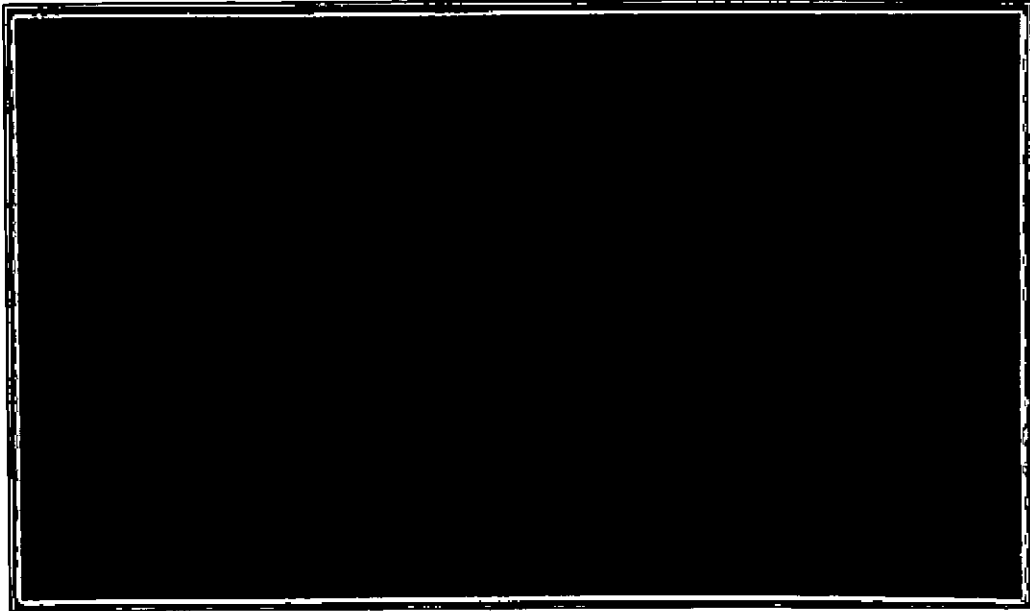


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FISH POPULATION SURVEY OF THE RIVER ITCHEN

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1. Introduction

The objective of the study was to survey fish species at six sites in the River Itchen catchment with particular emphasis on fish of angling interest.

At each site the following were determined:

- a) species composition
- b) population estimates
- c) biomass estimates
- d) length weight relationships
- e) length age relationships
- f) condition of fish
- g) visible signs of disease

2. Study sites

The six survey sites were chosen by NRA (Southern) in consultation with IFE and represented areas from the upper headwaters to the lower reaches of the river (Fig. 1). Details of the sites, their location and the survey dates are given in Appendix 1.

3. Methods

3.1 Site information

Sketch maps of the sites were drawn and lengths, widths and depths of the sites recorded. A subjective assessment of substratum type was also made (Appendix 1).

3.2 Stop nets

Stop nets were used to isolate the fishing reach. The mesh sizes of the nets was 20 and 25 mm. At Sites 3-6 the lead line was fixed to the bottom using metal stakes. At Site 5 (Brambridge) considerable difficulty was experienced in setting the stop nets. This was due to deep narrow runs between sediment banks creating gaps under the lead line of the net. At all other sites it was felt that the nets provided an adequate barrier to fish immigration and emigration.

3.3 Fishing techniques

With the exception of Site 1, three successive electrofishings were carried out at each site. Fish were processed after each fishing and placed in keep nets until completion of electrofishing. At Site 1 the river was narrow and shallow with few fish. It was not considered necessary therefore to carry out a third fishing.

The length and weight of each fish was recorded after anaesthetizing, if necessary, in benzocaine. Scales were taken from individuals of the major fish species for age determination. Where an obvious length age cohort was present, a subsample of fish was used, eg 0+ grayling. At Sites 5 and 6 some fishing was carried out outside the study reaches to provide extra information. Fish caught were not used in assessing population densities.

Four fishing techniques were used depending on the river width and depth.

3.3.1 Upstream wading, single anode (Sites 1 and 2)

The reach was waded from the downstream net to the upstream net. A 1 KVA single phase generator was used producing 220 V at 100 Hz output through a single 30 cm diameter anode. Two hand nets were used to capture fish.

3.3.2 Upstream wading, double anode (Site 5)

The reach was fished from the downstream to the upstream stop net. A 1.9 KVA single phase generator was used (output 220 V at 100 Hz) powering two 30 cm diameter anodes. Four hand nets were used to capture fish.

3.3.3 Downstream fishing from a punt (Sites 3 and 4)

The reach was fished from the upstream net to the downstream net. Ropes to both banks were used to control the speed and position of the punt. Speed was maintained at slightly faster than the current of the river to avoid the problem of stunned fish drifting out of reach of the netsmen. The punt was zig-zagged down the river in order to fish the full width at each fishing. A 1.9 KVA generator was used (output 220 V at 100 Hz) to power two 30 cm diameter anodes. Two standard and two extra large hand nets were used.

3.3.4 Boom boat (Site 6)

The site was fished using a multi anode boom boat. Fishing was carried out from the upstream stop net to the downstream net. Power was supplied from a 7.5 KVA generator (220 V at 100 Hz) to each of eight equally spaced anodes on an eight metre boom. The fishing team comprised two netsmen, a boom operator and an outboard engine operator.

3.4 Analysis of catch data

3.4.1 Population density

Population densities of individual species for all sites were estimated from either triple or double catch data. Calculations were carried out using the computer program 'Remove'. The program calculates the exact minimum likelihood estimate of the population (N) (Carle & Strub 1978). This method is slightly more precise than that of Zippin (1956) because it takes account of the fact that the population size is an integer. As with Zippin's method the exact maximum likelihood method requires the catch effort to remain constant between catches. To test this on the three catch estimates, a Chi-square test, based on the assumption of constant effort (p) is calculated. If the Chi-square value is significant, then the assumption is invalid and the estimate suspect.

Where population estimation was not possible from the catch data (eg because of non-constant fishing effort), minimum species densities were calculated based on actual numbers of fish caught. Minor species and eels were considered to be of secondary importance and minimum estimates only have been calculated as not all fish seen were caught. Numbers caught tended to increase with shock number as individuals of the major species were reduced.

3.4.2 Biomass estimate

Biomass estimates were calculated for each species caught at each site. The population biomass was estimated by multiplying the estimated population density by the mean weight of an individual of that species caught at that site. Where population density estimation was not possible, the minimum biomass was calculated based on the actual weight of fish caught.

3.4.5 Condition factor (CF)

The condition factors of individual trout, grayling and salmon caught at each site were calculated from the equation

$$CF = \frac{W}{L^b}$$

where W = wet weight (g), L = length (mm) and b = slope from length weight relationship. Mean values and 95% confidence limits for each age group at each site were calculated.

3.4.3 Age determination

The age composition of the fish was determined by examining the scales of individual fish. Where interpretation was difficult a second opinion was sought. If there was still doubt the fish was excluded from age related calculations. Many fish were in the process of laying down their winter check but were not considered to have reached their 'birthday' ie a fish laying down its first check was aged at 0+. A length age relationship for each major species was produced.

3.4.4 Length weight relationship

Length weight relationships were calculated for trout, salmon and grayling from the formula

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

where W = weight (g), L = length (mm), a and b are constants.

4. Results and interpretation

4.1 Species composition

A total of 14 species of fish were caught in the survey reaches. the common species were brown trout, present at all sites except Site 6, grayling, present at all sites from Site 3 downstream and eel present at all sites except Site 1. The length distribution of trout and grayling caught at each site are shown in Figs 2 and 3 respectively. All small trout (<200 mm) were caught in the upper reaches of the river (Sites 1-3). The largest trout were caught at Site 5.

The length range of grayling was similar at sites 5 and 6. At Site 4, however, there were greater numbers of small fish (<200 mm). Site 4 was the only site where fish >360 mm were caught (Fig. 3). One rainbow trout was caught at each of Sites 2 and 4. A female fish at Site 4 (Winchester College) appeared to have recently spawned. Salmon parr were only caught at Sites 4 and 5 and adult salmon only seen at Site 5.

A full species list and the sites at which they were recorded is shown in Table 1. Despite the reported presence of dace and bream at Site 6, none was caught or seen even when further electrofishing outside the study site was carried out.

4.2 Population density and biomass

Population density and biomass for each species caught at each site are given in Table 2.

The density of brown trout was highest at Site 2 with Site 3 having the second highest. Densities at Sites 1, 4 and 5 were similar. Biomasses for Sites 2 and 3 were similar even though densities were 2-3 times greater at Site 2 than Site 3. This reflects the larger size of trout found at Site 3. Biomasses at Sites 4 and 5 were also similar to each other. However the biomass at Site 1 was only one tenth of these values even though the density was approximately the same.

With the exception of one fish caught at Site 3, grayling were confined to Sites 4-6. The highest density and biomass occurred at Site 4.

Surprisingly salmon parr were found only at two of the study sites (4 and 5). It is probable that Sites 1 and 2 are too high up the river system and Site 6 was below the spawning areas. The result merits further investigation particularly in the middle to upper reaches of the river.

Only two rainbow trout were caught from the six sites on the river. This low density (and consequently low biomass) is notable in the light of concerns about fish farm escapes in the river.

Densities and biomasses of other major angling species, roach, tench and pike, were very low with only occasional fish caught. Biomass purely reflects the size of these few individuals. Densities of the minor fish species and eels should be regarded as minimum estimates. These species were not the primary target species and efficiency of capture, especially on the lower sites, was often low. However the highest population density and biomass of any species was found for eels at site 5.

4.3 Length weight relationship

Length weight relationships for brown trout, grayling and salmon were as follows:

Brown trout	$\log W = 4.93 + 3.01 \log l$
Grayling	$\log W = 5.49 + 3.22 \log l$
Salmon	$\log W = 4.26 + 2.65 \log l$

These are shown graphically in Figs 4-6.

4.4 Age and growth

Only three age groups of brown trout were found to be present in the survey sites. No fish older than 2+ were found at any site. The relationships between age and both length and weight are shown in Fig. 7. Length frequency distributions for age are given in Fig. 8.

Five age groups of grayling were present. Fig. 9 shows the relationship between age and both length and weight. Length frequency distributions for age are given in Fig. 10.

The instantaneous growth rate of brown trout decreased from 2.11 between the ages of 0+ and 1+ to 0.61 between ages 1+ and 2+ (Table 3). The four instantaneous growth rates calculated for grayling ranged from 1.49 between ages 0+ and 1+ to 0.15 between 3+ and 4+. The G values between ages 1+ and 2+ and 2+ and 3+ were very similar (Table 4).

4.5 Condition of fish

It is known that condition factor varies both between and within years and comparison with other river systems, therefore, ideally needs data to be collected over the same time period.

4.5.1 Brown trout

The condition factor of brown trout in the River Itchen was found to be highly variable (Fig. 11) with values for ages 1+ and 2+ being more variable than for 0+ trout. The condition factors of brown trout at Site 4 were generally lower than those at other sites. There were no differences between condition factors at each age (Fig. 11).

4.5.2 Grayling

Grayling at Site 6 (Gaters Mill) generally had good condition factors with most above the mean CF for the whole river population sampled (Fig. 12). Unlike brown trout, grayling showed a wide range of CF for 0+ fish. Generally there was no difference in CF with age.

4.6 Fish disease

Most fish caught on the survey were free of visible diseases. Fungus was found on one trout at Brambridge (Site 5) and two at Easton (Site 3). Two damaged trout were found at Brambridge and one at Easton had one gill cover missing. One deformed grayling was found at Winchester College (Site 4).

Several brown trout showed the fin deformities associated with stocked fish.

The fish leach *Piscicola geometra* occurred on many fish, particularly brown trout, heaviest infestations of several per individual fish occurring at Winchester College.

5. Summary and conclusions

- a) Trout and grayling were the only species of angling interest found in numbers during the survey. Although large numbers of coarse fish were reported to be present at Site 6 (Gaters Mill) they were probably highly aggregated and were not present in the survey reach or the extra reach electrofished.
- b) Only two rainbow trout were found suggesting that escapement from fish farms is slight or sporadic and is not a persistent problem in the areas fished. It should be noted, however, that one fish appeared to have spawned.
- c) Grayling were limited to below Easton.
- d) Salmon parr were only found at two sites. Further surveys in the middle to upper reaches are desirable.
- e) The whole river appears to be very silty. Very few areas of clean gravel (apart from headwater streams) were seen. Potential for trout and salmon spawning appears limited.

References

- Carle, F.L. & Strub, M.R. (1978). A new method for estimating population size from removal data. *Biometrics*, 34, 621-630
- Zipin, C. (1956). An evaluation of the removal method of estimating animal populations. *Biometrics*, 12, 163-189.

Fig. 1 Position of survey sites on the R. Itchen

Site 1 Abbotstone, Site 2 Vernal Farm, Site 3 Easton,
Site 4 Winchester College, Site 5 Brambridge, Site 6 Gaters Mill

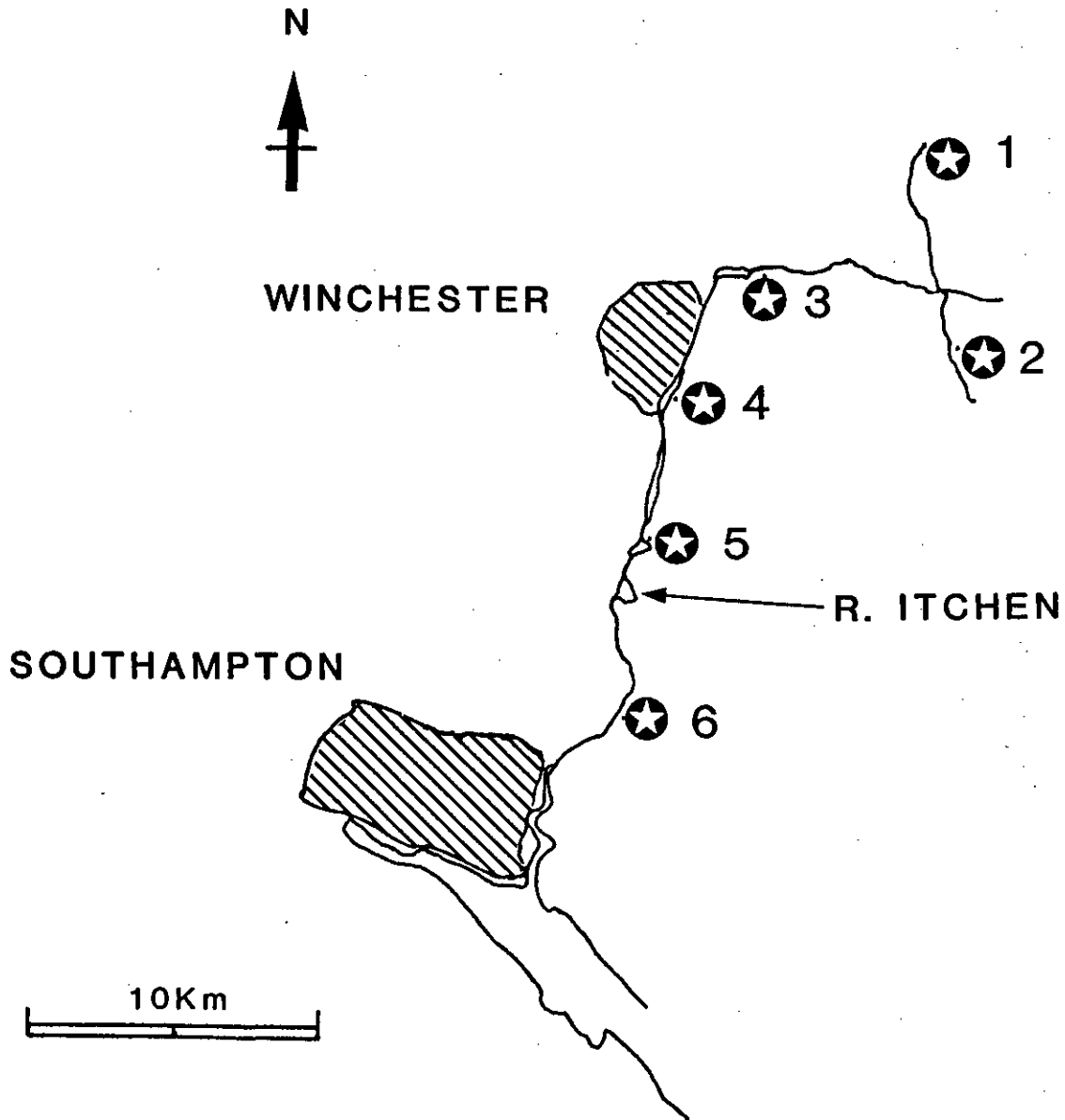


Fig. 2 Length distribution of brown trout caught at each site in the R. Itchen

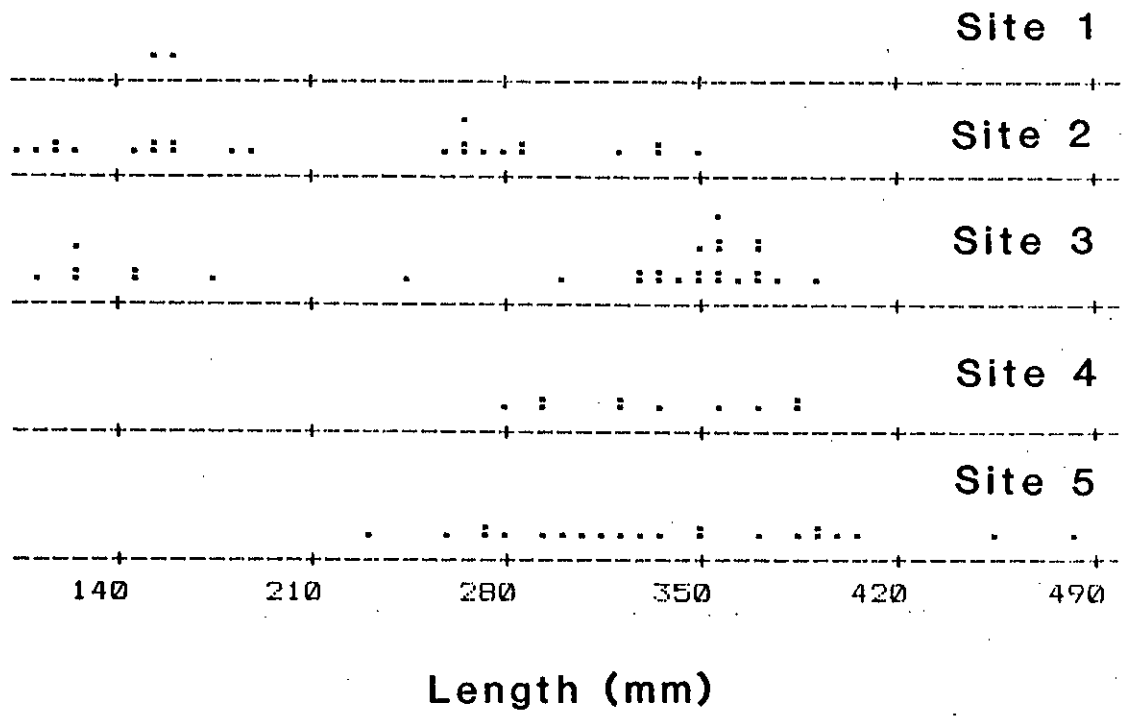


Fig. 3 Length distribution of grayling caught at each site in the R. Itchen

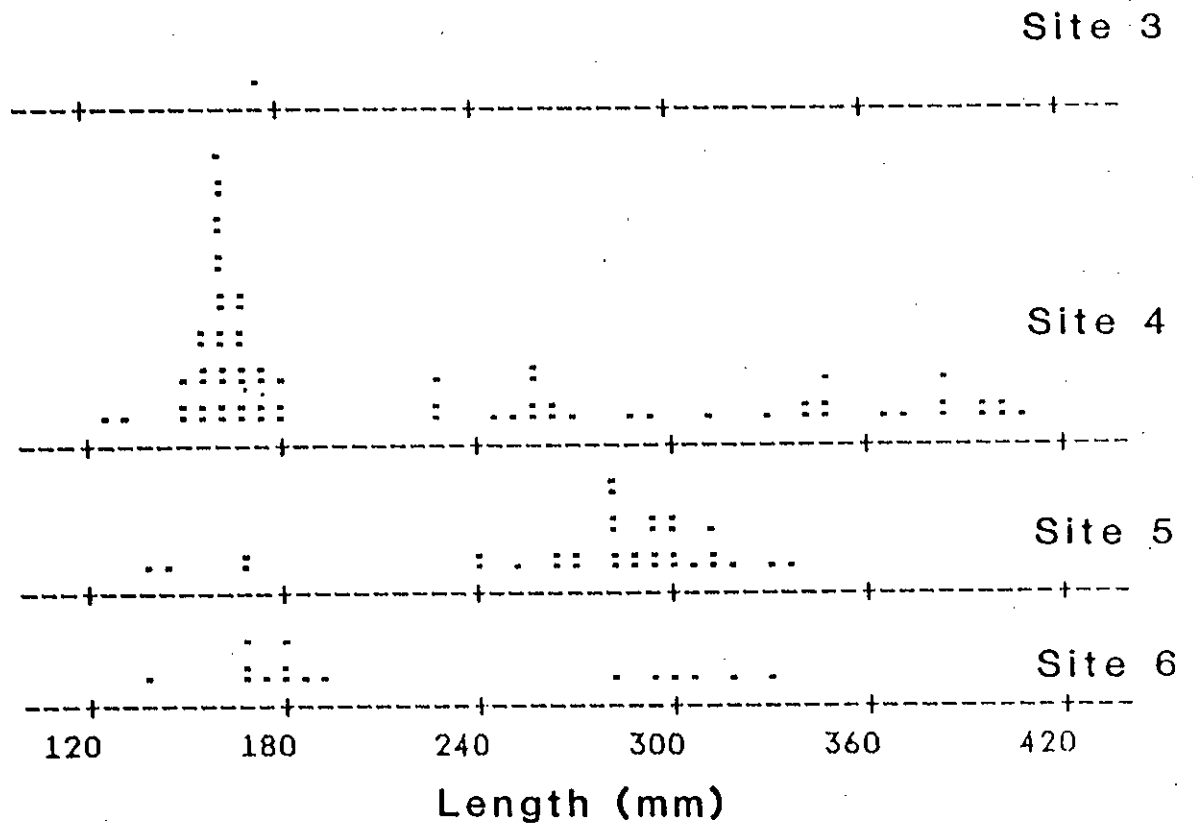


Fig. 4 Length weight relationship for brown trout in the R. Itchen. 95% CL for new individuals are shown.

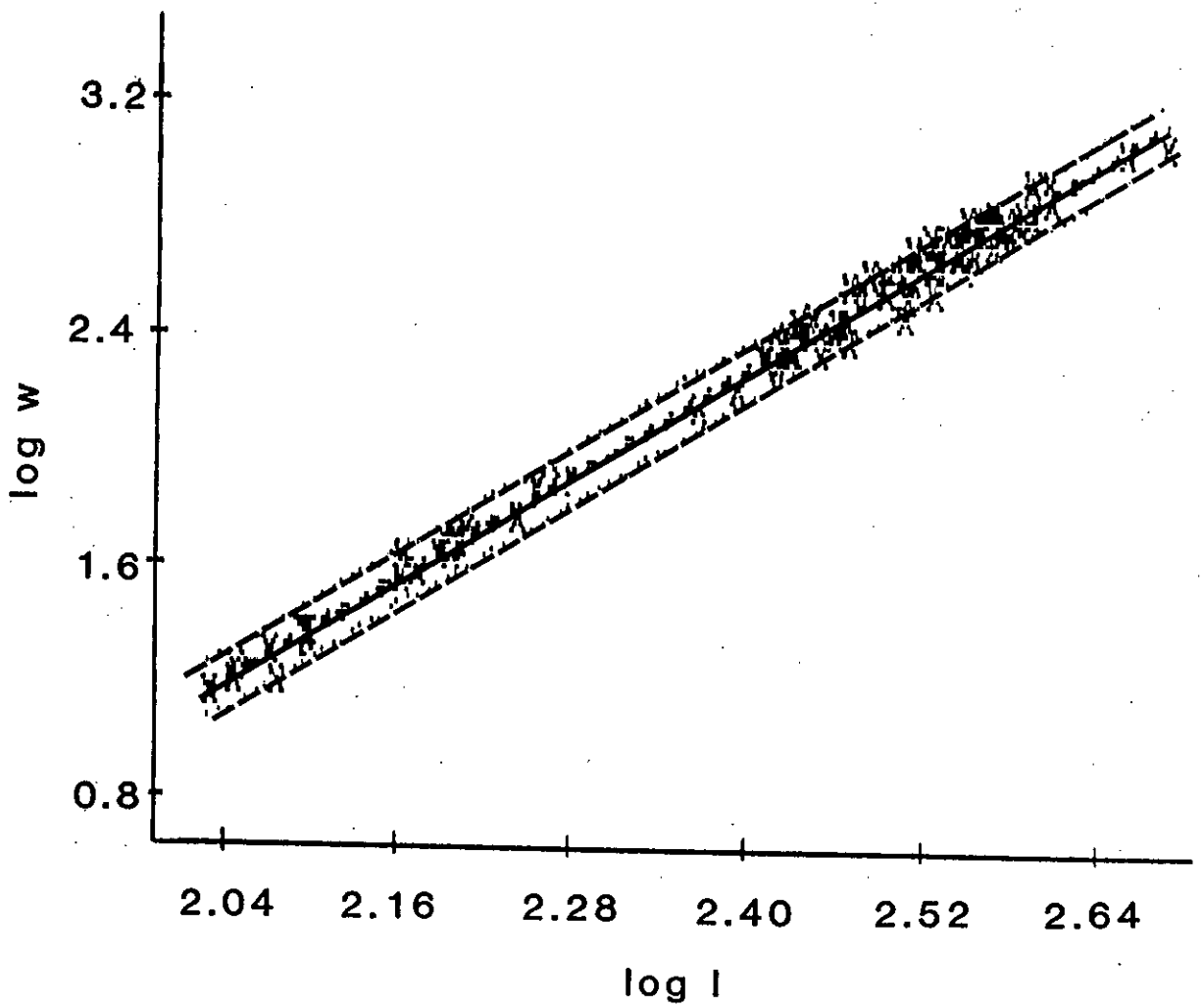


Fig. 5 Length weight relationship for grayling in the R. Itchen.
95% CL for new individuals are shown.

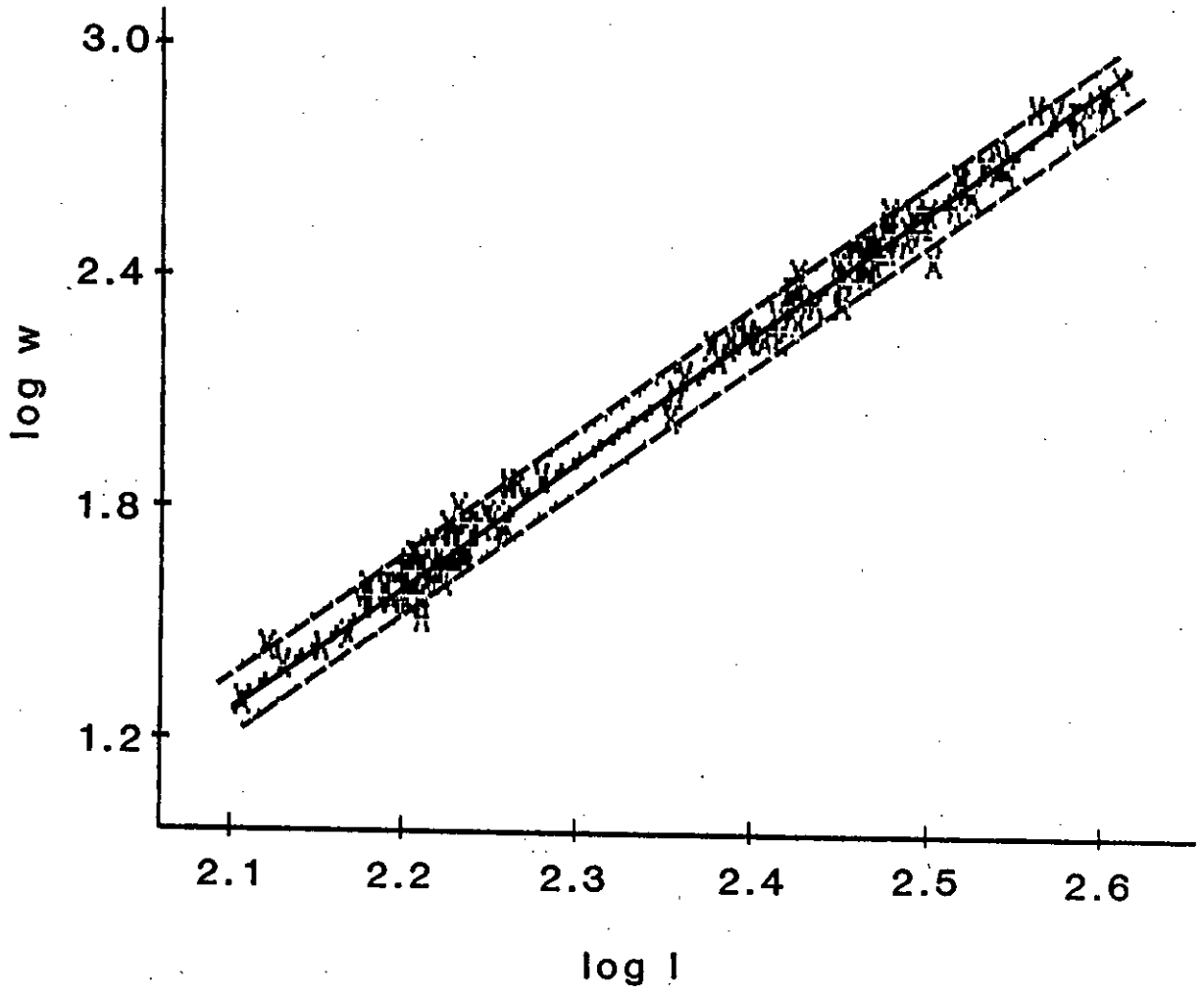


Fig. 6 Length weight relationship for salmon in the R. Itchen. 95% CL for new individuals are shown.

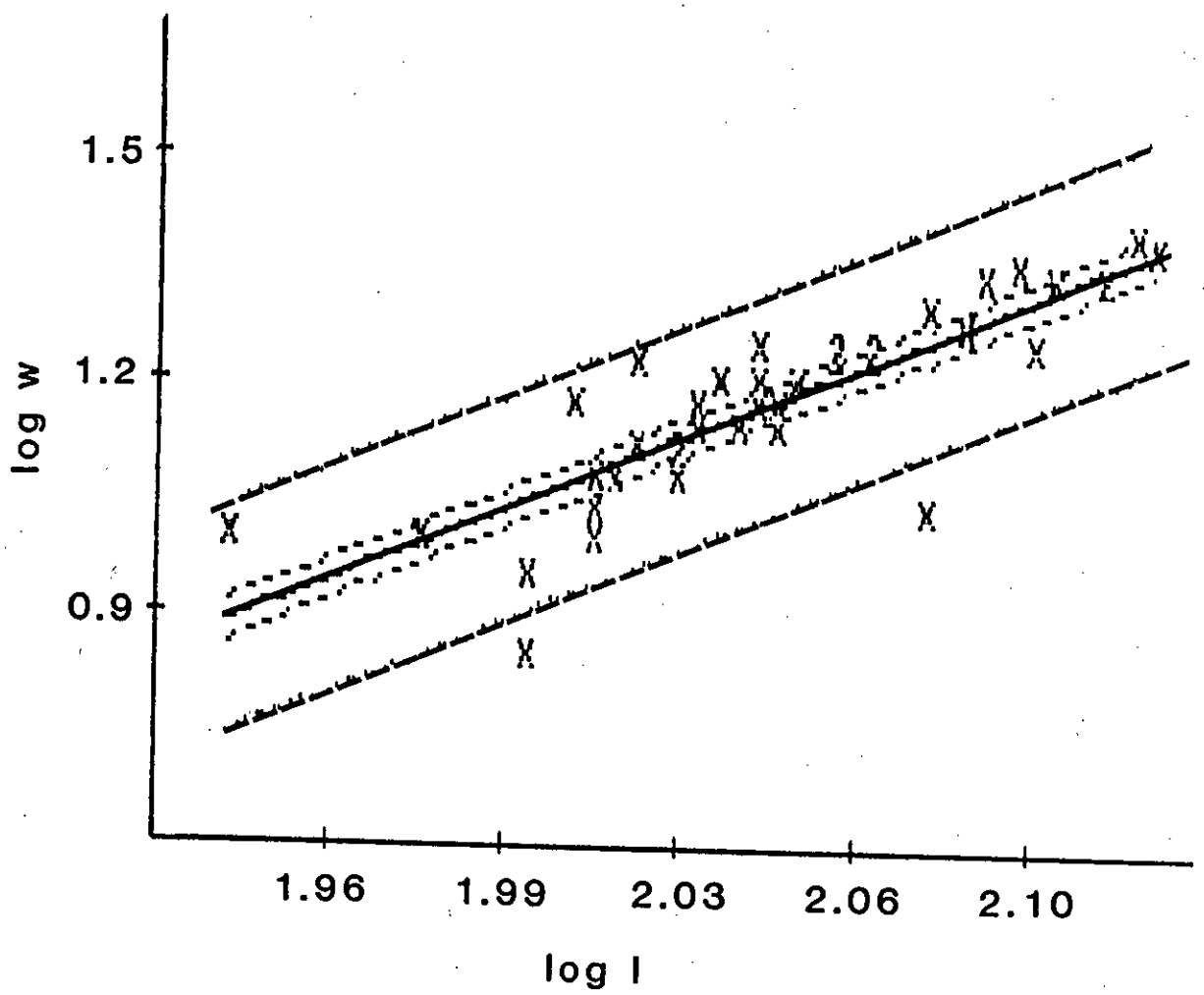


Fig. 7 Length age relationship for brown trout in the R. Itchen

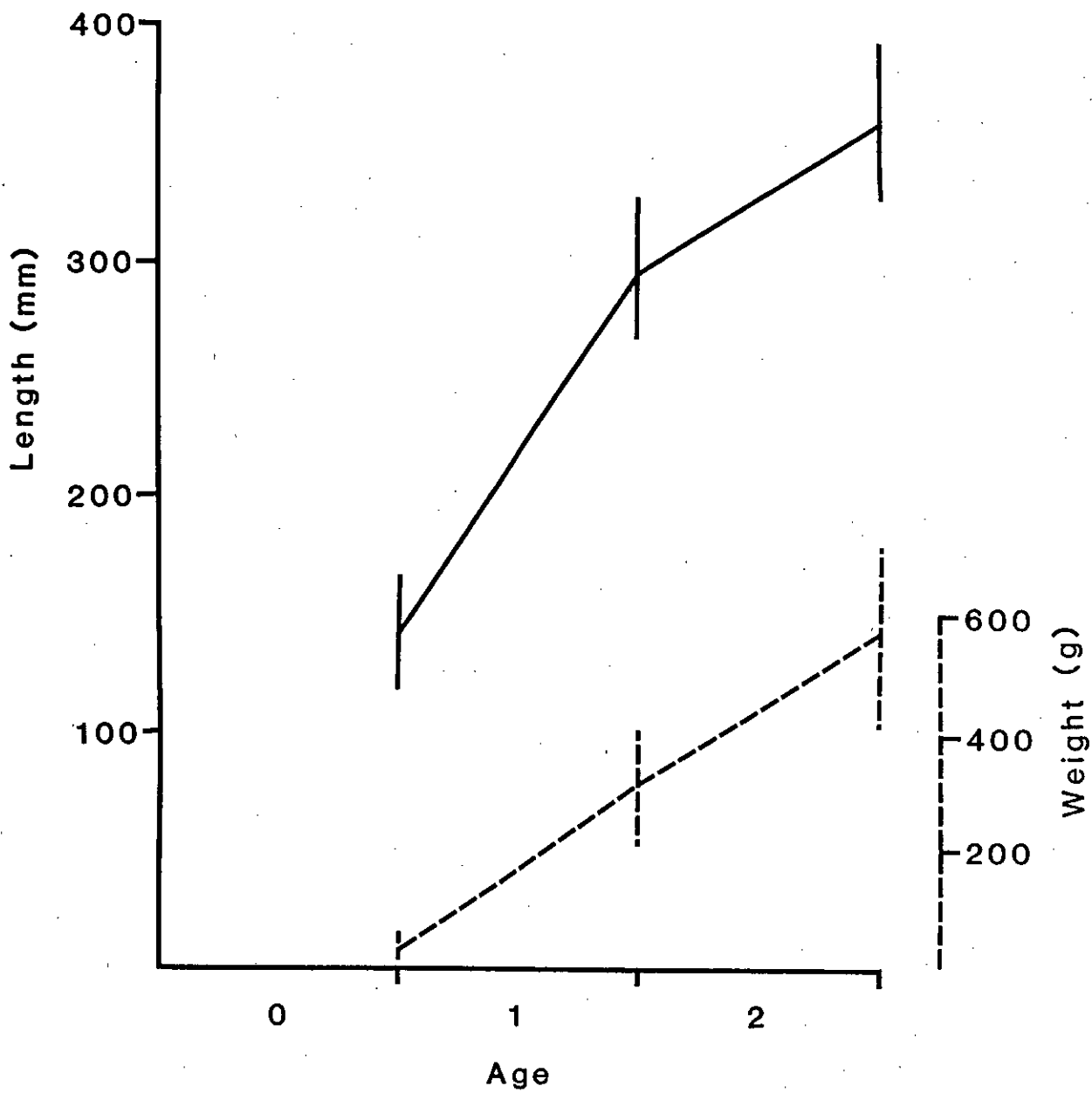


Fig. 8 Length frequency distribution for each age of brown trout in the R. Itchen

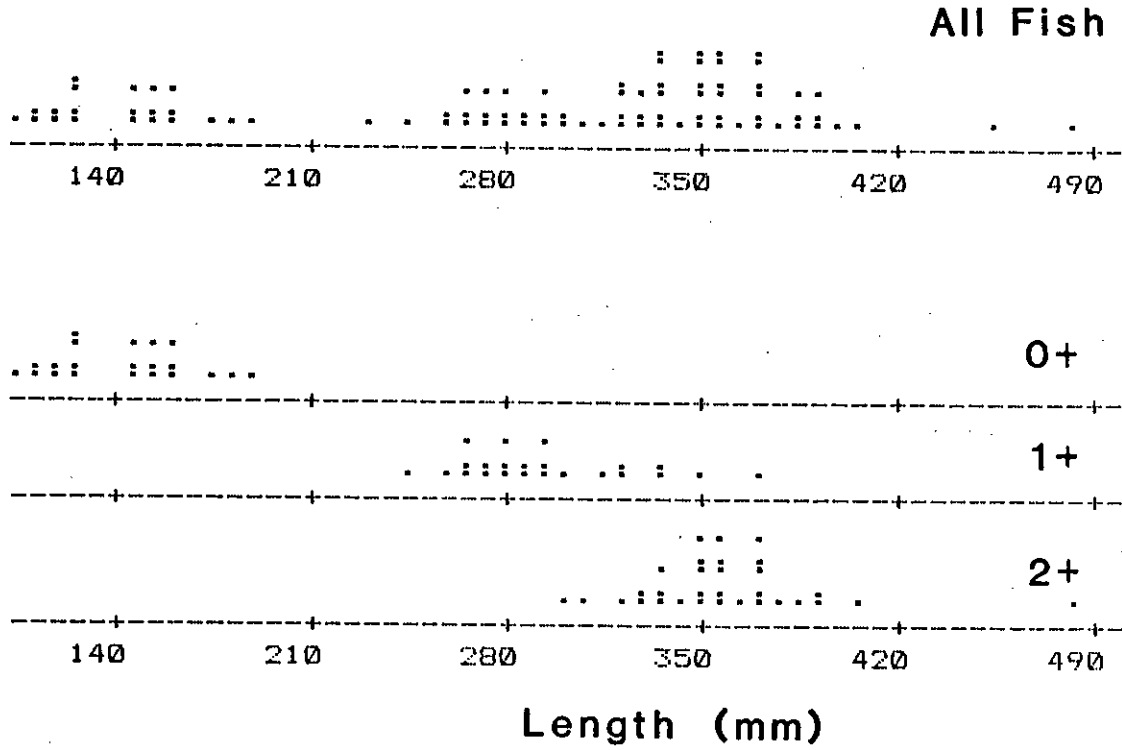


Fig. 9 Length age relationship for grayling in the R. Itchen

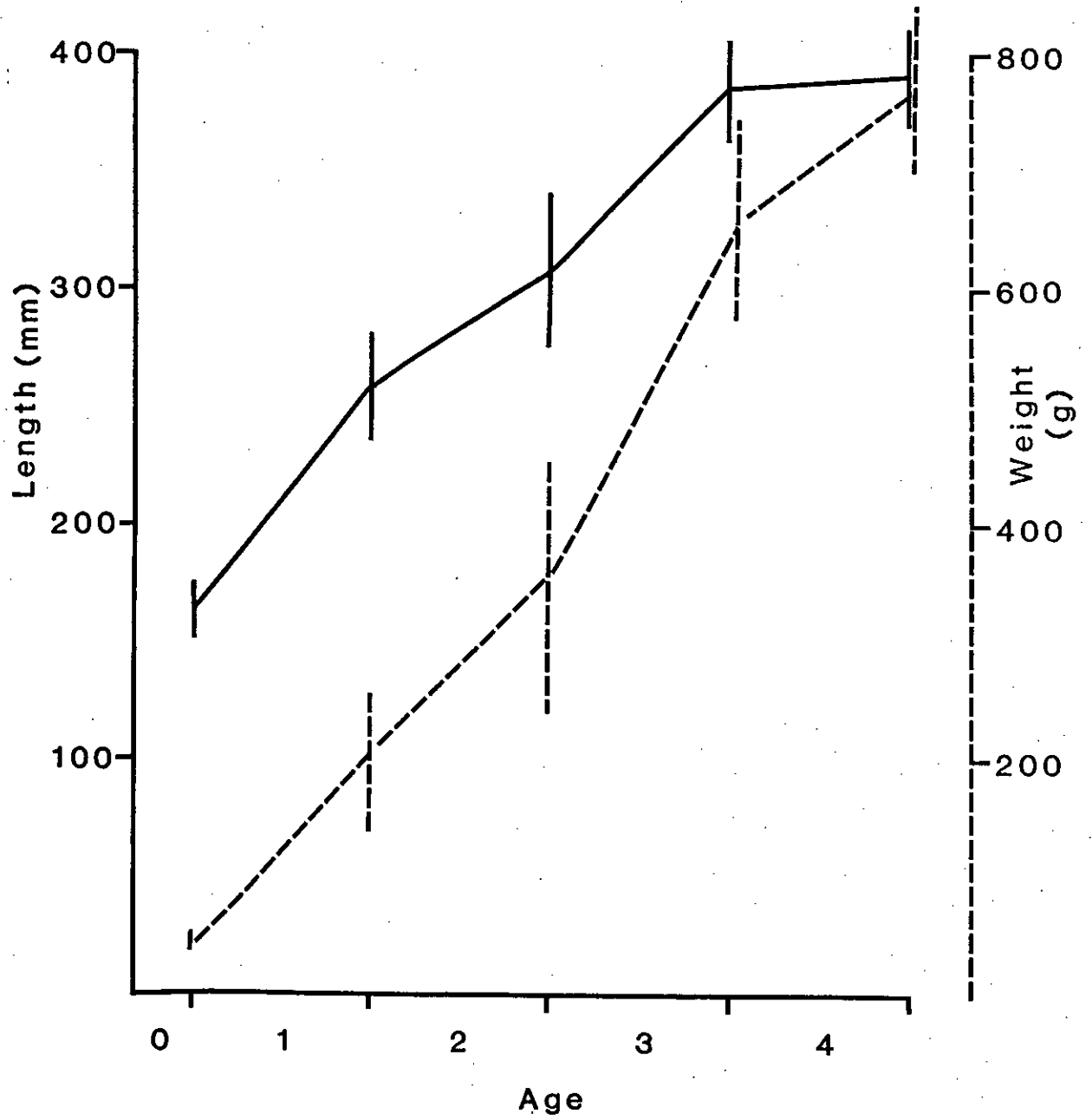


Fig. 10 Length frequency distribution for each age of grayling in the R. Itchen

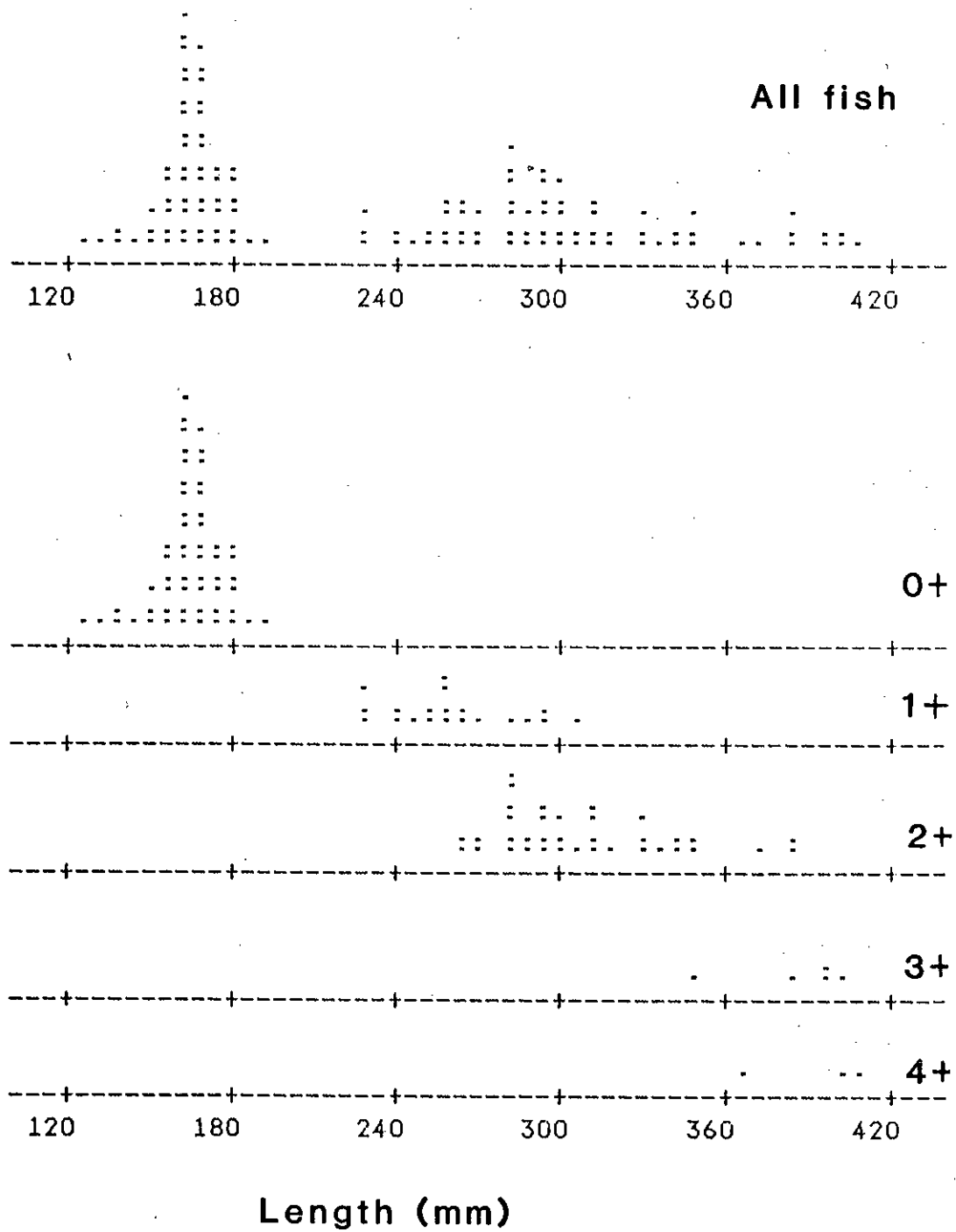


Fig. 11 Frequency distribution of condition factor for brown trout in the R. Itchen by site and by age. Arrows denote mean condition factor.

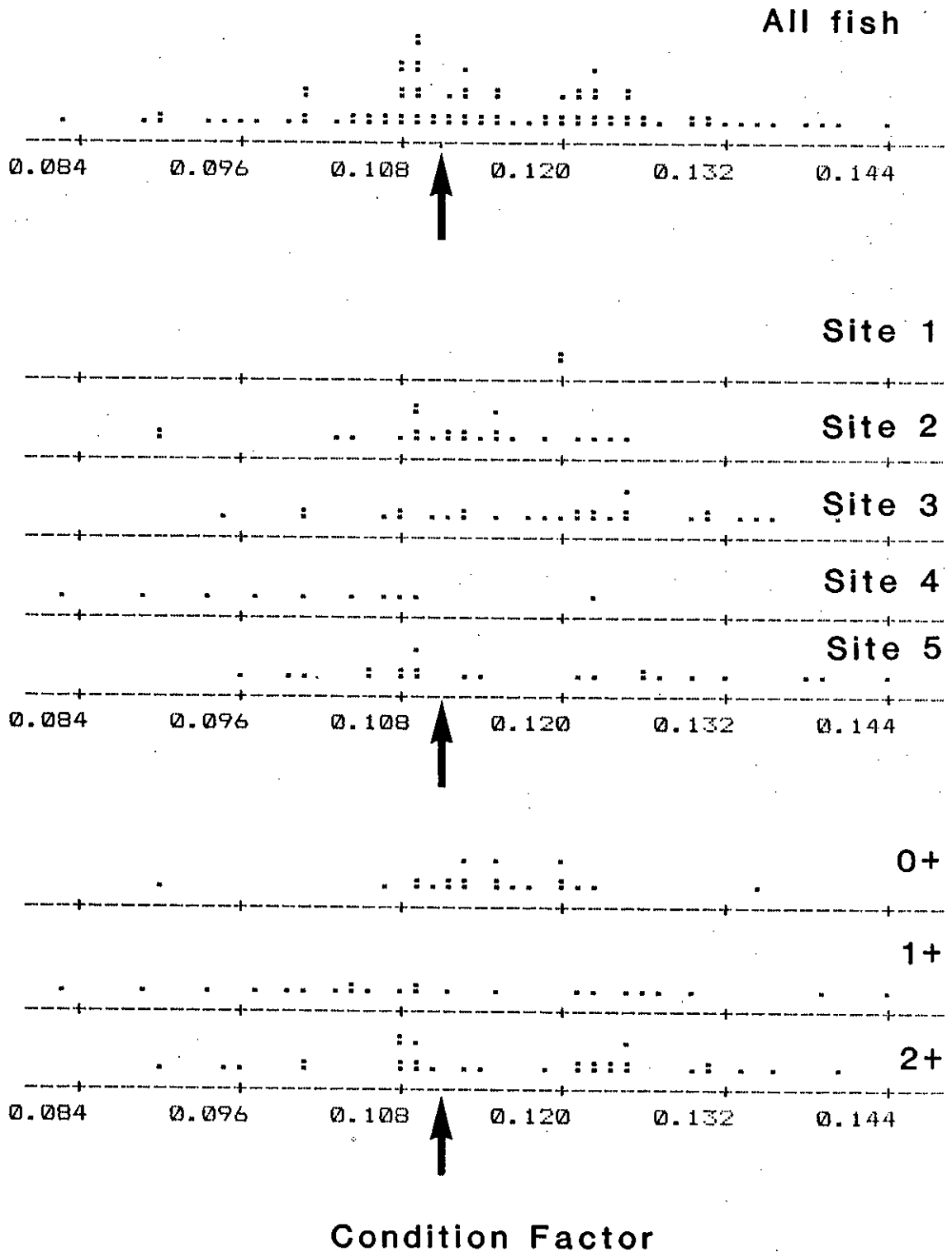


Fig. 12 Frequency distribution of condition factor for grayling in the R. Itchen by site and by age. Arrows denote mean condition factor.

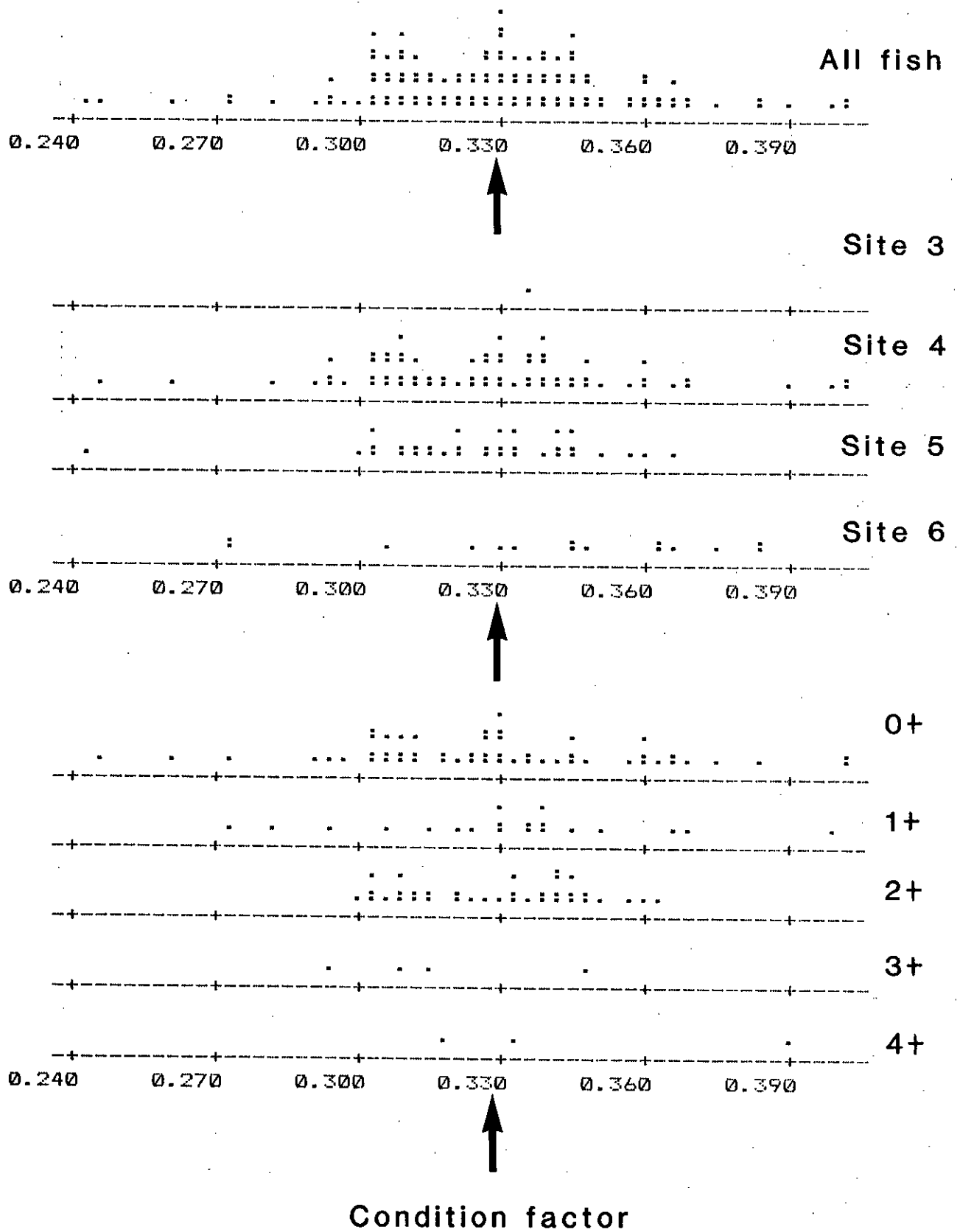


Table 1. Fish species caught during the survey of the R. Itchen and sites where each species was found are given.

Common name	Scientific name	Sites caught
Brown trout	<i>Salmo trutta</i> L.	1, 2, 3, 4, 5
Rainbow trout	<i>Oncorhynchus mykiss</i> (Walbaum)	2, 4
Salmon	<i>Salmo salar</i> L.	4, 5
Grayling	<i>Thymallus thymallus</i> (L)	3, 4, 5, 6
Eel	<i>Anguilla anguilla</i> (L)	2, 3, 4, 5, 6
Pike	<i>Esox lucius</i> L.	4, 5
Roach	<i>Rutilus rutilus</i> (L)	4
Tench	<i>Tinca tinca</i> (L)	6
Gudgeon	<i>Gobio gobio</i> (L)	5, 6
Minnow	<i>Phoxinus phoxinus</i> (L)	1, 3, 4, 5
Bullhead	<i>Cottus gobio</i> L.	1, 2, 3, 4, 5
Loach	<i>Noemacheilus barbatulus</i> (L)	1, 3, 4, 5
3-spined stickleback	<i>Gasterosteus aculeatus</i> L.	1, 2, 3, 4, 6
Brook lamprey	<i>Lampetra planeri</i> (Bloch)	1, 2, 3, 5, 6

Table 2. Densities and biomass of fish species at 6 sites on the R. Itchen

Site No. Name	1 Abbotstone	2 Vernal Farm	3 Easton
Trout			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$	4.85	49.48 ± 0.00	17.22 ± 2.37
$\underline{B} \text{ m}^{-2} \times 10^{-1}$	2.33	85.65 ± 0.00	72.07 ± 0.85
Rainbow trout			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$		2.06	
$\underline{B} \text{ m}^{-2} \times 10^{-1}$		2.00	
Salmon			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$			
$\underline{B} \text{ m}^{-2} \times 10^{-1}$			
Grayling			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$			0.56
$\underline{B} \text{ m}^{-2} \times 10^{-1}$			0.3
Eel			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$		4.12	51.67 ± 12.42
$\underline{B} \text{ m}^{-2} \times 10^{-1}$		12.02	88.54 ± 6.24
Pike			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$			
$\underline{B} \text{ m}^{-2} \times 10^{-1}$			
Roach			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$			
$\underline{B} \text{ m}^{-2} \times 10^{-1}$			
Tench			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$			
$\underline{B} \text{ m}^{-2} \times 10^{-1}$			
Gudgeon			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$			
$\underline{B} \text{ m}^{-2} \times 10^{-1}$			
Minnow			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$	21.84		0.56
$\underline{B} \text{ m}^{-2} \times 10^{-1}$	0.02		0.01
Bullhead			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$	128.64	158.76	45.00
$\underline{B} \text{ m}^{-2} \times 10^{-1}$	4.10	6.86	2.49
Loach			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$	2.43		2.22
$\underline{B} \text{ m}^{-2} \times 10^{-3}$	0.02		0.03
Stickleback			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$	67.96	6.18	1.11
$\underline{B} \text{ m}^{-2} \times 10^{-2}$	0.19	0.02	0.01
Lamprey			
$\underline{N} \text{ m}^{-2} \times 10^{-3}$	29.13	94.84	6.66
$\underline{B} \text{ m}^{-2} \times 10^{-1}$	0.82	3.60	0.41

Table 2 (Continued)

Site No. Name	4 Winchester College	5 Brambridge	6 Gaters Mill
Trout			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	7.18	5.42 ± 0.0	
$B \text{ m}^{-2} \times 10^{-1}$	30.33	26.25 ± 0.0	
Rainbow trout			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	0.72		
$B \text{ m}^{-2} \times 10^{-1}$	5.30		
Salmon			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	10.77	11.62 ± 0.0	
$B \text{ m}^{-2} \times 10^{-1}$	1.57	1.90 ± 0.0	
Grayling			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	106.32 ± 87.64	15.50 ± 7.10	6.66 ± 0.0
$B \text{ m}^{-2} \times 10^{-1}$	215.2 ± 177.4	38.44 ± 17.62	10.84 ± 0.0
Eel			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	10.06	192.20 ± 45.30	Present
$B \text{ m}^{-2} \times 10^{-1}$	12.56	257.20 ± 60.28	
Pike			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	3.59		
$B \text{ m}^{-2} \times 10^{-1}$	17.12		
Roach			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	0.72		
$B \text{ m}^{-2} \times 10^{-1}$	1.69		
Tench			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$			0.42
$B \text{ m}^{-2} \times 10^{-1}$			4.64
Gudgeon			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$			0.42
$B \text{ m}^{-2} \times 10^{-1}$			0.22
Minnow			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	0.72	3.10	
$B \text{ m}^{-2} \times 10^{-1}$	0.02	0.09	
Bullhead			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	0.72	4.6	
$B \text{ m}^{-2} \times 10^{-1}$	0.05	0.26	
Loach			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	2.87	0.77	
$B \text{ m}^{-2} \times 10^{-3}$	0.15	0.05	
Stickleback			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$	0.72		Present
$B \text{ m}^{-2} \times 10^{-2}$	0.01		
Lamprey			
$\bar{N} \text{ m}^{-2} \times 10^{-3}$		Present	Present
$B \text{ m}^{-2} \times 10^{-1}$			

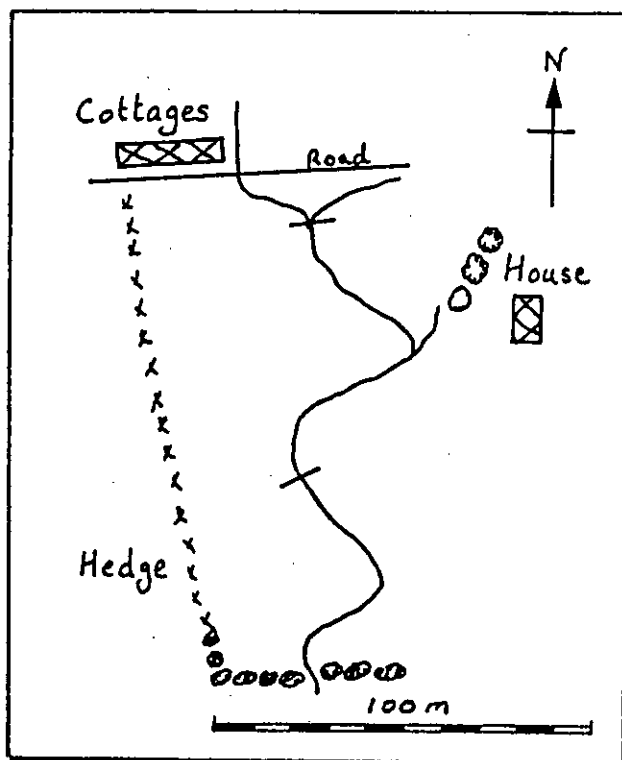
Table 3. Age length, Age weight relationships and instantaneous growth rate (G) for brown trout in the R. Itchen.

Age	Mean length mm	SD	Mean weight g	SD	G
0+	143	24	38.0	19.2	2.11
1+	295	32	312.2	104.7	0.61
2+	359	33	576.1	156.9	

Table 4. Age length, Age weight relationships and instantaneous growth rate (G) for grayling in the R. Itchen.

Age	Mean length mm	SD	Mean weight g	SD	G
0+	163	13	45.4	11.8	1.49
1+	260	24	202.9	60.3	0.56
2+	309	32	357.1	126.3	0.61
3+	385	21	657.0	84.9	0.15
4+	391	23	766.0	73.0	

Appendix 1. Site maps, physical characteristics of the sites and basic data on fish caught.



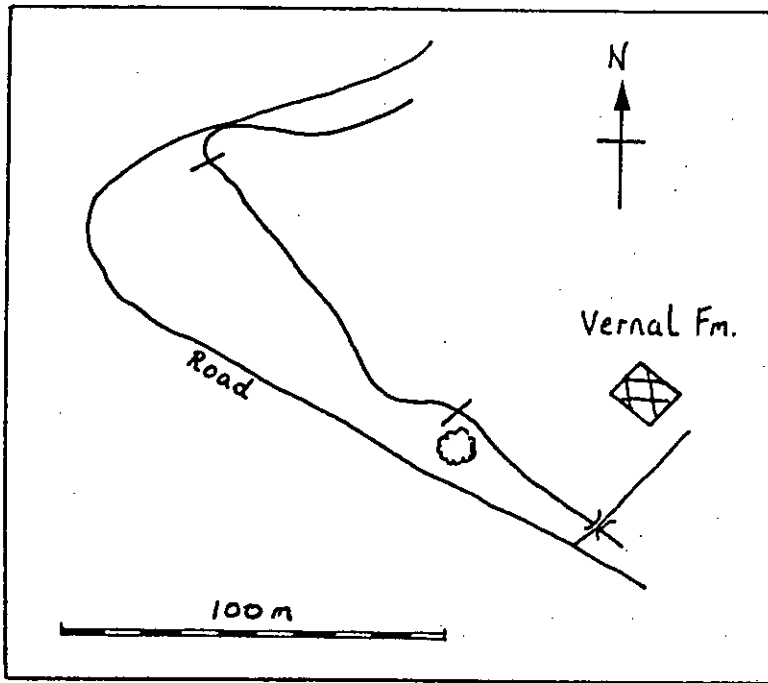
Site No. 1
 Name: Abbotstone
 NGR: SU 365 345
 Length: 103 m
 Mean width: 4 m
 Approximate depth range: 0.1-0.4 m
 Area: 412 m²
 Substratum: Silt/sand/cobbles
 Date sampled: 15.1.91

Species	Catch 1	Catch 2	Catch 3	N m ² (x10 ⁻³)	SE (x10 ⁻²)
Brown Trout	2	0	n/a	4.85	n/a
Minnow	0	9	"	21.84	"
Bullhead	26	27	"	128.64	"
Loach	0	1	"	2.43	"
Lamprey	3	9	"	29.13	"
Stickleback	28	0	"	67.96	"

Species	Total wt (g)	Ave wt (g)	B g m ² (10 ⁻¹)	SE (x10 ⁻¹)
Trout	96	48	2.33	

COMMENTS:

Recent weed cut - very little instream cover.

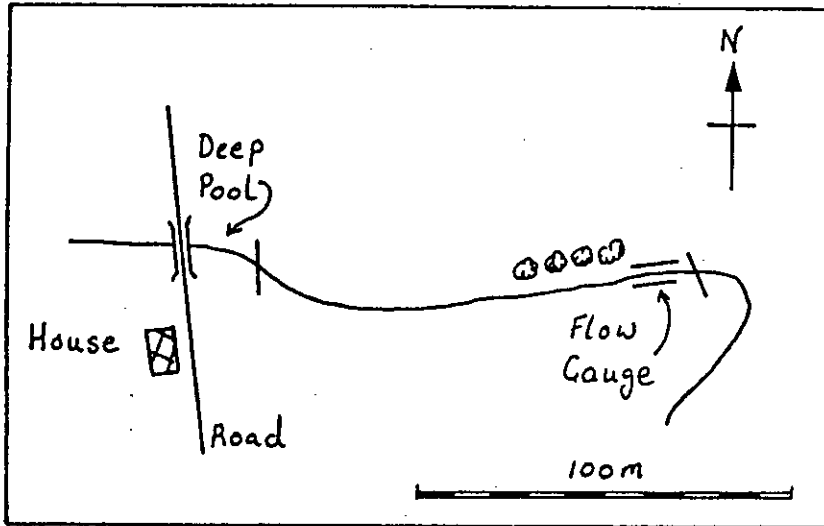


Site No. 2
 Name: Vernal Farm
 NGR: SU 572 312
 Length: 97 m
 Mean width: 5 m
 Approximate depth range: 0.1-0.5 m
 Area: 485 m²
 Date sampled: 15.1.91

Substratum: Sand/gravel/pebbles

Species	Catch 1	Catch 2	Catch 3	N m ² (x10 ⁻³)	SE (x10 ⁻²)
Brown trout	20	2	2	49.48	0.0
Rainbow trout	1	0	0	2.06	n/a
Eel	2	0	0	4.12	"
Bullhead	24	28	25	158.76	"
Lamprey	10	17	19	94.84	"
Stickleback	1	1	1	6.18	"

Species	Total wt (g)	Ave wt (g)	B g m ² (10 ⁻¹)	SE (x10 ⁻¹)
Brown trout	4.54	173.1	85.65	0.0
Rainbow trout	97	97	2.00	n/a



Site No. 3
 Name: Easton
 NGR: SU 510 324
 Length: 120 m
 Mean width: 15 m
 Approximate depth range: 1-1.6 m
 Area: 1800 m²
 Date sampled: 17.1.91

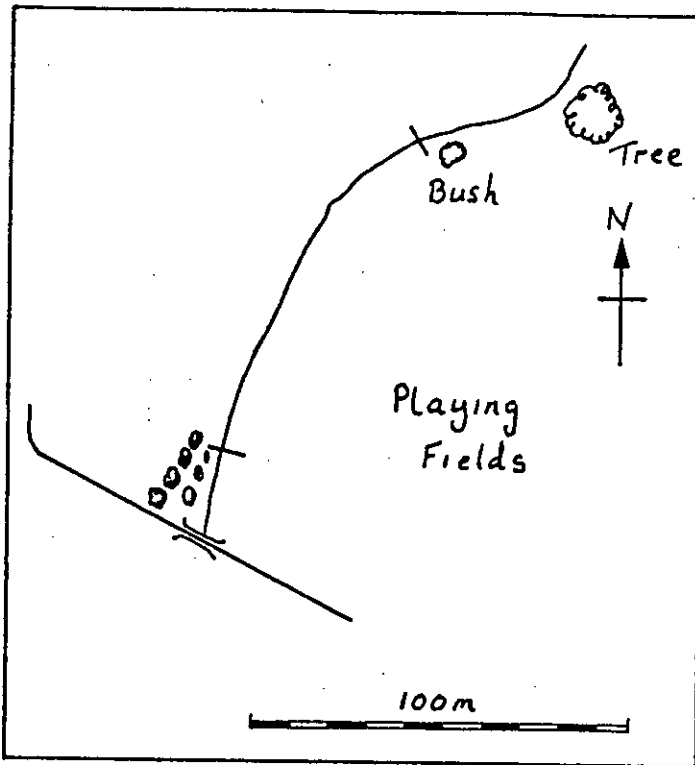
Substratum: Silt/sand. Some open gravel/pebble runs. Most of reach overlain with chalk silt.

Species	Catch 1	Catch 2	Catch 3	N m ² (x10 ⁻³)	SE (x10 ⁻²)
Brown trout	17	9	3	17.22	2.37
Grayling	0	0	1	0.56	n/a
Eel	44	9	21	51.67	12.42
Minnow	0	0	1	0.56	n/a
Bullhead	12	28	36	45.00	"
Loach	1	0	3	2.22	"
Lamprey	2	5	5	6.66	"
Stickleback	0	2	0	1.11	"

Species	Total wt (g)	Ave wt (g)	B g m ² (10 ⁻¹)	SE (x10 ⁻¹)
Brown trout	12295	423.97	72.07	0.85
Grayling	54	54	0.3	-

COMMENTS:

Bank reinstatement upstream causing extensive discoloration of river. Fishings delayed until river clear.



Site No. 4
 Name: Winchester College
 NGR: SU 481 283
 Length: 116 m
 Mean width: 12 m
 Approximate depth range: 1-1.75 m
 Area: 1392 m²
 Date sampled: 16.1.91

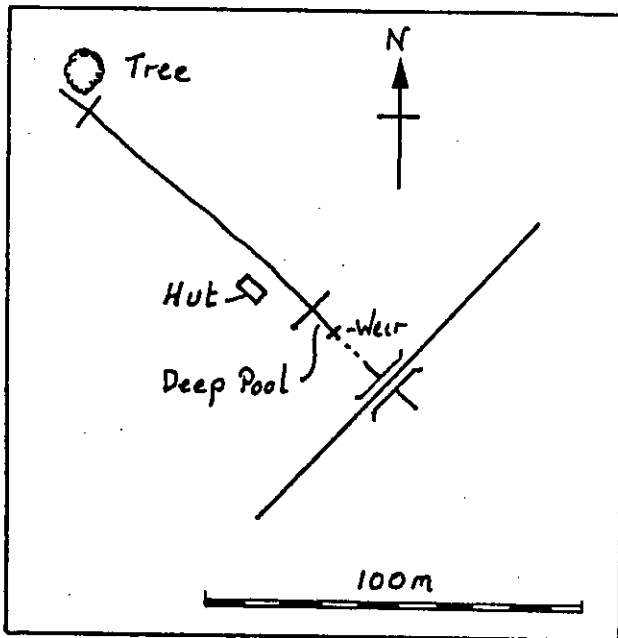
Substratum: Detritus/silt overlying gravel
 - some clean gravel near bank.

Species	Catch 1	Catch 2	Catch 3	N m ² (x10 ⁻³)	SE (x10 ⁻²)
Brown trout	2	6	2	7.18	n/a
Rainbow trout	1	0	0	0.72	"
Salmon	4	6	5	10.77	"
Grayling	28	25	19	106.32	87.64
Eel	2	4	8	10.06	n/a
Pike	1	4	0	3.59	"
Roach	1	0	0	0.72	"
Minnow	0	1	0	0.72	"
Bullhead	0	0	1	0.72	"
Loach	0	1	3	2.87	"
Stickleback	0	0	1	0.72	"

Species	Total wt (g)	Ave wt (g)	B g m ² (10 ⁻¹)	SE (x10 ⁻¹)
Brown trout	4222	422.2	30.33	
Rainbow trout	738	738	5.30	
Salmon	219	14.6	1.57	
Grayling	14661	203.2	215.2	177.4

COMMENTS:

Two trout obviously stocked fish. Rainbow trout a spent female.
 Water slightly discoloured from bank maintenance at Easton.



Site No. 5
 Name: Brambridge
 NGR: SU 468 213
 Length: 69 m
 Mean width: 18.7 m
 Approximate depth range: 0.5-1.5 m
 Area: 1290 m²
 Date sampled: 19.12.90

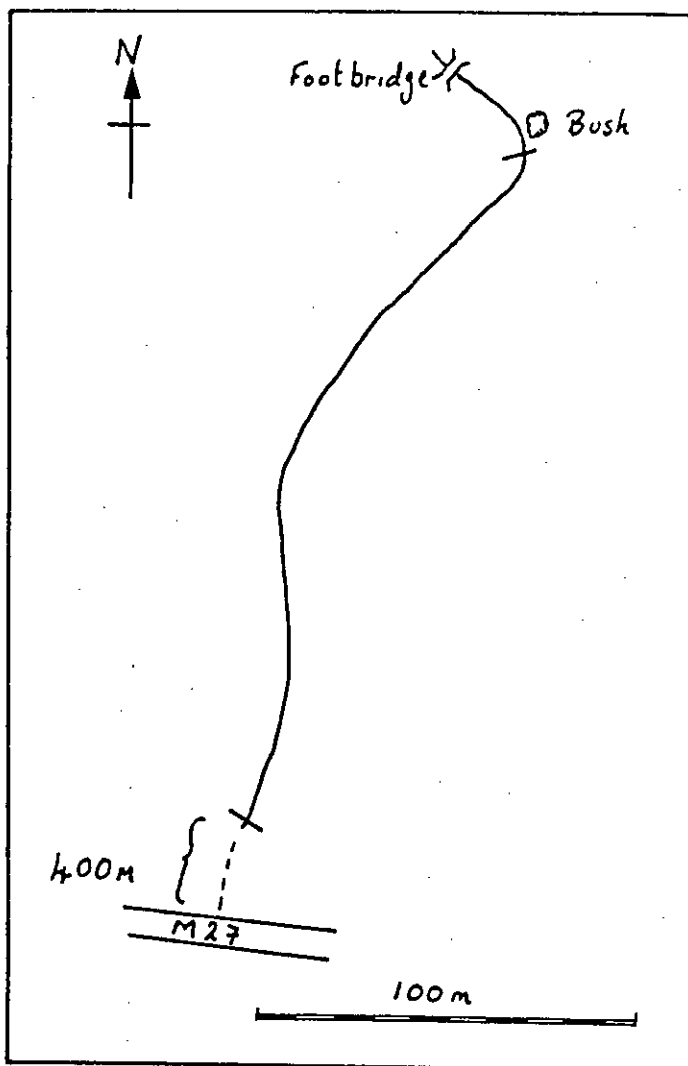
Substratum: Soft silt with overlying crust.
 Gravel runs through sediment.

Species	Catch 1	Catch 2	Catch 3	N m ² (x10 ⁻³)	SE (x10 ⁻²)
Brown trout	6	1	5	5.4	0.0
Salmon	13	2	3	11.62	2 catch estimate
Grayling	10	6	11	15.50	7.10
Eel	118	63	41	192.20	45.30
Minnow	4	0	0	3.10	n/a
Bullhead	4	1	1	4.6	"
Loach	1			0.77	"
Lamprey	-	Present	-	Present	

Species	Total wt (g)	Ave wt (g)	B g m ² (10 ⁻¹)	SE (x10 ⁻¹)
Brown trout	3386	282.2	26.25	0.0
Salmon	294	16.3	1.90	2 catch only
Grayling	8459	248	38.44	17.62
				2 catch only

COMMENTS:

Pool below reach fished and additional trout, grayling, adult salmon, pike and gudgeon caught.
 Stop nets difficult to set due to deep narrow runs through deep sediment.
 Fishery keeper fed stock fish upstream after second fishing. Shortly after trout and grayling seen actively feeding in reach; top stop net checked and found to be inadequate. Enhanced third catch almost certainly due to immigration from upstream.



Site No. 6
 Name: Gaters Mill
 NGR: SU 454 157
 Length: 200 m
 Mean width: 12 m
 Approximate depth range: 1.5-2.5 m
 Area: 2400 m²
 Substratum: fine sediment
 Date sampled: 29.1.91

Species	Catch 1	Catch 2	Catch 3	N m ² (x10 ⁻³)	SE (x10 ⁻²)
Grayling	12	3	1	6.66	0.0
Tench	1	0	0	0.42	n/a
Gudgeon	1	0	0	0.04	n/a
Eel		Present			
Lamprey		Present			
Stickleback		Present			

Species	Total wt (g)	Ave wt (g)	B g m ² (10 ⁻¹)	SE (x10 ⁻¹)
Grayling	2604	163	10.84	0.0

COMMENTS:

Bottom of survey reach to motorway fished after last survey fishing (c. 400 m). A total of 20 grayling and 2 unidentified fish seen.

Water slightly coloured but bottom of river visible for most of reach.

Appendix 2. Raw data of fish caught

Brown trout

	site	length	weight	condit.	age
1	1	154	46	0.120	0
2	1	158	50	0.121	0
3	2	107	14	0.109	0
4	2	112	17	0.115	0
5	2	119	16	0.091	0
6	2	118	20	0.116	0
7	2	125	23	0.112	0
8	2	161	53	0.121	0
9	2	157	45	0.111	0
10	2	149	38	0.109	0
11	2	159	47	0.111	0
12	2	157	46	0.113	0
13	2	180	75	0.122	0
14	2	187	79	0.115	0
15	2	264	204	0.105	1
16	2	258	207	0.114	*
17	2	270	227	0.109	1
18	2	269	225	0.109	1
19	2	287	258	0.103	1
20	2	277	259	0.115	1
21	2	265	246	0.125	1
22	2	288	283	0.112	1
23	2	337	367	0.090	2
24	2	336	477	0.119	*
25	2	320	428	0.123	2
26	2	352	500	0.108	2
27	3	111	16	0.112	0
28	3	124	24	0.120	0
29	3	125	24	0.117	0
30	3	125	23	0.112	0
31	3	145	37	0.115	0
32	3	146	44	0.135	0
33	3	175	60	0.106	0
34	3	247	161	0.101	1
35	3	301	378	0.131	2
36	3	327	455	0.123	2
37	3	327	480	0.130	2
38	3	334	555	0.141	2
39	3	338	460	0.112	2
40	3	343	536	0.125	2
41	3	347	551	0.124	2
42	3	350	562	0.124	2
43	3	352	440	0.095	2
44	3	354	522	0.111	2
45	3	354	640	0.136	2
46	3	357	485	0.101	2
47	3	357	582	0.121	2
48	3	360	615	0.124	2
49	3	365	630	0.122	2
50	3	368	627	0.119	2
51	3	368	640	0.121	2
52	3	368	689	0.130	2
53	3	374	599	0.108	2
54	3	375	605	0.108	2
55	3	392	855	0.134	2
56	4	282	222	0.094	1
57	4	293	278	0.104	1
58	4	294	240	0.089	1
59	4	321	292	0.083	1
60	4	322	343	0.097	1
61	4	335	432	0.108	1
62	4	355	579	0.122	*

Brown trout

	site	length	weight	condit.	age
63	4	372	594	0.109	2
64	4	383	634	0.106	*
65	4	385	608	0.100	2
66	5	233	145	0.109	*
67	5	257	227	0.127	1
68	5	272	257	0.121	1
69	5	272	280	0.132	*
70	5	279	299	0.130	1
71	5	294	373	0.139	1
72	5	304	427	0.144	1
73	5	311	362	0.114	2
74	5	312	411	0.128	1
75	5	325	500	0.137	*
76	5	326	386	0.105	*
77	5	339	507	0.123	1
78	5	347	482	0.109	2
79	5	350	481	0.106	1
80	5	369	529	0.099	1
81	5	385	681	0.112	*
82	5	391	683	0.108	2
83	5	392	644	0.101	*
84	5	402	872	0.126	*
85	5	403	761	0.110	2
86	5	453	1077	0.109	*
87	5	485	1167	0.096	2

Grayling

	site	length	weight	condit.	age
1	3	173	54	0.336	0
2	4	128	19	0.312	0
3	4	132	27	0.401	0
4	4	147	29	0.305	0
5	4	150	34	0.335	0
6	4	151	38	0.366	0
7	4	154	38	0.344	0
8	4	156	36	0.312	0
9	4	156	38	0.330	0
10	4	157	38	0.323	0
11	4	158	37	0.308	0
12	4	158	43	0.358	0
13	4	159	40	0.326	0
14	4	159	42	0.343	0
15	4	160	38	0.304	0
16	4	160	38	0.304	0
17	4	160	40	0.320	0
18	4	160	45	0.360	0
19	4	160	45	0.360	0
20	4	162	32	0.246	0
21	4	162	34	0.261	0
22	4	162	42	0.323	0
23	4	162	44	0.338	0
24	4	163	41	0.309	0
25	4	163	48	0.361	0
26	4	164	40	0.295	0
27	4	164	50	0.369	0
28	4	165	42	0.304	0
29	4	165	43	0.311	0
30	4	166	*	*	0
31	4	166	42	0.298	0
32	4	166	46	0.327	0
33	4	169	46	0.308	0
34	4	169	49	0.328	0
35	4	170	61	0.401	0
36	4	171	47	0.303	0
37	4	172	46	0.291	0
38	4	172	50	0.317	0
39	4	176	56	0.329	0
40	4	178	58	0.329	0
41	4	180	56	0.306	0
42	4	181	57	0.306	0
43	4	225	106	0.283	1
44	4	227	127	0.329	1
45	4	230	137	0.340	1
46	4	244	171	0.351	1
47	4	250	182	0.346	1
48	4	255	176	0.314	1
49	4	259	199	0.337	1
50	4	260	176	0.295	1
51	4	260	197	0.330	1
52	4	264	232	0.370	1
53	4	265	215	0.339	1
54	4	267	260	0.400	1
55	4	288	278	0.335	1
56	4	296	308	0.340	1
57	4	313	354	0.326	2
58	4	331	454	0.349	2
59	4	342	484	0.335	2
60	4	342	501	0.347	2
61	4	349	536	0.348	3
62	4	349	528	0.343	2
63	4	350	503	0.323	2
64	4	365	694	0.390	4

Grayling

	site	length	weight	condit.	age
65	4	374	652	0.339	2
66	4	385	656	0.310	2
67	4	386	652	0.306	2
68	4	386	661	0.310	3
69	4	395	723	0.315	3
70	4	396	*	*	3
71	4	400	764	0.319	4
72	4	401	708	0.294	3
73	4	407	840	0.332	4
74	5	135	24	0.332	0
75	5	142	27	0.317	0
76	5	169	49	0.328	0
77	5	170	50	0.329	0
78	5	238	165	0.367	1
79	5	240	152	0.329	1
80	5	250	169	0.321	1
81	5	263	212	0.342	2
82	5	266	229	0.356	2
83	5	267	197	0.303	2
84	5	272	217	0.314	2
85	5	280	262	0.346	2
86	5	282	250	0.322	2
87	5	283	244	0.311	2
88	5	283	244	0.311	2
89	5	284	275	0.346	2
90	5	284	275	0.346	2
91	5	288	284	0.342	2
92	5	290	283	0.333	2
93	5	291	261	0.304	2
94	5	293	317	0.361	2
95	5	294	293	0.330	2
96	5	295	269	0.300	2
97	5	297	293	0.320	2
98	5	299	307	0.328	*
99	5	299	319	0.341	2
100	5	301	337	0.352	2
101	5	307	315	0.309	2
102	5	311	360	0.339	2
103	5	314	345	0.315	2
104	5	314	364	0.332	2
105	5	318	277	0.242	*
106	5	327	385	0.308	2
107	5	335	409	0.303	2
108	6	140	*	*	0
109	6	167	39	0.272	0
110	6	168	55	0.376	0
111	6	170	50	0.329	0
112	6	172	55	0.348	0
113	6	177	60	0.346	0
114	6	182	69	0.364	0
115	6	182	73	0.385	0
116	6	184	72	0.367	0
117	6	190	75	0.345	0
118	6	282	211	0.272	1
119	6	291	263	0.306	1
120	6	300	365	0.385	*
121	6	308	333	0.323	1
122	6	316	372	0.332	2
123	6	329	461	0.362	2

Salmon

	site	length	weight	condit.	age
1	4	112	14	0.520	0
2	4	111	15	0.570	0
3	4	130	22	0.550	0
4	4	108	14	0.572	0
5	4	123	22	0.637	0
6	4	120	11	0.340	0
7	4	126	18	0.489	0
8	4	107	12	0.503	0
9	4	133	24	0.565	0
10	4	95	10	0.574	0
11	4	100	9	0.451	0
12	4	103	10	0.463	0
13	4	117	18	0.595	0
14	4	100	7	0.351	0
15	4	107	13	0.545	0
16	5	113	16	0.580	0
17	5	108	15	0.613	0
18	5	127	22	0.585	0
19	5	117	18	0.595	0
20	5	107	13	0.545	0
21	5	110	14	0.545	0
22	5	87	10	0.725	0
23	5	112	15	0.557	0
24	5	103	12	0.556	0
25	5	105	13	0.573	0
26	5	111	16	0.608	0
27	5	115	18	0.623	0
28	5	104	12	0.542	0
29	5	125	23	0.638	0
30	5	111	18	0.684	0
31	5	109	16	0.638	0
32	5	132	25	0.600	0
33	5	122	19	0.562	0
34	5	102	15	0.713	0
35	5	115	18	0.623	0
36	5	120	20	0.618	0
37	5	105	17	0.749	0
38	5	103	11	0.510	0