RIVEAL PROJECT

RIPARIAN FOREST VALUES AND ECOSYSTEM SERVICES - MACROINVERTEBRATES

MACROINVERTEBRATES ARE...

... aquatic boneless organisms, small but visible to the naked eye, that are found in the water, in which they live their entire life or at some stage of their development.

Benthic macroinvertebrates are present in nearly all stream and rivers worldwide, often found attached to rocks, vegetation, logs and twigs or buried into the sediments.

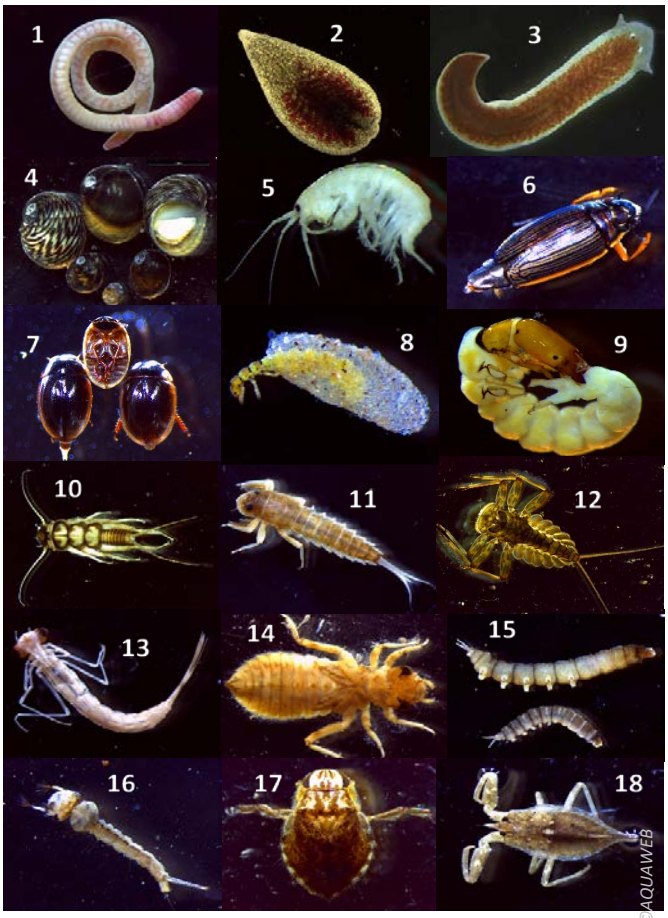
They are an abundant and diverse community dominated by aquatic insects (mainly larval or nymph stages), but including also molluscs, crustaceans and worms.

WHAT ARE THEIR FUNCTIONS?

Macroinvertebrates are key players in the functioning of stream ecosystems, contributing to nutrient cycling and decomposition.

They are a critical part of the stream´s food web, responsible for much of the energy transfer between the lower and upper trophic levels. They feed on primary producers, microorganisms and organic debris, and serve as an important food source for high consumers that include fish, amphibians, reptiles, birds and mammals.

Macroinvertebrates can be categorized in functional feeding groups according to their feeding habits, namely grazers, shredders, collectors and predators.



Macroinvertebrates of rivers: Annelida (worms & leeches) (1, 2); Tubellaria (flatworms) (3); Mollusca (snails & mussels) (4); Crustacea (shrimps, crayfishs & amphipods) (5); Coleoptera (beetles) (6, 7); Trichoptera (caddisflies) (8, 9); Plecoptera (stoneflies) (10); Epemeroptera (mayflies) (11, 12); Odonata (dragonfly nymphs) (13, 14); Diptera (midges larvae) (15, 16); Hemiptera (water boatman & scorpions) (17, 18).

MORPHOLOGICAL AND BEHAVIORAL ADAPTATIONS

Macroinvertebrates have intrinsic features and ecological preferences (traits) that reflect their ability to cope with environmental constraints, such as high flow velocity or oxygen limitation, and consequently their survival abilities.

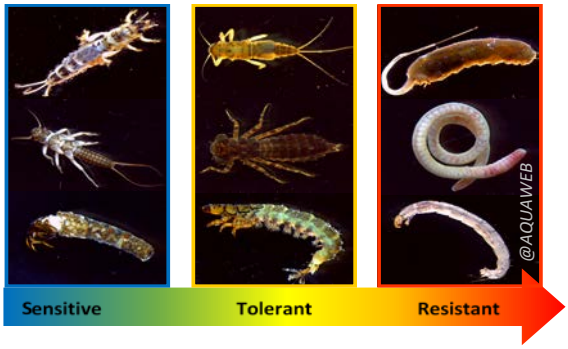
Organisms that live in fast-flowing water often have claws or hooks for holding on to stony substrates and a flat or hydrodynamic body shape. Organisms that live in poor oxygenated waters, with high organic contamination, frequently adopt behaviours to assess atmospheric oxygen or have respiratory pigments and body structures that maximizes water oxygen uptake.

MACROINVERTEBRATES AS BIOINDICATORS

Benthic macroinvertebrates are commonly used as reliable indicators of the biological condition of waterbodies. They are relatively easy to sample and identify and respond in fairly predictive ways to factors such as dissolved oxygen, pH, riparian vegetation removal, substrate alteration, nutrient enrichment and hydrological changes among other stressors.

Macroinvertebrates sample collection by hand-net kick sampling (left) *in the field and a sample ready to be identified under a stereomicroscope* (right).

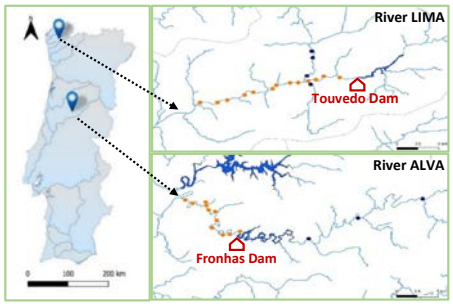
Because they spend all or most of their life cycle in the water and are relatively immobile, macroinvertebrates can integrate the impacts of aquatic stressors in combination and over time, thus disclosing the effects of short and long-term pollution events.



Different macroinvertebrates tolerate different stream conditions and levels of pollution. Sensitive groups like stoneflies (Plecoptera), mayflies (Ephemeroptera) and caddisflies (Trichoptera) are associated with good water quality, whereas more resistant organisms like worms (Oligochaeta) and some dipteran midges can be the sole taxa present in severely impacted streams.

MACROINVERTEBRATES IN RIVEAL

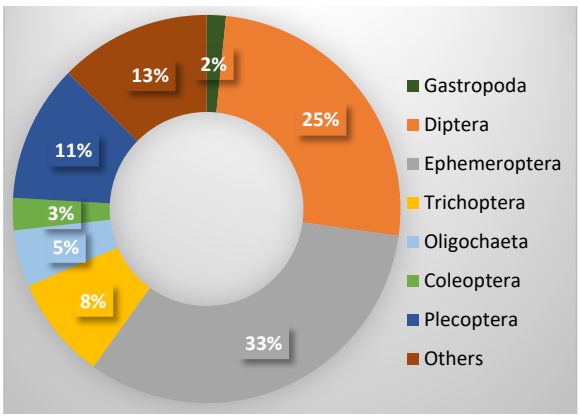
Part of RIVEAL aims the study of macroinvertebrate community in two Portuguese rivers impaired by dams (River Lima and River Alva), assessing differences between instream mesohabitats (riffles, runs and pools).



Sampling sites of the RIVEAL project in Lima and Alva Rivers affected by the dams (orange dots) and non-affected (blue dots).

We found **80** macroinvertebrate families in the overall study area corresponding to **71 854** individuals.

Most abundant taxa found in the overall study were distributed among Ephemeroptera (mostly *Baetis* sp., *Ephemerella* sp., *Caenis luctuosa* and Heptageniidae), Diptera (Chironomidae and Simulidae), Trichoptera (Hydropsychidae, Philopotamidae and Leptoceridae), Plecoptera (Leuctridae), Coleoptera (mainly Elmidae), Gastropoda (mostly *Potamopyrgus antipodarum*, an exotic invasive species) and Oligochaeta.



Other taxonomic groups found in the overall study include Bivalvia, Crustacea, Odonata, Tubellaria, Hirudinea, Hemiptera, Megaloptera and Cladocera.

Taxonomic composition and abundance of macroinvertebrate communities were different between regulated and unregulated sites, but also between instream mesohabitats.

Biological traits describing locomotion were strongly related with habitat conditions

- *Riffles*: higher presence of organisms with flight and temporary attachment modes
- *Runs*: swimmers and organims with permanent attachment
- *Pools*: epibenthic and endobenthic locomotion modes.

https://www.riveal.pt

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