ENVIRONMENT AGENCY

North Wessex Area

# Routine Fishery Survey
# BY BROOK

March – August 1999

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## 1. Introduction

This electrofishing survey has been carried out as part of the Environment Agency's rolling programme of strategic fish population surveys. The By Brook is an important catchment within the Bristol Avon, well known for its excellent fly-fishing. The By Brook is deemed to be so well populated with brown trout that North Wessex Byelaw 14 allows anglers to take individuals of 20cm and over from the By Brook and its tributaries, the size limit for the rest of North Wessex area is 25cm. This is subject to a daily limit of two fish (North Wessex Byelaw 17B).

The By Brook flows for approximately 23 kilometres in a southerly direction from the confluence of two of its main tributaries upstream of Castle Combe, and half way through its course it flows in a more south-westerly direction to join the River Avon at Bathford.

The two tributaries that join to form the By Brook are the Burton Brook and Broadmead Brook. They both flow in an east-north-easterly direction. The Burton Brook rises near Tormarton and flows for almost 10 kilometres to Castle Combe and the Broadmead Brook rises near Cold Ashton and flows for 12 kilometres before joining the Burton Brook. The Doncombe Brook rises near Marshfield and flows for 7 kilometres in approximately the same direction before joining the By Brook further downstream at Ford. The other notable tributary is the Lid Brook which flows east from its origins west of Colerne to the main river at Drewett's Mill, a distance of approximately 3.5 kilometres. These tributaries are all spring fed.

The geology of the catchment is dominated by Great Oolite limestone within a sequence of SSE'ly Lower and Middle Jurassic rocks. The Broadmead and Burton Brooks cut through Forest Marble Clays overlying the limestone. Further south from Slaughterford the main By Brook cuts through the underlying Fuller's Earth and Inferior Oolite limestone to expose the Midford Sands.

The By Brook catchment is of high scenic value. Land use is predominantly rural and agricultural, there are many small villages in the area and the largest town is Box. The By Brook and Doncombe Brook meander through fairly steep sided valleys much of which remain thickly wooded. Historically the waters of the By Brook were used to power mills for grinding corn, paper making and for other uses in the wool trade. Unfortunately the mills had to close down because of the variable and unreliable flow of the By Brook but most of the buildings remain intact and many have been carefully renovated.

## 2. Survey Methods

12 sites were surveyed on the By Brook catchment, their positions are shown on Map 1. BY21 was sampled during a crayfish survey in 1998 and 11 others BY20 and BY22 to BY31 inclusive were surveyed between March and August 1999. Sites BY27 By Brook at Drewett's Mill and BY30 Doncombe Brook at North Wraxall had never been surveyed before. The 10 other sites were previously surveyed in 1992 and six of them were also surveyed in 1988 and 1989.

The sites were sampled using 240V pulsed DC electric fishing equipment over an approximately 100m section. Stop nets were used at upper and lower ends of the site to prevent fish movement in and out of the area. Actual method used varied depending on depth and width of the river.

Sites BY20, BY29, BY30 and BY31 were shallow enough to allow both a net and bucket carrier to wade in an upstream direction with one anode operator using 50m of cable, the control box and generator remaining on the bank supervised. This method required 4 personnel in total.

5 people and an inflatable rubber boat were needed for sites BY22, BY23 and BY24. One person would pull the boat upstream with all the equipment in it and two anode operators and two net carriers would wade infront.

Sites BY25, BY26, BY27 and BY28 had pools that were too deep to wade so a wooden boat was used to carry equipment and 4 personnel – 2 anode operators and 2 net carriers. 2 other people stayed on the banks to manoeuvre the boat upstream with ropes. Shallow sections were waded where possible.

Three fishing runs were carried out at sites BY21, BY24, BY26, and BY27 and fish from each run contained separately on the fisheries vehicle before being weighed and measured. Scales were removed from the fish, except for eels and stocked trout, and sent to the Fisheries Laboratory for age and growth analysis. Minor species (stone loach, bullheads, sticklebacks and minnows) were not captured but their approximate numbers were recorded for each site. Only one fish was seen and captured at site BY29 so only one electric fishing run was necessary. At all other sites two fishing runs were carried out because the depletion rate between runs one and two was great enough for that to be sufficient to satisfy the model.

## 3. Site Details

BY20 Broadmead Brook at Lower Shirehill Farm

Site BY20 is in a steep sided valley 6 km upstream of its confluence with the By Brook at Castle Combe. The section consists of a fairly straight channel 102m long, roughly grazed on either side. Towards the upper end of the site some flow is lost through the bank across the field to a lower minor channel which rejoins the main brook near the farmhouse. The upper main section was formerly a mill leat. 90% of the brook is shaded by shrubs and trees which line the banks. The banks vary in steepness and are broken in places by livestock poaching. At the lower end of the site where the brook turns left towards the valley bottom there are two weirs. A stop net was placed on the level between the two.

The survey section is all shallow riffle with pools only below the weir and the substrate is 70% gravel and 30% stones. In channel vegetation included the following emergents *Rorippa nasturtium-aquaticum*, *Apium nodiflorum*, *Myosotis* sp., *Mentha aquatica*, *Sparganium erectum* and *Phalaris arundinacea*. (The common names for these are listed at the end of the section, not all plants are identified to species level.) There were

no submerged species in the shallow water. The dominant trees and shrubs are hazel and hawthorn, also present are ash, blackthorn, elder and apple trees.

BY21 Broadmead Brook at Fosse Way

BY21 is located upstream of the Fosse Way crossing. The brook meanders strongly throughout the 50m site, undercutting the banks. There are deep pools and riffle sections and the substrate consists of 80% gravel, 10% mud and silt, 8% stones and 2% is bare.

The left hand bank is pasture and the right hand bank is wooded with hazel most abundant. Crack willow, alder, oak and ash are also present, 40% of the channel is shaded by these species. In-stream submerged species cover 2% of the channel and include *Ranunculus* sp. and *Callitriche* sp. Other emergent species such as *Phalaris arundinacea, Veronica beccabunga, Apium nodiflorum* and *Juncus* sp. also cover approximately 2% of the channel.

BY22 Burton Brook at Gatcombe Mill

Site BY22 is a straight section of mill leat 123m long. The upper riffle section is well shaded, the right hand bank being wooded with hazel, field maple, elder and ash dominant. Further down is a slower and deeper glide section with pasture on both sides.

Submerged plants include *Ranunculus* sp., and moss species. *Callitriche* sp., *Rorippa* sp., *Myosotis* sp., and *Iris pseudacorus* are the main emergents. The substrate consists of 20% stones and equal amounts of gravel and silt.

BY23 Castle Combe Golf Course

Site BY23 is the main By Brook just downstream of the confluence of the Burton and Broadmead Brooks. The river is mostly glide with a few riffle sections, the 123m site starts at a series of concrete blocks across the river by a ford and meanders gently to the right where a vegetated island splits the flow in two. The left hand channel is fast riffle, the right hand channel is slower with deeper pools. The channels rejoin and the main flow meanders through beds of *Ranunculus* sp. towards the 'Norman Bridge'. This lower end of the site is predominantly riffled. There are few deep pools for trout but the banks are undercut in places below tree roots. The substrate is mostly gravel, 60%, with mud and silt also present.

The left hand bank is thickly wooded with ash, hazel, hawthorn and oak and the right hand bank is the golf course. Trees and shrubs on both banks give 50% shading to the river. Marginal and in-stream vegetation includes *Phalaris arundinacea, Apium nodiflorum, Mentha aquatica, Myosotis* sp., *Ranunculus* sp., *Carex* sp., *Sparganium erectum* and *Lythrum salicaria.*

BY24 Long Dean, Castle Combe

BY24 extends 76m from the small road bridge to just upstream of the weir at Lower Long Dean Mill. From the bridge the river meanders gently to the right and remains fairly straight for the rest of the site. It is mainly glide with only short riffle sections and one deep pool (1.5m) on the meander. Reeds, *Phalaris arundinacea* and *Sparganium erectum*, occur in the slower water on the right hand side of this turn. *Mentha aquatica* is also present. *Ranunculus* sp. and willow moss are abundant on the river bed which consists of approximately 50% gravel, 30 % mud and silt and 20% stones.

Trees and other vegetation shade 20% of the river. Ash trees occur in greatest abundance, also present are field maple, hawthorn, willow, elder and broad leaved poplar. These are mostly on the right hand bank which is the Lower Mill garden. The other side is pasture with thick herbaceous cover on the bank

BY25 Slaughterford

Site BY25 is just downstream of the old rag mill workings in an area of mixed woodland. The right hand bank is densely wooded, the left hand bank is more open and rough. Within the 100m site the river meanders widely, first to the right and then to the left. The section is all pool and glide, the pools are deep on the corners. The substrate is fine gravel 40% and sand/silt 60% and the banks are steep except where a sand or gravel bar has formed. Dominant tree species are ash and sycamore. Also present are beech, hazel, field maple, hawthorn, oak and lime. These give 60% shade to the river. *Glyceria maxima* is the only emergent species present.

BY26 Weavern Farm

Site BY26 is located downstream of Weavern Farm. The river meanders sharply through land grazed by cattle, cutting into the soft sandy banks easily. At the lower end of the site the bank is 4 or 5 feet high. The flow varies between riffle, pool and glide throughout the 132m long section. There are no trees along the river banks but both slopes of the valley are thickly wooded. Poaching occurs in places, the cattle cross the river in the centre of the site. The substrate is approximately 65% gravel and the remainder is sand and silt.

Emergent species include *Sparganium erectum, Phalaris arundinacea, Equisetum* sp., *Carex* sp., *Lycopus europaeus, Berula erecta, Mentha aquatica, Myosotis* sp. This vegetation provides only 2% shading to the river along the margins. In-stream submerged vegetation includes *Ranunculus* sp. and willow moss.

Scales were not taken from fish captured at this site due to heavy rain at the time of the survey.

BY27 Drewett's Mill

BY27 is located downstream of Drewett's Mill. The river meanders gently along the 96m site and there are deep pools with stretches of glide inbetween. The substrate is mostly mud and silt (75%) with gravel too. The verges are mostly shrubby with reed beds in places. The left hand bank is fairly steep – the edge of a grazed field, the right bank is gentler, bordering a meadow.

The river is shaded 50% by trees and shrubs along the banks, species include willow, field maple, hawthorn, blackthorn and elder. There are many emergent species including *Sparganium erectum, Phalaris arundinacea, Schoenoplectus lacustris, Berula erecta, Caltha palustris, Myosotis* sp., *Mentha aquatica* and *Rumex* sp.

BY28 Middlehill

Site BY28 is the last site on the main By Brook at Middlehill near Box. The 86m section surveyed meanders through pasture, first to the left then to the right more sharply. The channel is deep glide throughout except for a shallow sand bank in the upper reaches where *Ranunculus* sp. occurs. The substrate is 80% mud and silt and 20% gravel. Both banks are steep (except where sand bars occur) and thick with herbaceous cover.

Marginal vegetation includes *Phalaris arundinacea, Glyceria maxima, Berula erecta* and dominant tree species are willow and ash. Alder, blackthorn, elder and sycamore are also present. Approximately 45% of the river is shaded by these trees and shrubs.

BY29 Doncombe Brook, Fosse Way

Site BY29 is on the Doncombe Brook off the Fosse Way, downstream from the bridge over the river. There is a grazed field on the left hand side and the right side is thickly wooded shading the brook heavily (70%) so that there is no in-stream vegetation. The brook meanders gently, deep pools occur under tree roots, sandy bars and riffles occur in straighter sections of the 97m long site. The substrate is 50% fine gravel with mud and silt and some stones. Barbed wire and trash make electric fishing difficult in places. Tree species include hazel, ash, willow, field maple, hawthorn, oak and elder.

BY30 Doncombe Brook, North Wraxall

BY30 is also on the Doncombe Brook, further downstream at North Wraxall. The 52m section starts with a fast flowing straight riffle section and then meanders sharply to the right creating a pool up to 90cm deep. The brook straightens into a riffle section before another deep pool on a right turn. The substrate is 70% gravel, 28% silt and light clay and 2% stones.

The brook is well shaded, 50%, *Phalaris arundinacea* occurs only occasionally in the margins. The main mixed woodland species on the right side are ash, oak and hazel.

Also hawthorn, field maple, willow and elder occur. The left hand bank is rough grazing pasture.

BY31 Lid Brook, Colerne

Site BY31 is on the Lid Brook at Colerne. Long riffle stretches are broken up by deep pools on sharp meanders. Another deep pool occurs below a water outlet pipe from the left hand bank approximately half way down the 80m long site. The substrate is 40% gravel with approximately equal amounts of stones and mud and silt. Natural debris and thick brambles along the course of the site makes electric fishing difficult. There is a lot of poaching along the wooded left hand bank which slopes gradually to the brook, the ground is saturated on this side due to springs. The right bank is steeper and more thickly vegetated. It borders a field which is grazed.

There is very little in-stream vegetation due to 90% shading. Marginal species include *Berula erecta*, *Myosotis* sp. and ferns. The most common tree species are oak and hazel. Hawthorn, goat willow and poplar also occur with blackberry, elder and dog rose.

Common Names for Species Listed

| | |
|---|---|
| *Apium nodiflorum* | Fool's Watercress |
| *Berula erecta* | Lesser Water Parsnip |
| *Callitriche* sp. | Water Starworts |
| *Caltha palustris* | Marsh Marigold |
| *Carex* sp. | Sedges |
| *Glyceria maxima* | Reed Sweet-grass |
| *Iris pseudacorus* | Yellow Iris |
| *Juncus* sp. | Rushes |
| *Lythrum salicaria* | Purple Loosestrife |
| *Mentha aquatica* | Water Mint |
| *Myosotis* sp. | Forget-me-not |
| *Phalaris arundinacea* | Reed Canary-grass |
| *Ranunculus* sp. | Water Crowfoot |
| *Rorippa nasturtium-aquaticum* | Watercress |
| *Rumex* sp. | Dock |
| *Schoenoplectus lacustris* | Bulrush |
| *Sparganium erectum* | Branched Bur-reed |
| *Veronica beccabunga* | Brooklime |

## 4. Water Quality

The Environment Agency uses two schemes for reporting and management of river water quality: the general quality assessment (GQA) scheme which has a biological and chemical component, and the river quality objectives (RQO) scheme. River Ecosystem Classes within the RQO scheme can be used to generally describe a river's fishery potential.

## 4.1 General Quality Assessment

The Biological GQA is a broad measure of quality based on monitoring the invertebrates on the river bed. The 1995 Biological GQA results for the By Brook grade 8 out of 10 sites within the catchment as Very Good (class a) and 2 sites on the upper reaches of the Doncombe Brook (downstream of Marshfield STW and Fuddlebrook) as Fairly Good (class c).

The 1995 Chemical GQA describes quality in terms of dissolved oxygen, biochemical oxygen demand and total ammonia, in order to detect sanitary pollution. There are 8 stretches on the main By Brook. Moving downstream their classification changes from Good (B) at the confluence of the Burton and Broadmead Brook to 4 Very Good (class A) stretches followed by 3 class B stretches downstream of Lid Brook to the confluence with the River Avon. Both stretches on the Broadmead Brook are class B and two class B stretches on the Doncombe Brook are separated by a Fairly Good (class C) stretch that covers the Marshfield STW.

## 4.2 River Quality Objectives

The Bristol Avon LEAP report (consultation draft February 1999) shows the By Brook divided into stretches each assigned a River Ecosystem Classification (RE). Of 10 stretches in the catchment 7 currently have a RE of 1, the following 3 stretches have a RE of 2: the Burton Brook from Burton to the confluence with Broadmead Brook, and two adjacent stretches on the Doncombe Brook from Fuddlebrook to downstream of Marshfield STW. The Lid Brook is not classified. A stretch of water with an RE of 1 is described as a water of very good quality suitable for all fish species. RE 2 is a water of good quality suitable for all fish species.

In 1997 5 of the 10 stretches marginally failed to comply with the River Quality Objectives set above. These were the Broadmead Brook from West Kington to the confluence with By Brook; 2 adjacent stretches of the Doncombe Brook from upstream of Marshfield STW to the confluence with By Brook and 2 stretches of the By Brook from downstream of Lid Brook to the confluence with the River Avon. Reasons for failure are not clear cut but the Broadmead Brook is susceptible to very low summer flows and some of the 23 farm holdings in the catchment have slurry management systems that need updating. The problem for the Doncombe Brook is that there is very little flow other than from Marshfield STW. The stretch of the main By Brook to the confluence with the River Avon may have failed due to variable flows or infiltration of water from the main Avon.

The compliant stretches were from Burton to downstream of the confluence with the Lid Brook (4 stretches) and the upper reaches of the Doncombe Brook from Fuddlebrook to upstream of Marshfield STW.

## 4.3 EC Freshwater Fish Directive

The Burton, Broadmead, Doncombe and By Brooks are designated as salmonid fisheries under the EC Freshwater Fish directive.

## 5. Results

The basic physical data for each of the twelve By Brook sites are shown in Appendix 1 and Appendix 2 summarises the electric fishing survey results, detailing species caught at each site, estimated population total, density (n/100m²) and biomass (g/100m²).

The population total, density and biomass are estimated using Carle & Strubbe (1978). Population total is calculated using the number of fish caught in each electric fishing run and the probability of capture. In a few situations the probability of capture is too low for a population estimate to be made. The actual number of fish caught is therefore shown, this is the minimum estimate. The single capture method is used for BY29 where just one fish was caught.

Electric fishing is not an effective method of capture of individuals less than 10cm long so fish of this size are excluded from Carle and Strubbe calculations of biomass and density and from estimates of total population. The final column of Appendix 2 shows the number of individuals caught less than 10cm - significant numbers of small brown trout were found at BY21, Broadmead Brook Fosse Way, and BY31, Lid Brook Colerne. These sites are clearly important nursery areas for juveniles and their presence should not be ignored.

Figures 1 and 2 show, for each site, the density of brown trout above and below the 10cm cutoff and figure 3 shows the density of all other species captured. Note the difference in scale of the y-axis between these and all the figures to follow.

Figures 4 and 5 show the biomass of brown trout greater than and less than 10cm at each site. Figure 6 considers the biomass of eels and coarse fish species (dace, gudgeon and grayling) at each site. Carle & Strubbe and minimum estimates are used depending on the probability of capture. One brook lamprey was captured at BY23 and one roach at BY27 but their contribution to the biomass graph is too small to include.

The table below shows all remaining minor species and their approximate abundance at each site.

| Site | Bullheads | Sticklebacks | Minnows | Stone Loach | Brook Lamprey |
|---|---|---|---|---|---|
| BY20 | 100s | | | | |
| BY21 | 100s | | | | |
| BY22 | 100s | 100 | | | |
| BY23 | 100 | 10s | 10 | | |
| BY24 | 100s | | 100 | 10 | 3 |
| BY25 | 100 | 1 | | 1 | 3 |
| BY26 | 100s | 10s | 100 | 10 | |
| BY27 | | | 10s | 10 | |
| BY28 | 10 | | 100s | | |
| BY29 | 100 | | | | |
| BY30 | 100 | | | | |
| BY31 | | | | | |

Figures 7 to 18 show the population structures for brown trout at each site – the length of the fish from snout to fork of the tail plotted against the frequency.

Figures 19 to 22 show the population structures for eels. Brook lamprey, dace, gudgeon, roach and grayling are represented in figures 23 to 28.

The results of age analysis at the Fisheries Laboratory are shown in Appendix 3 and also graphically in figures 29 and 30 for brown trout only. Scales taken from brown trout, grayling and dace at each site were analysed and each fish given an age class according to the growth rings. The graphs show the average length of fish within each age class per site.

Finally figures 31 to 34 compare the 1999 By Brook survey results with those from 1992 and 1988/1989. The series of graphs shows density and biomass of brown trout and other species at each site. Sites BY27 and BY30 were new for 1999 so there is no previous data. Again the difference in scale on the y-axis should be noted. The 1992 data is shown in Appendix 4 and 1988/1989 data is in Appendix 5.

## 6. Discussion

### 6.1 Species Present

The electric fishing survey gives a reasonably accurate assessment of fish populations present. The dominant species within the By Brook is brown trout since they were found at every site in the survey. Eels and brook lamprey were found in the upper main river sites and other coarse fish species were found at the two sites furthest downstream: dace, roach and gudgeon at Drewett's Mill and grayling and gudgeon at Middlehill. In total eleven species of fish were captured during the survey, those mentioned above plus the following minor species, stone loach, sticklebacks, bullheads and minnows. Native and signal crayfish were also seen.

### 6.2 Density and Biomass

Fish densities ranged from less than one per 100m² at Doncombe Brook, Fosse Way to 24 per 100m² Doncombe Brook North Wraxall. The lowest biomass was 7.4g/100m² at Lower Shirehill Farm on the Broadmead Brook and the highest was 1491g/100m² on the Doncombe Brook at North Wraxall. (Density and biomass calculations exclude minor species.)

### 6.3 Site Results

#### BY20 Broadmead Brook, Lower Shirehill Farm

At BY20 only juvenile brown trout were captured, all of them in the first weir pool at the lower end of the site. The density of 1/100m² has changed little since 1992 when it was 1.7/100m² but since older fish were captured last time the biomass has reduced from

522g/100m² in 1992 to only 7.4g/100m² in 1999. It is good to find that this upper stretch of the Broadmead Brook is being used as a nursery area. Although the channel is fairly straight the gravel substrate, shallow riffles and small weir pool provide a reasonable habitat for juveniles.

BY21 Broadmead Brook at Fosse Way

The 1999 results show a large decrease in both density and biomass of brown trout (10.5/100m² and 792.75g/100m² respectively) when compared to 1992 (16.8/100m² and 1382g/100m² respectively) and 1989 (19.55/100m² and1909g/100m² respectively). Comparison of length frequency distributions from the three years shows where the change has occurred. In 1992 and 1989 there was a reasonable spread of individuals across the 8-30cm range. In 1999 more fish were caught but 80% of them were less than 10cm and these are omitted from biomass and density estimates. This site has therefore become a very important nursery area sustaining fewer large fish than it previously did.

BY22 Burton Brook at Gatcombe Mill

Results for BY22 also show a change in population structure but in the opposite way to BY21. The 1992 biomass was low, 72g/100m² because most of the fish captured were in the 1+ age group (10.5cm average). In this survey a similar number of fish were captured (density 2.29/100m² in 1999 and 1.6/100m² in 1992) but their ages ranged from 2 to 5 years. The estimated biomass was therefore much greater, 362g/100m². The site has both riffle and deeper glide sections suitable for all ages of fish. A fairly even distribution of year classes was also found in 1988 when density and biomass were higher (density 4.5/100m² and biomass 790g/100m²). It is therefore encouraging to record the presence of more age classes this year compared to 1992. It is likely that the fluctuations recorded are part of the normal population dynamics of brown trout.

BY23 Castle Combe Golf Course

Density and biomass estimates have both increased dramatically at BY23 since 1992 in particular. Density of brown trout has increased from 5.19/100m² in 1988 and 1.3/100m² in 1992 to 7.79/100m² in 1999. Biomass has increased from 421g/100m² in 1988and just 58g/100m² in 1992 to 1000.71g/100m². In 1992 90% of individuals were in the 1+ age group, now all age classes from 1+ to 4+ are well represented (as they were in 1988 also). The combination of riffle and glide areas, gravel substrate, in-stream vegetation and undercut banks below tree roots together provide excellent habitat for all age classes of brown trout.

BY24 Long Dean

This is the site where least change seems to have occurred since 1992. Brown trout density estimates are similar (3.4/100m² in 1992 and 4.46/100m² in 1999) and biomass has decreased only slightly (797g/100m² in 1992 and 706.71g/100m² in 1999). The population structure shows a fairly even spread of age groups from 1+ to 4+. In 1992 all

age groups from 1 to 5 were represented but 3 and 4 year olds were most common within the population.

BY25 Slaughterford

At BY25 estimated total trout population has changed little but density has increased slightly since the previous survey so that it is on a level with 1989 results (10.1/100m² in 1989, 6.7/100m² in 1992 and 9.86/100m² in 1999). Biomass is less than it was in both previous surveys (1035g/100m² in 1989, 1258g/100m² in 1992 and 808.45g/100m² in 1999). This is because the population in 1999 is made up of more small individuals – 49% of trout captured are in the 8-13cm size range. The other 51% are spread fairly evenly over the larger size classes. In 1989 however 90% of the population were in the 16-28cm range and in 1992 90% of the population were within the 19-28cm range. Even though this site is all pool and glide and much deeper than sites higher in the catchment the habitat is obviously suitable for all age classes of brown trout.

BY26 Weavern Farm

Of the whole survey the greatest number of brown trout were captured at BY26. Hence, as in previous years, it has the largest estimated total population. The density has decreased slightly since 1988 and 1992 (20.71/100m² in 1988, 21.9/100m² in 1992 and 17.74/100m² in 1999) and the biomass has also decreased (1570g/100m² in 1988, 2345g/100m² in 1992 and 1117.5g/100m² in 1999). The 1999 length frequency distribution curve is similar to the previous site BY25 Slaughterford, with 55% of brown trout captured in the 8-14cm range and larger fish up to 30cm making up the rest of the population. In 1988 and 1992 there were more medium size fish and the length frequency distribution curves had two peaks, approximately 10cm and 20cm in 1988 and approximately 15cm and 22cm in 1992. Despite the decrease the density and biomass estimates are still excellent, infact the highest of the main river sites. The population distribution curve shows all age/size classes are represented which is due to the varied habitat within the site.

The number of eels found at this site has dropped through the years, 21 in 1988, 11 in 1992 and 5 in 1999. This is clearly a worrying trend though much more data is required to verify it and the situation should be monitored carefully in future with respect to this species.

BY27 Drewett's Mill

At BY27 the density of brown trout is 3.06/100m² and the biomass is 426.25g/100m². This is less than other main river sites upstream but is the first site where coarse fish (dace, roach and gudgeon) are present. Drewett's Mill is a new site for the survey so there are no previous results to compare these with. The length frequency distribution curve for brown trout shows that the population is not dominated by one age group in particular. The spread is fairly even across size/age classes from 9.5cm to 32.8cm. The two dace captured at the site (25.0 and 25.6cm in length) were estimated to be 5+ years

old. The marginal reed beds and the pool and glide regime at the site are clearly suitable for coarse fish and for all ages of brown trout.

BY28 Middlehill

Density and biomass of brown trout are similar at BY28 Middlehill to BY27 Drewett's Mill - 2.9/100m² and 427.83g/100m² respectively. Comparisons of these results with those from 1989 and 1992 show a decrease in both figures, density was 7/100m² in both 1989 and 1992 and biomass was 813g/100m² in 1989 and 917g/100m² in 1992. The length frequency distribution curves for 1989 and 1992 are similar but far fewer fish were captured in 1999. In 1989 95% of fish were in the 15-26cm size range and in 1992 all fish (except one of 4cm) were in the 14-27cm range. In 1999 the range was very similar, 14-31cm. The most common age classes for all surveys are 2+ and 3+. This site is not suitable for juvenile trout but there are plenty of deep pools for older fish.

Middlehill is the final site of the main By Brook nearest to the River Avon and more coarse fish species are present. Gudgeon were found in very good numbers (14cm average) and one grayling was captured (aged 1+). The species list was quite different in the other surveys when large numbers of eels were found along with dace and roach and gudgeon in 1989 only. The coarse fish species will still be present but migration may have occurred up or downstream depending on the time of year for spawning. The absence of eels in 1999 makes the 'other species' biomass considerably less than in previous years. Conditions were not ideal for surveying this year due to very high water levels which may have reduced the efficiency of electrofishing at this already deep site.

BY29 Doncombe Brook, Fosse Way

Estimated density and biomass have decreased slightly since 1992. In this survey the density was estimated as 0.59/100m², in 1992 it was 1.7/100m². The 1999 biomass was 61.18g/100m² and in 1992 it was 98g/100m². Only one fish of 21.1cm was found this time, in 1992 four trout of 1+ to 3+ years were present but the majority of fish were juveniles below 8cm (excluded from the population estimate). The habitat is in theory ideal as a spawning or nursery area. The substrate is 50% gravel and there are plenty of riffles and a few shallow pools below tree roots for example throughout the site. It is not entirely clear why juveniles were not found in 1999 but the Doncombe Brook is susceptible to low flows which may limit the spawning grounds available for brown trout. This will of course vary greatly from one year to the next depending on rainfall and affect the spawning success and population dynamics at the site.

BY30 Doncombe Brook at North Wraxall

Site BY30 further downstream at North Wraxall is the second new site. The results show the maximum density 24.17/100m² and maximum biomass 1491.08g/100m² of the whole survey. The ages of the fish ranged from 1 to 4 years with 90% within years 2 and 3. There are more deep pools at this site for older fish but low flows may also be affecting recruitment here because the gravel substrate and riffle sections should be suitable for spawning and it is surprising more juveniles weren't found.

BY31 the Lid Brook at Colerne

The final site showed an increase in estimated density (11.4/100m² in 1992 and 20/100m² in 1999) and biomass (561g/100m² in 1992 and 992g/100m² in 1999). Length frequency curves show more fish were captured in 1999 than in 1992, however the shape of the curve, or population distribution, has changed little. Fish of all age classes up to 3 years were well represented in both surveys but the peak or most abundant size has increased slightly from 5cm in 1992 to 8 or 9cm in 1999. In this survey almost the same number of juveniles (<10cm) were captured as older fish. Long riffle stretches, deep pools, a substrate of stones and gravel and higher flows than the Doncombe Brook mean that this is a very important spawning and nursery site within the catchment.

## 6.4 Growth Rates

Growth rates of brown trout from BY22 Gatcombe Mill, BY23 Castle Combe, BY24 Long Dean, BY25 Slaughterford and BY27 Drewett's Mill all show similar curves, see figures 28 and 29. Although there are no 'length at age' standards for brown trout to compare these with, the growth rates do appear to be regular. The curve from BY28 Middlehill is slightly more varied, the 2 year olds are longer, on average, than 2 year olds from all other sites but for 3 and 4 year olds growth returns to the normal pattern.

Brown trout from BY30 Doncombe Brook at North Wraxall and BY31 Lid Brook have slower growth rates than the other sites. Growth rates vary due to both genetic factors and conditions in the local environment. The water chemistry for example or greater competition for food may be affecting trout growth rates at these two tributary sites.

Evidence outlined in the 1992 By Brook Fisheries Survey suggests that due to large numbers of fish present brown trout from the By Brook catchment do have slower growth rates than trout in other rivers such as the Sherston Avon. The 1999 growth rates do not dispute this theory since the patterns have changed little since 1992.

## 6.5 Age Analysis/Byelaws Size Limit

Of all brown trout sent to the Fisheries Laboratory the most common age groups were 2 and 3 years. The average size of a 2 year old was 17.9cm and the average for a 3 year old was 23.4cm. It is therefore reasonable that the South West Region byelaws size limit for brown trout from the By Brook and its tributaries should stand at 20cm instead of 25cm for the rest of North Wessex.

The oldest brown trout of the survey was found to be 5 years old (31.8cm) from the Burton Brook at Gatcombe Mill. The largest one was found at Drewett's Mill measuring 32.8cm and weighing 503g (scales from this fish were not taken for ageing).

## 7. Conclusion

The By Brook continues to thrive with a very healthy population of brown trout, and coarse fish are important at the lower end of the catchment near the confluence with the River Avon. Spawning and nursery areas occur in the gravel substrates of the tributaries and larger fish (14-32cm) are found in the deeper waters at Middlehill furthest downstream. Fish of all sizes (8-32cm) and ages (1+ to 4+ years) occur in the other 5 main river sites. One year old fish (11cm average) are found in very good numbers as far downstream as Slaughterford and Weavern.

This broad pattern of population distribution throughout the catchment is similar to the 1988/1989 and 1992 distributions. Comparisons of site results for the surveys show fluctuations in fish density and biomass to a varying degree. 1999 results may be slightly underestimated when compared to 1988/1989 and 1992 results because the cut off length for population total, density and biomass calculations is 10cm whereas previously it was 8cm, so more fish are excluded than they would have been before. Further differences could be due to the time of year of the survey which will affect fish movement up or downstream for spawning. Also the length of site was shorter in the 1999 survey (averaging 94m, in 1992 it was 157m), because the stop nets are closer a greater proportion of fish may be lost out of the site when the nets are being put into position. Differences in results for the Doncombe Brook may be due to low flows which may have reduced spawning success this year compared to 1992. All things considered however most change will be due to normal population dynamics.

Overall the results show that the By Brook population structure is currently stable and self-sustaining. The By Brook catchment represents one of the best brown trout fisheries in the region. It has miles of unspoilt river of high water quality and conservation value, and perfect brown trout and coarse fish habitat.

## 8. References


1. Environment Agency (1996) A History of the By Brook by Ken Tatem.

2. Environment Agency (1999) Local Environment Agency Plan, Bristol Avon Consultation Draft.

3. Carle & Strubbe (1978). A new method of estimating population size from removal data. Biometrics 34, 621-630.

4. NRA-Wessex Region Routine Fishery Survey – By Brook, April-June 1992.

5. NRA-Wessex Region Routine Fishery Survey – Broadmead Brook, Fosse Way 4/1/89.

6. NRA-Wessex Region Routine Fishery Survey – Burton Brook, Gatcombe Mill 11/5/88.

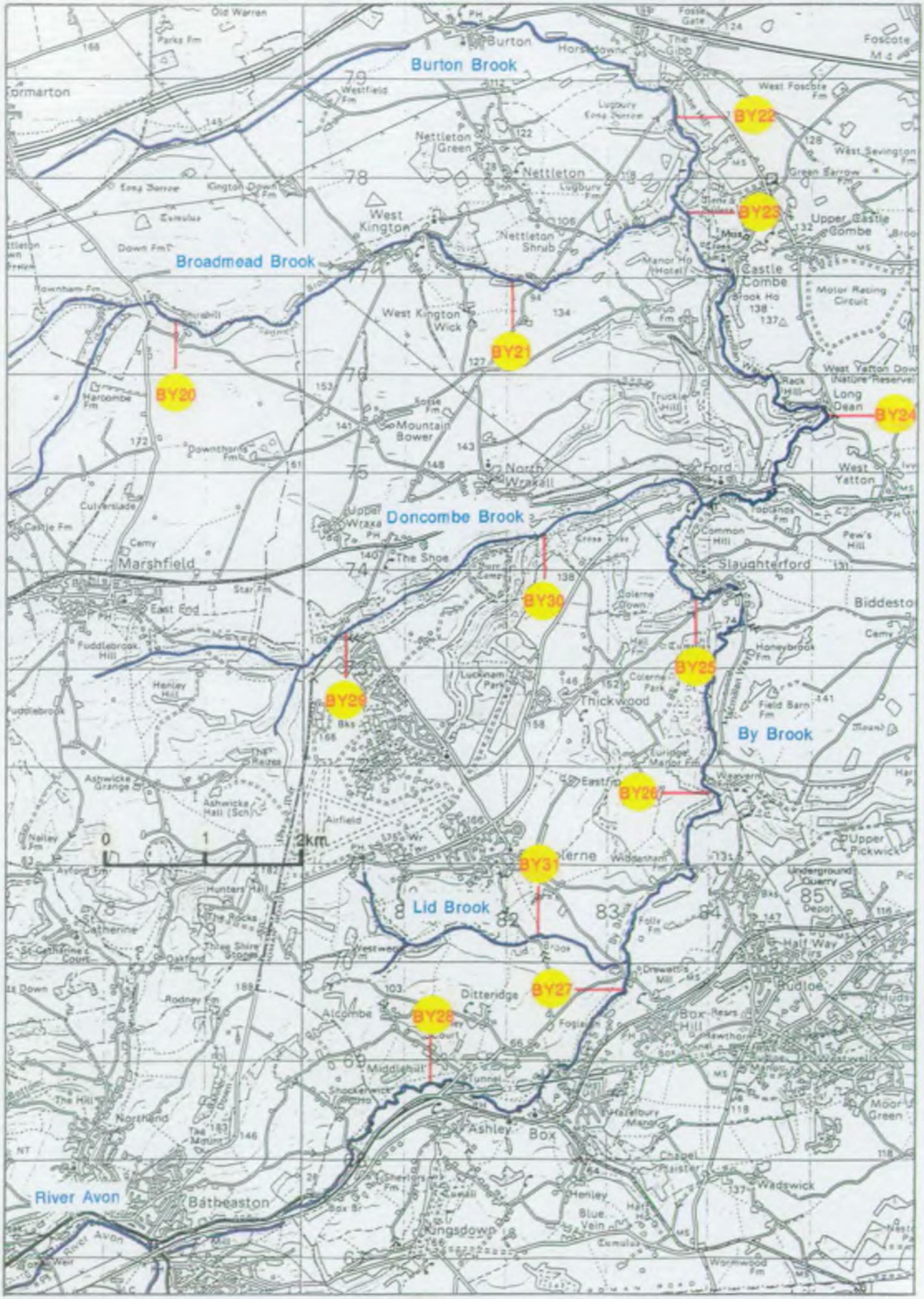
7. NRA-Wessex Region Routine Fishery Survey – By Brook, Nettleton 24/5/88.

8. NRA-Wessex Region Routine Fishery Survey – By Brook, Slaughterford 5/4/89.

9. NRA-Wessex Region Routine Fishery Survey – By Brook, Weavern Farm 25/11/88.

10. NRA-Wessex Region Routine Fishery Survey – By Brook, Middlehill 19/4/89.

Map 1. By Brook Survey Sites



Appendix 1. By Brook Site Details

| Site Code | BY 20 | BY 21 | BY 22 | BY 23 |
|---|---|---|---|---|
| Site Name | Broadmead Brook, Lower Shirehill Farm | Broadmead Brook, Fosseway | Gatcombe Mill | Castle Combe Golf Course |
| NGR | ST 788765 | ST 823769 | ST 836786 | ST 837776 |
| Date | 27 Aug 99 | 26 Jul 98 | 23 Mar 99 | 8 Apr 99 |
| Width (m) | 3.9 | 4.0 | 3.9 | 8.5 |
| Length (m) | 102 | 50 | 123 | 133 |
| Area (ha) | 0.040 | 0.020 | 0.048 | 0.113 |
| Mean Depth (m) | 0.15 | 0.3 | 0.4 | 0.25 |
| Gradient | 1:120 | 1:180 | 1:160 | 1:184 |
| Weed Cover (%) | 3 | 4 | 8 | 18 |
| Shade (%) | 90 | 40 | 5 | 20 |

| Site Code | BY 24 | BY 25 | BY 26 | BY 27 |
|---|---|---|---|---|
| Site Name | Long Dean | Slaughterford | Weavern | Drewetts Mill |
| NGR | ST 852755 | ST 838736 | ST 839718 | ST 832698 |
| Date | 14 Apr 99 | 14 Apr 99 | 20 Apr 99 | 13 May 99 |
| Width (m) | 8.5 | 7.1 | 6.4 | 7.5 |
| Length (m) | 76 | 100 | 132 | 96 |
| Area (ha) | 0.065 | 0.071 | 0.084 | 0.072 |
| Mean Depth (m) | 0.5 | 1.0 | 0.7 | 1.2 |
| Gradient | 1:250 | 1:250 | 1:440 | 1:520 |
| Weed Cover (%) | 60 | 5 | 52 | 20 |
| Shade (%) | 20 | 60 | 2 | 50 |

| Site Code | BY 28 | BY 29 | BY 30 | BY 31 |
|---|---|---|---|---|
| Site Name | Middlehill | Doncombe Brook, Fosseway | Doncombe Brook, North Wraxall | Lid Brook, Colerne |
| NGR | ST 814688 | ST 804734 | ST 823747 | ST 824703 |
| Date | 7 May 99 | 24 Mar 99 | 23 Mar 99 | 24 Mar 99 |
| Width (m) | 8.0 | 1.8 | 2.3 | 1.9 |
| Length (m) | 86 | 97 | 52 | 80 |
| Area (ha) | 0.069 | 0.017 | 0.012 | 0.015 |
| Mean Depth (m) | 1.0 | 0.15 | 0.3 | 0.3 |
| Gradient | 1:470 | 1:80 | 1:130 | 1:80 |
| Weed Cover (%) | 14 | 1 | 0 | 0 |
| Shade (%) | 45 | 70 | 50 | 90 |

Appendix 2. By Brook Survey Results Summary 1999

| Species | Estimated Total Population | Population Method * | Density (n/100m²) | Biomass (g/100m²) | Probability of Capture | Mean Weight (g) | Mean Condition Factor | Actual Catch >10cm | Catch <10cm |
|---|---|---|---|---|---|---|---|---|---|
| **BY20 Broadmead Bk Lower Shirehill Farm** | | | | | | | | | |
| BT | 4 | 2 | 1.00 | 7.4 | 0.00 | 7.4 | | 0 | 4 |
| **BY21 Broadmead Brook Fosse Way** | | | | | | | | | |
| BT | 21 | 1 | 10.5 | 792.75 | 0.88 | 75.5 | 1.32 | 21 | 87 |
| **BY22 Gatcombe Mill** | | | | | | | | | |
| BT | 11 | 1 | 2.29 | 362.54 | 0.92 | 158.2 | 1.19 | 11 | 0 |
| **BY23 Castle Combe Golf Course** | | | | | | | | | |
| BT | 88 | 1 | 7.79 | 1000.71 | 0.92 | 128.5 | 1.22 | 88 | 5 |
| EE | 3 | 1 | 0.27 | 56.20 | 0.75 | 211.7 | | 3 | 0 |
| LA | 1 | 1 | 0.09 | 0.35 | 1.00 | 4.0 | | 1 | 0 |
| Total | 92 | | 8.15 | 1057.26 | | | | 92 | 5 |
| **BY24 Long Dean** | | | | | | | | | |
| BT | 29 | 1 | 4.46 | 706.71 | 0.78 | 158.4 | 1.78 | 29 | 1 |
| EE | 3 | 1 | 0.46 | 179.68 | 1.00 | 389.3 | | 3 | 0 |
| Total | 32 | | 4.92 | 886.39 | | | | 32 | 1 |
| **BY25 Slaughterford** | | | | | | | | | |
| BT | 70 | 1 | 9.86 | 808.45 | 0.90 | 82.0 | 1.18 | 70 | 5 |
| EE | 2 | 1 | 0.28 | 60.42 | 0.67 | 214.5 | | 2 | 0 |
| Total | 72 | | 10.14 | 868.87 | | | | 72 | 5 |
| **BY26 Weavern** | | | | | | | | | |
| BT | 149 | 1 | 17.74 | 1117.50 | 0.63 | 63.0 | 1.19 | 149 | 5 |
| EE | 5 | 2 | 0.60 | 236.31 | 0.00 | 397.0 | 0.18 | 5 | 0 |
| Total | 154 | | 18.34 | 1353.81 | | | | 154 | 5 |
| **BY27 Drewett's Mill** | | | | | | | | | |
| BT | 22 | 1 | 3.06 | 426.25 | 0.60 | 139.5 | 1.18 | 21 | 1 |
| DA | 2 | 1 | 0.28 | 55.97 | 1.00 | 201.5 | | 2 | 0 |
| GU | 2 | 2 | 0.28 | 6.39 | 0.00 | 23.0 | | 2 | 0 |
| RO | 1 | 2 | 0.14 | 1.25 | 0.00 | 0.0 | | 0 | 1 |
| Total | 27 | | 3.76 | 489.86 | | | | 26 | 1 |
| **BY28 Middlehill** | | | | | | | | | |
| BT | 20 | 1 | 2.90 | 427.83 | 0.83 | 147.6 | 1.24 | 20 | 0 |
| GR | 1 | 1 | 0.15 | 13.04 | 1.00 | 90.0 | | 1 | 0 |
| GU | 25 | 1 | 3.62 | 141.67 | 0.93 | 39.1 | 1.32 | 25 | 0 |
| Total | 46 | | 6.67 | 582.54 | | | | 46 | 0 |
| **BY29 Doncombe Brook, Fosse Way** | | | | | | | | | |
| BT | 1 | 3 | 0.59 | 61.18 | 0.80 | 104.0 | | 1 | 0 |
| **BY30 Doncombe Brook, North Wraxall** | | | | | | | | | |
| BT | 29 | 1 | 24.17 | 1491.08 | 0.85 | 61.7 | 1.24 | 29 | 1 |
| **BY31 Lid Brook, Colerne** | | | | | | | | | |
| BT | 30 | 1 | 20.00 | 992.00 | 0.78 | 49.6 | 1.28 | 30 | 28 |

* Population Method
1. Carle & Strubbe 2. Minimum Estimate 3. Single Capture

Appendix 3. Growth Rates

Brown Trout (sampled in March, age given in whole years)

| Age/Year Class | 1<br>1998 | 2<br>1997 | 3<br>1996 | 4<br>1995 | 5<br>1994 |
|---|---|---|---|---|---|
| **BY22 Gatcombe Mill** | | | | | |
| Average length (cm) | | 18.6 | 25.1 | 29.5 | 31.8 |
| No. of fish aged | | 6 | 3 | 1 | 1 |
| Length range (cm) | | 15.7-19.9 | 23.5-28.3 | 29.5 | 31.8 |
| **BY30 Doncombe Brook North Wraxall** | | | | | |
| Average length (cm) | 9.7 | 14.6 | 19.9 | 25.7 | |
| No. of fish aged | 2 | 18 | 7 | 1 | |
| Length range (cm) | 7.4-11.9 | 12-18.6 | 18-21.6 | 25.7 | |
| **BY31 Lid Brook Colerne** | | | | | |
| Average length (cm) | 9.9 | 14.1 | 21.6 | | |
| No. of fish aged | 4 | 10 | 4 | | |
| Length range (cm) | 8.8-10.9 | 11.1-16.4 | 18.4-24.5 | | |

Brown Trout (sampled April-August, aged using '+' notation)

| Age/Year Class | 1+<br>1998 | 2+<br>1997 | 3+<br>1996 | 4+<br>1995 | 5+<br>1994 |
|---|---|---|---|---|---|
| **BY23 Castle Combe** | | | | | |
| Average length (cm) | 10.3 | 20.4 | 24.3 | 26.9 | |
| No. of fish aged | 6 | 11 | 10 | 4 | |
| Length range (cm) | 9-12.7 | 15-24.5 | 21.5-28.4 | 25-29 | |
| **BY24 Long Dean** | | | | | |
| Average length (cm) | 11.5 | 21.3 | 26.2 | 29.8 | |
| No. of fish aged | 9 | 6 | 6 | 2 | |
| Length range (cm) | 9-14.7 | 19.1-23 | 20.9-30.3 | 29-30.6 | |
| **BY25 Slaughterford** | | | | | |
| Average length (cm) | 12 | 20 | 24.8 | 30.6 | |
| No. of fish aged | 5 | 7 | 10 | 2 | |
| Length range (cm) | 10.5-12.5 | 17.5-21.5 | 20.5-26.9 | 30.4-30.8 | |
| **BY27 Drewett's Mill** | | | | | |
| Average length (cm) | 11.3 | 19.5 | 22.3 | | |
| No. of fish aged | 6 | 5 | 6 | | |
| Length range (cm) | 9.5-13.4 | 16.3-21.4 | 20.6-24 | | |
| **BY28 Middlehill** | | | | | |
| Average length (cm) | | 21.5 | 22.7 | 28.3 | |
| No. of fish aged | | 6 | 9 | 2 | |
| Length range (cm) | | 18-25.7 | 19.9-25.4 | 25.3-31.2 | |

Dace

| **BY27 Drewett's Mill** | 1+ | 2+ | 3+ | 4+ | 5+ |
|---|---|---|---|---|---|
| Average length (cm) | | | | | 25.3 |
| No. of fish aged | | | | | 2 |
| Length range (cm) | | | | | 25-25.6 |

Grayling

| **BY28 Middlehill** | 1+ | 2+ | 3+ | 4+ | 5+ |
|---|---|---|---|---|---|
| Average length (cm) | 20 | | | | |
| No. of fish aged | 1 | | | | |
| Length range (cm) | 20 | | | | |

Appendix 4. 1992 Results Summary
(Various methods used to estimate total population for individuals > 8cm)

**BY01 (BY20) Broadmead Brook Lower Shirehill Farm** 15 Apr 92 NGR: ST788765

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 7 | 1.7 | 522 |
| Eel | 1 | 0.2 | 111 |
| Total | 8 | 1.9 | 633 |

**BY03 (BY21) Broadmead Brook Fosse Way** 23 Apr 92 NGR: ST823769

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 94 | 16.8 | 1382 |

**BY02 (BY22) Burton Brook Gatcombe Mill** 22 Apr 92 NGR: ST836786

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 13 | 1.6 | 72 |

**BY04 (BY23) Upstream Castle Combe** 29 Apr 92 NGR: ST837776

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 20 | 1.3 | 58 |
| Eel | 2 | 0.1 | 5 |
| Lamprey | 2 | 0.1 | 1 |
| Total | 24 | 1.5 | 64 |

**BY05 (BY24) Long Dean** 19 May 92 NGR: ST852755

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 31 | 3.4 | 797 |
| Eel | 6 | 0.7 | 134 |
| Total | 37 | 4.1 | 931 |

**BY06 (BY25) Slaughterford** 27 May 92 NGR: ST838736

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 76 | 6.7 | 1258 |
| Eel | 4 | 0.4 | 80 |
| Total | 80 | 7.1 | 1338 |

**BY07 (BY26) Weavern Farm** 28 May 92 NGR: ST839718

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 247 | 21.9 | 2345 |
| Eel | 11 | 1 | 369 |
| Total | 258 | 22.9 | 2714 |

**BY08 (BY28) Middlehill** 3 Jun 92 NGR: ST814688

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 63 | 7 | 917 |
| Dace | 5 | 0.6 | 65 |
| Eel | 26 | 2.9 | 595 |
| Roach | 5 | 0.6 | 29 |
| Total | 99 | 11.1 | 1606 |

**BY09 (BY29) Doncombe Brook Fosse Way** 4 Jun 92 NGR: ST804734

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 4 | 1.7 | 98 |

**BY10 (BY31) Lid Brook Colerne** 4 Jun 92 NGR: ST824703

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 24 | 11.4 | 561 |

Appendix 5. 1988 & 1989 Survey Results Summary
(Various methods used to estimate total population for individuals >8cm)

**Broadmead Brook Fosse Way (BY21)** 4 Jan 1989

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 130 | 19.55 | 1909 |

**Gatcombe Mill (BY22)** 11 May 1988

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 36 | 4.5 | 790 |

**Nettleton (Castle Combe BY23)** 24 May 1988

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 83 | 5.19 | 421 |

**Slaughterford (BY25)** 5 Apr 1989

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout (Eels present also) | 163 | 10.1 | 1035 |

**Weavern (BY26)** 25 Nov 1988

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 348 | 20.71 | 1570 |
| Eel | 21 | 1.25 | 460 |
| Total | 369 | 21.96 | 2030 |

**Middlehill (BY28)** 19 Apr 1989

| Species | Estimated Total Population | Density (n/100m²) | Biomass (g/100m²) |
|---|---|---|---|
| Brown Trout | 101 | 7 | 831 |
| Dace | 46 | 3 | 258 |
| Eel | 15 | 1 | 207 |
| Gudgeon | 28 | 2 | 111 |
| Roach | 3 | 0 | 68 |
| Total | 193 | 13 | 1475 |

**Figure 1. Density of Brown Trout >10cm**

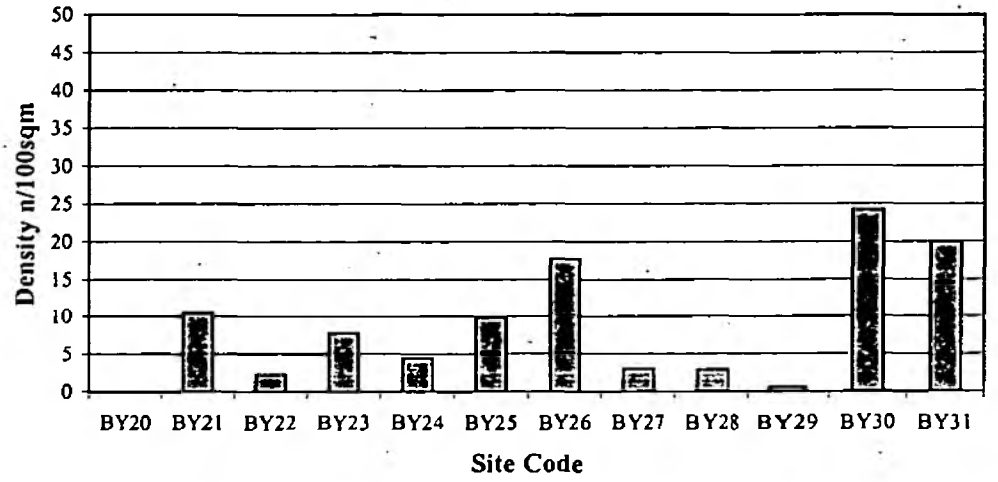



**Figure 2. Density of Brown Trout < 10cm**

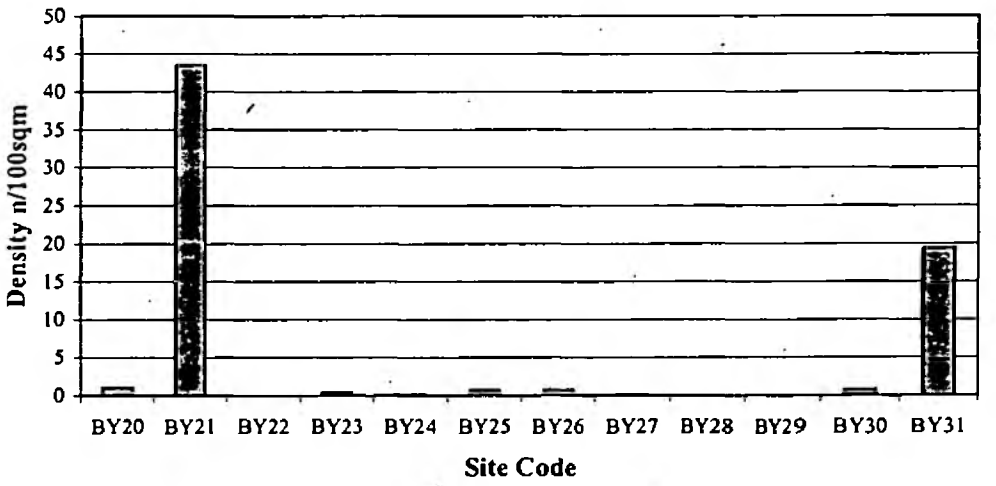



**Figure 3. Density of Other Species**

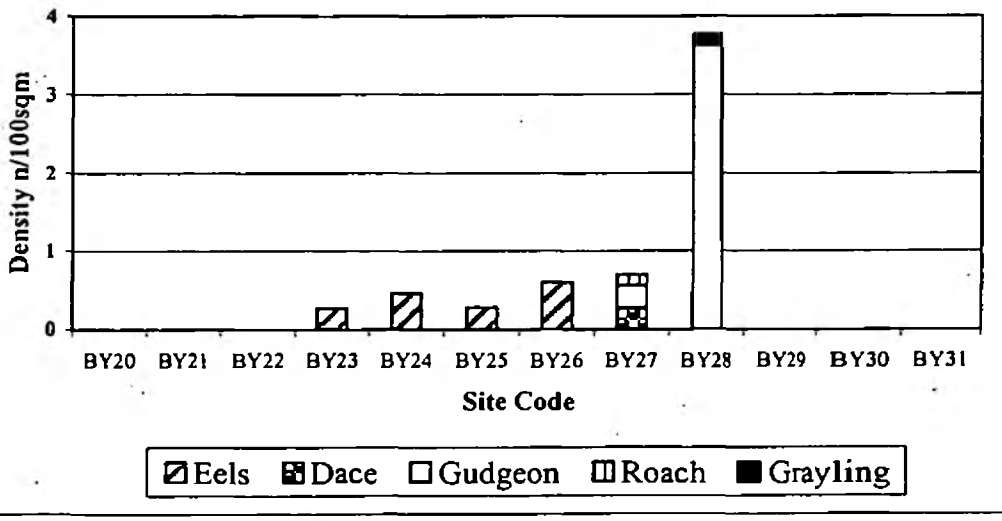


**Figure 4. Brown Trout >10cm**

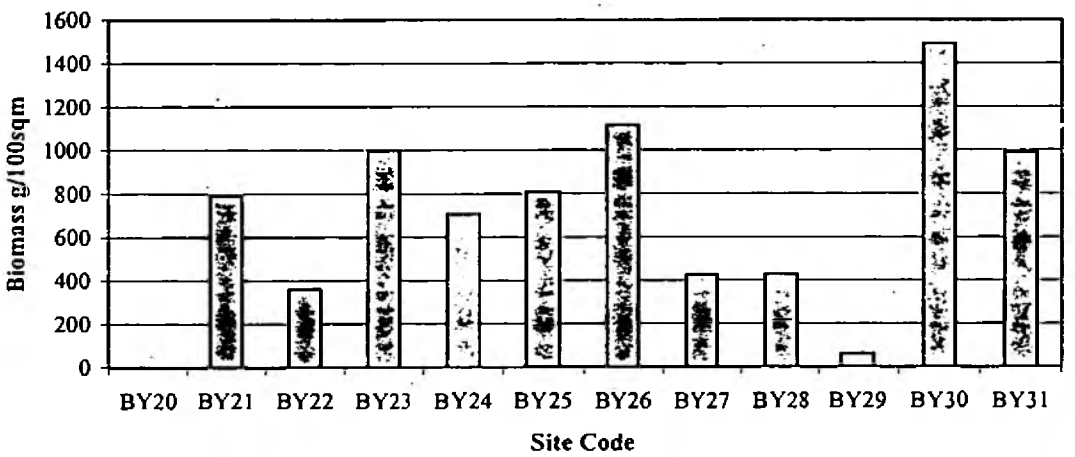



**Figure 5. Brown Trout < 10cm**

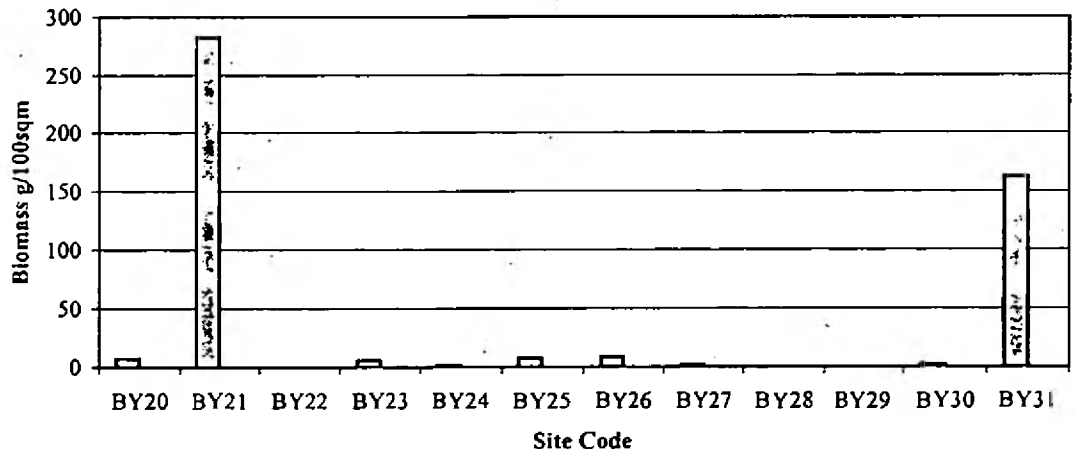



**Figure 6. Other Species**

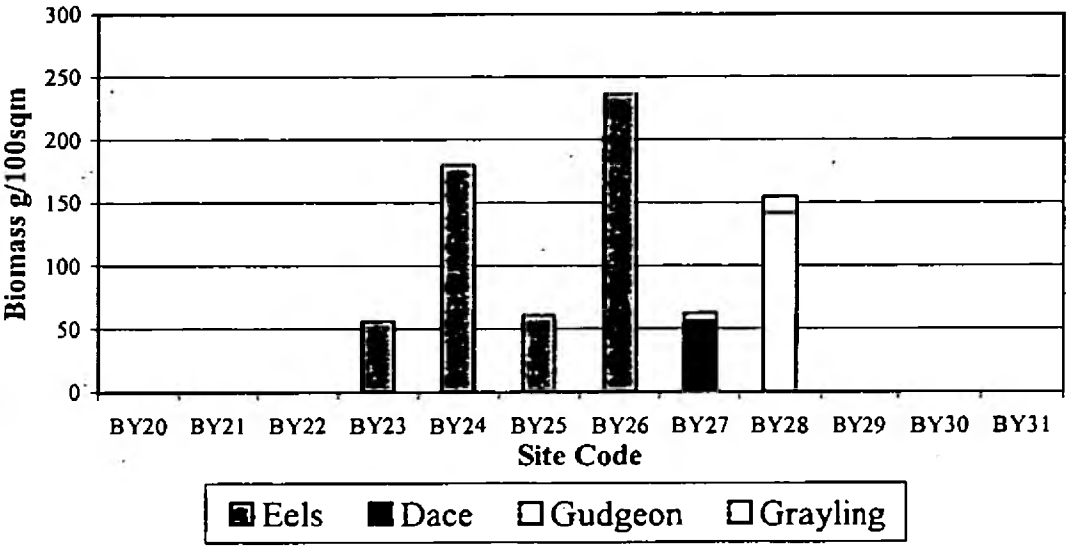


**Figure 7. BY20 Broadmead Brook, Lower Shirehill Farm**

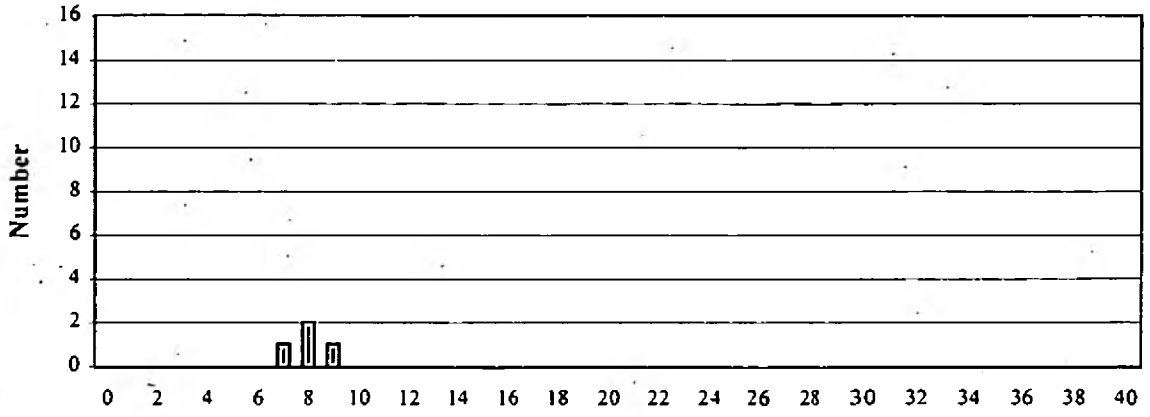



**Figure 8. BY21 Broadmead Brook, Fosse Way**

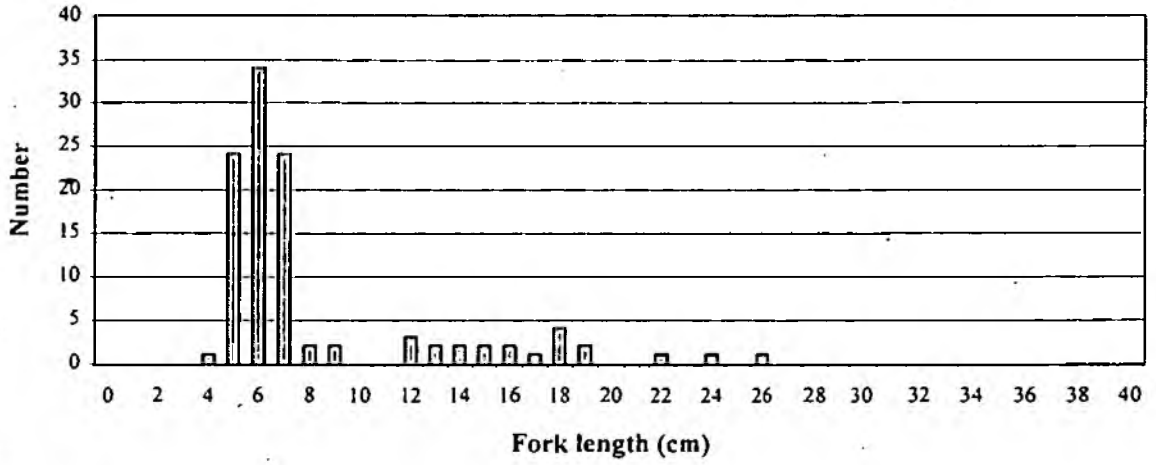



**Figure 9. BY22 Burton Brook, Gatcombe Mill**

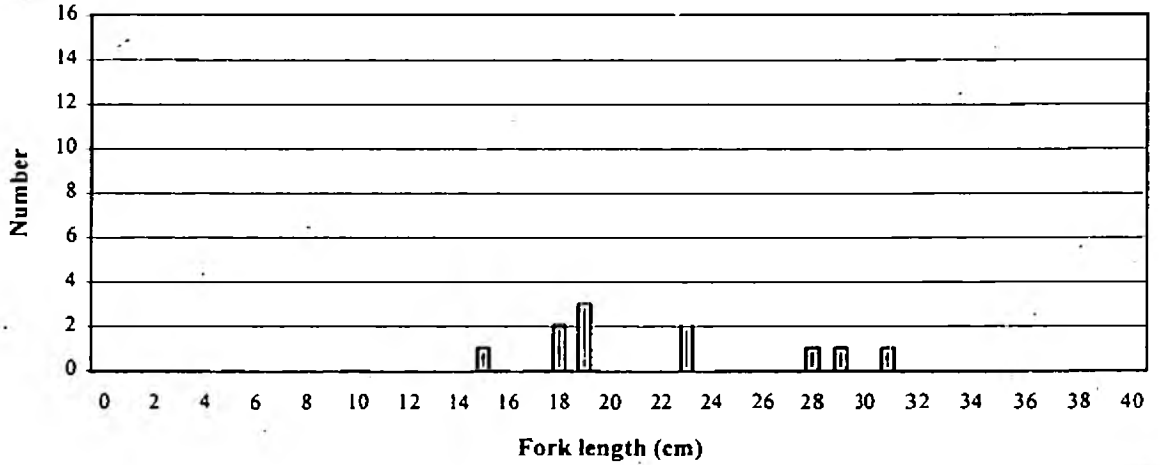


**Figure 10. BY23 Castle Combe**

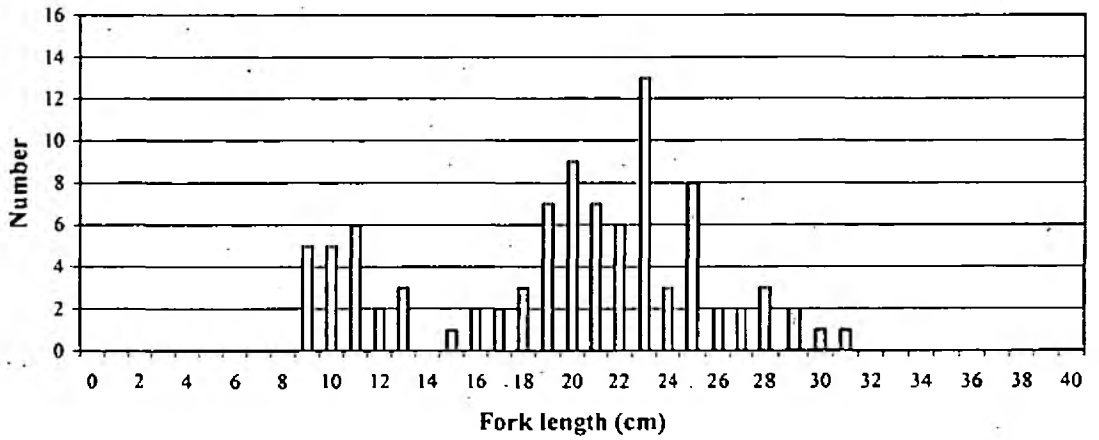



**Figure 11. BY24 Long Dean**

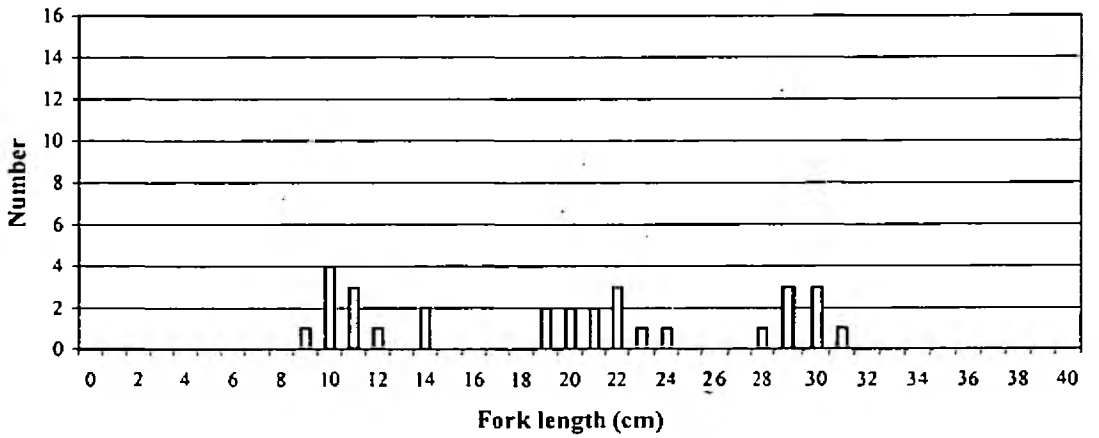



**Figure 12. BY25 Slaughterford**

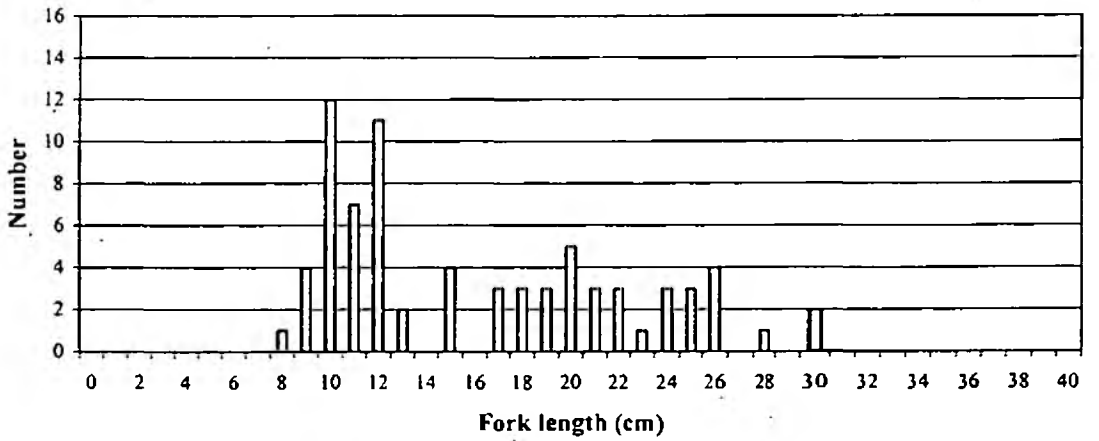


**Figure 13. BY26 Weavern Farm**

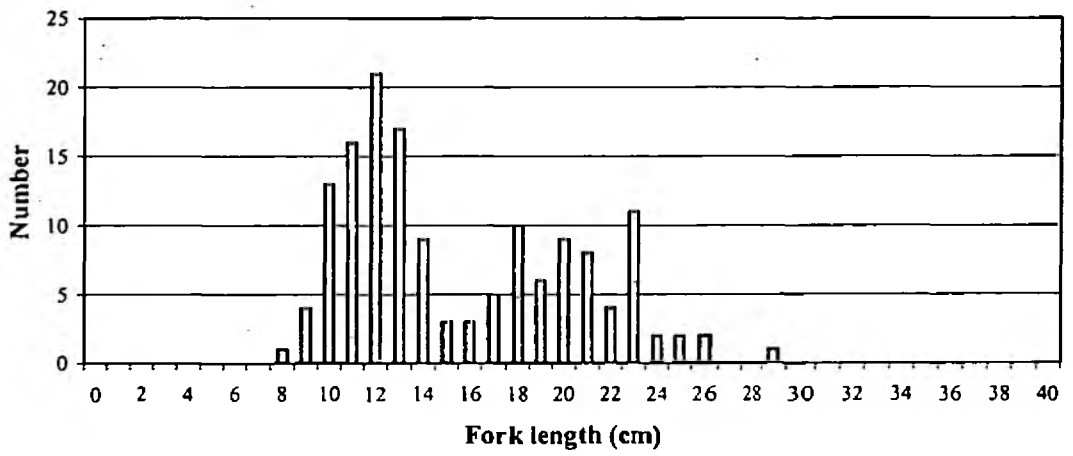



**Figure 14. BY27 Drewett's Mill**

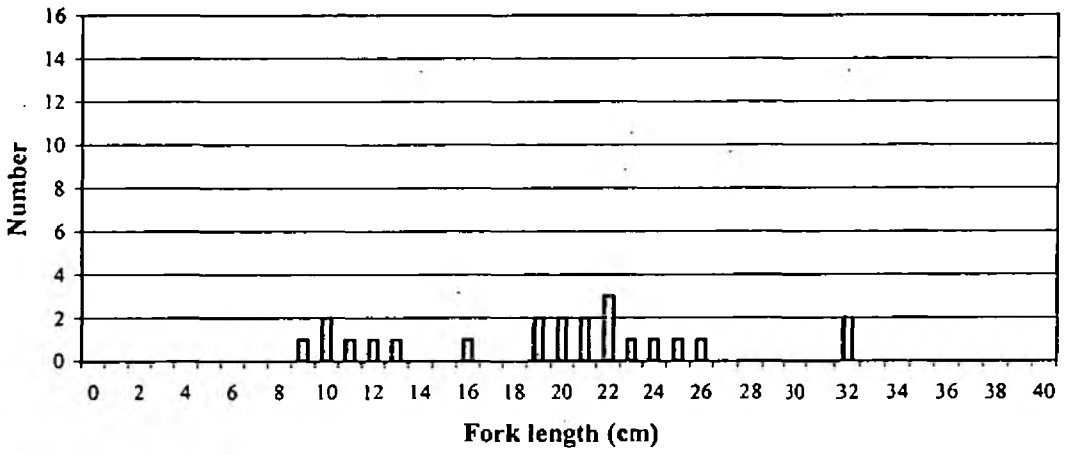



**Figure 15. BY28 Middlehill**

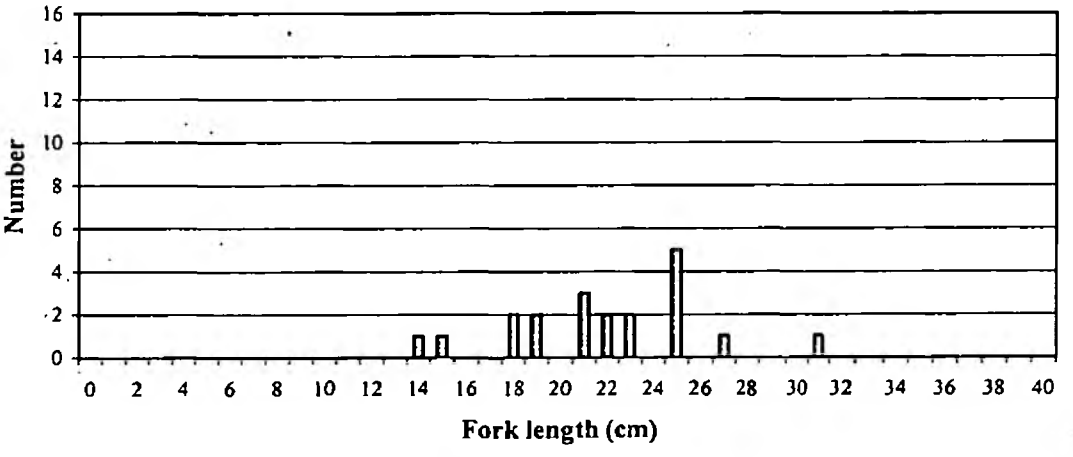


**Figure 16. BY29 Doncombe Brook, Fosse Way**

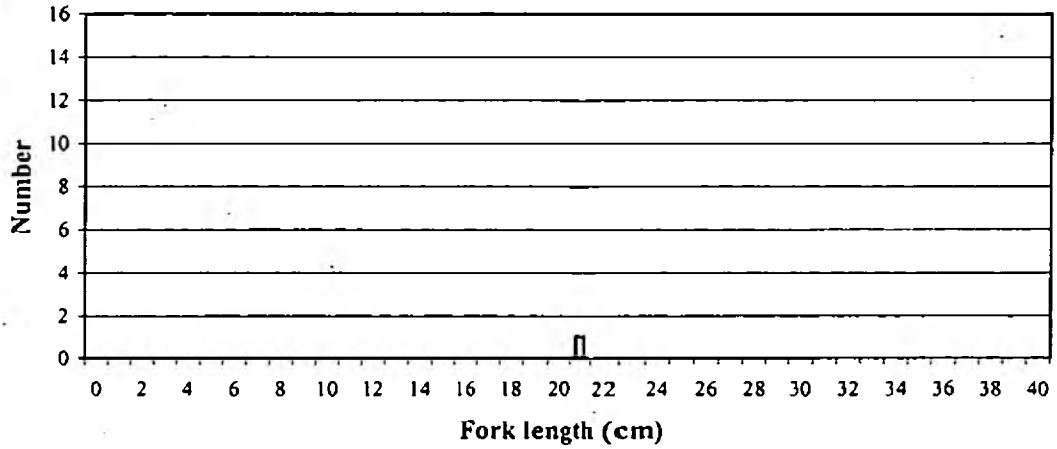



**Figure 17. BY30 Doncombe Brook, North Wraxall**

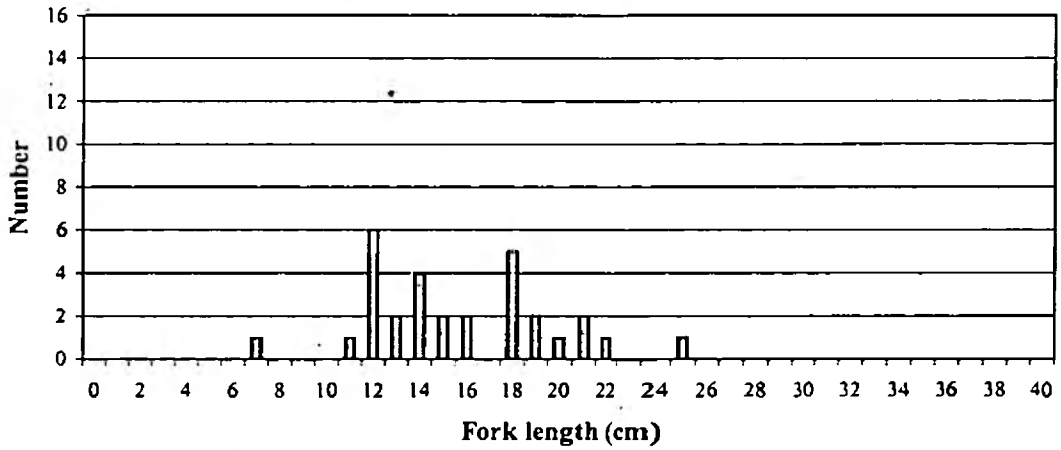



**Figure 18. BY31 Lid Brook, Colerne**

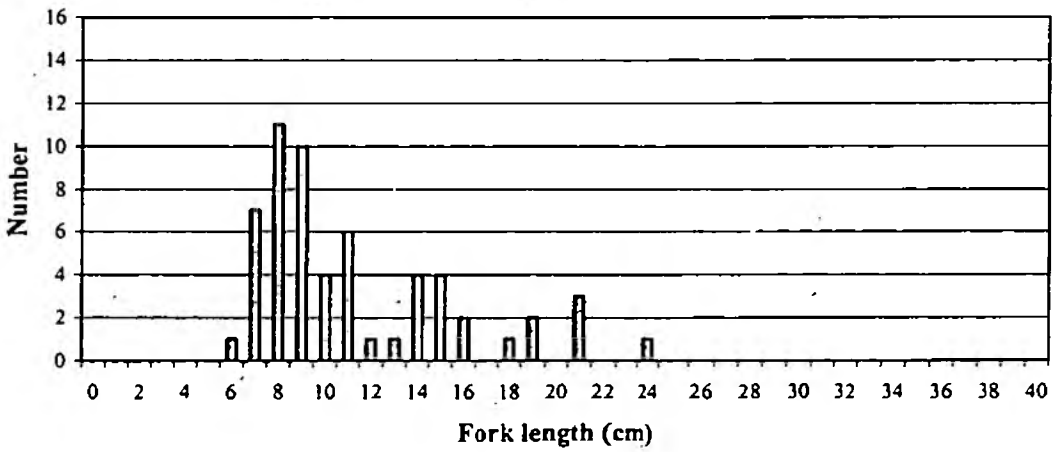


**Figure 19. BY23 Castle Combe**

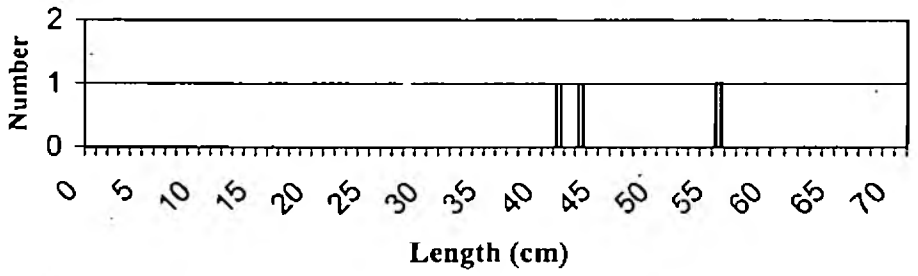



**Figure 20. BY24 Long Dean**

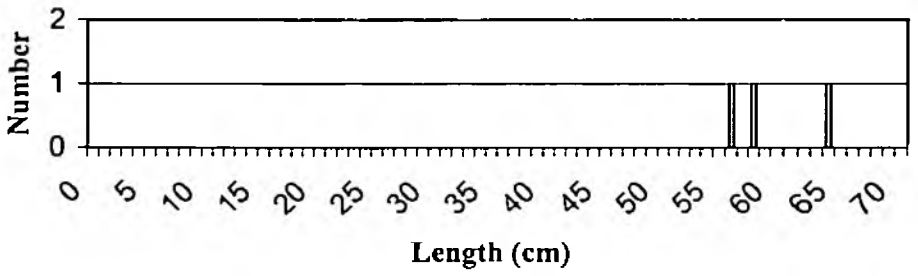



**Figure 21. BY25 Slaughterford**

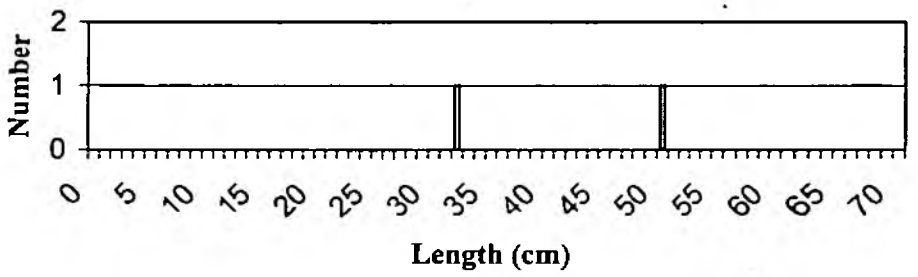



**Figure 22. BY26 Weavern Farm**

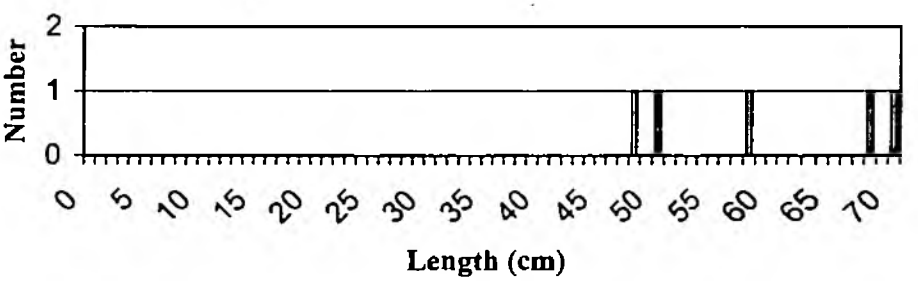


**Figure 23. Gudgeon BY27 Drewett's Mill**

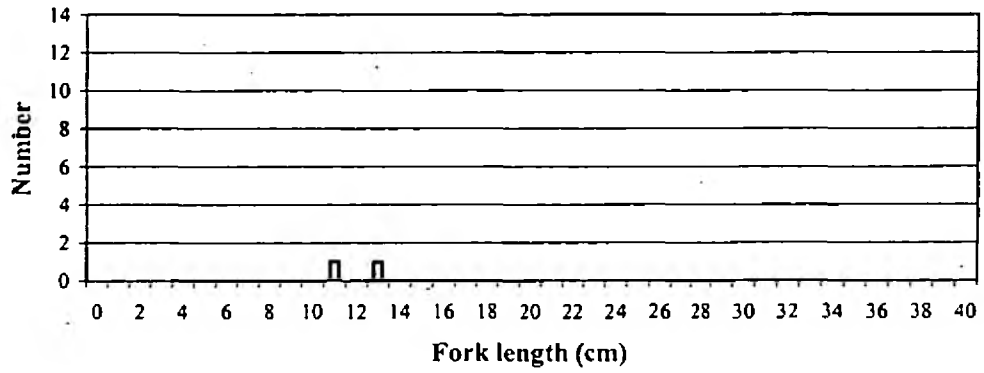



**Figure 24. Gudgeon BY28 Middlehill**

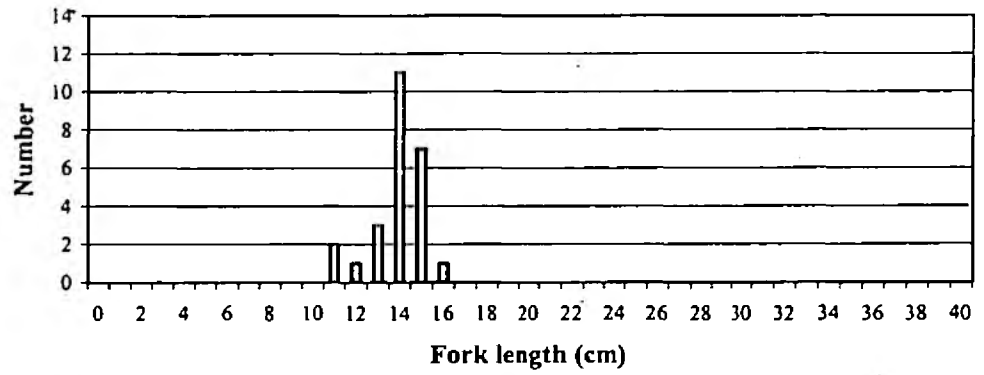



**Figure 25. Brook Lamprey BY23 Castle Combe**

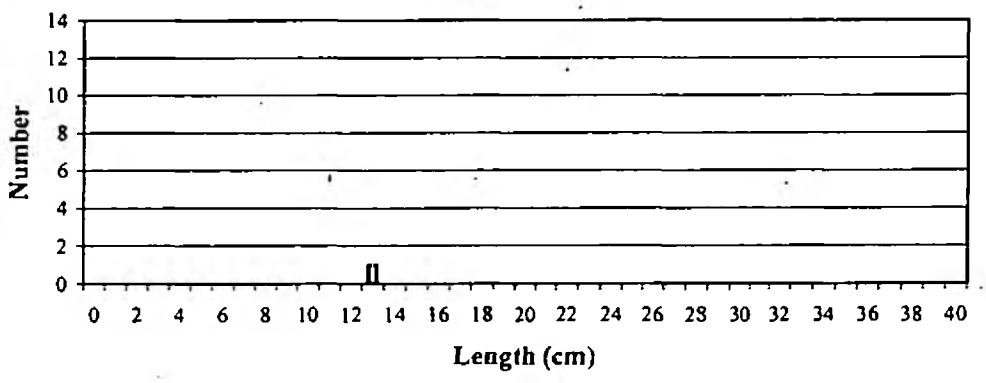


**Figure 26. Dace BY27 Drewett's Mill**

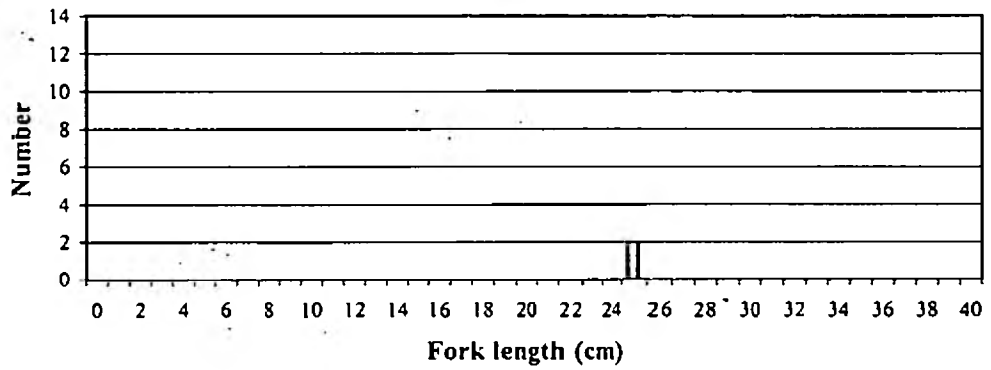



**Figure 27. Roach BY27 Drewett's Mill**

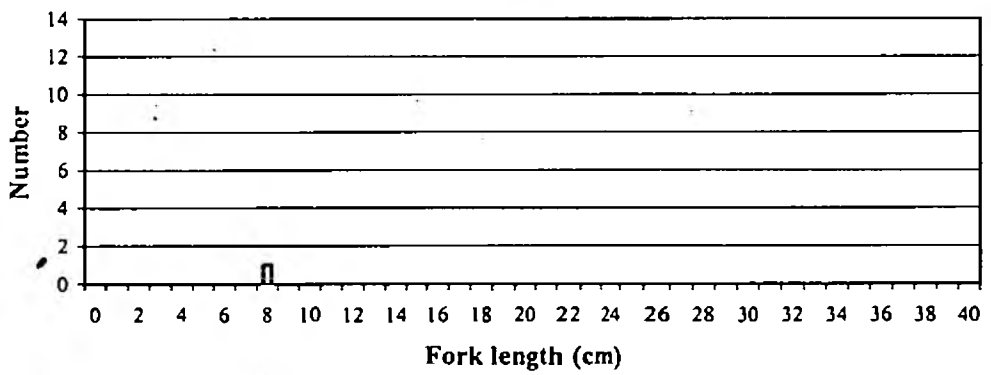



**Figure 28. Grayling BY28 Middlehill**

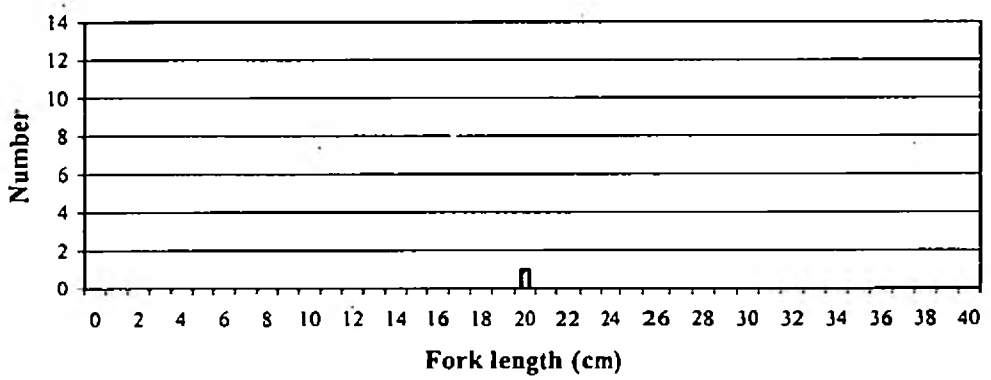


Figure 29. Sites BY22 to BY25

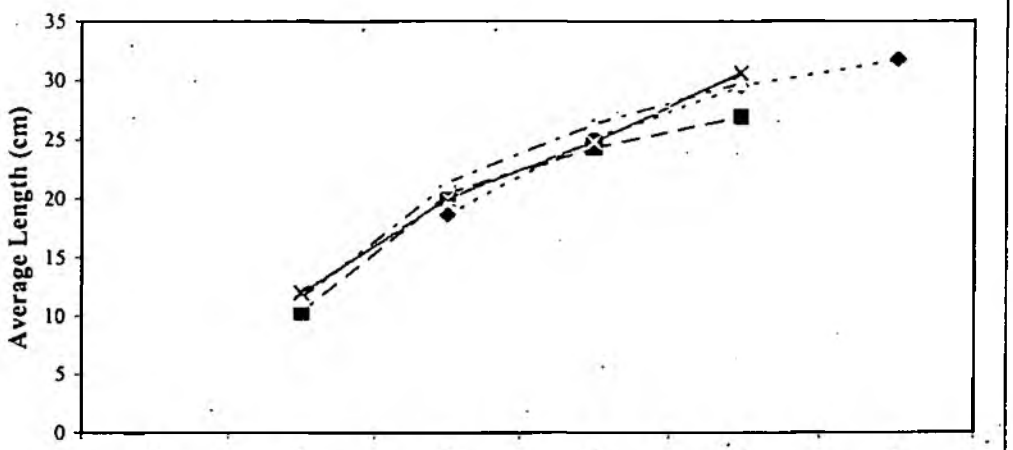



Figure 30. Sites BY27, BY28, BY30, BY31

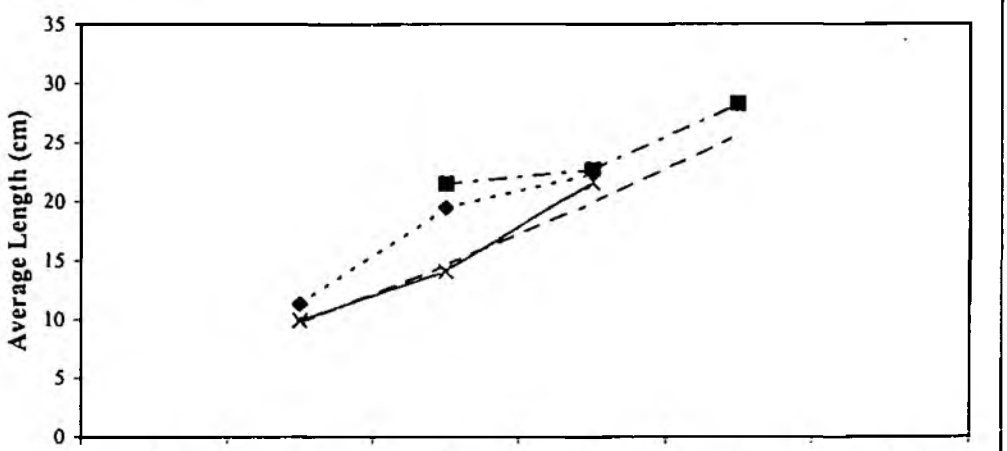


**Figure 31. Density of Brown Trout**

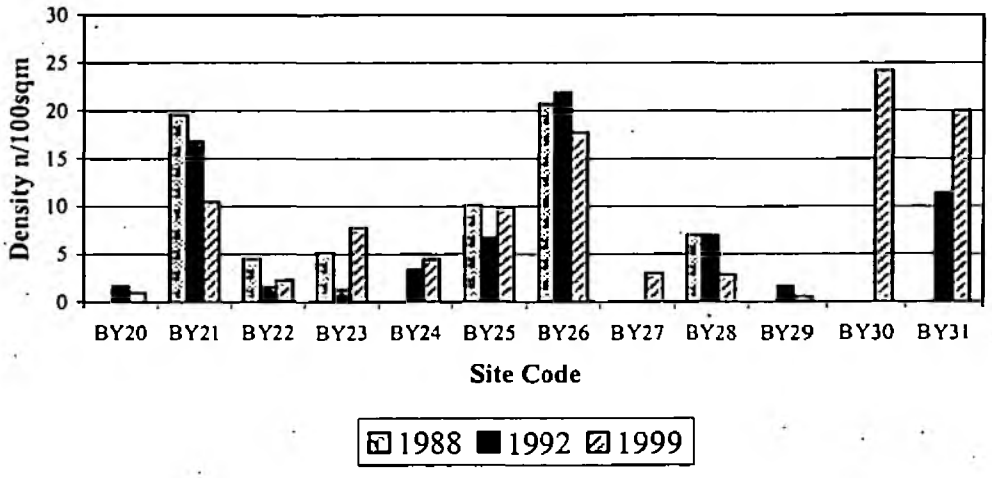



**Figure 32. Density of Other Species**

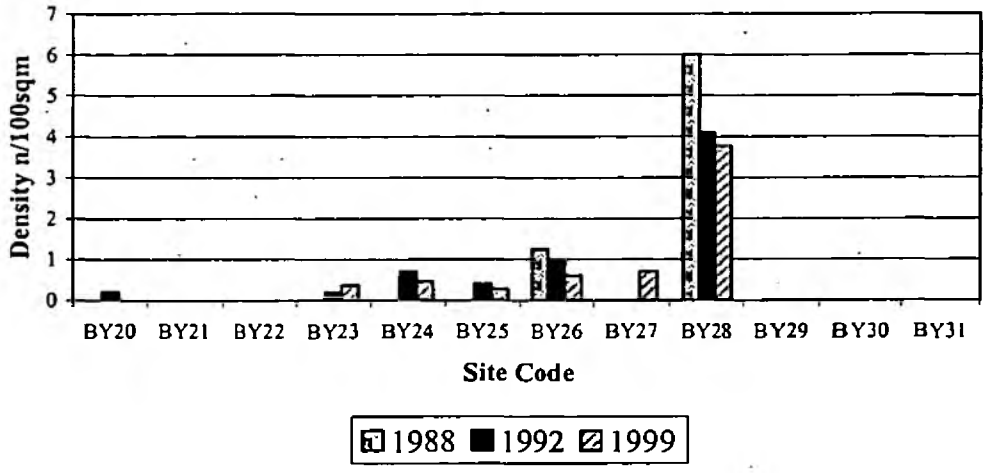


**Figure 33. Brown Trout Biomass**

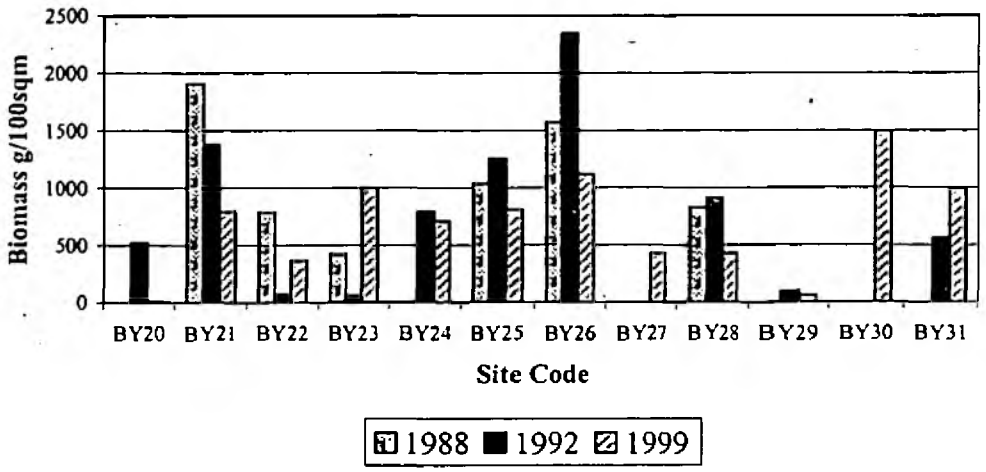



**Figure 34. Biomass of Other Species**