SOUTH WEST WATER AUTHORITY

DIRECTORATE OF FISHERIES AND RECREATION

TECHNICAL REPORT

FISHERIES SURVEY OF THE RIVER OTTER, 1978

Summary. There has been concern about the trout fishery in the River Otter and the possible effects of abstraction and/or pollution. A survey was carried out to describe the fish stocks. Trout and eels were the dominant species. The population structure of trout was peculiar, there being relatively few juveniles. Growth was good and there were numerous trout of takeable size in the river at the end of the fishing season. Variations in the parameters measured are explained and nothing can be attributed to abstraction or pollution.

Introduction.

This report gives details of a survey carried out in September and November 1978. The purpose of the investigation was to determine the distribution and abundance of fish stocks in the River Otter. There has been concern about the decline of the trout fishery and this has been attributed to pollution and/or abstraction, but little information about the fish stocks exists. In 1974 a survey at Newton Poppleford "revealed a surprisingly small population (of trout), for which there (was) no obvious explanation". There was a recommendation to restock. This report provides information with which future work can be compared.

Description of the river.

The River Otter rises in the Blackdown Hills in the Greensand. It is spring fed and has four major tributaries, the Rivers Lupp (or Wick), Gessage, Wolf and Tale. To its junction with the River Lupp it is narrow and shallow, as are all its tributaries. From Honiton downstream the river is relatively wide and deeper, with runs and pools being more extensive than riffles. The river meanders through well managed grass and arable land with occasional woodland to the sea at Budleigh Salterton. The two main centres of population are at Honiton and Ottery St. Mary. The only industrial discharge is at Honiton. Both point source and diffuse discharges of pollutants probably occur from farms. There is a small abstraction by Wessex Water Authority from Otterhead and this is dependant on maintaining certain residual flow requirements downstream. There are several borehole abstractions in the catchment. Chemical analyses of water samples taken throughout the year indicate the River Otter to be clean. The water is alkaline and pH is generally between 7.0 and 9.0. The concentration of free ammonia may sometimes be high but is generally low. Summer temperatures must be high and in recent years extensive stands of vegetation have developed. Daytime oxygen saturation is high but overnight this probably drops to levels which may stress fish.

Methods.

Twelve sites were chosen, those in the upper reaches and tributaries to provide information on the distribution of juvenile salmonids, and those from Honiton downstream to describe the fishery with special reference to known discharge points. Their positions are shown in Figure 1. At Cottarson the section was downstream of Honiton Sewage Treatment Works and Express Dairies discharge points and at Feniton the Sewage Treatment Works outfall was in the upper part of the section. The sections chosen were typical of the river in that reach. In the upper reaches and tributaries where the river is narrow and shallow short sections were enclosed with nets and electro-fished in an upstream direction with DC equipment, the operators wading. At other wider and deeper sites on the main river long sections were confined between nets and electro-fished from a boat in a downstream direction using AC equipment. DC machinery is ineffective in deep water. Each section was fished three times except at Otterton where only one fishing was done. Fish were identified, counted and their lengths measured to the nearest mm, fork length where appropriate and total lengths in other cases. Scales were taken from salmonids and large cyprinids for subsequent age analysis. Fish were returned alive to the water at the end of each days operation. The lengths and widths of the sections were measured and areas calculated. Values are shown in Table. 1.

Ages were assessed using length-frequency histograms and scale readings. Population estimates for each age group were made using the method attributed to Zippin (1956) and 95% confidence limits attached. If the data were unsuitable for this method that of Seber and Le Cren (1967) was used on catches 2 and 3 and catch 1 was added. If the data were unsuitable for either method direct summation gave a minimum estimate. Overall percentage efficiency of capture was calculated. Population estimates were converted to densities and for trout of takeable size also to number/100m. At Otterton where only one fishing was completed population estimates were obtained by dividing the catch by the mean probability of capture at other similar sites which were fished in the same way. No confidence limits were set but they must be wide. Mean lengths and standard deviations were calculated and mean weights were obtained from length-weight relationships previously obtained for other Devon and Southern rivers. Species and total biomass values were calculated.

Results.

Species caught and distribution. The list below shows the species caught.

Salmon, Salmo salar L.
Trout, Salmo trutta L. (including Sea Trout)
Stoneloach, Nemacheilus barbatula (L)
Minnow, Phoxinus phoxinus (L)
Bullhead, Cottus gobio L.
Eel , Anguilla anguilla (L)
Dace, Leusiscus leusiscus (L)
Roach, Rutilus rutilus (L)
3 spined Stickleback, Gasterosteus aculeatus L
Flounder, Platichthys flesus (L)
Mullet, Mugilidae
Brook Lamprey, lampetra planeri (Bloch)

Only trout and eels were caught at all sites. Bullheads were absent at Cottarson. Loach, minnows and lampreys were widespread being occasionally absent from some tributary sites. All other species were restricted to one or two sites, the majority being present at Otterton. Lampreys are not considered further in this report. Overall efficiency of capture was high for trout, being greater than 90% for all except 0+ trout at Feniton (80%); it was high for eels, being greater than 80% everywhere except at Cadhay (70%); it was greater than 75% for most loach, greater than 50% for bullheads and greater than 35% for minnows.

Densities.

Table 2 shows the densities of all species in age groups where possible, in number/100 m^2. In addition the densities of trout greater than or equal to 20.3 cms (8" +), 25.4 cms (10" +) and 30.5 cms (12" +) are shown. Flounders were grouped according to size but ages cannot be allocated to these sizes. Eels and mullet could not be aged.

Mean lengths.

Table 3 shows the mean lengths and standard deviations in cms for all ages or groups for all species.

Biomass.

Table 4 shows the total biomass in grams/100 m^2 for each species at all sites, corrected to the nearest whole gram. The total fish biomass is also shown and the Mean values for those sections fished in November, the shallow sections fished in September and the deep sections fished in September are shown separately. In addition the weights of takeable trout of various sizes in 100m of river, irrespective of its width, and the appropriate means are shown.

Discussion.

Salmon were present only downstream of Otterton Weir. It is unlikely that any ascend the weir and since only 1+ juveniles were caught it is possible that spawning in the lower reaches of the river is sporadic. The few 1+ salmon caught were of large size and greatly in excess of similarly aged fish elsewhere in the south-west. It is unlikely that the salmon population is self-sustaining and the adults are probably wandering individuals which have been derived from neighbouring South Devon rivers.

The structure of the trout population is odd. Table 5 shows the mean densities and percentage contribution of different ages at various site groups. 0+ fish were present at low densities in the main river except at Clapper Lane where they were absent. They were present at slightly higher densities at some upstream sites but were absent from others. The numbers of 1+ trout were greater than those of 0+ trout at most sites, Tuckmill excluded. The observed densities of 0+ trout could not sustain those of 1+ trout. This may be explained by the 1977/78 spawning being at a disadvantage either in numbers or from other outside influences, or there may be extensive pools of juvenile trout in areas where we did not fish, or the large numbers of 1+ and older fish may be sustained by stocking and the stocked fish distribute themselves widely. It is known that many trout are stocked at various placed in the river and this may be a large part of the explanation for the atypical population structure. A further explanation may be that juvenile trout are present in large numbers at upstream sites early in the year but migrate into deeper water during their first summer. Although they are well grown they are small relative to other trout in the main river and the efficiency of capture of small fish using AC apparatus is known to be low. These young trout may be present but we could not catch them. This explanation is the least likely as a summer migration is contrary to the known behaviour of juvenile trout in other rivers.

1+ trout were large, those in the main river being generally larger than those at upstream sites. 2+ and older fish were present at all sites and densities were relatively high, as was the density of trout $\geq$ 20.3 cms. The mean lengths of takeable trout were similar at all sites.

Growth is generally good and trout are larger at any age than those in other south-western rivers which have been investigated. Whilst some are undoubtedly of farm origin the growth of wild trout is so fast that it is not possible to say from cursory examination of the scales whether an individual is a wild or a farm fish.

Total trout biomass values fall within the normal range for the U.K., the upstream sites having values towards the top of the range, the downstream sites being near the bottom. However, most work in the U.K. has been done

on small shallow streams, similar in character to the upstream sites on the River Otter. There is little information available about larger, deeper rivers and comparisons should be treated with caution. Biomass/100 m^2 of takeable trout was generally high at upstream sites down to Cottarson, excluding Clapper Lane, and generally lower in the main river. The high values for large trout in the tributaries may be related to the survey being carried out late in the year when mature fish accumulate preparatory to spawning. The number of takeable trout in every 100m of river, irrespective of width, was relatively constant at all sites fished in September i.e, excluding tributaries.

For fish $\geq$ 20.3 cms (8" +) the mean was around 20/100m, range 15-25 but fish $\geq$ 25.4 cms (10" +) were less numerous, mean around 6/100m, range 2-8. Trout $\geq$ 30.5 cms (12" +) were present from Cottarson downstream only, the mean number being around 2/100m, range 1-4.

Clearly there are many trout of takeable size remaining in the river at the end of the fishing season. A significant proportion of these are immature. Table 6 shows the proportions of the 1+ and 2+ and older age groups $\geq$ 20.3 cms at each site fished in September. If angling was more efficient in removing those fish of takeable size there would be a danger of diminished spawning and recruitment. A large number of sea trout were caught at Otterton and a few further upstream. It is probable that many juveniles are derived from sea trout parents.

The population of eels in the River Otter is large and distributed throughout. In September they were more numerous in the main river than in the upstream sites. The mean lengths were greater at the upstream sites and were high overall. Biomass was high and eels were dominant in the main river. During November it should have been more difficult to catch eels as they tend to bury themselves under stones as the water becomes cooler. However, large numbers were caught in the tributaries and biomass was high. There are conflicting theories about the effects of eels on trout, through both competition and predation. Conditions in which trout may be stressed are probably suitable for eels, so the presence of the latter in the absence of the other does not necessarily mean that eels have eaten all the trout.

Dace were caught from Cadhay downstream, although those at Tipton were outside the section and have not been considered here. Four age groups up to 4+ were caught, 1+ fish being absent. This is probably due to chance. Shoaling species are difficult to catch with electricity. Growth appears to be good and compares favourably with that in other southern rivers. A few roach were caught at Otterton. They appeared to be growing well.

Loach and bullheads prefer shallow, clean water. One or both species were present at all sites, being numerous in the upstream sections. From Clapper Lane downstream they were few in number and biomass in the main river was low. This could be an artefact, being due to the inefficiency of AC electro-fishing for these small fish in deep water. The absence of bullheads at Cottarson may be due to chance, especially since densities are generally low in the main river.

Overall mean biomass and percentage contribution by different species at various site groups are shown in Table 7. It is clear that trout and eels are the dominant species, bullheads and loach providing the only other significant contribution at the upstream sites.

Conclusions.

Twelve species of fish were found in the River Otter. Trout and eels were dominant, having the greatest biomass densities. At shallow upstream sections trout contributed 57% of the total biomass and eels 25%. In large, main river sections trout contributed 24% and eels 71% of the total. The numbers of juvenile trout were low. Growth was fast and many trout of takeable size remained in the river at the end of the angling season. Variations in the parameters measured were explained. Abstraction or pollution cannot be identified as affecting the distribution or abundance of fish stocks.

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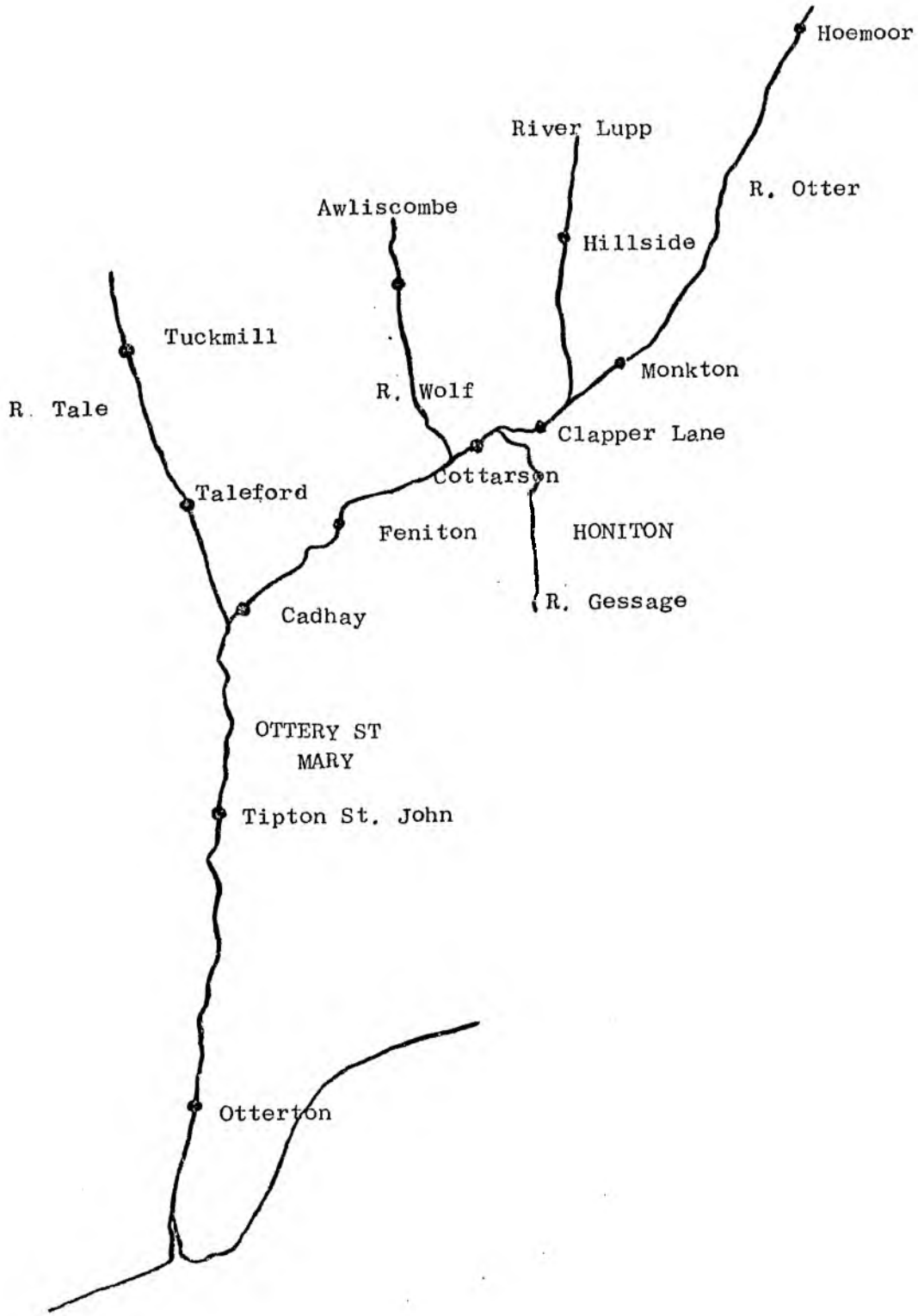

Figure 1. Sketch Map of the R. Otter showing sites fished.

Table 1. River Otter - sections fished

	DATE	LENGTH M	MEAN WIDTH M	AREA M^2	O.S. REF
R. Lupp Hillside	15 Nov	39.9	2.8	111.3	171053
R. Wolf Awliscombe	15 "	31.8	2.4	76.7	133016
R Tale Tuckmill	14 "	35.0	2.5	87.5	079011
" Taleford	14 "	45.3	4.5	202.6	089969
R. Otter Hoemoor	13 Sept	43.9	3.1	136.5	221104
" Monkton	19 "	47.7	5.2	246.6	184030
" Clapper	21 "	135	8.6	1168	164012
" Cottarson	20 "	160	9.2	1478	146005
" Feniton	18 "	145	16.4	2382	117992
" Cadhay	15 "	160	11.6	1864	095962
" Tipton	14 "	160	12.0	1922	090919
" Otterton	12 "	180	12.7	2282	080855

TABLE 2 River Otter Densities of fish $\hat{N}/100m^2$

		River Lupp Hillside	R. Wolf Awliscombe	R. Tale Tuckmill	R. Tale Taleford	Hoemoor	Monkton	Clapper	Cottarson	Peniton	Cadhay	Tipton	Otterton
Salmon	1+												0.22
	Adult												0.09
Trout	0+	7.20		11.50		12.45	0.81		0.07	0.16	0.05	0.05	
	1+	7.19		4.98	1.97	18.89	5.85	1.22	1.76	0.87	1.56	4.79	1.51
	2+	1.80	3.90	8.00	1.48	5.13	1.64	0.79	0.88	0.08	0.47	0.42	0.42
	Older	4.49	5.20	4.57		1.46	1.24	0.17		0.04	0.16	0.10	0.25
	⩾ 20.3 cms	5.39	9.10	11.43	2.48	5.13	3.74	1.74	⩾ 1.96	⩾ 0.92	1.40	1.92	2.15
	⩾ 25.4 cms	2.70	5.20	2.29	0.99	0.74	1.24	0.56	⩾ 0.68	0.40	0.61	0.42	0.66
	⩾ 30.5 cms		1.30						⩾ 0.34	0.16	0.11	0.05	0.27
Sea Trout												0.16	3.15
Dace	0+												0.26
	1+												
	2+												0.66
	3+										0.05		0.61
	4+												0.31
Roach	2+												0.13
	3+												0.18
	4+												0.04
Loach	0+		24.58	28.57	132.09		53.01	4.64	0.83	4.38	2.49	1.52	
	1+		37.08	43.55	37.30		20.34	0.95	0.62	1.28	0.21	1.23	0.22
	2+		1.30				0.41						
Minnow	0+				7.94		22.37	2.36	14.89	⩾ 12.81	0.11	2.04	0.15
	Older				81.76		24.17	2.15	2.42	⩾ 8.19	1.94	0.27	0.97
Bullhead	0+	70.05		71.56	11.15	151.57	153.59	5.62		0.32	0.47	1.20	0.20
	Older	163.45	6.81	83.88	16.98	57.84	51.66	2.45		0.62	0.56	0.37	
Eel		6.63	15.29	27.43	28.17	6.06	6.27	10.54	9.64	12.48	25.83	27.15	13.34
Flounder	Size A												0.53
	" B												0.61
	" C												0.04
Mullet													0.39
3 spined Stickleback				1.14									

TABLE 3 RIVER OTTER SEPT/NOV 1978 Mean lengths ± S.D., cms

		Lupp Hillside	Wolf Awliscombe	Tale Tuckmill	Tale Taleford	Hoemoor	Monkton	Clapper	Cottarson	Feniton	Cadhay	Tipton	Otterton
Salmon	1+												17.88 ± 1.25
	Adult												59.20 ± 2.27
Trout	0+	9.11 ± 0.71		9.37 ± 0.71		8.62 ± 0.82	10.15 ± 0.92		10.30	10.53 ± 0.67	9.80	10.80	
	1+	17.64 ± 0.81		17.05 ± 1.69		15.69 ± 1.91	18.19 ± 1.73	20.37 ± 1.23	20.88 ± 1.80	24.47 ± 2.49	20.30 ± 1.78	19.05 ± 2.31	21.77 ± 2.30
	2+	20.35 ± 1.45	24.10 ± 0.14	22.84 ± 1.98	24.30 ± 2.06	21.66 ± 1.43	23.05 ± 0.59	25.90 ± 2.75	28.16 ± 3.46	35.50 ± 0.42	27.36 ± 2.67	27.32 ± 2.58	24.31 ± 4.33
	Older	25.28 ± 1.44		24.10 ± 2.37		24.20 ± 1.70	26.97 ± 1.48	28.55 ± 2.33		34.20	30.30 ± 4.30	28.35 ± 1.48	32.12 ± 0.87
	⩾ 20.3cms	24.70 ± 2.02	26.77 ± 2.85	23.65 ± 2.12	24.20 ± 2.49	22.89 ± 1.37	23.79 ± 2.73	24.41 ± 3.35	24.78 ± 3.93	25.91 ± 4.39	24.49 ± 4.11	23.09 ± 2.98	24.80 ± 4.15
	⩾ 25.4cms	26.27 ± 0.71	28.77 ± 1.94	26.85 ± 1.34	26.55 ± 0.07	25.40	26.97 ± 1.48	28.53 ± 1.37	29.48 ± 2.72	30.09 ± 3.78	28.47 ± 2.89	28.19 ± 2.17	29.01 ± 3.29
	⩾ 30.5cms		30.90						31.90 ± 0.62	35.07 ± 0.81	33.75 ± 1.91	32.00	32.02 ± 0.79
Sea Trout												42.65	39.65 ± 9.66
Dace	0+												5.70 ± 0.42
	1+												
	2+												17.15 ± 0.79
	3+										21.30		19.96 ± 0.88
	4+												21.60 ± 0.72
Roach	2+												17.60 ± 0.36
	3+												20.12 ± 0.68
	4+												22.00
Loach	0+		5.30 ±0.44	4.85 ±0.61	4.98 ±0.59		4.78 ±0.77	4.87 ±0.79	4.90 ±0.74	5.05 ±0.63	5.60 ±0.62	5.53 ±0.56	
	1+		9.22 ±0.52	8.72 ±0.99	9.03 ±0.98		9.44 ±1.14	9.75 ±1.45	10.48 ±0.99	9.70 ±0.73	11.62 ±1.50	9.88 ±1.01	9.83 ±0.55
	2+		12.80				14.00						
Minnow	0+				4.33 ±0.46		3.40 ±0.62	3.04 ±0.58	3.10 ±0.44	3.60 ±0.50	3.00	3.65 ±0.39	3.65
	Older				6.93 ±0.74		6.52 ±1.04	7.16 ±1.00	6.72 ±0.55	6.98 ±1.13	6.44 ±0.63	7.38 ±0.28	7.23 ±1.02
Bullhead	0+	3.71 ±0.38		4.12 ±0.49	4.44 ±0.39	3.36 ±0.49	3.47 ± 0.47	4.15 ±0.58		4.13 ±0.29	4.67 ±0.46	4.41 ±0.56	4.95 ±0.21
	Older	6.06 ±0.75	7.92 ±0.61	6.23 ±0.77	6.12 ±0.89	5.92 ±0.88	5.85 ±0.59	6.10 ±0.70		6.37 ±1.02	7.00 ±0.58	6.61 ±1.05	
Eel		35.17 ±3.14	42.14 ±8.88	23.01 ±7.93	31.50 ±9.19	35.10 ±7.35	40.16 ±11.05	38.36 ±9.91	40.45 ±8.69	33.24 ±10.67	27.48 ±12.50	29.97 ±10.59	33.15 ±9.58
Flounder	A												9.53 ±1.43
	B												15.96 ±1.49
	C												22.00
Mullet													44.29 ±1.52
3 spined Stickleback				3.60									

TABLE 4 RIVER OTTER BIOMASS IN G/100m^2

	R. Lupp Hillside	R. Wolf Awliscombe	R. Tale Tuckmill	R. Tale Taleford	Hoemoor	Monkton	Clapper	Cottarson	Feniton	Cadhay	Tipton	Otterton
almon												8
rout	1514	2036	2224	454	1761	912	316	402	200	305	493	335
oach		270	242	345		186	11	6	13	6	11	1
nnow				377		103	12	16	46	7	3	5
ullhead	539	42	362	70	267	259	15		3	3	4	1
spined Stickleback			Trace									
ace										6		133
oach												38
l	511	2018	590	1549	467	721	1043	1138	799	930	1249	854
Totals	2564	4366	3418	2795	2495	2181	1397	1562	1061	1257	1760	1375
Means		3286			2338				1402			
Biomass of Trout of takeable size in 100m length of river												
⩾ 20.3 cms (8" +)	2608	4962	4339	1809	2191	2989	2518	3175	3047	2755	3254	4789
Means		3430			2590				3256			
⩾ 25.4 cms (10" +)	1575	3480	1280	955	430	1461	1306	1863	2089	1903	1314	2389
Means		1823			946				1811			
⩾ 30.5 cms (12" +)		1083						1186	1326	564	240	1333
Means		271			0				775			

Table 5 River Otter. Mean densities and percentage contribution of trout of different ages.

		Tributaries fished in November		Up stream sections in September		Main river sections in September	
		$\hat{N}/100m^2$	%	$\hat{N}/100m^2$	%	$\hat{N}/100m^2$	%
Trout	0+	4.675	30.03	6.63	27.93	0.055	1.94
	1+	3.535	22.70	12.37	52.12	1.95	68.78
	2+	3.795	24.37	3.385	14.26	0.51	17.99
	Older	3.565	22.90	1.35	5.69	0.32	11.29
Total		15.57		23.735		2.835	

Table 6. River Otter. Proportions of 1+ and older classes of trout $\geq$ 20.3 cms

	1+	Older
Hoemoor	0.0%	77.8%
Monkton	14.3	100
Clapper	50.0	100
Cottarson	61.5	100
Feniton	100.0	100
Cadhay	48.3	100
Tipton	31.0	100
Otterton	77.3	90.9

Table 7. River Otter. Overall biomass and percentage contribution of all species

	Tributaries fished in November		Upstream sections in September		Main river sections in September	
	$\bar{B}$iomass	%	$\bar{B}$iomass	%	$\bar{B}$iomass	%
Salmon					1	0.1
Trout	1557	47.4	1336	57.2	342	24.4
Loach	214	6.5	93	4.0	8	0.6
Minnow	94	2.9	51	2.2	15	1.1
Bullhead	253	7.7	263	11.3	4	0.3
Stickleback	T	T				
Dace					23	1.6
Roach					6	0.4
Eel	1167	35.5	594	25.4	1002	71.5
TOTAL	3285		2337		1401	