

NRA SOUTH WEST 500

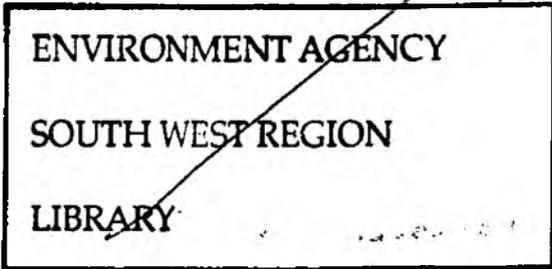
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River Okement fish
mortality 16/09/89
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ENVIRONMENTAL PROTECTION
FISHERIES CONTROL
RIVER OKEMENT FISH MORTALITY
16.09.89.

N.A. READER
FISHERIES SCIENTIST
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AKP1



RIVER OKEMENT FISH MORTALITY - 16.09.89

SUMMARY

Fish surveys were carried out in the River Okement prior to and following a fish mortality on 16th. September 1989. The results indicate that there was a total mortality of salmonid fish over a 14.1km. stretch of the Rivers Okement and West Okement. The total loss of all age groups of salmonids is calculated to be in the order of 110,000 fish. The exact point at which the fish kill commenced is difficult to define in relation to known discharges into the West Okement.

WORK CARRIED OUT IN ASSESSING THE EXTENT AND DEGREE OF THE MORTALITY

1. Torridge Fish Survey 1989

Eight sites on the River Okement system were fished as part of this routine survey between 19th. June and 29th. August. These sites are listed in Table 1. Relative site location is given in Diagram 1.

At these sites, full, quantitative surveys were carried out, involving triple-shock operations in stop-netted sections. All fish caught were removed, identified to species level, measured (a sub-sample where large numbers caught) and counted. From the data collected, estimates of the densities of each species and age-group (in the case of salmonids) were calculated at each site. Standard statistical methods were used in these calculations. Details of the numbers of salmonids caught, together with calculated densities of these fish are given in Table 2.

2. Post Mortality Studies

Torridge Fish Survey (1989) Sites

Seven of the eight routine survey sites were refished after the mortality. Details of these sites are given in Table 3, whilst details of the fish caught are shown in Table 4.

At each site, stop-nets were set as in the original survey and a single shock carried out in the isolated section. Where salmonids were present, these fish were removed, identified, counted and measured in the normal way.

Qualitative Fish Surveys

Ten sites were fished in a qualitative manner (i.e. without the use of stop-nets) in order to assess the extent of the mortality. Table 5 gives details of the sites whilst information on the fish caught here are shown in Table 6. Site distribution is given in Diagram 1.

RESULTS, EXTENT AND DEGREE OF THE MORTALITY

The results of the post-incident survey (Tables 4 and 6) indicate that there was a substantial mortality of salmonid fishes in the River West Okement which continued downstream in the River Okement. The fish kill extended from the Meldon Quarry Road Bridge (Site 15), downstream to Woodhall Bridge (Site 5) - see Diagram 1. There was no effect on fish stocks in the River East Okement.

In view of the negligible numbers of live salmonids found at sites within the affected reach, particularly when compared with the very large numbers of fish present before the pollution (see Tables 2 and 6), it is assumed for the purposes of this report that the salmonid fish kill here was absolute. It is further assumed that the affected stretch extends upstream and downstream of Sites 15 and 5 respectively, to include half the section river between these and the next sites (numbers 16 and 4), where salmonids were found in reasonable numbers. Thus, the total affected length is calculated as being 14.1km. (Diagram 2).

The exact point at which the fish kill commenced is difficult to define in relation to the known discharges into the West Okement. There is some circumstantial evidence that discharges from Meldon Quarry stimulated the mortality. Live fish were found after the incident, downstream of the Quarry tunnel outfall (Table 6, Site 16), although these fish may well have been moved down by the spate of 15/16th. September, from unaffected parts of the river upstream of the tunnel outfall.

Additionally, there was a reduction in the numbers of fish caught at Site 17 (U/s Meldon Quarry) after the incident as compared with the numbers encountered there during the summer survey. This depletion could have been caused by a) natural mortality between sampling dates (11.08.89 and 27.09.89), b) dispersion of fish downstream as a result of the spate of 15/16th. September (because of the proximity of Meldon Dam upstream of the site, there is a limited source of fish to be moved down to replace such emigrants) and c) mortality as a result of the influence of the Red-a-ven Brook.

CALCULATION OF SALMONID FISH LOSS

It is assumed that there was a total salmonid mortality from a point half-way between the A30 Roadbridge and the Quarry Access Roadbridge downstream to a point half-way between Woodhall Bridge and Holne Down (Diagrams 1 and 2).

It is assumed that salmonid densities in the river at the time of the incident were the same as at the time of the 1989 quantitative surveys (Table 1). It is further assumed that densities of fish at each site in this survey were representative of densities in the river upstream and downstream of each site. The river has therefore been split into sections around each sampling site. Upstream and downstream boundaries of each section occur at the half-way points between each site (Diagram 2). Densities of each age group of salmon and trout from a particular survey site have been applied to the total area of the relevant river section to calculate the total loss of fish in that section.

In calculating areas of the sections, river lengths were measured to the nearest 0.1km. from 1:10000 scale O.S. maps. Average river widths have been calculated from field measurements taken at the time of the quantitative surveys. Average width at each site has been applied to the whole of the section associated with that site.

Estimates of fish loss for each section are given in Table 7. Total loss estimates are summarised below:

Species	Age class	Numbers killed
Trout	0+	6472(6500)
	≥1+	8181(8100)
Salmon	0+	68129(68100)
	≥1+	24112(24100)
TOTAL		106894(110000)

Diagram 1

ELECTRIC FISHING SURVEY SITES - RIVER OKEMENT - 1989

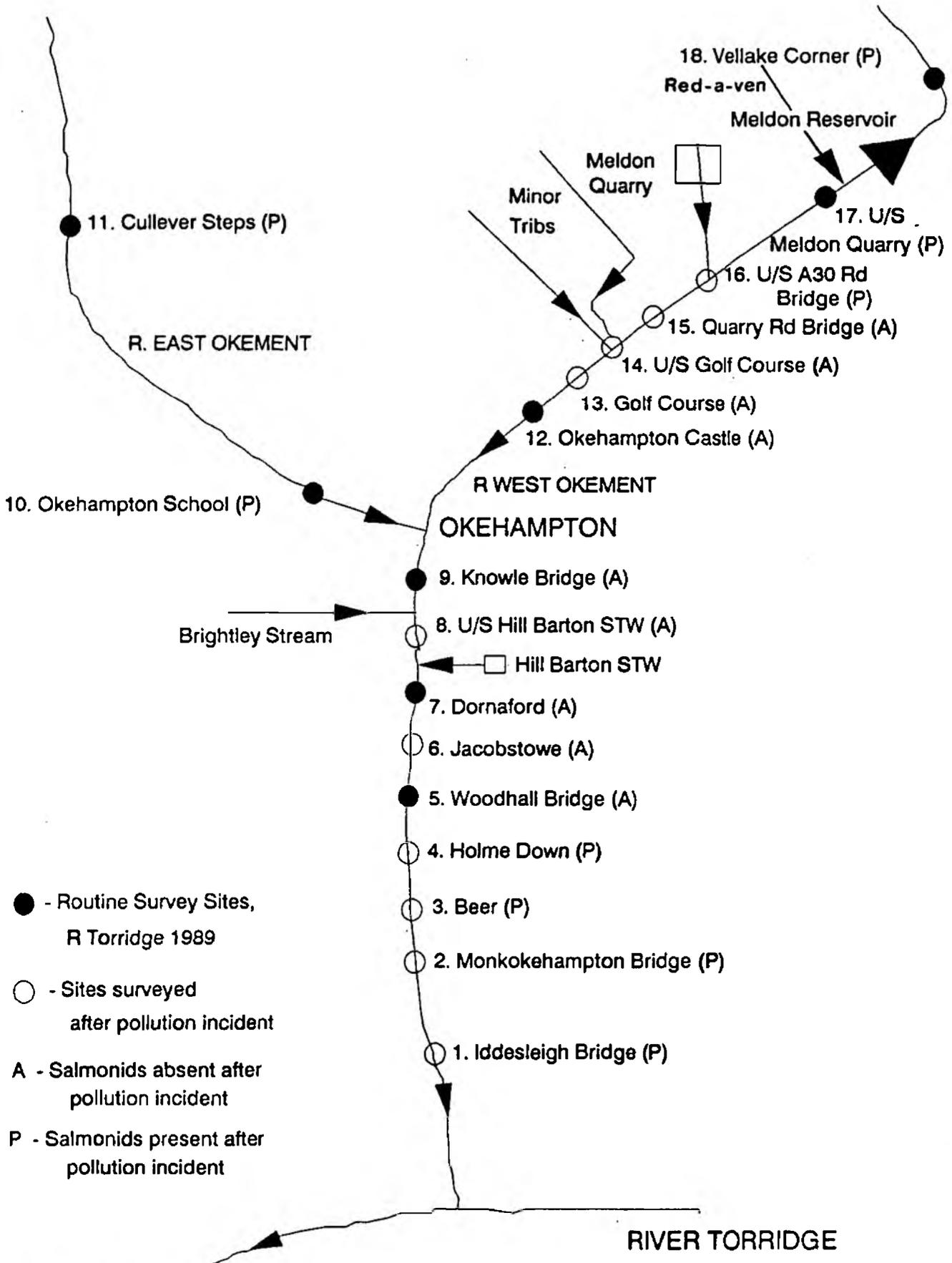
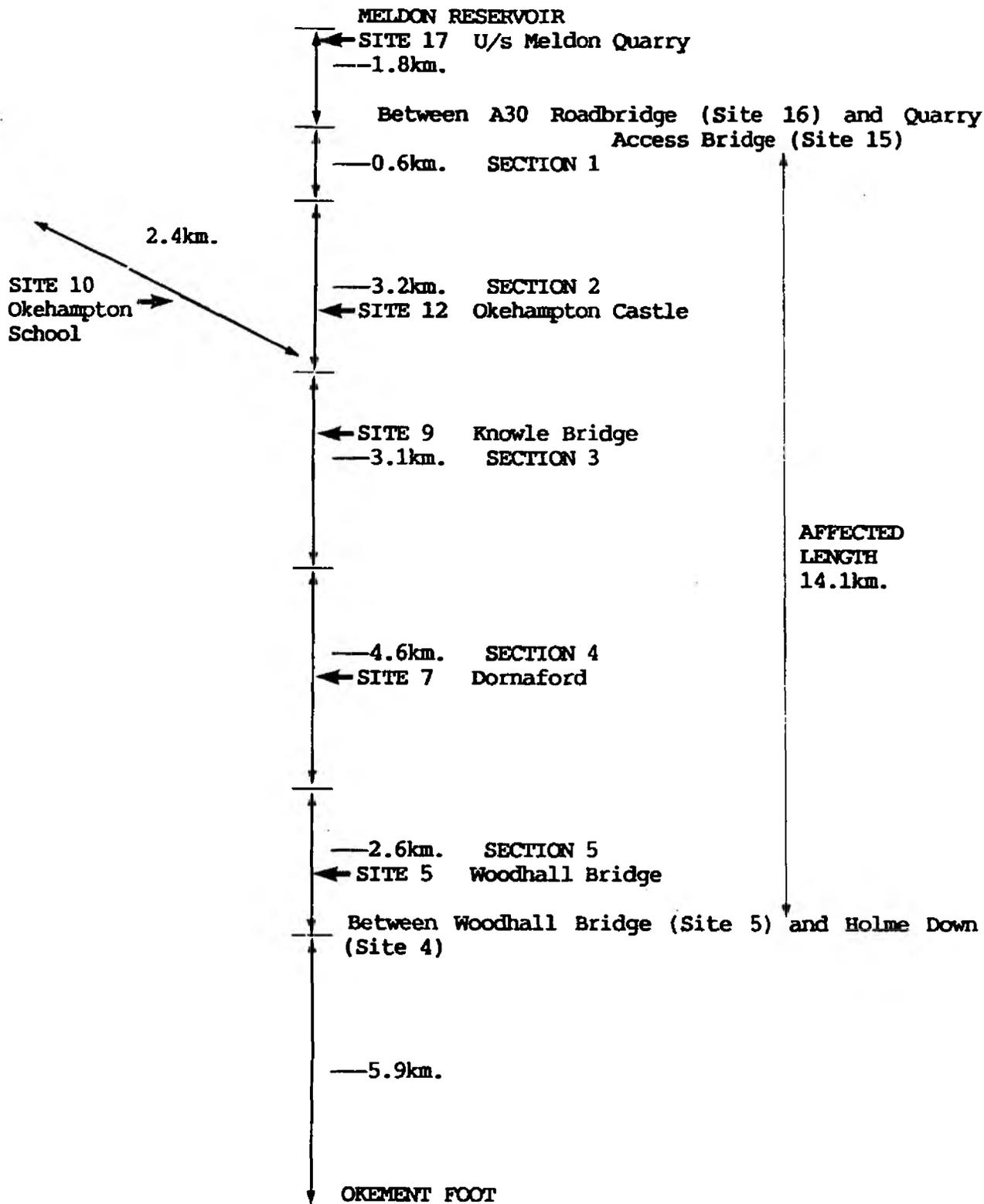


DIAGRAM 2. SURVEY SITES AND RIVER LENGTHS



RIVER OKEMENT: ELECTRIC FISHING SURVEYS: 1989

TABLE 1.

SITE NUMBER	WATERCOURSE	SITE DETAILS		TORRIDGE FISH SURVEY 1989						
		SITE NAME	N.G.R.	DATE FISHED	LENGTH (m)	AVERAGE WIDTH(m)	WETTED AREA(m2)	COND. (uS/cm)	WATER TEMP.	FISHING METHOD
5	RIVER OKEMENT	Woodhall Bridge	SS 585 034	14.07.89	60	10.0	600	150	15.2	A
7		Dornafoord	SX 994 600	29.08.89	65	9.2	598	143	14.1	A
9		Knowle Bridge	593 964	09.08.89	61	9.3	567			A
10	EAST OKEMENT	Okehampton School	595 945	26.06.89	61	5.0	305	67	16.2	B
11		Cullever Steps	606 921	19.06.89	66	2.9	191	48	15.0	C
12	WEST OKEMENT	Okehampton castle	585 943	22.06.89	60	9.4	564	104	12.0	B
17		U/s Meldon Quarry	565 922	11.08.89	66	4.5	297	66	13.9	B
18		Vellake Corner	556 904	04.09.89	74	7.3	540			B

METHOD:-

- A : Quantitative Survey: Triple Shock between stop-nets; 3 anodes
 B : Quantitative Survey: Triple Shock between stop-nets; 2 anodes
 C : Quantitative Survey: Triple Shock between stop-nets; 1 anode

TABLE 2

SPECIES	AGE	NUMBER OF FISH	
		C1	C2
1. WOODHALL BRIDGE			
Trout	0+	6	1
	>=1+	6	4
Salmon	0+	82	68
	>=1+	30	13
2. DORNAFORD			
Trout	0+	20	7
	>=1+	14	3
Salmon	0+	233	135
	>=1+	81	32
3. KNOWLE BRIDGE			
Trout	0+	11	9
	>=1+	23	12
Salmon	0+	153	79
	>=1+	131	64
4. OKEHAMPTON SCHOOL			
Trout	0+	3	1
	>=1+	33	14
Salmon	0+	10	6
	>=1+	7	4
5. CULLEVER STEPS			
Trout	0+	6	1
	>=1+	67	29
6. OKEHAMPTON CASTLE			
Trout	0+	21	7
	>=1+	41	16
Salmon	0+	5	2
	>=1+	7	2
7. D/S MELDON DAM			
Trout	0+	8	2
	>=1+	44	9
Salmon	0+	35	28
	>=1+	10	2
8. VELLAKE			
Trout	0+	102	47
	>=1+	91	41

CAUGHT C3	POPULATION ESTIMATES			POPULATION DENSITIES		
	N	N High	N Low	N	N High	N Low

0	7			1.16		
0	10			1.66		
37	274	420	225	45.59	69.88	37.44
5	50	61	48	8.32	10.15	7.99
5	34	47	32	5.69	7.86	5.35
1	19	21	18	3.18	3.51	3.01
74	537	601	499	89.90	100.50	83.44
15	137	152	130	22.91	25.42	21.74
9	29			5.11		
6	46	67	41	8.11	11.82	7.23
56	359	424	325	63.32	74.78	57.72
24	239	260	227	42.15	45.86	40.04
0	4			1.31		
12	70	108	61	22.95	35.41	20.00
5	21			6.89		
2	13			4.26		
3	10			5.24		
19	131	157	120	68.59	82.20	62.83
4	33	42	32	5.85	7.45	5.67
6	66	75	63	11.70	13.30	11.17
1	8			1.42		
1	10			1.77		
1	11			3.70		
10	66	76	63	22.22	25.59	21.21
18	81			27.27		
4	16			5.39		
11	168	179	162	31.11	33.15	30.00
8	145	155	140	26.85	34.44	25.93

RIVER OKEMENT: ELECTRIC FISHING SURVEYS: 1989

TABLE 3.

		SITE DETAILS	TORRIDGE FISH SURVEY 1989 - POST MORTALITY							
SITE NUMBER	WATERCOURSE	SITE NAME	N.G.R.	DATE FISHED	LENGTH (m)	AVERAGE WIDTH(m)	WETTED AREA(m2)	COND. (uS/cm)	WATER TEMP.	FISHING METHOD
5	RIVER OKEMENT	Woodhall Bridge	SS 585 034	26.09.89	60					A1
7		Dornafor	SX 994 600	26.09.89	65					A1
9		Knowle Bridge	593 964	26.09.89	61					A1
10	EAST OKEMENT	Okehampton School	595 945	02.10.89	61	5.4	329	61	11.0	B1
11		Cullever Steps	606 921	02.10.89	66	3.1	205	52	11.8	C1;S
12	WEST OKEMENT	Okehampton castle	585 943	25.09.89	68	9.7	660			B1
17		U/s Meldon Quarry	565 922	27.09.89	66	5.6	370			B1

METHOD:-

A1: Quantitative Survey: Single Shock between stop-nets; 3 anodes
 B1: Quantitative Survey: Single Shock between stop-nets; 2 anodes
 C1: Quantitative Survey: Single Shock between stop-nets; 1 anode
 S : Sample of fish taken for metals analysis.

TABLE 4.

TORRIDGE FISH SURVEY 1989 - FISH CAUGHT POST MORTALITY

SITE NUMBER	WATERCOURSE	SITE NAME	FISH CAUGHT				BULLHEAD	STONE LOACH	MINNOW	EEL
			TROUT FRY	PARR +	SALMON FRY	PARR				
5	RIVER OKEMENT	Woodhall Bridge	NIL	1	2	1	PRESENT	PRESENT	PRESENT	PRESENT
7		Dornafor	NIL	2	NIL	NIL	PRESENT			PRESENT
9	EAST OKEMENT	Knowle Bridge	1	NIL	NIL	NIL	PRESENT			
10		Okehampton School	3	30	6	6				PRESENT
11		Cullever Steps	18	67						
12	WEST OKEMENT	Okehampton castle	1	1	NIL	NIL				PRESENT
17		U/s Meldon Quarry	7	14	13	4				

RIVER OKEMENT: ELECTRIC FISHING SURVEYS: 1989

TABLE 5.

SITE NUMBER	WATERCOURSE	SITE DETAILS		QUALITATIVE SURVEYS - POST MORTALITY						
		SITE NAME	N.G.R.	DATE FISHED	LENGTH (m)	AVERAGE WIDTH(m)	WETTED AREA(m2)	COND. (uS/cm)	WATER TEMP.	FISHING METHOD
1	RIVER OKEMENT	Iddesleigh Bridge	SS 567 058	20.09.89		11.5		204	14.0	F
2		Monkokehampton Bridge	579 053	26.09.89	62	11.2	694			F
3		Beer	583 047	04.10.89	100	10.9		151	12.6	E
4		Holme Down	584 042	04.10.89	100	10.4		152	11.7	E
6		Jacobstowe	592 017	04.10.89	100	11.2		146	11.4	E
8		U/s Hill Barton STW	SX 981 600	03.10.89	100			131	11.0	E
13		Golf Course	789 660	27.09.89	100			158	13.2	B1
14		u/s Golf Course	574 939	27.09.89	200					D
15		Quarry Road Bridge	567 933	03.10.89	200			178	10.8	D
16		U/s A30 Road Bridge	565 930	25.09.89	59	6.0	354	158	13.9	B1

METHOD:-

D : Qualitative Survey : Single Shock; no stop-nets ; 2 anodes
 E : Qualitative Survey : Single Shock; no stop-nets ; 1 anode
 F : Qualitative Survey : Single Shock for 20 minutes; no stop-nets; 1 anode

TABLE 6.

QUALITATIVE SURVEY SITES - FISH CAUGHT POST MORTALITY

SITE NUMBER	WATERCOURSE	SITE NAME	FISH CAUGHT				BULLHEAD	STONE LOACH	MINNOW	EEL
			TROUT FRY	PARR +	SALMON FRY	PARR				
1	RIVER OKEMENT	Iddesleigh Bridge	NIL	NIL	11	3	PRESENT	PRESENT	PRESENT	PRESENT
2		Monkokehampton Bridge	NIL	1	25	18	PRESENT	PRESENT	PRESENT	PRESENT
3		Beer	1	2	21	10	PRESENT	PRESENT	PRESENT	
4		Holme Down	NIL	2	17	4	PRESENT	PRESENT	PRESENT	PRESENT
6		Jacobstove	NIL	NIL	NIL	1	PRESENT		PRESENT	
8		U/s Hill Barton STW	NIL	NIL	NIL	1				PRESENT
13		WEST OKEMENT	Golf Course	NIL	1	NIL	NIL			PRESENT
14			U/s Golf Course	NIL	NIL	NIL	NIL			PRESENT
15	Quarry Road Bridge		NIL	2	NIL	NIL			PRESENT	
16	U/s A30 Road Bridge		4	24	1	1			PRESENT	

Table 7. Estimated Salmonid Fish Loss for Each Section of River

(See Diagram 2 for location of each section)

SECTION 1

Section Length: 0.6km.
 Average width : 6m.
 Total area : 3600m²

Species	Age class	Density/100m ²	Area(+100)	Fish killed
Trout	0+	3.70	x 36 =	133
	≥1+	22.22	x 36 =	800
Salmon	0+	27.27	x 36 =	982
	≥1+	5.39	x 36 =	194

SECTION 2

Section Length: 3.2km.
 Average width : 9m.
 Total area : 28800m²

Species	Age class	Density/100m ²	Area(+100)	Fish killed
Trout	0+	5.85	x 288 =	1684
	≥1+	11.70	x 288 =	3370
Salmon	0+	1.42	x 288 =	409
	≥1+	1.77	x 288 =	510

SECTION 3

Section Length: 3.1km.
 Average width : 9m.
 Total area : 27900m²

Species	Age class	Density/100m ²	Area(+100)	Fish killed
Trout	0+	5.11	x 279 =	2096
	≥1+	8.11	x 279 =	2263
Salmon	0+	63.32	x 279 =	17666
	≥1+	42.12	x 279 =	11760

Table 7. Continued...

SECTION 4

Section Length: 4.6km.
 Average width : 9m.
 Total area : 41400m²

Species	Age class	Density/100m ²		Area(+100)		Fish killed
Trout	0+	5.69	x	414	=	2356
	≥1+	3.18	x	414	=	1317
Salmon	0+	89.89	x	414	=	37219
	≥1+	22.91	x	414	=	9485

SECTION 5

Section Length: 2.6km.
 Average width : 10m.
 Total area : 26000m²

Species	Age class	Density/100m ²		Area(+100)		Fish killed
Trout	0+	1.16	x	260	=	302
	≥1+	1.66	x	260	=	431
Salmon	0+	45.59	x	260	=	11853
	≥1+	8.32	x	260	=	2163