A STUDY INTO THE MACROINVERTEBRATE FAUNA & WATER QUALITY OF LUNDY ISLAND'S LOTIC ENVIRONMENT.

By

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INTRODUCTION

In addition to its geographical isolation, Lundy Island also has specific characteristics related to its geology, terrestrial habitats and its climate. The factors influencing the island's aquatic habitats make them very different to those located on the mainland. It would follow that the biocoenosis of streams should be influenced by this difference and this, in turn, should be displayed in the aquatic community structure.

Very little work has been done on island lotic habitats. Lundy itself hasn't been extensively surveyed to date, although two streams were investigated by George and Sheridan (1986), so a detailed survey covering the entire island would offer the opportunity of breaking new ground and would also create a foundation for future studies.

Although the island's streams are subjected to gross fluctuations in conditions, especially in flow and temperature, it was considered that a richer community than that previously found could exist on the island. It was also the aim of this survey to assess the water quality of the island's streams and relate this to the macroinvertebrate fauna.

As a result, a thorough biological, physical and chemical survey of the island's less temporary streams was conducted in the summer of 1993.

METHODS

Before the main survey was undertaken a feasibility study was carried out; this consisted of a systematic appraisal of each of the island's major watercourses and the invertebrate communities found therein. This was necessary in order to determine whether enough useful data could be collected to constitute a worthwhile and viable project. A sampling strategy was then chosen which would enable the maximum amount of useful data to be collected within the constraints of time and available resources. Only six streams were considered suitable for inclusion in the main survey; these are identified in Table 1.

The main survey was carried out during the last two weeks of July and the first two weeks of August 1993. This coincided with a period of dry weather and the lowest flows of the year; by the completion of the survey only these six streams were experiencing any degree of sustained flow.

Table 1: Map reference of streams selected for inclusion in the survey.

Stream Code	Stream Name	O.S. Map Reference
West 1	St. Peter's Stone stream	MR 1333.4697
West 2	St. Mark's Bay stream	MR 1329.4634
West 3	Pyramid stream	MR 1330.4609
West 4	Punchbowl stream	MR 1318.4548
East 1	Gannets' Bay (main stream)	MR 1332.4750
East 2	St. John's stream	MR 1385.4384

Physical and Chemical Parameters:

Mapping: Each of the streams considered viable for the survey was mapped by standard surveying techniques, using a theodolite and staff (Fig. 1).

Flow/discharge: The streams were irregular and small in cross-sectional area, with greatly reduced flow. Conventional methods of measuring flow could not be employed and so the actual discharge of stream water at the cliff edge was measured against time.

Dissolved oxygen & temperature: A dissolved oxygen and temperature meter (pHOX® Type 67) was employed in the field to gather continuous data from each stream; the data being logged against time for a period of 48 hours. In each case the meter was set up with the probe situated towards the lower reaches of the stream, in a site of unimpeded flow and beyond the immediate oxygenating influence of either waterfalls or rapids (Fig. 2).

pH: This was measured using a calibrated meter (Whatman® PHA 300® Stick Meter). Readings were taken from five standard sites, spaced equidistantly along the samplable length of each stream.

Conductivity: Readings were taken from the five standard sites, using a calibrated meter (Whatman® CDM 270® Conductivity Meter).

Total hardness: Five replicate samples were taken at each of the five standard sites along each stream and analysed using the standard Ethylene-diaminetetra-acetic acid (EDTA) titration method.

Suspended solids: Five replicate samples were taken from the point of discharge of each stream and filtered through preweighed filters (7 cm Whatman® GF/C Glass Microfibre Filters). These were then dried and reweighed; the difference in weight equating to the suspended solid content.

Biochemical oxygen demand: The standard method for the determination of B.O.D. was used, with a five day incubation period at a constant 20°C; five replicate samples being taken from the five standard sites along each stream. Dissolved oxygen was measured using an OXI 196® microprocessor oximeter.

Laboratory testing of water quality: Water samples were systematically taken from the five standard sites along each stream and analysed at the field laboratory using a WPA Hydrocheck® HC6000 photometer. Samples were analysed for Ammonia, Phosphate, Nitrate and Silicate; five replicates being used in each analysis to enable statistical testing to be carried out.

Macroinvertebrates:

In order to accurately estimate the spatial distribution of each stream's macroinvertebrate community, each area of microhabitat was sampled intensively. This was necessary to obtain the maximum possible proportion of those communities, thereby ensuring that species of low abundance would be represented in the samples.

As the streams on Lundy are small and the substrate mostly of boulder or bedrock, standard 'kick-sampling' techniques were found to be inappropriate; a combination of methods was therefore adopted. Firstly, a variation of the standard 'kick-sampling' method (Macan 1958; Haynes 1961) was used, where a net is held against the stream bed and the benthic fauna displaced from the substrate upsteam. Typically, the substrate is vigorously agitated by kicking; however as the small size of the streams made this inappropriate, an alternative method of agitation was chosen. A three pronged gardening implement, a hand cultivator, was tried and proved to be more efficient at dislodging macroinvertebrates from the variety of substrates encountered, and so was adopted for the main survey. The stream beds were very irregular, so two nets were used in conjunction; a small, fine meshed, hand net with a flexible wire frame, which could be pressed into small areas, and a standard, firm framed, FBA net (0.96mm mesh) positioned 1 metre downstream, to catch anything initially missed. Also incorporated into the sampling strategy was the rock washing method used by Macan (1958). Rocks and macrophytes were washed in the current at the mouth of the net to dislodge any

Fig. 1: Mapping of streams in preliminary survey, using theodolite & staff; P. Clabburn assisting. *(Photo: P.S. Long)*

Fig. 2: The pHOX® Type 67 Logging D.O.Temperature meter deployed at one of the sampling stations, St. Mark's Bay Stream (West 2) *(Photo: P.S. Long)*

specimens adhering to them.

In addition to these two methods, each stream was examined along the lines of a standard search,, with large stones, macrophytes, gravel and areas of bed-rock being very carefully inspected for species not obtained by the other methods.

Macrophytes (bryophytes):
In accordance with the results of the preliminary survey, only bryophytes were considered appropriate for sampling. Unlike the sampling strategy adopted for macroinvertebrates, there were no plans to quantitatively compare communities or distributions, so sampling was neither extensive nor random. Samples of bryophytes were collected, where encountered, during macroinvertebrate sampling and identified to species level in the field laboratory.

Plankton:
Samples were taken to determine whether the water flowing into the streams, from the wetlands on the plateau, had a retention time long enough to maintain a zooplankton population. Sampling was conducted at each stream's point of discharge using a standard FBA (0.96mm mesh) net. Being purely qualitative, no standardisation of sampling protocol was adopted. Samples were identified in the field laboratory using binocular microscopes.

Epilithon:
Microscope slides were placed in each stream and left for a period of seven days. When collected, due to the constraints of time, the epilithic growth was not assessed qualitatively, but purely on the basis of density (percentage cover).

Water Quality Assessment:
In addition to physiochemical determinants, the macroinvertebrate fauna was also used to determine water quality. The B.M.W.P. (Biological Monitoring Working Party) score for each stream was calculated along with the A.S.P.T. (average score per taxa). These were then used to classify each stream into categories ranging from 'Unsatisfactory' to 'Excellent' (after Extence et al, 1987).

The water quality data was analysed using basic analysis of variance (ANOVA), comparison of means and principle component analysis (PCA) to compare the streams and the regions of the island in which they fell. Results of these analyses are given in the complete account of this survey, (Long, 1993).

RESULTS

Physical and Chemical Parameters:

Table 2. Results of Physical/Chemical Survey.

	E1	W1	W2	W3	W4	E2
Mean Depth (m)	0.014	0.028	0.024	0.018	0.033	0.040
Mean Width (m)	0.43	0.25	0.24	0.20	0.68	0.62
Mean Slope	0.25	0.37	0.44	0.41	0.47	0.45
Discharge (l/s)	0.25	0.22	0.30	0.50	0.80	0.65
Mean Temperature [48hrs] (°C)	13.70	13.36	14.34	12.79	15.75	12.49
Mean D.O. [48hrs] (%)	54.3	80.1	74.0	99.3	57.2	86.7
pH	4.05	5.22	5.85	4.31	5.95	6.95
Conductivity (µs)	691	1175	865	363	539	711
Total Hardness (mg/l)	15.2	18.4	13.6	12.8	12.8	20.4
S.S. (mg/l)	0.0052	0.0065	0.0057	0.0079	0.0072	0.0120
B.O.D. (mg/l)	3.5	2.1	2.0	2.5	3.2	3.8

Ammonia (mg/l)	0.076	0.047	0.041	0.045	0.063	0.060
Phosphate (mg/l)	0.027	0.027	0.013	0.057	*	0.593
Nitrate (mg/l)	*	*	*	*	*	*
Silicate (mg/l)	1.530	0.947	0.745	1.117	1.260	1.567

*	Undetectable

Macroinvertebrates:

Different groups dominated different streams across the island, however, the Diptera appeared to have had a consistently strong presence throughout, as did the Trichoptera. The dominant family of Diptera present on the island were the Chironomidae; and of the Trichoptera, the Polycentropodidae were most commonly encountered. Overall, and individually in all the streams except for West 1 and 2, these two groups made up over one half of all the aquatic macroinvertebrates sampled.

Another interesting group which also constituted a large proportion of the island's aquatic community were the Crustacea. Two common species dominated this group, the amphipod *Gammarus duebeni* (Liljeborg) and the isopod *Asellus meridianus* (Racovitza), both tolerant of saline water and commonly found on small islands; also present, but only found in small numbers, was a saline tolerant, but less common species of amphipod, *Crangonyx pseudogracilis* (Bousfield).

The Mullusca were also very prominent, although this was mainly due to the very large abundance of Hydrobiidae found in streams East 2 and West 3.

The community structure of most of the streams was quite typical of acidic upland habitats, with low species richness but reasonable to good A.S.P.T.; the main exception being East 2 which, with a near neutral pH regime, had the greatest species richness of all the streams sampled, (Fig. 3).

The complete species list for each stream (Appendix A) has been summarised to family level in Table 3.

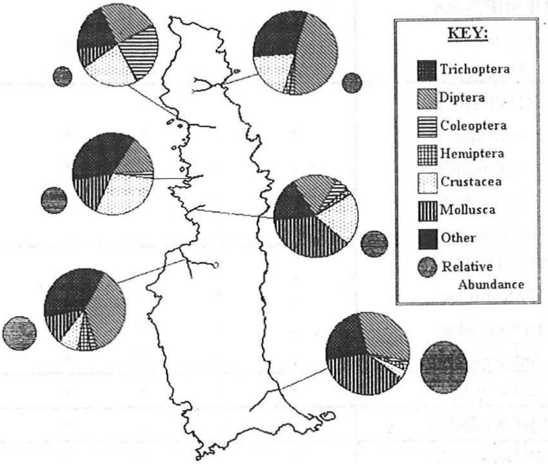

Fig. 3: Distribution & relative abundance of aquatic macroinvertebrates recorded in the streams on Lundy Island.

Table 3. Summary of macroinvertebrate sampling data from the streams of Lundy Island.

	E1	E2	W1	W2	W3	W4
TRICHOPTERA						
Beraeidae	-	*	-	-	-	-
Hydroptilidae	-	-	-	*	*	*
Limnephilidae	-	*	-	-	-	-
Philopotamidae	-	*	-	*	-	*
Polycentropodidae	*	*	*	*	*	*
Psychomyidae	-	*	*	*	*	-
DIPTERA						
Ceratapogonidae	*	-	-	*	*	-
Chironomidae	*	*	*	*	*	*
Culicidae	-	*	-	-	-	-
Dixidae	-	*	-	-	-	-
Psychodidae	-	*	-	-	-	-
Simuliidae	*	*	-	*	*	*
Tipulidae	*	*	*	*	*	*
COLEOPTERA						
Dryopidae	-	-	*	*	*	-
Dytiscidae	-	*	-	-	-	-
Elmidae	*	-	-	-	-	-
Hydrophilidae	-	*	*	*	*	*
Hygrobiidae	-	-	-	-	-	*
HEMIPTERA						
Corixidae	-	-	-	-	*	*
Veliidae	*	*	-	-	-	*
CRUSTACEA						
Asellidae	*	*	*	*	*	*
Crangonictidae	-	-	-	*	-	*
Cyprididae	-	*	-	*	*	-
Gammaridae	-	-	-	-	*	*
MOLLUSCA						
Hydrobiidae	-	*	*	*	*	*
Lymnaeidae	-	*	*	*	-	-
Sphaeriidae	-	*	*	*	-	-
OLIGOCHAETA	*	*	*	*	*	*
HIRUNDINEA	-	-	-	*	-	-
HYDROZOA	-	-	*	*	-	-
PLATYHELMINTHEA	-	*	-	-	-	*

KEY * Present - Absent

Macrophytes (Bryophytes):

There were several different Bryophytes growing densely throughout each stream. Members of the Hepaticae dominated in the more acidic streams and were more sparse in the others. Sphagnum was found in all the island's streams to greater or lesser degrees.

Table 4. Aquatic Bryophytes recorded in surveyed streams.

	E1	E2	W1	W2	W3	W4
HEPATICAE						
Conocephalum conicum	*	*	-	-	-	-
Pellia epiphylla	*	*	*	*	*	*
Scapania undulata	*	*	*	*	*	*
Solenostoma triste	*	-	-	-	-	-
MUSCI						
Fissidens bryoides	-	-	-	-	*	*
Fontinalis antipyretica	*	*	*	*	*	*
Hyocomium armoricum	-	-	-	*	-	-
Rhynchostegium reparioides	-	-	-	-	*	*
Sphagnum spp.	*	*	*	*	*	*

KEY * Present - Absent

Plankton:

A range of organisms was collected from each of the streams; with larger abundances in those streams with expansive areas of bogland in their catchments. The samples were dominated by Copepoda (e.g. Cyclops spp.) and Branchiopoda (e.g. Daphnia spp.)

Epilithon:

The growth of the epilithon observed after a seven day period was such as to confirm that primary production was a potentially major source of energy input to the lotic system. The trophic importance of this had not been recognised in previous work on the island.

Water Quality:

The physical/chemical survey showed the island's streams to be of relatively good quality. However, the mean dissolved oxygen concentration in streams East 1 and West 4 over the 48 hour period monitored, was slightly low; the B.O.D. of streams East 1 and East 2 were slightly too high and the pH of streams East 1 and West 3 were too low to be of the generally required standard. Considering the nature of these streams, the deviation from the required standard was not too great. Biological assessment of the water quality confirmed this, with the majority of the streams achieving good quality status (Table 5).

Table 5. Biological Assessment of water quality.

Stream Code	B.M.W.P. Score	A.S.P.T.	Classification
West 1	45	4.09	Moderate
West 2	73	4.56	Good
West 3	61	4.59	Good
West 4	66	4.71	Good
East 1	28	4.00	Moderate
East 2	80	5.00	Good

DISCUSSION

The cliff-top streams of Lundy Island were assessed for water quality and aquatic macroinvertebrate community composition. Water quality analysis gave no indication of excessive organic pollution or nutrient enrichment resulting from the livestock farming carried out on the island; although the stream rising in the main region of habitation (East 2) was influenced in its lower reaches by severe, intermittent organic pollution of domestic origin.

Due to the predominantly metamorphic nature of the underlying rock and an accumulated layer of overlying peat, the streams were nutrient poor and exhibited a pH range, in dry conditions, of between 4 and 6 pH units. This range was seen to extend to below pH 4 during periodic rain events, when accumulated H+ ions were washed into the streams. Many of the streams experienced a short-term drop in pH during these periods.

Extensive macroinvertebrate sampling of each of the more permanent streams showed the island's benthic fauna to be considerably impoverished. However, many taxa new to the island's records were identified; previous to this survey only one species of Trichoptera, *(Plectrocnemia conspersa)*, and one family of Diptera, (Tipulidae), had been recorded in the island's streams.

The reasons for the impoverished fauna are varied. The absence of some groups identified in comparisions with similar mainland streams, (e.g. Plecoptera, which are known to be poor fliers), illustrates the effect of geographical isolation on island community structure, and evidence exists of a relationship between pH regime and benthic community structure, with low pH being the major factor limiting species number at levels below pH5 (Fryer 1980). In addition, the influence of food supply and habitat can also be considered as possible limiting factors to species richness.

Although many factors were shown to contribute to the faunal impoverishment, it became apparent that the temporary nature of the streams, especially during prolonged dry periods, was the overwhelming factor influencing the biocoenosis. The most species rich stream (East 2) was the only stream with a significant discharge eight days after the completion of the survey, and by late August most of the island's watercourses had dried up completely, with most of the aquatic fauna dead or present only in resistant forms, perhaps as eggs buried in the remaining moist areas.

Although the island was found to have an impoverished aquatic macroinvertebrate community it was considerably greater and more diverse than anything that had been recorded previously. The communities contained a range of species exhibiting many different trophic strategies; with examples of grazers, filter-feeders, scavengers and predators present across the island. This suggeseted that the island was capable of maintaining more than just a rudimentary aquatic fauna, even if this fauna was subject to the explosion and crash population trends associated with unstable environments.

The fact that so many more species were recorded in this survey either casts doubts on the accuracy of previous work, or more likely, illustrates how successful some species are at colonising unfavourable habitats and establishing viable populations. In this way some species are able to cope with, if not benefit from catastrophic events such as the periodic drying out of temporary streams.

It is likely that the island's streams are subjected to a recurring cycle of crash and boom effects with occasional colonisation from the mainland, when suitable weather conditions allow, but with perennial recolonisation from St. John's Stream (East 2), the one stream which has not yet been known to run dry (Gade 1978), and which contained very nearly all the species found in the other streams.

Further work would have to be conducted over several consecutive seasons to confirm this theory.

ACKNOWLEDGEMENTS

I am endebted to the University of Wales and the Lundy Field Society for their financial support and logistical assistance with this project. In addition, I should like to thank Dr. M. Learner and Mr. R. Hemmings (U.W.C.C.) for their advice and help in the planning and execution of the field work; to the employees of the Landmark Trust on Lundy Island, for their willing help and boundless hospitality; the National Rivers Authority for the use of monitoring equipment and comparative data, and to P. Clabburn for his assistance and camaraderie during all stages of this project.

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APPENDIX A

EAST 1

PHYLA	CLASS	ORDER	FAMILY (Subfamily)	GENERA	SPECIES
Arthropoda	Insecta	Trichoptera	Polycentropodidae	*Plectrocuemia*	*couspera*
			Polycentropodidae	*Plectrocuemia*	*geuiculata*
Arthropoda	Insecta	Diptera	Ceratopogonidae	-	-
			Chironomidae		
			(Orthocladiinae)	*Chaetocladius*	*species group*
			Simuliidae	*Simulium*	*aureum* [1]
			Tipulidae	*Dicranota*	*sp.*
				Holorusia	*sp.*
Arthropoda	Insecta	Coleoptera	Elmidae	*Limnius*	*volckmari* [2]
Arthropoda	Insecta	Hemiptera	Veliidae	*Velia*	*caprai* [3]
Arthropoda	Crustacea	Isopoda	Asellidae	*Asellus*	*meridianus*
Annelida	Oligochaeta	-	Lumbricidae	-	-
		-	Naididae	-	-

[1] Fries, [2] Panzer, [3] Tamanini.

EAST 2

PHYLA	CLASS	ORDER	FAMILY (Subfamily)	GENERA	SPECIES
Arthropoda	Insecta	Trichoptera	Beraeidae	*Beraea*	*manrus* [1]
			Limnephilidae	*Microperua*	*sequax* [2]
			Philopotamidae	*Wormaldia*	*species. group*
			Polycentropodidae	*Plectrocuemia*	*conspera*
			Polycentropodidae	*Plectrouemia*	*geniculata*
			Psychomyidae	*Timodes*	*assimilis* [3]
Arthropoda	Insecta	Diptera	Chironomidae		
			(Tanytarsinae)	*Microspectra*	*species. group*
			(Othocladiinae)	*Billia*	*modesta*
			Culicidae	(Pupae)	-
			Dixidae	*Dixa*	*dilatata* [4]
				Dixa	*maculata* [5]
			Psychodidae	*Pericoma*	*sp.*
			Simuliidae	*Simulium*	*aureum*
				Simulium	*brevicaule* [6]
			Tipulidae	*Dicranota*	*sp.*
				Holorusia	*sp.*
Arthropoda	Insecta	Coleoptera	Dytiscidae	*Agabus*	*didymus* [7]
			Hydrophilidae	*Anacaena*	*globulus* [8]
Arthropoda	Insecta	Hemiptera	Viliidae	*Velia*	*capri*
Arthropoda	Crustacea	Isopoda	Asellidae	*Asellus*	*meridianus*
		Ostracoda	Cyprididae	*Psychrodromus*	*robertsoni* [9]
Mollusca	Gastropoda	Proso-branchiata	Hydrobiidae	*Hydrobia*	*jenkinsi* [10]
		Pulmonata	Limnaeidae	*Limnaea*	*pereger* [11]
	Lamelli-branchiata	-	Sphaeriidae	*Pisidium*	*personatum* [12]
Annelida	Oligochaeta	-	Lumbricidae	-	-
		-	Naididae	*Pristina*	*sp.*

[1] Curtis, [2,3] McLachlan, [4] Strobl, [5] Meigen, [6] Dorier & Grenier, [7] Olivier
[8] Paykull, [9] Brady & Norman, [10] Smith, [11] Mull, [12] Malm

WEST 1

PHYLA	CLASS	ORDER	FAMILY (Subfamily)	GENERA	SPECIES
Arthropoda	Insecta	Trichoptera	Polycentropodidae	*Plectrocuemia*	*conspera*
			Polycentropodidae	*Plectrocuemia*	*geniculata*
Arthropoda	Insecta	Diptera	Chironomidae		
			(Tanypodinae)	*Goetghebueri*	*sp.*
			(Tanytarsini)	*Microspectra*	*species*
			Tipulidae	*Dicranoia*	*sp.*
Arthropoda	Insecta	Coleoptera	Dryopidae	*Dryops*	*sp.*
			Hydrophilidae	*Amacaena*	*globulus*
Arthropoda	Crustacea	isopoda	Asellidae	*Asellus*	*meridianus*
Mollusca	Gastropoda	Proso-branchiata	Hydrobiidae	*Hydrobia*	*jenkinsi*
		Pulmonata	Limnaeidae	*Limnaea*	*pereger*
	Lamelli-branchiata	-	Sphaeriidae	*Pisidium*	*personatum*
Annelida	Oligochaeta	-	Lumbricidae	-	-
		-	Naididae	-	-
Coelenterata	Hydrozoa	-	-	*Chlorohydra*	*viridissima*

NOTE: Sample contained 2 Coleoptera of the family Carabidae

WEST 2

PHYLA	CLASS	ORDER	FAMILY (Subfamily)	GENERA	SPECIES
Arthropoda	Insecta	Trichoptera	Hydroptilidae	*Oxyethira*	*species group*
			Philopotamidae	*Wormaldia*	*species. group*
			Polycentropodidae	*Plectrocuemia*	*conspera*
			Polycentropodidae	*Plectrocuemia*	*geniculata*
			Psychomyiidae	*Timodes*	*assimilis*
Arthropoda	Insecta	Diptera	Chironomidae		
			(Tanytarsinae)	*Microspectra*	*species. group*
			(Orthocladiinae)	*Chaetocladius*	*species group*
			Simuliidae	*Simulium*	*brevicaule*
			Tipulidae	*Dicranota*	*sp.*
Arthropoda	Insecta	Coleoptera	Dryopidae	*Dryops*	*sp.*
			Hydrophilidae	*Amacaena*	*globulus*
Arthropoda	Crustacea	isopoda	Asellidae	*Asellus*	*meridianus*
		Amphipoda		*Crangonyx*	*pseudogracilis*
		Ostracoda	Cyprididae	*Psychrodromus*	*robertsoni*
Mollusca	Gastropoda	Proo-branchiata	Hydrobiidae	*Hydrobia*	*jenkinsi*
		Pulmonata	Limnaeidae	*Limnaea*	*pereger*
	Lamelli-branchiata	-	Sphaeriidae	*Pisidium*	*personatum*
Annelida	Hirudinae	Gnathob-dellae	Hirundinidae	*Haemopis*	*sanguisuga*
	Oligochaeta	-	Lumbricidae	-	-
		-	Naididae	-	-
Coelenterata	Hydrozoa	-	-	*Chlorohydra*	*viridissima*

NOTE: Sample contained 2 Coleoptera of the family Carabidae.

WEST 3

PHYLA	CLASS	ORDER	FAMILY (Subfamily)	GENERA	SPECIES
Arthropoda	Insecta	Trichoptera	Hydroptilidae	*Oxyethira*	*sp. group*
			Polycentropodidae	*Plectrocuemia*	*conspera*
			Polycentropodidae	*Plectrocuemia*	*geniculata*
			Psychomyiidae	*Timoides*	*assimilis*
Arthropoda	Insecta	Diptera	Chironomidae		
			(Tanypodinae)	*Macropelopia*	*species. group*
			(Tanytarsinae)	*Microspectra*	*species. group*
			Ceratopogonidae	-	-
			Simuliidae	(Pupae)	-
			Tipulidae	*Dicranoata*	*sp.*
				Holorusia	*sp.*
Arthropoda	Insecta	Coleoptera	Dryopiidae	*Dryops*	*sp.*
			Hydrophilidae	*Anacaena*	*globulus*
Arthropoda	Insecta	Hemiptera	Corixidae	*Sigara*	*scotti* [1]
Arthropoda	Crustacea	Amphipoda	Gammaridae	*Gammarus*	duebeni
		isopoda	Asellidae	*Asellus*	*meridianus*
		Ostracoda	Cyprididae	*Psychrodromus*	*robertsoni*
Mollusca	Gastropoda	Proso-branchiata	Hydrobiidae	*Hydrobia*	*jenkinsi*
Annelida	Oligochaeta	-	Lumbricidae	-	-
		-	Naididae	-	-

[1] Douglas & Scott

WEST 4

PHYLA	CLASS	ORDER	FAMILY (Subfamily	GENERA	SPECIES
Arthropoda	Insecta	Trichoptera	Hydroptilidae	*Oxyethira*	*sp. group*
			Polycentropodidae	*Plectrocuemia*	*conspera*
			Polycentropodidae	*Plectrocuemia*	*geniculata*
			Philopotamidae	*Wormaldia*	*species. group*
Arthropoda	Insecta	Diptera	Chironomidae		
			(Tanypodinae)	*Macropelopia*	*species. group*
			(Tanytarsini)	*Microspectra*	*species. group*
			Simuliidae	*Simulium*	*aureum*
				Simulium	*brevicaule*
			Tipulidae	*Dicranota*	*sp.*
				Holornsia	*sp.*
Arthropoda	Insecta	Coleoptera	Hydrophilidae	*Anacaena*	*globulus*
			Hygrobiidae	*Hygrobia*	*sp.*
Arthropoda	Insecta	Hemiptera	Coixidae	-	-
			Veliidae	*Velia*	*capri*
Arthropoda	Crustacea	Amphipoda	Gammaridae	*Gammarus*	*duebeni*
			Crangonictidae	*Crangonyx*	*pseudogracilis*
		Isopoda	Asellidae	*Asellus*	*meridianus*
Mollusca	Gastropoda	Proso-branchiata	Hydrobiidae	*Hydrobia*	*jenkinsi*
Annelida	Oligochaeta	-	Lumbricidae	-	-
		-	Naididae	-	-
Platyhelmin-thes	-	Tricladia	Planariidae	*Polycelis*	*nigra*