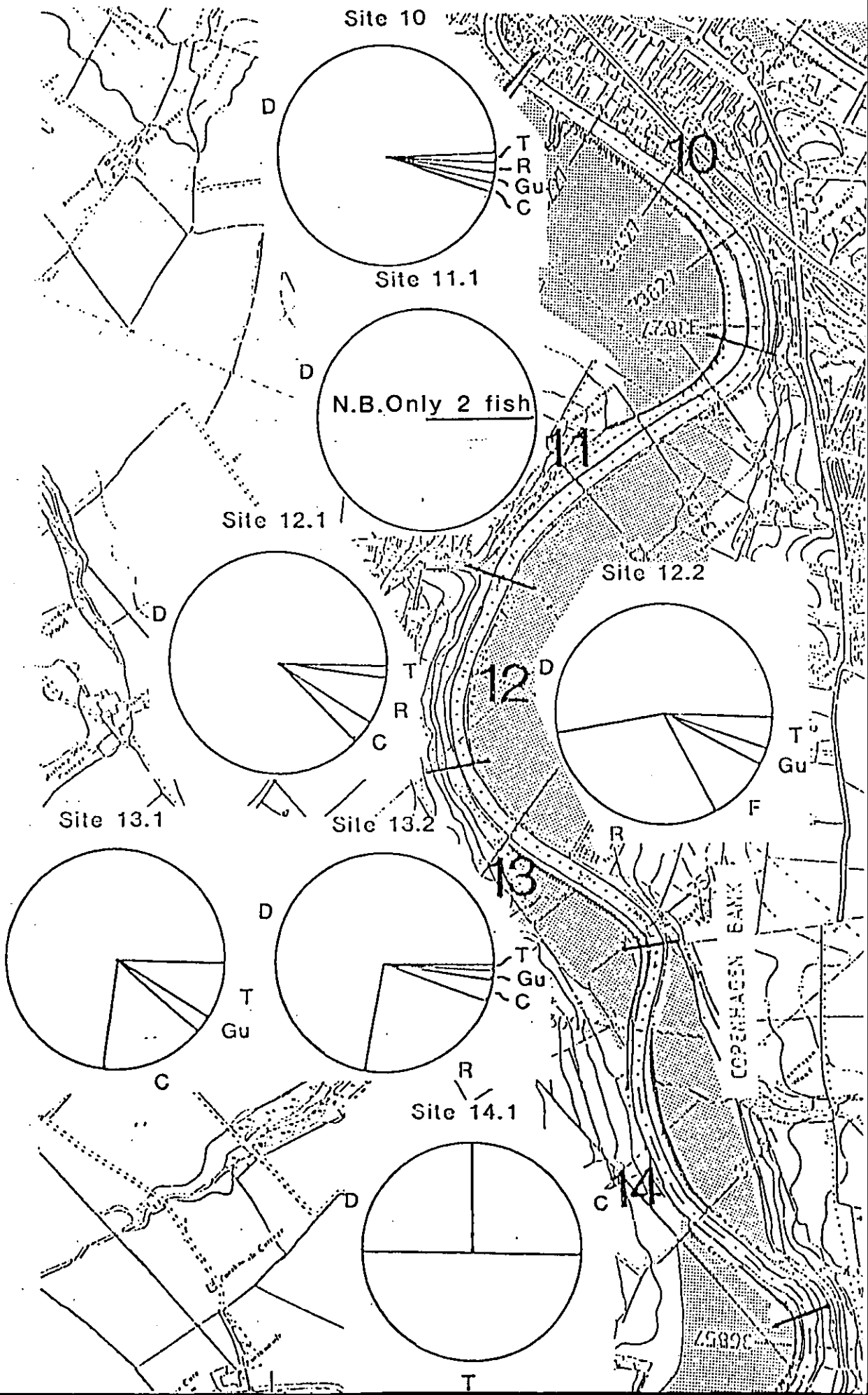


Fig. 5. Species composition in Sections 15 and 16 of the R. Tees.

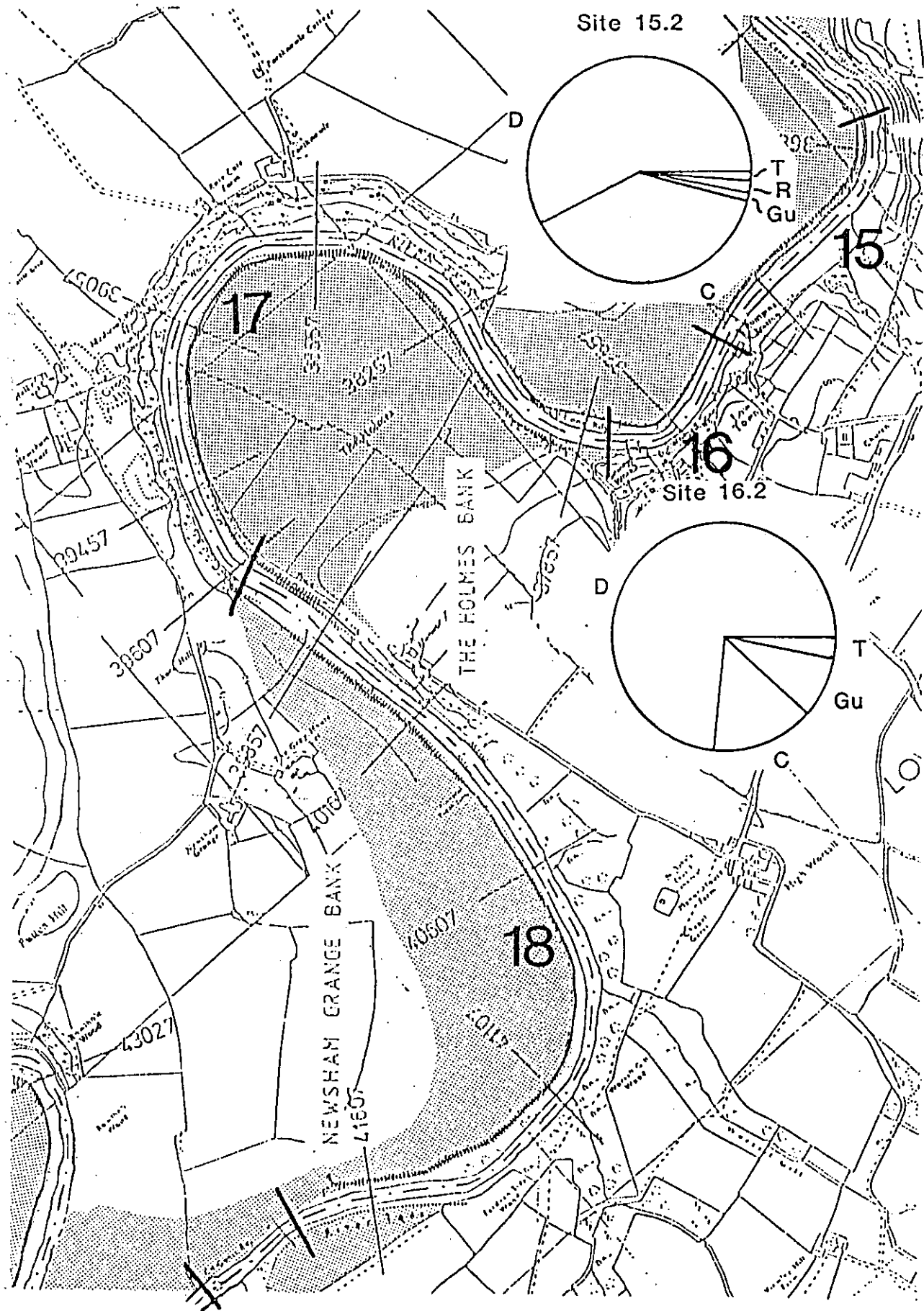


Fig. 6. Species composition in Sections 19 and 21 of the R. Tees.

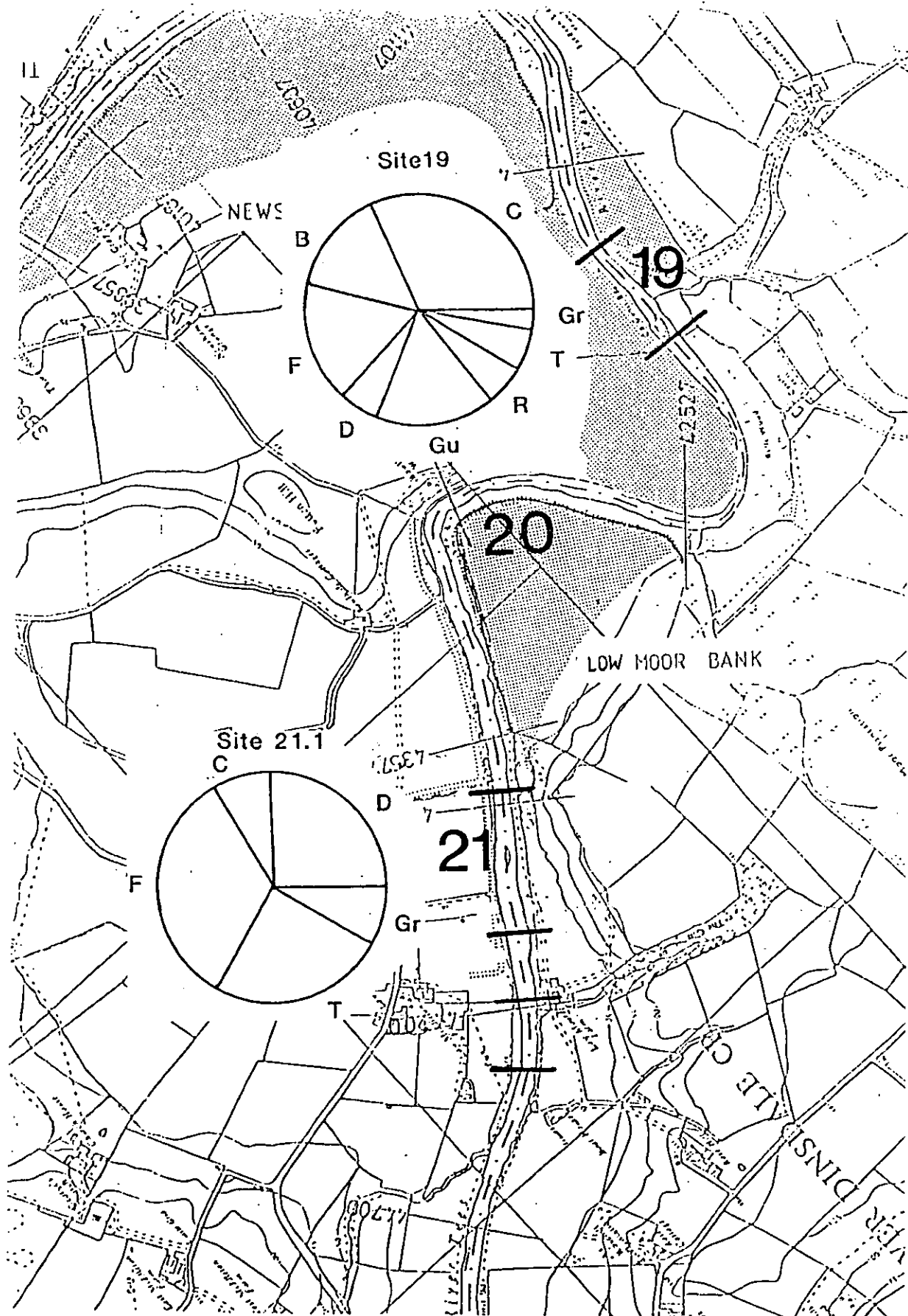


Fig. 7. Species composition in Sections 22 and 25 of the R. Tees.

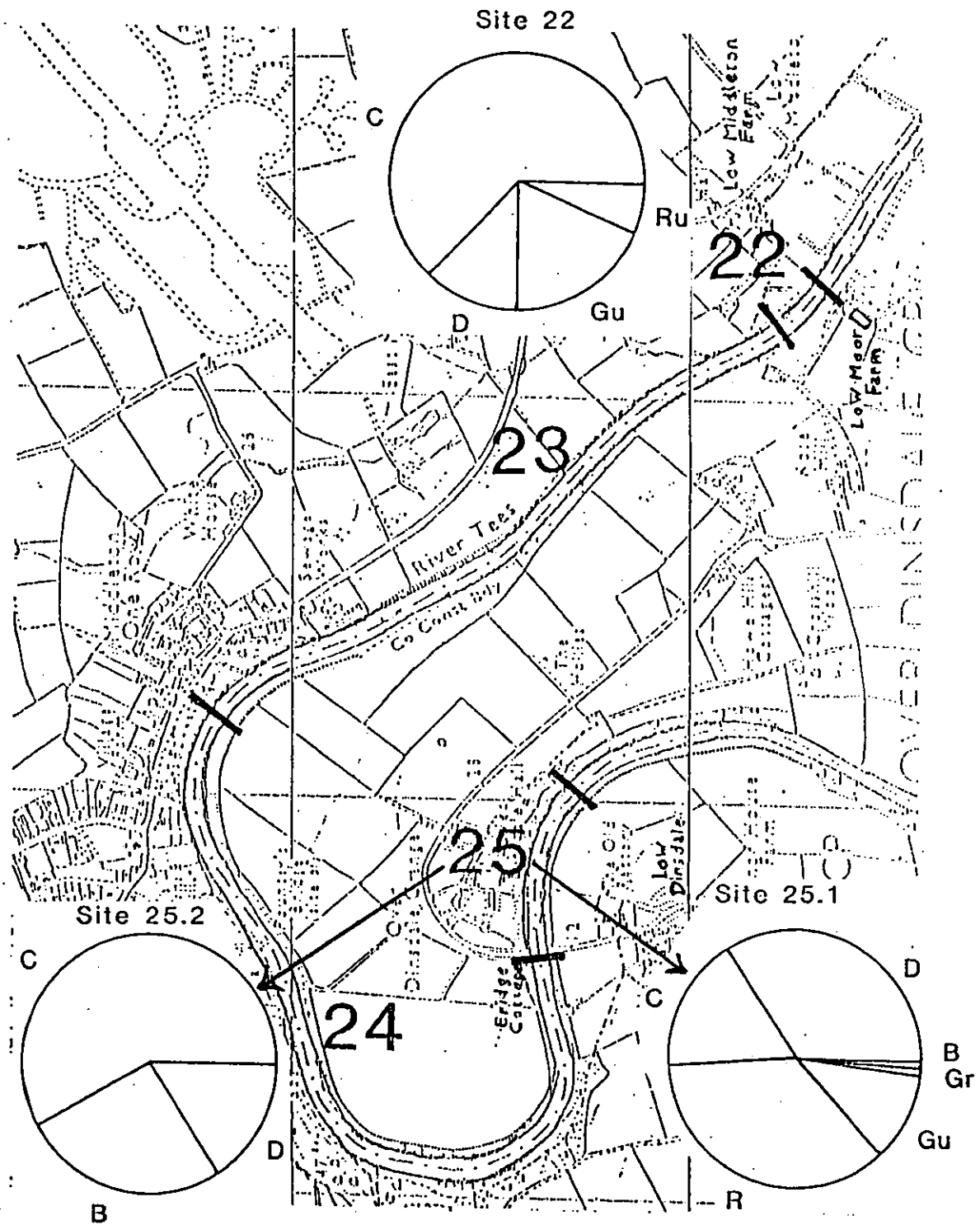
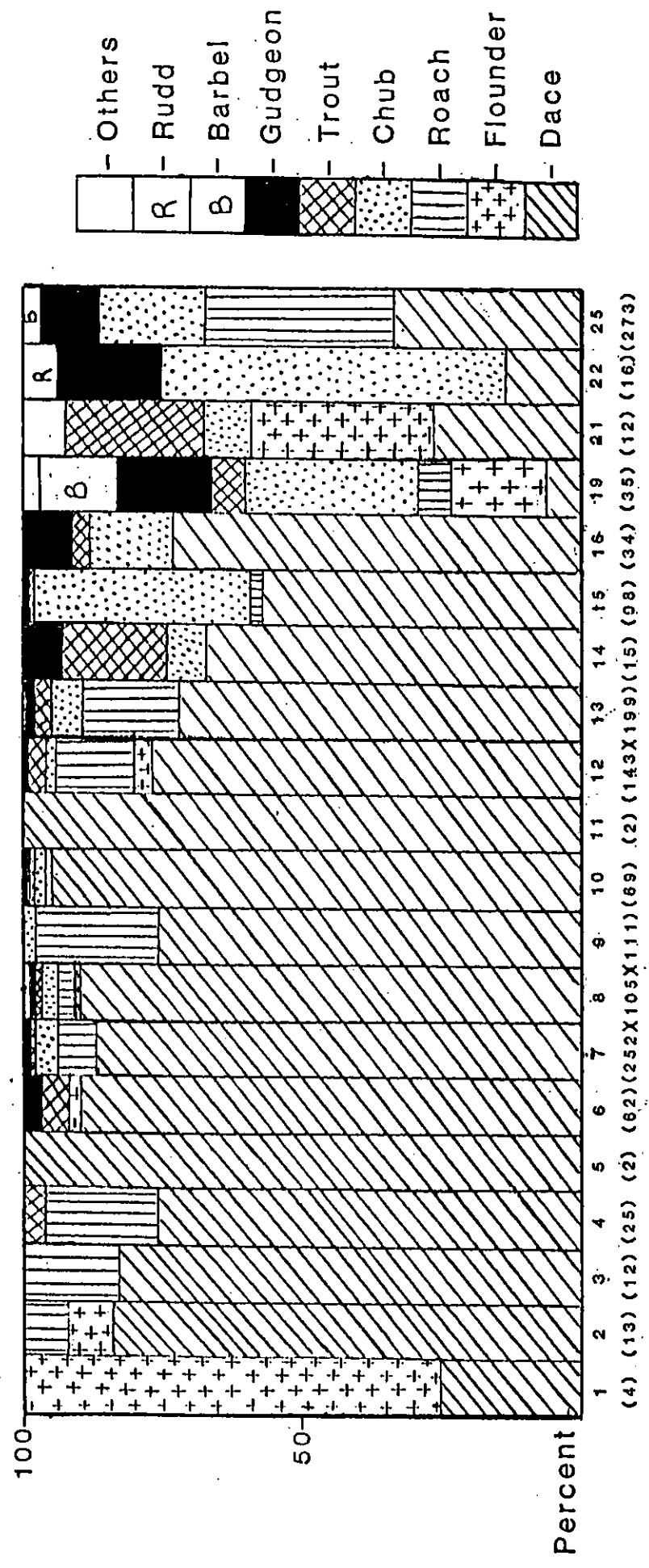


Fig. 7a. Species composition of fish of angling interest in the R. Tees at various sites in June. The numbers caught are shown in brackets.



For comparative purposes, the number of each common species per 100 m of river fished has been calculated (Table 3). Factors such as turbidity, water depth and state of tide will have considerable effects on efficiency and consequently numbers caught. However, it still produces worthwhile comparisons if the limitations are borne in mind.

Table 3. Numbers of fish per hundred metres found in each section.

	Fish species		
	Dace	Roach	Chub
Section 1	<0.1	-	-
Section 2	1.4	0.1	-
Section 3	1.3	0.3	-
Section 4	0.8	0.2	-
Section 5.1	0.1	-	-
Section 6	4.5	-	-
Section 7	19.4	1.5	0.8
Section 8.2	118.8	3.8	3.8
Section 9.1	28.3	8.0	0.7
Section 10	11.6	0.2	0.2
Section 11.1	0.2	-	-
Section 12.1	20.0	1.6	0.7
Section 12.2	5.0	3.0	-
Section 13.1	5.7	-	1.2
Section 13.2	18.0	5.7	0.8
Section 14.1	0.1	-	0.1
Section 14.2	0.9	-	-
Section 15.2	9.7	0.4	6.6
Section 16.2	6.3	-	1.3
Section 19	1.0	1.0	5.5
Section 21.1	1.2	-	0.4
Section 22	1.4	-	7.1
Section 25	25.7	26.3	15.1

Dace were found in all of the sites fished. Section 8.2 (between the bridges at Yarm) had by far the highest aggregation of dace in June being about 5 times greater than any other section fished (Table 3). Sections upstream and downstream of this also held good stocks of dace. Other areas of high density occurred in Section 12.1 (The Cabins), Section 13.2 (next section upstream but on the opposite bank) and Section 25 (Low Dinsdale). These four main areas have quite different physical characteristics and shows the degree of variation in habitat types which this species can tolerate. The Yarm area, Sections 7-9, has a gravel substratum and generally shallow water (very shallow and fast riffles at low tide). Sections 12.1 (The Cabins) and 13.2 (upstream, south bank) are considerably deeper and slower flowing and consequently have a more silty substratum. The majority of the dace found in Section 13.2 were associated with

a sewage outfall which was discolouring the river. Low Dinsdale (Sections 25) is much further up the river and unlike the previous areas is unaffected by the tide. The substratum is bedrock with gravel areas and macrophytes are present. The water is generally clearer and faster flowing. Within this section it was noticeable that the fish had a more specific habitat requirement and were practically confined to areas where dense cover provided by fallen trees and trapped macrophyte debris occurred. The flow in these areas was very low.

Roach were present in much lower numbers than dace and were only caught in about half of the sections fished. They were abundant only at Low Dinsdale, aggregated in the same areas as the dace and present in larger numbers (Tables 2 and 3). This was the only site where dace were not dominant in terms of numbers. Roach were also common in both Section 13.2 associated with the sewage outfall and in the lower Yarm area (Section 9.1).

The only other commonly caught species of angling importance was chub. Numbers were generally higher in upstream sections particularly those unaffected by the tide (above Low Moor weir, Low Dinsdale and Fardenside). Section 15.2 (below the pumping station) was the only tidally influenced reach with a good head of chub. They were associated with overhanging trees and bushes in areas of good flow and deep water.

Barbel were present in the non-tidal reaches at Low Dinsdale and Fardenside (Section 19) in the same habitat as the large chub. One small specimen was caught between the bridges at Yarm.

Gudgeon were only found in small numbers at sites fished by boom boat. It is probable that they were not sampled effectively in deep water. They were common at site 25 (Low Dinsdale).

Grayling were confined to the non-tidal reaches but salmon parr and smolts were caught in the tidal reaches only. One rudd was caught at Low Moor weir and a sea-lamprey was found at Fardenside. Flounders were recorded in the non-tidal reaches at Low Moor and Low Dinsdale as well as in the tidal reaches downstream.

Eels were not caught during the survey but notes were taken of their occurrence. Sightings in Sections 1-10 were sporadic. In Sections 11-16 few eels were seen on the north bank, more were seen on the south bank particularly in Section 16 and below the sewage input (Section 13). In total approximately 100 eels were seen. Eels were easier to see in the wadable sections and were present in the margins, under rocks and under macrophytes in Section 21 where >100 eels from 10 cm to several pounds were seen in the 260 m reach. Eels were present at Low Dinsdale (Section 25) mainly in the margins but also in mid-river under boulders and macrophytes. In general, eels in the tidal area of the Tees can be important to anglers and there are reports of matches being won with eels in the summer months.

1.3.1 Length frequency distribution

The length frequency distribution of each species of angling importance is given (Fig. 8). These results have been divided into length frequency by section for each major species (Appendix 2).

Dace of length 10-14 cm were represented at all sites where dace were common. Large dace were concentrated in the area between the bridges at Yarm (Section 8) and immediately upstream (Section 9) associated with a drain input. Other sections containing large dace but in smaller numbers were 12, 13, 16 and 25.

Most large chub were found in the upstream part of the river, particularly at sites 19 and 25, neither of which will be affected by the barrage.

Most of the larger roach were found at Low Dinsdale (Section 25). There is a tendency showing that the size range of the smaller fish may be extended at this site with numbers of 13-16 cm fish which were not apparent elsewhere.

Numbers of barbel, gudgeon and trout were too low to be able to comment on length frequency distribution within the river at this stage.

Fig. 8. Length frequency distribution of each species in the R. Tees.

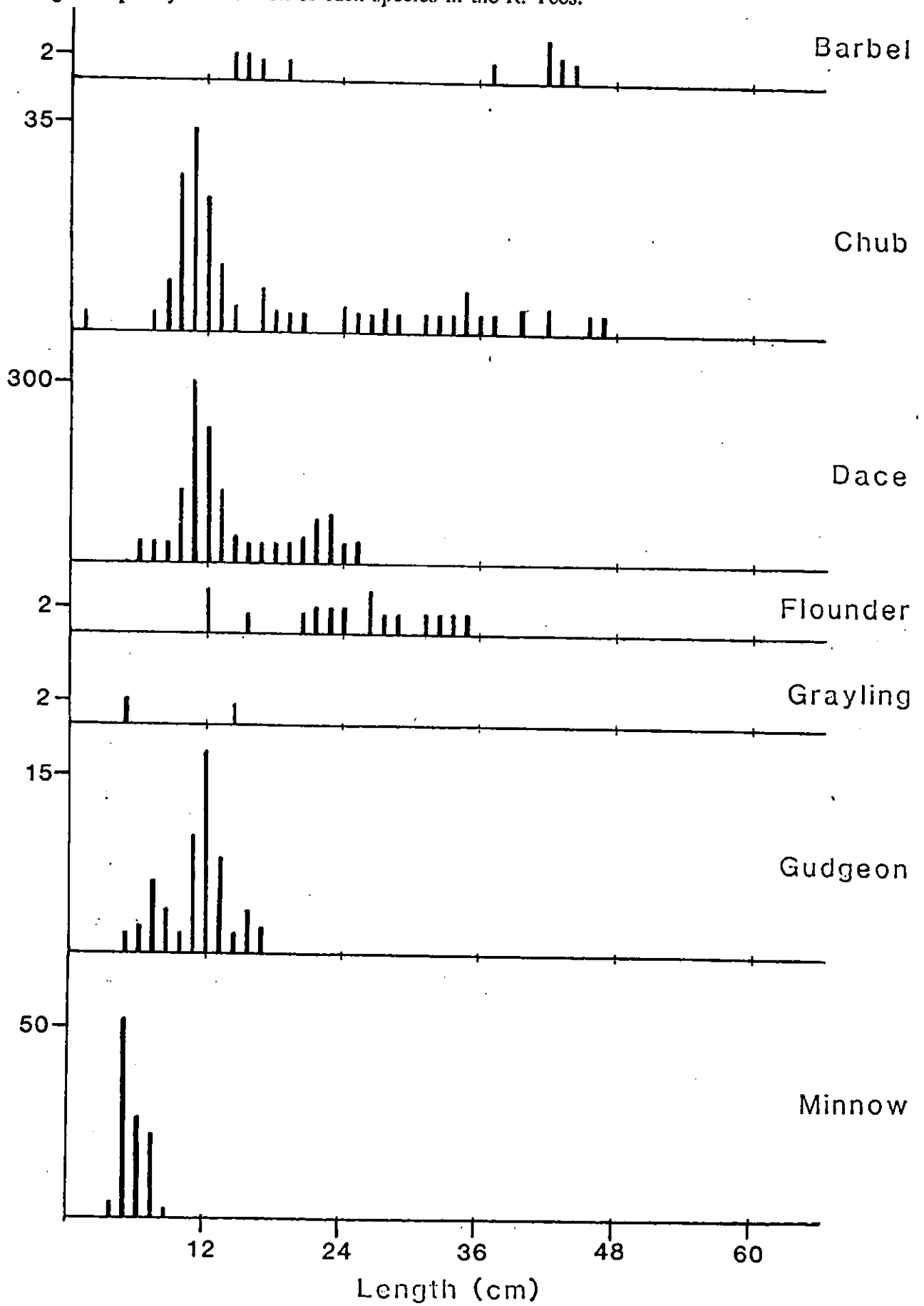
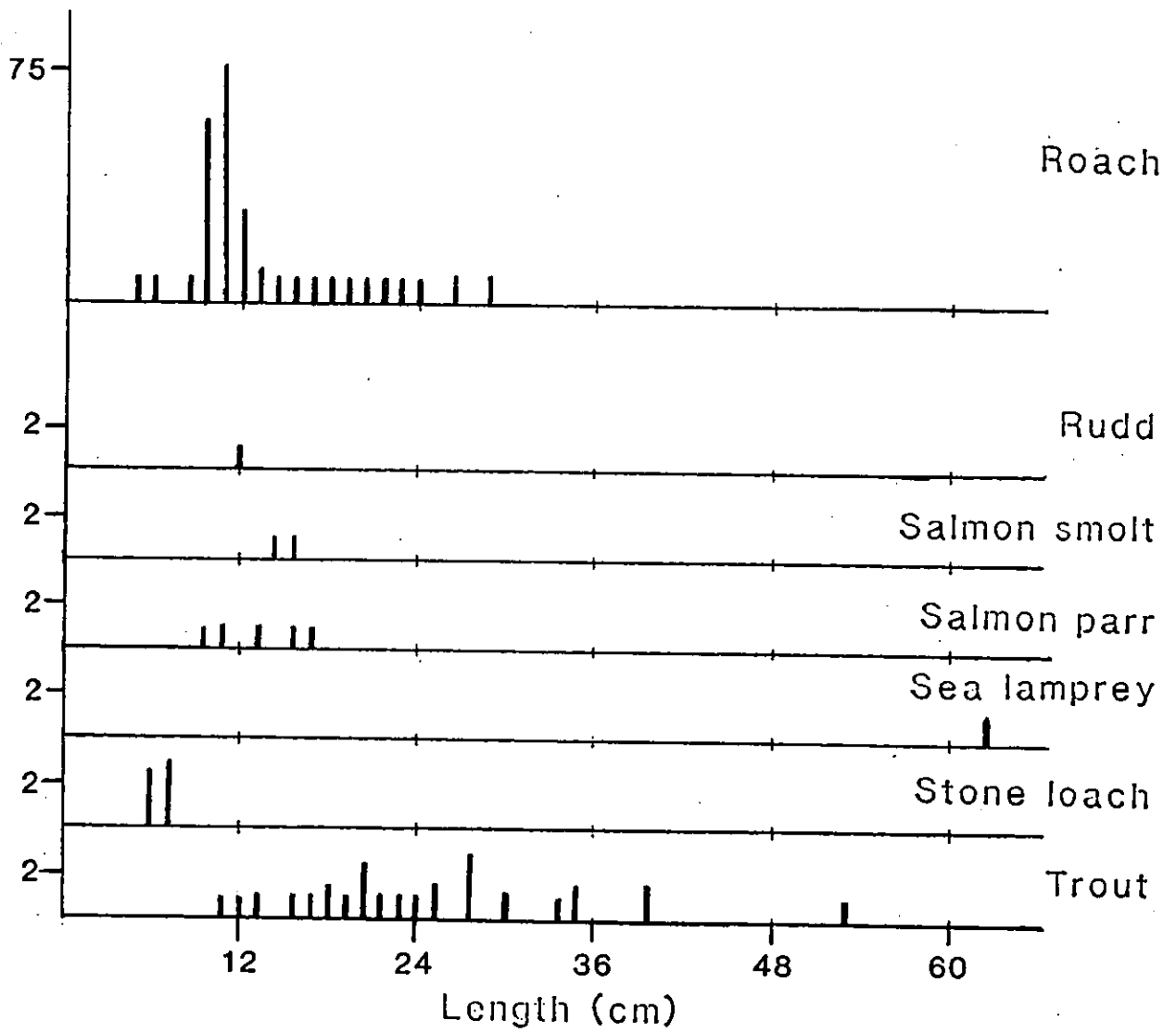


Fig. 8. Continued.



2. FURTHER SURVEY OF COARSE FISH SEPTEMBER 1991

2.1 Introduction

This survey was designed to produce information which will be of use in assessing the effect on the fish of any change in environmental conditions caused by the construction of the barrage.

2.2 Methods

Selected sections were electrofished and over 1200 fish were caught. Length and weight measurements were taken from each fish for condition factor calculation and scales were taken from over 400 fish for age determination.

2.3 Results

The number of each species is shown in Table 4. Pike was added to the species list for the river. Dace, roach and chub accounted for most of the fish caught.

Table 4. Species list for the R. Tees and number of each species caught - September 1991.

Species	Totals
Barbel <i>Barbus barbus</i> (L.)	16
Chub <i>Leuciscus cephalus</i> (L.)	153
Dace <i>Leuciscus leuciscus</i> (L.)	550
Flounder <i>Platichthys flesus</i> (L.)	20
Gudgeon <i>Gobio gobio</i> (L.)	85
Roach <i>Rutilus rutilus</i> (L.)	422
Trout (brown) <i>Salmo trutta</i> L.	10
Pike <i>Esox lucius</i> L.	1

2.3.1 Length weight relationship

Regression analysis of length on weight for each species was carried out. 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 5. (Graphs are given in Appendix 3).

Table 5. Values of the length weight regression for major species in the R. Tees.

Species	a	b	r ²
Barbel	-1.73	2.88	98.2
Chub	-2.03	3.11	99.6
Dace	-2.33	3.37	98.4
Flounder	-1.71	2.85	99.4
Gudgeon	-2.00	3.07	90.1
Roach	-2.05	3.22	96.9
Trout	-1.95	2.99	99.5

2.3.2 Condition factor

Condition factor (CF) was calculated from the formula

$$CF = W/L^b$$

where W = weight (g), L = length (cm) and b = slope from regression equation of length on weight.

Histograms of condition factor for each species of angling importance are shown in Fig. 9. In addition, box plots have been produced showing the median value (+), and the upper and lower quartiles (I). Possible outliers (*) and probable outliers (O) are shown. One set of results is of little use but a succession may show sections where fish are consistently outside the interquartile. Any adverse effect of the barrage may show up in a loss of condition in the older fish so that comparisons of condition factor pre and post barrage may be valuable in assessing whether any species has been affected.

Fig. 9. Histograms and box plots of condition factor for each major species in the R. Tees.

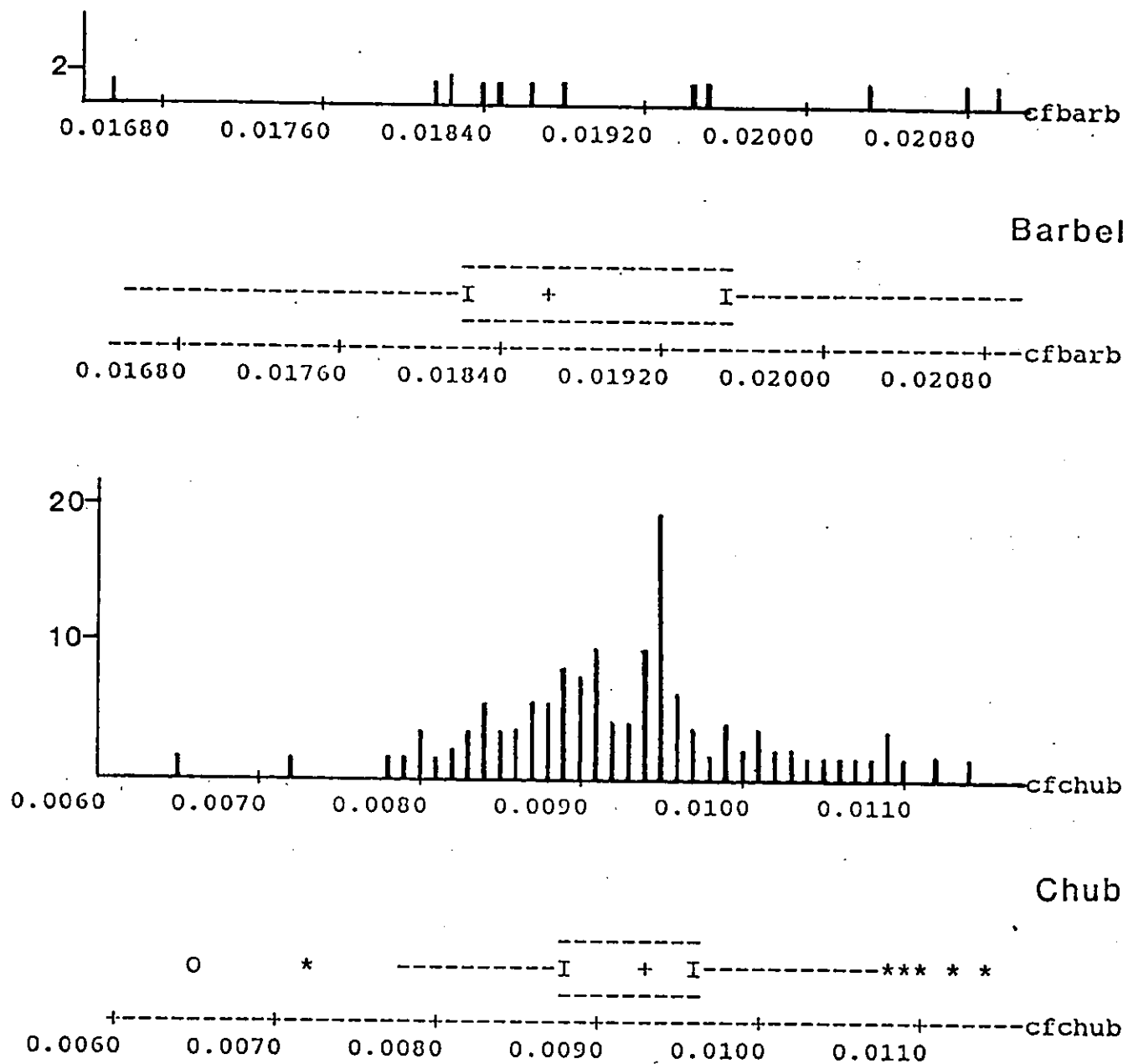
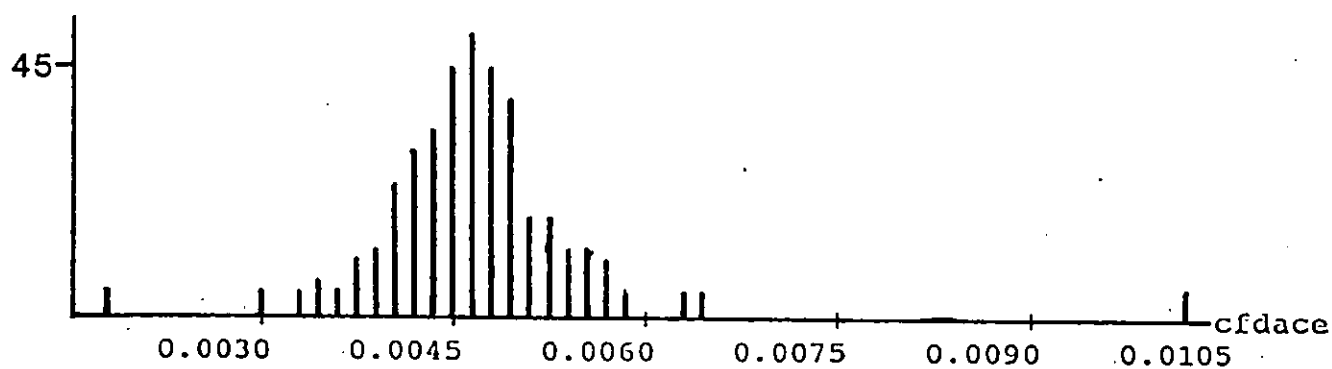
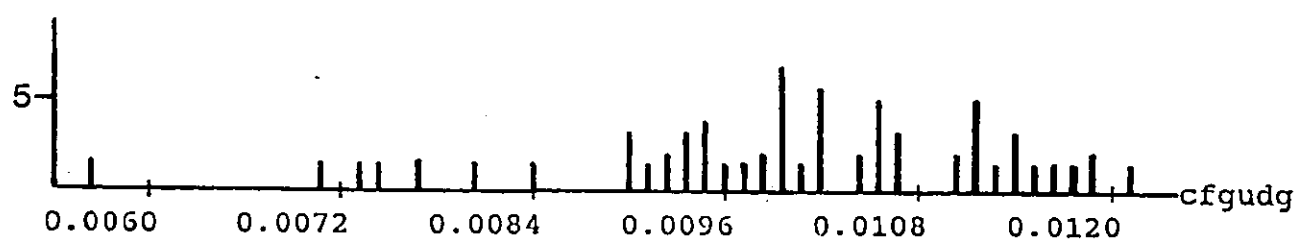
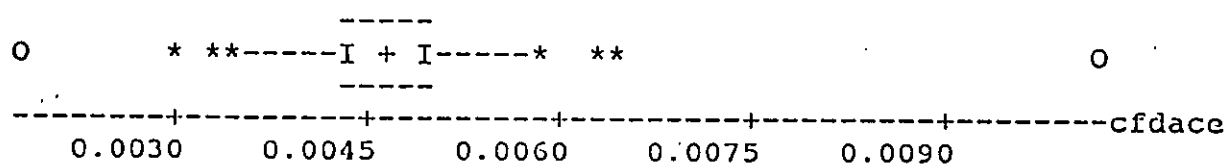


Fig. 9. Continued.



Dace



Gudgeon

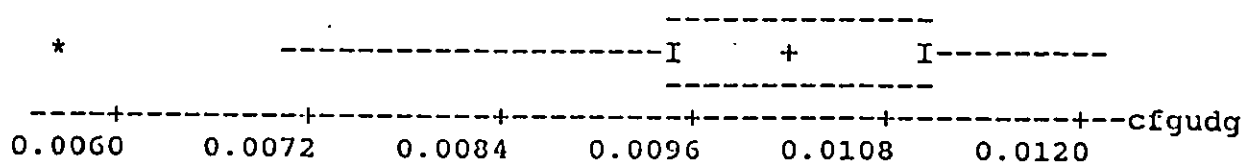
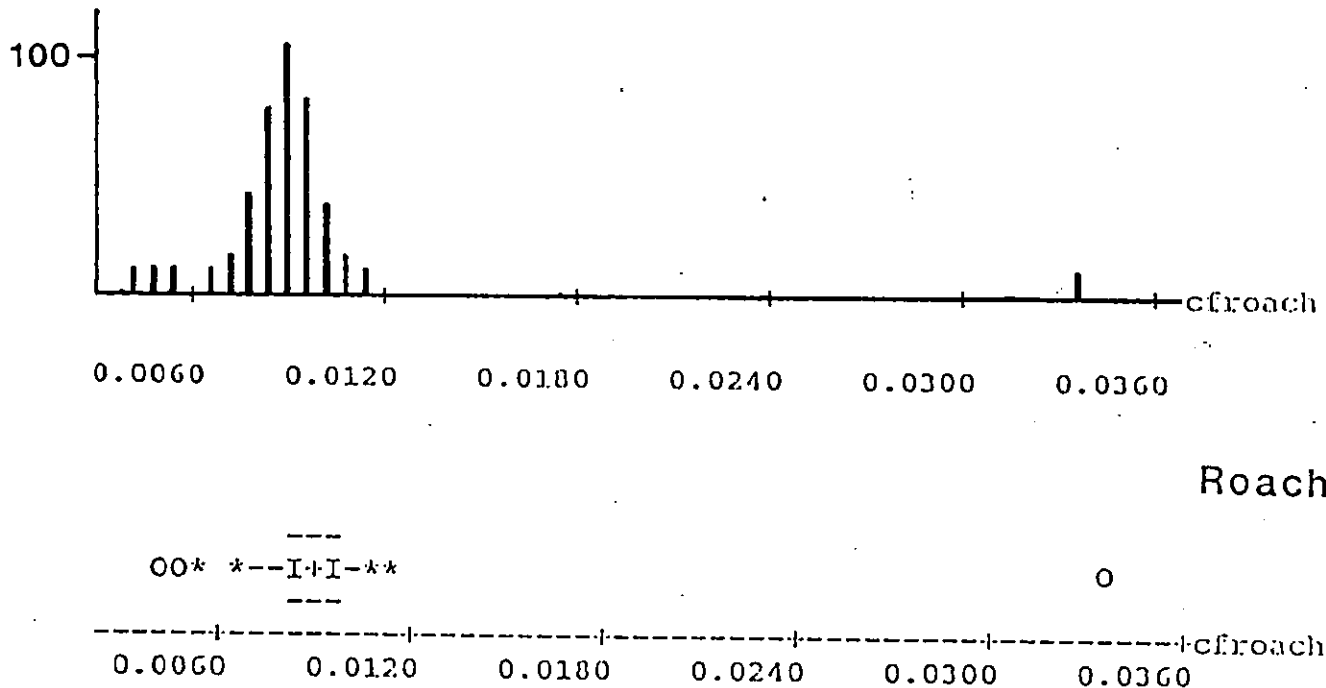


Fig. 9. Continued.



2.3.3 Year class strengths

The length frequency histograms for each age group of barbel, chub, dace, roach and trout are shown in Figs 10-14.

Only small numbers of barbel were caught but it is clear that they have a fast growth rate reaching 20-25 cm at age 2+ (Fig. 10)

The histograms of chub lengths for each age show a clear size progression. Fish up to age 14+ were sampled. Recruitment from the 1989 spawning (fish of age 2+) was strong. Other strong year classes are 1984 and 1983, ages 7+ and 8+. Weak year classes are 1988 (3+), 1987 (4+) and 1986 (5+) (Fig. 11). It should be noted that old chub are very difficult to age from scales and ages of fish over 12 years are liable to error.

Eight year classes were found for dace, several were strong including the 1989 (2+) class (as in chub). Unlike chub, the 1990 (1+) year class also looks strong. The 5+ and 6+ age class are well represented and fish of age 3+ are under-represented. The majority of growth occurs over the first four years, little growth can be seen in older fish (Fig. 12). Dace in other rivers grow throughout their life. Data from the Rivers Frome, Stour, Thames and Wye show that fish up to age 10+ can be found. The largest dace in these rivers varies between 17 and 25 cm. This range of lengths is reached by Tees dace at age 4+ showing that the fish grow at a very fast rate and that this species may not live as long as in other rivers. The lack of growth in length after age 4+ is not expected unless there is a finite length attainable by dace. Further analysis, e.g. of L_{∞} would be interesting when more data are available.

The 2+ and 7+ year classes are strong in roach and unlike dace, the 1990 (1+) year class looks weak (Fig. 13).

Very few trout were caught in September. The largest fish was in fact a sea trout (Fig. 14).

Fig. 10. Length by age for barbel in the R. Tecs.

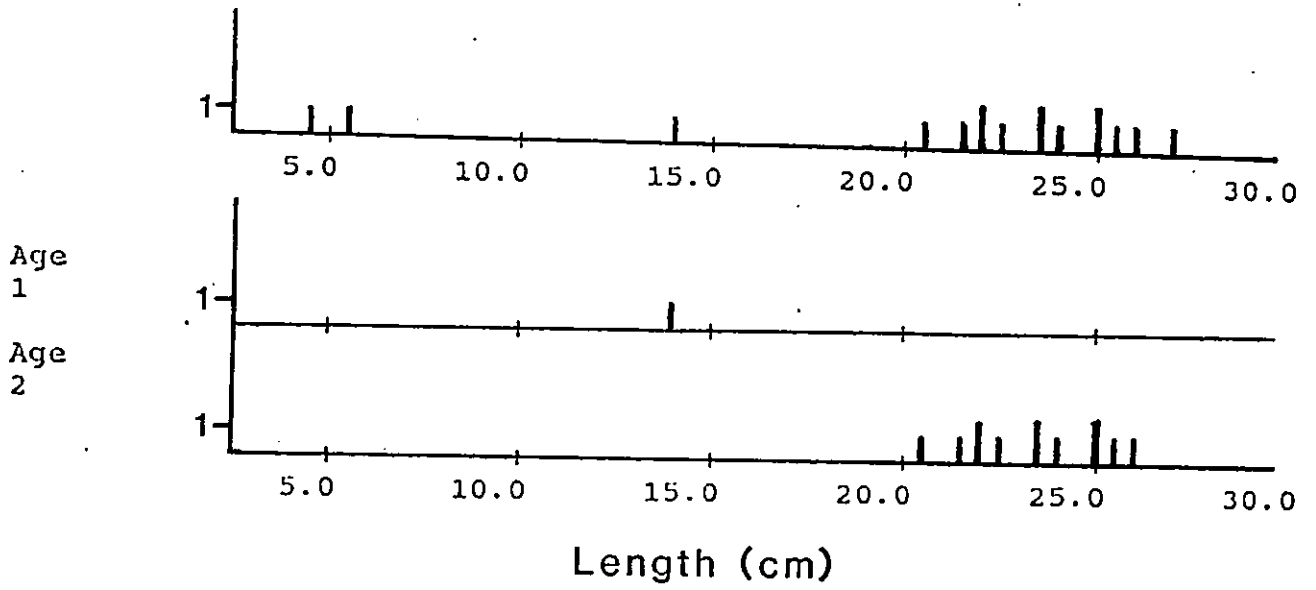


Fig. 11. Length by age for chub in the R. Tees.

Chub

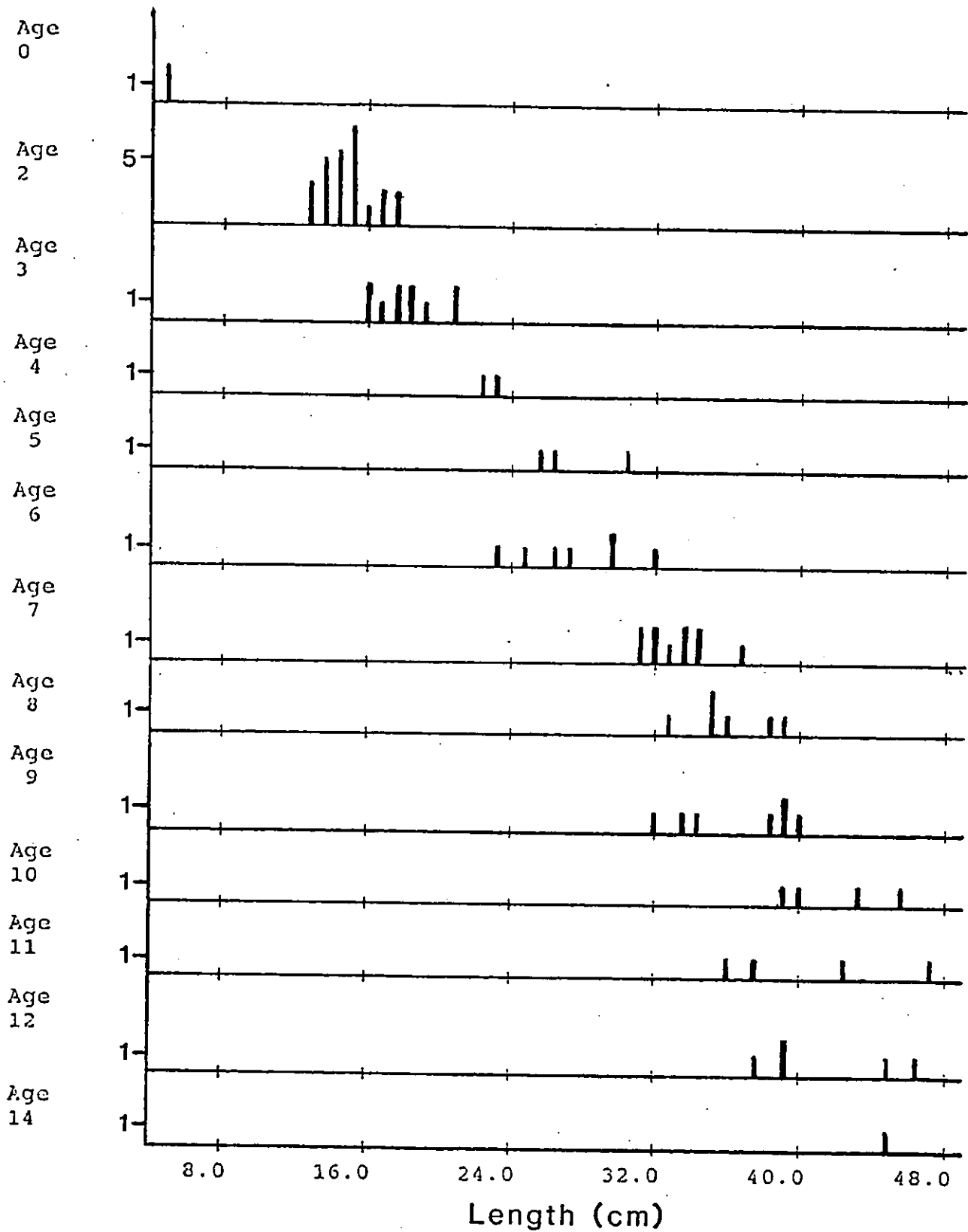
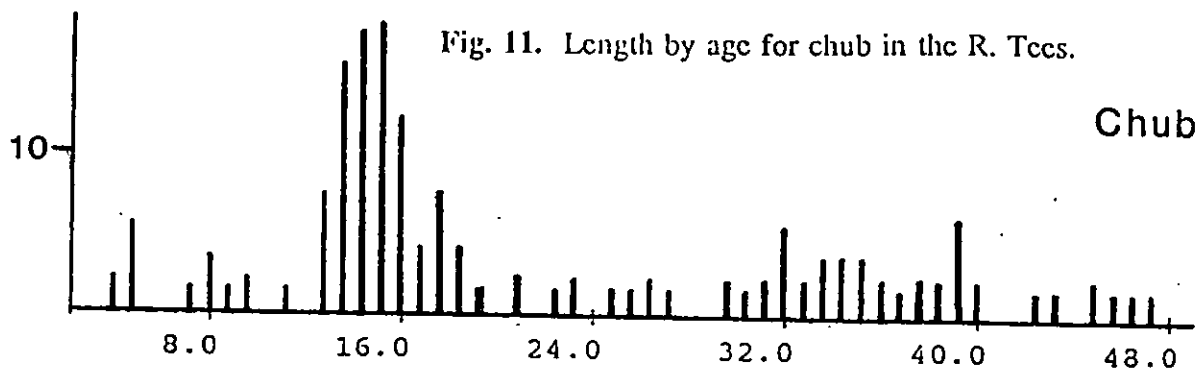


Fig. 12. Length by age for dace in the R. Tees.

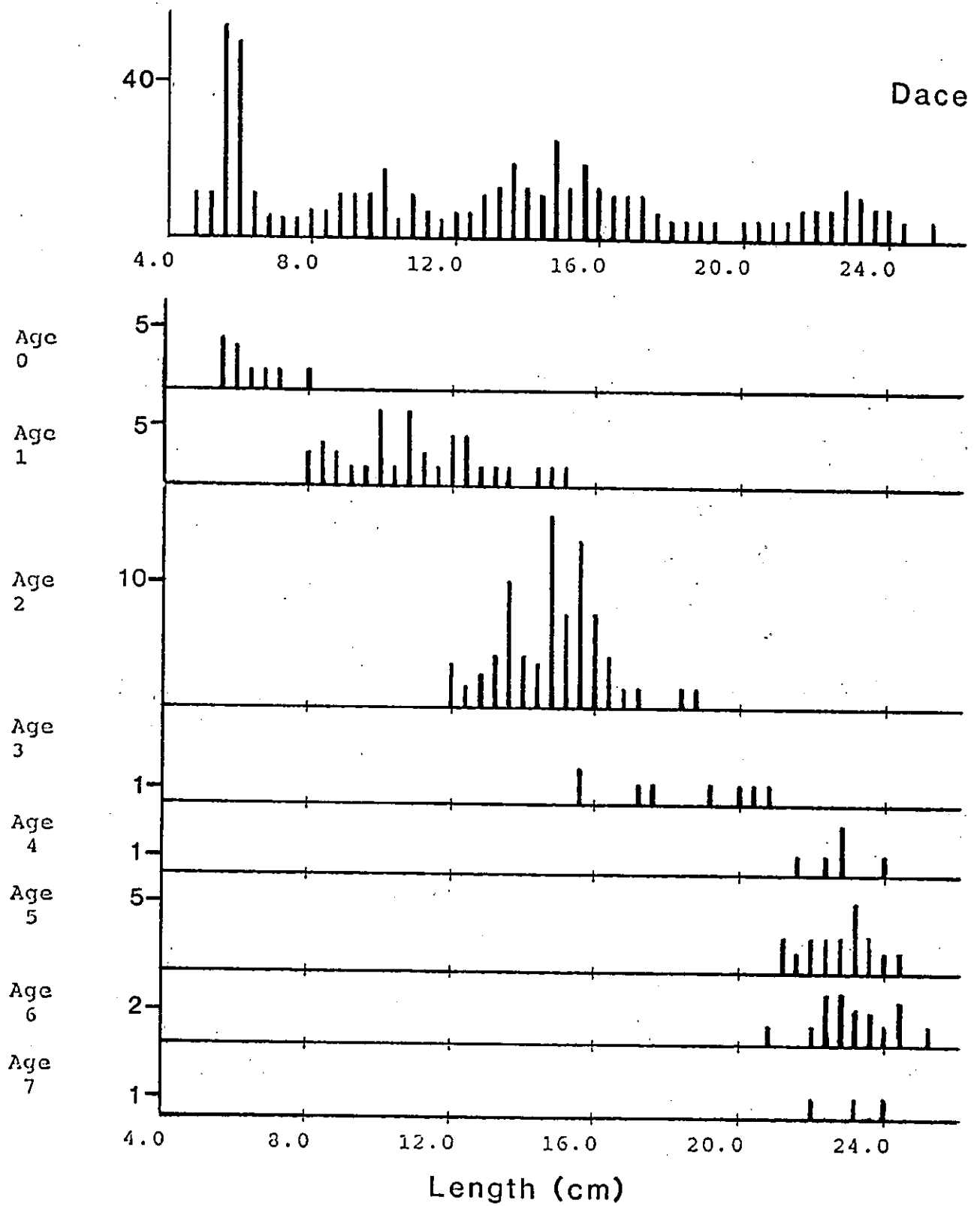


Fig. 13. Length by age for roach in the R. Tees.

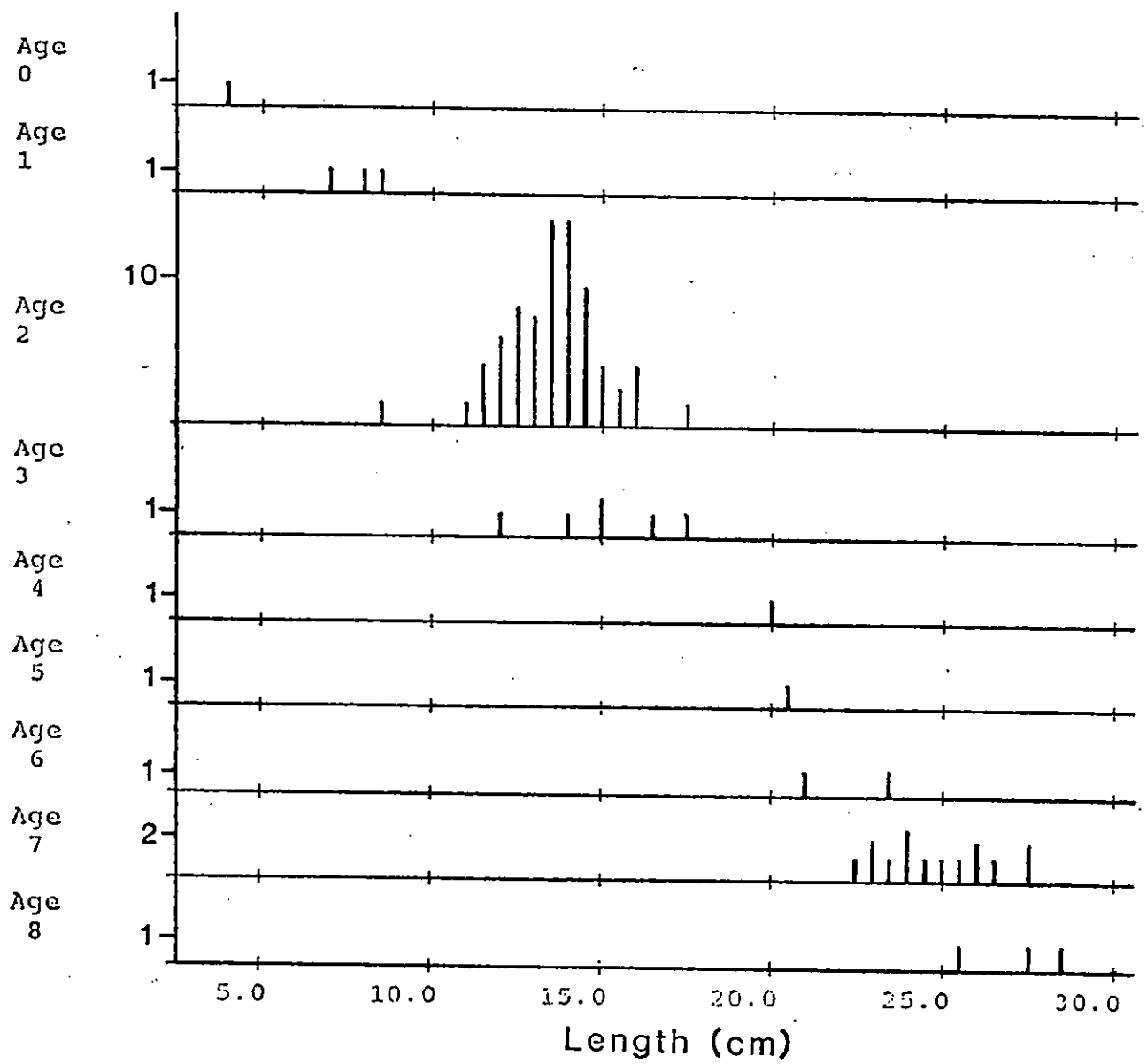
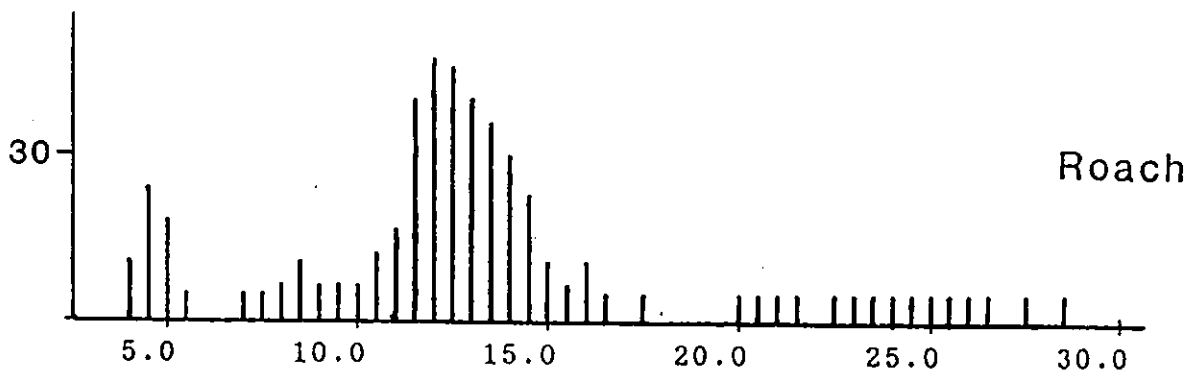
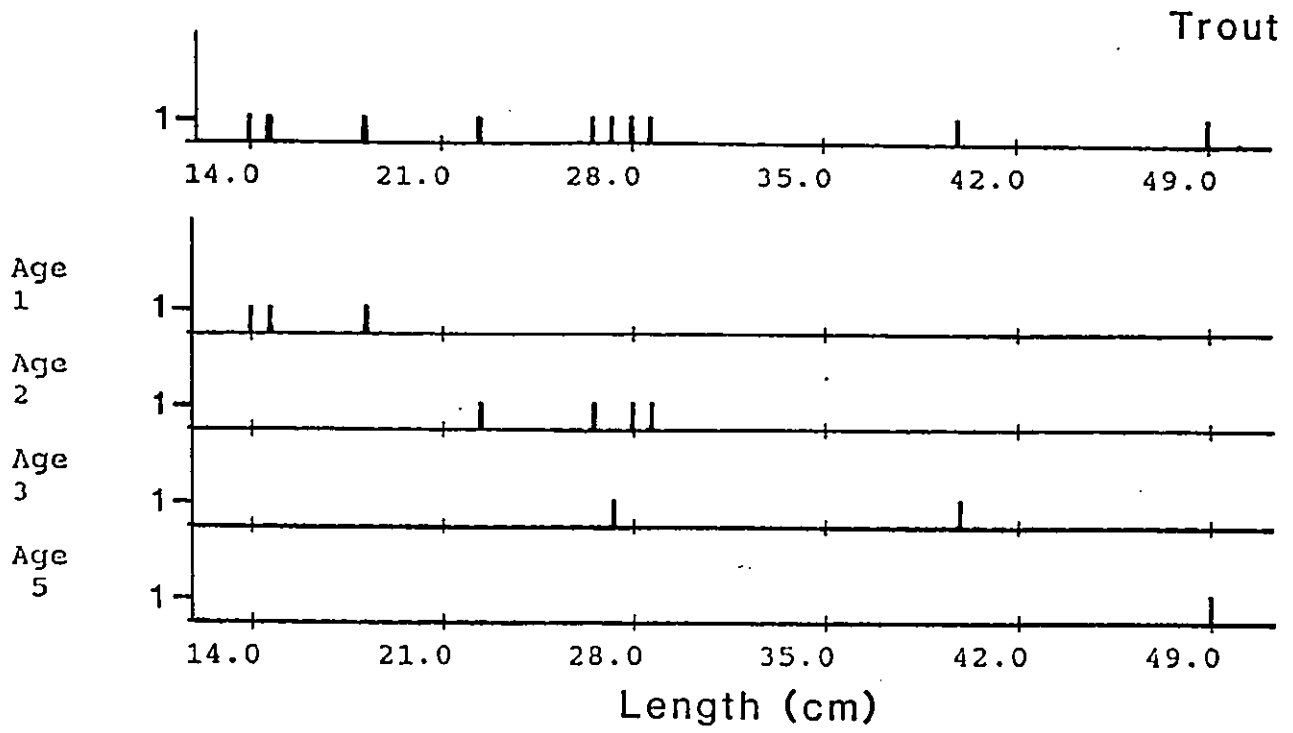


Fig. 14. Length by age for trout in the R. Tecs.



3. FRY SURVEY

3.1 Introduction

This survey was designed to identify areas of the river favoured by fry and to determine species composition where fry were numerous. This baseline information will be compared with the post-barrage position when changes in species composition of the fish will be reflected firstly in the fry stage.

3.2 Methods

The survey was conducted in September over the whole length of the river expected to be affected by the barrage from The Holmes (Section 1) to Low Worsall (Section 16) upstream. In addition, fry were sampled at Low Moor (Sections 21 and 22) and Low Dinsdale (Section 25).

Electric fishing 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 disturbance. The shape and size of the anode allows point sampling, producing a high intensity field capable of stunning fry in a small area. At each sampling area up to 10 point samples were taken over a 25 metre area. The number of point samples depended on the number of fry caught.

In addition to the electric fishing, a micromesh seine was used in areas where large congregations of fry were expected and where no snags were present. These seines were thought to provide a more accurate species composition than point sampling as the results were based on larger numbers of fry.

3.3 Results

Over 1600 fry were sampled, measured and identified. The sampling points and species composition are shown in Figs 15-20a. Many adult minnows are included in the results (as well as a few 3 spined sticklebacks) as these fish occupy similar habitats to those used by the fry of larger coarse fish. Minnow and chub were the most common representing 36% and 31% respectively (Table 6). Only 9% of the fry caught were dace. This percentage was unexpectedly low and may have been due to the movement of dace fry into deeper, faster flowing areas while sampling was concentrated at the margins. In future, the sampling time may be brought forward so that the fry are younger and consequently smaller and still occupying the marginal habitats. Timing is critical in that very young stages of fry are more difficult to sample and identify. Three spined sticklebacks were collected, adding a new species to the list found in the baseline survey. The presence of barbel fry indicates that the original stocked fish are now breeding successfully in the R. Tees.

Table 6. Percentage composition and numbers of each species of fry sampled in the R. Tees, September 1991.

Species	Total	Percentage
Barbel <i>Barbus barbus</i> (L.)	13	0.8
Chub <i>Leuciscus cephalus</i> (L.)	523	31.3
Dace <i>Leuciscus leuciscus</i> (L.)	150	8.9
Gudgeon <i>Gobio gobio</i> (L.)	71	4.2
Minnow <i>Phoxinus phoxinus</i> (L.)	600	35.9
Roach <i>Rutilus rutilus</i> (L.)	301	18.0
Stone loach <i>Noemacheilus barbatulus</i> (L.)	6	0.4
3 spined stickleback <i>Gasterosteus aculeatus</i> L.	8	0.5

Key to Figs 15-20

B = barbel
C = chub
D = dace
Gu = gudgeon
M = minnow
R = roach
SL = stone loach

Fig. 15. Sites of fry samples in Sections 1-4.

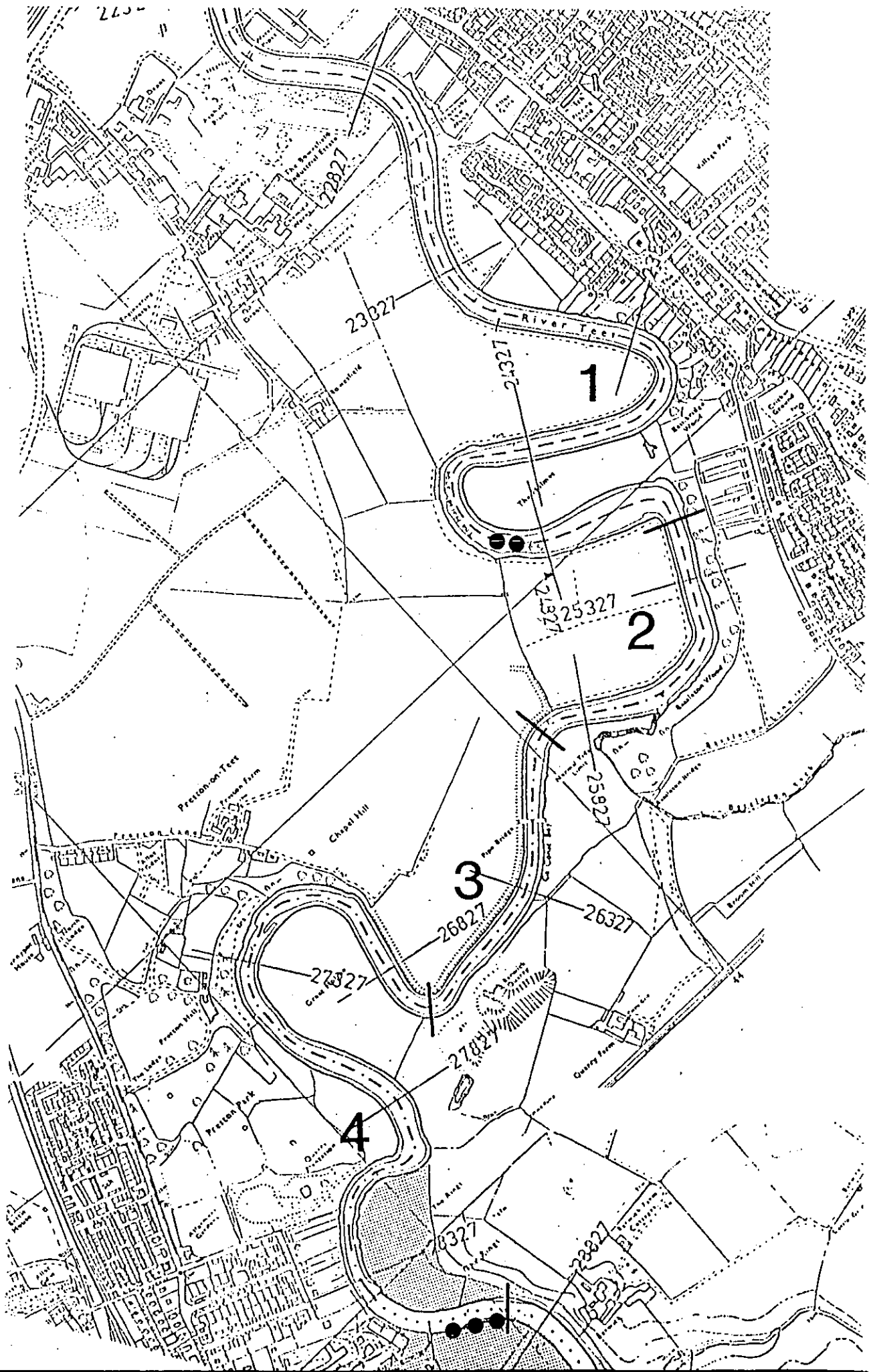


Fig. 16. Sites of fry samples and species composition of fry in Sections 5-9.

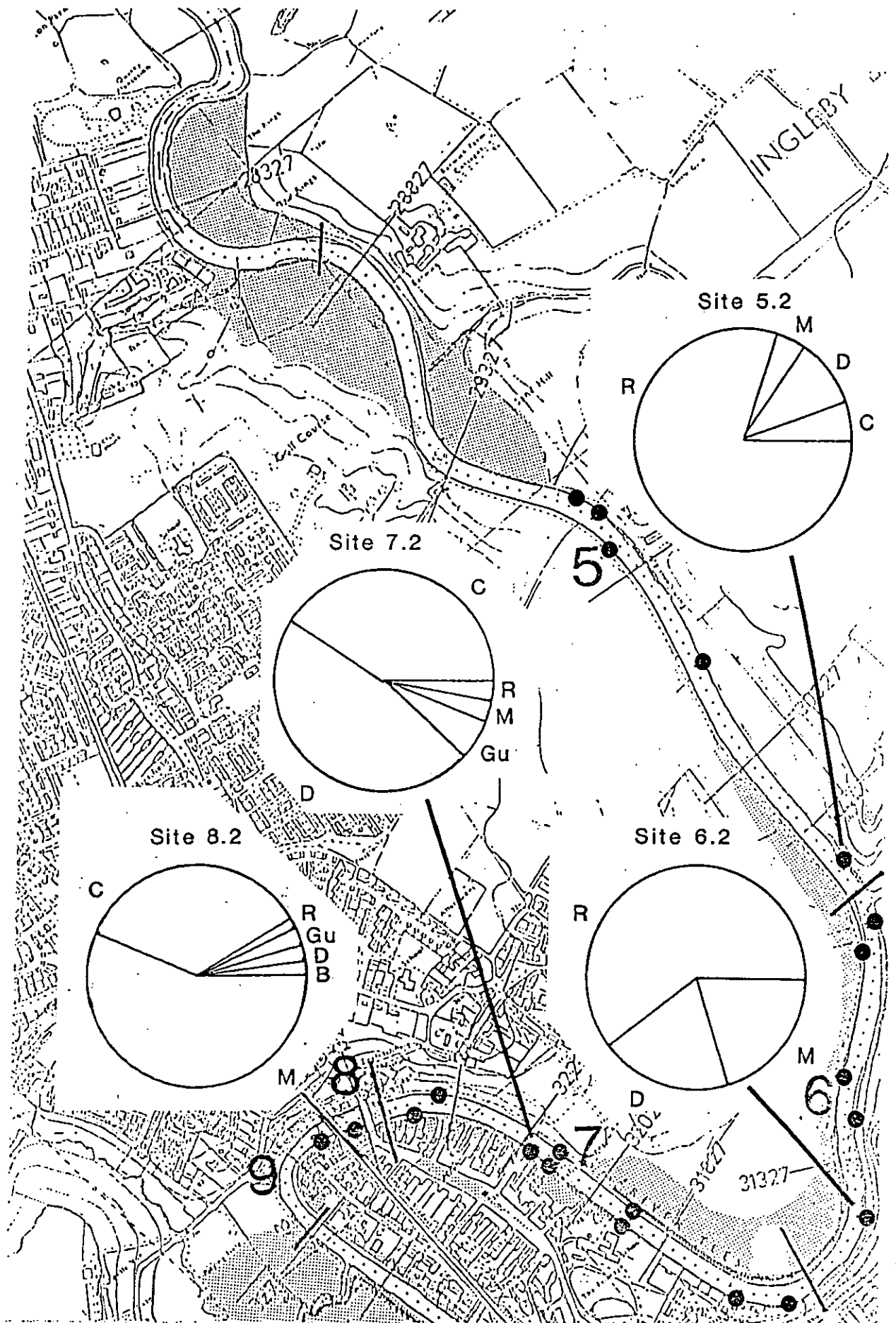


Fig. 17. Sites of fry samples in Sections 10-14.

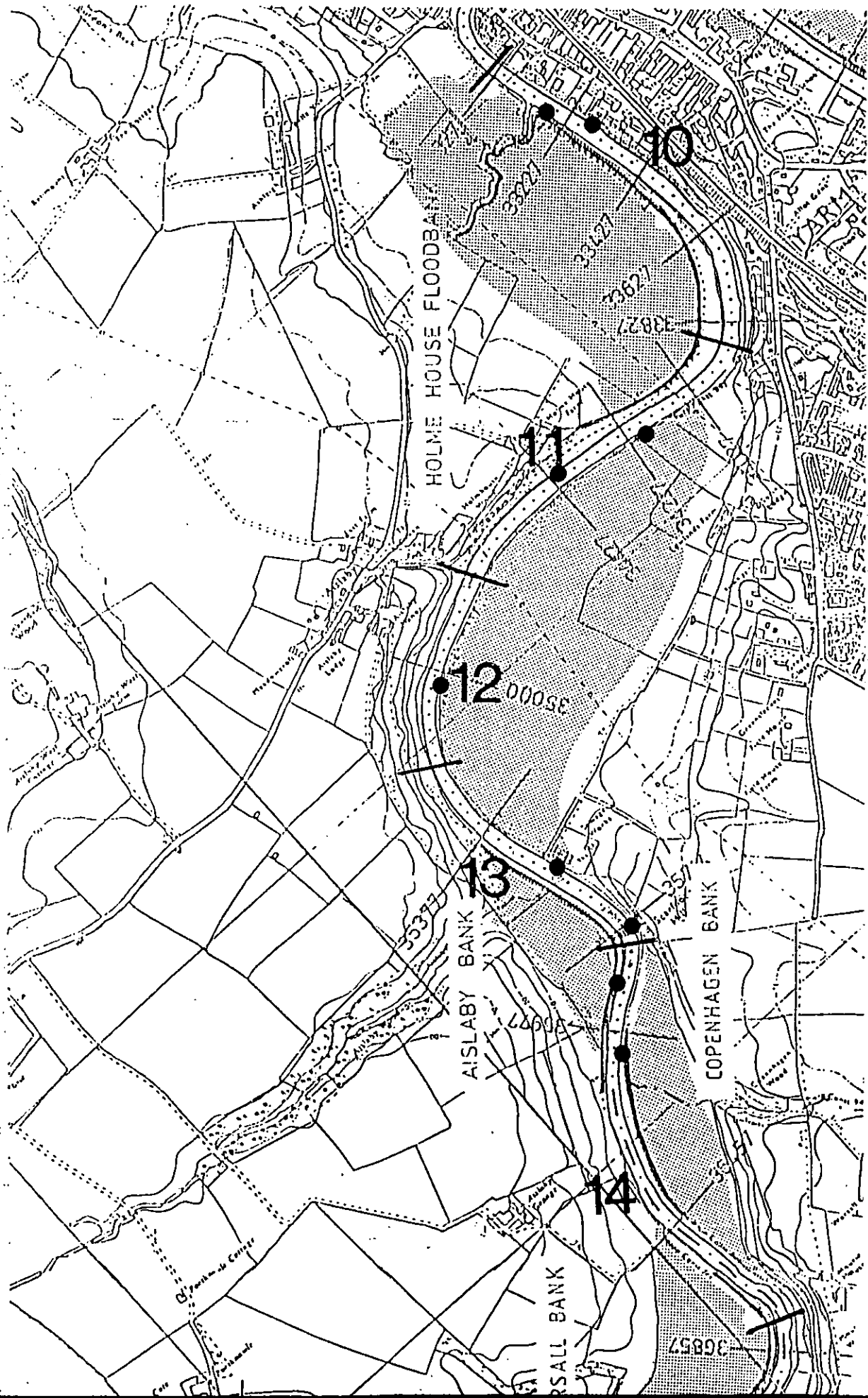


Fig. 18. Sites of fry samples and species composition of fry in Sections 15-18.

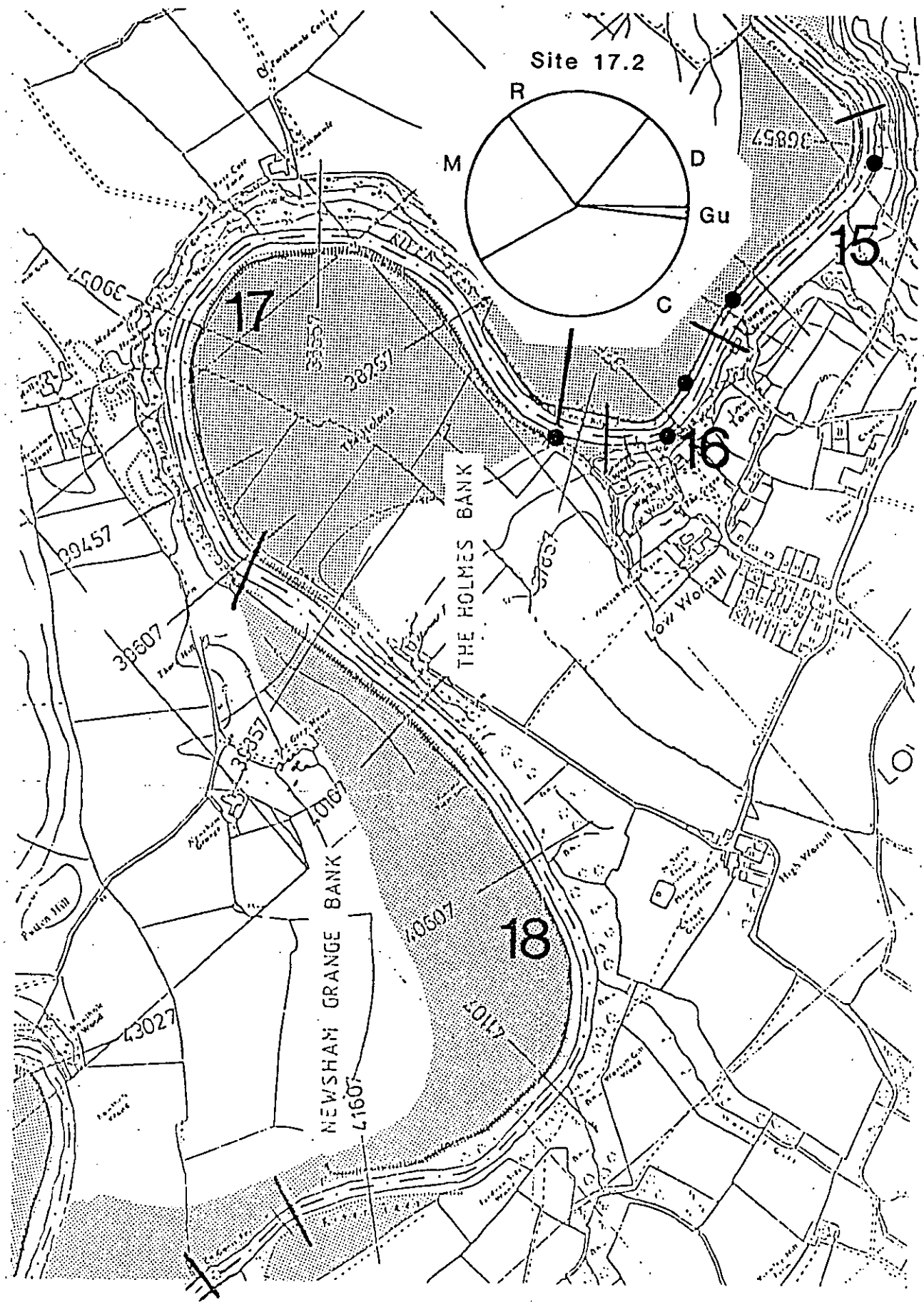


Fig. 19. Sites of fry samples and species composition of fry in Sections 19-21.

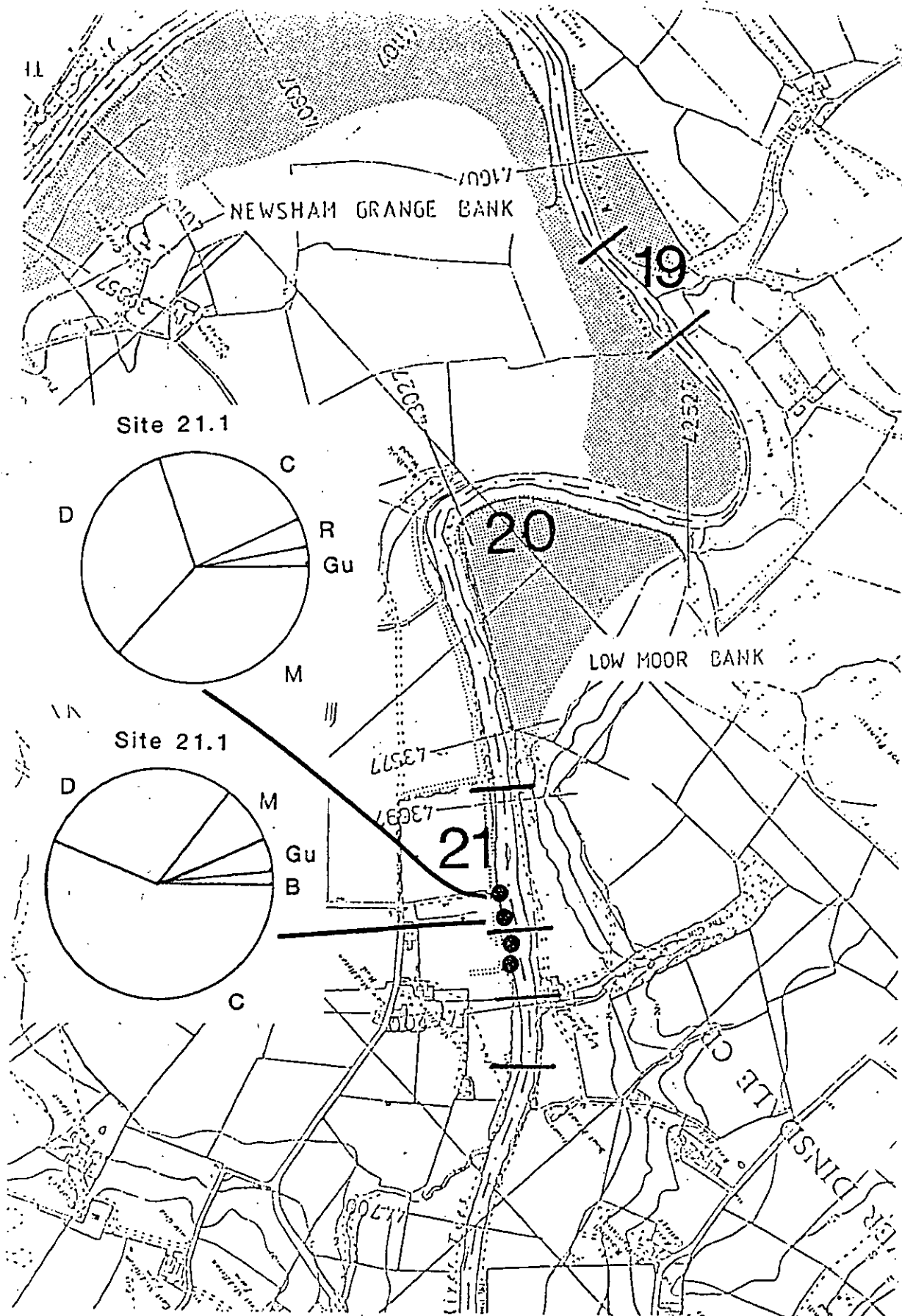


Fig. 20. Sites of fry samples and species composition of fry in Sections 22-25.

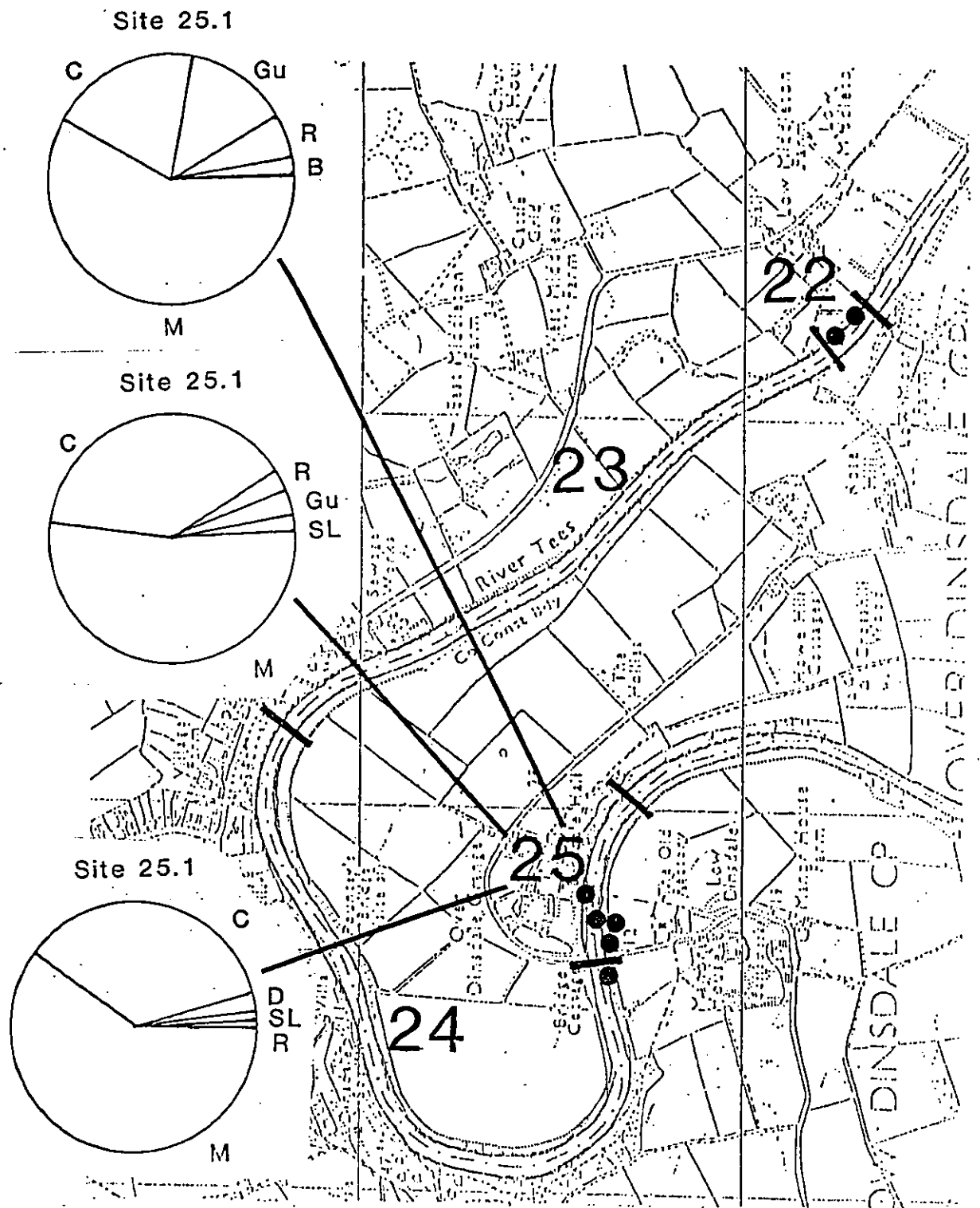
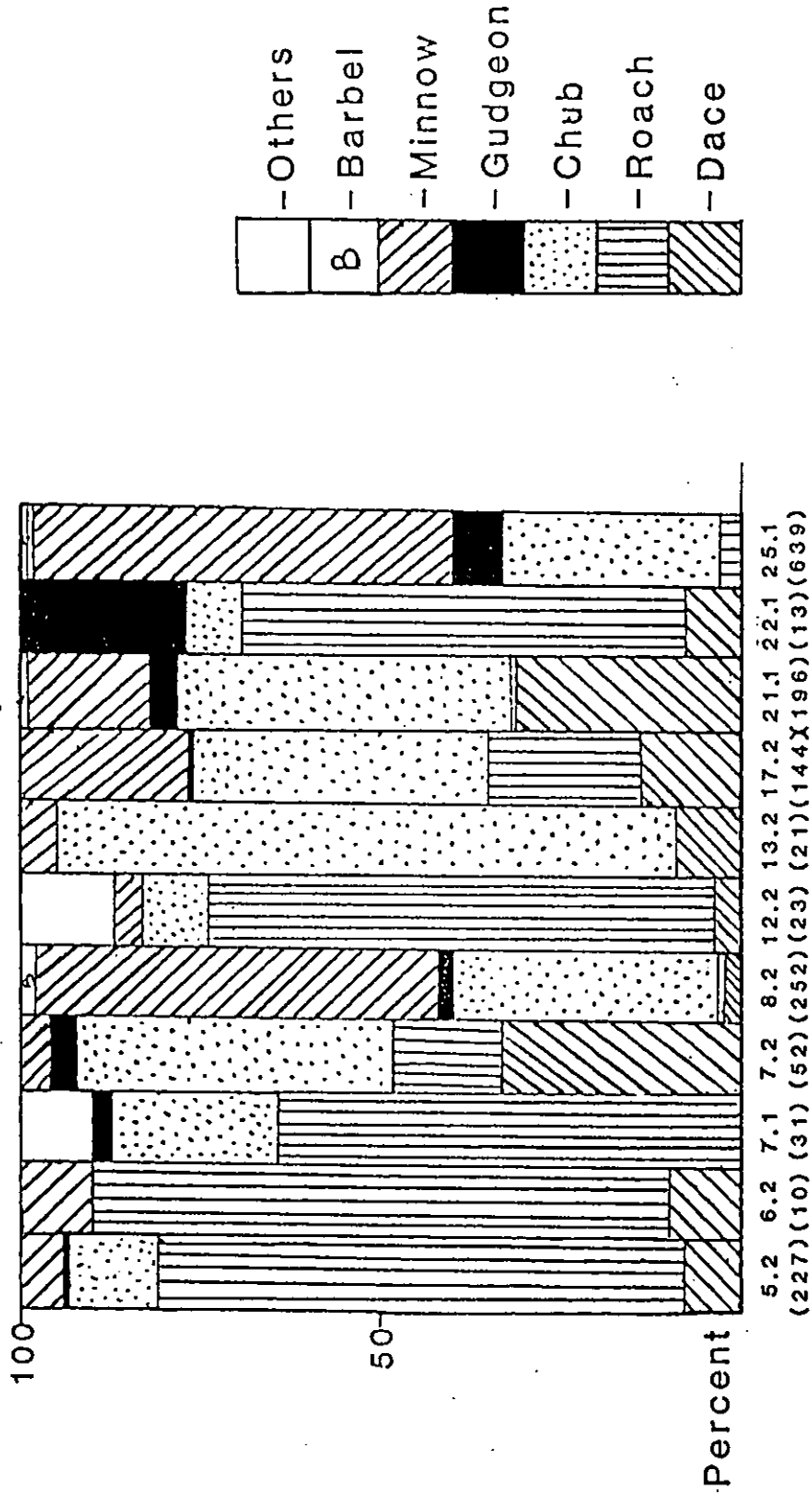


Fig. 20a. Species composition of fry in the R. Tees in September at various sites.
The numbers of fry caught are shown in brackets.



3.3.1 Distribution of fry

No fry were caught by seine netting at Thornaby (Section 1). Electric fishing was not possible as the conductivity was $>2000 \mu\text{S cm}^{-1}$, even though sampling was calculated to coincide with a low spring tide. Fry were also absent in Section 4 (The Rings).

Sampling was concentrated around Yarm (Sections 5-8), the main area of concern and, for comparison, Low Moor and Low Dinsdale, two areas which will be unaffected by the proposed barrage. Results are variable showing that microhabitats may be important for fry. The sample in Section 5 was taken in a bay in the bedrock at low slack tide. Roach were dominant by number (81% of 186 fish). Further upstream in Section 6, a marginal area in the shade with a muddy substratum, produced only 5 fish. The percentage of dace increased in Section 7. The seine was used over a gravel substratum on an ebbing tide. Dace and chub predominated and roach provided only 3% of the catch. The gravel at Yarm is, according to the anglers, an important spawning area for dace. The presence of dace fry at this site may substantiate this claim. Section 8 (between the bridges at Yarm) produced a large number of fry (252). The substratum was gravel and the area fished included fast flowing water (flood tide) and the slack behind a gravel bank in the margins. Only four dace were netted, the main species being minnow and chub. Barbel fry were found at this site.

The area fished at Low Worsall (Section 17) had a hard packed soil/clay substratum with semi-emergent vegetation. The tide had just started to ebb. Chub and minnow again predominated although roach and dace were present in reasonable numbers.

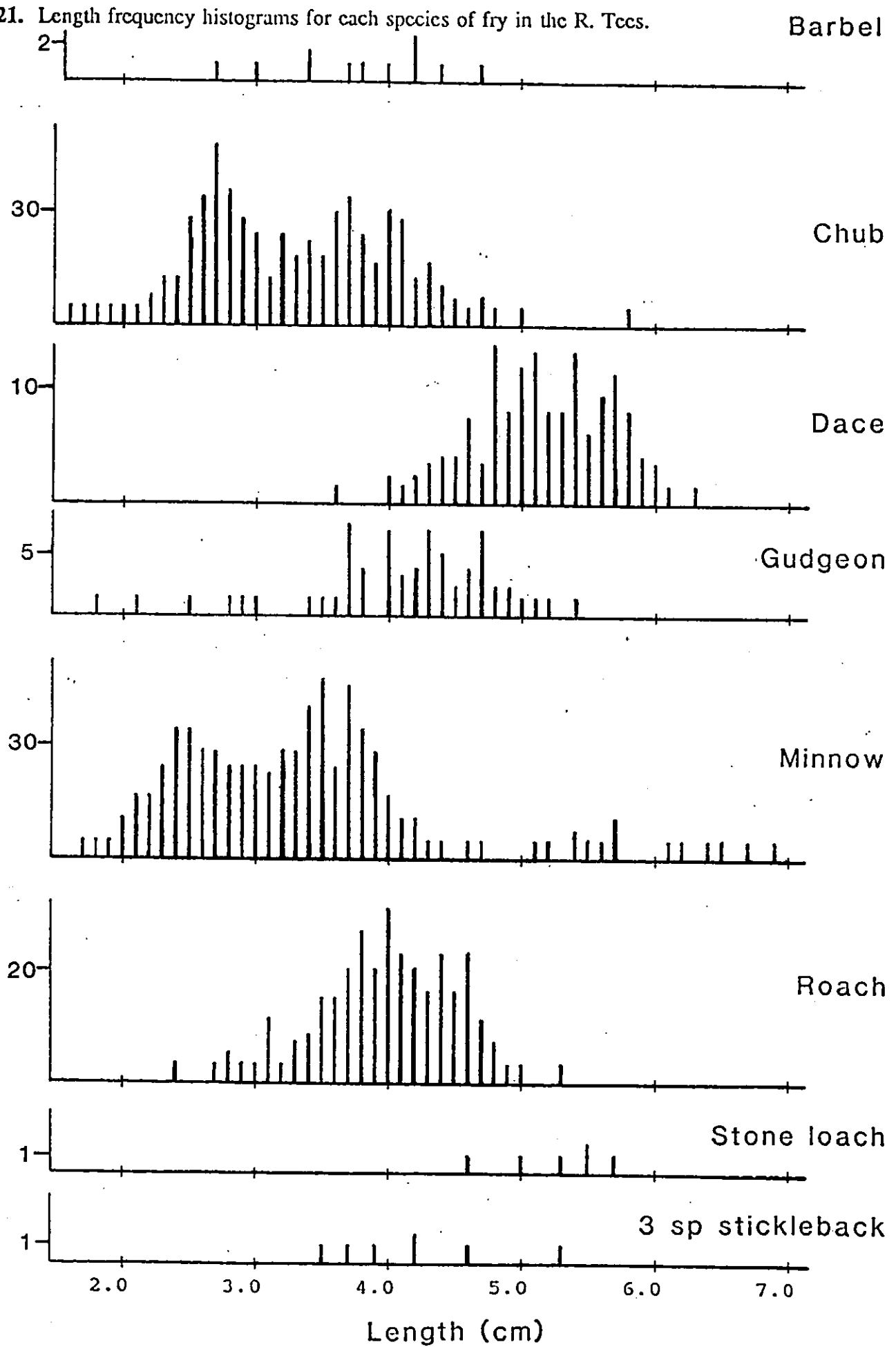
Two nettings were carried out on the gravel substratum at Low Moor weir (Section 21). The first was sited along the margin in slack water and the second included an area of deeper flowing water as well as margin. Only two roach were netted (second haul). Barbel fry were found at this site. Chub, dace and minnow were common. The second netting did not produce an increase in numbers of dace.

The first seine netting at Low Dinsdale (Section 25), in slack water with a gravel substratum produced no dace. Two further nettings in deeper and faster flowing water produced only two dace. Roach were also poorly represented (only 22 fish from 3 hauls). Both roach and dace adults were extremely common in this section and the evidence points to this being a poor spawning area for these two species. Chub and minnow were abundant in each netting. Gudgeon fry were common in the deep slack area and barbel were also found there.

3.3.2 Length frequency distribution

Length frequency histograms are shown for each species (Fig. 21). This confirms that dace fry were the largest (4-6 cm) and would be more capable of living in faster flowing water than the other species. Of the three major species of angling importance, chub were the slowest growing and had the widest size range (2-5 cm). Roach were intermediate in length (3-5 cm).

Fig. 21. Length frequency histograms for each species of fry in the R. Tees.



4. TEMPERATURE

4.1 Introduction

Temperature is one of the main factors affecting growth and survival of fish. Barrage construction may cause changes in the mean temperature of the river. Three sites were chosen to represent the temperature of the river in areas unaffected by the tide, areas in the main angling section and areas affected by saline intrusion.

4.2 Methods

Three data loggers fitted with temperature probes were positioned in the river. The upstream site is at the NRA gauging station above Low Moor weir (NGR NZ 365105). This site is above the tidal limit. The middle site was chosen to represent the temperature in the tidal section of the river that is regularly fished. The logger was sited at Barwick Farm, Ingleby Barwick below Yarm (NGR NZ 431144). The third logger was situated in Stockton-on-Tees at the Castlegate Marine Club (NGR NZ 451192).

4.3 Results

The monthly means, maxima, minima and range at each site is given in Table 7. All sites have had problems. The downstream site was accidentally set wrongly and the September to December data was lost. The probe at the middle site was lost (vandals or animal damage to the wire) in October and the upstream logger was flooded out in December.

The temperature range at Stockton is high due to the influence of cold sea water twice a day. The small temperature range at the middle site suggests that the influence of the tide is minimal at this point.

The results have been compared with the R. Frome in Dorset which has a large dace population. The monthly means for this river ($^{\circ}\text{C}$) are as follows; July 17.4, August 17.0, September 14.6, October 11.9 and November 8.3. During the summer which is the crucial time for growth and survival of fry, the temperature of the Tees is higher than the Frome dispelling the theory that the Tees is a 'cold river'.

5. ANGLING DATA

5.1 Correspondence with Angling Clubs

The co-operation and assistance of the angling clubs was initial to the success of the project in that their claims of the state of the course fish stocks needed to be verified.

A standard letter was sent to all angling clubs in the area asking for details of fishing rights on the tidal section of the R. Tees in particular and enquiring whether records of matches are kept. Replies suggest that very few clubs fish the tidal Tees and even fewer keep records. Four clubs regularly fished the tidal water; Preston Park Angling

Club (no longer in existence), Association of Teesdale and District Angling Club (ATDAC), Stockton Angling Association (SAA) and Yarm Angling Association (YAA).

ATDAC have a small amount of water on the tidal Tees and few matches are held. Records of catches have been kept for the last two seasons and these data have been made available.

Stockton A.A. have held a few matches but records were not kept.

The three clubs have agreed to keep records in the future with Yarm A.A and ATDC being willing to fill in Survey sheets.

5.2 Methods

The match records from Yarm A.A. were the most detailed and informative and form the basis of the analysis of anglers data. Records have been kept in detail since 1977 with weights caught by each individual recorded. There is also a brief description of the composition of the catch and the river conditions in some cases.

Data have been included in the analysis if the following criteria were met

1. The match must be on Yarm A.A. water on the tidal Tees
2. It must be a senior competition
3. It must be a 5 hr match
4. There must be no restriction on anglers in terms of methods or baits
5. The position of the angler on the river is determined by a random draw

5.3 Results

5.3.1 Between year variation

The mean catch per angler per match was calculated for each season from 1977/78 to the present (Table 8). 95% confidence limits were also calculated. There was a significant decrease in mean catch in 1983 which coincided with the "Hargreaves pollution". Recovery can be seen to have been slow with only the mean catch in the 1990/91 season being comparable to the pre-pollution catches.

5.3.2 Within year variation

Mean catch per angler per match was calculated for each of eleven time periods (Table 9). The length of these time periods was dependent on the number and timing of the matches. There is some variability in catches with high catches in January, February, July/August and December and low catches in October and November. The results were combined into seasons with the spring period corresponding with the close season (Table 10). This shows that catches in autumn are significantly lower than for other times of year.

5.3.3 Additional information from matches

Two methods were investigated.

1. Collection of data from individual pegs in matches.
2. Setting up a survey system to record match statistics from a larger number of anglers.
 1. A section of river expected to fish well in a match was chosen in advance and one or two individuals catches were processed (identified and measured).
 2. A survey sheet (Appendix 4) was devised and, after consultation with the anglers, they agreed that the sheets would be filled in by the person recording the weights of fish caught in the match.

The advantage of method one is that precise information is gathered on size and species composition. The disadvantage is that only spot values for the river are obtained which may be unrepresentative of the section in general due to distribution of the fish or method employed by the angler.

Method two involves the long term co-operation of the anglers. Data collected will be less accurate in that fish will be categorized into small and large only and species composition may involve a quick subjective assessment. Its advantage is that the data collected will be representative of the whole section fished.

Initial results show that a maximum of only two anglers catches can be processed in the time available. Survey sheets were being filled in until the first match in the rain when anglers refused to co-operate. This year was considered to be a trial of methods available and the results will be analysed before July when the next student takes up appointment. The preferred method will then become the standard for the study. It is likely that the survey sheet method will be found to be better than processing individual catches and that the procedure will involve the sandwich student filling in details. It must be noted that it will not be possible to collect a full years data as money is only available for a 6 month student.

Table 7. Monthly means ($^{\circ}\text{C}$) of daily maxima, minima, mean and range in the R. Tees at a) Low Moor, b) Ingleby Barwick and c) Stockton. n = number of days that data were collected.

Month	Max	Min	Mean	Range	n
a)					
July	20.0	17.4	18.7	2.5	29
August	19.1	17.3	18.3	1.8	31
September	15.5	14.4	15.0	1.1	30
October	10.0	9.4	9.8	0.6	31
November	6.1	5.3	5.8	0.7	30
b)					
July 12-31	19.7	18.5	19.2	1.2	20
August	18.9	18.0	18.5	0.9	31
September	15.7	14.8	15.3	0.9	30
c)					
July	20.4	14.9	17.0	3.6	28
August	20.3	15.7	17.4	4.6	31

Table 8. Results of angling matches 1977-1991. \bar{x} = mean catch per angler per match (ounces) \pm 95% confidence limits.

Year	\bar{x}
1977/78	59.4 \pm 6.0
1978/79	68.3 \pm 6.6
1979/80	76.2 \pm 8.6
1980/81	58.3 \pm 8.2
1981/82	85.5 \pm 11.7
1982/83	66.1 \pm 7.7
1983/84	25.1 \pm 3.6
1984/85	14.8 \pm 2.9
1985/86	22.6 \pm 3.0
1986/87	20.4 \pm 3.1
1987/88	27.4 \pm 4.0
1988/89	30.9 \pm 4.0
1989/90	47.5 \pm 5.7
1990/91	62.1 \pm 7.1

Table 9. Within year variation in angling catches 1977-1991. \bar{x} = mean catch per angler per match (ounces) \pm 95% confidence limits.

Period	\bar{x}
Jan 20-Feb 14	70.2 \pm 10.3
Feb 15-Mar 2	68.6 \pm 10.1
Mar 3-March 14	38.4 \pm 4.5
Mar 15-Jun 15	close season
Jun 16-Jul 11	42.6 \pm 7.2
Jul 12-Aug 7	63.5 \pm 4.8
Aug 8-Aug 31	44.2 \pm 3.6
Sep 1-Sep 30	42.2 \pm 2.8
Oct 1-Oct 31	23.2 \pm 3.1
Nov 1-Nov 28	30.4 \pm 4.5
Nov 29-Dec 25	53.6 \pm 7.4
Dec 26-Jan 19	36.0 \pm 4.4

Table 10. Seasonal variation in angling catches 1977-1991. \bar{x} = mean catch per angler per match (ounces) \pm 95% confidence limits.

Period	\bar{x}
Winter Dec 16-Mar 15	49.5 \pm 3.1
Spring Mar 16-Jun 15	close season
Summer Jun 16-Sep 15	48.0 \pm 2.3
Autumn Sep 16-Dec 15	33.4 \pm 2.2

6. COSTS OF WORK DURING THE REPORTING PERIOD (APRIL 1991-JANUARY 1992)

Costs of the work are in accordance with the tender document accepted by the Authority namely £41000.

7. ANTICIPATED COSTS OF WORK IN THE PERIOD UP TO JANUARY 1993

Costs for the next reporting period are expected to be in line with the tender proposal dated February 1991 plus an inflation adjustment.

8. PROGRAMME FOR THE NEXT REPORTING PERIOD

A detailed survey will again be conducted to increase the data base before the construction of the barrage. A survey of adults will be undertaken in September. An effort will be made to find the lower limit of coarse fish in the Tees. Methods suitable to the conditions where electrofishing is not possible will be employed. Fry will be sampled in July and efforts will be made to identify the spawning areas of dace in the tidal Tees. Collection of temperature data will be continued at the three monitoring points. Data from angling matches will again be collected and the analysis of past match records will be continued.

9. FACTORS LIKELY TO AFFECT COMPLETION OF THE WORK ACCORDING TO THE TIMETABLE

Adverse weather conditions is the only likely factor to be considered. Although conditions may delay the sampling programme in the short term, it is unlikely that the completion date of the project will be affected.

10. ACKNOWLEDGEMENTS

Our thanks go to Diana Morton for production of the text.

Appendix 1. Site descriptions and details of fish caught.

SECTION 1

Date fished	2 July 1991
Area	The Holmes and downstream
Length	1300 m
NGR	NZ446159 - NZ448161
State of tide	Slack low tide - flooding
Time	14.00-15.00
Fishing method	Boom boat
Site description	River lined with reeds. Meadows, few trees.

SECTION 2

Date fished	2 July 1991
Area fished	Bend below pipe bridge to upstream limit of The Holmes
Length fished	780 m
NGR	NZ441157 - NZ446159
State of tide	Ebbing south bank, flooding north bank.
Time	13.30-14.00 and 15.05-15.30
Fishing method	Boom boat
Site description	River lined with reeds. Meadows, few trees.

SECTION 3

Date fished	2 July 1991
Area fished	Bend below Great Holme to bend below pipe bridge. North bank to pipe bridge and south bank downstream.
Length fished	800 m
NGR	NZ434154 - NZ441157
State of tide	Ebbing
Time	12.55-13.30
Fishing method	Boom boat
Site description	River lined with reeds. Meadows, few trees.

SECTION 4

Date fished	2 July 1991
Area fished	The Rings and Great Holmes
Length fished	2280 m
NGR	NZ431147 - NZ434154
State of tide	Ebbing
Time	12.15-12.45
Fishing method	Boom boat
Site description	High banks with meadows and few trees. River lined with reeds.

SECTION 5.1

Date fished 2 July 1991
 Area fished Downstream of R. Leven - start of The Rings. North bank
 Length fished 1840 m
 NGR NZ365105 - NZ431147
 State of tide Ebbing
 Time 11.30-12.15
 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. Water colour dark peat and turbid, visibility 30 cm.

Species from sections 1-5	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)		
Dace <i>Leuciscus leuciscus</i> (L.)	43	7.5-25.1
Flounder <i>Platichthys flesus</i> (L.)	4	27.6-35.3
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)		
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)	8	11.1-29.0
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	1	16.9

SECTION 6

Date fished 8 June 1991
 Area fished River Leven - large bend upstream. South bank for downstream half and North bank for upstream half.
 Length fished 1240 m
 NGR NZ423122 - NZ430130
 State of tide Just started to flood after low tide.
 Time 10.10-10.40
 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 <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)		
Dace <i>Leuciscus leuciscus</i> (L.)	56	7.8-23.0
Flounder <i>Platichthys flesus</i> (L.)	1	15.2
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	2	12.3-13.1
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)		
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.	3	10.1-13.2
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	3	17.7-25.1

SECTION 7

Date fished 8 June 1991
 Area fished Upstream of section 6 - Yarm road bridge
 Length fished 1140 m
 NGR NZ418132 - NZ423122
 State of tide Flooding
 Time 10.45 - 11.15
 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 <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	9	9.1-12.7
Dace <i>Leuciscus leuciscus</i> (L.)	221	6.5-24.2
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	3	6.5-13.0
Minnnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)	17	5.6-22.4
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	2	28.1-33.1

SECTION 8.2

Date fished 8 June 1991
 Area fished Yarm road bridge - Yarm railway bridge. South bank.
 Length fished 80 m
 NGR NZ417132 - NZ418132
 State of tide Flooding
 Time 11.45-12.00
 Fishing method Boom boat
 Site description High banks. Gravel bar on south bank. Water otherwise deep.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)	1	14.6
Chub <i>Leuciscus cephalus</i> (L.)	3	9.5-34.1
Dace <i>Leuciscus leuciscus</i> (L.)	95	6.2-25.1
Flounder <i>Platichthys flesus</i> (L.)	1	12.5
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	1	7.2
Minnnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)	3	18.4-21.2
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	1	12.5

SECTION 9.1

Date fished 8 June 1991
 Area fished Yarm railway bridge - upstream to outfall on north bank.
 Length fished 300 m
 NGR NZ415131 - NZ417132
 State of tide Flooding
 Time 12.20-12.40
 Fishing method Boom boat
 Site description Flood defence construction on south bank. On north, high bank with bushes and herbacious vegetation.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	2	16.6-25.6
Dace <i>Leuciscus leuciscus</i> (L.)	85	9.4-24.8
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)		
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)	24	8.7-12.0
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.		

SECTION 10

Date fished 8 June 1991
 Area fished Upstream of section 9 - downstream of section 11. Fished the inside of the bends.
 Length fished 560 m
 NGR NZ415122 - NZ415131
 State of tide Flooding, approaching high tide.
 Time 12.45-13.00
 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 <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	1	12.5
Dace <i>Leuciscus leuciscus</i> (L.)	65	6.3-23.3
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	1	12.8
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)	1	10.9
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.	1	15.6
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	1	18.1

SECTION 11.1

Date fished 7 June 1991
 Area fished Aislaby at The Cabins - bend downstream. North bank.
 Length fished 840 m
 NGR NZ407123 - NZ415122
 State of tide Ebbing
 Time 17.15-17.30
 Fishing method Boom boat fishing against the flow
 Site description High banks. Wooded area.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)	2	12.5-20.0
Chub <i>Leuciscus cephalus</i> (L.)		
Dace <i>Leuciscus leuciscus</i> (L.)		
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)		
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)		
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.		

SECTION 12.1

Date fished 7 June 1991
 Area fished Aislaby at The Cabins - middle of 1st bend upstream north bank
 Length fished 440 m
 NGR NZ405120 - NZ407123
 State of tide Flooding
 Time 11.00-11.30
 Fishing method Boom boat
 Site description High banks, meadows with few overhanging trees.
 Water peaty colour but not turbid.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	3	10.3-34.3
Dace <i>Leuciscus leuciscus</i> (L.)	88	7.9-24.1
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)		
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)	7	8.7-11.3
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	2	19.4-28.1

SECTION 12.2

Date fished 7 June 1991
 Area fished Aislaby at The Cabins - middle of first bend upstream
 Length fished 440 m
 NGR NZ405120 - NZ407123
 State of tide Ebbing
 Time 16.30-1715
 Fishing method Boom boat
 Site description High banks, open meadows with few trees.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)		
Dace <i>Leuciscus leuciscus</i> (L.)	22	10.4-23.3
Flounder <i>Platichthys flesus</i> (L.)	4	11.5-28.3
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	1	11.9
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)	13	8.9-26.3
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.	1	14.2
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	2	29.7-35.4

SECTION 13.1

Date fished 7 June 1991
 Area fished Upstream of Aislaby, end of Section 12 - next bend upstream. North bank.
 Length fished 600 m
 NGR NZ404114 - NZ405120
 State of tide Flooding near to high tide.
 Time 12.00-12.25
 Fishing method Boom boat
 Site description High banks, meadows with few overhanging trees.
 Water peaty colour but not turbid.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	7	8.8-30.9
Dace <i>Leuciscus leuciscus</i> (L.)	34	9.2-24.2
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	1	10.9
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)		
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.	1	15.8
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	4	22.0-27.9

SECTION 13.2

Date fished 7 June 1991
 Area fished Upstream of Aislaby. End of Section 12 - next bend upstream
 Length fished 600 m
 NGR NZ404114 - NZ405120
 State of tide Ebbing
 Time 15.50-16.15
 Fishing method Boom boat
 Site description High banks, wooded. Sewage input on south bank. Water extremely turbid near bank, visibility nil.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	5	16.9-37.6
Dace <i>Leuciscus leuciscus</i> (L.)	108	7.5-23.3
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	2	11.4-11.8
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)	34	9.0-12.7
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)	2	7.6
Trout (brown) <i>Salmo trutta</i> L.	1	15.5

SECTION 14.1

Date fished 7 June 1991
 Area fished End of section 13 - next bend upstream. North bank.
 Length fished 1040 m
 NGR NZ401105 - NZ404114
 State of tide High tide slack to start of the ebb.
 Time 12.30-13.15
 Fishing method Boom boat
 Site description High banks, more wooded than sections 12 and 13. Deep water, peaty colour.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	1	10.0
Dace <i>Leuciscus leuciscus</i> (L.)	1	13.5
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)		
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)		
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.	1	16.6
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	2	24.6-39.4

SECTION 14.2

Date fished 7 June 1991
 Area fished Copenhagen Bank end of section 13 to next bend upstream. South bank.
 Length fished 1040 m
 NGR NZ401105 - NZ404114
 State of tide Ebbing
 Time 15.25-15.45
 Fishing method Boom boat
 Site description High banks, wooded. Deep section with shallow margins.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)		
Dace <i>Leuciscus leuciscus</i> (L.)	9	8.8-22.8
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	1	17.3
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)		
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr. <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	1	23.1

SECTION 15.2

Date fished 7 June 1991
 Area fished Pumping station - bend downstream. South bank. Lower limit opposite upstream limit of section 14.
 Length fished 580 m
 NGR NZ395103 - NZ401105
 State of tide Ebbing
 Time 15.00-15.15
 Fishing method Boom boat
 Site description High banks, wooded section. Shallow water with gravel banks.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	38	8.8-27.1
Dace <i>Leuciscus leuciscus</i> (L.)	56	6.0-22.6
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	1	7.2
Minnow <i>Phoxinus phoxinus</i> (L.)	1	3.4
Roach <i>Rutilus rutilus</i> (L.)	2	5.0-9.7
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	1	13.2

SECTION 16.2

Date fished 7 June 1991
 Area fished Low Worsall - pumping station. South bank.
 Length fished 400 m
 NGR NZ392103 - NZ395103
 State of tide Ebbing
 Time 14.25- 14.50
 Fishing method Boom boat
 Site description Banks less steep. Open meadows upstream with tree cover increasing downstream. Shallow water, substratum visible.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	5	10.5-11.3
Dace <i>Leuciscus leuciscus</i> (L.)	25	8.9-23.8
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	3	11.1-13.1
Minnow <i>Phoxinus phoxinus</i> (L.)	3	5.6-8.1
Roach <i>Rutilus rutilus</i> (L.)		
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.	1	52.5

SECTION 19

Date fished 9 June 1991
 Area fished Fardenside Farm to top of second island upstream.
 Length fished 200 m
 NGR NZ371095 - NZ373095
 State of tide Not affected by the tide.
 Time 14.00-16.00
 Fishing method Twin anode wading where possible with some single anode electrofishing from a boat in deeper areas.
 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 <i>Barbus barbus</i> (L.)	5	15.5-43.0
Chub <i>Leuciscus cephalus</i> (L.)	11	9.1-41.6
Dace <i>Leuciscus leuciscus</i> (L.)	2	12.7-19.2
Flounder <i>Platichthys flesus</i> (L.)	6	20.4-33.4
Grayling <i>Thymallus thymallus</i> (L.)	1	4.3
Gudgeon <i>Gobio gobio</i> (L.)	6	11.1-15.6
Minnow <i>Phoxinus phoxinus</i> (L.)	14	4.6-7.3
Roach <i>Rutilus rutilus</i> (L.)	2	9.2-9.6
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.	1	62.0
Stone loach <i>Noemacheilus barbatulus</i> (L.)	1	6.9
Trout (brown) <i>Salmo trutta</i> L.	2	10.8-34.6

SECTION 21.1

Date fished 6 June 1991
 Area fished Downstream of ford below Low Moor weir.
 Length fished 260 m
 NGR NZ365106 - NZ376104
 State of tide Not affected by the tide.
 Time 14.00-16.00
 Fishing method 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. Filamentous algae (10%) and *Ranunculus* (1%) present. Sewage smell.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	1	12.1
Dace <i>Leuciscus leuciscus</i> (L.)	3	6.5-7.7
Flounder <i>Platichthys flesus</i> (L.)	4	21.1-26.2
Grayling <i>Thymallus thymallus</i> (L.)	1	15.0
Gudgeon <i>Gobio gobio</i> (L.)		
Minnow <i>Phoxinus phoxinus</i> (L.)	24	4.2-7.2
Roach <i>Rutilus rutilus</i> (L.)		
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)	2	6.4-6.7
Trout (brown) <i>Salmo trutta</i> L.	3	20.0-40.0

SECTION 22

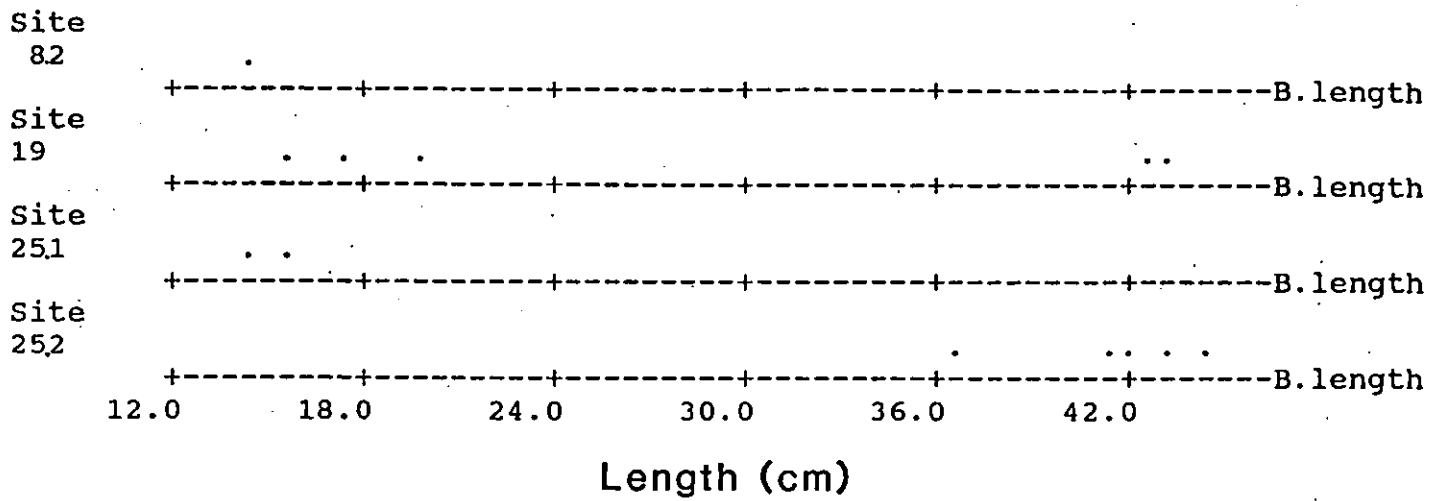
Date fished 6 June 1991
 Area fished Immediately upstream of Low Moor weir.
 Length fished 140 m
 NGR NZ365105 - NZ365106
 State of tide Not affected by the tide.
 Time 16.30-17.00
 Fishing method Twin anode wading
 Site description High banks. Open meadow on north bank, trees on south bank. Substratum cobbles/gravel with silt. Some reed beds and areas of *Potamogeton* near north bank. Depth up to 1 m. Water clear.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)		
Chub <i>Leuciscus cephalus</i> (L.)	10	11.2-28.4
Dace <i>Leuciscus leuciscus</i> (L.)	2	13.4-22.6
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)		
Gudgeon <i>Gobio gobio</i> (L.)	3	7.1-16.0
Minnow <i>Phoxinus phoxinus</i> (L.)		
Roach <i>Rutilus rutilus</i> (L.)		
Rudd <i>Scardinius erythrophthalmus</i> (L.)	1	11.6
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)	2	5.9-6.4
Trout (brown) <i>Salmo trutta</i> L.		

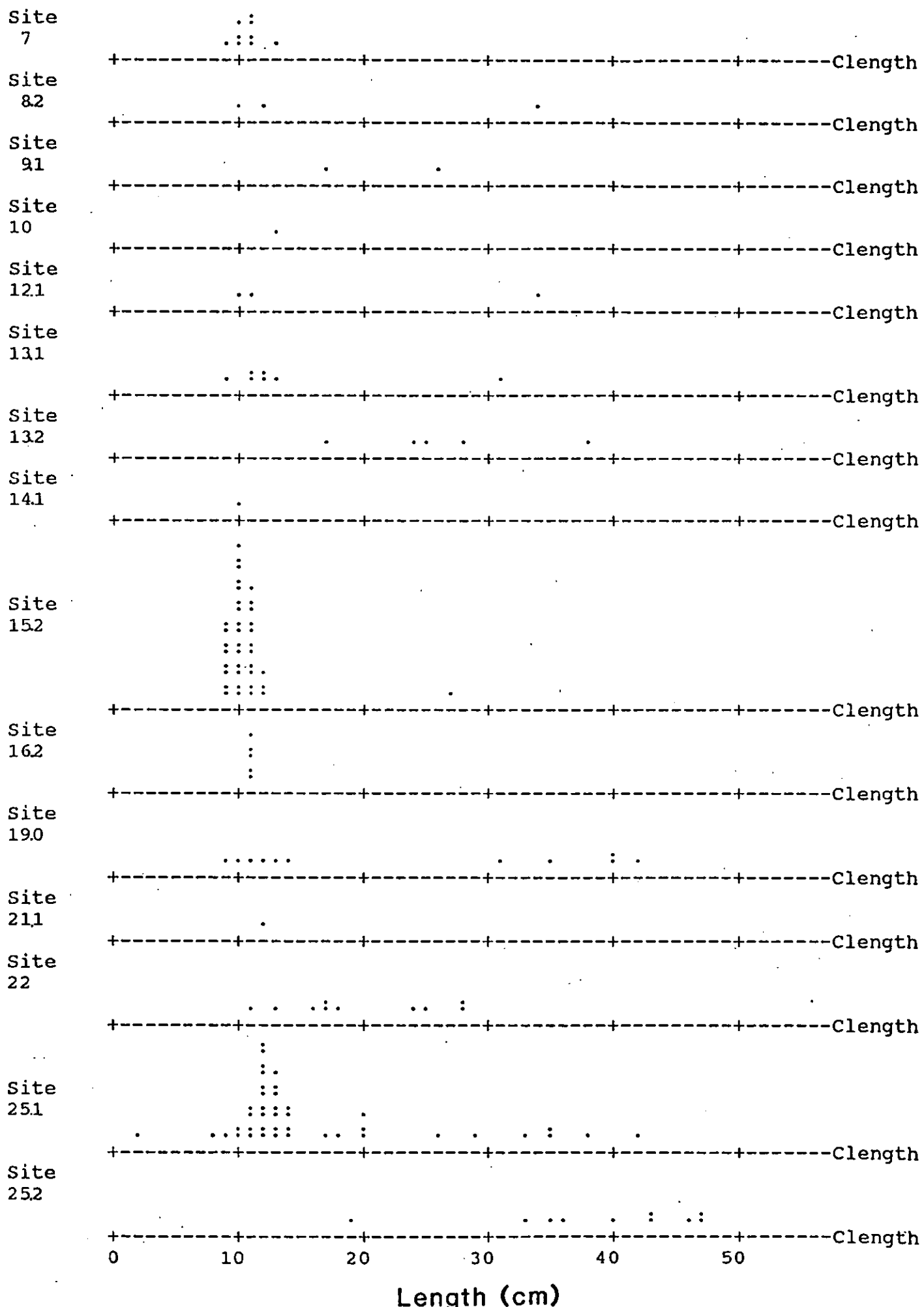
SECTION 25

Date fished 9 June 1991
 Area fished Low Dinsdale toll bridge - first bend upstream.
 Length fished 350 m
 NGR NZ350113 - NZ345114
 State of tide Not influenced by the tide
 Time 10.00-13.00
 Fishing method Twin anode wading
 Site description Fast flowing over bedrock. Gravel banks present in places usually near the bank. Some filamentous algae and macrophytes present. Very high wooded banks. Fallen trees in the water often with associated macrophyte debris. Clear water.

Species	No. of individuals	Size range (cm)
Barbel <i>Barbus barbus</i> (L.)	7	14.7-44.4
Chub <i>Leuciscus cephalus</i> (L.)	53	1.8-47.2
Dace <i>Leuciscus leuciscus</i> (L.)	90	6.6-25.1
Flounder <i>Platichthys flesus</i> (L.)		
Grayling <i>Thymallus thymallus</i> (L.)	1	4.7
Gudgeon <i>Gobio gobio</i> (L.)	30	4.4-17.0
Minnnow <i>Phoxinus phoxinus</i> (L.)	71	3.5-8.3
Roach <i>Rutilus rutilus</i> (L.)	92	9.2-23.2
Rudd <i>Scardinius erythrophthalmus</i> (L.)		
Salmon parr <i>Salmo salar</i> L.		
Salmon smolt <i>Salmo salar</i> L.		
Sea lamprey <i>Petromyzon marinus</i> L.		
Stone loach <i>Noemacheilus barbatulus</i> (L.)		
Trout (brown) <i>Salmo trutta</i> L.		

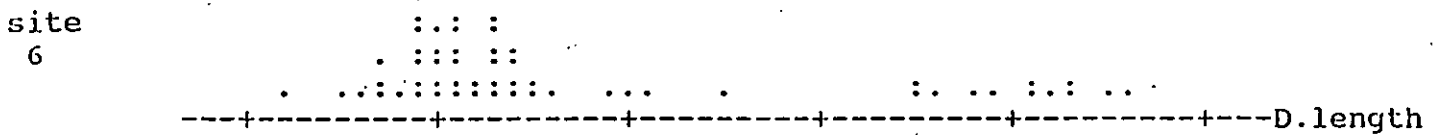
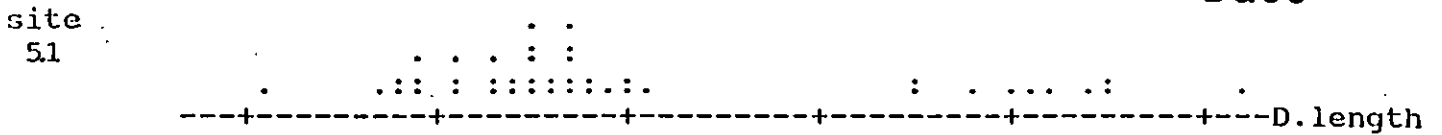
Appendix 2. Length frequency distributions for each species in each section. **Barbel**

Appendix 2. Continued.

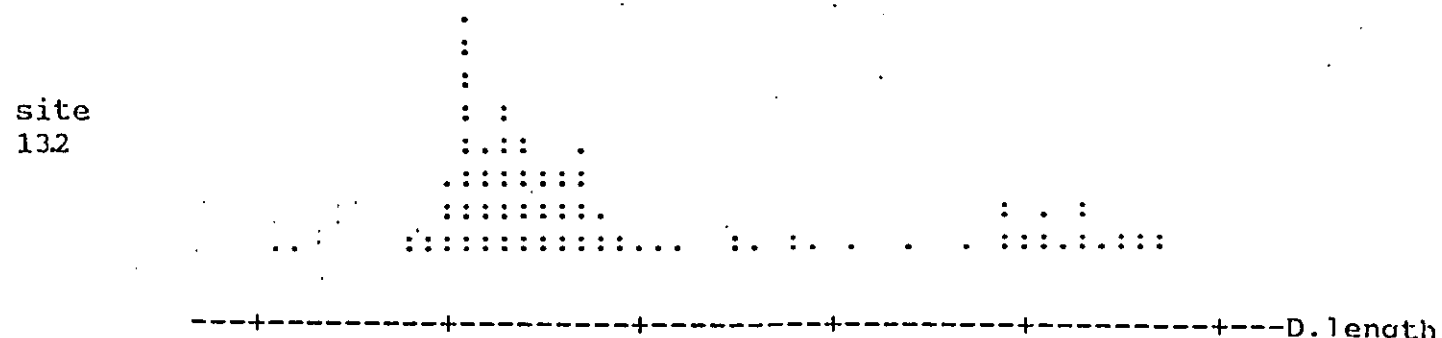
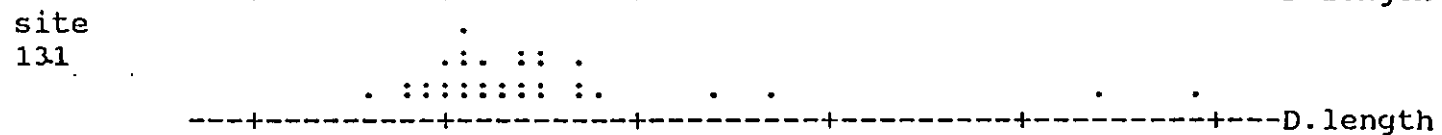
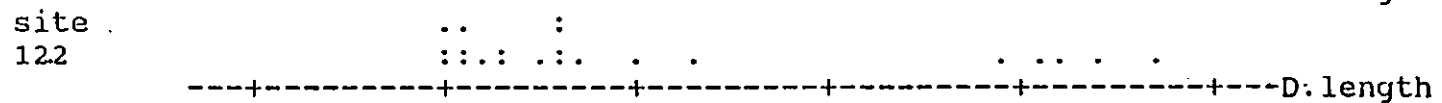
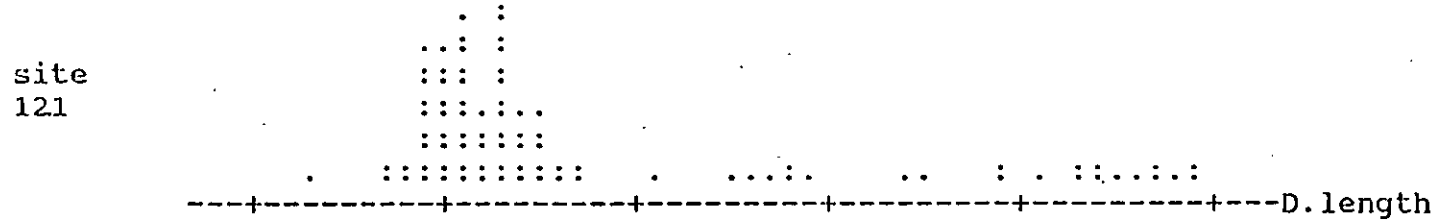
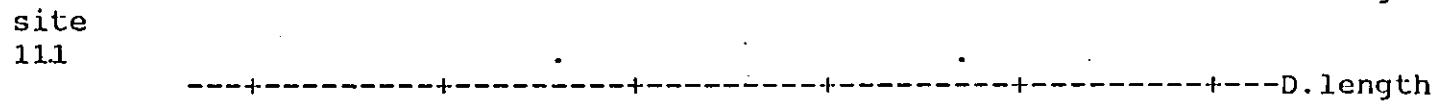
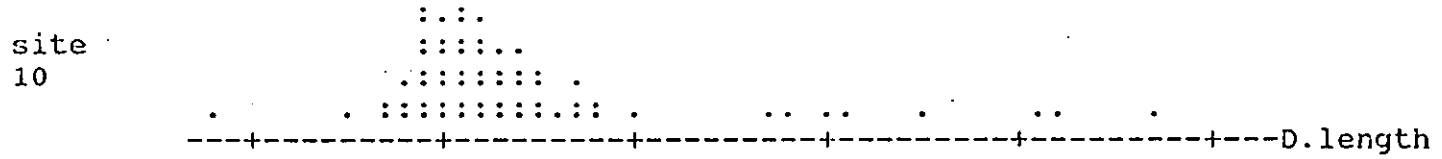
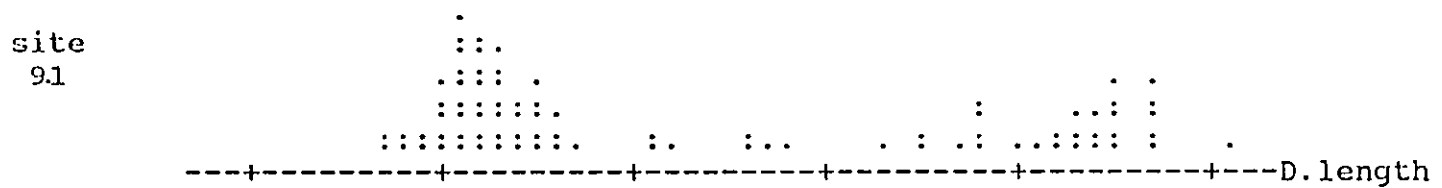
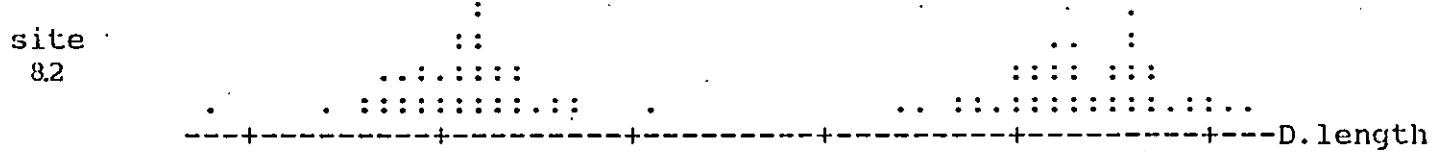
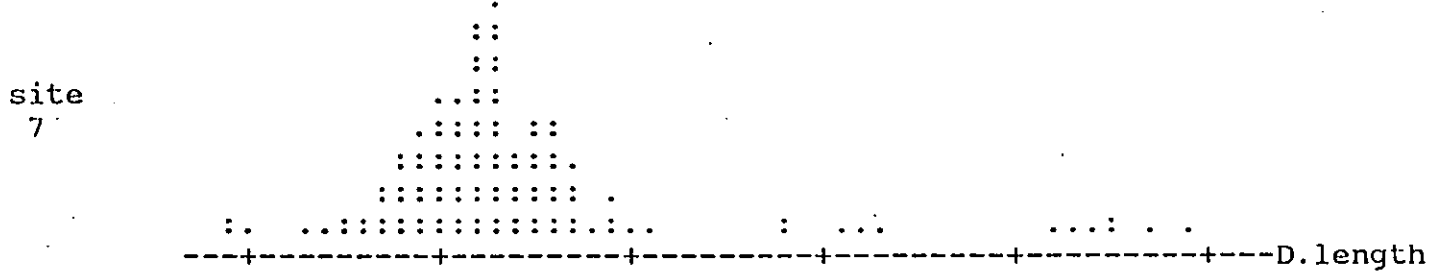


Appendix 2. Continued.

Dace



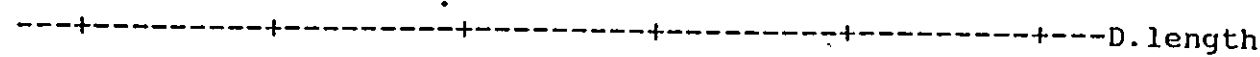
Each dot represents 2 points



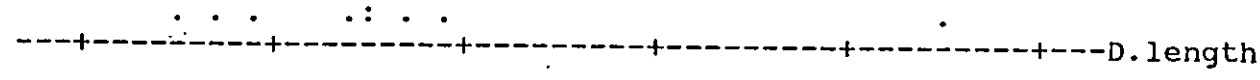
Appendix 2. Continued.

Dace

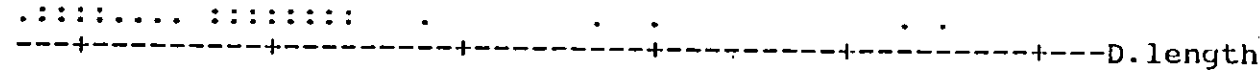
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14.1



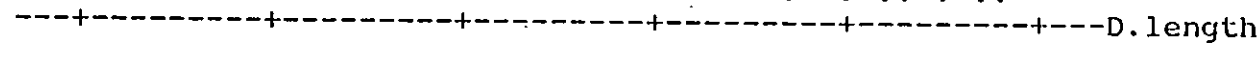
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14.2



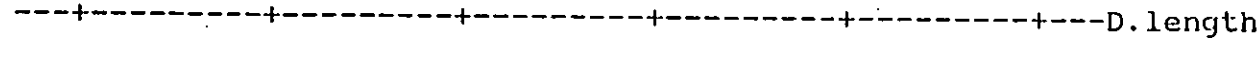
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15.2



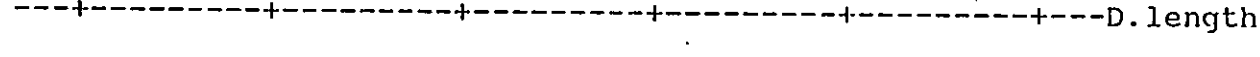
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16.2



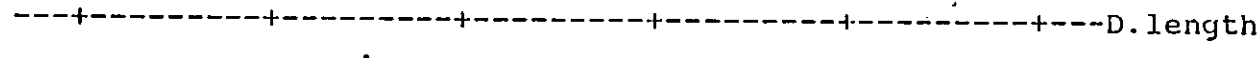
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19



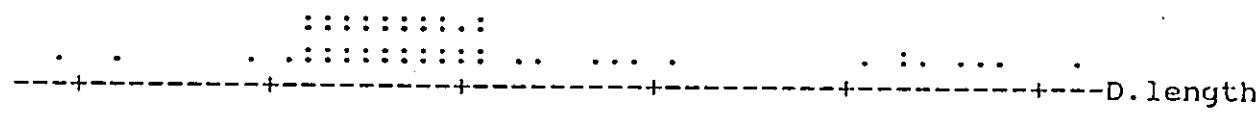
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21.1



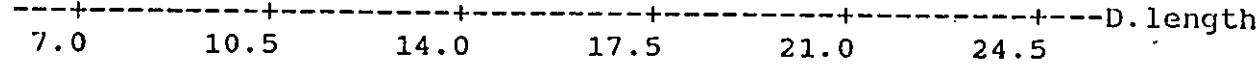
site
22



site
25.1



site
25.2

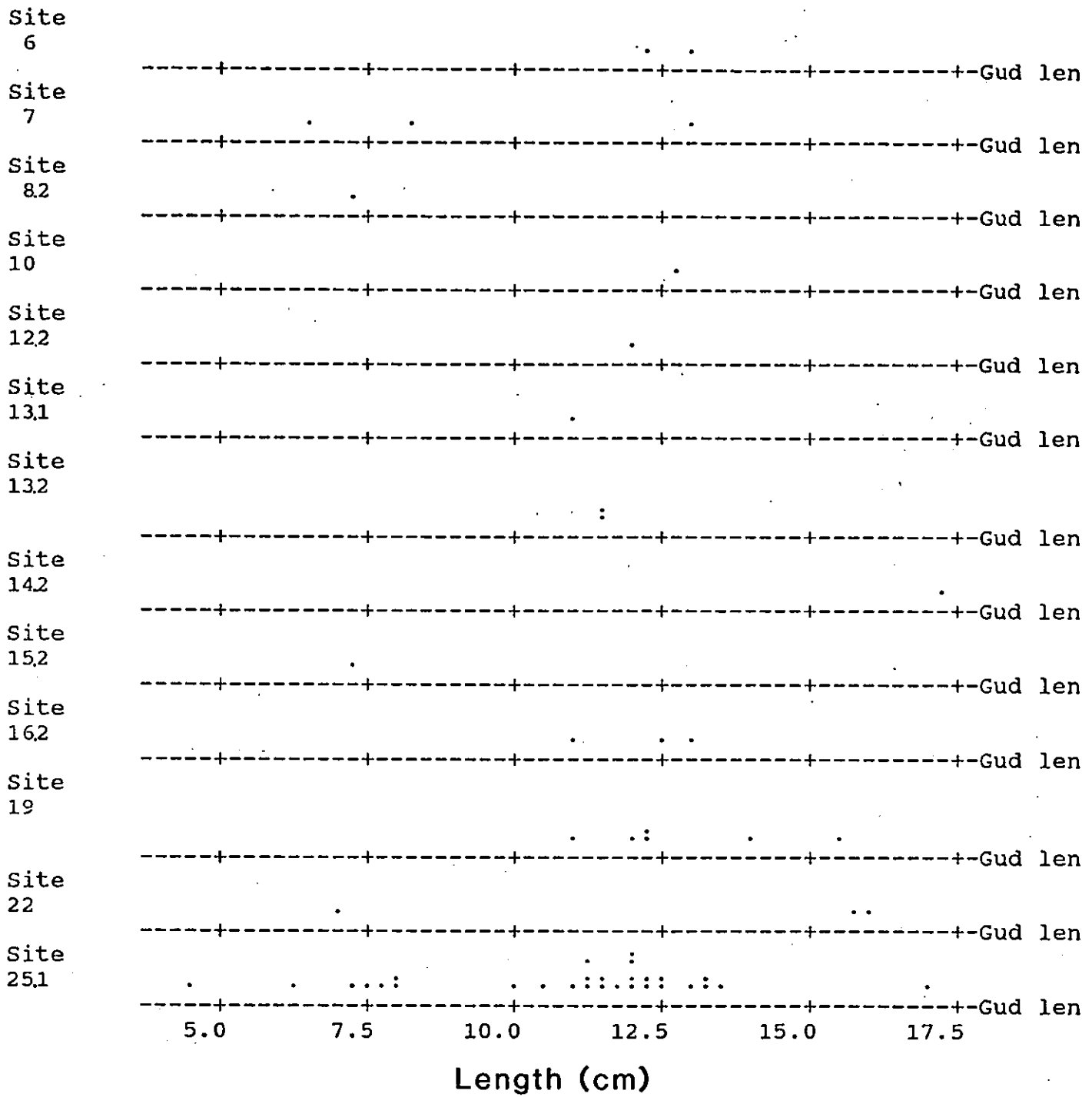


7.0 10.5 14.0 17.5 21.0 24.5 D.length

Length (cm)

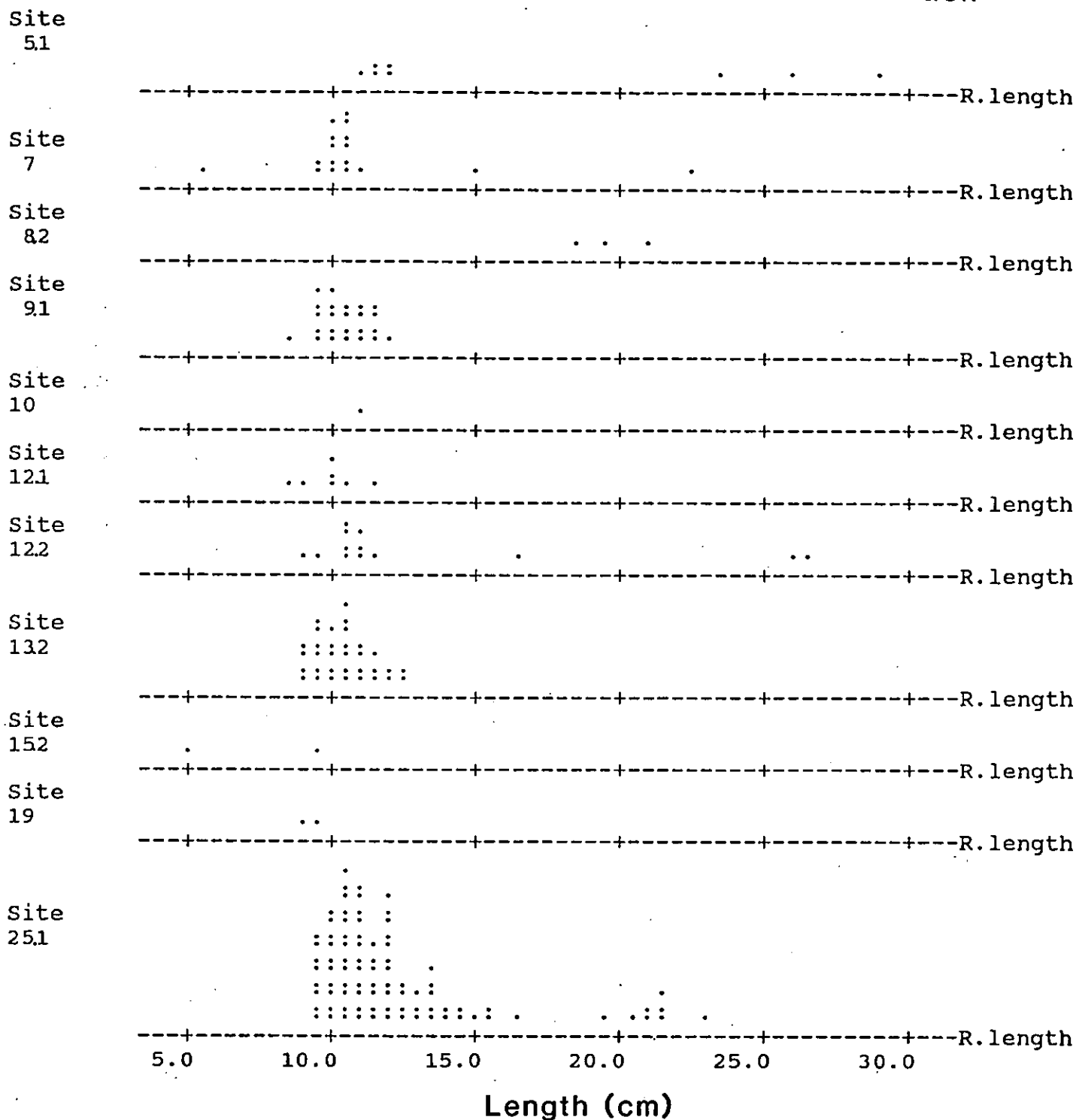
Appendix 2. Continued.

Gudgeon



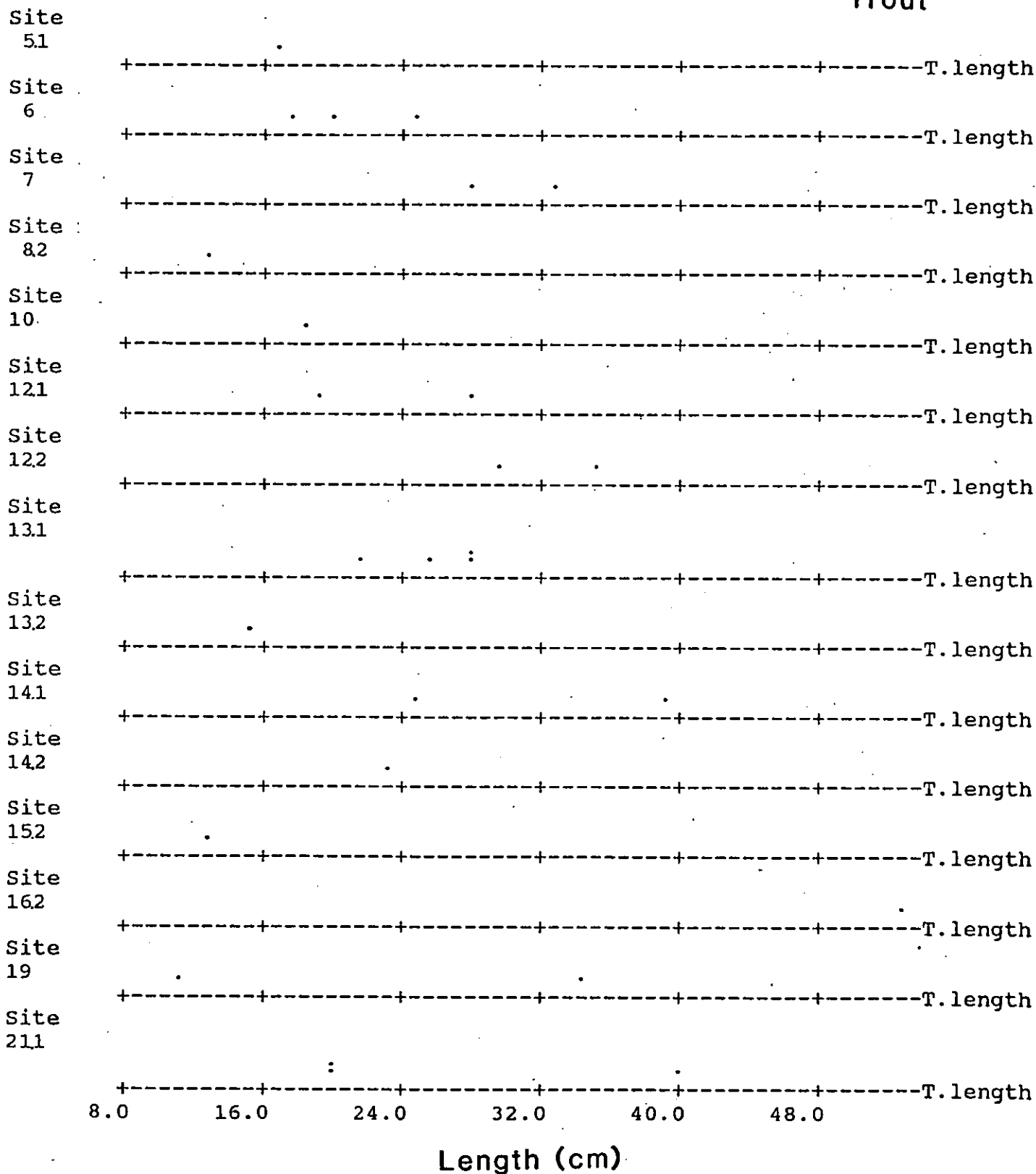
Appendix 2. Continued.

Roach

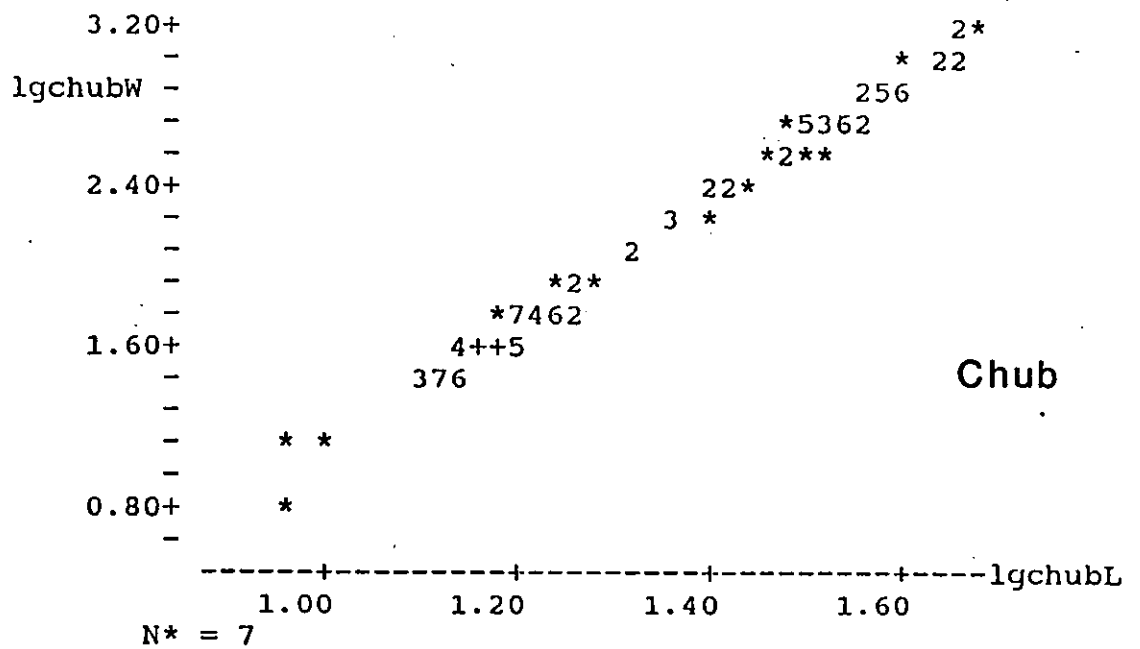
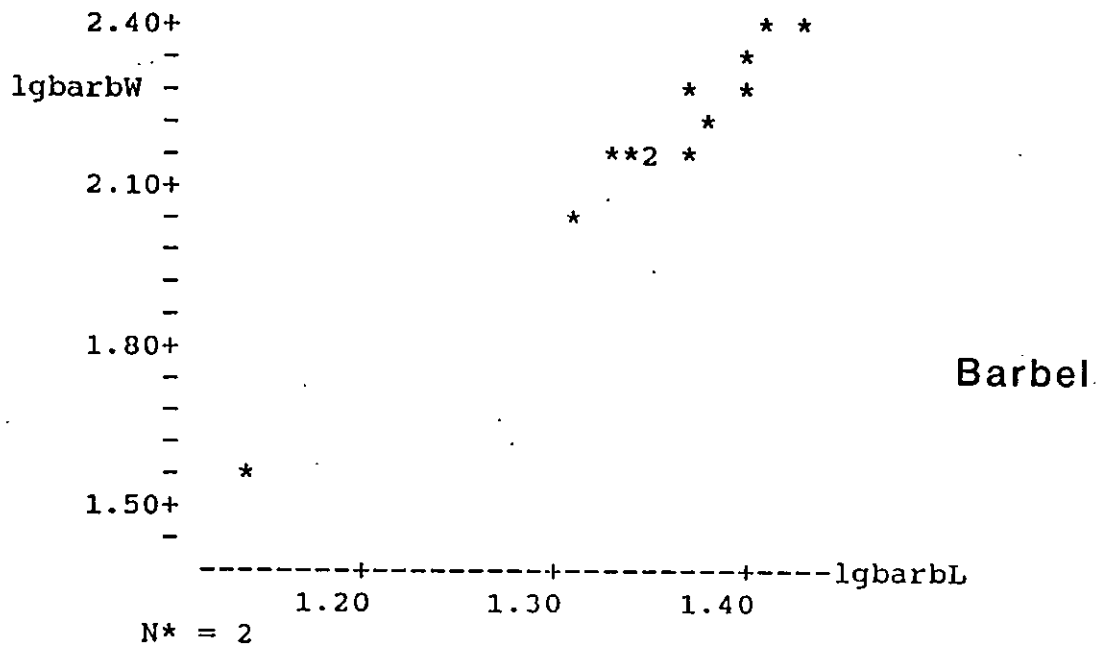


Appendix 2: Continued.

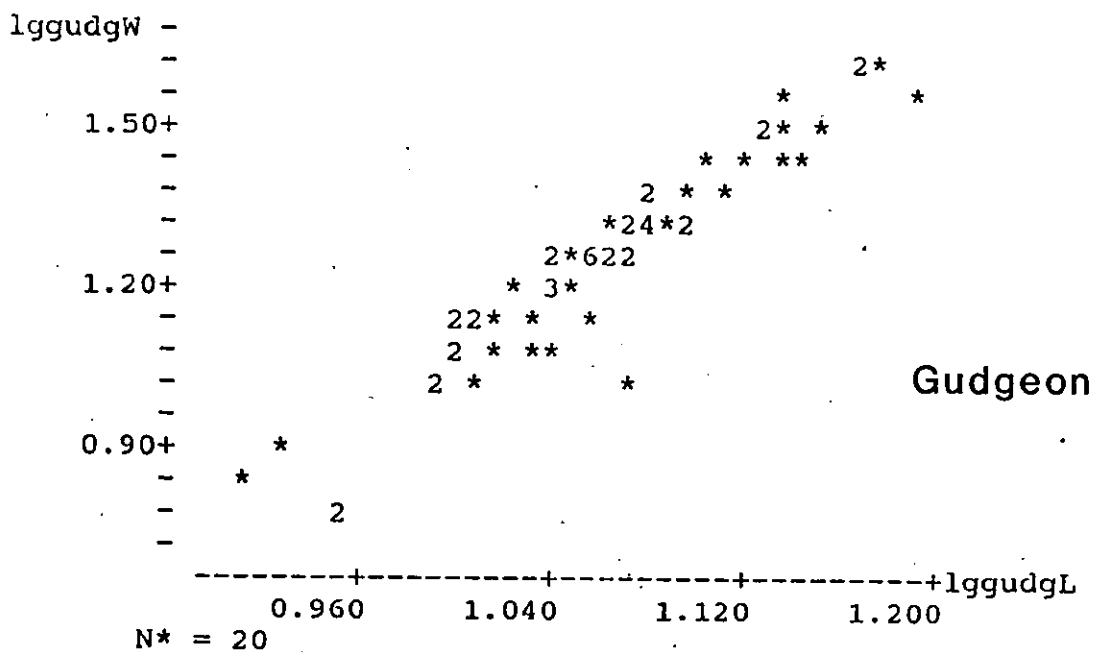
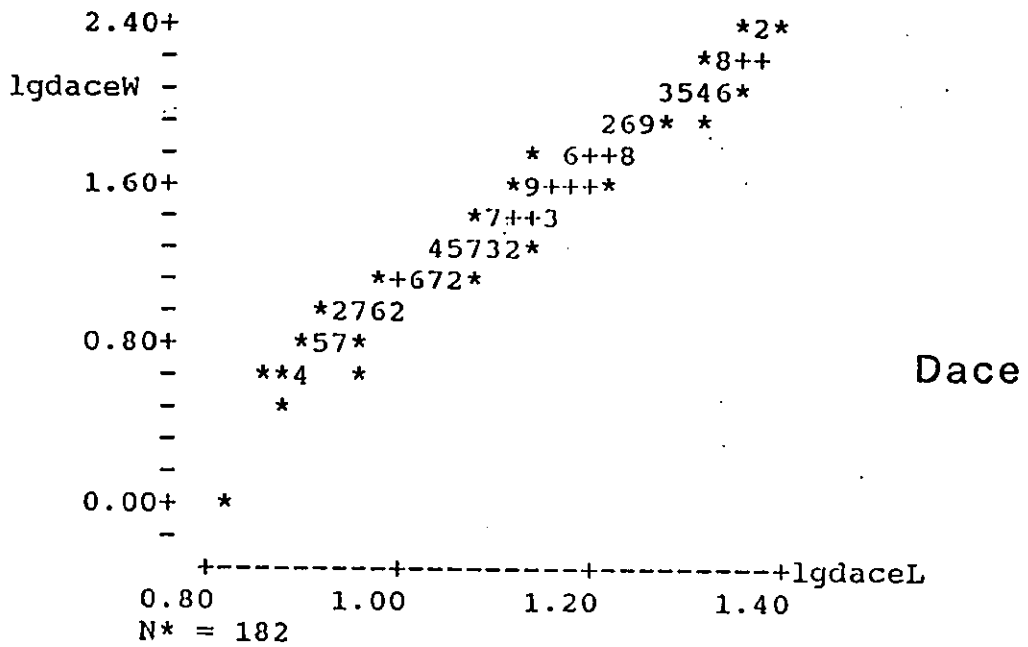
Trout



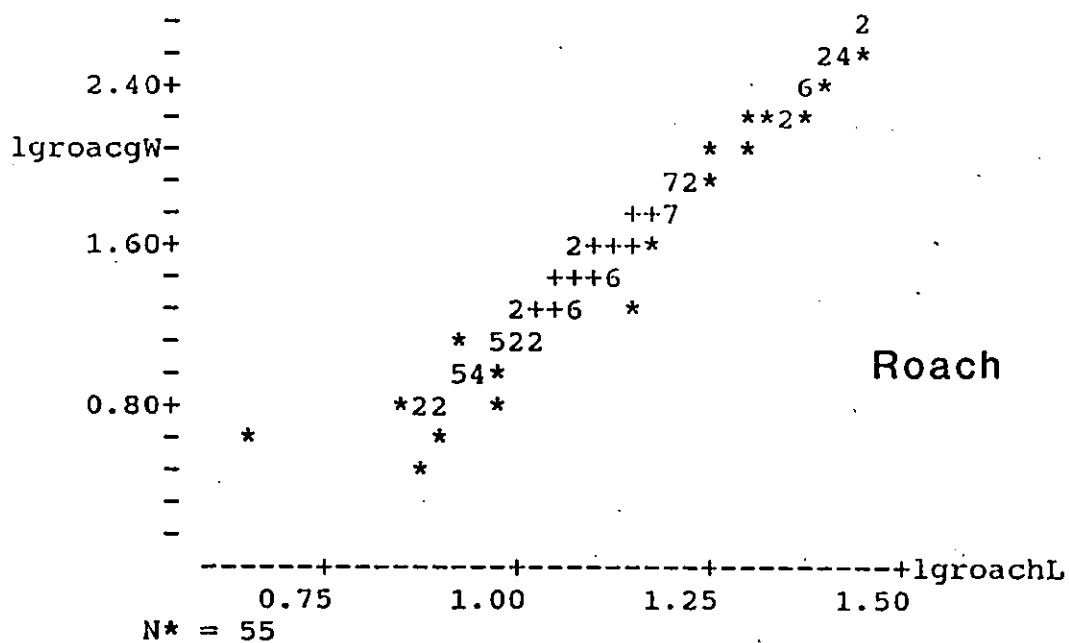
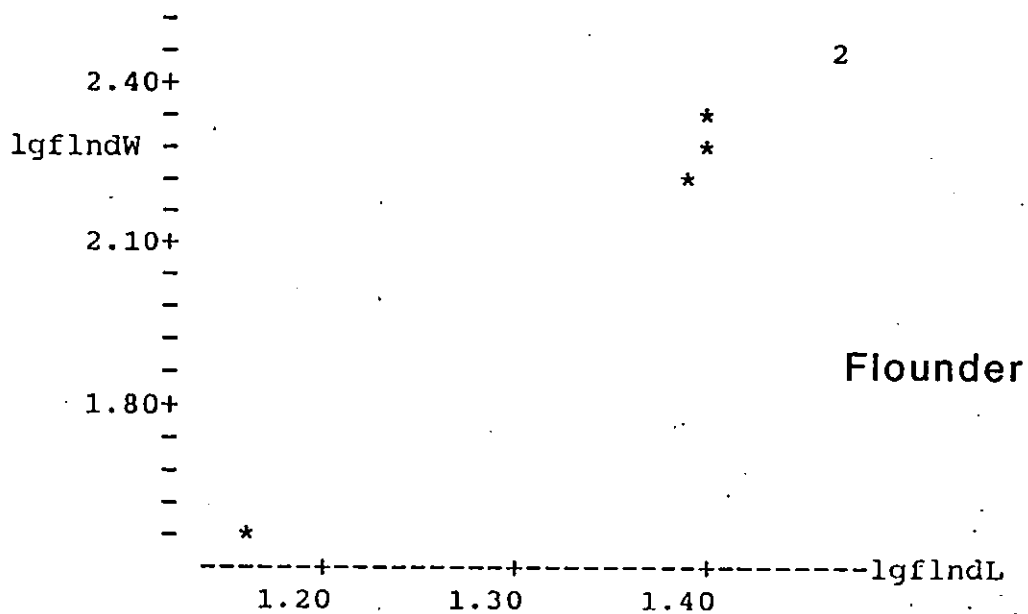
Appendix 3. Length weight relationships for major species in the R. Tees.



Appendix 3. Continued.



Appendix 3. Continued.



Appendix 3. Continued.

