



**RAPPER (Rapid  
Assessment of  
Periphyton in Rivers):  
trials with citizen  
scientists in six UK  
catchments**

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# RAPPER (Rapid Assessment of PeriPhyton in Rivers): trials with citizen scientists in six UK catchments

## Summary

An approach for assessing filamentous algae in rivers and streams has been modified for citizen scientists and trialled in six catchments in England and Wales. This complements existing citizen science methods such as phosphorus analysis and invertebrate monitoring by providing insights into a different aspect of stream ecology. Workshops in Summer 2025 introduced volunteers and co-ordinators to the method, and generated feedback. Overall, 6 out of 8 surveys gave similar results to those from the EA Weight of Evidence approach. Slightly lower agreement was obtained when Water Framework classifications were used, but inherent limitations in these broad scale assessments will have contributed. Feedback from the workshops allowed the draft manual to be revised, ready for national rollout in 2026.

## Introduction

A byproduct of rising concern over the state of rivers in the UK has been the empowerment of the public via citizen science, with methods addressing a range of ecosystem health properties developed in recent years (Brooks et al., 2019; Gurnell et al., 2019; Kelly-Quinn et al., 2023; Loiselle et al., 2024; Shao & Bishop, 2025). Prolific growths of filamentous algae are often an important factor in shaping public perceptions of river health (Suplee et al., 2009) but, to date, there has been no method aligned with the needs of citizen scientists that can be used widely in the UK (and, based on the literature search reported in Shao & Bishop, 2025), anywhere else in the world).

Kelly et al. (2016) described an approach for rapid assessment of algae in rivers that had been developed for UK statutory agencies. It was a response to a combination of reduced budgets in the aftermath of the 2008 global financial crisis and a recognition of a need for biologists to collect information on finer spatial and temporal scales than was possible with the methods used for statutory assessments (DARLEQ – Kelly et al., 2008 and LEAFPACS – Willby et al., 2012). This involved a simple survey of a stretch of river bed, assessing the percent covered by visible algal growths, followed by identification of the algae present to genus. This latter process required a microscope and the ability to negotiate some of the specialist terminology necessary to name algae. The survey method is largely compliant with the macroscopic phytobenthos survey described in BS EN 15708: 2009 (CEN, 2009).

An early trial of RAPPER with the South Cumbria Rivers Trust indicated that these requirements would be a limitation to citizen scientists and that a rethink would be necessary to bring RAPPER to a state where citizen scientists would be comfortable

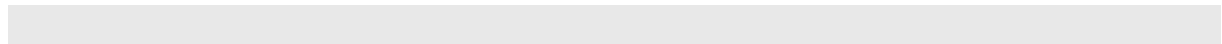
with the method. This rethink happened in two stages: some funding from the Local Authorities Water Programme in Ireland allowed the method to be simplified, and this was subsequently tested as part of an undergraduate dissertation project at Lancaster University (Woodfield et al., 2023). The current report describes further trials, across six contrasting catchments in England and Wales, in order to prepare the way for a wider roll-out of the method.

In addition to the simplification of the method, there has been one other conceptual change since the first version of RAPPER. Kelly et al. (2016) related changes in algal communities primarily to nutrients, in line with the intended uses of RAPPER within the regulator's workplans. Subsequently, however, we have broadened interpretation to encompass a wider range of stressors, with a particular focus on the impact that low flows and warm weather may have on algal growth. More information is given in Box 1.

The specific objective of the 2025 testing programme was to review and assess the method across a range of river types to ensure that the method is:

- 1) as robust as possible,
- 2) suitable for use by citizen science volunteers
- 3) ready for national rollout.

In order to do this, training materials had to be developed, and data collected by volunteers required analysis, visualization and contextualization. This, in turn, would enable us to identify any modifications to the method and training materials that were required before national rollout.



**Box 1. RAPPER in context: links to a series of posts on Microscopes and Monsters that help potential users to understand the factors that encourage algal growth in rivers.**

RAPPER is a tool that helps us make objective assessments of the types of algae present, and their extent, in rivers, contributing to judgements on the health of these rivers, and potential measures for their management.

The training day introduces you to the “how” of conducting a RAPPER survey; this handout directs you to a series of posts which explain the “why”: the conditions under which filamentous algae thrive. This, in turn, helps us to interpret the results of RAPPER surveys, and to plan more effective monitoring programmes.

First, an introduction that lays out the problem, and highlights the danger of leaping to false conclusions:

<https://microscopesandmonsters.wordpress.com/2024/05/14/understanding-verdant-rivers/>

There is a strong link between extensive algal growths and nutrients, but other factors can also lead to prolific growths, even when nutrient concentrations are low:

<https://microscopesandmonsters.wordpress.com/2024/05/26/understanding-verdant-rivers-2/>

The importance of grazers in controlling algal biomass is further explored in this post:

<https://microscopesandmonsters.wordpress.com/2024/06/08/understanding-verdant-rivers-3/>

Another condition that can influence the amount of algae growing on the riverbed is alteration of the riverbed or flow regime. This is discussed in the next post in the series:

<https://microscopesandmonsters.wordpress.com/2024/06/24/understanding-verdant-rivers-4/>

The next post in the series is a digression on terminology, questioning whether the term “eutrophic” (which was first used to describe the condition of lakes) should be used to describe the condition in rivers too:

<https://microscopesandmonsters.wordpress.com/2024/08/20/understanding-verdant-rivers-v/>

We now move on to the “superpowers” that make filamentous algae so successful in rivers:

<https://microscopesandmonsters.wordpress.com/2024/09/02/understanding-verdant-rivers-vi/>

The final post in the series pulls these threads together and relates them to the RAPPER method:

<https://microscopesandmonsters.wordpress.com/2024/09/08/understanding-verdant-rivers-vii/>

## Overview

Six workshops were delivered as part of this project (Table 1). The workshop for the Western Sussex Rivers Trust was linked to the Arun demonstration catchment but, in fact, two small chalk streams between Chichester and Havant were visited instead. Volunteer coordinators for each demonstration catchment advertised or communicated the opportunity with local volunteers and organised the training workshops. Each workshop was attended by volunteer co-ordinators and other staff, EA Citizen Science co-ordinators, if available and demo volunteers. All of the volunteers had been involved in river monitoring e.g. water quality, RiverFly and MorPH.

Each visit started with a classroom session that included an introduction to RAPPER, followed by two field visits, and concluded with a feedback session. At the field sites the volunteer co-ordinators gave a H&S briefing that included generic and dynamic risk assessments and a biosecurity briefing – especially important as we were visiting two sites. All participants were asked to fill in a feedback form. For the field visits, we asked local contacts to locate one reach that fulfilled our preconditions for an “ideal” RAPPER site, and also to choose one site that was more representative of the challenges that they thought they were likely to face. All locations had experienced prolonged periods of low flow and warm weather prior to the workshops, although rain on the night before the River Beane workshop did lead to a slight rise in water level and made the water turbid.

Only one location visited during workshops was unsuitable for a RAPPER survey (River Teme near Bransford), being too deep and having relatively small substrata. There was also considerable disturbance, as this was a popular local site for bathing. However, site selection was biased by our instructions. Many stretches of the River Arun demonstration catchment, for example, have combinations of silt-sand dominated beds, deep water and steep banks making access difficult. Consequently, other streams in the region were visited during this workshop. As a general rule, the constraints on RAPPER surveys are the same as those encountered for RiverFly, so a single set of criteria for site selection could be used (the exception is that unshaded sites are preferred for RAPPER, where possible).

Comments received in the feedback sessions and from the feedback sheets are summarised in Table 2. As the same point was often made at several workshops, these comments have been gathered under some general headings, rather than organised by catchment.

**Table 1. Locations of the six workshops where RAPPER was introduced to citizen science volunteers. See Appendix 1 for more details.**

Date	River(s)	Partners
16 June 2025	Ribble + Leagram Beck	Ribble Rivers Trust
1 July 2025	Teme	Severn Rivers Trust
2 July 2025	Usk + Gavenny	Wye & Usk Foundation
7 July 2025	Beane	Hertfordshire Wildlife Trust
17 July 2025	Ems + Fishbourne Stream	Western Sussex Rivers Trust
23 July 2025	Wensum	Norfolk Rivers Trust

**Table 2. Comments gathered during feedback sessions and forms following RAPPER demonstrations. Several points (especially those concerning the workshops) were addressed between workshops.**

Point	Catchments	Comment
<b>Training Workshop</b>		
1	Ribble Teme Usk Beane Wensum	Send out materials prior to workshop
2	Ribble Wensum	Advise that waders are required
3	Ribble Teme Usk Beane Arun Wensum	Bring more samples to enable participants to see the diversity of algae – either in meeting room or in trays in field. Possibly with microscopes.
4	Ribble Usk Beane Wensum	Provide example of completed field sheet
5	Ribble Wensum	Standardise language and definitions: 1) between presentation and field sheet and 2) between different methods – RP, MorPH, WQ and RAPPER eg substrate categories
6	Ribble Usk Beane Wensum	Do demonstration of method at first site before setting volunteers off to work in pairs
<b>Survey method</b>		
7	Ribble	Need to think about how we standardise effort. Original recommendation is to survey 10 m stretch by zig-zagging.

Point	Catchments	Comment
	Teme Usk Beane Arun	This is fine in a small river (< 5 m) but not in a wide river. Options tried include zig-zagging across (rather than along) a wide river, setting up “permanent quadrats” and a longitudinal survey that extends as far out from the bank as is safely wadable. Do we need to recommend a standard survey area (i.e. 50 m <sup>2</sup> ), or could we include some spot checks upstream and downstream? How do you handle sections of a stream that cannot be accessed (i.e. too deep)
8	Ribble Wensum	How do we include thickness into assessment of nutrient risk? How do we deal with differences in cover and thickness across a reach?
9	Teme	Second site visited was too deep and substrate too fine for visible algal communities to develop – we need to have a clearer rationale for site selection.
10	Wensum	A general consensus was that canoes are not an option for surveys (but best strategy is probably not to mention canoes at all)
<b>Revisions to manual</b>		
11	Ribble Wensum	Manual needs to mention that mosses, liverworts, lichens and freshwater sponges are excluded. Needs also to describe the difference between a moss and an alga
<b>Revisions to manual (cont.)</b>		
12	Arun	Why are mosses excluded? Maybe add comment that mosses are potentially useful but there are about 50 species that live in rivers, and we need to keep the method as straightforward as possible. Maybe add mosses/liverworts etc as broad recording categories even if we don’t use data at this stage?
13	Usk	The strength of the method is that it forms part of a bigger picture. Manual needs to have an overview of how RAPPER fits into the broader “weight of evidence” approach.
14	Ribble Wensum	Start method section of manual with a “step-by-step” overview - survey, reflect, check, fill in sheet
<b>Revisions to field sheets</b>		
15	Ribble	Revise section of field sheet where algal growths are recorded. The current layout was not as intuitive as we had hoped.
16	Usk	Field sheet: what does “evidence of eutrophication” mean? What we can see or what we know from other sources? Explain the type of information that is required. [Do we even need this on the field sheet?]
17	Usk	Some terminology on field sheets needs to be better aligned with other CS methods (RiverFly, MoRPh etc).

Point	Catchments	Comment
18	Beane	Add data interpretation to field sheet (I think that this just means allowing the risk assessment to be calculated on site)
19	Wensum	Add "silt" to substrate cover values
<b>Revisions to laminated field guides</b>		
20	Ribble Usk Beane	Need better photos on field handouts in some cases, and also need indication of scale on illustrations. Maybe aim for an AIDGAP-style foldout sheet or an ID app. Add indication of scale to algal photos
21	Teme Beane Wensum	Include sewage fungus on field sheets
22	Beane Wensum	Include cyanobacterial crusts on field sheets
<b>Proposals for data recording etc</b>		
23	Ribble Usk Beane	Integrate with iNaturalist or develop a specific app, possibly covering both recording and identification . survey123 and Cartographer also suggested. Consider using Cartographer as database for storing data (MorPH, RP and Outfall Safari are already hosted in Cartographer)
<b>Going forward ...</b>		
24	Teme Beane	Concerns expressed that RT Volunteer co-ordinator staff still did not have confidence to train others. We subsequently made sure that they were not distracted by phosphorus measurements or RiverFly sampling during our visits, but need to budget for a "train the trainers" session next year. A training video, as well as face-to-face training, would be beneficial. This could include a more detailed description of some of the taxa involved. Also, consider including a lab session with variety of algal types to look at including microscope examinations,
25	Beane Arun	How does the physical data we record influence interpretation? Is there any way that we can use this to set "benchmarks" for different types of river?
26	Beane	Where is method going next? How do we intend to analyse the data? How is it going to be used in river management? (maybe overlaps with point 7)
27	Arun	Potential student project: surveying above and below CSOs
28	Wensum	How do we train and accredit whilst still accounting for regional differences?

## Data Analysis

Data collected during the workshops contributes to our understanding of RAPPER, particularly in regions where it has not previously been tested. There is, however, one important qualification: the CaSTCo Demonstration Catchments have all been selected because there are known problems, which introduces a sampling bias. On the other hand, previous testing in Scotland and NW England had given us a broad overview of the performance across a range of ecological health, so the new data is balanced by these previous experiences, to some extent.

Results from surveys performed in summer 2025 were compared to outcomes from the EA eutrophication Weight of Evidence assessments and also from Water Framework Directive classifications. The former is derived from 2021 WoE assessments based on 2019 classification data and the latter is primarily based on data from 2022; 2025 data were not available at the time of writing. Data used to derive the classifications for the water body were not necessarily obtained from the same location as surveyed for this study.

RAPPER results were compared to Water Framework Directive classifications in two ways:

1. A comparison against all ecological components used in WFD Classification, along with phosphorus; and,
2. A comparison against just phosphorus, macrophytes and phytobenthos.

In both cases, the assumption was that “not at risk” equated to high and good status, whilst “at risk” equated to moderate, poor or bad status. “maybe at risk” was interpreted as meaning that the site could not be classified as good status with confidence, and so was combined with “at risk” for our analyses.

There is, however, a specific “uncertain” category in the WoE approach that can be matched to “maybe at risk”.

Of the 13 surveys that could be matched to WoE and WFD data:

10 RAPPER surveys agreed with the outcomes from the WoE approach (77%)

8 RAPPER surveys agreed with WFD classifications based on all ecological components plus phosphorus (62%)

10 RAPPER surveys agreed with WFD classifications based on just phosphorus, macrophytes and phytobenthos (77%)

Strong agreement with WoE outcomes is encouraging; some mismatches are to be expected, because the WoE and RAPPER are each contributing different information to give a holistic view of a river at a particular point in space and time.

The slightly lower agreement to WFD assessments is also not a surprise. WFD classifications apply to relatively wide areas and long time periods, and the potential to identify “hot spots” within a water body is a strength of RAPPER. The weaker agreement with the full WFD suite compared to just phosphorus, macrophytes and phytobenthos is

due, in these cases, to other factors such as obstacles to fish migration, which influence WFD outcomes, but would not be expected to influence RAPPER.

## Modifications to the method

As a result of feedback from volunteers, two changes to the method have been made, the explanatory framework has been revised, and the manual have been edited to include new information. These points are considered below:

### Updated explanatory framework

The workshops were conducted during a summer of prolonged warm weather and low flows, leading to discussion about the extent to which algal growths should be attributed to elevated nutrients and the role that other factors played. Other rivers visited by us this summer also showed similar effects (see Fig. 1). The original explanatory framework for RAPPER focussed on interpretation in terms of nutrient enrichment, as this was the primary stressor that it was to be used to assess, and it was not being used as part of a wider package, akin to the “weight of evidence” (WoE) framework developed for CaSTCo. Because this WoE framework also encompasses direct measurements of nutrients, RAPPER can be used more straightforwardly as a measure of the algae that are present and can acknowledge the roles that other pressures may play. This, in turn, links through to possible consequences for other elements of the biota, such as benthic invertebrates and contributes to a richer explanation of the condition of a river or stream.



**Fig. 1. The River Irt in west Cumbria where human influences are minimal and measured nutrient concentrations are low but which, in summer 2025, still had prolific growths of green algae.**

Table 3 is highly simplified, but shows how the quantity of algae can lead to consequences for other organisms (known as “undesirable disturbances”). The likelihood of such consequences will depend not just on the quantity of algae, but also on day length and temperature (see

<https://microscopesandmonsters.wordpress.com/2025/08/26/blinded-by-the-light/>).

The quantity of algae is, in turn, determined not just by the availability of nutrients, but also by invertebrate grazing and high-flow events, which can remove biomass and “reset” a river to a less algae-rich state.

The original version of RAPPER distinguished between “good guys” – expected in a healthy river – and “bad guys” – which would proliferate in enriched rivers. In practice, most of the “bad guys” are not found in soft water, so the revised explanatory framework also accommodates situations where “good guys” are also prolific. A warm, dry summer allows all algae to thrive, regardless of their natural affinity for nutrients. We suspect that, under such circumstances, algal growth outpaces the ability of invertebrates to graze them and, eventually, by removing nighttime oxygen and smothering the substratum, sets up a positive feedback loop that threatens the survival of invertebrates and fish.


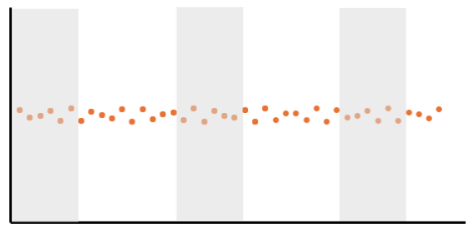
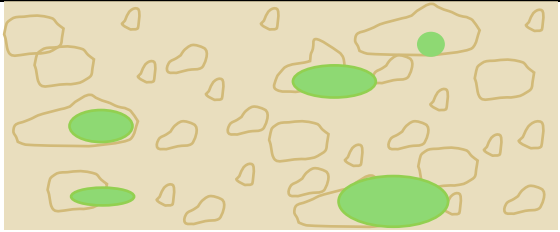
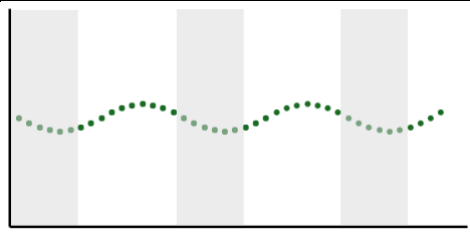
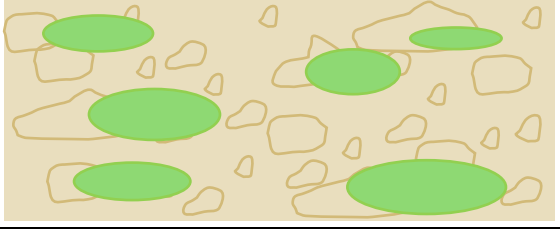
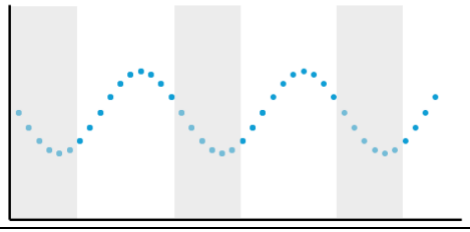
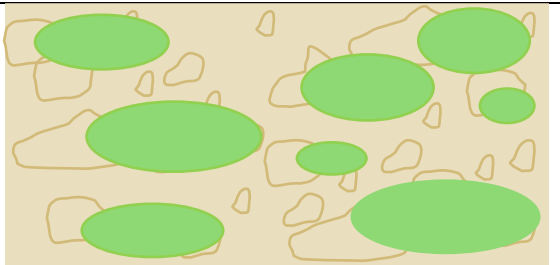
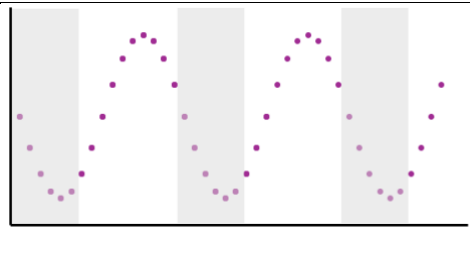
This very basic explanatory framework can then be extended to encompass other variables that may influence the quantity of algae and their consequent effects. For example, bankside shade may reduce algal growth, and dampen the cycles of dissolved oxygen that these drive. Similarly, a rise in river levels could mitigate the problems of low nighttime dissolved oxygen and, if high enough, could even scour some of the algae away. Obstacles such as weirs may exacerbate problems, whilst reverting to a more natural flow regime (if this is possible) should increase turbulent flow, allowing more gas exchange and, again, lessening the risk of low nighttime dissolved oxygen.

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## Standardisation of effort

An assumption underpinning the first version of RAPPER was that it was to be used primarily on small rivers and streams, in order to allow SEPA biologists to explore sub-catchments in detail. The recommended survey approach was to designate a 10 m length, then to survey this by zig-zagging along the length using a Bathyscope to view the stream bottom. However, several of the rivers where RAPPER has been trialled subsequently were larger and this survey approach is not always appropriate.

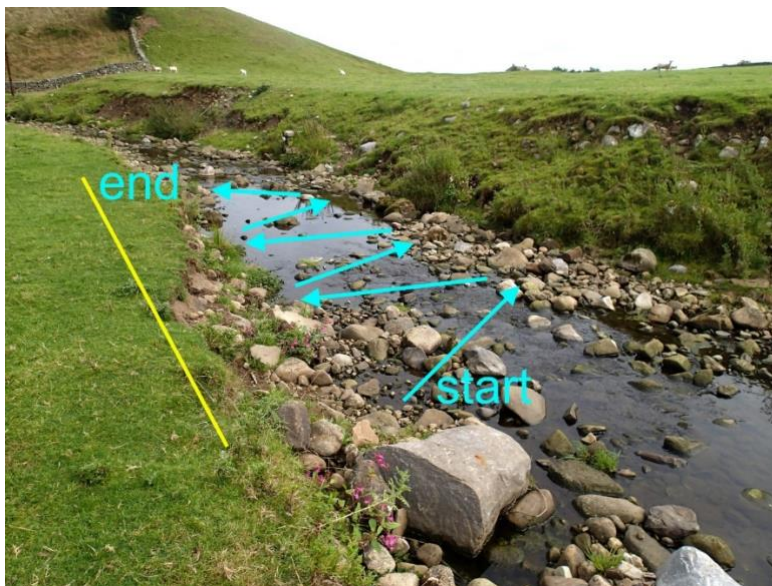
**Table 3. The relationship between algal growth and likely consequences for stream health. The left-hand column shows a diagrammatic representation of what a citizen scientist might see, the right-hand column indicates plausible patterns of dissolved oxygen arising from this. Grey shaded bars indicate night-time, when plant and algal respiration can reduce oxygen concentrations, to the point where other organisms may struggle to survive.**

What you see ...	What you get ...
	
<p><b>High/good status:</b> a few patches of algae may be visible, but will not have a significant effect on the condition of the stream as a whole</p>	
	
<p><b>Moderate status:</b> several visible patches of algae (&gt; 5% of total stream bed covered). These may have a perceptible influence on stream processes, but are still unlikely to affect the health of the invertebrates and fish across the whole reach, except under extreme conditions (e.g. prolonged periods of warm weather and low flow).</p>	
	
<p><b>Moderate/poor status:</b> many visible patches of algae, some quite thick, leading to significant fluctuations in oxygen and, potentially, restricting activities of invertebrates and fish</p>	
	
<p><b>Poor/bad status:</b> extensive growths of filamentous algae, often thick, smothering the substratum and leading to fluctuations in oxygen and, potentially, nighttime anoxia and restricting activities of invertebrates and fish.</p>	

The following recommendations emerged from conversations during workshops and with Environment Agency staff who use RAPPER on the English stretches of the River Wye. Local knowledge is essential when planning RAPPER surveys; in particular, some sense of flow variations is necessary. If your first survey takes place when the river is low, you need to ask whether a survey will still be feasible when the river level is more normal. In particular, are there areas of the river that might be inaccessible when flow is elevated? This will limit your ability to see the streambed and record algal growths as well as representing an unacceptable risk for the surveyor.

RAPPER surveys should cover approximately 50 m<sup>2</sup> of the stream bed, with a configuration determined at the first visit. Options include:

1. A transect along a small stream (as per original recommendations). If the stream is 5 m wide, then the survey length should be 10 m.
2. A narrow transect across a moderate or wide stream (upper rectangle in Fig. 2). If the river is 10 m wide, then the transect would be 5 m across.
3. A fixed quadrat along (or across) a wide river (rectangle in foreground in Fig. 2). This needs to be located in relation to stable objects to ensure that you can return to the same location on each visit.
4. A belt extending a fixed distance from the bank (this is, in effect, a fixed quadrat but which is anchored to the bank – Fig. 3). Local knowledge will be necessary to be sure that surveys are not performed on areas only recently submerged. Our recommendation is that this type of survey is never performed when the river is above base flow.



5.



**Fig. 2. The River Ribble at Bradford Bridge, showing two possible survey options for a medium or large river. The rectangle at the back shows a narrow transect; the rectangle in the foreground shows a fixed quadrat.**



**Fig. 3. The River Usk at Abervavenney, where the survey transect extended approximately 5 m out from the shore. The area on the right hand side of the image was too deep to permit safe wading, and was also heavily shaded by trees.**

### Incorporation of thickness

The need to incorporate thickness had been identified before the workshops, as situations where there was an extensive but thin cover of algae could result in a misleading interpretation (i.e. insufficient biomass to influence oxygen dynamics – see Table 3). This was reinforced by feedback during these sessions. A proposed thickness scale is given in Table 4. Surveyors are encouraged to aim for a median value for the reach – i.e. if there are thick growths at edge but no more than a trace on surfaces in the middle of a stream, then a score of 2 might be appropriate; comments on the patchiness

across a reach can be made on the field sheet. Table 5 shows the interpretation framework revised to include thickness. Although the “good guys” versus “bad guys” interpretation was developed with nutrients in mind, it has been retained, as the presence of “good guys” can be useful for informing interpretation of conditions at a site. Our experience is that summer 2025 (a combination of warm weather, long days and low flows) resulted in a general increase in abundance of all filamentous algae, which favoured those that were already established, irrespective of their traits (see: <https://microscopesandmonsters.wordpress.com/2025/09/06/green-days/>).

**Table 4. The scale for recording the thickness of algal growths.**

Score	Description / thickness	Note
1	Trace (< 1 mm)	Algae follows contours of the stone, and the substratum is still visible beneath. A finger pulled across the surface leaves no impression.
2	Thin (1-2 mm)	Algae smothers surface and the substratum is no longer visible. Major contours are still apparent and a finger pulled across the surface leaves a slight impression.
3	Thick (2 – 5 mm)	Algae forms an opaque layer that also obscures most of the contours of the substratum. A finger pulled across the surface leaves a distinct impression.
4	Massive (> 5 mm)	As above but even thicker.

**Table 5. The revised interpretation framework for RAPPER.**

Algae		Thickness			
Good guys	Bad guys	1	2	3	4
Present	< 5%				
Present	≥ 5, < 25%				
Present	≥ 25%				
Absent	< 5%				
Absent	≥ 5, < 25%				
Absent	≥ 25%				

Risk of “eutrophication”

Low	Maybe	High
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## Other changes to method manual

- Add information to show how RAPPER fits into the “Weight of Evidence” approach
- Include a “step-by-step” guide
- Add information to help citizen scientists differentiate algae from mosses, liverworts and lichens
- Include extra information on measuring shade
- Include guidance on designing surveys to ensure consistent effort across all locations and occasions.
- Include extra information on recording thickness, and the implications of this for data interpretation

In addition, some minor changes to the field record sheet have been made.

## Next steps

Some insightful suggestions were made are out of scope for the present project:

**Revisions to laminated field guide** – Several good suggestions for improvements were made, but we are currently constrained by the technology we have available (A4 printers and laminators). Suggestions are logged in Table 2 and we propose that the next phase includes a budget for a professional designer to develop an A3 foldout sheet, similar to that developed for Extended RiverFly and it may be possible to access external funding (e.g. from British Phycological Society).

**Proposals for data recording** – .

- a) Field app for data collection
- b) Data platform for field data and option to use and import relevant EA/NRW/SEPA data

Both have budget implications and should be held over until more funding is available.

**“Train the trainer” sessions in preparation for 2026 surveys.** Ideally two days with a mixture of indoor and field sessions. Indoor sessions to include a mixture of lectures and laboratory sessions, giving participants an opportunity to better understand the algae that they encounter. Possibly a “northern” and “southern” workshops, depending on demand.

Development of online training and certification primarily for volunteers

Further development of explanatory framework, potentially starting with an expert workshop but aiming at a public-facing accessible outcome.

## Concluding thoughts

The 2025 workshops, conducted across six contrasting catchments, provided an excellent opportunity to test RAPPER in a range of situations. Generally, we found good

agreement with the Eutrophication WoE approach, and the slightly weaker agreement with statutory WFD classifications could usually be explained by the different spatial and temporal scales of the two approaches.

Our take-home message from the workshops was of volunteers becoming aware of an aspect of the biology of their local streams that was hitherto hidden, and which could complement the other CS methods that they were using. In addition to generating information that contributes directly to the ongoing work of Rivers Trusts, regulators and water companies, we see RAPPER as playing a role as an opportunity to move the debate on ecological health away from a simplistic “high nutrients leads to excess algae” mantra towards a more nuanced understanding of a complex system sensitive to a range of pressures, of which nutrients are certainly important but others, including climate change, can also contribute. There is a great opportunity to use RAPPER as a means for increasing eco-literacy and to aid in the development of a “personalised ecology” (see Soga & Gaston, 2024) that bypasses exaggerated media reports and generates more informed conversations about the management of local catchments.

## References

- Brooks, S. J., Fitch, B., Davy-Bowker, J., & Codesal, S. A. (2019). Anglers' Riverfly Monitoring Initiative (ARMI): A UK-wide citizen science project for water quality assessment. *Freshwater Science*, 38(2), 270-280.
- CEN (2009). Water quality – Guidance standard for the surveying, sampling and laboratory analysis of phytobentos in shallow running water. Comité Européen de Normalisation, Geneva.
- Gurnell, A. M., England, J., Shuker, L., & Wharton, G. (2019). The contribution of citizen science volunteers to river monitoring and management: International and national perspectives and the example of the MoRPh survey. *River Research and Applications*, 35(8), 1359-1373.
- Kelly, M., Juggins, S., Guthrie, R., Pritchard, S., Jamieson, J., Rippey, B., Hirst, H. & Yallop, M. (2008). Assessment of ecological status in UK rivers using diatoms. *Freshwater biology*, 53(2), 403-422.
- Kelly, M. G., Krokowski, J., & Harding, J. P. C. (2016). RAPPER: A new method for rapid assessment of macroalgae as a complement to diatom-based assessments of ecological status. *Science of the Total Environment*, 568, 536-545.
- Kelly-Quinn, M., Biggs, J. N., Brooks, S., Fortuno, P., Hegarty, S., Jones, J. I., & Regan, F. (2023). Opportunities, approaches and challenges to the engagement of citizens in filling small water body data gaps. *Hydrobiologia* 850: 3419-3439.
- Loiselle, S., Bishop, I., Moorhouse, H., Pilat, C., Koelman, E., Nelson, R., ... & Lewis, V. (2024). Citizen scientists filling knowledge gaps of phosphate pollution dynamics in rural areas. *Environmental Monitoring and Assessment*, 196(2), 220.
- Shao, G. P., & Bishop, I. J. (2025). Citizen science in river monitoring: a systematic literature review of the whys and hows. *Frontiers in Environmental Science*, 13, 1609084.

Soga, M. & Gaston, K.J. (2024). Extinction of experience among ecologists. *Trends in Ecology and Evolution* 40: 212-215

Suplee, M. W., Watson, V., Teply, M., & McKee, H. (2009). How green is too green? Public opinion of what constitutes undesirable algae levels in streams 1. *JAWRA Journal of the American Water Resources Association*, 45(1), 123-140.

Willby, N.J., Pitt, J-A., & Phillips, G.L. (2012). The ecological classification of UK rivers using aquatic macrophytes. Science Report SC010080/R1. Environment Agency, Bristol.

Woodfield, K., Kelly, M.G., Brierley, S.J. & White, B. (2023). Feeling our way towards macroalgal assessments for citizen scientists. <https://www.fba.org.uk/articles/feeling-our-way-towards-macroalgal-assessment-for-citizen-scientists>.

## Appendix 1: List of sites visited

River / stream	Location	NGR
<b>Ribble Rivers Trust</b>		
Ribble, River	West Bradford Bridge	SD 7460 4412
Leagram Brook		SD 6379 4264
<b>Severn Rivers Trust</b>		
Teme, River	Powick Bridge	SO 8357 5247
Teme, River	The Fold, near Brasford	SO 7968 5318
<b>Wye &amp; Usk Foundation</b>		
Gavenny tributary	Kingsmeadow, Abergaveney	SO 3006 1364
River Usk	Castle Meadows, Abergaveney	SO 2948 1376
<b>Hertfordshire Wildlife Trust</b>		
River Beane	Woodhall New Channel	TL 3145 1794
<b>West Sussex Rivers Trust</b>		
Fishbourne Stream	Fishbourne	SU 8392 0443
River Ems	Emsworth	SU 7503 0622
<b>Norfolk Rivers Trust</b>		
River Wensum	Hellesdon Mill	TG 1986 1030
River Tud	Red Bridge Lane	TG 1914 1092