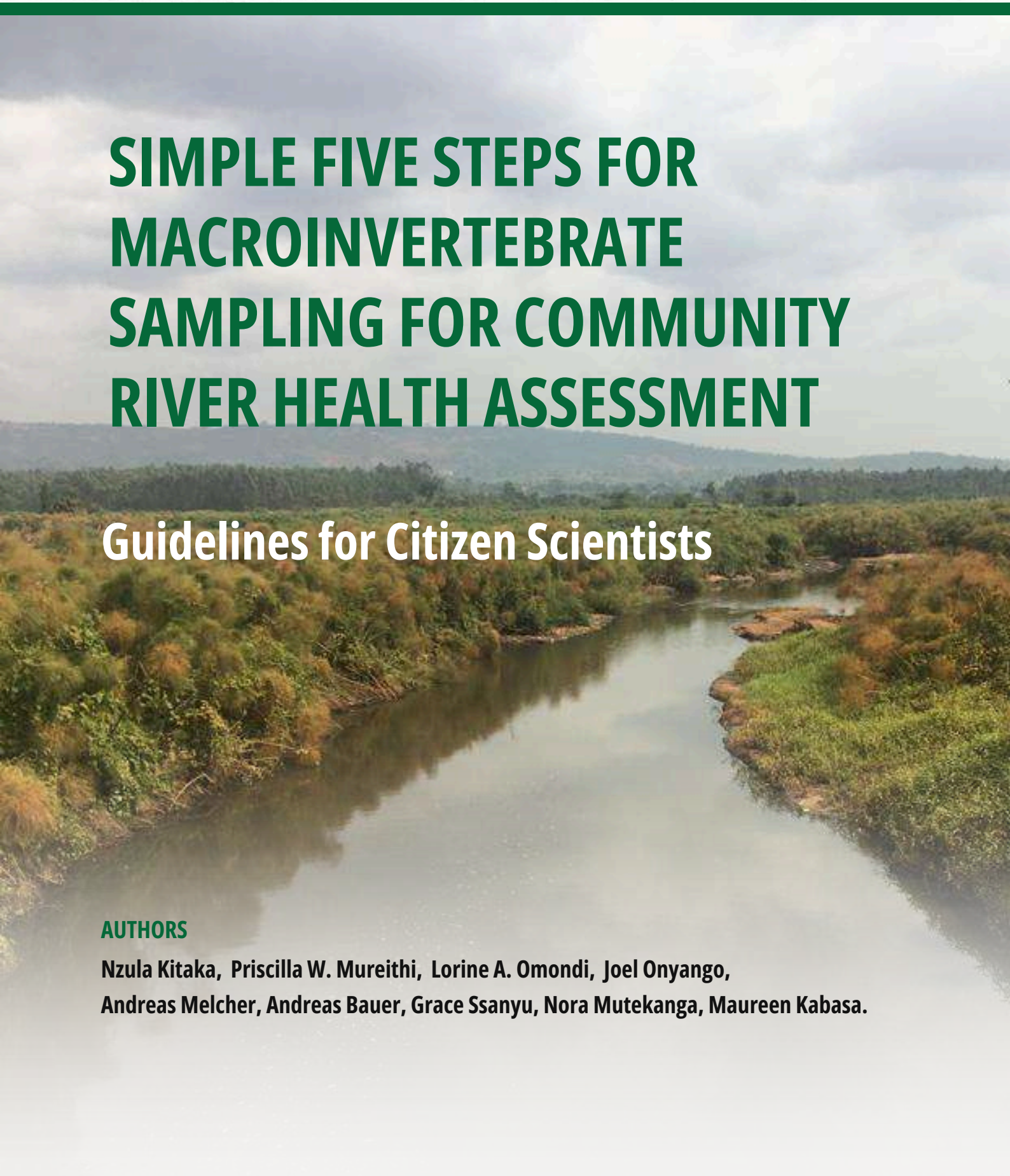
Strengthening Community-Based Research for River Health and Climate Change Mitigation in Eastern Africa (STREM) Project

# SIMPLE FIVE STEPS FOR MACROINVERTEBRATE SAMPLING FOR COMMUNITY RIVER HEALTH ASSESSMENT

## Guidelines for Citizen Scientists

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# INTRODUCTION

Macroinvertebrates are animals that lack backbones and are large enough to be seen with the naked eye. Worms, snails, beetles, dragonflies, mayflies, and stoneflies, are examples of macroinvertebrates found in rivers. Pollution and other changes brought about by human activity in and around a river will impact on the species and numbers of macroinvertebrates that reside at the area. Therefore, due their response to changes on their immediate environment, river macroinvertebrates have been frequently employed to assess a river's biological health consequently the river water quality. Healthy rivers are often unpolluted and offer a variety of macroinvertebrate habitats. Therefore, one would expect to find a variety of macroinvertebrate species in a healthy river, including those that are sensitive to water pollution. Unhealthy rivers may be heavily polluted or have lost the majority of their macroinvertebrate niches. Below is a simple 5 steps protocol for sampling macroinvertebrates for assessing the water quality in rivers.

## Equipment Required

Handheld kick nets 0.5mm mesh, Hand lens, Gumboots, 2 White sorting trays, Sample collection jars, plastic bucket, Labels, tweezers, brush (tooth brush), Pencils, notebook, protocol sheet.

## STEP 1

Selection of a Sampling Site

## STEP 2

Positioning the Kick Net for Kicking the Riverbed

## STEP 3

Removing the Sample from the Kick Net

## STEP 4

Sorting, Identifying and Counting The Macroinvertebrates

## STEP 5

Macroinvertebrates Data Analysis for River Heath Assessment

# DETAILED MACROINVERTEBRATE SAMPLE COLLECTION PROCEDURES

## STEP 1

### Selection of a Sampling Site

Identify sampling sites in the river with different pollution levels or human activities that you wish to compare. For example, upstream (at the river source- where the river originates), midstream (middle of the river as you move downstream), and downstream sites (near where the river discharges to either another river, lake, a wetland or ocean).

Once you select the site (e.g. at the upstream), then select a sampling point preferably a riffle. A good riffle for sampling will have cobble-sized stones, fast-moving water, and shallow with a depth ranging from 10 to 50 cm (Figure 1). Select a one meter by one meter (1x1) area within the riffle for sampling.

**Caution:** The sampling area must not be disturbed by physical contact, if at all possible.


**Plate 1:** **Demonstration of STEP 1** - Suitable macroinvertebrates sampling sites (A & B) comprising of fast- moving water with stones (Photos by Nzula Kitaka)

# STEP 2

## Positioning The Kick Net for Kicking the Riverbed

During sampling, one person should hold the net upright facing the flow at downstream of the sampling area (Plate 2A). Stretched out the net to its full width with the bottom edge lying firmly against the stream bed. Stones, bedrock, or benthic substrates in habitats are sampled by kicking, dislodging, and collecting the invertebrates into the kicking net for approximately for one minute (Plate 2B). This is done by kicking the stream bed using your foot with a sideways shuffling motion towards the net. Once this is done, immediately remove the net from the water.


**Plate 2: Demonstration of STEP 2 -** Positioning the kicknet (A) and kicking the riverbed (B) for macroinvertebrate sample collection (Photos by Lorine Omondi (A) and Nzula Kitaka (B) )

# STEP 3

## Removing the Sample from the Kick Net

Carry the kick net to the stream bank and pour the collected sample into a bucket with water by inverting the net into the bucket (Plate 3A). Wash/flush out with water to ensure that macroinvertebrates do not remain in the net (Plate 3B). Sieve the content into a smaller sieve of a lower mesh size (smaller holes) than the kick net and pour the content into a white tray with river water. Remove the debris, stones, and other materials, so that you can easily pick the macroinvertebrates.


**Plate 3: Demonstration of STEP 3 -** Removing the sample from the kicknet (A) and washing of the net (B) (Photos by Nzula Kitaka)

# STEP 4

## Sorting, Identifying and Counting the Macroinvertebrates

Using a hand lens look carefully through the sample on the tray to pick as many specimens (organisms) as possible. Using tweezers or fingers, place all the specimens in another container as you sort, identify, and count the species of macroinvertebrates found using simple identification key provided (Plate 4). Record the organisms collected in the data sheet given in Table 1. Interpret the results to categorize the site as of good or bad ecological status (Plate 4, Table1)

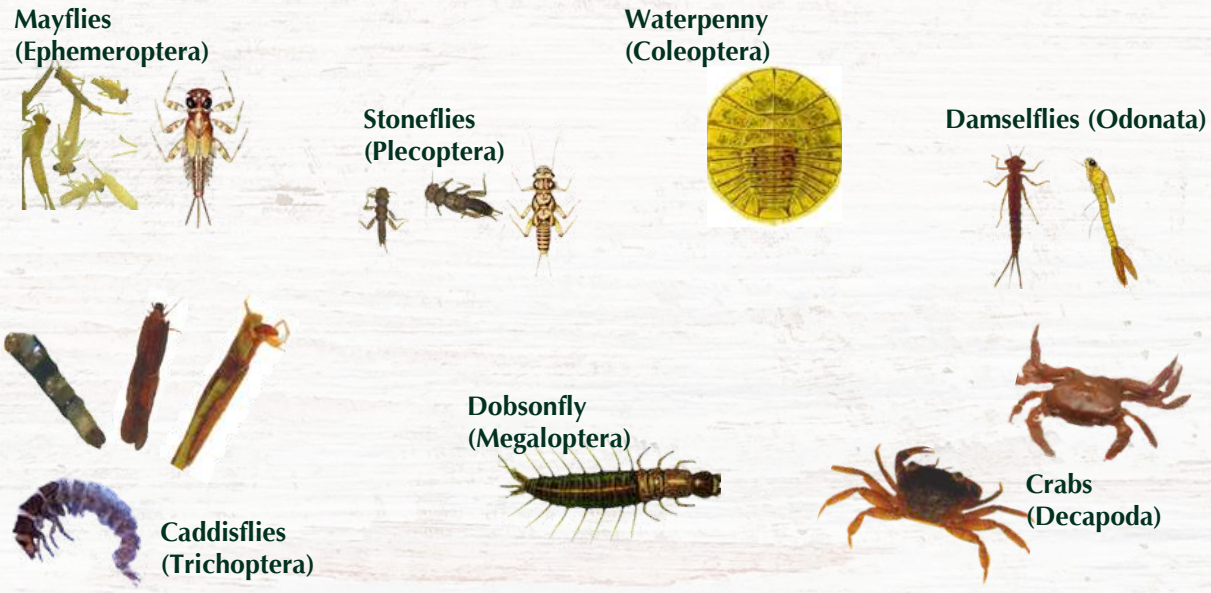
**NB:** Since volunteers do not have the taxonomic experience to identify up to a much lower taxonomic level this could lead to data inaccuracy. Thus, identification of macroinvertebrates will be done to order level for Ephemeroptera, Plecoptera, and Trichoptera (EPT), Diptera, and subclass level for Oligochaeta. A site with good ecological status will have a higher number of EPT than Diptera and Oligochaeta. All macroinvertebrates will be returned to the stream after counting.

**NOTE:**

1. If you plan to transport the sample to your "laboratory" for further identification, you can place the macroinvertebrates into a container filled with 70% alcohol e.g. ethanol.
2. It's important to note that some families in the EPT group (Caenidae, Hydropsychidae, and Baetidae) can tolerate polluted water and this could affect the performance of EPT metrics.

In situations where EPT Metric does not give a conclusive ecological status of a site, consult an experienced macroinvertebrate taxonomist to give a professional judgment.

### Good and Moderate Water Quality Indicators



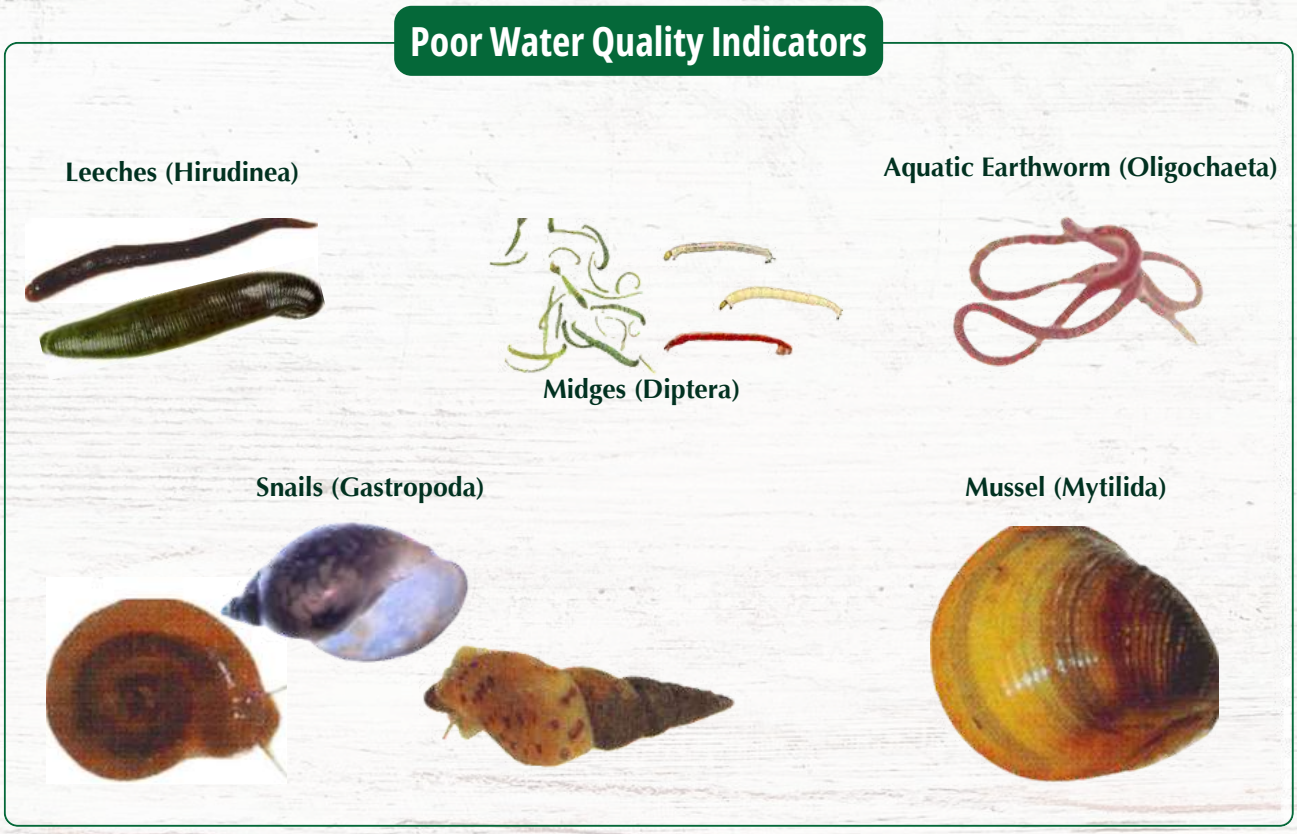



**Plate 4:** Photos of different macroinvertebrates and their related water quality to aid in sorting identifying and counting the macroinvertebrates (Photos from Priscilla Mureithi and Gerber & Gabriel, 2002)

# STEP 5

## Macroinvertebrates Data Analysis for River Heath Assessment

Using the data collected in the field (Table 1) and samples carried to the laboratory for further analysis, different analyses can be conducted using the available macroinvertebrate data analysis tools and indices. Although currently there is no Kenyan Biometric Indices, other appropriate existing tools and indices especially those developed for African river systems can be used with assistance from a professional. However, there are several initiatives to come up with a Kenyan Biomonitoring Indices. Once developed, it's advisable to take it up and compare the results obtained with those previously used which were developed for other countries river systems.

**NB:** The communities will require basic training and retooling on the above procedures and provided with other support materials for River Health Assessment from time to time.

## RIVER HEALTH ASSESSMENT SHEET FOR CITIZEN SCIENTISTS

**Name of Volunteer:**
**Name of River:**
**Site Name:**
**Date of Sampling:**

| MACROINVERTEBRATE TAXA | | | |
|---|---|---|---|
| **INTOLERANT (SENSITIVE)** | **COUNTS** | **TOLERANT** | **COUNTS** |
| Ephemeroptera (Mayflies) | | Oligochaeta | |
| Plecoptera (Stoneflies) | | Diptera | |
| Trichoptera | | | |
| **Total** | | **Total** | |

| ECOLOGICAL STATUS | |
|---|---|
| **GOOD** | **BAD** |
| Total intolerant taxa greater than tolerant taxa | Total tolerant taxa greater than intolerant taxa |

**CONCLUSION:**

**Table 1:** Data Sheet sample for recording macroinvertebrates and assessment of River Health Status (Adopted from Engel & Voshell, 2002)

## REFERENCES


1. Engel, S. R., & Voshell Jr, J. R. (2002). Volunteer biological monitoring: can it accurately assess the ecological condition of streams? American Entomologist, 48(3), 164-177.
2. Gerber, A., & Gabriel, M. J. M. (2002). Aquatic invertebrates of South African rivers. Department of Water Affairs and Forestry.