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UWIST Paper 2

Fisheries Studies – R. Wye

Introduction

Although the Wye is well known for its salmon fisheries, no data, other than very basic fisheries statistics (Wye River Division Annual Reports) are available to assess the status of these fisheries. The current programme, primarily restricted to the upper reaches of the river where the effects of regulation are likely to be greatest, is intended to describe the distribution of salmonid and coarse fish and to assess the stock of salmonid species.

In a large river like the Wye where conventional sampling techniques are generally inadequate (E.I.F.A.C. 1974) only certain species and life-stages are likely to be sampled adequately. In order to supplement data collected from the main river a number of representative tributaries, above and below the proposed point of regulation of the river have been studied, primarily to obtain base-line data so that any major change in the distribution of salmon can be detected.

In order to establish some relationship between spawning adult salmon and recruitment, a programme of adult trapping on a nursery tributary was undertaken during November and December 1975.

In conjunction with W.N.W.D.A. (Brecon) and the Wye River Division, a programme has been designed to assess the catchability of adult salmon in the River Wye.

Methods

Quantitative sampling, generally 4 times a year, was carried out at up to 25 sites in several tributaries and on the main river (Fig 1) using electrofishing apparatus based on the design of Moore (1968). The location and areas of the stations and dates of sampling are given in Table 1. Stations 50 m long were sampled in Run 1, 3 and 4 and stations 100m long in Run 2. Each station was enclosed by stop-nets and fished 3-4 times. After each electrofishing, fish were anaesthetized in MS222 and fork-lengths measured. All fish over 8 cm were panjetted with Alcian Blue dye, the position of these batch-marks indicating the date of capture. Scales were taken from selected trout and salmon. Except for anumber of bullheads, retained for otolith analysis, all fish were returned to the water.

The catch-depletion data were analysed by the method of Zippin (1956). Where possible, abundance estimates were made for each size/age group of each species. Mean lengths are related statistics were computed using conventional methods; polymodal frequency distributions were treated by the method of Cassie (1954). Dead fish were weighed and measured and length-weight regressions calculated.

Samples of fish were obtained on the main river at Ty Mawr and Ddol Farm using 3.6 Kva A.C. electrofishing apparatus from a drifting boat (Fig. 1.) The fish obtained were treated in the same way as at the quantitative sampling stations.

Due to equipment failure A.C. electrofishing was not possible for most of 1975, and the proposed sampling programme on the main river Wye could not be undertaken.

Adult salmon ascending the Dhonw were caught using a two-way trap similar to that of Shetter (1938). In practice most fish were caught by electrofishing immediately below the trap. These fish were weighed, measured, tagged with Floy anchor tags and a note made of their sex and condition before being returned to the river upstream of the trap.

Measurement of the physical characteristics of the sampling sites was made following the procedure of Herrington and Dunham (1967).

Annual catch returns for the past 10 years for all the Wye fisheries are currently being analysed with a view to choosing representative fisheries for more detailed fish catch analysis. Catch and effort statistics will be collected and catchability estimated by the method of Leslie and Davies (1939).

Results

Distribution

Most species were widely distributed throughout the Upper Wye system. Trout were found at all stations; salmon were recorded at all stations except Duhonw 4, 5, 6, Bidno 4, 5 and Chwefru 6 (Table 2). Waterfalls on the Duhonw apparently prevent utilization of this river above Llanddewi'r Cwm. Bullheads were not recorded from stations on the Wye, Bidno, Elan and Irfon. The other species listed in Table 2 were generally found in low numbers.

Salmon *(Salmo salar* L.)

a. Population structure

Figs 2, 3 and 4 show length-frequency distributions for salmon in samples from the Wye, Bidno and Duhnw but are not necessarily representative of the numerical strength of different year-classes within the river. It is apparent that 0+ parr were not sampled efficiently until about July. Prior to this time of year the length-frequency distributions were tri-modal in the Bidno (1974, 1973 and 1972 year-classes, Fig. 3) and bimodal in all other stations (1974 and 1973 year-classes Figs 2 and 4). Little growth occurred between March and May. By July both the 1974 and 1973 year classes (and 1972 in the Bidno) decreased in abundance and all populations were dominated by the 1975 year-class. By October this trend had continued such that the populations consisted almost entirely of two year-classes, the 1975 and 1974 groups, as shown in Figs 2d, 3d and 4d.

Table 3 gives the proportion of each age group of parr in a selection of populations studied. In July-August the dominant group were 0+, 2+ parr representing less that 10% of the population. Generally, the figures given in Table 3 are similar to those of Mills (1971) for several tributaries of the Tweed.

b. Abundance and Density

Examples of Zippin estimates, computed for all sites, are illustrated in Table 4. The standard error of the estimate is lowest when the probability of capture is highest. This is generally the case for larger fish. It is important to note that low estimates of probability of capture occur when the assumptions of the Zippin model are not met. Uder these circumstances estimates of standard-error, and hence abundance, are of doubtful validity.

Using the areas of each sampling station given in Table 1 densities were calculated. A selection of these are given in Table 5 for July-August 1975. The highest densities of salmon parr (>11.1/m^2) were found in the lower Bidno, Duhonw, Edw and Chwefru, intermediate densities (0.6 – 1/m^2) in stations Wye 2 and Marteg 2. These densities are similar to those of the Tweed, 0.02 – 1.35/m^2 (Mills, 1971), for the same time of year, but much higher than in Cove Brook, 0.39 – 0.66 m^2 (Meister, 1962).

Recruitment, mortality and migration affect densities within any station throughout the year. In particular, differences in the time of sampling and the growth rate of the parr make comparisons between stations at any time of year of restricted validity and an understanding of the significance of the population throughout the year. A selection of the density estimates for separate year-classes during 1975 are given in Table 6. Some fluctuations in density are evident and these can be attributed to sampling error. However, the average densities for the Bidno, Duhonw and the Wye show a general fall in abundance of each year-class throughout the year. For 0+ and 1+ parr this decrease in abundance is probably a result of mortality. The average 2+ parr loss from the Duhonw and Bidno is 0.062 and 0.024 fish per m^2 respectively. These figures can be taken as the maximum smolt production for these tributaries during 1975.

Table 6 shows that the majority of the older parr or smolts disappeared from the stations between February and June, though there was a continuous loss of these fishes throughout the year. From the Bidno data and the length-frequency distributions in general (Figs 2, 3 & 4) it appears that the larger (and older in the case of the Bidno) parr left earlier.

Twenty-seven adult salmon were caught before the trap on the Duhonw collapsed in a heavy flood. No estimate of the run of spawning adults was possible. The catch (Table 7) was characterised by the high proportion of grilse (63%), and the biased ♂ : ♀ ratio (2 : 1). The largest fish caught was a 5.4 kg hen kelt.

c. <u>The Growth of Salmon Parr</u>

Table 8 shows the mean lengths of the 1975 year-class parr in the Wye, Bidno and Duhonw. These are all very similar, though lengths were small for Run 3 in Wye 1 (28/7/75) and Bidno 2 (14/7/75). The latter increased considerably by Run 4 (28/10.75) to be comparable with the lengths for other stations. The mean length of Bidno 3 Run 4 (29/10/75) parr were larger than for all other stations. Composite year-class growth curves for salmon are probably not indicative of true growth due to the continuous loss of faster growing two year old parr as smolts. The length-frequency distributions indicate that the growth of parr in all waters was fairly similar where parr appear to have smolted at 2+ fish, apart from in the Bidno

where 12% of 'smolts' were 3+; the later time of smolting was due to the lower growth rate of these fish.

Trout *(Salmo trutta* L.)

a. Population structure and mortality

The Duhonw and Bidno were the only tributaries providing sample sizes large enough to allow analysis of age class structure. The densities of each year class at each sampling time and station are given in Tables 9 and 10. In the Bidno for runs 1 and 2 the samples were too small to permit calculation of Zippin estimates or densities.

In both streams there were generally four-year classes after 0+ fish had been recruited to the poulation. 4+ fish were recorded from the Duhonw in run 2 but few fish older than this are found in the tributaries. It is clear that 0+ fish were not sampled efficiently until run 3.

The classical picture of age distribution shows a continuing decline in numbers with age corresponding to natural mortality. This is seen for stations 2 and 3 on runs 3 and 4 respecitvely in the Duhonw (Table 9) and stations 1 and 3 on runs 3 and 4 in the Bidno (Table 10). Deviations from this pattern occur and of particular interest is the predominance of the 1973 year class (2+ fish) in the Duhonw.

Using the densities expressed as no's/1000m^2 for each year class from selected stations at runs 3 and 4, regressions of log no's/1000m^2 against age were calculated for each station and, combining data from the stations, for each stream. The parameters of the regressions are given in Table 11. The slopes of these lines are estimates of –Z, the natural mortality rate: although, because other factors such as emigration and immigration may contribute to the change in numbers, "loss rate" is perhaps a more realistic term.

b. Abundance and densities

Most stations produced sufficient numbers of 0+ fish to allow Zippin population estimates to be made, but for most ages other year classes could not be adequately distinguished due to the small numbers caught. Table 12 summarizes 0+ and total fish densities for all stations on run 3. Lowest total fish densities were recorded from the Elan and the Ithon, 0.003 and 0.005/m^2 respectively. Highest densities (0.347 – 0.689/m^2) were recorded from the Duhonw. Between-station variation in recorded densities for any one stream was low, the greatest range being that quoted above for the Duhonw.

c. Growth

Growth curves for the different waters are plotted in Fig. 5. Maximum growth rate for all year classes occurred between runs 2 and 3, approximately May to July, and annual growth in all year classes was 5-6 cm. 0+ growth was comparable in the Duhonw, Bidno and Wy stations 2 and 3, but fish from station 1 on the Wye produced the lowest growth. In the older year classes, 1+, 2+ and 3+, the

Duhonw fish showed high growth rates, being 2.5 cm longer than Bidno fish by the end of their third year.

Other species

Analysis of data on species other than salmon and trout is not yet complete. Catch-depletion estimates for bullheads, loach, minnows and lampreys have been computed but are not presented in full here; Table 4 presents some examples.

Details of all the fish caught in the A.C. electrofishing survey (designed to map the distribution of coarse fish in the main river) are given in Table 13. No coarse fish were caught in the site above the proposed regulation point; 2 chub and 1 dace were caught below this point.

Discussion

Ideally, the following parameters should be included in the surveillance programme:-

1. egg, parr and smolt production in representative sections of the Wye system, particularly in the region of the proposed regulation point.
2. abundance of the adult salmon in the system.
3. catchability by anglers of adult salmon.
4. distribution and abundance of other, coexisting species such as trout, grayling and cyprinids.

However, practical difficulties hinder the attainment of this ideal. The River Wye is of such a size, except in the headwaters, that standard quantitative fish sampling procedures such as catch-depletion and capture-recapture are only possible in a few restricted shallow areas. Netting is considered impracticable because flows are generally too high. Experience in the main river indicates that A.C. electrofishing provides little meaningful information on either abundance or distribution of fish.

The alternative approach employed by the group has been to sample a few stations on the main river but to concentrate the main effort on selected tributaries. These tributaries act as nursery areas for salmon. Factors, such as the proposed regulation, affecting the adult salmon run in the main river will also, indirectly, affect the spawining run into the tributaries. Density-dependent mortality in the early stages is particularly pronounced in salmonids (Le Cren, 1949) so that large differences in adult stocks may be necessary to significantly affect hose of their offspring. This is true both in the tributaries and in the main river. It has already been argued that knowledge of parr or smolt production in isolation to that of the whole stock is of limited usefulness. Production of salmon smolts cannot be considered in complete isolation from other species because interactions between members of the fish community may be very pronounced. Mann (1971) has demonstrated that the growth of 0+ salmon in particular is dependent on the densities of bullheads and 0+ trout.

Atlantic salmon parr can spend up to 7 years in freshwater before migrating to sea though few fish stay for more than 3 years in British waters (Dymond, 1961). The age at which smolts migrate varies roughly with latitude. In the south of England most smolts migrate at 1+; in the Wye, Scottish rivers and Irish rivers smolts are mostly 2+; in southern

Norway most smolts are 3+ (Pyefinch, 1955). In most of those stations sampled in 1975 no parr more than 2+ were found. However, in the Bidno, the most northerly of the tributaries, 3 year old parr were found in May 1975 and were the oldest found in the Wye system. No parr of this 1972 year-class were found outside the Bidno. The average 2+ parr loss from the Duhonw and Bidno was 0.062 and 0.024 fish per m^2. If these figures are taken as the maximum smolt production of these tributaries they compare well with the known smolt production of other waters in which counting fences and traps were employed. For example, Jessop (1975) estimated 0.017 – 0.044 smolts/m^2 in the Big Salmon River, New Brunswick with a mean of 0.039/m^2 after correcting for counting fence efficiency.

Mills (1964) found 0.028 smolts/m^2 in the River Bran, and Meister (1962) 0.036 smolts/m^2 in the Cove Brook, Maine. Elson (1967) found 0.06 – 0.07 smolts/m^2 in the Pollett and Miramichi rivers.

Le Cren (1969) concluded that the highest smolt production was obtained where the population was dominated by young fish (i.e. faster growing fish). The Big Salmon River and River Bran are similar in having a high proportion (~50%) of 3 year old smolts and Cove Brook has some 3 year old smolts (~2%). However, in the Pollett and Miramichi rivers all the 'smolts' were 2 years old. In comparison, the Duhonw, with no 3 year old smolts, has a lower 'smolt' production.

Approximately 3.5 km of the Bidno are occupied by salmon parr giving a total area of 14,000 m^2. A smolt production estimate of 0.024/m^2 gives an estimated total run of 336 smolts. Similarly for the Duhonw, the area available is 20,250m^2, a smolt density of 0.062/m^2 giving a total smolt run of approximately 1250 fish.

Variations in growth rate and density of 0+ and 1+ parr exist between those stations sampled but, as discussed previously, are within the range found in other waters.

The classical picture of progressively declining numbers with age of the year classes comprising a fish population assumes a steady state situation with constant levels of recruitment, mortality, emigration and immigration. In practice, with fish populations, this is rarely the case and deviations from this pattern were found in the trout populations of the Duhonw and Bidno. The reasons for the anomalies found are probably fluctuating levels of recruitment and movements of fish into and out of the sampling reaches. The extent of these movements cannot yet be established but analysis of mark-recapture experiments currently in progress will provide information on the subject.

Densities of fish over the system vary appreciably, with lower densities being found in the Wye and the longer rivers Ithon, Irfon and Elan. Crisp *et al* (1974) noted similar vcariations in the Upper Tees system. They found total fish densities of 0.011 to 0.059/m^2 in the main river compared with 0.029 to 1.372/m^2 (mean 0.455) in the tributaries. Densities reported here for the R. Wye system are typical of soft waters but much higher densities have been recorded in certain streams in England e.g. Walla Brook – 2.7/m^2 (Horton, 1961) and Scotland e.g. Black Brows Beck – 2.4/m^2 (le Cren 1969) – both values refer to July/August samples.

Growth of trout and other species in the Wye system is comparable with values found by other workers and some comparative data for trout are shown in Table 15. Fish weights

and total biomass data are not included in this report but are in preparation and from these, production estimates will be made.

It is obvious from the results of the A.C. electrofishing survey that no assessment of the structure, growth rate nor distribution of coarse fish populations is possible using the current method. Such data as are collected must be of very limited value. As there are no practicable alternatives, however, the method will probably be retained.

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Table 1 – Sampling dates, O.S. map references and areas (m^2) of sampling stations, 1975

Station	Map Reference	Run 1		Run 2		Run 3		Run 4	
		Date	Area	Date	Area	Date	Area	Date	Area
(a) Electrofishing sites (D.C.)									
Wye 1	ST 849823	13.3	538	3.6	1030	28.7	538	31.10	538
Wye 2	SN 922739	20.3	796	21.5	904	30.7	503	30.10	503
Wye 3	SN 939727	19.3	1500	22.5	3000	-	-	4.11	1500
Bidno 1	SN 893805	19.2	255	29.5	390	16.7	195	27.10	195
Bidno 2	SN 892808	27.2	325	14.5	390	14.7	195	28.10	195
Bidno 3	SN 888811	27.2	265	4.7	400	31.7	200	29.10	200
Bidno 4	SN 879819	7.3	285	-	-	-	-	-	-
Bidno 5	SN 872828	14.3	220	-	-	-	-	-	-
Marteg 1	SN 962713	20.2	520	20.5	620	21.7	310	-	-
Marteg 2	SN 964716	21.2	440	8.5	620	24.7	310	-	-
Elan 1	SN 959661	17.3	1500	-	-	5.8	1500	-	-
Elan 2	SN 951666	18.3	-	-	-	-	-	-	-
Chwefru 1	SO 031512	7.2	350	15.5	480	15.7	240	22.10	240
Chwefru 2	SO 127513	3.3	410	16.5	510	17.7	255	23.10	255
Chwefru 3	SO 026514	25.2	390	4.6	650	18.7	325	24.10	325
Chwefru 4	SO 014517	4.3	500	-	-	-	-	-	-
Chwefru 5	SN 989538	12.2	750	-	-	-	-	-	-
Chwefru 6	SN 974563	18.2	255	-	-	-	-	-	-
Duhonw 1	SO 063509	3.2	285	6.5	520	7.7	260	10.10	260
Duhonw 2	SO 054498	12.3	410	7.5	630	8.7	315	16.10	315
Duhonw 3	SO 052496	11.3	380	23.5	480	9.7	240	17.10	240
Duhonw 4	SO 038488	10.3	400	17.6	480	-	-	-	-
Duhonw 5	SO 033490	26.2	365	18.6	450	-	-	-	-
Duhonw 6	SO 021475	18.2	275	3.7	390	-	-	-	-
Edw	SO 095477	-	-	-	-	23.7	375	-	-
Ithon	SO 052514	-	-	-	-	25.7	560	-	-
Irfon	SN 854513	-	-	-	-	4.8	-	-	-
(b) Electrofishing sites (A.C.) (boat sampling) on R. Wye									
Ty Mawr	SN 922737 to 925735	-	-	-	-	-	-	15.10	-
Ddol Farm	SN 975676 to 976674	-	-	-	-	-	-	15.10	-

Table 2 – Distribution of fish species during 1975 survey (+ present, - absent)

Station	Species										
	Brown Trout (*Salmo trutta* L.)	Salmon *(Salmo salar* L.)	Bullhead *(Cottus gobio* L.)	Loach *(Nemacheilus barbatula* L.)	Minnow *(Phoxinus phoxinus* L.)	Dace *(Leviscus leviscus* L.)	Chub *(Squalius cephalus* L.)	Grayling *(Thymallus thymallus* L.)	Pike *(Esox lucius* L.)	Eel *(Anguilla anguilla* L.)	Brook Lamprey *(Lampetra planeri* Bloch)
Wye 1	+	+	-	-	+	-	-	-	-	-	-
Wye 2	+	+	-	-	+	-	-	-	-	+	-
Wye 3	+	+	-	+	+	+	+	-	+	-	+
Bidno 1	+	+	-	-	+	-	-	-	-	+	-
Bidno 2	+	+	-	-	-	-	-	-	-	+	-
Bidno 3	+	+	-	-	+	-	-	-	-	+	-
Bidno 4	+	-	-	-	-	-	-	-	-	-	-
Bidno 5	+	-	-	-	-	-	-	-	-	-	-
Marteg 1	+	+	+	-	-	-	-	-	-	+	+
Marteg 2	+	+	+	-	-	-	-	-	-	+	+
Elan 1	+	+	-	-	-	-	-	-	-	-	-
Elan 2	+	+	-	-	-	-	-	-	+	+	+
Chwefru 1	+	+	+	+	+	+	-	-	+	-	+
Chwefru 2	+	+	+	+	-	+	-	-	-	-	+
Chwefru 3	+	+	+	+	-	-	-	-	-	+	+
Chwefru 4	+	+	+	-	-	-	-	-	-	-	-
Chwefru 5	+	+	+	+	+	-	-	-	-	-	+
Chwefru 6	+	-	+	-	-	-	-	-	-	-	-
Duhonw 1	+	+	+	+	+	+	-	-	-	-	+
Duhonw 2	+	+	+	-	+	-	-	-	-	+	+
Duhonw 3	+	+	+	-	+	-	-	-	-	+	-
Duhonw 4	+	-	+	-	-	-	-	-	-	-	-
Duhonw 5	+	-	+	-	-	-	-	-	-	-	-
Duhonw 6	+	-	+	-	-	-	-	-	-	-	-
Edw	+	+	+	-	-	-	-	-	-	+	-
Ithon	+	+	+	+	+	+	-	-	-	+	-
Irfon	+	+	-	-	-	-	-	-	-	-	-

Table 3

Percentage of salmon in their 1st, 2nd and 3rd year of life.

July – August 1975

Sites	O+	1+	2+
Duhonw 1	90.0	9.5	0.5
Duhonw 2	88.4	10.1	1.5
Duhonw 3	63.3	27.0	9.6
Bidno 1	84.1	14.1	1.8
Bidno 2	86.5	13.5	0.0
Bidno 3	77.5	22.5	0.0
Wye 1	100.0	0.0	0.0
Wye 2	90.5	8.9	0.6
Wye 3	89.1	11.9	0.0
Elan	91.8	8.2	0.0
Edw	94.0	5.5	0.5
Chwefru 1	98.9	1.1	<0.1
Chwefru 2	86.7	12.8	0.5
Marteg 1	63.6	32.2	4.2
Marteg 2	63.9	34.7	1.4
Range	63.3 – 100.0	0 – 34.7	0 – 9.6
Range in Tweed (Mills, 1971)	66.3 – 73.5	25.0 – 29.5	0 – 3.8

Table 4 – Typical Zippin Catch-depletion estimates for 50m. lengths of stream (July 1975)

Station	Species/Age	Probability of Capture	Estimated Abundance	Standard Error of Estimate
Duhonw 2	Trout 0+	0.29	142	32
"	Trout > 0+	0.65	75	3
"	Salmon 0+	0.33	380	41
"	Salmon > 0+	0.44	49	7
"	Bullheads	0.17	80	66
" 3	Trout 0+	0.48	73	4
"	Trout > 0+	0.65	73	1
"	Salmon 0+	0.39	208	12
"	Salmon > 0+	0.61	120	2
"	Bullheads	0.35	52	8
Chwefru 1	Trout	0.63	21	1
"	Salmon 0+	0.26	425	41
"	Salmon > 0+	0.38	43	5
"	Loach	0.32	88	12
" 2	Trout	0.77	33	1
"	Salmon 0+	0.29	332	28
"	Salmon > 0+	0.63	50	1
"	Bullheads 0+	0.16	216	72
"	Bullheads > 0+	0.26	590	47
"	Minnows	0.32	413	26
"	Loach	0.33	19	5
" 3	Trout 0+	0.33	23	6
"	Trout > 0+	0.65	12	1
"	Salmon 0+	0.57	8	1
"	Bullheads 0+	0.18	52	29
"	Bullheads > 0+	0.14	92	60
Bidno 1	Trout 0+	0.71	15	1
"	Trout > 0+	0.75	12	1
"	Salmon 0+	0.31	244	21
"	Salmon > 0+	0.74	46	1
" 2	Trout 0+	0.72	8	1
"	Trout >0+	0.69	32	1
"	Salmon 0+	0.41	201	10
"	Salmon > 0+	0.54	31	2
" 3	Trout 0+	0.64	20	2
"	Trout > 0+	0.72	19	1
"	Salmon 0+	0.50	22	4
"	Salmon > 0+	0.54	6	2
Marteg 1	Trout 0+	0.82	18	1
"	Trout > 0+	0.69	37	1
"	Salmon 0+	0.44	167	8
"	Salmon > 0+	0.66	96	1
"	Bullheads	0.40	110	8
" 2	Trout 0+	0.54	8	2
"	Trout > 0+	0.66	48	2
"	Salmon 0+	0.35	41	12
"	Salmon > 0+	0.82	23	1
"	Bullheads 0+	0.09	130	248
"	Bullheads > 0+	0.21	226	76
Elan	Trout	0.79	4	1
"	Salmon 0+	0.20	503	133
"	Salmon > 0+	0.06	44	268
Ithon	Trout 0+	0.14	28	34
"	Trout > 0+	0.33	7	3
"	Salmon 0+	0.20	39	22
Edw	Trout 0+	0.70	12	1
"	Trout > 0+	0.91	8	1
"	Salmon 0+	0.41	523	28
"	Salmon > 0+	0.66	33	2
"	Bullheads 0+	0.26	42	23
"	Bullheads > 0+	0.26	458	72
Wye 1	Trout 0+	0.44	21	5
"	Trout > 0+	0.92	9	1
"	Salmon 0+	0.39	45	9
" 2	Trout	0.36	31	6
"	Salmon 0+	0.30	386	29

Table 5

Salmon parr densities (No/m^2) July – August 1975

Station	0+	1+	2+	Total
Duhonw 1	1.406	0.148	0.008	1.562
Duhonw 2	1.207	0.138	0.020	1.365
Duhonw 3	0.869	0.371	0.132	1.372
Bidno 1	1.252	0.210	0.027	1.489
Bidno 2	1.035	0.161	0	1.196
Bidno 3	0.172	0.050	0	0.222
Wye 1	0.084	<0.0001	0	0.084
Wye 2	0.769	0.076	0.005	0.850
Wye 3*	0.180	0.022	0	0.202
Elan	0.335	0.030	0	0.365
Edw	1.397	0.081	0.008	1.486
Chwefru 1	1.594	0.017	0.001	1.612
Chwefru 2	1.305	0.192	0.008	1.505
Chwefru 3				
Marteg 1	0.542	0.274	0.036	0.852
Marteg 2	0.133	0.072	0.003	0.208
				Range: 0.08 – 1.61

* November sample

Table 6

Densities (No./m^2 of Salmon Parr in the R. Wye, R. Duhonw and R. Bidno

(a) River Wye			
	Year Classes		
Date	1973	1974	1975
17.3.75	0.011	0.091	-
25.5.75	0.002	0.058	-
29.7.75	0.002	0.038	0.426
1.11.75	0.001	0.063	0.256
Av. decrease in density			
	0.010	0.028	

(b) Duhonw			
	Year Classes		
Date	1973	1974	1975
8.3.75	0.077	0.204	-
12.5.75	0.069	0.167	-
8.7.75	0.053	0.219	1.161
14.10.75	0.015	0.147	0.755
Av. decrease in density			
	0.062	0.057	0.406

(c) Bidno				
	Year Classes			
Date	1972	1973	1974	1975
24.2.75	0.007	0.039	0.122	-
22.5.75	0.003	0.048	0.195	-
15.7.75	0	0.027	0.143	0.849
28.10.75	0	0	0.129	0.634
Av. decrease in density				
	1			

1 excluding February sample

Table 7

Adult salmon caught in R. Duhonw in November 1975

Females			Males		
Length (cm)	Wt. (kg)	Age [1]	Length (cm)	Wt. (kg)	Age [1]
63	2.7	2/1+	61	1.8	1/1+
64	3.0	2/1+	64	1.9	2/1+
68	3.3	2/1+	64	2.3	2/1+
72	3.0	2/1+	67	2.4	2/1+
76	4.3	2/2+	67	2.6	2/1+
79	4.5	2/2+	67	2.7	2/1+
80	4.8	2/2+	67	2.8	2/1+
86	5.0	2/2+	70	3.0	2/1+
92	5.4	2/2+	70	3.1	2/1+
			71	2.8	2/1+
			72	3.9	2/1+
			73	3.6	2/1+
			74	4.2	2/2+
			77	3.7	2/1+
			79	4.0	2/2+
			79	4.2	2/2+
			82	-	2/2+
			82	4.3	2/2+

1 River age shown on left, sea age on right.

Table 8

The growth of salmon in 1975

Station	Run 3			Run 4		
	$\bar{1}$	S.E.	Date	$\bar{1}$	S.E.	Date
Duhonw 1	5.4	0.02	7.7	6.3	0.08	10.10
Duhonw 2	5.1	0.03	8.7	6.2	0.06	16.10
Duhonw 3	5.1	0.03	9.7	6.4	0.09	17.10
Bidno 1	5.2	0.03	16.7	6.8	0.04	27.10
Bidno 2	4.8	0.03	14.7	6.7	0.05	28.10
Bidno 3	5.7	0.15	31.7	7.5	0.12	29.10
Wye 1	4.8	0.06	28.7	*	*	*
Wye 2	5.3	0.03	30.7	*	*	*
Wye 3	-	-	-	6.1	0.06	4.11

$\bar{1}$ = mean length. S.E. = standard error. * = data not yet processed.

Table 9

Density data by year classes for R. Duhonw (trout)

(a) Station 1

Year Class	Run 1 (3.2)	Run 2 (6.5)	Run 3 (7.7)	Run 4 (10.10)
	Density No./m^2	Density No./m^2	Density No./m^2	Density No./m^2
0+	0	0	0.081	0.081
1+	0	0.010	0.054	0.027
2+	0.039	0.056	0.189	0.069
3+	0.035	0.030	0.023	0.015
4+	0	0.010	0	0
Total	0.074	0.104	0.347	0.192

(b) Station 2

Year Class	Run 1 (12.3)	Run 2 (7.5)	Run 3 (8.7)	Run 4 (16.10)
	Density No./m^2	Density No./m^2	Density No./m^2	Density No./m^2
0+	0	0.008	0.451	0.162
1+	0.063	0.076	0.108	0.187
2+	0.066	0.157	0.210	0.248
3+	0.078	0.087	0.019	0.022
4+	0.007	0.010	0	0
Total	0.215	0.338	0.667	0.619

(c) Station 3

Year Class	Run 1 (11.3)	Run 2 (23.5)	Run 3 (9.7)	Run 4 (17.10)
	Density No./m^2	Density No./m^2	Density No./m^2	Density No./m^2
0+	-	0.021	0.304	0.287
1+	0.020	0.048	0.133	0.104
2+	0.056	0.127	0.204	0.037
3+	0.039	0.046	0.008	0
4+	0.005	0.015	0	0
Total	0.119	0.258	0.650	0.420

Table 10

Density data by year classes for Bidno (trout)

(a) Station 1

Year Class	Run 3 (16.7)	Run 4 (27.10)
	Density No./m^2	Density No./m^2
0+	0.077	0.077
1+	0.046	0.041
2+	0.015	0.026
3+	0	0.005
4+	0	0
Total	0.138	0.149

(b) Station 2

Year Class	Run 3 (14.7)	Run 4 (28.10)
	Density No./m^2	Density No./m^2
0+	0.041	0.026
1+	0.046	0.077
2+	0.062	0.072
3+	0.021	0.010
4+	0	
Total	0.169	0.185

(c) Station 3

Year Class	Run 3 (31.7)	Run 4 (29.10)
	Density No./m^2	Density No./m^2
0+	0.105	0.130
1+	0.065	0.105
2+	0.030	0.030
3+	0.005	0
4+		0
Total	0.210	0.272

Table 11

Mortality rates for trout from Duhonw and Bidno – regression parameters of log No./1000m^2 on age (years).

Station	Run	n	Slope	Intercept	% yearly loss
Duhonw 2	3	4	-0.88	6.98	58.7
Duhonw 3	3	4	-1.25	7.12	65.0
Duhonw 3	4	3	-1.02	6.69	64.1
Duhonw combined		11	-0.95	6.91	61.5
Bidno 1	3	3	-0.82	5.26	55.9
Bidno 1	4	4	-0.87	5.40	57.9
Bidno 3	3	4	-0.99	5.94	62.9
Bidno 3	4	3	-0.73	5.77	52.0
Bidno combined		14	-0.91	5.68	59.6

Table 12
Densities (No./m^2) of trout from stations on the Upper Wye System Sampled during run 3 (July – August 1975).

Station	Date	0+ trout density No./m^2	Total trout density No/m^2
Wye 1	28.7	0.041	0.058
Wye 2	30.7	0.038	0.062
Bidno 1	16.7	0.076	0.138
Bidno 2	14.7	0.041	0.168
Bidno 3	31.7	0.100	0.195
Marteg 1	21.7	0.058	0.177
Marteg 2	24.7	0.029	0.187
Elan 1	5.8	(0.002)	0.003
Chwefru 1	15.1	(0.008)	0.087
Chwefru 2	17.7	(0.027)	0.129
Chwefru 3	18.7	0.074	0.111
Duhonw 1	7.7	0.081	0.347
Duhonw 2	8.7	0.451	0.689
Duhonw 3	9.7	0.304	0.608
Edw 1	23.7	0.032	0.053
Ithon 1	25.7	(0.002)	0.005
Irfon 1	4.8	0.019	0.023

Table 13

Total catch of A.C. Electrofishing in the River Wye 15th October 1975

a) Ty Mawr – above the proposed regulation point.

Species	Length (cm)	Age
Salmon	9.9	1+
	10.2	1+
Trout	13.2	1+
	17.5	2+
	18.1	2+
	19.8	2+
	21.2	2+
	21.2	Unreadable
	23.6	3+
	27.4	3+
	32.0	5+
	36.9	Unreadable
	41.0	8+

b) Ddol Farm – below the proposed regulation point

Species	Length (cm)	Age
Chub	38.0	10+
	41.0	12+
Dace	22.4	5+
Salmon	10.4	1+
	11.0	1+
	12.1	1+
	12.3	1+
	13.0	1+
	13.7	1+
	13.8	1+
Trout	11.6	1+
	12.0	1+
	12.0	1+
	13.0	1+
	13.8	1+
	16.8	2+
	17.0	2+
	20.0	Unreadable

Table 14

Comparative data for trout lengths from other rivers in Britain

Age Group	Durham[1] tributaries	R. Tees[1]	R. Bran[1]	R. Tweed[2] tributaries	Bere[3] Stream	Dockens[3] Water
0+	3.8	4.6	4.6	4.6-6.7	8.2	5.9
1+	7.5	10.2	10.2	10.3-14.8	16.9	13.6
2+	9.5	13.2	16.5	16.5-20.7		19.6
3+	11.8	17.2	24.3	19.83-24.5		24.3
4+	-	-	-			

1 = July – August, Crisp *et al* (1974)

2 = End of year lengths, Mills *et al* (1971)

3 = 1st August, Mann (1971)

Figure 1

Fish Sampling Stations

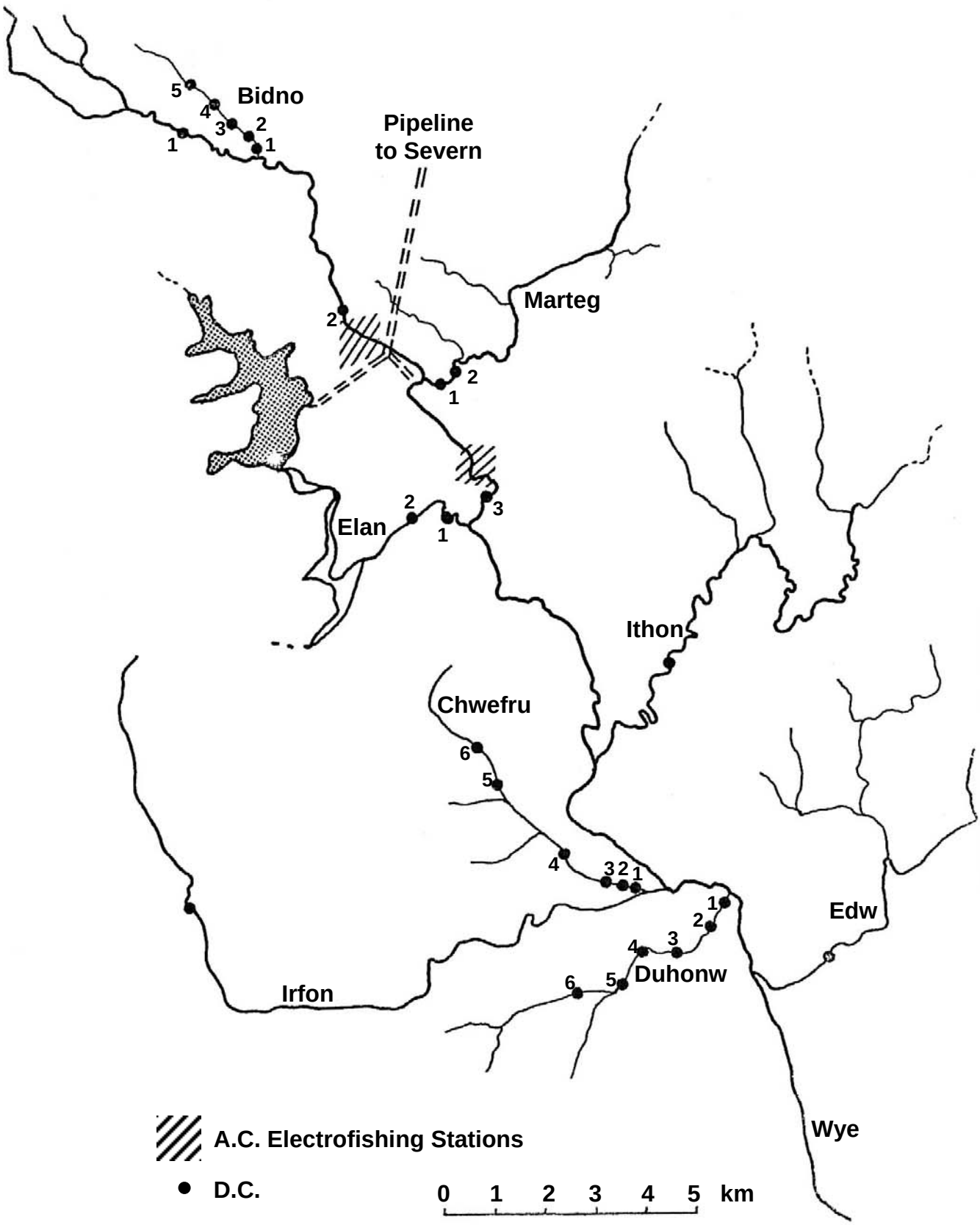

Figure 2

Wye Station 2 (salmon)

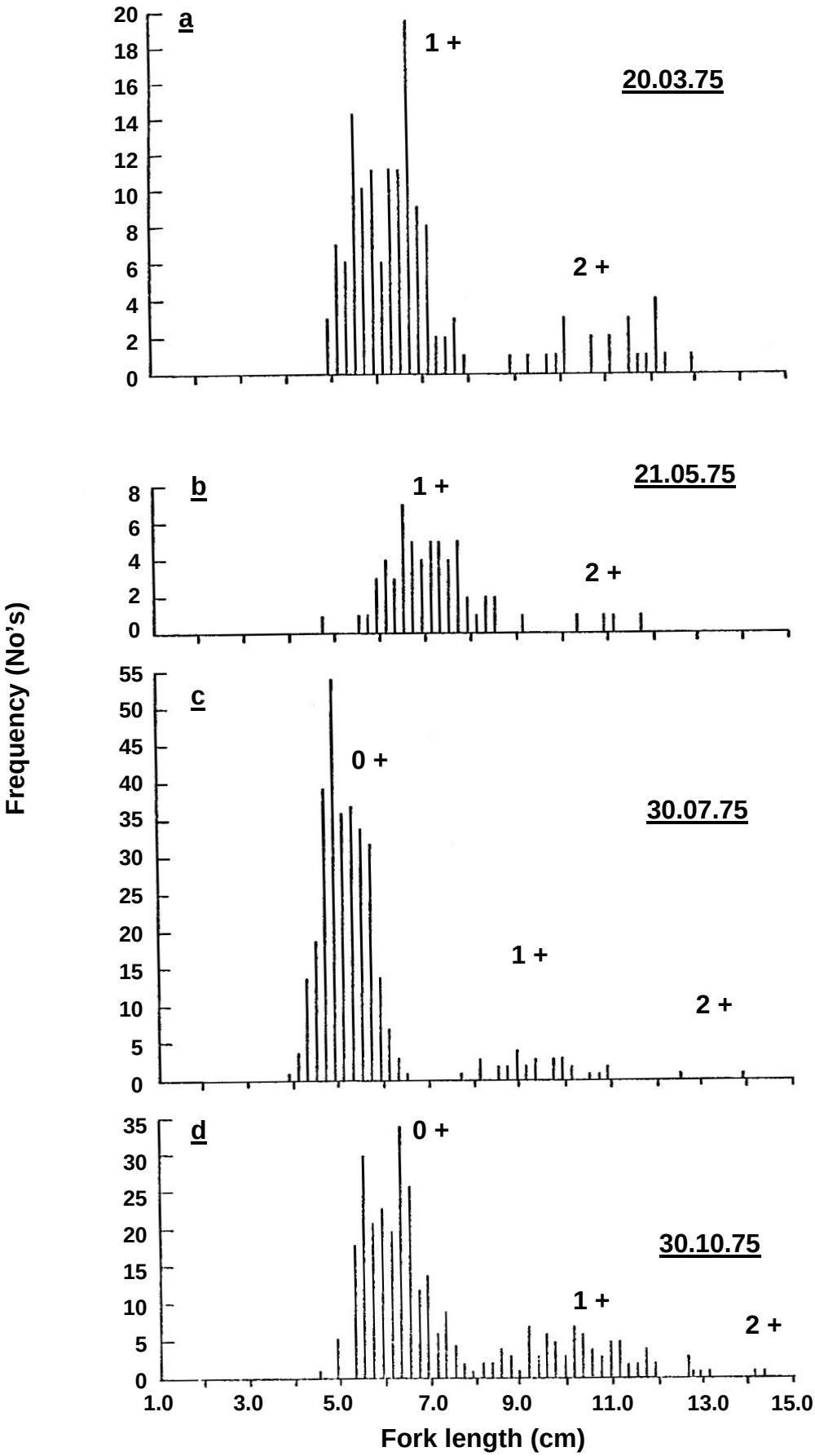

Figure 3

Bidno Station 2 (salmon)

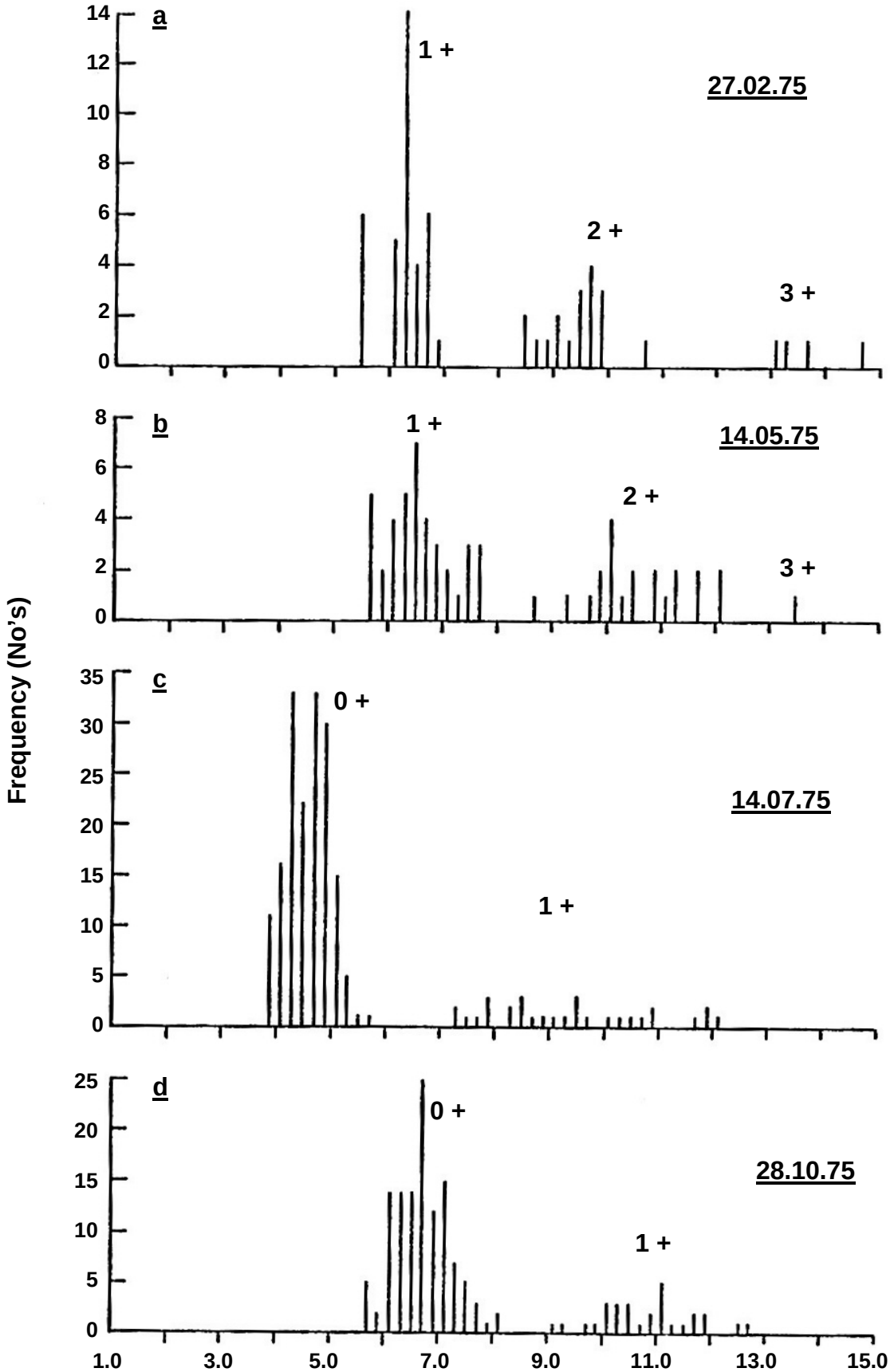

Figure 4

Duhonw Station 3 (salmon)

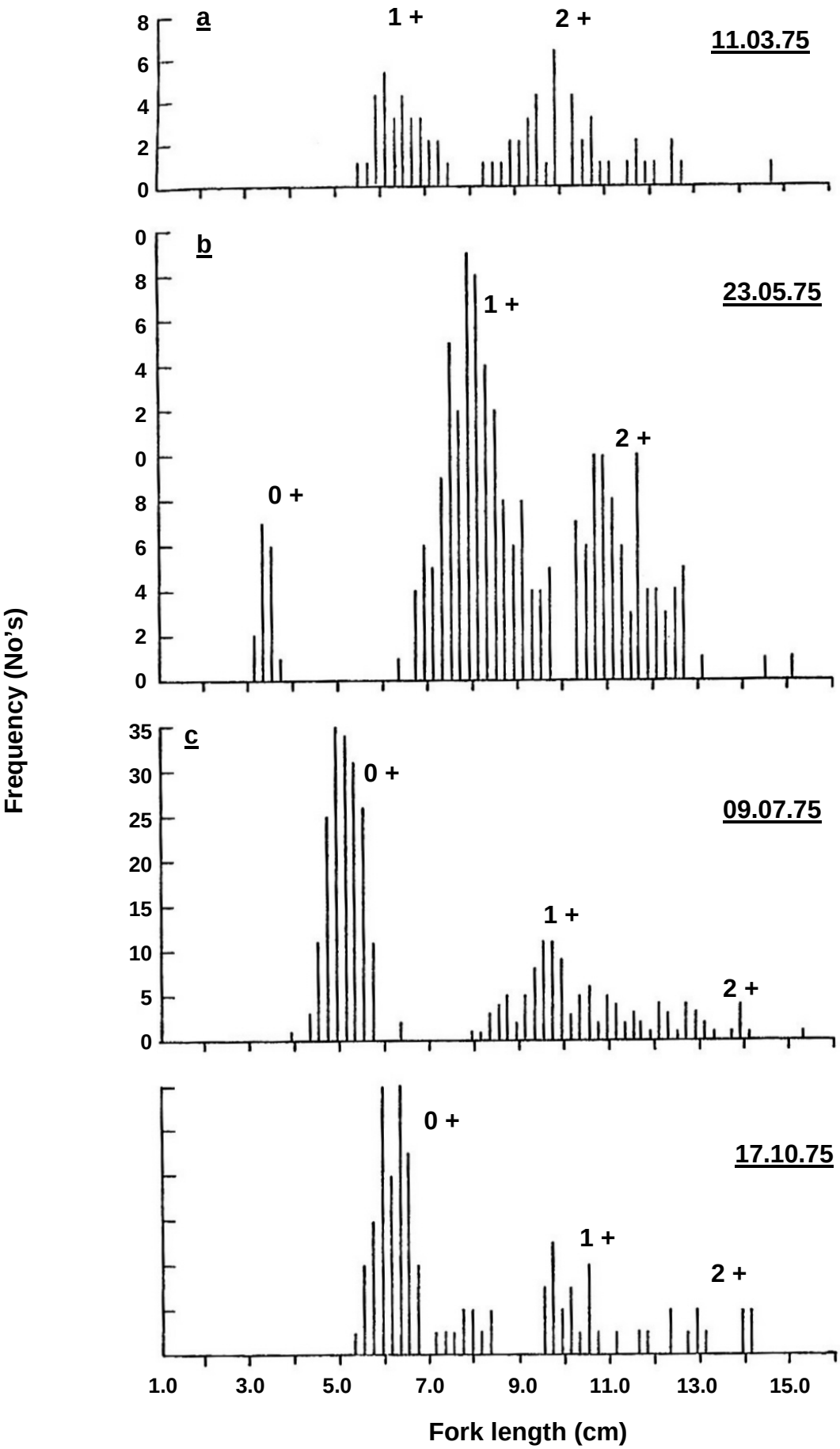

Figure 5

Growth of trout *(S. trutta)* 1975