BIOLOGICAL WATER QUALITY SURVEY, LOCH WOOD COMMUNITY WOODLAND, 18 APRIL 2024

David McColl, Toby Miller & William E. Yeomans

Clyde River Foundation, Graham Kerr Building, University of Glasgow, Glasgow, G12 8QQ

Correspondence: william.yeomans@glasgow.ac.uk

www.clyderiverfoundation.org

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Cover Photograph: Kick sampling in the polluted Cander Water

The Clyde River Foundation is a registered charity which researches the ecology of the Clyde and its tributaries, and promotes community engagement and environmental education throughout the catchment.

Dr Willie Yeomans
Clyde River Foundation
Graham Kerr Building
University of Glasgow
Glasgow
G12 8QQ

william.yeomans@glasgow.ac.uk

www.clyderiverfoundation.org

1. Introduction

A baseline benthic macroinvertebrate survey was undertaken to investigate the biological water quality of the three watercourses within the Loch Wood Community Woodland, near Blackwood, South Lanarkshire (approximate NGR NS 776 434).

2. Materials and Methods

A total of four sites were sampled on 18 April 2024 using the field method outlined in FBA (2013).

A three-minute benthic macroinvertebrate kick sample, followed by a one-minute stone and surface search, were undertaken at each site. The sample was collected in a standard FBA pond net with a mesh size of 1mm and was stored in a 1.5l 'Niftilid' snap-lidded container until it was preserved in a solution of 80% Industrial Methylated Spirit (80% IMS) on the same day. The preserved sample was stored at room-temperature until it was processed in the laboratory. To sort the invertebrates from the preservative and biological/mineral debris, the sample was gently washed through a 1mm mesh sieve to remove silt and fine particles before being examined as subsamples in a white, gridded sorting tray. All animals were removed from the sample to 35ml polypropylene "Universal" bottles and preserved in excess 80% IMS. Animals were later identified to Family level under a dissecting microscope at x8-x80 magnification using appropriate keys. The number of individuals in each taxon was enumerated.

Field data were documented and archived on a standard CRF macroinvertebrate sample recording sheet. The environmental and biological data are stored in the CRF Invertebrate Database and were used to assess the environmental quality at each site using the Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT) (WFD-UKTAG 2014). A quality classification was generated for each site using the method defined by WFD-UKTAG (2014).

The raw data were fed into RICT, which is the standard method for assessing biological water quality. A numerical value is allocated to each invertebrate taxon (ie. Family or Class) based on its tolerance to organic pollution (WHPT). For example, mayfly and stonefly nymphs are intolerant to organic pollution, and therefore score higher in comparison to water beetles, snails, and worms (which can live in poor water quality). The score per taxon can also increase or decrease depending on the number of individuals found in the sample. The WHPT score for the site is calculated by summing the values for each taxon found in the sample. The Average Score Per Taxon (ASPT) is an index of organic pollution. It is calculated by dividing the WHPT score for a site by the number of scoring taxa found at that site, and represents the average sensitivity of the taxa present. ASPT is considered a reliable index of organic pollution because it is not greatly increased or decreased by variations in sampling effort and/or the presence/absence of a few rare taxa (which is sometimes caused by habitat disturbance). The number of different scoring taxa (NTAXA) is used as an index of both organic and toxic pollution and physical pollution, such as siltation. A large number of

taxa indicate a rich community and a healthy environment but a low number does not necessarily indicate polluted conditions. Biologists use these indices to detect and evaluate changes in quality at monitoring sites, as well as differences between similar sites on the same stretch of river (eg. when comparing conditions upstream and downstream of an effluent or impact).

Different invertebrate communities are characteristic of different river types and natural differences in the nature of the streambed, gradient, flow rate, underlying geology and geographical location. It is therefore possible that RICT scores from different sites will differ irrespective of water quality. The RICT computer program takes natural differences into account, and allows comparison of sites in terms of their biological quality alone. From a site's physical and chemical characteristics, RICT can predict the number of scoring taxa in a sample and the ASPT if the site were free of human influence (ie. pollution and/or habitat degradation.) The difference between the invertebrate community observed at a site and that predicted by RICT (ie. the ratio of observed:predicted - the RICT Environmental Quality Index) indicates the magnitude of the impacts attributable to anthropogenic activities. If the RICT EQI is equal to or greater than one, the biological quality is satisfactory. As the value drops below one, progressively poorer biological quality is indicated. The RICT EQIs were calculated for each site.

Two sampling sites were identified on the Cander Water, one on the Cairns Burn above the Cander Water and one on a minor tributary near the downstream boundary of the site (Figure 1; Plates 1-4).

3. Results

The biological taxa recorded at each of the four sites are given in Appendix 1.

The biological water quality at three sites was classified as 'High', with that in the Un-named Tributary of the Cander Water (Site CAV049I) being 'Moderate' (Figure 1; Appendix 2).

An ongoing water pollution incident was occurring at the upper Cander Water site (CAV046I) during the sampling period (Plates 5 & 6).

4. Discussion

Overall the quality of the three watercourses is what we would expect in areas with little pollution or human disturbance.

The apparent lower quality at Site CAV049I on the un-named Tributary was due to a more pollution-tolerant fauna than the RICT model had predicted. The number of invertebrate taxa present was very close to that predicted (NTAXA in Appendix 2) but their pollution tolerance (ASPT) was lower. This is probably of little significance but the data generated from further sampling will quality our assertion.

Of greater concern during our visit was an apparent ongoing incidence of organic pollution at the upper site on the Cander Water (Site CAV046I). At the time of sampling, the river water was discoloured (green), smelled strongly of organic pollution and had gross surface signs of pollution (discoloured bubbles) (Plates 5 & 6). This incident was reported to the SEPA Pollution Hotline (0800 807060) and any further signs should be treated similarly. We suspect that the biological community had just been exposed to the pollutant (which will stimulate bacterial growth, in turn decreasing oxygen content) and had not had time to react to it. The severity of the situation will be checked at the next sampling round and it may be prudent to obtain further invertebrate samples as soon as is practicable.

5. References

FBA (2013) RIVPACS/RICT Bioassessment Training. Course Manual. Freshwater Biological Association, Windermere, loose-leaf.

UKTAG (2014) UKTAG River Assessment Method. Benthic Invertebrate Fauna. Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT). Water Framework Technical Advisory Group (WFD-UKTAG), Stirling, 17pp.

Figure 1: Sampling site locations and biological water quality classifications

Plate 1: Cander Water upstream of Cairn Burn, Site CAV046I

Plate 2: Cairn Burn upstream of the Cander Water, Site CAV047I

Plate 3: Cander Water near the downstream margin of the woodland, Site CAV048I

Plate 4: Un-named tributary of the Cander Water near the downstream margin of the woodland, Site CAV049I

Plate 5: Ongoing organic pollution recorded during sampling at Site CAV046I

Plate 6: Ongoing organic pollution recorded during sampling at Site CAV046I

APPENDIX 1 – TAXA LISTS (Family-level)

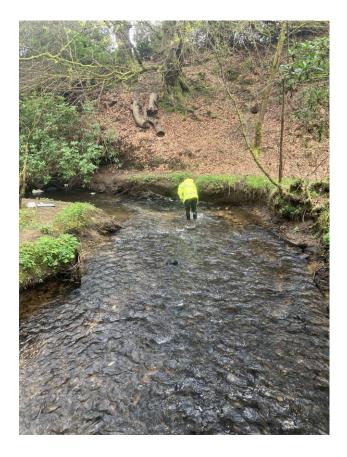|	
River	**Cander Water u/s Cairn Burn**
Sitecode	**CAV046I**
Easting	**277103**
Northing	**643401**

Order	**Family**
Tricladia (Flatworms)	Planariidae
Mollusca (Snails, Limpets and mussels)	Sphaeriidae
Oligochaeta (Worms)	Oligochaeta
Crustacea (Crayfish, Shrimps and Slaters)	Gammaridae
Ephemeroptera (Mayflies)	Heptageniidae
	Leptophlebiidae
	Baetidae
Plecoptera (Stoneflies)	Chloroperlidae
	Taeniopterygidae
	Perlodidae
	Leuctridae
	Nemouridae
Megaloptera (Alderflies)	Sialidae
Coleoptera (Beetles)	Scirtidae
	Elmidae
	Hydraenidae
Trichoptera (Caddis-flies - Caseless)	Philopotamidae
	Hydropsychidae
	Glossosomatidae
	Rhyacophilidae
Trichoptera (Caddis-flies - Cased)	Odontoceridae
	Goeridae
	Sericostomatidae
	Leptoceridae
	Limnephilidae
Diptera (True flies	Simulidae
	Tipulidae
	Chironomidae
	Ceratopogonidae

29 taxa recorded

River	Cairn Burn
Sitecode	**CAV047I**
Easting	**277141**
Northing	**643352**

Order	Family
Mollusca (Snails, Limpets and mussels)	Sphaeriidae
	Lymnaeidae
	Planorbidae
Oligochaeta (Worms)	Oligochaeta
Crustacea (Crayfish, Shrimps and Slaters)	Gammaridae
Ephemeroptera (Mayflies)	Heptageniidae
	Leptophlebiidae
	Baetidae
Plecoptera (Stoneflies)	Chloroperlidae
	Taeniopterygidae
	Perlodidae
	Leuctridae
Coleoptera (Beetles)	Gyrinidae
	Elmidae
	Dytiscidae
	Hydraeneidae
Trichoptera (Caddis-flies - Caseless)	Polycentropodidae
	Hydropsychidae
	Rhyacophilidae
Trichoptera (Caddis-flies - Cased)	Odontoceridae
	Goeridae
	Sericostomatidae
	Limnephilidae
Diptera (True flies)	Simulidae
	Tipulidae
	Chironomidae
	Empididae

27 taxa recorded

River	**Cander Water d/s site**
Sitecode	**CAV048I**
Easting	**277952**
Northing	**643551**

Order	**Family**
Tricladia (Flatworms)	Planariidae
Mollusca (Snails, Limpets and mussels)	Sphaeriidae
	Ancylidae
Oligochaeta (Worms)	Oligochaeta
Crustacea (Crayfish, Shrimps and Slaters)	Gammaridae
Ephemeroptera (Mayflies)	Heptageniidae
	Leptophlebiidae
	Baetidae
Plecoptera (Stoneflies)	Chloroperlidae
	Taeniopterygidae
	Perlodidae
	Leuctridae
	Nemouridae
Coleoptera (Beetles)	Elmidae
	Hydraeneidae
Trichoptera (Caddis-flies - Caseless)	Hydropsychidae
	Glossosomatidae
	Rhyacophilidae
Trichoptera (Caddis-flies - Cased)	Sericostomatidae
	Limnephilidae
Diptera (True flies)	Tipulidae
	Chironomidae
	Empididae

23 taxa recorded

River	**Un-named trib of Cander Water**
Sitecode	**CAV049I**
Easting	**278030**
Northing	**643552**

Order	**Family**
Tricladia (Flatworms)	Planariidae
Mollusca (Snails, Limpets and mussels)	Sphaeriidae
	Hydrobiidae
Oligochaeta (Worms)	Oligochaeta
Hirudinia (Leeches)	Glossiphoniidae
	Erpobdellidae
Crustacea (Crayfish, Shrimps and Slaters)	Gammaridae
Ephemeroptera (Mayflies)	Heptageniidae
	Baetidae
Plecoptera (Stoneflies)	Taeniopterygidae
	Leuctridae
Coleoptera (Beetles)	Scirtidae
	Elmidae
Trichoptera (Caddis-flies - Caseless)	Glossosomatidae
	Rhyacophilidae
Trichoptera (Caddis-flies - Cased)	Limnephilidae
Diptera (True flies)	Simuliidae
	Tipulidae
	Chironomidae
	Dixidae
	Tabanidae

21 taxa recorded

APPENDIX 2 – Derivation of the Water Quality Classifications

Site	Watercourse	Date	ASPT (Observed)	NTAXA (Observed)	WHPT (Observed)	Ave ASPT EQR	Ave NTAXA EQR	Most probable ASPT classification	Most probable NTAXA classification	Most probable overall classification	Suitability Code	Suitability Text
CAV046I	Cander Water US	18/04/2024	7.52	29	218.2	1.04	1.40	H	H	High	1	>5%
CAV047I	Cairn Burn	18/04/2024	7.34	27	198.3	1.00	1.32	H	H	High	1	>5%
CAV048I	Cander Water DS	18/04/2024	7.29	23	167.6	1.00	1.11	H	H	High	1	>5%
CAV049I	Trib of Cander Water	18/04/2024	5.84	21	122.7	0.84	0.97	M	H	Moderate	1	>5%
						Average EQR for Number of Taxa for autumn from the Monte-Carlo simulations	Average EQR for Number of Taxa for autumn from the Monte-Carlo simulations	The status (H, G, M, P or B) with the greatest probability	The status (H, G, M, P or B) with the greatest probability	The status (H, G, M, P or B) for either ASPT or NTAXA depending on which is worse.	The suitability code is the probability that the assigned end group actually belongs to that sample/site.	If the maximum probability is <5% (suitability code 2 or more), the user should consider it a warning and if <1% (suitability code 4 or more) they could consider abandoning the results.