River Monitoring Guidelines

Contents

Acknowledgements

Information included in this handbook comes from a variety of sources and has been referenced where appropriate. Please do not reproduce information from this handbook for purposes other than undertaking river monitoring. The Rivers Team would like to thank the Love Your River Telford volunteers and funders for their support and dedication during this project.

Overview

This handbook is designed to provide an understanding of the practical skills the Love Your River team gathers during their on-ground training days and the reasoning behind the suggested methods. It forms part of an essential resource pack that equips volunteers with skills and resources to undertake monitoring on rivers, streams and other waterbodies. The pack includes recording sheets and other useful information. Further supplementary resources are available through the Shropshire Wildlife Trust website (www.shropshirewildlifetrust.org.uk/what-we-do/wild-water).

Health and Safety

River monitoring can pose great risk and should only be undertaken when it is safe to do so. To determine the safety of a river a physical evaluation should always be conducted to evaluate whether it is safe to undertake a survey. This should include key observations such as height and flow of the river, its appearance, terrain and weather conditions.

Potential hazards of surveying a river include:

- The risk of falling into water and drowning
- Contact with contaminated water, presenting, for example, the risk of Weil's disease
- Trips, slips and falls
- Exposure to chemicals
- Impact with submerged objects
- Floating or submerged debris
- Hypothermia/ dehydration
- Extreme weather conditions

A river should not be surveyed if in flood or in extreme whether conditions. However, if the rivers flow or height is slightly above usual there is equipment that can be used to reduce risks such as collection cups on long poles. Other ways to mitigate potential hazards are to:

- Be careful of waterborne diseases, such as Weil's disease. Care must be taken to ensure hands are sanitised after working in freshwater.
- Avoiding eating or drinking until hands have been sanitised or washed
- Wear correct gear such as waterproof trousers (if appropriate) and wellington boots.
- Always check the weather forecast before attempting to carry out a survey
- Do not work by yourself.

Why Monitor Rivers?

All of life depends on water. Our activities, the way we use water resources and the type of land adjacent to the water affect the quality of our drinking water, recreational opportunities and the health and diversity of aquatic plants and animals. Our activities also affect whether our rivers and streams will continue to be beautiful places to visit and live now and in the future.

Through river monitoring, it can help provide a snap-shot in time and can give an indication of the current health of the waterbody. To fully access the impacts a river is experiencing, monitoring for a long time frame at various stages in the year can be really helpfully to gauge the health of the river. Returning to the same section of waterway over several years will give an understanding of whether the waterway is improving, declining or staying the same over time.

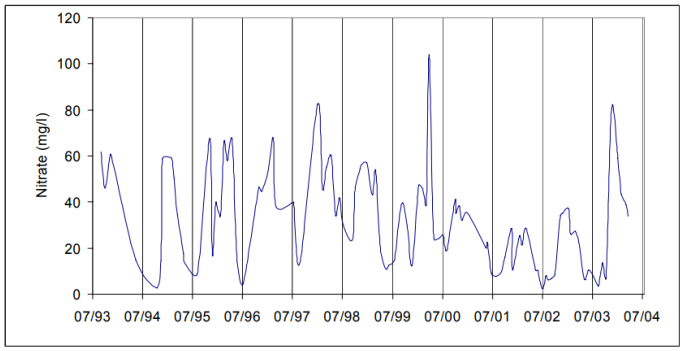


Figure 1- Nitrate concentrations in the Whittle Burn from 1993- 2004

Freshwater invertebrate monitoring

The presence/absence and abundance of certain freshwater invertebrates (often called macroinvertebrates– the aquatic larval stage of various insects) can tell a story of a water body's health. Some invertebrates are more sensitive to pollutants than others and are referred to as "indicator species". Assessing the types of invertebrates found indicates something about the health of the water body they have been found in. For example, worms can tolerate high levels of pollutants but some mayflies don't tolerate even low levels of pollution. They also help describe when pollution events occur because some populations take a while to recover if they have been harmed by pollution.

Figure 2 - Volunteers kick sampling on the Reabrook in Shrewsbury

A good strategy for monitoring invertebrates in waterways is to carry out sampling twice a year, once in spring and once in autumn. This will give an indication of seasonal changes. It can also be useful to carry out sampling before and after any major changes in the catchment such as construction of buildings or habitat improvement projects.

To monitor the invertebrates present in our waterways, we assign a score to them. There are various standardised methods for doing this type of scoring. Some require advanced knowledge of

invertebrate identification by the use of microscopes and the dissection of different parts of the animal. Our aim is to be able to collect samples and identify the invertebrates present as accurately as possible in the field. In light of that, we have compiled a list of common aquatic invertebrates and assigned a score to each one that reflects how tolerant it is to pollution based on the **Whalley Hawkes Paisley Trigg (WHPT)** Method for assessing river invertebrate communities. Once we have identified and counted each invertebrate present in the sample and added up the scores we get an indication of how healthy that waterway is.

Kick Sampling

The typical sampling method for streams and rivers is called kick sampling and involves disturbing the material on the bed of the river or stream and collecting the freed organisms in a net. Invertebrates use a variety of habitat types therefore, it is important to collect samples from the different habitats present such as fast moving riffles, shallow water, slow water, weeds and tree roots. This increases the chances of collecting all the different species present at the site.

Figure 3 - LYR volunteer kick sampling on the Nedge Brook in Telford

The kick sample should be conducted for three minutes. Where possible, the time should be divided proportionally between the different habitats depending on their abundance. For example, if riffles occupy half (50%) of the site they will be sampled for half of the time (90 seconds), and if vegetation occupies a quarter (25%) of the site it will be sampled for a quarter of the time (45 seconds).

How to Kick Sample

Place the net on the riverbed and disturb the area just upstream of the net by kicking or shuffling through the substrate, for the time allocated. The animals will then be carried downstream by the current into the net. Avoid kicking coarse debris into the net. Any debris caught in the net should be removed, while making sure to rinse the invertebrates that are clinging to it back into the net.

For in-stream vegetation and tree roots, sweep the net through the area for the allocated time, trying to scrape the net against the debris. It is also advisable to carry out an additional one minute hand search of large stones by gently rubbing the stones in the water, letting any animals be carried downstream into the net. Be careful as there may be glass, metal or other sharp objects on the riverbed.

To identify what has been collected during the kick sample, fill a tray with river water to a depth of a couple of centimetres and lower the net into the water. Carefully turn the net inside out, and shake gently to release the contents. If you have collected a large sample or lots of debris, it may be necessary to examine the contents by taking smaller portions at a time. To do this you will need to empty the contents of the net into a bucket half filled with water. Remove a sample from that bucket using a kitchen sieve or similar, and empty the contents into your tray. When you have finished examining the sample, empty the contents into a

Figure 4 - Volunteers identifying aquatic invertebrates from kick samples

second bucket or put it back into the river. Continue taking sub- samples until your first bucket is empty.

It may be necessary to remove each invertebrate into a separate tray using a small spoon as this will make identification easier. It may not be possible to count every individual present if there are lots. In this case the abundance should be estimated into the abundance groupings (greater than or less than 10, greater than or less than 100 or greater than or less than 1000). Take care when removing individuals as some bite!

Once all the animals have been identified, return the sample to the river, ideally in the same location as where the sample was collected from.

Identification

To ensure that data collected is reliable and useful we use a standardised method for identifying and recording the invertebrates collected in each sample.

The Field Studies Council publication “A key to the major groups of British freshwater invertebrates” provides a clear and easy to follow identification key. All the target species listed in the appendix that have been selected for scoring are present in this guide book.

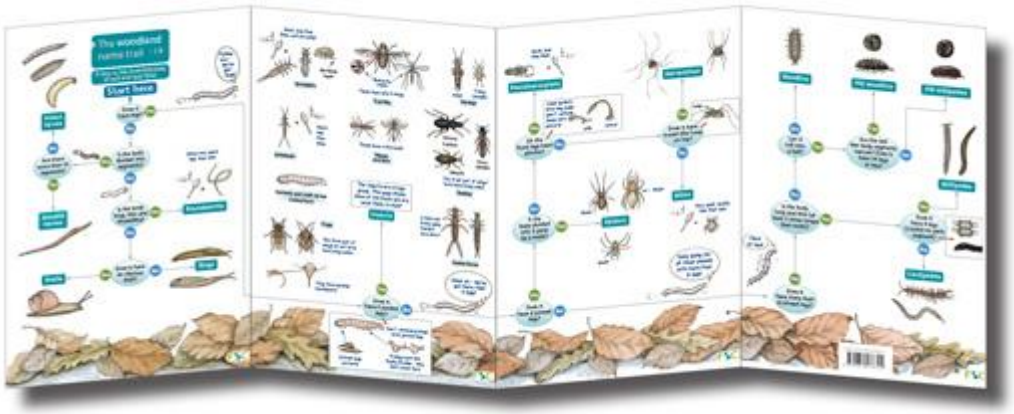


Figure 5 – Invertebrate ID guides

Water Chemistry Analysis

Certain chemicals are harmful to plants, animals and humans. When these chemicals are present in our waterways they can be detected using a variety of scientific methods. Sometimes there are visual clues that there is something present in the water that is out of the ordinary such as detergent smells or bubbles, strange colours, or the presence of dead fish. Sometimes the water will look clean and healthy but analysis can show that levels of certain chemicals are too high for certain plants and animals to tolerate.

Regular monitoring can help us understand how the chemistry of the water changes both within a season and between different seasons and therefore how to identify unnatural levels of chemicals.

Figure 6 - collecting water samples for further analysis on the War Brook

Environmental Quality Standards (EQS)

To understand why we do a chemical analysis of a river, it is important to understand EQS (Environmental Quality Standards). These are set by the EU for Priority Hazardous Substances under the Water Framework Directive (WFD). This includes providing a standard limit for pollutants such as nitrate. The standard maximum contaminant level for nitrate is 10 ppm (parts per million). By conducting frequent chemical tests and reporting back results, it enables frequent monitoring of the state of the environment as trends in exceedances and reductions are taken account of. Furthermore, they provide a base line for how we assess whether a river is in good health or not. For example, a nitrate level that exceeds 20 ppm (parts per million) would need to be reported to the Environmental Agency.

Sampling Methods

A standard water monitoring kit will contain:

- Test strips for ammonia, nitrate and pH
- A temperature probe (or a combined temperature, conductivity, pH probe)
- Sample bottles
- Sampling pole with attached sample cup
- Gloves
- Pencil and note pad
- Net
- White Tray or similar for sample

Results should be recorded either on a printed record sheet or in the note pad provided and transferred onto the Excel spreadsheets once complete (available from the Trust website).

Ammonia and Nitrate

Nitrates and ammonia are essential plant nutrients but elevated levels can cause significant water quality problems. Sources of nitrates include sewage, runoff from fertilised lawns and parkland, run-off from agricultural land and industrial discharges. Ammonia can also find its way into watercourses from misconnected properties where, for example, plumbing for washing machines is incorrectly connected to surface water drains that discharge into nearby rivers, streams and canals.

Unlike temperature and dissolved oxygen, the presence of nitrates and ammonia usually does not have a direct effect on aquatic insects or fish. However, excess levels in water can create conditions that make it difficult for aquatic insects and fish to survive. Algae and other plants use nitrates and ammonia as a source of food, and if available they will consume large amounts leading to accelerated growth. Excessive amounts of algae can cause extreme fluctuations in dissolved oxygen. In the day, photosynthesis by algae and other plants can generate oxygen. However, at night, dissolved oxygen may decrease to very low levels as a result of large numbers of oxygen consuming bacteria feeding on dead or decaying algae and other plants. This can result in aquatic fish and invertebrates been unable to survive as levels of oxygen decreases.

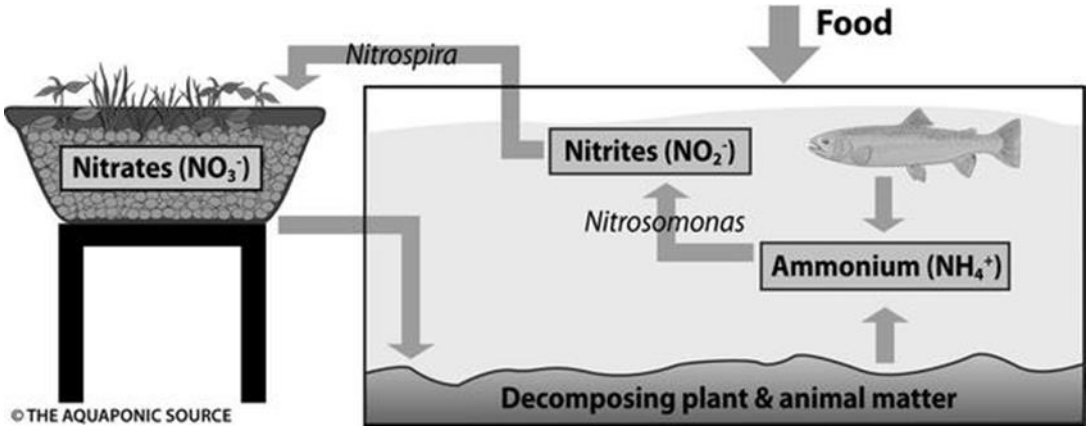


Figure 7 – Diagram showing the conversion of nitrogen into ammonia

How to measure ammonia and nitrate

Collect a small sample of water from the waterbody you are monitoring. Use the test strips or similar, ensuring you return the lid to the test strip bottle. Dip the strip into the water sample, moving it up and down within the sample for 30 seconds. With other tests you may be required to add 8-10 drops of a particular solution.

Allow the test strip to sit for an additional 30 seconds before using the colour chart on the bottle to determine the level of ammonia or nitrate present in the water sample. The amount of ammonia and nitrate is measured in parts per million (ppm). Do this using the individual strips for ammonia and nitrate and record these values on the record sheet.

Figure 8 - Matching up the colour of the test strip with the colour coding on the bottle

Phosphate

Phosphate is a common constituent of agricultural fertilisers, manure, and organic wastes in sewage and industrial effluent. It is also an essential element for plant life but when there is a large amount present in water, it can speed up eutrophication (a reduction in dissolved oxygen in water bodies caused by an increase of mineral and organic nutrients) of rivers and lakes. Soil erosion is a major contributor of phosphate to streams as well as sewage treatment processes and agriculture.

When phosphate reaches a watercourse it can be carried further downstream by suspended particles or absorbed into the riverbed where it will accumulate overtime. When phosphate remains in the riverbed it can lead to stimulated growth of algae and aquatic plants. The increase in algae and aquatic plants will provide food for larger organisms, including fish, invertebrates, and other mammals. This increased productivity will cause an increase in the fish population and overall biological diversity of the system. However, as the phosphate accumulation continues and builds-up in the river or surface water ecosystem, the aging process of the water ecosystem will be accelerated. The overproduction of the river can lead to an imbalance in the nutrient and material cycling process and lead to eutrophication. It has been found that excessive nutrient inputs, usually nitrogen and phosphate, have been shown to be the main cause of eutrophication over the past ten years.

Figure 9 – Eutrophication caused by runoff of chemicals including phosphates, nitrate and ammonia

How to measure phosphate

Similarly to nitrate and ammonia, you will need to take a sample of the water. Either with test strips or adding drops of solution. You will need to wait between 5- 8 minutes for the reaction to take place. Once the time is over, compare the colour to the chart. Values below <0.02 -0.05 ppm are good whereas anything above 0.15 ppm is Poor.

Figure 10–Phosphate measuring kit

pH

pH is a measure of the alkalinity or acidity of a substance. This is measured on a scale from 1 to 14. Lower pH values indicate more acidic conditions while higher pH values indicate more alkaline (or basic) conditions. Factors such as bedrock type or influence from other sources such as sewage treatment waste can affect this. pH can be affected by chemicals in the water and can therefore change many chemical and biological processes in the aquatic ecosystem. Low pH can allow toxic elements in the water to become mobile. This can produce conditions that are toxic to aquatic life, particularly to sensitive species. Most aquatic animals prefer a range of 6.5 - 8.0. pH outside of this range reduces the biodiversity in the watercourse.

How to measure pH

Collect a small sample of water from the waterbody you are monitoring. Use the paper test strips by dipping the strip into the water sample and removing it immediately. Allow the test strip to sit for a few seconds before using the colour chart on the container to determine the pH of the water. Record this value in the record sheet. If using the pH probe, insert the probe into the water sample or directly into the water body. Keep the probe tips fully submerged in the water until the read-out on the probe is stable. Record this value in the record sheet.

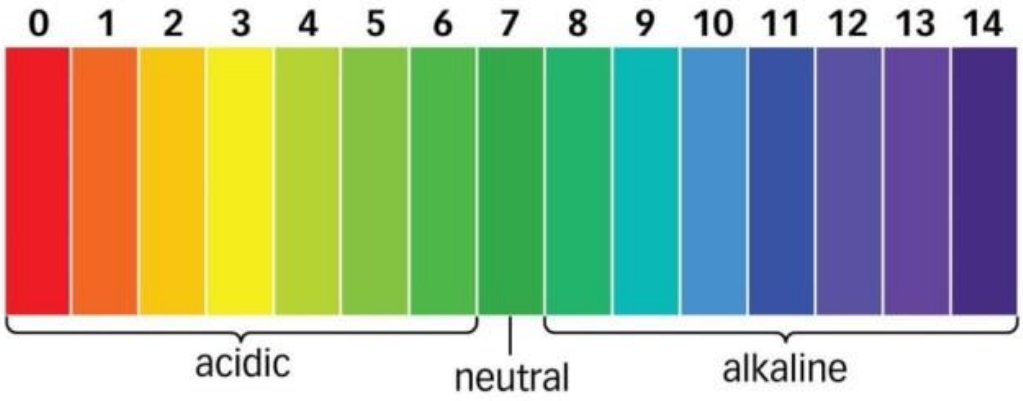


Figure 11 – pH scale

Temperature

Changes in temperature impact plants and animals that are adapted to living within specific temperature ranges and can make them more sensitive to parasites and disease. As temperature increases, oxygen levels decrease which can also adversely affect organisms.

The temperature of a watercourse will vary naturally depending on many factors including the width and depth of the water body. Shading from vegetation will significantly alter the temperature of the water, particularly in the summer months. Causes of temperature change include weather, removal of vegetation and other shade providers, impoundments (a body of water confined by a barrier, such as a dam), and discharge of cooling water, urban rain/storm water, and groundwater inflows to the stream.

How to measure temperature

Temperature can be recorded directly from the water body you are monitoring. If there is no safe access to the water, collect a small sample of water using a long pole with a cup on the end or a similar piece of equipment. Insert the temperature probe into the water sample or directly into the water body. Keep the probe tips fully submerged in the water until the read-out on the probe is stable. Temperature is measured in degrees Celsius (°C) or degrees Fahrenheit (°F). Record this value in the record sheet.

Figure 12 - Combined temperature, pH and conductivity probe

Dissolved Oxygen (DO)

Simply, it is the amount of oxygen dissolved in water. It is an important parameter in assessing water quality because of its influence on the organisms living within a body of water. Dissolved oxygen is an essential factor second only to water itself. A dissolved oxygen level that is too high or too low can harm aquatic life and affect water quality.

Dissolved oxygen is necessary to many forms of life including fish, invertebrates, bacteria and plants. These organisms use oxygen in respiration, similar to organisms on land. Fish and crustaceans obtain oxygen for respiration through their gills, while plant life and phytoplankton require dissolved oxygen for respiration when there is no light for photosynthesis. The amount of dissolved oxygen needed varies from creature to creature. Bottom feeders, oysters and worms need minimal amounts of oxygen (1-6 ppm), while shallow water fish need higher levels (4-15 ppm).

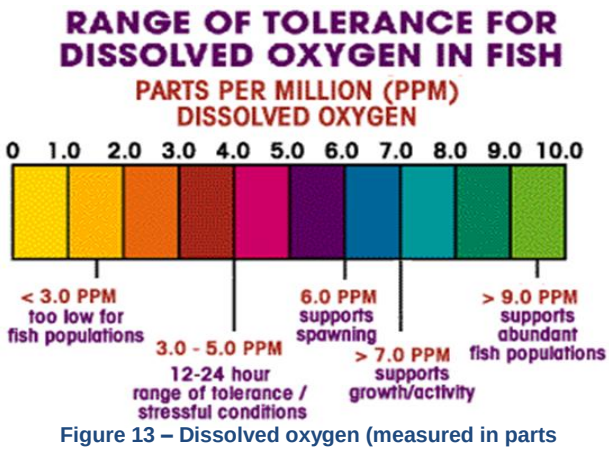


Figure 13 – Dissolved oxygen (measured in parts per million) to ideal values

How to measure dissolved oxygen

You will need a dissolved oxygen kit to do this. This involves inserting a probe which will measure the amount of dissolved oxygen in the water. It is important to note that at night when photosynthesis creases dissolved oxygen will reduce.

Biological Oxygen Demand

BOD refers to Biological Oxygen Demand. It is a measurement of the amount of dissolved oxygen (DO) that is used by aerobic microorganisms (microorganisms that need oxygen to obtain energy) when decomposing organic matter in water. It is important when testing water quality because it provides an index to assess the effect of discharged wastewater will have on the receiving environment. The more organic matter there is (e.g., in sewage and polluted bodies of water), the greater the BOD; and the greater the BOD, the lower the amount of dissolved oxygen available for higher animals such as fishes. The BOD is therefore a reliable gauge of the organic pollution of a body of water. One of the main reasons for treating wastewater prior to its discharge into a water resource is to lower its BOD—i.e., reduce its need of oxygen and thereby lessen its demand from the streams, lakes, rivers, or estuaries into which it is released.

Figure 14 – Dissolved oxygen (measured in parts per million) to ideal values

Heavy Metals

Heavy metals are introduced in aquatic systems as a result of the weathering of soils, rocks, volcanic eruptions and from a variety of human activities. These include mining, processing or use of metals or substances that contain metal pollutants. The most common heavy metal pollutants are arsenic, cadmium, chromium, copper, nickel, lead and mercury.

When the pH in water decreases, metal solubility increases and the metal particles become more mobile. That is why metals are more toxic in soft waters (water that contains low concentrations of ions, in particular is low in ions of calcium and magnesium). Metals can become ‘locked up’ in bottom sediments, where they remain for many years. Streams coming from draining mining areas are often very acidic and contain high concentrations of dissolved metals with little aquatic life. Both

localised and dispersed metal pollution cause environmental damage because metals are non-biodegradable.

Figure 15 – Ideas of where heavy metals come from

Conductivity

Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, nitrate, phosphate and sodium. Organic compounds like oil and alcohol do not conduct electrical current very well and therefore have a low conductivity when in water.

Figure 16 – Conductivity levels in different types of water

Conductivity in streams and rivers is affected primarily by the geology of the area through which the water flows. Streams that run through areas with granite bedrock tend to have lower conductivity because granite is composed of more inert materials. Streams that run through areas with clay soils tend to have higher conductivity because of the presence of conductive minerals that are washed into the water from the clay.

Discharges of pollution into streams can change the conductivity depending on their make- up. Sewage from a missed plumbing connection would raise the conductivity because of the presence of chloride, phosphate, and nitrate; an oil spill would lower the conductivity.

Conductivity is measured in microsiemens per centimetre (µs/cm). The conductivity of rivers generally ranges from 50 to 1500 µs/cm. Rivers supporting good aquatic life have a range between 150 and 500 µs/cm. Conductivity outside this range could indicate that the water is not suitable for certain species.

How to measure Conductivity

Conductivity can be recorded directly from the water body you are monitoring. If there is no safe access to the water, collect a small sample of water using a long pole with a cup on the end or a similar piece of equipment.

Figure 17 – Conductivity probe

Using the conductivity probe, insert the probe into the water sample or directly into the water body. Keep the probe submerged in the water until the read-out on the probe is stable. Record this value in the record sheet.

Turbidity

Turbidity is a measure of how cloudy a water sample is. It is the amount of material in the water that limits light passing through. Materials include soil (clay, silt, and sand), algae, plankton and other substances. It is often measured in Nephelometric Turbidity Units (NTU). Some water bodies are naturally turbid or turbid at certain times, while others are not.

Higher turbidity increases water temperatures because the materials in the water absorb more heat. This in turn reduces the concentration of dissolved oxygen (DO) because warm water holds less DO than cold. Suspended materials can clog fish gills, reducing resistance to disease in fish, lowering growth rates, and affecting egg and larval development by the smothering of sediment. As the particles settle, they can blanket the stream bottom, especially in slower waters, and smother fish eggs and invertebrates.

Turbidity can be useful as an indicator of the effects of runoff from construction, urban environments, agricultural practices, discharges, and other sources. Regular monitoring of turbidity can help detect trends that might indicate changes such as increasing erosion in developing areas. However, turbidity is closely related to stream flow and velocity and should be linked to these factors. Comparisons of the change in turbidity over time, therefore, should be made at the same place and in similar flow conditions.

Figure 18 – Suspended solids

How to measure Turbidity

There are several technical and expensive pieces of equipment that can be used to measure turbidity. These include spectrophotometers, Secchi tubes and turbidimeters. However a more simple and cost effective method can be used in the field. For this we can use the indicative scale provided at the back of this handbook.

Figure 19 – Secchi disk to measure turbidity

Take a sample of water from free flowing water using a sampling pole and cup. Take care not to stir up debris from the river bed or surroundings. Pour the water into the clear sample pot to about two-thirds full. Look through the water to determine how turbid the water is using the graded scale supplied (measured in NTU). Record the NTU value for how cloudy the water looks. Record whether it is more, less or the same cloudiness compared to the last sample.

Stream Flow Rates

Stream flow rate is the volume of water that moves over a designated point over a fixed period of time. It is often expressed as cubic metres per second (m3/sec).

The flow of a watercourse is affected by weather, increasing when it rains and decreasing during dry periods. It also changes during different seasons of the year, typically decreasing during the summer months when evaporation rates are high and riverbank vegetation is actively growing and removing water from the ground.

Flow is important because of its impact on water quality and on the living organisms and habitats in the water body. The stream flow rate determines the kinds of organisms that can live in the watercourse (some need fast-flowing areas while others need quiet pools). It also affects the amount of silt and sediment carried by the stream. Sediment in quiet, slow flowing watercourses will settle quickly to the stream bed. Fast moving watercourses will keep sediment suspended for longer in the water. Fast moving watercourses also generally have higher levels of dissolved oxygen because they are better aerated.

How to measure Stream Flow

The speed of the water flowing at the surface of the stream is a simple measurement that gives an approximate indication of the stream flow rate. Additional measurements of the shape of the waterway are needed to calculate the volume of water in the stream.

If a flow meter is not at hand, you can take measurements from using a float such as a stick and calculate velocity using the formula:

$$v = \frac{d}{t}$$

v = speed
d = distance travelled
t = time taken

Figure 20- Flow meter for measuring stream flow

Dog biscuits make good floats as they are not easily moved by the wind and break down if they are swept away unlike golf balls.

- Measure out 5 – 10 metres downstream, longer sections are better for faster flowing waterways
- Make note of the location and length. Use something permanent like a tree to make start and finish points. This will make it easier when repeating the measurements
- Place the float into the water and measure the time it takes for the float to reach the finish. Repeat this measurement 3-4 times to get an average and record each time.
- Calculate the mean time using the equation above.

Overview

Understanding the Results

If your water quality sampling shows the following results, please repeat the test:

- pH below 6 or above 8
- Ammonia reading above 3.0 ppm
- A change in turbidity that is not thought to be related to weather e.g. following
- rainfall, warm temperatures
- A temperature higher than 20°C

If, after a second test the results are still the same, please report this to the Environment Agency Clean Stream Team on **0800 807060**. Please also report any pollution incidents to the same number.

River Habitat Survey

Overview

We can learn a lot about our waterways by walking along beside them, looking at how they flow and the land use near them. This information can be used to assess the physical structure of our waterways and help determine the conservation value of the waterway.

Using the River Habitat Survey developed by the Environment Agency means we can record our observations in a systematic, standardised way. The 2003 Field Survey Guidance Manual is a great resource for volunteers as specialist knowledge on geology or botany is not required in order to understand the methodology.

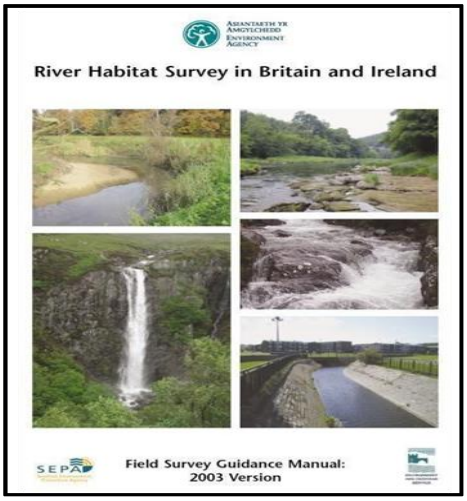


Figure 21- 2003 river survey field survey guide

Appendices

The following documents include:

1. Recording sheet for chemical test
2. Recording sheet for aquatic invertebrates
3. A list of priority species and their abundance scores
4. A guide for estimating turbidity
5. Equipment list

Shropshire Wildlife Trust

Recording Sheet for Chemical Analysis

Watercourse				
Date				
Time				
Weather				
Recorder initials				
Temperature (^{o}c)				
pH				
Turbidity				
Nitrate				
Ammonia				
Phosphate				
Flow Rate				
Comments				

Shropshire Wildlife Trust

Species name	**Rough estimate of total present in sample**	**Abundance category (AB1 - AB4)**	**Score (find species on abundance sheet and look for their abundance category to find the species score)**
Example: Freshwater shrimp	30	AB2	4.5

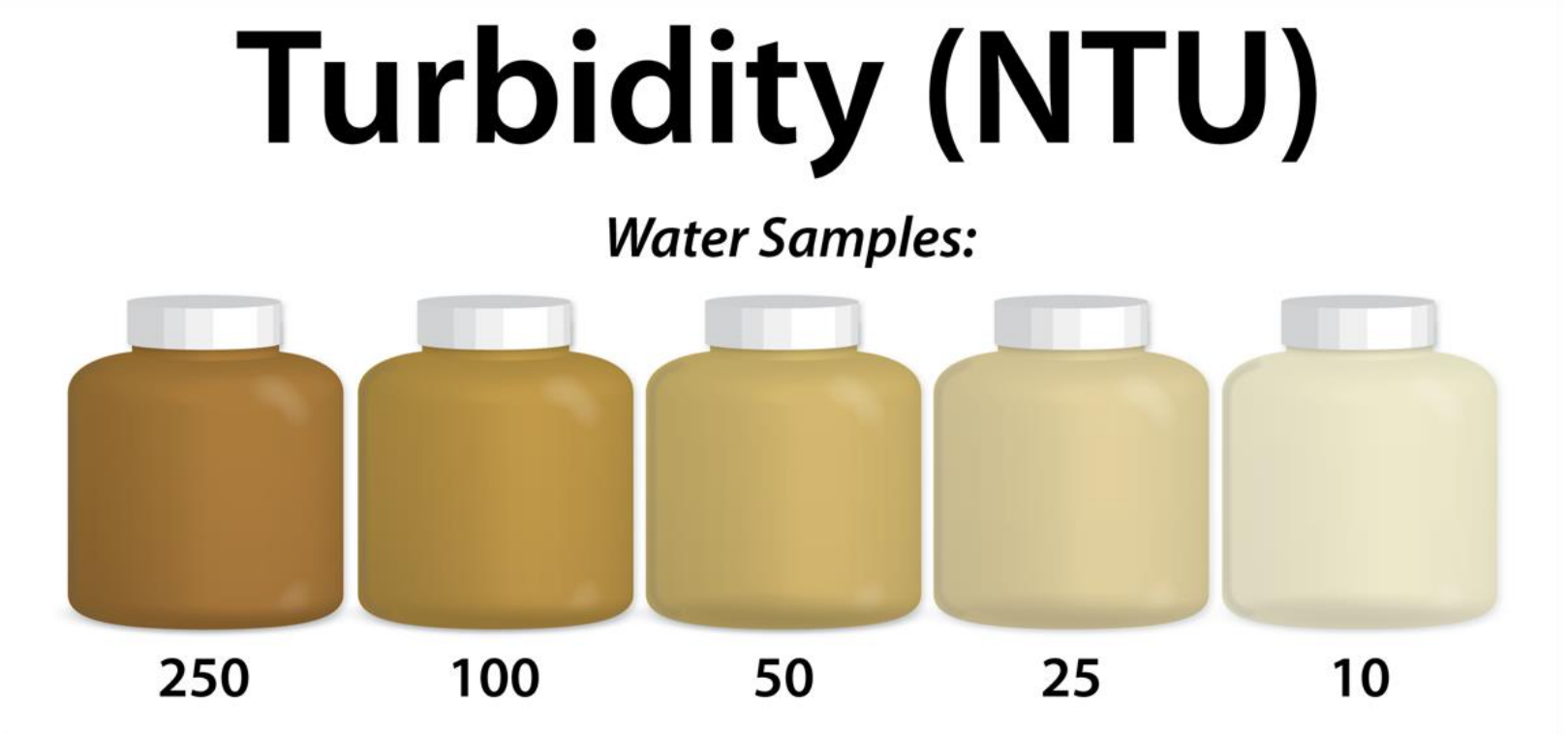
Number of Species	
Score	
Average Score Per Species Sum of scores for all species ÷ number of different species (*0- poor, 5- moderate, 10- Excellent)	

AB1 = 1-10
AB2 = 11-100
AB3 = 101-1000
AB4 = >1000

Shropshire Wildlife Trust

	Common name	Scientific name	AB1	AB2	AB3	AB4
Crustacea						
	Freshwater shrimp	*Gammaridae*	4.2	4.5	4.6	3.9
	Freshwater hog louse	*Asellidae*	4.0	2.3	0.8	-1.6
	Freshwater crayfish	*Astacidae*	7.9	7.9	7.9	7.9
Bivalves						
	Swan or duck mussel	*Unionidae*	5.2	6.8	6.8	6.8
	Orb cockle or pea mussel	*Sphaeriidae*	4.4	3.5	3.4	2.3
	Zebra mussel	*Dreissenidae*	3.7	3.7	3.7	3.7
Snails (Gastropods)						
	Freshwater limpet	*Ancylidae*	5.8	5.5	5.5	5.5
	Pond snail	*Lymnaeidae*	3.6	2.5	1.2	1.2
	Ramshorn snail	*Planorbiidae*	3.2	3.0	2.4	2.4
True Flies						
	Blackfly	*Simuliidae*	5.5	6.1	5.8	3.9
	Meniscus midge	*Dixidae*	7.0	7.0	7.0	7.0
	Non-biting midge (Bloodworms)	*Chironomidae*	1.2	1.3	-0.9	-0.9
	Biting midge	*Ceratopogonidae*	5.4	5.5	5.5	5.5
	Mosquito	*Culicidae*	2.0	1.9	1.9	1.9
	Rat-tailed maggot	*Syrphidae*	1.9	1.9	1.9	1.9
	Crane fly larvae and their relatives	*Tipulidae*	5.4	6.9	6.9	7.1
Leeches						
		Piscicolidae	5.2	4.9	4.9	4.9
		Glossiphoniidae	3.4	2.5	0.8	0.8
		Hirudinidae	-0.8	-0.8	-0.8	-0.8
Water Bugs						
	Water measurer	*Hydrometridae*	4.3	4.3	4.3	4.3
	Pond skater	*Gerridae*	5.2	5.5	5.5	5.5
	Water scorpion	*Nepidae*	2.9	2.9	2.9	2.9
	Greater water boatman	*Notonectidae*	3.4	3.9	3.9	3.9
	Lesser water boatman	*Corixidae*	3.7	3.9	3.7	3.7
Water Beetles						
	Whirligig beetle	*Gyrinidae*	8.1	9.0	9.0	9.0
	Diving beetle	*Dytiscidae*	4.5	4.8	4.8	4.8
	Water scavenger beetle	*Hydrophilidae*	5.8	8.8	8.8	8.8
Mayflies						
	Swimming mayfly	*Baetidae*	3.6	5.9	7.2	7.5
	Burrowing mayfly	*Ephemeridae*	8.3	8.8	9.4	9.4
	Flattened or flat-headed mayfly	*Ecdyonuridae*	8.5	10.3	11.1	11.1
Dragonflies						
	Dragonfly	*Anisoptera*	6.2	6.2	6.2	6.2
Damselflies						
	Damselfly	*Zygoptera*	5.1	5.3	5.3	5.3
Caddisflies						
	Finger net caddisfly	*Philopotamidae*	11.2	11.1	11.1	11.1
	Trumpet net/tube net caddisfly	*Polycentropodidae*	8.2	8.1	8.1	8.1
	Net spinning caddisfly	*Hydropsychidae*	5.8	7.2	7.4	7.4
	Purse-case caddisfly	*Hydroptilidae*	6.1	6.5	6.8	6.8
	Cased caddisfly	*Leptoceridae*	6.7	6.9	7.1	7.1
		Phryganeidae	5.5	5.5	5.5	5.5
Stoneflies						
	Stonefly	*Plecoptera*	10.5	11.3	11.4	11.4
Worms						
	True worm	*Oligochaeta*	3.6	2.3	1.4	-0.6
Flatworms						
	Flatworm	*Triclada*	3.5	3.7	3.7	3.7

Turbidity (NTU)



Equipment	Supplier	Cost for one (£)
White trays for invertebrate sample 	NHBS https://www.nhbs.com/white-sampling-trays	2.99
Net for kick sampling 	NHBS https://www.nhbs.com/search?q=POND+NET&qtview=214071	31.99
10x Magnification Hand lens 	NHBS https://www.nhbs.com/opticron-hand-lens-18mm-10x-magnification?bkfno=210078	11.50
Temperature probe 	Amazon https://www.amazon.co.uk/Silverline-469539-Pocket-Digital-Thermometer/dp/B000QHD09K/ref=sr_1_2?s=diy&ie=UTF8&qid=1539683942&sr=1-2&keywords=water+temperature+probe	9.15
pH metre 	Amazon https://www.amazon.co.uk/Semlos-Resolution-Calibration-0-00-14-00-Measurement/dp/B01C5OOF6I/ref=sr_1_3?ie=UTF8&qid=1539683815&sr=8-3&keywords=ph+meter	12.98
Ammonia tests 	Amazon https://www.amazon.co.uk/API-130-Test-Freshwater-Saltwater-Aquarium/dp/B0002566TC/ref=sr_1_3?ie=UTF8&qid=1540390353&sr=8-3&keywords=water+test+ammonia	10.68

Nitrate tests 	Amazon https://www.amazon.co.uk/API-NITRATE-Freshwater-Saltwater-Aquarium/dp/B002DVVICS/ref=sr_1_3?s=pet-supplies&ie=UTF8&qid=1540390405&sr=1-3&keywords=water+test+nitrate		9.90
Phosphate tests 	Amazon https://www.amazon.co.uk/API-130-Test-Freshwater-Saltwater-Aquarium/dp/B00BUFRY30/ref=sr_1_3?ie=UTF8&qid=1540390353&sr=8-3&keywords=water%2Btest%2Bammonia&th=1		12.79
Freshwater Name Trail 	FSC https://www.field-studies-council.org/publications/pubs/freshwater-name-trail.aspx Shropshire Wildlife Trust Visitor Centre, SY2 6AH.		3 3
Collecting pot 	NHBS https://www.nhbs.com/wildlife-survey-and-monitoring?q=&hPP=60&idx=titles&p=0&fR[shops.id][0]=1&fR[shops.id][1]=1&hFR[subjects_equipment.lvl1][0]=Aquatic%20Survey%20%26%20Monitoring%20>%20Pond%20Dipping%20Equipment&qtview=204539		0.6
Total (if you were to buy all parts of the kit)			**105.58 – 106.58**
NHBS Delivery		£7.50	113.08 – 114.08
FSC Delivery		£1	114.08 – 115.08
Amazon Delivery		Variable	-