



FRESHWATER  
BIOLOGICAL  
ASSOCIATION




The **Freshwater Biological Association** is the leading scientific research organisation for the freshwater environment in the United Kingdom. It was founded in 1929 as an independent organisation to pursue fundamental research into all aspects of freshwater biology and chemistry. The FBA has two main laboratories. The headquarters is at Windermere in the Lake District and the River Laboratory is in the south of England. A small unit has recently been established near Huntingdon to study slow-flowing eastern rivers.

The FBA's primary source of funding is the Natural Environment Research Council but, in addition, the Association receives substantial support from the Department of the Environment and the Ministry of Agriculture, Fisheries and Food who commission research projects relevant to their interests and responsibilities. It also carries out contracts for consulting engineers, water authorities, private industry, conservation bodies, local government and international agencies.

The staff includes scientists who are acknowledged experts in all the major disciplines. They regularly attend international meetings and visit laboratories in other countries to extend their experience and keep up to date with new developments. Their own knowledge is backed by a library housing an unrivalled collection of books and periodicals on freshwater science and with access to computerized information retrieval services. A range of experimental facilities is available to carry out trials under controlled conditions. These resources can be made available to help solve many types of practical problems. Moreover, as a member of the Terrestrial and Freshwater Sciences Directorate of the Natural Environment Research Council, the FBA is able to link up with other institutes to provide a wider range of environmental expertise as the occasion demands. Thus, the FBA is in a unique position to bring relevant expertise together for problems involving several disciplines.

Recent contracts have involved a wide variety of topics including biological monitoring, environmental impact assessment, fisheries problems, salmon counting, ecological effects of reservoirs and other engineering works, control of water weeds, control of insect pests and effects of chemicals on plants and animals.

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**FRESHWATER BIOLOGICAL ASSOCIATION**

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A30 Okehampton Bypass  
Control of Pollution  
Biological Monitoring  
Interim Report, September 1988

An interim report to Babbie Shaw & Morton, Consulting  
Engineers

by

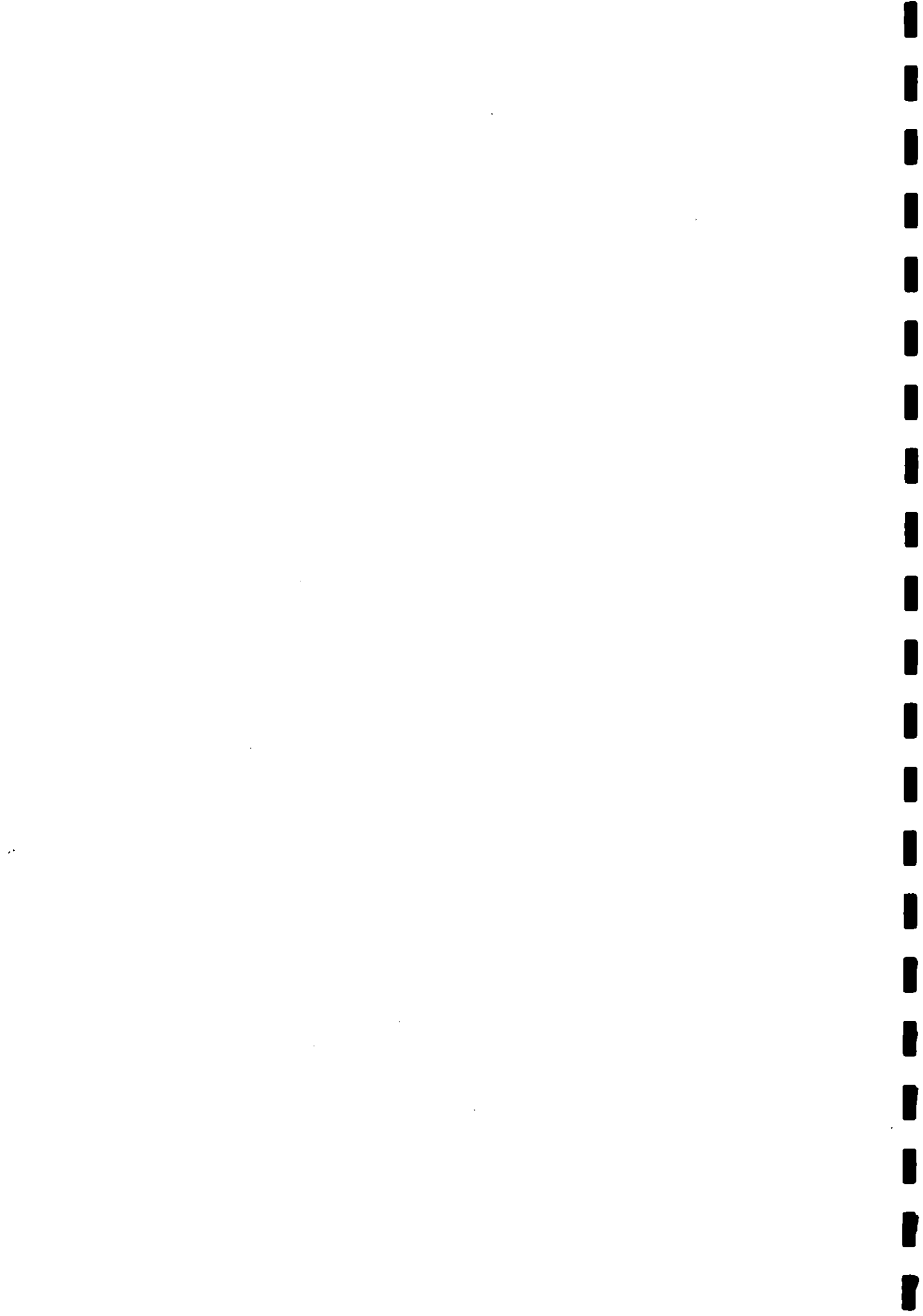
M.T. Furse, J.H. Blackburn & B.E. Dear

Project Leader:	M.T. Furse
Report Date:	October 1988
Report to:	Babbie Shaw & Morton, Consulting Engineers
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**A30 Okehampton Bypass  
Control of Pollution  
Biological Monitoring  
Interim Report, September 1988**

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The Freshwater Biological Association is part of the Terrestrial and Freshwater Sciences Directorate of the Natural Environment Research Council.



Interim Report - September 1988

Sampling Programme

Sampling of aquatic macro-invertebrate communities was undertaken at the following sites on Tuesday 13th September 1988.

West Okement

<u>Code</u>	<u>Site Name</u>	<u>NGR</u>	<u>Chemical sampling point</u>
W1	Vellake Cottage	SX 555 906	SB1
W2	U/S of Meldon Quarry Adit and Bypass	SX 565 928	SB2
W3	D/S of Bypass	SX 566 932	SB3
W4	U/S of Wigney	SX 568 935	SB4
W5	Okehampton Golf Course	SX 575 939	SB5
W6	Okehampton Castle	SX 585 944	SB6

East Okement

E7	U/S of Bypass	SX 604 947	SB7
E8	D/S of Bypass	SX 602 948	SB8
E9	Ball Hill	SX 597 946	SB9
E10	Okehampton Grammar School	SX 589 949	SB10

Sampling Procedure

Three macro-invertebrate samples were collected at each site using a box-sampler of the type recommended by the Standing Committee of Analysts. The area enclosed by the sampler was 0.05 m<sup>2</sup>.

Sample Analysis

Samples were examined in the laboratory. In most cases all macro-invertebrates were removed from the sample for identification, but occasionally sub-sampling procedures were adopted. Most taxa, with the exception of Oligochaeta (worms) and Chironomidae (midges), were identified to species where possible.

The following data were recorded:

1. Abundances of individual species in each sample.
2. Abundances of individual families in each sample.
3. Biological Monitoring Working Party (BMWP) scores, number of scoring taxa and Average Score per Taxon (ASPT). Details of these indices are given in the June 1987 Interim Report.

## Results (Assessment of Environmental Quality)

Full results of the sampling programme are presented at the end of this report (Appendices 1-6).

Heavy rainfall in the Okement catchment in early September led to both the West and East Okement being in spate in the week preceding sampling.

Similar, but less severe spates preceded the samples collected in June 1987 and March 1988.

At the time of sampling water levels had returned to the approximate seasonal norm and no practical difficulties were experienced in data collection.

The likely effects of spate conditions on the macro-invertebrate fauna were outlined in the interim report of March 1988. These are the reduction in numbers due to dislodgement and the displacement of taxa downstream with the current.

### West Okement

The environmental quality of sites W1 and W2, upstream of both the Meldon Quarry adit and the bypass crossing point, continued to be high (Fig. 1; Appendix 3). The index values of both sites lie within, or above, the previously recorded range and compare closely with September 1987.

As on all previous occasions there was a marked decline in environmental quality downstream of the adit and the bypass crossing point (Fig. 1). Furthermore the additional decline in quality between March and June 1988, noted in the June interim report, had not been reversed. Index values for W3 and W4 were very close to the lowest recorded values, of June 1988, whilst at W5 and W6 all three indices (score, number of taxa and ASPT) were as low or lower than at any time during the monitoring period.

The proximity of the quarry adit and the bypass crossing point presents continuing difficulties in identifying the principal source of environmental perturbation of the river. The heavy metal loads and high levels of suspended solids noted in the Railway Stream (Babbie Shaw & Morton 1988) are likely to have had further detrimental effects on the environmental quality W5 and W6 downstream of its confluence with the West Okement. Heavy metal loads were associated with sporadic discharge of piped water from Meldon Quarry whilst the increases in suspended matter were attributed to the bypass construction (Babbie Shaw & Morton 1988).

### East Okement

In the interim report of June 1988 concern was expressed about the gradual decline in the values of indices of environmental quality for sites E9 and E10 at Ball Hall and Okehampton Grammar School.

Attention was drawn to the heavy suspended solid loads observed in the river in March 1988. These emanated from bypass construction works at the river crossing point. No such suspended solid loads were noted during the collection of the June 1988 samples. However, during the September collections a faint milky discolouration of the river was again noted which was also traced to a discharge from construction works at the crossing point.

Despite this, a marked reversal in the apparent decline in environmental quality of E9 and E10 was noted (Table 2).

Environmental quality indices at sites E7 (just upstream of the bypass) and E8 (just downstream of it) were at or near their lowest recorded levels (Table 2). Reduced values for the upstream site suggest that these declines, which are not regarded as evidence of significant environmental disturbance, are not associated with bypass construction work.

Index values for sites E9 and E10 were generally in the upper section of the previously recorded range (Table 2). One possible reason for the improvement on the June values is the early September spate. This would have removed any fine sediment deposited on the stream bed as a result of high loads of suspended matter. It would also have displaced macro-invertebrates downstream "re-setting" the fauna towards its natural condition.

#### Future Programme

In the interim report of June 1988 it was noted that these September samples were the last scheduled for collection. These do not post-date the completion of construction work.

Ideally assessment of the impact of a major engineering project, such as the Okehampton bypass, should include an evaluation of environmental conditions after all work has finished.

It is therefore recommended that consideration is given to supporting a final assessment of the environmental quality of both rivers in June 1989.

Production of the final contract report on the biological studies will await instructions from the contractors.

#### Reference

Battie Shaw & Morton (1988). A30 Okehampton By-pass Control of Pollution. Interim Report No. 2 for period February 1987 to May 1988. Unpublished report to Devon County Council. 11pp plus appendix.

Figure 1. Indices of environmental quality, West Okement, September 1988. Combined box samples.

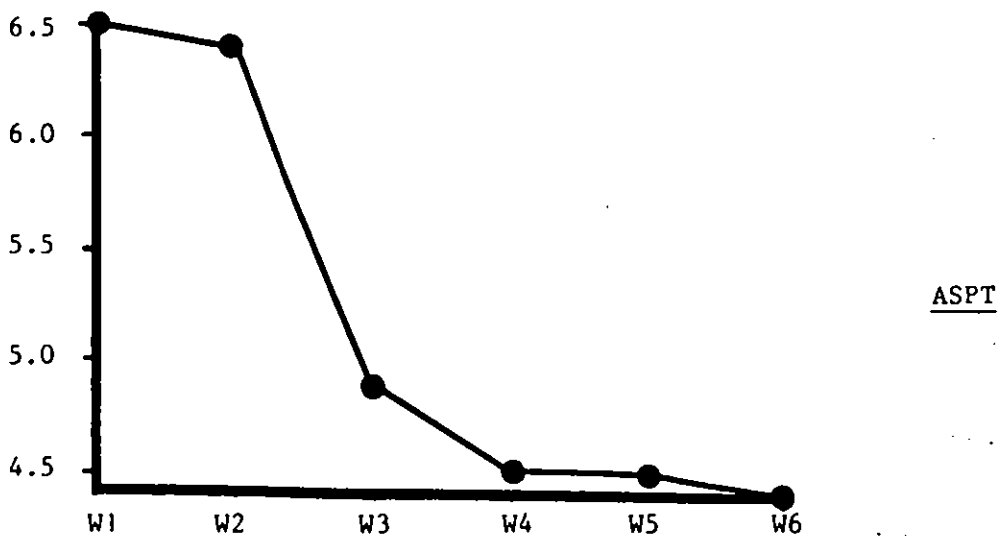
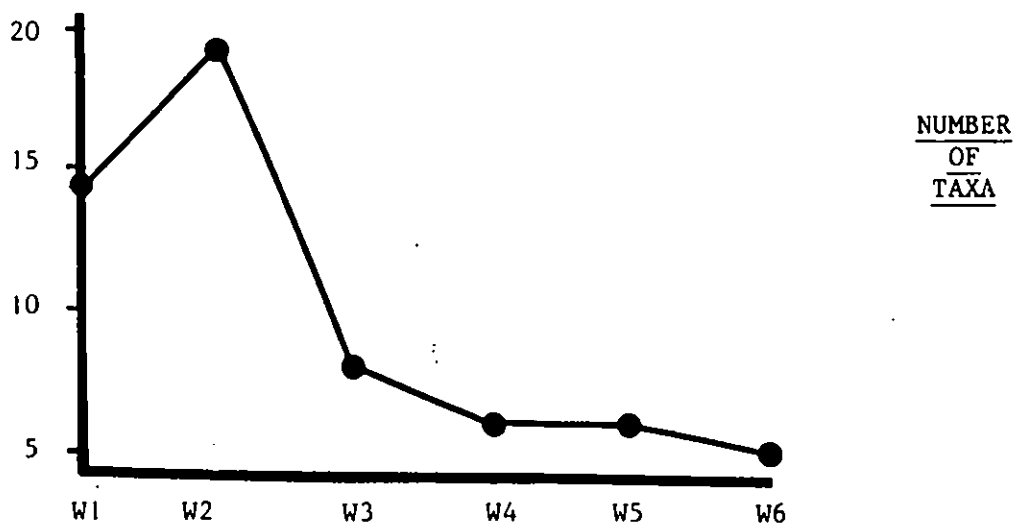
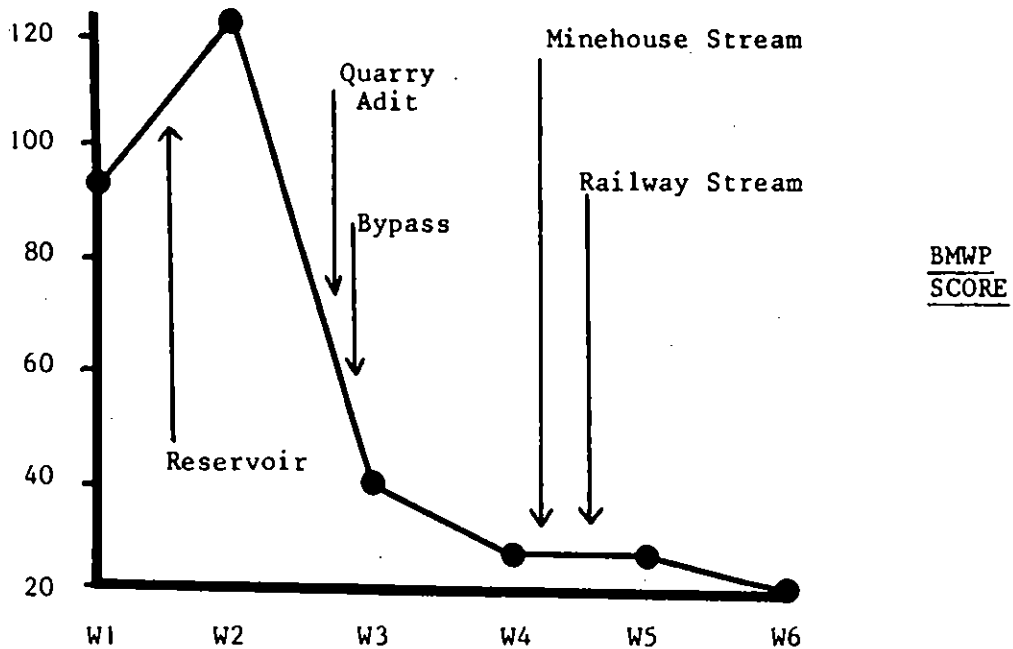
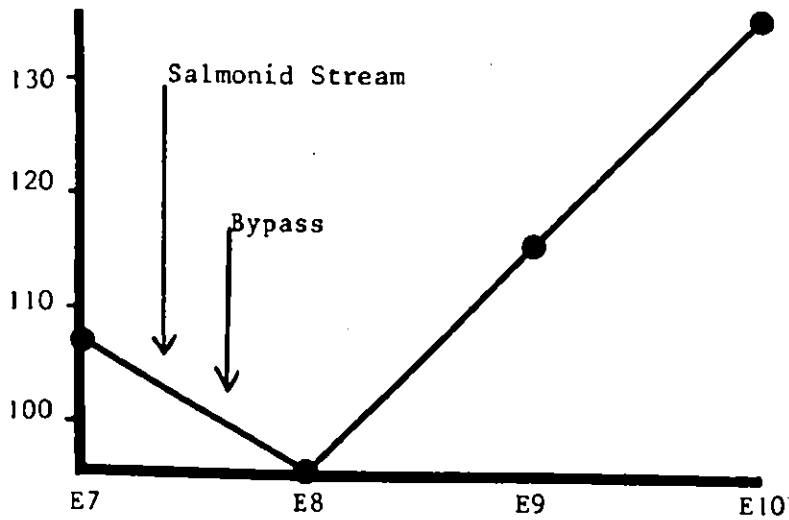




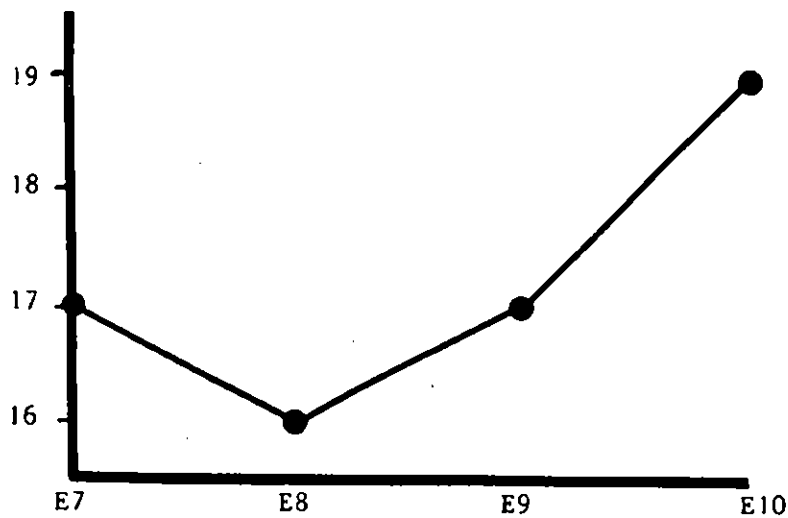
Table 1. Comparison of measures of environmental quality, West Okement, June 87 - September 88

			Score	Taxa	ASPT
W1	June	87	74	12	6.17
Vellake	Sept	87	113	17	6.65
Cottage	March	88	99	15	6.60
	June	88	98	16	6.13
	Sept	88	91	14	6.50
W2	June	87	108	16	6.75
u/s Adit	Sept	87	118	19	6.21
u/s Bypass	March	88	107	16	6.69
	June	88	100	16	6.25
	Sept	88	122	19	6.42
W3	June	87	53	10	5.30
d/s Bypass	Sept	87	63	11	5.73
	March	88	70	11	6.36
	June	88	37	8	4.63
	Sept	88	39	8	4.88
W4	June	87	68	11	6.18
u/s Wigney	Sept	87	40	8	5.00
	March	88	57	9	6.33
	June	88	25	6	4.17
	Sept	88	27	6	4.50
W5	June	87	37	8	4.63
Okehampton	Sept	87	58	11	5.27
Golf Course	March	88	45	8	5.63
	June	88	36	8	4.50
	Sept	88	27	6	4.50
W6	June	87	71	12	5.92
Okehampton	Sept	87	39	8	4.88
Castle	March	88	44	9	4.89
	June	88	48	9	5.33
	Sept	88	22	5	4.40

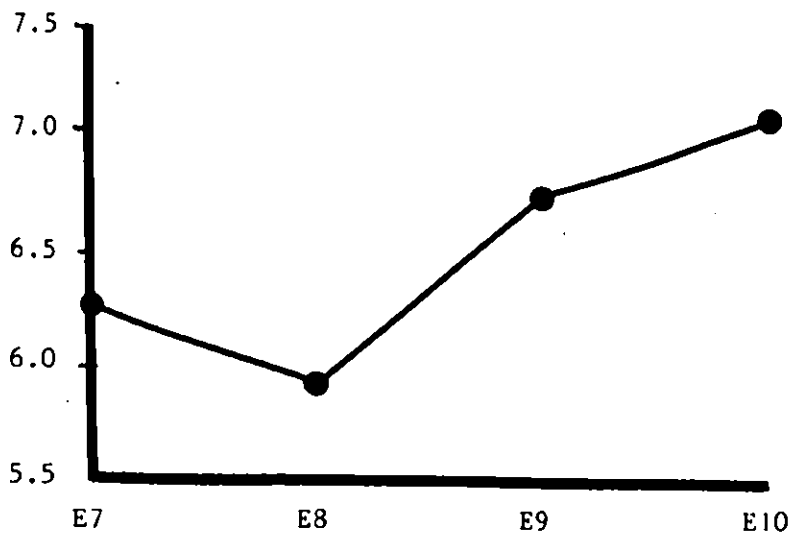
Figure 2. Indices of environmental quality, East Okement, September 1988. Combined box samples.



BMWP  
SCORE



NUMBER  
OF  
TAXA



ASPT

Table 2. Comparison of measures of environmental quality, East Okement, June 87 - September 88

		Score	Taxa	ASPT
E7 u/s Bypass	June 87	93	14	6.64
	Sept 87	135	21	6.43
	March 88	101	16	6.31
	June 88	155	22	7.05
	Sept 88	107	17	6.29
E8 d/s Bypass	June 87	93	16	5.81
	Sept 87	128	20	6.40
	March 88	107	16	6.69
	June 88	119	18	6.61
	Sept 88	95	16	5.94
E9 Ball Hill	June 87	106	17	6.24
	Sept 87	145	21	6.90
	March 88	99	15	6.60
	June 88	94	16	5.88
	Sept 88	115	17	6.76
E10 Okehampton Grammar School	June 87	124	18	6.89
	Sept 87	139	19	7.32
	March 88	95	15	6.33
	June 88	74	12	6.17
	Sept 88	135	19	7.11

ASO OKEHAMPTON BYPASS SCHEME - MACROINVERTEBRATE SURVEY OF THE WEST AND EAST OKEMENT RIVERS.  
WEST OKEMENT - SEPT. 13th 1988 (BS-BOX SAMPLE)  
ABUNDANCES OF INDIVIDUAL SPECIES IN EACH SAMPLE

TAXON NAME	SITE NAME																	
	VELLAKE COTT			U/S ADIT/BYPASS			D/S BYPASS			U/S WIGNEY			GOLF COURSE			OKEHAMPTON CASTLE		
	SITE W1			SITE W2			SITE W3			SITE W4			SITE W5			SITE W6		
	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3
<b>TRICLADIDA (FLATWORMS)</b>																		
Planariidae																		
Polycelis felina	0	0	0	0	0	2	0	0	0	2	1	0	1	0	0	0	0	0
Phagocata vittea	0	1	0	0	0	0	0	0	0	3	0	1	1	0	0	0	0	0
Crenobia alpina	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>BIVALVIA (BIVALVE SNAILS)</b>																		
Sphaeriidae																		
Pisidium sp.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>OLIGOCHAETA (TRUE WORMS)</b>																		
	18	17	93	8	4	12	36	11	2	27	30	19	72	35	61	7	18	9
<b>ARACHNIDA (SPIDERS &amp; MITES)</b>																		
Hydracarina	1	1	1	2	2	0	1	0	1	0	0	0	1	0	1	0	0	0
<b>AMPHIPODA</b>																		
Gammaridae																		
Gammarus pulex	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>EPHEMEROPTERA (MAYFLIES)</b>																		
Baetidae																		
Baetis sp.	0	0	0	0	10	3	1	0	0	0	0	0	0	1	0	0	0	0
Baetis scambus	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Baetis vernus	1	1	1	0	1	3	1	1	0	2	1	0	1	0	1	0	0	0
Baetis rhodani	0	1	0	3	8	5	2	0	1	8	2	0	0	0	0	0	0	0
Heptageniidae																		
Rhithrogena semicolorata	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Ecdyonurus sp.	0	0	1	6	9	5	1	1	0	0	1	1	0	0	0	0	0	0
Leptophlebiidae	2	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephemerelellidae																		
<b>FLECOPTERA (STONEFLIES)</b>																		
Neouridae																		
Protonoeura sp.	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Anphineura sp.	0	2	0	3	6	8	2	0	0	0	0	0	0	0	0	0	0	0
Leuctridae																		
Leuctra sp.	14	13	9	11	2	3	0	0	0	0	0	0	1	0	0	0	0	0
Leuctra inerals	0	1	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0
Leuctra fusca	0	1	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0
Perlodidae																		
Perlodes microcephala	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isoperla grammatica	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Perlidae																		
Dinocras cephalotes	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloroperlidae																		
Chloroperla torrentium	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloroperla tripunctata	0	0	1	8	1	1	0	0	0	0	0	0	0	0	0	0	0	0
<b>COLEOPTERA (BEETLES)</b>																		
Gyrinidae																		
Orectochilus villosus	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Elmidae																		
Elmis aenea	8	10	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limnius volchearti	12	11	26	1	0	0	3	1	0	0	1	1	1	0	2	1	0	1
Dulianius sp.	1	2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2	1

Cont.

A30 OKEHAMPTON BYPASS SCHEME    MACROINVERTEBRATE SURVEY OF THE WEST AND EAST OKEMENT RIVERS,  
WEST OKEMENT - SEPT. 13th 1988 (BS-PQX SAMPLE)  
ABUNDANCES OF INDIVIDUAL SPECIES IN EACH SAMPLE

TAXON NAME	SITE NAME																	
	VELLAKE COTT.			U/S ADIT/BYPASS			D/S BYPASS			U/S WIGNEY			GOLF COURSE			OKEHAMP. CASTLE		
	SITE W1			SITE W2			SITE W3			SITE W4			SITE W5			SITE W6		
	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	PS3
<b>TRICHOPTERA (CADDISFLIES)</b>																		
Rhyacophilidae																		
Rhyacophila sp.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Polycentropodidae																		
Polycentropus sp.	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polycentropus flavomaculatus	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Polycentropus kingi	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Hydropsychidae																		
Hydropsyche sp.	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Hydropsyche pellucidula	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydropsyche siltalai	0	0	0	4	4	10	0	0	0	0	0	0	0	0	0	0	0	0
<b>DIPTERA (TRUE FLIES)</b>																		
Tipulidae																		
Eloeophila sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dicranota sp.	6	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Simuliidae																		
Simulium cryophilum group	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Simulium ornatum group	0	1	0	0	3	0	1	1	0	0	0	0	0	0	0	0	0	0
Simulium variegatum group	0	1	0	3	20	2	2	0	4	0	0	0	0	0	0	0	0	0
Chironomidae	15	12	7	8	51	30	4	1	6	0	3	5	1	4	7	9	8	5
Epididae																		
Wiedemannia group	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Rhagionidae																		
Atherix marginata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

A30 OKEHAMPTON BYPASS SCHEME    MACROINVERTEBRATE SURVEY OF THE WEST AND EAST OKEMENT RIVERS.  
WEST OKEMENT - SEPTEMBER 13th 1988 (BS-BQ1 SAMPLE)  
FAMILY ABUNDANCES

TAXON NAME (BMWP SCORE)	SITE NAME																		
	VELLAKE COTT SITE W1			U/S ADIT/BYPASS SITE W2			D/S BYPASS SITE W3			U/S WIGNEY SITE W4			GOLF COURSE SITE W5			OKEHAMP. CASTLE SITE W6			
	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	
Planariidae (5)	1	1	0	0	0	2	0	0	0	5	1	1	2	0	0	0	0	0	0
Sphaeriidae (3)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OLIGOCHAETA (1)	18	17	93	8	4	12	36	11	2	27	30	19	72	35	61	7	19	9	
Hydracarina (/)	1	1	1	2	2	0	1	0	1	0	0	0	1	0	1	0	0	0	0
Gammaridae (6)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baetidae (4)	1	2	1	3	19	11	4	1	1	10	4	0	1	1	1	0	0	0	0
Heptageniidae (10)	0	0	1	6	11	5	1	1	0	0	1	1	0	0	0	0	0	0	0
Leptophlebiidae	2	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nemouridae (7)	0	2	0	4	7	9	2	0	0	0	0	0	0	0	0	0	0	0	0
Leuctridae (10)	14	15	9	11	7	7	0	0	0	0	0	0	1	0	0	0	0	0	0
Perlodidae (10)	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Perlidae (10)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloroperlidae (10)	0	1	1	8	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Gyrinidae (5)	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Elmidae (5)	21	23	34	2	0	0	3	1	0	1	1	1	1	0	2	1	2	2	2
Rhyacophilidae (7)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Polycentropodidae (7)	1	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0
Hydropsychidae (5)	0	0	0	4	5	10	2	0	0	0	0	0	0	0	0	0	0	0	0
Tipulidae (5)	6	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sieuliidae (5)	0	2	0	3	28	2	3	1	4	0	0	0	0	0	0	0	0	0	0
Chironomidae (2)	15	12	7	8	51	30	4	1	6	0	3	5	1	4	7	9	8	5	5
Epididae (/)	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Rhagionidae (/)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

FIGURES IN PARENTHESES INDICATE THE BIOLOGICAL WORKING PARTY (BMWP) SCORE FOR THE FAMILY. (/)=NON-SCORING TAXON.

A30 OKENHAMPTON BYPASS SCHEME    MACROINVERTEBRATE SURVEY OF THE WEST AND EAST OKENENT RIVERS.  
WEST OKENENT - SEPTEMBER 13th 1988 (BS-BOX SAMPLE)  
BIOLOGICAL MONITORING WORKING PARTY (BMWP) SCORES AND AVERAGE SCORES PER TAXON (ASPT)

INDEX	SITE NAME																	
	VELLAKE COTTAGE SITE W1			U/S ADIT/BYPASS SITE W2			D/S BYPASS SITE W3			U/S WIGNEY SITE W4			GOLF COURSE SITE W5			OKENHAMPTON CASTLE SITE W6		
	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3
BMWP SCORE	49	39	74	83	74	78	39	27	12	15	27	23	27	7	12	8	22	8
COMB. SCORE	91		122			39			27			27			22			
No. TAXA	9	10	11	14	11	13	8	6	4	4	6	5	6	3	4	3	5	3
COMB. No. TAXA	14		19			8			6			6			5			
ASPT	5.44	5.90	6.73	5.93	6.73	6.00	4.88	4.50	3.00	3.75	4.50	3.00	4.50	2.33	3.00	2.67	4.40	2.67
COMB. ASPT	6.30		6.42			4.88			4.50			4.50			4.40			

A30 OKEHAMPTON BYPASS SCHEME    MACROINVERTEBRATE SURVEY OF THE WEST AND EAST OKEMENT RIVERS.  
EAST OKEMENT - SEPT. 13th 1988 (BS=BOX SAMPLE)  
ABUNDANCES OF INDIVIDUAL SPECIES IN EACH SAMPLE

TAXON NAME	SITE NAME											
	U/S BYPASS SITE E7			D/S BYPASS SITE E8			BALL HILL SITE E9			GRAMMAR SCHOOL SITE E10		
	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3
TRICLADIDA (FLATWORMS)												
Planariidae	0	0	1	1	0	0	0	0	0	0	0	0
Polycelis felina	0	0	3	1	1	0	0	1	0	1	0	1
Phagocata vitta	0	0	0	1	3	0	0	2	1	0	0	0
BIVALVIA												
Sphaeriidae												
Pisidium sp.	0	0	0	0	1	0	0	0	0	0	0	0
EASTROPODA (SNAILS)												
Hydrobiidae												
Potamopyrgus jenkinsi	0	0	0	0	0	0	0	0	1	0	0	0
Ancyliidae												
Ancyclus fluviatilis	0	0	1	6	0	0	0	2	2	1	1	6
OLIGOCHAETA (TRUE WORMS)	83	29	39	98	99	73	39	46	38	77	60	85
ARACHNIDA (SPIDERS & MITES)												
Hydracarina	0	1	1	0	0	0	3	1	0	3	1	3
AMPHIPODA												
Gammaridae												
Gammarus pulex	0	0	0	0	0	0	0	0	0	0	1	0
EPHEMEROPTERA (MAYFLIES)												
Baetidae												
Baetis sp.	0	0	0	0	0	0	0	0	19	0	0	0
Baetis scambus	0	0	0	0	0	0	4	1	0	2	2	6
Baetis rhodani	8	4	5	25	54	13	8	62	20	11	5	6
Baetis muticus	0	2	1	0	0	0	0	0	0	0	0	0
Heptageniidae												
Rhithrogena semicolorata	7	9	4	2	0	0	0	0	0	1	0	0
Ecdyonurus sp.	11	12	21	8	4	6	5	0	3	16	6	8
Leptophlebiidae	0	0	0	0	0	0	0	0	0	0	3	0
Ephemerellidae												
Ephemerella ignita	0	0	0	0	0	0	0	1	0	0	0	1
PLECOPTERA (STONEFLIES)												
Neouridae												
Protonemura sp.	0	3	2	0	2	0	0	0	0	1	1	0
Nemoura avicularis	0	0	0	0	0	0	0	0	0	0	1	0
Leuctridae												
Leuctra sp.	1	2	6	2	1	0	2	1	1	0	0	0
Leuctra inermis	0	1	0	0	0	0	0	0	0	0	0	0
Leuctra fusca	0	1	4	0	1	0	0	0	0	0	0	0
Perlodidae	0	0	0	0	0	0	1	0	0	0	0	0
Perloides microcephala	0	0	0	0	0	0	0	0	0	1	0	0
Chloroperlidae												
Chloroperla sp.	0	0	0	1	0	0	0	0	0	0	0	0
Chloroperla torrentium	0	1	1	0	0	0	0	0	0	0	0	0
Chloroperla tripunctata	2	15	25	0	1	2	1	0	0	2	0	0

Cont.



A30 OKEMHAMPTON BYPASS SCHEME    MACROINVERTEBRATE SURVEY OF THE WEST AND EAST OKEMENT RIVERS.  
EAST OKEMENT - SEPT, 13th 1988 (BS=BOX SAMPLE)  
ABUNDANCES OF INDIVIDUAL SPECIES IN EACH SAMPLE

TAXON NAME	SITE NAME											
	U/S BYPASS SITE E7			D/S BYPASS SITE E8			BALL HILL SITE E9			GRAMMAR SCHOOL SITE E10		
	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3
<b>COLEOPTERA (BEETLES)</b>												
Hydrophilidae												
Hydraena gracilis	1	3	0	0	0	0	0	0	0	0	0	0
Elmidae												
Elmis aenea	0	2	2	5	0	0	3	7	3	3	7	14
Esolus parallelipedus	0	0	0	0	1	0	3	5	3	2	5	2
Lianius volckowi	2	2	1	15	1	5	11	10	3	16	14	9
Oulimnius sp.	0	0	1	0	0	0	4	1	1	6	5	2
Oulimnius tuberculatus	0	0	0	0	0	0	0	1	0	0	0	0
<b>TRICHOPTERA (CADDISFLIES)</b>												
Rhyacophilidae												
Rhyacophila sp.	0	0	0	1	0	1	0	0	0	0	0	1
Rhyacophila dorsalis	0	0	0	0	2	1	2	0	0	0	0	0
Agapetus sp.	0	0	0	1	0	1	0	0	0	0	0	1
Polycentropodidae												
Polycentropus sp.	0	0	0	0	0	0	0	0	1	0	0	0
Polycentropus flavomaculatus	0	0	1	0	0	0	0	0	0	0	0	0
Hydropsychidae												
Hydropsyche siltalai	0	2	0	1	4	0	2	6	1	3	0	0
Odontoceridae												
Odontocerum albicorne	0	0	0	0	0	0	0	0	0	0	0	1
Leptoceridae												
Athripsodes sp.	0	0	0	0	0	0	0	0	0	0	1	1
Goeridae												
Silo pallipes	1	1	0	0	0	0	0	0	0	0	0	0
Lepidostomatidae												
Lepidostoma hirtum	0	0	0	0	0	0	0	0	1	0	0	0
Sericostomatidae												
Sericostoma personatum	0	0	1	1	1	1	1	0	2	2	1	3
<b>DIPTERA (TRUE FLIES)</b>												
Diptera indet.												
Diptera indet.	0	0	0	0	0	0	0	0	0	0	1	1
Tipulidae												
Dicranota sp.	2	2	3	2	0	1	0	0	0	0	0	0
Simuliidae												
Simulium cryophilus	0	3	0	0	0	0	0	0	0	0	0	0
Simulium ornatum group	0	0	1	0	0	0	0	0	0	0	0	0
Simulium variegatum group	0	1	1	0	3	2	0	0	0	0	0	0
Ceratopogonidae												
Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	1	0
Chironomidae												
Chironomidae	3	6	8	20	12	9	7	9	14	31	16	16
Empididae												
Empididae	0	0	0	0	0	0	0	0	1	0	0	0
Chelifera group												
Chelifera group	0	0	0	0	1	0	0	0	2	2	0	2
Hemerodromia group												
Hemerodromia group	0	0	0	0	0	0	0	0	1	0	0	1
Wiedemannia group												
Wiedemannia group	1	0	0	1	2	0	3	0	0	1	3	2
Rhagionidae												
Atherix marginata	0	1	0	1	3	0	1	2	0	0	0	2

A30 OKEHAMPTON BYPASS SCHEME    MACROINVERTEBRATE SURVEY OF THE WEST AND EAST OKENENT RIVERS.  
EAST OKENENT - SEPTEMBER 13th 1988 (BS=BOX SAMPLE)

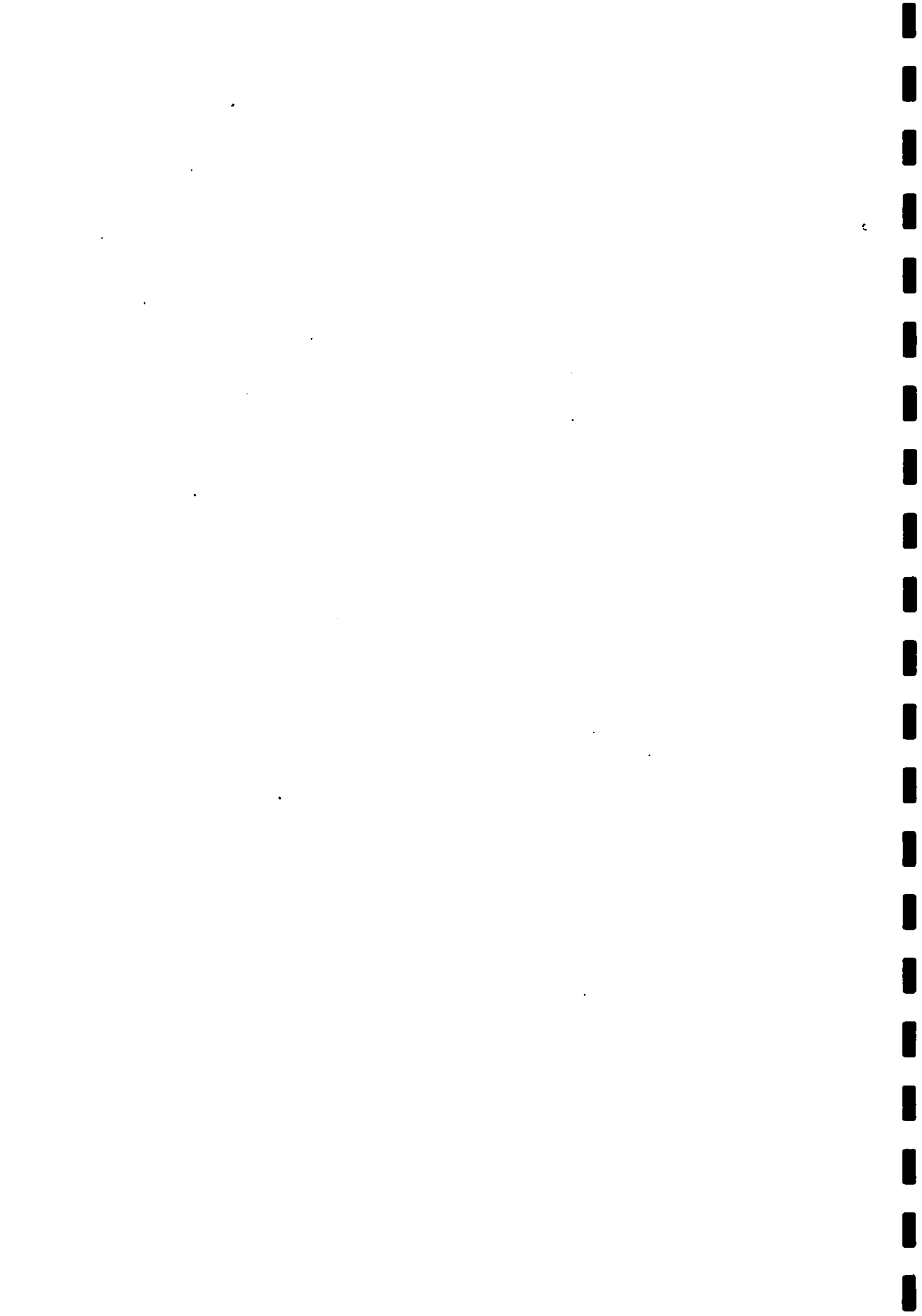
FAMILY ABUNDANCES

<u>TAXON NAME (BMWP SCORE)</u>	<u>SITE NAME</u>											
	<u>U/S BYPASS</u>			<u>D/S BYPASS</u>			<u>BALL HILL</u>			<u>GRAMMAR SCHOOL</u>		
	<u>SITE E7</u>			<u>SITE E8</u>			<u>SITE E9</u>			<u>SITE E10</u>		
	<u>BS1</u>	<u>BS2</u>	<u>BS3</u>	<u>BS1</u>	<u>BS2</u>	<u>BS3</u>	<u>BS1</u>	<u>BS2</u>	<u>BS3</u>	<u>BS1</u>	<u>BS2</u>	<u>BS3</u>
Planariidae (5)	0	0	4	3	4	0	0	3	1	1	0	1
Hydrobiidae (3)	0	0	0	0	0	0	0	0	1	0	0	0
Ancylidae	0	0	1	6	0	0	0	2	2	1	1	6
Sphaeriidae (3)	0	0	0	0	1	0	0	0	0	0	0	0
OLIGOCHAETA (1)	83	29	39	98	99	73	39	46	38	77	60	85
Hydracarina (/)	0	1	1	0	0	0	3	1	0	3	1	3
Gammaridae (6)	0	0	0	0	0	0	0	0	0	0	1	0
Baetidae (4)	8	6	6	25	54	13	12	63	39	13	7	12
Heptageniidae (10)	18	21	25	10	4	6	5	0	3	17	6	8
Leptophlebiidae (10)	0	0	0	0	0	0	0	0	0	0	3	0
Ephemerellidae (10)	0	0	0	0	0	0	0	1	0	0	0	1
Nemouridae (7)	0	3	2	0	2	0	0	0	0	1	2	0
Leuctridae (10)	1	4	10	2	2	0	2	1	1	0	0	0
Perlodidae (10)	0	0	0	0	0	0	1	0	0	1	0	0
Chloroperlidae (10)	2	16	26	1	1	2	1	0	0	2	0	0
Hydrophilidae (5)	1	3	0	0	0	0	0	0	0	0	0	0
Elmidae (5)	2	4	4	20	2	5	21	24	10	27	31	27
Rhyacophilidae (7)	0	0	0	2	2	3	2	0	0	0	0	2
Polycentropodidae (7)	0	0	1	0	0	0	0	0	1	0	0	1
Hydropsychidae (5)	0	2	0	1	4	0	2	6	1	3	0	0
Dontoceridae (10)	0	0	0	0	0	0	0	0	0	0	0	1
Leptoceridae (10)	0	0	0	0	0	0	0	0	0	0	1	1
Goeridae (10)	1	1	0	0	0	0	0	0	0	0	0	0
Lepidostomatidae (10)	0	0	0	0	0	0	0	0	1	0	0	0
Sericostomatidae (10)	0	0	1	1	1	1	1	1	2	2	1	3
Tipulidae (5)	2	2	3	2	0	1	0	0	0	0	0	0
Simuliidae (5)	0	4	1	0	3	2	0	0	0	0	0	0
Ceratopogonidae (/)	0	0	0	0	0	0	0	0	0	0	1	0
Chironomidae (2)	3	6	8	20	12	9	7	9	14	31	16	16
Empididae (/)	1	0	0	1	3	0	3	0	4	3	3	5
Rhagionidae (/)	0	1	0	1	3	0	1	2	0	0	0	2

FIGURES IN PARENTHESES INDICATE THE BIOLOGICAL WORKING PARTY (BMWP) SCORE FOR THE FAMILY.  
 (/)=NON-SCORING TAXON.

AJO OKEHAMPTON BYPASS SCHEME    MACROINVERTEBRATE SURVEY OF THE WEST AND EAST OKEMENT RIVERS.  
EAST OKEMENT - SEPTEMBER 13th 1988 (BS-BOX SAMPLE)  
BIOLOGICAL MONITORING WORKING PARTY (BMWP) SCORES AND AVERAGE SCORES PER TAXON (ASPT)

INDEX	SITE NAME											
	U/S BYPASS SITE E7			D/S BYPASS SITE E8			BALL HILL SITE E9			GRAMMAR SCHOOL SITE E10		
	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3	BS1	BS2	BS3
BMWP SCORE	62	79	87	80	84	59	74	58	78	75	71	87
COMB. SCORE		107			95			115			135	
No. TAXA	10	13	14	13	14	10	11	10	13	12	11	13
COMB. No. TAXA		17			16			17			19	
ASPT	6.20	6.08	6.21	6.15	6.00	5.90	6.73	5.80	6.00	6.25	6.45	6.69
COMB. ASPT		6.29			5.94			6.76			7.11	



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