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UWIST Paper 3

Comparison of two methods of collecting macro-invertebrates from the R. Wye

Introduction

The adequacy of different methods of sampling invertebrates for the collection of qualitative and quantitative information for surveillance purposes has been the centre of discussion at Craig Goch Surveys Group meetings (Abel, 1975). This paper compares two methods of collecting macro-invertebrates from the R. Wye.

Methods and Sites

Samples were collected from riffles using a cylinder sampler, modified after Neill (1938), and a kick sampling technique. The cylinder sampler comprised of a metal cylinder with a serrated base which when driven and rotated into the substratum enclosed an area of $0.05m^2$. The enclosed substratum was vigorously disturbed and dislodged macro-invertebrates were swept downstream into a detachable net (aperture size 400u) by water flowing through an upstream gauze window. Attached organisms e.g. *Hydropsyche* spp. were removed from stones by hand. Four cylinder samples were taken across the width of each riffle. This technique has been used by UWIST in their surveillance programme of the *R. Wye* and tributaries in 1975.

Kick samples were taken by disturbing the substratum in front of a hand net (aperture size 400µ) for a fixed period of three minutes whilst moving upstream. Thus, a 'ribbon' of riffle, generally some 15.0m in length and 0.3m in width, was sampled. This sampling technique has been used by Severn-Trent Water Authority in their surveillance programme of the R. Severn and its tributaries. The area sampled is about $5m^2$ (Abel, 1975).

After collection all samples were returned to the laboratory, preserved in 5% formaldehyde solution and sorted by hand. The time taken to collect and sort each sample was recorded.

Sampling was carried out on 8th October 1975 at three sites on the R. Wye: Pant Mawr (7km from source), Rhayader (34km from source) and Glasbury (85km from source). The discharge at Rhayader was 4.5 cumec, equivalent to 0.74 x A.D.F.

Results

Table 1 indicates that 1.3 to 2.4 times more macro-invertebrates were collected in kick samples, covering an area of about $5m^2$, than in four cylinder samples, equivalent to an area of $0.2m^2$ and this was reflected in the longer time spent sorting kick samples. Kick samples contained more extraneous material than cylinder samples, e.g. leaves, which made sorting more difficult. The time taken to collect the different samples in the field was similar.

At all sites there were more species or species-groups collected in the cylinder samples (Table 1), and, although at different sites both sampling methods collected taxa which

were exclusive to each technique the cylinder samples always contained a greater number of exclusive taxa. Except for species or species-groups of Oligochaeta, which were consistently exclusive to cylinder samples, there were no other groups of macro-invertebrates which could be exclusively associated with the sampling method.

Table 2 indicates that the proportions of Ephemoptera and Plecoptera in kick samples were always greater than in cylinder samples and the proportion of Oligochaeta in cylinder samples was always greater than in kick samples. No other generalisation can be made from these data.

Assuming that kick sampling collects animals from $5m^2$ of river bed some comparison of estimates of macro-invertebrate density can be made between the two sampling methods (Table 3). Total density estimates from kick samples were 10 to 20 times lower than estimates of mean total density made from cylinder samples.

Discussion

It might seem logical that the larger the area of sampling (implicitly related to the number of microhabitats) and the more animals collected, the greater the number of taxa recorded. For any one sampling procedure this would be true (Edwards, Hughes & Read, 1975) but it does not follow that in a comparison of two sampling procedures the more extensive will yield more taxa. In the current study the cylinder sampler is not only more efficient in terms of taxa recovered per unit area or per individual; it recovers more in $0.2m^2$ than the kick-sampling method in about $5m^2$.

This results from the low recovery efficiency, only 5-10% (Table 3), of kick sampling, which creates an opportunity for selectivity of recovery of animal types: this more than compensates for the larger area covered by the kick sampling procedure. Another conclusion from the data presented here is that a more rigorous taxon list is likely to result from increasing the number of cylinder samples than extending the time spent, or area covered, in kick sampling for cylinder samples are 10-20 times more efficient in recovering animals from a specific area and their ratio of taxa : individuals is higher. The criticism in their use has been the very limited area and range of microhabitats sampled. Table 1 shows that in terms of sorting time, the number of cylinder samples could be approximately doubled before post-treatment time exceeds that of the current kick-sampling procedure. This doubling would also improve the confidence limits of population estimates.

This very limited study of the two sample methods cannot be accepted as universally applicable and it should be extended to other sites and seasons. Nevertheless the demonstrably low efficiency of recovery of animals in kick-sampling procedures provides an opportunity for environmental and biological variables to operate on this efficiency. This difference in efficiency is suggested in Table 3 for sites sampled in the current investigation. Therefore acceptance that this kick-sampling method can be used in a comparative quantitative manner, providing the procedure is standardized, is very doubtful.

The qualitative pattern of recovery shown in Table 2 supports Armitae *et al* (1974) who concluded that the poor representation of Oligochaetes in kick samples probably results from fragmentation.

In addition, in this study, where Oligochaete species or species-groups were exclusive to a sampling technique at a station, this was always the cylinder.

Conclusion

In the R. Wye, at sites and at the time investigated, the standardized kick-sampling procedure, as used by the Severn-Trent team, is less efficient than the cylinder sampling routine adopted by the UWIST group in terms of the number of taxa recovered. Furthermore, cylinder samples take less time to sort.

The claim that 'if kick-sampling is standardized it can be regarded as comparatively quantitative' is highly dubious.

References

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Table 1

Comparison of Cylinder and Kick Samples

Site	Total No. of individuals collected		Total No. of species or species-groups collected		Exclusive species or species-groups collected		Sorting time (h)	
	C	K	C	K	C	K	C	K
Pant Mawr	65	100	21	18	7	4	0.5	1.25
Rhayader	296	693	35	30	11	6	1.75	3.5
Glasbury	850	1069	55	54	7	6	2.0	4.0

C = 4 cylinder samples

K = 3 minute kick sample

Table 2

% representation of total number of macro-invertebrates collected

	Pant Mawr		Rhayader		Glasbury	
	C	K	C	K	C	K
Platyhelminthes	6.2	15.5	1.0	3.1	-	-
Oligochaeta	18.8	7.0	24.6	1.2	15.4	13.0
Hirudinea	0	0	0	0	1.6	1.2
Plecoptera	6.2	17.2	8.7	18.3	0.5	1.3
Ephemeroptera	0	0	30.1	47.9	10.1	12.9
Trichoptera	11.6	16.1	12.1	7.8	34.1	35.2
Coleoptera	10.4	3.0	12.5	13.4	6.8	4.2
Crustacea	0	0	0	0	3.1	5.3
Chronomidae	14.5	13.3	3.7	1.1	15.4	10.4
Simulidae	29.0	17.1	3.3	0.7	4.2	6.0
Mollusca	-	-	-	-	7.8	8.8
Others	3.3	10.8	3.1	5.9	1.0	1.7

- = included in others
C = 4 cylinder samples
K = 3 minute kick sample

Table 3

Total density estimates from cylinder (C) and kick (K) samples

Site	Cylinders (No./m^2)						Kick (No./m^2)	$\frac{C}{K}$
	1	2	3	4	$\bar{x}$	S.E.		
Pant Mawr	**280**	**220**	**240**	**260**	**250**	**13**	**20**	**12.5**
Rhayader	**1040**	**1640**	**1780**	**1460**	**1480**	**161**	**139**	**16.5**
Glasbury	**3700**	**3000**	**4540**	**5760**	**4250**	**594**	**214**	**19.9**

$\bar{x}$ = arithmetic mean

S.E. = standard error of mean