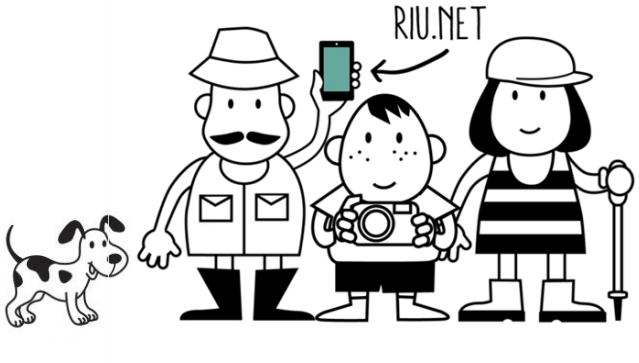
An app for assessing the hydrological status and ecological quality of a river



RiuNet 'The Manual'

to view the contents of the APP and to make an assessment without the use of a smart device

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CONFEDERACIÓN HIDROGRÁFICA DEL JÚCAR

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incognita

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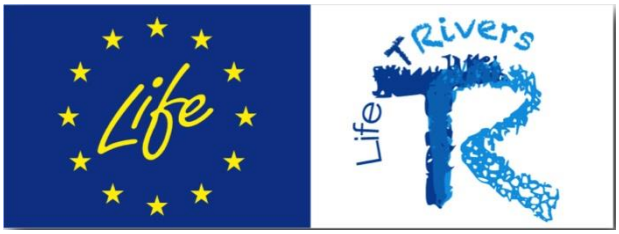

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Rivera family drawings by:
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FEHM

This is an interactive education tool that will help you with the assessment of the hydrological status and the ecological quality of a fluvial ecosystem. Moreover, it will provide scientific data to members of the research group FEHM from the Department of Ecology at the University of Barcelona and Institute of Environmental Assessment and Water Research IDAEA-CSIC.

This written version contains the same content found at the app. This will let you complete the assessment using sheets for times when your electronic device is not working properly, not having the app, or any other incident.

What will you do?

1. First, provide information on the river you are assessing, name of river, hydrographical district (if known), and town (nearby). Enter the geographical location and take a photo of the river. You can also describe where you are, how you got there or explain the river's location.	**Sheet 1**
2. Then, choose the current aquatic phase of the river, the river's hydrological regime and the river type. Not all the rivers are the same!	**Sheet 1**
3. Assess the river's hydrological status	**Sheet 2**
4. The assessment of the river's ecological quality has two steps: 4.1 Hydromorphological test (riparian forest and river's channel) 4.2 Biological test (river's invertebrates)	**Sheet 5** **Sheet 3** **Sheet 4**
5. Fill in the complementary data (other data) module.	**Sheet 6**
6. Finally, send us the data.	

What will you achieve by participating?

1. You will learn how rivers work and about the organisms that live in them.
2. You will assess the quality of your river, and measuring its hydrological and ecological status.
3. You will provide data to both researchers and stakeholders, helping to improve management and conservation of the river.
4. Above all, you will have fun doing it!

If your electronic device does not have signal you will obviously not be able to complete the geolocalization. However, you may provide information about the site, how you got there or where it is located in the sheest, as well as some of its features. Take a picture of your river and and send it later with your assessments.

Before going to the river

- **Read:**

Security measures	Annex 1
Essential material	Annex 2
Sampling tutorial	Annex 3

Getting to the river

- **Check you have all the essential material**
- **Check the sampling tutorial.**
- **Follow the security measures and, if you are not confident, do not get into the river.**

Where and how is the river?

Get a geoposition with GPS
How is your river? And make a picture!

Detect my position	SHEET 1
Aquatic phase	
Hydrological regime	
River type	
Picture the river	

Start the tests

Following all the explanations found here you will be able to fulfil all the sheets and assess the hydrological status and the ecology quality of a river.

STATUS TEST Hidrological	SHEET 2
QUALITY TEST Hidromorfological	SHEET 3
QUALITY TEST Biological	SHEET 4
+ → QUALITY TEST ECOLÓGICA	SHEET 5
OTHER RESULTS	SHEET 6

When possible, send the results using the app

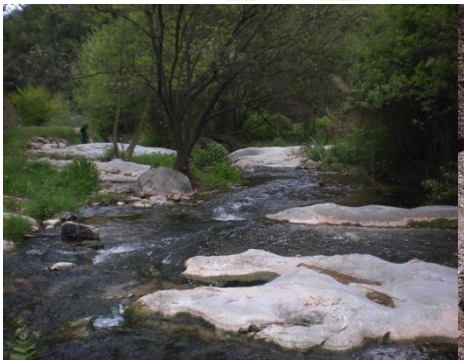
The aquatic phase is a simplified description of the water conditions observed at the time of sampling. To perform a test using RiuNet, a **single aquatic phase** must be selected based on observation of water levels and flow in the river. The aquatic phase at the time of sampling will determine whether a biological assessment of the river can be carried out using RiuNet.

Three simplified aquatic phases are used in RiuNet:

1. **FLOWING WATER**: water is flowing and is sufficient to connects habitats such as rifles and ppols.
2. **DISCONNECTED POOLS**: water is not flowing, and is present only in disconnected pools.
3. **DRY RIVERBED**: the river is dry, or if water is present, it is of a minimal ammount.

Look at the river **and select the current aquatic phase of the river**: flowing water, disconnected pools, or dry riverbed. Write it down in Sheet 1.

Flowing water



The water in the river is flowing and is sufficient to connect habitats such as riffles and pools.

Disconnected pools

The water in the river is not flowing, and is present only in disconnected pools.

Dry riverbed

There is no water in the river, or water is present only in small amounts (because of recent rains, for example).

The biological evaluation with RiuNet can only be carried out if the river is in a *flowing water* aquatic phase.

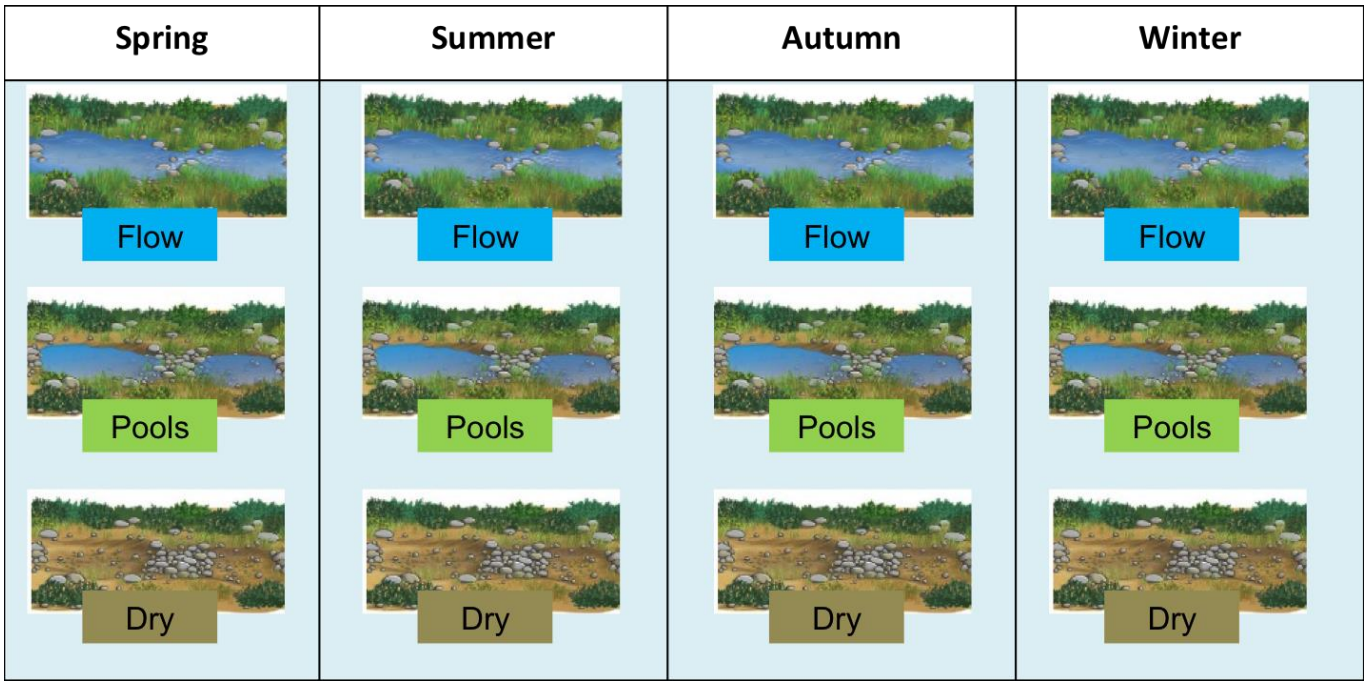
(1) **If flow is selected all year round**, the river regime is **PERMANENT.** It is a river where water flows all year round and river habitats (e.g. riffles and more lentic habitats such as pools) are connected.

If one season is different from **flow**ing water, the river regime cannot be characterized as a permanent hydrological regime.

(2) With a mixture of **Flow**ing water and Disconnected **Pools**, the river regime is **INTERMITTENT WITH POOLS**. It is a river where water flows for most of the year but stops at some point (usually in summer), when water is only present in disconnected pools.

If one season is selected as **Dry**, the river regime cannot be determined as intermittent with pools.

The hydrological regime indicates whether a river is **permanent or temporary**. In the case of temporary rivers, it also indicates the level and duration of water flow. To determine a rivers's hydrological regime, we need to know **the frequency and timing of water flow** at different times of the year. **The hydrological regime is** necessary because it influences the level of development of biological communities meaning that the methodologies used by RiuNet to evaluate river ecological status will vary.



To find the hydrological regime for your river, RiuNet uses this table in roder to select the appropriate options for water flow (water **flow**ing, disconnected **pools** or **dry** riverbed) for each season of the year (spring, summer, autumn, and winter

RiuNet separates hydrological regimes into four simplified groups: permanent, intermittent with pools, intermittent dry, and ephemeral. Select the hydrological regime of your river and write it down in sheet 1.

(3) With a mixture of water flow where **one or maximal two seasons are Dry**, the river regime is **INTERMITTENT DRY**. It is a river where water flows for part of the year (usually four months) but at some point (usually in summer), the flow declines until the riverbed dries completely.

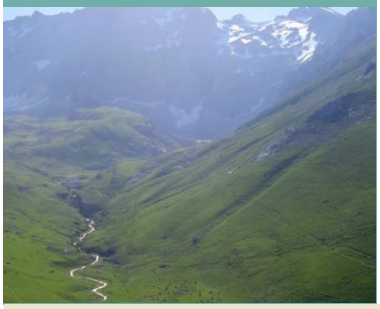
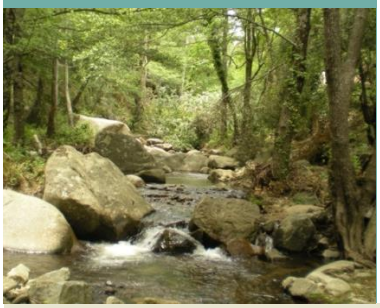
If three or more seasons are selected as **Dry**, the river hydrological regime cannot be determined as Intermittent dry.

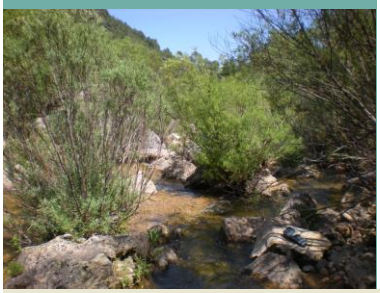
(4) If three or more seasons are **Dry**, the river regime is **EPHEMERAL**. It is a river where the riverbed is dry for most of the time, with flowing water only after heavy rains or flooding. Water generally flows only a few days (15 to 30), but may be present for up to two months.

The ephemeral river regime is determined when three or more seasons are selected as **Dry**.

Select one river type from the seven options presented at the next table. Typology concerns the natural charateristics and variability of each river, and it is key for evaluating ecological status using RiuNet. Aquatic communities and bioindicators may also vary based on typology.
In the case of rivers with **permanent hydrological regime, the type of river** is determined by the location and size of the river. Rivers may have a mountain, mid-altitude, lowland or river-mouth location. In terms of size, small rivers can easily be crossed by jumping from stone to stone, while large rivers require a boat or long waders to cross. Record the type of river on **sheet 1**.

Rivers with a non permanent hydrological regime (i.e. intermittent with ponds, intermittent dry, or ephemeral) are classified as temporary rivers (T8).

TYPE OF RIVER	Size	Riparian vegetation	River basin vegetation	Altitude (m asl)	River substrata	Current	Depth	Water temp.
T1- HIGH-ALTITUDE RIVERS 	Small or Medium -size rivers	Absent	Meadows or Shrubs	>2000	Boulders Stones and Gravels	Strong – Modera-te	Low – Medium	Very cold
T2 – SMALL MOUNTAIN RIVERS 	Small rivers	Alders Ashes	Pines Beeches Oaks Chesnuts	>600	Boulders Stones	Strong – Modera-te	Low	Cold
T3 – LARGE MOUNTAIN RIVERS 	Medium to large rivers	Alders Ashes	Pines Beeches Oaks Chesnuts	>600	Boulders Stones	Strong – Modera-te	Low – Medium	Cold

TYPE OF RIVER	Size	Riparian vegetation	River basin vegetation	Altitude (m asl)	River Substrata	Current	Depth	Temp.
T4 – SMALL MID-ALTITUDE RIVERS 	Small rivers	Black Poplars White Willows Shrubs Common reed	Forests or Shurbs	<600	Stones Pebbles Gravels Sand Clay	Modera-te – Weak	Low	Warm, warmer in summer
T5 – LARGE MID-ALTITUDE RIVERS 	Large, >10m	Black poplars Aspen Alders Elms	Forests	<600	Stones Pebbles Gravels Sand Clay	Modera-te	Consire-dable, up to 4m	Variable, warm in summer
T6 –SMALL LOWLAND RIVERS 	Small – Medium	Narrow or Limited	Variable or only shrubs	<250	Stones Pebbles Gravels	Modera-te or weak (can dry up)	Low	Warm in summer
T7 – LARGE LOWLAND RIVERS 	Very wide, Up to 50m or more	Poplars Alders	Forests	Low	Pebbles Gravels Sands Clay	Weak – Very weak	High, up to 15m	Warm, hot in summer

The RiuNet app has three tests, which are complemented by a module for other results or data. The first test assesses the **hydrological status**, while the second addresses **ecological status**. The latter is determined based on a **hydromorphological quality test** (i.e. the physical properties of the river channel and the riparian area) and a **biological quality test** (i.e. the invertebrates living in the river). In order to validate any assessment is necessary to send us a **photograph** of the river.

The **hydrological assessment** has **three parts** (questions 1 to 3); you have to choose different options based on your proximate observations of activity (infrastructures and water uses), signs of hydrological alterations, and personal impressions.

The **hydromorphological assessment** has **eight parts** (letters A-H); where you have to select different options in each one. The hydromorphological assessment has 7 parts for high-altitude type or rivers with an intermittent dry or ephemeral hydrological regime.

Questions A and B are combined into one for the high-altitude type rivers or rivers with an intermittent dry or ephemeral hydrological regimes. For the other river typologies questions A and B remain divided. Questions C-E are all the same or all river types. If the river is dry the questions F, G and H are merged into one different FGH.

For each question, a list of features is provided to facilitate and select the best matching choice. Not all the conditions must be met; just choose the one that best describes the river and surroundings that you are evaluating.

> Record the results of each question at **sheet 3** and assess the hydromorphological quality found at **sheet 5**.

The **biological assessment** only has **one part**. To do it correctly, it is necessary to know the current aquatic phase of your river is and the type of river. You will find the list of organisms used for the evaluation and their quality indicators according to each type of river in **sheet 4**.

> List all the macroinvertebrates you found in **sheet 4** and, using the table for the biological assessment, you may write down the result of this test. The biological test cannot be performed if you have not identified the indicator taxa for the type of river you are assessing.

Using the last figure in **sheet 4** and with the combination of two quality tests – hydromorphological and biological, you will determine the river **ecological quality**.

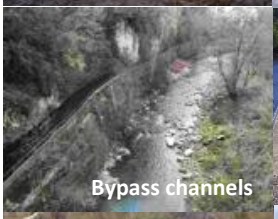
> You will determine the degree of ecological quality of your river at **sheet 5.** Quality indicator colours are the same as those used in the **Water Framework Directive**: and you will check if the regulations are being complied with if the final color is blue or green (very good or good quality, respectively).

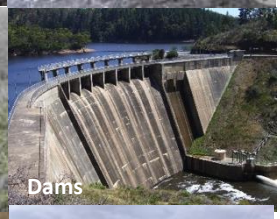
In the "other data" module, you can provide a **social and cultural assessment** of the river. Where the tools are available, you can also include, an assessment of the environmental characteristics of the area, such as the physicochemical parametres of the water, a summary of **observed biodiversity**, or the presence of **invasive species**.

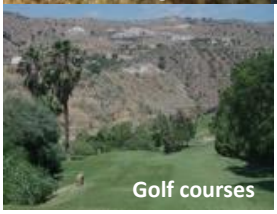
To determine hydrological status, we need accurate information regarding the entire river basin, and not just the immediate area. However, you will be assessing the **hydrological status** of the river based on your proximate observations of human activities (infrastructure and water uses), signs of hydrological alterations, and personal impressions compared to 25 years ago or more. The findings will indicate whether river hydrology is the result of natural elements or human action.

The first question you need to select any type of infrastructure that can be seem in the river or along its banks: wells, weirs, diversion channels, dams or other unidentified bypass channels. Also identify the different uses of river water: livestock (farms), agricultural, small gardesn or orchards or golf courses.

1 WHAT TYPE OF INFRAESTRUCTURE AND WATER USAGE CAN YOU SEE AT THE RIVER?



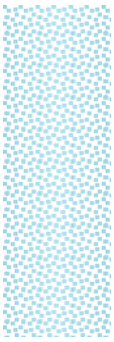
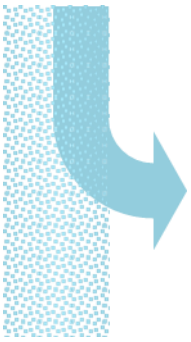




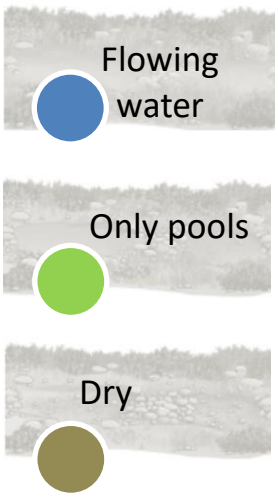
	POINTS (+5)
Wells	-0.5
Weirs	-0.5
Bypass channels	-1
Dams	-2
Other water catchments or diversions	-1
Livestock (farms)	-1
Agriculture	-1
Small gardens or orchads	-0.5
Golf courses	-1
TOTAL	**5 +(*Sum*)***

*** the total score varies between 5 and 0 points.** A river begins with a score of 5 points (reflecting a natural river without human impact), but as different types of insfrastructure and water use are selected, the score is reduced, to a minimum of 0 points.

To answer the second question, you need to know how much water is taken from the river based on the observed uses and infrastructure. There are three options.
If river water is not being used and the river's hydrological regime has not been modified, the n*atural river* option should be selected. This means that the flow of water in the river and its distribution over the year reflects a natural hydrological regime. The highest score of 5 points is awarded.
If the flow of water in the river is below its natural level (because water is diverted from the river or drawn from the aquifer for irrigation or livestock use) but the regime is only somewhat affected, select the option *some*, which yields a score of 3 points.
If *most or all* of the water in the river or aquifer is being used, meaning that the river's hydrological regime has been heavily modified (for example, a formerly permanent river has now become an intermittent dry river), then zero points are awarded.

2 HOW MUCH WATER IS USED BY THE DIFFERENT TYPES OF INFRASTRUCTURES OR WATER USE?			POINTS
1 - NONE (NATURAL RIVER)			**5**
	Water flow levels	NATURAL	
	River's hydrological regime during the seasons	NATURAL	
	Wells or bypass channels	ABSENT	
	Agricultural, industrial or landscaped basin	NO	
2 - SOME			**3**
	Water flow levels	MODIFIED	
	River's hydrological regime during the seasons	LITTLE MODIFIED	
	Wells or bypass channels	COULD BE PRESENT	
	Agricultural, industrial or landscaped basin	<50%	
3 - MOST OR ALL			**0**
	Water flow levels	MODIFIED	
	River's hydrological regime during the seasons	VERY MODIFIED	
	Wells or bypass channels	COULD BE PRESENT	
	Agricultural, industrial or landscaped basin	>50%	

The last question involves providing information on how the river flows have changed (mainly water volumes) have changed compared to 25 years ago or more. If flows are similar, the maximum score of 5 points is awarded. If they have change somewhat, the score is 3 points. If the river flow has been completely altered in recent years, the score will be zero.

3 HOW HAS THE RIVER FLOW CHANGED IN THE RECENT YEARS?			POINTS
BEFORE	**NOW**		
		The river flow has not changed significantly, so the options selected are the same	**5**
		River flow has changed but the difference is small (e.g. where there was mostly *pools* before, now there is constantly *flowing water*)	**3**
		River flow has changed completely (e.g. where there was *flowing water* previously, now the river is mostly *dry*	**0**

Write down your results in sheet 2. The score obtained yielded by the hydrological assessment reflects the hydrological status of the river, as summarized in the following table:

HIDROLOGICAL QUALITY	
Total:	
0-5	**Poor**
6-10	**Moderate/ Impacted**
11-15	**Good**

ONLY FOR RIVERS IN HIGH-ALTITUDE AREA

Question AB' –Structure and naturalness of the riparian zone

As forest is absent in high-altitude areas, forest structure cannot be assessed. Instead, we focus the assessment on alterations along the banks of the river due to human activity. As most impacts stem from livestock or the presence of infrastructure (for example, roads, dams, urban areas, etc.), we will be looking for evidence of such activities (e.g. livestock droppings, river bank erosion, or infrastructure that is either on or close to the riverbed, such as river walls.

SELECT ONE OF THE NEXT OPTIONS TO ANSWER THE NEXT QUESTION:

AB	IS IT LOCATED IN A HIGH-ALTITUDE AREA WITHOUT HUMAN ACTIVITY?	SCORE
1 – NO IMPACT DUE TO HUMAN ACTIVITY		**10**
	Livestock grazing: ABSENT Livestock droppings: ABSENT Buildings: ABSENT River's banks: NATURAL Meadows vegetation: NO BARE PATCHES Meadows condition: UNTRODDEN	
2 – MODERATE IMPACT DUE TO HUMAN ACTIVITY		**5**
	Livestock grazing: PRESENT Livestock edroppings: NOT IN THE RIVER ITSELF Buildings: LIMITED IN NUMBER River's banks: SOME IMPACT Meadows vegetation: SOME BARE PATCHES Meadows condition: TRODDEN	
3 – HIGH IMPACT DUE TO HUMAN ACTIVITY		**1**
	Livestock grazing: PRESENT Livestock droppings: IN THE RIVER Buildings: PRESENT River's banks: ERODED Meadows vegetation: GREAT CLEARINGS Meadows condition: EXTREMELY TRODDEN	

ONLY FOR RIVERS WITH AN <u>INTERMITENT DRY OR EPHEMERAL HYDROLOGICAL REGIME</u>

Question AB' –Structure and naturalness of the riparian zone

In rivers with an intermittent dry or ephemeral hydrological regimes, the seasonal availability of water and its duration are key factors that determine the condition and development river banks. Such rivers are therefore assessed differently to others. For example, in the case of temporary rivers such as *ramblas*, shrubs such as **oleander** or **chaste trees** may be the natural form of vegetation, rather than trees. In these cases, the vegetation closest to the river is treated as riverside vegetation, and is valid for determining river bank coverage. This is also true in the case of very small rivers with rocks that prevent from taling root close to the river bed, but in which the area closest to the river is occupied by forest or other vegetation characteristic of the area (such as oaks). You need to know whether vegetation (trees or shrubs) is present at the site that you are assessing (no more than 100 meters); the degree of continuity of vegetation along the river banks; whether more herbaceous vegetation is present; and to what extent the banks of the river have been altered by human activity.

SELECT ONE OF THE NEXT OPTIONS TO ANSWER THE NEXT QUESTION:

AB HAS THE RIPARIAN ZONE BEEN MODIFIED?			POINTS
1 – NO IMPACT DUE TO HUMAN ACTIVITY			**10**
	Vegetation adjacent to the riparian area	Autochthonous trees or bushes (at least 1,5m in height)	
	Vegetation degree of continuity	>60%	
	RIparian vegetation	bushes or herbaceous plants (at least >50%)	
	River banks	NOT MODIFIED	
2 – MODERATE IMPACT DUE TO HUMAN ACTIVITY			**5**
	Vegetation adjacent to the riparian area	Autochthonous or allochthonous trees or bushes	
	Vegetation degree of continuity	<50%	
	RIparian vegetation	bushes or herbaceous plants (at least <40%)	
	River banks	LITTLE MODIFIED	
3 – HIGH IMPACT DUE TO HUMAN ACTIVITY			**0**
	Vegetation adjacent to the riparian area	Lack of trees, isolated shrubs or just giant reed	
	Vegetation degree of continuity	Absent	
	RIparian vegetation	bushes absent and few herbaceous plants	
	River banks	HEAVILY MODIFIED	

FOR OTHER RIVERS

Question A – Structure and condition of the riparian zone

All **riparian zones** (except those around high-altitude rivers) should have forested areas comprising native tree species such as alders, black poplars, or willows. In the case of very small rivers, or where rocks prevent trees from taking roots close to the river bed, the area closest to the river is occupied by forest or other vegetation characteristics of the area (such as oaks). In these cases, the trees closest to the river are considered to be riparian vegetation and are used to determine river bank coverage.

Human activity may have destroyed the trees (only isolated trees, bushes, or grassland remain) or replaced them with invasive tree species (trees of heaven, acacias, eucalyptus, etc.).

Observe whether the riparian zone has trees or not. If there are trees, check whether they are characteristic of the area or whether they have been introduced through human activity.

Native or autochtonous trees: Alders, black poplars, ahses, elms, willows, common hazels, and sallows.
Alien or allocthonous trees: Eucalyptus, willows, desmais, trees of heaven, acacias or giant reed.

SELECT ONE OF THE NEXT FIVE OPTIONS:

A WHAT IS THE RIPARIAN FOREST LIKE ALONG THIS STRETCH RIVER?		SCORE
1 - RIPARIAN FOREST WITH NATIVE VEGETATION		5
	Native trees: NUMEROUS Non-native trees: ABSENT Bushes: UNDER THE TREES Giant reed: ABSENT Grassland cover: UNDER THE TREES Agriculture: ABSENT Buildings: ABSENT	
2 - PREVALENCE OF BUSHES WITH SCATTERED TREES		3
	Native trees: SCATTERED Non-native trees: FEW OR ABSENT Bushes: DOMINANT Giant reed: ABSENT OR FEW Grassland cover: MAY BE PRESENT Agriculture: ABSENT Buildings: ABSENT	
3 - RIPARIAN FOREST WITH NON-NATIVE TREES OR GIANT REED		2
	Native trees: SCATTERED Non-native trees: HIGHLY PRESENT Bushes: PRESENT Giant reed: 50% Grassland cover: PRESENT Agriculture: LITTLE Buildings: FEW	
4 - RIPARIAN FOREST WITH AND ABSENCE OF TREES, AND PRESENCE OF GIANT REED OR AGRICULTURAL ACTIVITY		1
	Native trees: FEW Non-native trees: FEW Bushes: PRESENT Giant reed: 50% Grassland cover: PRESENT Agriculture: LITTLE Buildings: FEW	
5 – PRESENCE OF BUILDINGS OR AGRICULTURAL ACTIVITIES		**0**
	Native trees: FEW OR ABSENT Non-native trees: FEW OR ABSENT Bushes: COULD BE PRESENT Giant reed: COULD BE PRESENT Grassland cover: COULD BE PRESENT Agriculture: COULD BE PRESENT Buildings: COULD BE PRESENT	

Question B – Continuity of the riparian forest

Here we assess whether if **riparian trees** (native and non-native) are present in a **continuous manner** along the river, or whether they **form disconnected patches** or are **absent**.

Although question A notices how many trees are there in the riparian forest and whether or not they are native; in question B, we notice if **riparian trees** (native and non-native ones) are located in a **continuous way** along the river course, they **form disconnected patches** (without continuity), or **there are not trees**. This is an important issue as the **riparian forest connects** the upper and lower parts of a river and allows birds, mammals, and reptiles to move along the river course in safety keeping populations healthy and viable.

SELECT ONE OF THE NEXT FOUR OPTIONS:

B IS RIPARIAN FOREST CONTINUOUS ALONG THIS STRETCH OF RIVER?		SCORE
1 - CONTINUOUS VEGETATION ON BOTH RIVER BANKS		**5**
	Trees: CONTINUOUS Bushes: UNDER THE TREES Giant reed: ABSENT Agricultural activity: ABSENT Buildings: ABSENT	
2 - DISCONNECTED PATCHES OF VEGETATION		**3**
	Trees: IN PATCHES Bushes: MANY Giant reed: BETWEEN THE BUSHES Agricultural activity: ABSENT Buildings: ABSENT	
3 - ONLY ISOLATED CLUSTERS OR INDIVIDUAL TREES ARE PRESENT		**1**
	Trees: SCATTERED Bushes: PATCHES Giant reed: PATCHES Agricultural activity: 50% Buildings: MAY BE PRESENT	
4 - THE RIPARIAN ZONE LACKS TREES OR SHRUBS		**0**
	Trees: ABSENT Bushes: ISOLATED Giant reed: ISOLATED Agricultural activity: MAY BE PRESENT Buildings: MAY BE PRESENT	

Question C – Connectivity of riparian vegetation

The natural landscape close to the river is different for each type of river. In high-altitude areas, only meadows or small shrubs will be present, while in mountain mid-altitude, and lowland areas, forests can be expected. In arid zones, the natural landscape may be again be limited to grasslands or shrublands. In any event, the characteristics of landscapes close to the riparian zone should be evaluated based on the geographical area in which the assessment is being conducted.

This assesses if whether riparian vegetation is connected to natural landscapes (such as forests or meadows), or whether it is surrounded by cultivated fields, tree plantations, urban or industrial areas, or whether linear infrastructures (roads, railways, etc.) is present parallel to the river.

*** Adjacent riparian vegetation according the areas**:

- High-altitude areas: meadows, pastures, small bushes.
- Mountain areas: Forests.
- Mid-altitude areas: Forests such as pines or holm oaks.
- Lowlands: Forests.
- Arid zones: Maquia, grasslands.

**** Urban elements** such as industrial states, sport facilities, etc.

SELECT ONE OF THE NEXT FOUR OPTIONS:

(It is not necessary to accomplish all the stated features)

C WHAT KIND OF LANDSCAPE IS THERE PRESENT ADJACENT TO THE RIPARIAN ZONE?		SCORE
1 - UNCHANGED BASIN LANDSCAPE		**5**
		
	Adjacent riparian vegetation*	ACCORDING AREA
	Tree plantation	ABSENT
	Agricultultural activity	ABSENT
	Livestock walls	ABSENT
	Urban elements **	ABSENT
	Railways	ABSENT
	Animal crossing permeability	TOTAL
2 - MODIFIED BASIN LANDSCAPE		**3**
		
	Adjacent riparian vegetation*	BUSHES OR THINNED FORESTS
	Tree plantation	MAYBE PRESENT
	Agricultultural activity	EXTENSE, <50%
	Livestock walls	ABSENT
	Urban elements **	ABSENT
	Railways	DIRT ROADS
	Animal crossing permeability	GOOD
3 - HEAVILY MODIFIED BASIN LANDSCAPE		**1**
		
	Adjacent riparian vegetation*	BUSHES
	Tree plantation	MAYBE PRESENT
	Agricultultural activity	INTENSE, >50%
	Livestock walls	SCATTERED
	Urban elements **	HIGHLY PRESENT
	Railways	PAVED
	Animal crossing permeability	DIFFICULT
4 - URBANIZED BASIN LANDSCAPE		**0**
		
	Adjacent riparian vegetation*	MAQUIA
	Tree plantation	ABSENT
	Agricultultural activity	INTENSE, >50%
	Livestock walls	PRESENT
	Urban elements **	URBANIZED
	Railways	HIGHWAYS
	Animal crossing permeability	NONE

Question D – Naturalness of the river channel

This assesses whether the river has been modified by human activity. Alterations may be slight (such as **agricultural terraces** that constrain the river channel), channel **modifications** (where the river has been forced to follow a channel that it is not natural), or total **channelization**. We include here any kind of work done to the channel or banks (such as walls or breakwaters), and diversion of the main watercourse. Changes in river terraces due to agricultural activities that encroach on the river channel and reduce its width are also considered to be alterations to the river channel.

SELECT ONE OF THE FIVE OPTIONS: (It is not necessary to accomplish all the stated features)

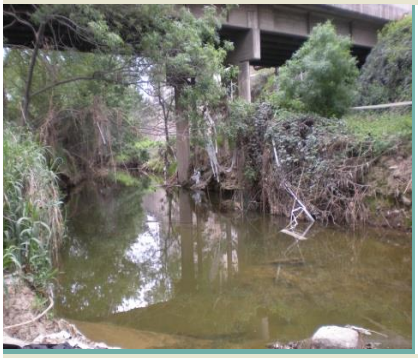
D HAS HUMAN ACTIVITY MODIFIED THE RIVER CHANNEL?			SCORE
1 - HUMAN ACTIVITY HAS NOT MODIFIED THE RIVER CHANNEL			**5**
	Agricultural terraces	NO	
	Jetties or gabions	NO	
	Concrete walls	NO	
	Channelization	NO	
	River course	NOT MODIFIED	
2 - RIPARIAN AREA HAS BEEN MODIFIED BY TERRACES			**3**
	Agricultural terraces	PRESENT <50%	
	Jetties or gabions	SCATTERED	
	Concrete walls	SCATTERED	
	Channelization	NO	
	River course	NOT MODIFIED	
3 - PARTLY CHANNELIZED RIVER			**1**
	Agricultural terraces	50-75% OF THE STRETCH	
	Jetties or gabions	MAYBE PRESENT	
	Concrete walls	MAYBE PRESENT	
	Channelization	PARTIAL <50%	
	River course	PARTIALLY MODIFIED	
4 - CHANNELIZED RIVER			**0**
	Agricultural terraces	ALL OVER THE STRETCH	
	Jetties or gabions	>50% OF THE STRETCH	
	Concrete walls	>50% OF THE STRETCH	
	Channelization	TOTAL	
	River course	TOTALLY MODIFIED	

Question E – River litter

We need to know if the area is frequently visited by people, and whether or not they leave a footprint, in the form of **litter**, **debris**, etc. This would indicate that in addition to being frequently visited, the area is also degraded.

Litter is any kind of material resulting from human activity, such as plastics, debris, domestic waste, etc. In the event that any waste is potentially highly polluting (for example, petrol cans), additional points should be subtracted even if the waste is not abundant.

SELECT ONE OF THE NEXT THREE OPTIONS:
(It is not necessary to accomplish all the stated features)

E IS THERE LITTER IN THE RIPARIAN ZONE?		SCORE
1 - NO; THERE IS **NO LITTER**		**5**
	Accumulations of litter on top of the vegetation: VERY FEW Garbage dumbs: NO Rubbish: NO Potentially dangerous rubbish*: NO	
2 - THERE IS SOME LITTER, BUT IT IS NOT ABUNDANT		**3**
	Accumulations of litter on top of the vegetation: ABUNDANT Garbage dumbs: VERY FEW Rubbish: SCATTERED Potentially dangerous rubbish*: MAYBE PRESENT	
3 - YES, THERE IS ABUNDANT LITTER		**0**
	Accumulations of litter on top of the vegetation: HIGHLY ABUNDANT Garbage dumbs: ABUNDANT Rubbish: ABUNDANT Potentially dangerous rubbish*: MAYBE PRESENT	

*Potencially dangerous rubbish: refered to any potential spill that could cause serious pollution of the aquifer or river, for example a can of gasoline or toxic products.

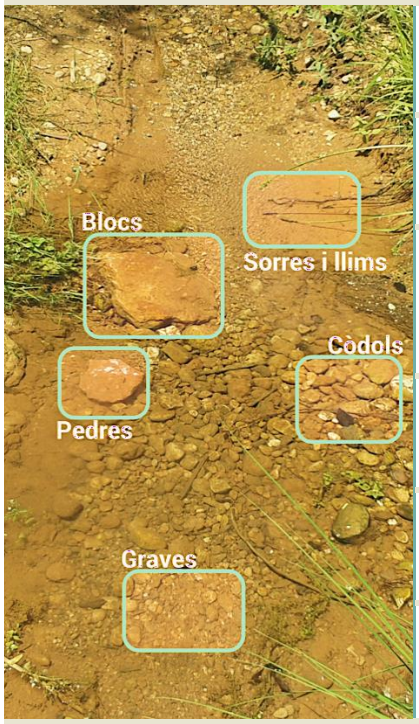
Question F – Substrata composition

River biodiversity depends not only on water quality but also on the **diversity of substrata** that organisms use to shelter from predators.

Five types of hard substrata should be found in any river: **boulders** (very large stones, > 25 cm), **stones** (5-25 cm long), **pebbles** (1-5 cm, like the ones that we skim across the surface of the water), **gravel and sand** (a few millimetres long, doesn't slip through closed fingers), and **clay and silt** (very fine material that seeps even through closed fingers). The final score is dependent on whether these different types of substrata are present. If all are identified, the maximum score of 5 points is awarded. If only one substratum is observed, a single point is scored.

In the case of rivers with a **cemented beds** (occurring naturally, due to the presence of **rock slabs**, or artificially, in **urban areas**), check wheter the cement or rock slabs cover the entire stretch or only part of it. If they cover the entire stretch, choose a different stretch of river (move upstream or downstream). **Warning:** if you move a significant distance, you must provide your new geographical coordinates.

SIX OPTIONS, MULTIPLE OPTIONS MAY BE SELECTED:

F HOW MANY HARD SUBSTRATA HAS THE RIVER?			SCORE
	**Boulders**	Size: > 25 cm (very large stones)	**1**
	Stones	Size: 5 - 25 cm (up to 1 inch)	**1**
	Pebbles	Size: 1 - 5 cm (like the ones we skim across the surface of the water)	**1**
	Gravel and sand	Size: few milimeters (doesn't slip through closed fingers)	**1**
	Clay and silt	Size: very fine material (seeps even through closed fingers)	**1**
	Rock slabs or cemented bed	Uniform substrata	**0**

TOTAL ***Sum***

Question G – River velocity and depth

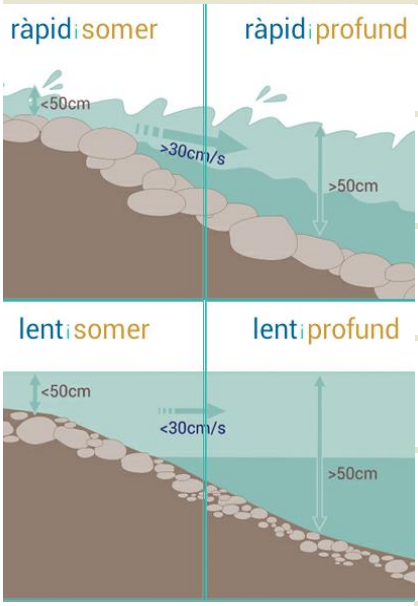
Biodiversity will be greater in rivers of varied water velocity and depth. Some organisms are characteristic of slow or fast-flowing areas, while others prefer deep water, and another group is found only in areas that are no more than few centimetres deep.

To make things easier, we distinguish between two types of velocity: fast (water flows at more than 30 cm/sec and creates eddies) and slow (water does not flow, or flows at less than 30 cm/sec, and does not create eddies). There are also two types of depth: shallow (less than 40 cm, or below the knee) and deep (more than 40 cm, or above the knee).

There are four possible combinations or **regimes**: **shallow/fast**, **deep/fast**, **shallow/slow**, and **deep/slow**. When the river does not circulate at the surface but instead consists of disconnected pools, the system is understood to be deep and slow. You can measure water velocity using a floating object, a stopwatch, and a tape measure. However, you don't need to take measurements if you don't have these items or are short of time; just refer to the indicators above.

The score varies depending on the number of regime types present. If all are observed, the maximum possible score of 5 points is attained. Three regimes socre 3 points, two score 2 points, and one regime (when there is now flow, only disconnected pools) scores a single point.

FOUR OPTIONS, MULTIPLE OPTIONS MAY BE SELECTED:

G ARE THERE AREAS OF VARYING WATER VELOCITY AND DEPTH?		SCORE
		
SHALLOW AND FAST	Velocity > 30 cm/s Depth < 50 cm	**1**
DEEP AND SLOW	Velocity < 30 cm/s Depth < 50 cm	**1**
DEEP AND FAST	Velocity < 30 cm/s Depth > 50 cm	**1**
SHALLOW AND SLOW	Velocity > 30 cm/s Depth > 50 cm	**1**
ALL FOUR REGIME TYPES ARE PRESENT		**4**

TOTAL ***Sum***

Question H - Heterogeneity components

A part from stones, gravel, and pebbles, a river may contain **leaf litter**, **branches and wood**, **natural dams**, **tree roots**, **algae**, and **mosses**. Each substratum adds one point, but if all substrata (6 types) are observed, the maximum score of 5 points is awarded.

Different types of **substratum** are used by organisms for **refuge** and **food**. The more types of substrata there are, the greater the number of organisms that are likely to be found. These are known as **heterogeneity components**. The components we look at are as follows: **leaf litter** -leaves that have fallen from trees; **branches and wood** -that have fallen from nearby trees or been dragged down from the upper parts of the river; **transversal natural dams** -made up of rocks or leaves that create a noticeable chenage in current; **sunken tree roots** -which you should look for near trees growing along the banks of the river; **algae** -that create a slippery surface on stones and gravel; and **mosses** -which grow on shallow stones.

SIX OPTIONS, NONE OR MULTIPLE OPTIONS MAY BE SELECTED:

H BESIDES HARD SUBSTRATA, IS THERE ANY OTHER TYPE OF SUSBTRATUM?	SCORE
Algae	1
Sunken tree roots	1
Transversal natural dams	1
Leaf litter	1
Mosses	1
Branches and wood	1

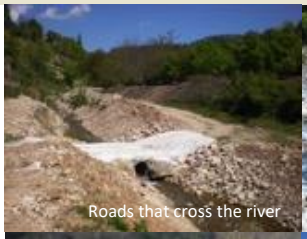
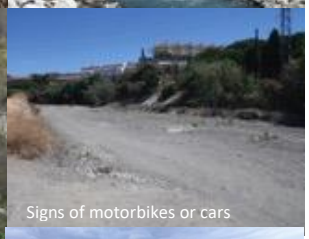
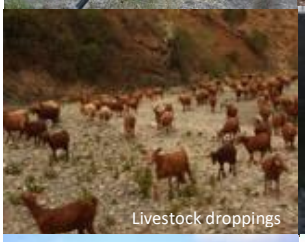
TOTAL ***Sum****

*** the total score varies between 5 and 0 points.** So, if all of the six types of substratum are present, it will not sum up 6 but instead a total score of 5 points.

ONLY FOR RIVERS WITH A DRY AQUATIC PHASE

Apartat F – Impactes a l'espai fluvial

To answer this question, select all impacts observed in the river and its surrounding area. As in the case of the hydrological test, points are subtracted depending on the degree of impact. We begin with 15 points (reflecting a natural river without any modifications of human origin), and as impacts are selected, the score is reduced progressively (with a minimum score of 0 points).

F WHAT ALTERATIONS CAN YOU SEE IN THE RIVER AND IN THE FLUVIAL HABITAT?	POINTS (+15)
 Roads that cross the river  Aggregate extraction	Roads (paved or unpaved) that cross the river -5 Aggregate extraction -5
 Dumps or piles of rubble  Signs of motorbikes or cars	Dumps and/or piles of rubble in the fluvial habitat -4 Signes of motorbikes or cars -3
 Wells in the fluvial habitat  Other construction	Wells in the fluvial habitat -2 Other construccion in the fluvial habitat -2
 Livestock droppings  Crops on the river banks	Livestock droppings -1 Crops on the river banks -1
 River used as a trail  Burnt vegetation	River used as a trail -1 Burnt vegetation or agricultural burning -1
	TOTAL 15 +(*Sum*)*

*** the total score varies between 15 and 0 points.** It starts with 15 points (a natural river without human impact), but as different types of insfrastructure and water use are selected, the score is reduced, to a minimum of 0 points.

WHAT ARE AQUATIC MACROINVERTEBRATES?

The RiuNet APP uses aquatic macroinvertebrates as the bioindicators to assess the biological quality. For anyone who does not know what aquatic macroinvertebrates are, they are **invertebrate animals**. That is, they do not have a spinal column (unlike fish, frogs and newts, which do have a spinal column). Invertebrates include **worms, snails, prawns, leeches, and insects** that live in water. Some of them (such as worms, snails, and beetles) spend their entire lives in water, while others only live in water at some stages of their lifecycle (such as insects that are aquatic as larvae, but as adults fly). The name of macroinvertebrates is because they have a **size between 0.5 and 10 cm** (at most), though the majority **do not get larger than 2 cm**. You can see them with the naked eye or with the help of a small magnifying glass. We distinguish them from **microinvertebrates**, which are much smaller and can only be seen with a very strong magnifying lens or under a microscope.

Macroinvertebrates are highly varied and as a group are characterized for being rich in **biodiversity**. It is also a group that responds in extremely diverse ways to pollution. Some are **highly resistant** to changes in rivers caused by natural phenomena (such as flooding) or by manmade disturbances (such as wastewater discharge). Others are **highly sensitive** to these changes and quickly disappear. At RiuNet we are examining not only the most plentiful macroinvertebrates in rivers, but also the ones that are a little easier for people who are not experts to recognize in the field using only the naked eye. In total, you may be able to recognize up to 40 different types of organisms using the RiuNet **dichotomous key**. Although more macroinvertebrates can be found in rivers, in RiuNet only a group of indicators are used for the assessment of biological quality.

To **observe macroinvertebrates**, you should go to a river and collect stones or leaves or other materials there. If you do not know how to do this, you can use the *sampling tutorial*, which you will in **Annex 3**. To improve your collection and observation, we suggest using a **tray with a white background** and a few additional materials. The list of materials that might help you appears in the sampling tutorial. If today is your first day of observation and you do not have this material, observe the organisms under the stones and take note of the material that you need for the next time. A **small handheld magnifying glass** will also be very useful, so it is better if you carry one with you. Once you have collected your macroinvertebrates, you will see that they come in many shapes. There are long ones and round ones. Some have legs and others do not. Some move rapidly and others move slowly. Normally, they are not brightly coloured, but some do have a variety of coloration, though they are mostly brown or dark. Notice that all of these characteristics will help you to distinguish different animals.

Once you have the animals on your tray or in your hand (none will hurt you), **how to identify them**?

If you need help, you will find in **annex 4** a simplified dichotomous key for their identification. A dichotomous key works by giving you a series of two options to choose between. For example, when you first enter the key, you will be asked whether the animal has 6 or more jointed legs. If it does, the key will send you to entry 2. If it does not, the key will send you to entry 3. Depending on your answer, the key will then send you to another entry or it may give you the name of the organism in question. The dichotomous key also has drawings to illustrate the text. As soon as the key gives you a name instead of a further entry number, you have successfully made the identification. Write down the identified macroinvertebrate in the list of **Sheet 5**.

In the key, you will find forty different macroinvertebrates. These are the most common and we will be using them as indicators. Rivers contain many more macroinvertebrates (up to 123 families), so you may find organisms that you cannot identify. Do not worry about this, because you do not need to know all of them to do the assessment of biological quality. Many are not included in the key, because they are not indicator organisms (that is, it does not matter to them whether the water is clean or dirty) or they are very rare or their identification is very complicated using the materials that you will have in the field. So if you cannot identify one, do not be overly concerned. Take another organism and keep going. For each organism, you will also have a fact sheet with its main characteristics to help you in the identification.

When you have successfully identified an organism and selected it, start over again to identify the next organism. Choose another macroinvertebrate in your tray and follow the key until you have completed your next identification.

For each organism in RiuNet, you can find a fact sheet with its main characteristics that will help you in the identification and its differentiating features to other similar macroinvertebrates. Remember that you may find organisms that you cannot identify because RiuNet only uses forty different macroinvertebrates as indicators. If you want to identify it, you will need other keys or guides and probably you will need other materials than the ones you have in the field.

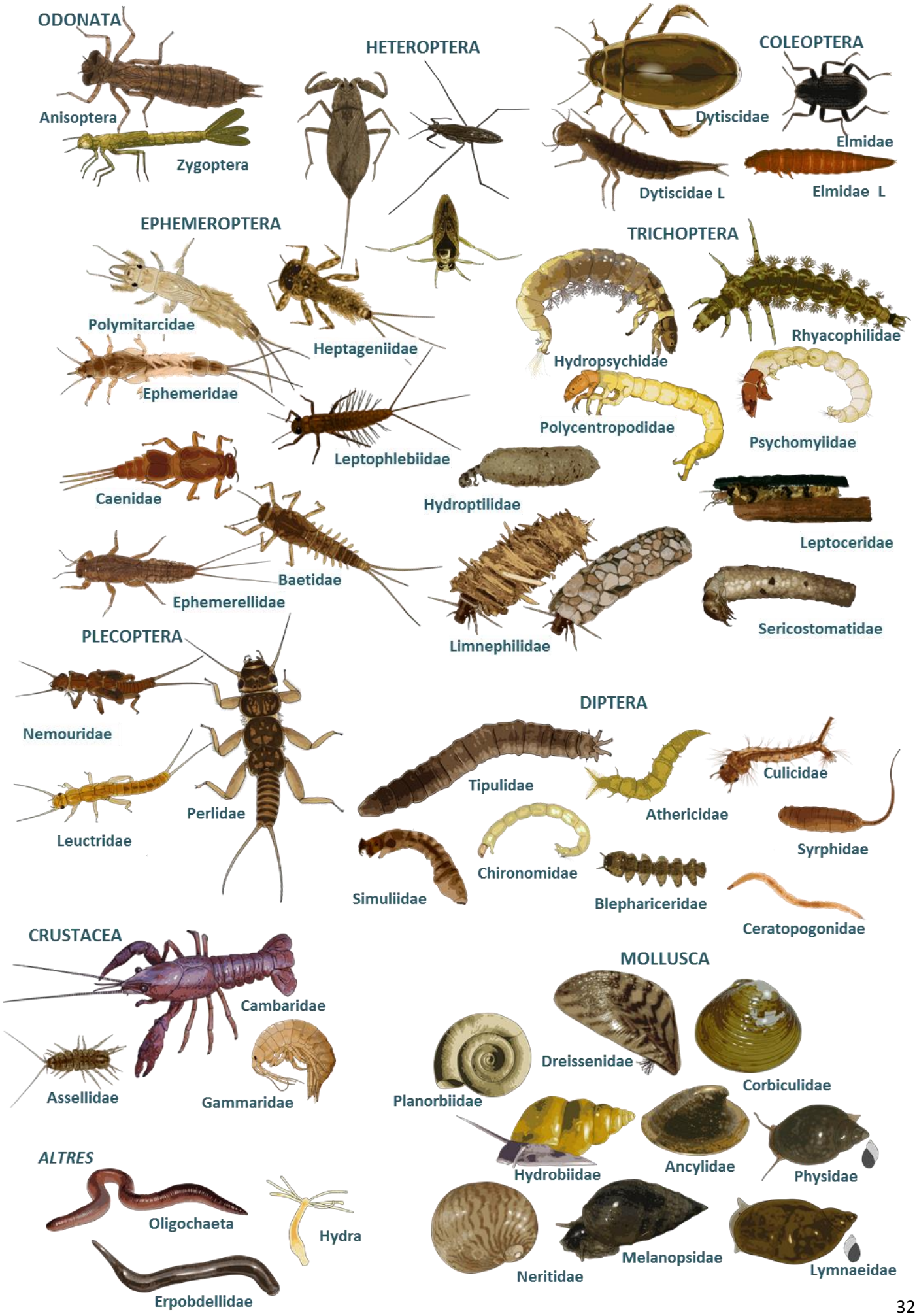
MACROINVETEBRATES FAMILY AND BIOLOGICAL QUALITY ACCORDING THE RIVER TYPOLOGY.

We will use **sheet 4** to have the list of all the macroinvertebrate that are used in RiuNet. The quality is represented by a gradient of four colours: blue, green, yellow, and orange, blue being the best quality and orange the worst one.

Once more, not all macroinvertebrate organisms are included in **sheet 4**. For those that can identify all the different groups of macroinvertebrates that are used for example in the IBMWP index, you may complete the list using the appendix 1. All macroinvertebrate organisms groups found in this appendix but not at sheet 4 are not used in our indicator system indicator, because some of them are especially difficult to identify in the field.

You are able to assess the biological quality once you have completed the sheet 4.

Figure 1 (next page): aquatic macroinvertebrates families that are used to assess the biological quality. Most of them are identified to family level, but not in other cases. For example, Odonata (dragonflies) are only identified to suborder (Anisopera and Zigoptera) or Heteroptera (Heteroptera) only to order level. Some individuals of the same family may look very different among them as they go through different life cycle stages, such as beetles (Coleoptera) where the larva and the adult live in water or some Tricòpters (Trichoptera) as Limnephilidae can build their cases with different plant materials or minerals.


ODONATA
Anisoptera
Zygoptera
HETEROPTERA
COLEOPTERA
Dytiscidae
Elmidae
Dytiscidae L
Elmidae L
EPHEMEROPTERA
Polymitarcidae
Heptageniidae
Ephemeridae
Leptophlebiidae
Caenidae
Baetidae
Ephemerellidae
TRICHOPTERA
Hydropsychidae
Rhyacophilidae
Polycentropodidae
Psychomyiidae
Hydroptilidae
Leptoceridae
Limnephilidae
Sericostomatidae
PLECOPTERA
Nemouridae
Leuctridae
Perlidae
DIPTERA
Tipulidae
Athericidae
Culicidae
Syrphidae
Chironomidae
Simuliidae
Blephariceridae
Ceratopogonidae
CRUSTACEA
Cambaridae
Assellidae
Gammaridae
MOLLUSCA
Dreissenidae
Corbiculidae
Planorbiidae
Hydrobiidae
Ancylidae
Physidae
Melanopsidae
Neritidae
Lymnaeidae
ALTRES
Oligochaeta
Hydra
Erpobdellidae

BIOLOGICAL QUALITY

Once you have examined and identified all of the organisms collected, RiuNet uses the list of macroinvertebrates families to aassess the biological quality of the river, as follows:

Un cop hagis examinat tota la safata i ja no tinguis més organismes diferents per seleccionar, el sistema d'avaluació és molt senzill: s' agafen el nombre total de macroinvertebrats i el nombre de famílies indicadores que representen una qualitat millor. Recorda que és important saber quina es la tipologia de riu i emprar només la columna de la Fitxa 4 que així ho indica.

Un cop tinguis el total de famílies de macroinvertebrats i el nombre de famílies indicadores que representen una millor qualitat obtindràs la qualitat biològica emprant la taula de la **Figura 2** i que també trobaràs a la **Fitxa 4**.

For example, if more than 9 families of macroinvertebrates are identified and 3 of them are indicators of the highest quality (blue), according to the biological quality table, the diagnosis of the river will be of biological quality (blue) but if only 1 of them is of the highest quality, you will have a good quality (green) river. Another couple of examples of biological evaluation: if 16 families of macroinvertebrate and those of highest quality are identified, they are 3 indicators of good quality (green), the diagnosis will be of good quality but if the total were of 10 families with the same number of indicator families, the diagnosis will be of mediocre quality (yellow). In cases of absence of macroinvertebrate indicators (without color in File 4) or total, we must continue looking for invertebrates to find the ones that are indicators. If you have already looked for a lot and you can not find it, you can not do the diagnosis of this river section and the result will be undetermined.

In order to complete the **biological test**, is necessary that the river is with a **flowing water aquatic phase**. If the river is with a disconnected pool or dry aquatic phase you may write down the macroinvertebrates you identified but the biological quality cannot be determined.

Figura 2. Table to determine the **biological quality score** based on the type of river of RiuNet

Number of macroinvertebrate families Total				
Indicators	1-2	3-8	9-15	>15
≥ 3		8	9	10
2		7	8	9
1		6	7	8
≥ 3		6	6	7
2	5	5	5	6
1	4	5	5	5
≥ 3		4	5	5
2	2	3	4	4
1	2	3	3	3
≥ 2	1	2	2	
1	1	1	1	

The **ecological status** is a combination of the hydromorlogical and biological qualities and is assessed using the table found in **figure 2** and also located in **sheet 5**.

Once obtained the quality levels of the two tests, an intersection is made using the two colours where the final state is obtained using the Table in Figure 3. Note that the biological quality has more influence in determining the ecological status, because if the biological quality is blue and the hydromorfological quality is yellow, the final state is green (good); whereas if the hydromorphological quality is blue or green and the biological yellow, the final state is yellow.

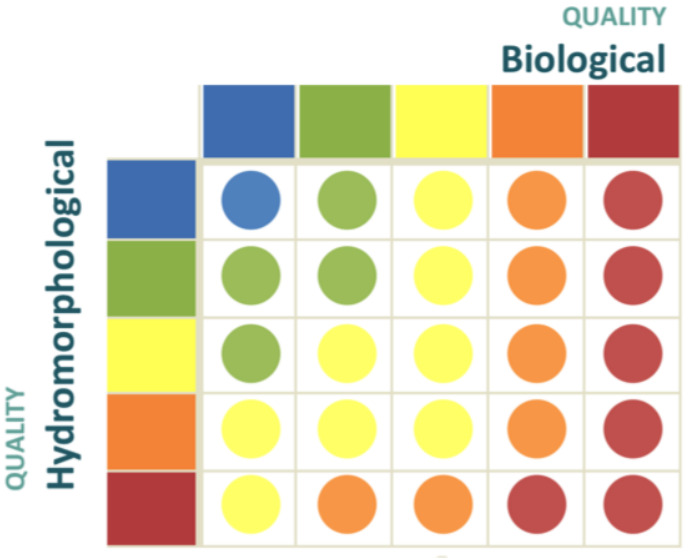


Figure 3. Table to assess the river ecological quality based on the results obtained on the hydromorphological and biological qualities tests.

YOU HAVE FINISHED YOUR ASSESSMENT!

If you were in a river and you were not able to use the RIU.net APP because of geolocalization problems but you spotted in a map, or if you did not had the app but completed on a paper, or any other circumstance that hold you back to complete the assessment, you may enter the data other time in the app and send the information.

Remember that before leaving the river; take a picture that you will send so that we can validate your data.

If for any reason you cannot or do not want to send the data, we expect that this material you have in your hands has been helpful and that beside the quality assessment, you had a good time.

THANK YOU FOR USING THE RiuNet APP!

Before you start using RiuNet, you should review the safety measures:

General safety measures:

- If possible, go with a firend.
- Use appropriate footwear.
- Use plastic gloves.
- Bring insect repellent.
- Avoid times of day when it is too hot or too cold.

If water levels in the river are high or it is raining heavily:

- Never enter the river if water levels are high or it is raining heavily.

If water levels are normal:

- Avoid areas that are very deep (more than 75 cm) or fast flowing (more than 1 m/s).
- Tread with care when in the water.
- Avoid walking on large rocks or slabs: they can be very slippery.
- Avoid muddy areas where you can get trapped.
- If water is murky, use a stick; this will help you to gauge the depth of the water and alert you to anything lying on the riverbed.
- Wear appropriate footwear, as there may be sharp objects on the botton (glass and metal).

Don't let your footsteps be a cause of river degradation:

- Pay attention to where you walk.
- Avoid spreading invasive species. Clean your equipment and boots with a 4% bleach solution.
- Be particularly careful in protected areas.
- Return all organisms to the river. If you want to keep them, make sure that this is permitted.

Appropriate footwear for entering the water:

Wellies, sandals, water shoes, flip-flops, etc.

A net for collecting macroinvertebrates

You can mke your own net using a wire and mosquito netting, or other similar materials. Remember that the animals you will be collecting are very small animals, so the holes in the net must be also as small as possible.

A plastic tray or other plastic container

For temporary storage of the animals that you collect. The tray also makes them easier to observe.

Magnifying glass and tweezers

These will help you to handle better the animals you collect.

Rubeer gloves

Rubber gloves will protect you against harmful microorganisms. If you think that the river may be polluted, you must use them.

Optional:

Tape measure

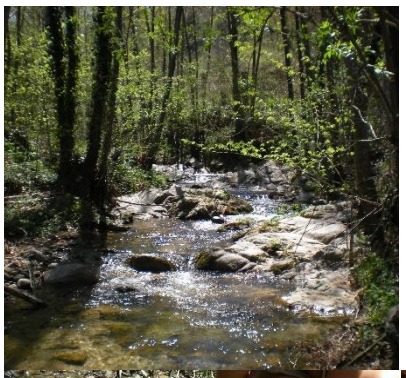
Use a tape measure the width and depth of the river. If you do not have one, make a rough estimate.

Guides for identifying plants and animals

The RiuNet app will help you to identify macroinvertebrates, but any other materials to recognize plants and animals that you may have may be useful.

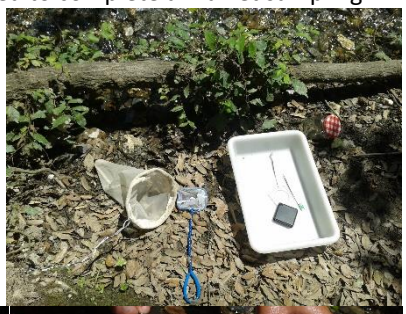
4% bleach solution (spray bottle)

Use this to clean equipment and footwear before entering the water and when switching to a different stretch of the river. If you don't clean and sanitize your equipment, you may spread harmful microorganisms, causing damage to river ecosystems.



Choose a river section where you can work comfortably and safely, and check you have the tolls needed to complete a RiuNet sampling:

- A white tray.
- Hand lens of 2X-3X.
- A pair of tweezers to handle organisms.
- A net or an olf coffee strainer.
- Transparent glass or plastic pots.



Sample the stones you find in the riffle areas.

Take a stone from the river and place the strainer behind the stone with the help of the current to avoid organisms sweep when you lift the stone.

Clean the stone on the tray carefully.

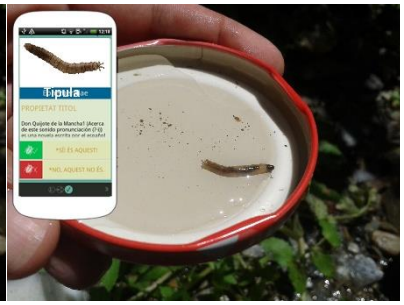
Empty the content of the strainer into the tray.

Remove stones, leaves, branches and all distracting elements on the tray in order to observe better the animals.

You are ready to start classifying them.

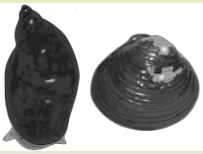
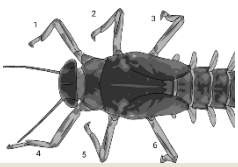
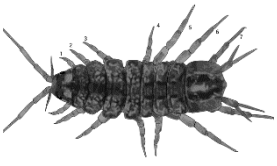
If there are many animals you can take one invertebrate with the pair of tweezers...

...and place it in a pot so you can observe it better.

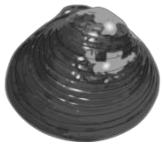
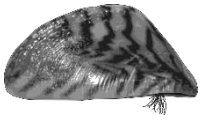
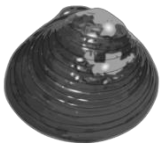
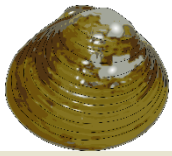
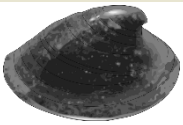
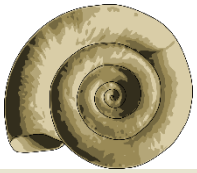
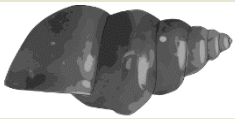
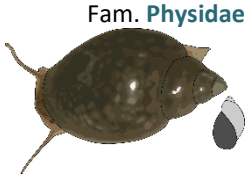


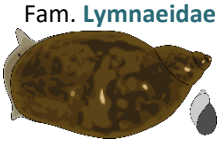
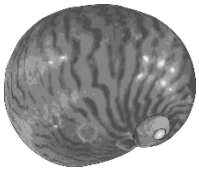
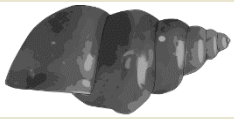
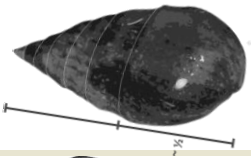
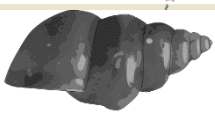
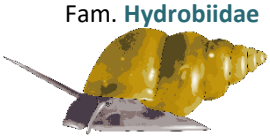
You are ready to classify the organism considering the dichotomous key and descriptive texts.

KEY TO MAJOR GROUPS

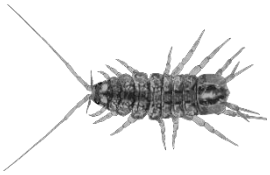
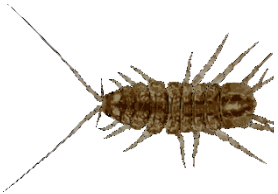
STEP		Characteristic	Go to
1	1.1	Animals without joined legs.	2
	1.2	 Animals with 6 or more joined legs.	5
2	2.1	 Shelled body or body composed of two valves.	Class MOLLUSCA Go to **Key 1**
	2.2	Different body, no shell.	3
3	3.1	 Body composed of many similarly shaped segments and no appendages.	Class **OLIGOCHAETA** 
	3.2	Segmented body, but segments are not all alike.	4
4	4.1	 Leeches, body with a sucker at the end.	Class HIRUDINEA  Fam. **Erpobdellidae**
	4.2	 Body typically composed of twelve segments and a head. The body can have prolegs (false legs).	Class INSECTA Order DIPTERA Go to **Key 8**
5	5.1	 Animals with six jointed legs. They can have gills, cerci or prolegs	Class INSECTA No DIPTERA Go to **Key 3**
	5.2	 Animals with many legs.	Class CRUSTACEA Go to **Key 2**

Key 1. MOLLUSCA

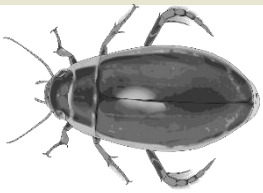
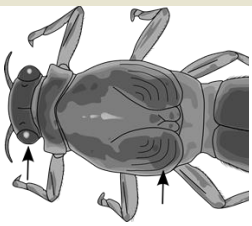
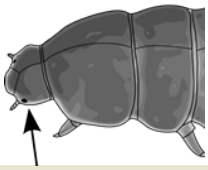
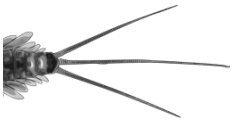
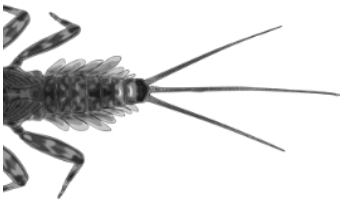
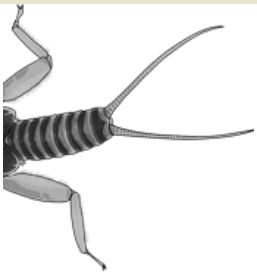
STEP		Characteristic		Go to
6	6.1		Shell composed of two valves (like mussels).	**7**
	6.2		Shell composed of one valve (like snails).	**8**
7	7.1		Elongated valves (like sea mussels). Shells have light and dark stripes.	Fam. **Dreissenidae** 
	7.2		More rounded valves (like clams).	Fam. **Corbiculidae** 
8	8.1		Cap-shaped shell.	Fam. **Ancylidae** 
	8.2	Different shell.		**9**
9	9.1		Shell coiled flat, semi-circular.	Fam. **Planorbiidae** 
	9.2		Shell coiled in a spiral (like sea snails).	**10**
10	10.1		Shell aperture is sinistral (to the observer's left). The aperture is on the left when observing the snail with the aperture down and the point up.	Fam. **Physidae** 
	10.2		Shell aperture is dextral (to the observer's right).	**11**

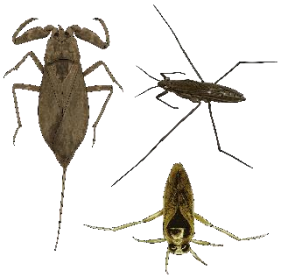
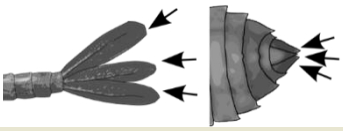
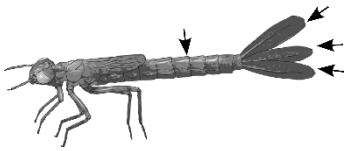
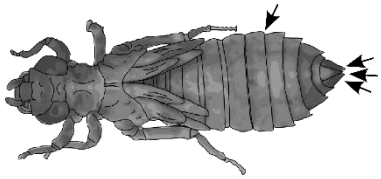
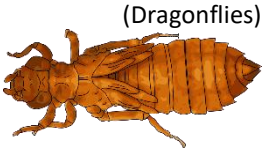
STEP		Characteristic	Go to
11	11.1	Snails without operculum (the operculum is a plate that forms a lid over the shell's aperture). If you touch the snail when it is inside its shell and the aperture is firm that means that it has an operculum, whereas if you feel its soft body, it does not have an operculum.	Fam. **Lymnaeidae** 
	11.2	 Snails with operculum. When the snail is out of its shell and moving, it carries the operculum in its back part (not easy to see).	**12**
12	12.1	 Semi-circular shell aperture, round-shaped snails that typically have many stripes.	Fam. **Neritidae** 
	12.2	 Round or oval shell aperture, elongated shells.	**13**
13	13.1	 The last spiral of the shell (the one closest to the aperture) is higher than (and roughly half the length of) the other apical spirals.	Fam. **Melanopsidae** 
	13.2	 The last spiral of the shell is not so high. Snails smaller than the Lymnaeidae, for which they can be mistaken.	Fam. **Hydrobiidae** 

Key 2: CRUSTACEA

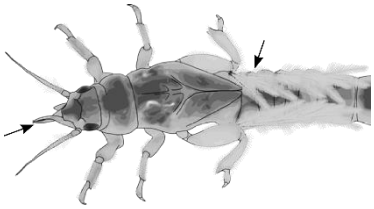
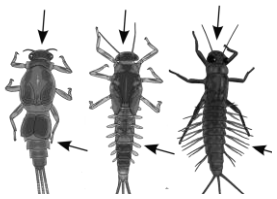
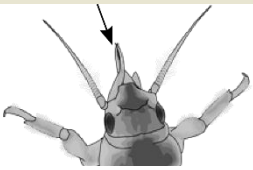
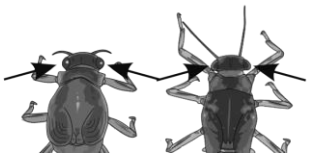
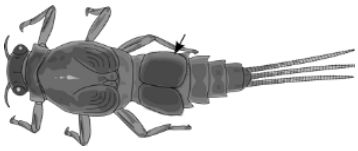
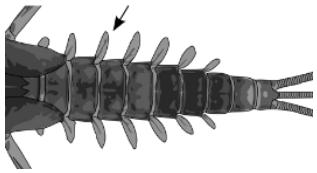
STEP		Characteristic	Go to
14	14.1	 Crayfish, with long claws	Fam. **Cambaridae** 
	14.2	Not a crayfish, front pair of legs never in the form of claws. Animals much smaller than crayfish.	**15**
15	15.1	 Laterally compressed bodies, they swim rapidly sideways. Resembling prawns or shrimp	Fam. **Gammaridae** 
	15.2	 Hoglouse. Dorso-ventrally flattened body. 7 pairs of legs.	Fam. **Asellidae** 

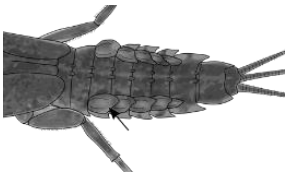
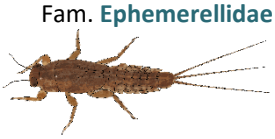
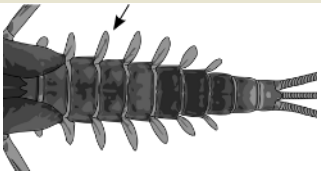
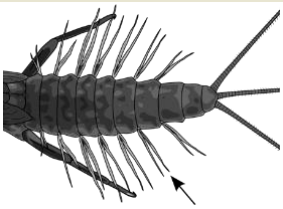
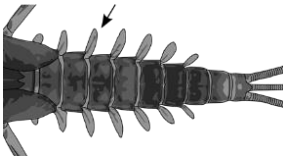
Key 3. Insects (Orders no DIPTERA)

STEP		Characteristic		Go to
16	16.1		Beetle-shaped, with an upper pair of wings that have become hard coverings (elytra) to protect the other wings and the rest of the body.	Order COLEOPTERA (adults) Go to **Key 7**
	16.2	Not beetle-shaped.		**17**
17	17.1		Larvae have very big round eyes composed of small units similar to the eyes of adult insects. On the dorsal part of the thorax, they have coverings in which wings become formed. As they grow, these extend towards the abdomen.	**18**
	17.2		Eyes are a single spot. No wing coverings.	**22**
18	18.1		Slender, multi-jointed tails	**19**
	18.2		No tails of this kind.	**20**
19	19.1		Three slender tails. If they only have two, they have lateral abdominal gills that are easy to see.	Order EPHEMEROPTERA Go to **Key 4**
	19.2		wo slender tails. No lateral abdominal gills.	Order PLECOPTERA Go to **Key 5**

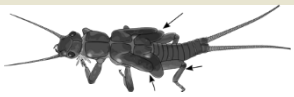
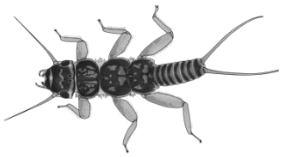
20	20.1		Without any type of appendage at the rear of the body (only the water scorpion has a very long breathing tube). Their mouth is a tube-like sucking structure that they use to digest their prey. Some skim over the water's surface.	Order **HETEROPTERA** 
	20.2		Abdomen terminates in three long spine-like plates or appendages. Jaw developed into a large retractable mask	Order ODONATA **21**
21	21.1		Cylindrical-shaped abdomen terminating in three broad feathery tails.	Suborder **Zygoptera** (Damselflies) 
	21.2		Stout abdomen, wider in the middle than at the end. Abdomen terminating in five short spine-like appendages that form a small dome.	Suborder **Anisoptera** (Dragonflies) 
22	22.1		Elongated body. Some larvae carry a case. At the rear end of the abdomen, all have a single pair of claws attached to fleshy protuberances to anchor them to the substrate or hold onto case. Only the thorax is hard; the abdomen is soft.	Order TRICHOPTERA Go to **Key 6**
	22.2		Body may be elongated, but they do not carry a case and do not have claws at the rear end of abdomen. All body segments are very hard.	Order COLEOPTERA (larvae) Go to **Key 7**

Key 4. EPHEMEROPTERA

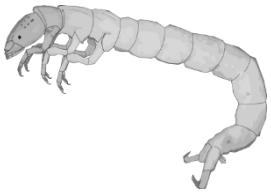
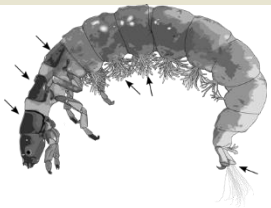
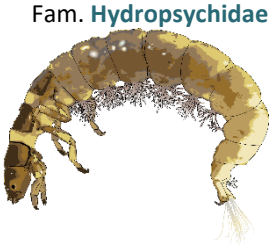
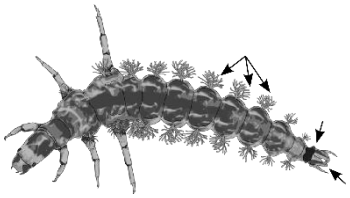
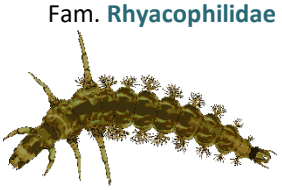
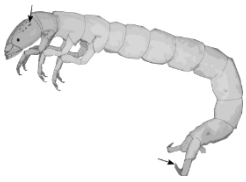
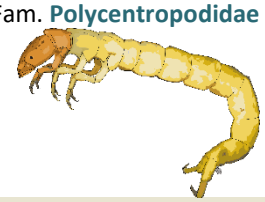
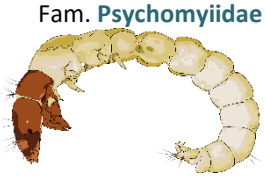
STEP		Characteristic		Go to
23	23.1		Feathery forked gills and tusk-like jaws (resembling fangs).	**24**
	23.2		No jaw prolongations, gills are never feathery	**25**
24	24.1		Jaw prolongations converging at their tips. Lateral gills	Fam. **Polymitarcidae** 
	24.2		Jaw prolongations diverge at the end. Dorsal gills	Fam. **Ephemeridae** 
25	25.1		Very flattened body. Large head, dorsal eyes and large lateral abdominal gills that are plate-like.	Fam. **Heptageniidae** 
	25.2		Body not flattened; eyes lateral.	**26**
26	26.1		Gills hidden under the first gill, which is operculum-shaped and covers the others.	Fam. **Caenidae** 
	26.2		Gills visible (except in very small individuals), they can be dorsal or lateral.	**27**

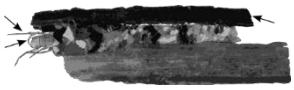
27	27.1		Small plate-like gills on upper part of the abdomen	Fam. **Ephemerellidae** 
	27.2		Lateral gills.	**28**
28	28.1		Gills composed of two or more long filaments. Tails at least as long as the body.	Fam. **Leptophlebiidae** 
	28.2		Rounded gills, typically with a single lobe. Tails shorter than the body.	Fam. **Baetidae** 

Key 5. PLECOPTERA

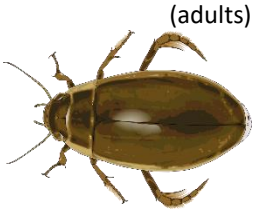
STEP		Characteristic	Go to
29	29.1	 Larvae with very long hind legs; when extended, they are longer than the abdomen. Wing pads, when present, diverge from the body (they point outwards). Uniform brown colour	Fam. **Nemouridae** 
	29.2	Hind legs never so long. Or if they are so long, the animals are black and white and their wing pads do not diverge	**30**
30	30.1	 They can be very big (up to 3 cm long), with contrasting dark and light colouring and a rather rounded head	Fam. **Perlidae** 
	30.2	 Smaller animals (they are at most 2 cm long) with long head and cylindrical body. They typically have a uniform light colour. Wing pads are not divergent	Fam. **Leuctridae** 

Key 6. TRICHOPTERA

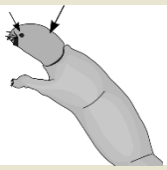
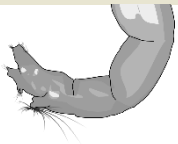
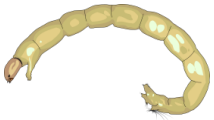
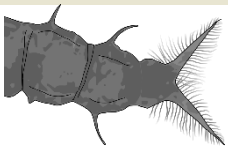
STEP		Characteristic	Go to
31	31.1	 Animals with a case that always carry it with them, dragging it. Typically, only the thorax and legs are visible as they protrude from the case.	**35**
	31.2	 Animals without case; we see the entire animal.	**32**
32	32.1	 T ufted gills on the underside of the abdomen. Head and the three abdominal segments are hardened and dark. At the end they have claws and a brush.	Fam. **Hydropsychidae** 
	32.2	No abdominal gills, or if present, they appear on the sides. No brush at rear part of the abdomen.	**33**
33	33.1	 Only the first segment is hardened (it is darker). Typically with tufted gills on the sides of the abdomen. Rear hooks are strong and located on long prolegs. Sometimes they are bright green in colour.	Fam. **Rhyacophilidae** 
	33.2	Without these characteristics.	**34**
34	34.1	 Bright yellow head and first thorax segment, with black spots. They have long hooks at the end of the body emerging from long prolegs.	Fam. **Polycentropodidae** 
	34.2	 Ungles finals petites. Pseudopodis curts. Lighter coloured animals, particularly on the abdomen. Head and first thorax segment are reddish. Hooks are small and prolegs short	Fam. **Psychomyiidae** 
35	35.1	 Round or purse-shaped cases made of very small grains of sand or algal filaments. If we observe a larva without the case, the abdomen is wider than the thorax segments	Fam. **Hydroptilidae** 
	35.2	Case different.	**36**

STEP		Characteristic		Go to
36	36.1		Case made of plant matter.	**37**
	36.2		Case made of mineral particles.	**38**
37	37.1		Elongated case made of plant matter. Typically, it is made from a twig to which irregular pieces of leaves, remains of plant tissue and grains of sand are attached. Second and third legs are much longer than the first ones.	Fam. **Leptoceridae** 
	37.2		Different plant case, typically made of small branches that form a spiral around the case or of two pieces of leaf joined in the middle. If they have a long branch in the structure, they are much bigger and the plant matter is more regular and better structured than Leptoceridae. All legs have the same length	Fam. **Limnephilidae** 
38	38.1		Case made up of small, evenly sized sand grains that are very well organized, making a compact case. The head is dark and functions like a lid when the animal is retracted into the case.	Fam. **Sericostomatidae** 
	38.2		Highly varied case. It can be made of well-distributed medium-sized mineral particles. Sometimes it is also made of a mix of mineral particles and plant matter.	Fam. **Limnephilidae** 

Key 7. COLEOPTERA (larvae and adults)

STEP			Characteristic	Go to
39	39.1		Body cylindrical or rhomboidal (in the latter case, the front part is wider than the back part). Without appendages in the back part. They do not swim.	Fam. **Elmidae** (larvae) 
	39.2		Their mandibles are powerful and visible on the front part of the head. They have two long cerci in the back part (which are sometimes as long as the abdomen).	Fam. **Dytiscidae** (larves) 
40	40.1		These animals walk on stones and hard substrates. They are dark in colour and their thorax and elytra have carinae that appear striped. Maxillary palps are short and antennae long, so when they walk, we see two appendages at the front (in other families palps are long and we see four front appendages).	Fam. **Elmidae** (adults) 
	40.2		Their legs are relatively short. They use hind legs to swim. Round shape. Large individuals are black, small ones can have stripes or spots against a lighter background or other types of patterns.	Fam. **Dytiscidae** (adults) 

Key 8. DIPTERA

STEP		Characteristic	Go to
41	44.1	Larvae have a well-developed head that is clearly differentiated from thorax segments. With an eyespot. 	**43**
	44.2	Head indistinguishable from the rest of the body, with no eyespot. 	**42**
42	42.1	 Elongated larvae. The back end looks like a crown with protruding hairs. No ventral prolegs.	Fam. **Tipulidae** 
	42.2	Larvae with abdominal prolegs and one or more long appendages at the end.	**47**
43	43.1	 Flattened larvae, with round abdominal and thorax segments, typically very dark. They have six big suckers on the ventral part of the segments to anchor themselves to stones.	Fam. **Blephariceridae** 
	43.2	Different shape, no suckers.	**44**
44	44.1	 Swollen thorax, wider than the abdomen. Breathing tube at the rear of the abdomen. Mosquito larvae.	Fam. **Culicidae** 
	44.2	Different shape, more cylindrical.	**45**
45	45.1	 Larvae with back part swollen. In the front part of the head, they have foldable fans surrounding their mouths that expand to filter particles suspended in the water.	Fam. **Simuliidae** 
	45.2	Cylindrical, with rounded head. The back part of the body is not swollen as in Simuliidae.	**46**
46	46.1	 The back part of their abdomen has two prolegs with hooks to anchor them to the substrate. They also have a proleg on the front part.	Fam. **Chironomidae** 
	46.2	 No prolegs on the back part (at most they can have some hairs). The most common in rivers are very elongated and almost thread-like in shape.	Fam. **Ceratopogonidae** 
47	47.1	 Larvae with different body appendages (lateral and dorsal) and two long feathery appendages at the end.	Fam. **Athericidae** 
	47.2	 Larvae with a very long appendage used as a breathing tube.	Fam. **Syrphidae** 

For each organism in RiuNet, you can find a fact sheet with its main characteristics that will help you in the identification and its differentiating features to other similar macroinvertebrates. Remember that you may find organisms that you cannot identify because RiuNet only uses forty different macroinvertebrates as indicators. If you want to identify it, you will need other keys or guides and probably you will need other materials than the ones you have in the field.

For each macroinvertebrate found in RiuNet you will find a fact sheet that cover five sections: 1) Taxonomy. 2) How to identify an organism; 3) How it moves; 4) Habitat and food, and 5) Size.

TAXONOMY. This is the creature's position on the scale of taxonomic ranks from the broadest rank (the kingdom *animal*) to the rank that identifies each creature with a unique name (genus and species). In RiuNet we do not use the rank of genus or species, because doing so would require checking for highly detailed characteristics that are impossible to see in the field without specialized materials. Typically, the taxonomic rank at which we recognize most macroinvertebrates at RiuNet is the family, although this can vary by taxonomic group and we sometimes only identify class (in the case of worms), order or suborder. This is why we do not speak of species, but of taxa, because we are not always working at the same taxonomic rank. A taxon is a taxonomic group that is recognized internationally. To do a quick assessment of biological quality with the RiuNet application, it is good enough to use the animals selected and identified at the taxonomic level that we propose.

We have also indicated the common names (in parentheses) of some of the most generic creatures. In the Iberian Peninsula, there is a long tradition of common names for this group of organisms, but many families in the same order have the same common name. This is also true in other locations and languages.

HOW TO IDENTIFY AN ORGANISM? There is a summary of distinctive features to help you distinguish an organism from other similar taxa that we are using at RiuNet, when you go through the dichotomous key to make your identification. (It is not a complete detailed description of all the characteristics of each taxon, but only its differentiating features).

HOW IT MOVES. How an organism moves or other related characteristics will help you to identify the organism better, if you are in doubt. To observe the creature's type of movement, you will need to observe it in water. As a result, it is a good idea to have a bowl with a white background to see the movement more easily.

HABITAT AND TYPE OF FOOD. The wide variety of macroinvertebrates in rivers is related to the great heterogeneity of substrates that you can find there, the different speeds of the water and the different types of food. For each organism, we can indicate to you what its preferences are:

1- *Speed of water current*: If the organism lives in areas where the current is very fast (speeds of 1 metre/second or greater); fast (between 0.3 and 1 m/sec), moderate (less than 0.3 m/sec) or zero (water in a pond).
2- *Specific habitat*: Between stones or pebbles, among fallen leaves, in gravelly areas, in muddy areas, in very fine materials (normally buried), or among aquatic vegetation.
3- *Type of food*: We can distinguish animals as follows:
- **Chewers**: they graze over stones or on vegetation, feeding on algae or matter covering stones.

- **Shredders**: they feed on organic matter, particularly leaves, which they cut and eat in pieces.
- **Gatherers**: they gather matter deposited at the bottom of rivers or between stones, fine matter that comes from leaves and the decomposition of aquatic plants.
- **Filterers**: they feed by filtering matter carried by the water, either passively (in a place that has a current) or actively (by creating a current).
- **Predators**: they feed on other animals that they capture in various ways, by actively hunting, lying in wait or using nets to ensnare their prey.

SIZE. This provides a range of sizes that are most typical of adult individuals or larvae or nymphs if they are large. The minimum size we have put is always 0.5 cm, but most macroinvertebrates are obviously much smaller when they are juveniles. We have provided a small scale in the figures of each taxon to give you an idea of size in comparison to the other drawings.

WORMS AND LEECHES

Oligochaeta (worm)

Taxonomy: Phylum: ANNELIDA, Class: OLIGOCHAETA
How is it identified? Elongated annelid, cylindrical, soft, and with many body segments. The segments are similar in length and width or slightly wider than long. They lack suckers on the body. Some have a small eyespot.
Alive: Usually interstitial, moving slowly through the substrate's cavities. They can swim, zigzagging. Light colours (white, yellow, sometimes red, pink or green).
Habitat and feeding mode: They live in areas without flow or very low flow in fine substrates (silts), and feed on organic matter (collectors). Some are very small (naidids) and live among vegetation, on the algae on which they feed.

Size: 0,5-5 cm. Some are always very small, while others can stretch and shrink and be very large.

Erpobdellidae (leech)

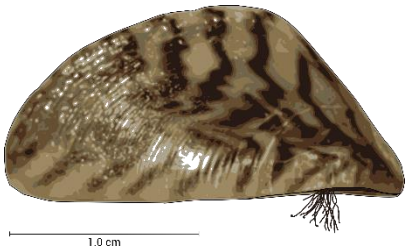
Taxonomy: Phylum: ANNELIDA, Class: HIRUDINEA, Family: ERPOBDELLIDAE
How is it identified? Annelid with an elongated, soft and very flexible body formed by narrow and wide segments. It has a sucker on the caudal end of the body
Alive: It moves stretching and shrinking the body. It fixes to the substrate with the sucker and then elongates the body by advancing its cephalic section; once the cephalic section is fixed, the sucker is disengaged, and so on. It uses the sucker to catch its prey if necessary. Dark brown body, sometimes with lighter longitudinal lines.
Habitat and feeding mode: It does not like strong flows and it lives on stones and pebbles. It feeds on other aquatic animals.
Size: From less than 1 cm to 4, 5 or more cm, depending on whether it is stretched or shrunk, or if it is an adult or a new-born individual.

MOLLUSCS

Corbicullidae (basket clam)

Taxonomy: Phylum: MOLLUSCA, Class: BIVALVIA, Order: VENEROIDA, Family: CORBICULIDAE
How is it identified? Rounded shells. It is found exclusively at the bottom of the river between pebbles or gravel. Homogeneous brown colour.
Alive: Sometimes is so abundant that it covers the whole riverbed.
Habitat and feeding mode: Living on silt or gravel substrates in areas without flow or with very low flow. It feeds on organic matter particles that it filters. *Corbicula sp.* is an invasive species, common in the lowlands of the great Iberian rivers like the Ebro.
Size: Diameter between 1 and 5 cm.

Dreissenidae (zebra mussel)

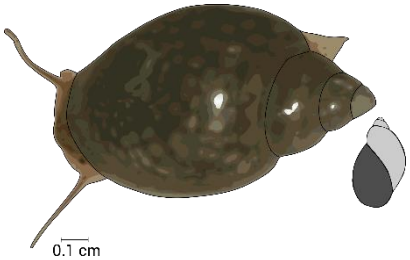


Taxonomy: Phylum: MOLLUSCA, Class: BIVALVIA, Order: VENEROIDA, Family: DREISSENIDAE
How is it identified? The valves of the shell are long and narrow, like a sea mussel but much smaller. The shell has a drawing with light and dark stripes.
Alive: *Dreissena polymorpha* is a small invasive bivalve. It lives in the middle and lower river sections, especially in the Ebro basin. Usually many individuals are clustered, sometimes on top of each other.
Habitat and feeding mode: It lives attached to hard substrates, including concrete walls. It does not like strong flows and it can live in zero-flow areas, filtering suspended material.
Size: 0,5-2 cm.

Lymneidae (gastropoda, aquatic snail)

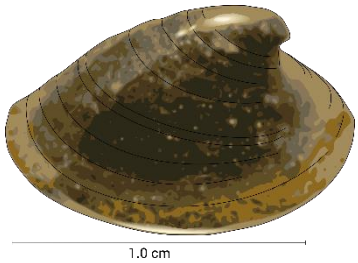
Taxonomy: Phylum: MOLLUSCA, Class: GASTEROPODA, Family: LYMNAEIDAE
How is it identified? Snail without operculum (cover that isolates the body from the outside when the body is inside the shell) and a large shell aperture. The shell is wrapped up counter-clockwise (the opening is on the right when viewed with the tip of the shell up). To verify that no operculum is present you can touch the aperture when the snail is within the shell and notice if it is soft or hard.
Alive: Crawler, organism that moves using a muscular foot. When moving it shows a pair of long thin tentacles with eyes on their tips.
Habitat and feeding mode: It commonly lives on hard substrates like stones or wood, and sometimes on vegetation. It prefers zero-flow or low flow areas. It is a grazer, scraping with its teeth (radula) the algae on the substrate.
Size: 1-3 cm.

Physidae (gastropoda, aquatic snail)



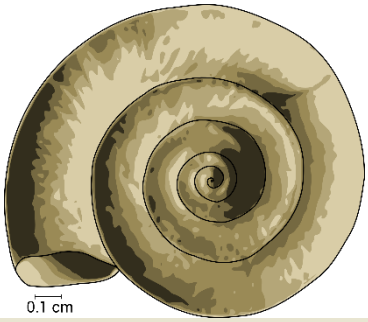
Taxonomy: Phylum: MOLLUSCA, Class: GASTEROPODA, Family: PHYSIDAE
How is it identified? Snail with the shell opening to the left (from all the snails registered in Riu.net it is the only one opening to the left). No operculum (cover that isolates the body from the outside when the body is inside the shell).
Alive: Crawler, like all gastropods. It moves slowly, crawling over hard substrates.
Habitat and feeding mode: It commonly lives on hard substrates like stones or wood, and sometimes on vegetation. It prefers zero-flow or low flow areas. It is a grazer, scraping with its teeth (radula) the algae on the substrate. It is the most pollution tolerant gastropod.
Size: 0,5-1,5 cm.

Ancylidae (gastropoda, river limpet)



Taxonomy: Phylum: MOLLUSCA, Class: GASTEROPODA, Family: PLANORBIDAE
How is it identified? Christmas hat-shaped snail with the tip directed backwards in the direction of movement of the animal. Very dark brown-green colour, sometimes difficult to distinguish from stones.
Alive: It moves very slowly over the stones. Most of the time it seems perfectly quiet and engaged by suction on the substrate. Very common in all types of rivers when algae are present on the rocks.
Habitat and feeding mode: It lives on hard substrates (e.g. stones), in rivers with strong to weak flows. It is a grazer, feeding on algae. Sometimes there are so many that the stones do not show the green colour originated by the algal cover.
Size: Up to 1,5 cm.

Planorbidae (gastropoda, aquatic snail)

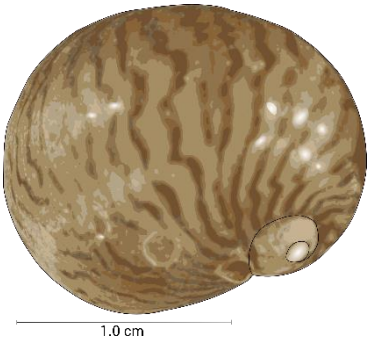


Taxonomy: Phylum: MOLLUSCA, Class: GASTEROPODA, Family: PLANORBIDAE
How is it identified? Snail with a flat spiral.
Alive: Crawler, like all gastropods. It moves slowly, crawling over hard substrates and aquatic plants.
Habitat and feeding mode: It lives on hard substrates (stones and especially plants), in rivers with zero or low flow. It is a grazer, scraping with its teeth (radula) the algae on the substrate.
Size: Maximum diameter 1 cm.

Melanopsidae (gastropoda, aquatic snail)

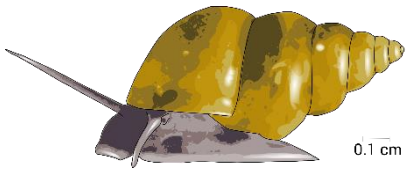
Taxonomy: Phylum: MOLLUSCA, Class: GASTEROPODA, Family: MELANOPSIDAE
How is it identified? Shell which last spire is twice larger than the rest of apical spires. Shell opening to the right. It has a big and hard operculum that covers the opening of the shell when the body is inside, and which looks like a hat when the snail moves.
Alive: Crawler, it moves slowly over hard substrata. It is exclusively found in Mediterranean basins, from the Ebro southwards.
Habitat and feeding mode: It commonly lives on hard substrates, in zero-flow or low flow areas. It is a grazer, scraping with its teeth (radula) the algae on the substrate.
Size: 1-3 cm.

Neritidae (gastropoda, aquatic snail)



Taxonomy: Phylum: MOLLUSCA, Class: GASTEROPODA, Family: NERITIDAE
How is it identified? Operculum forming a semicircle. Shell rounded, usually with many stripes. The last spire is very large, much more than the terminal ones.
Alive: Crawler, often live in areas with higher flows than those preferred by other gastropods and near freshwater springs.
Habitat and feeding mode: It commonly lives on hard substrates, in zero-flow or low flow areas. It is a grazer, scraping with its teeth (radula) the algae on the substrate. It is found mainly in springs and Mediterranean rivers of clean and calcareous waters.
Size: 0,5-1,5 cm.

Hydrobidae (gastropoda, aquatic snail)



Taxonomy: Phylum: MOLLUSCA, Class: GASTEROPODA, Family: HYDROBIIDAE

How is it identified? The closest spire to the opening is as large as the rest. It has a small operculum that covers the opening when the animal is retracted into the shell. The operculum can be seen as a small hat when the animal moves.

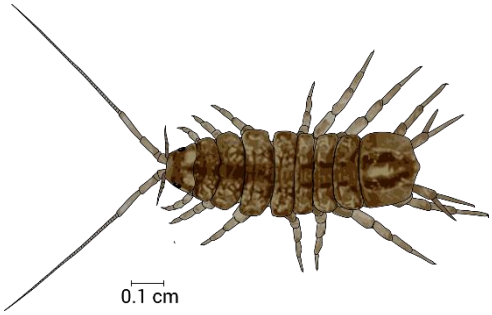
Alive: It crawls over the riverbed or aquatic plants. If disturbed, it hides inside its shell. It is much smaller than all the other gastropods that we use as indicators. One of the most common species is the invasive species *Potamopyrgus antipodarum*.

Habitat and feeding mode: It commonly lives on hard substrates, in zero-flow or low flow areas. Some species are only found in springs. It is a grazer, scraping with its teeth (radula) the algae on the substrate. *P. antipodarum* can also live attached to the phanerogam *Potamogeton pectinatus* in nutrient rich rivers as is the middle and lower sections of the Llobregat River.

Size: 0,5-1 cm.

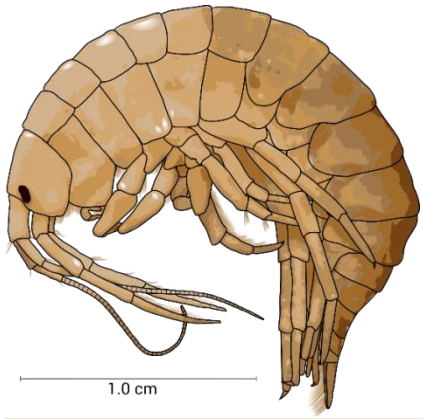
CRUSTACEANS

Asellidae (crustacean)



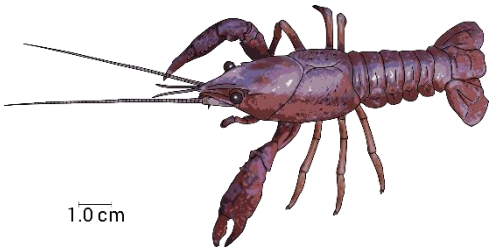
Taxonomy: Phylum: ARTHROPODA, Class: MALACOSTRACA, Order: ISOPODA, Family: ASELLIDAE
How is it identified? Dorsoventrally flattened body, with seven pairs of side legs, long antennae and two caudal appendages.
Alive: It is found in the lower reaches of rivers and also in some springs, usually among the leaf litter. It moves slowly, walking.
Habitat and feeding mode: It lives in zero or low flow areas, especially in zones of leaf litter or organic matter accumulation. It is a shredder or a collector. It can be found both in clean springs and in highly polluted waters.
Size: 1-2,5 cm.

Gammaridae (crustacean, scud)



Taxonomy: Phylum: ARTHROPODA, Class: MALACOSTRACA, Order: AMPHIPODA, Family: GAMMARIDAE
How is it identified? Laterally compressed body, similar to a shrimp. It has twelve pairs of legs and a yellow-orange colour.
Alive: It swims very fast, sideways.
Habitat and feeding mode: It lives among the leaf litter, the aquatic vegetation or under stones in low or even moderate to strong flow areas. It is a leaf shredder, but when leafs cannot be found it feeds on aquatic plants or it collects materials from the riverbed.
Size: 0,5-2 cm.

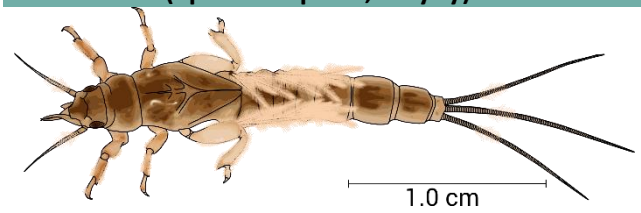
Crayfish (crayfish, American crayfish, signal crayfish)



Taxonomy: Phylum: ARTHROPODA, Class: MALACOSTRACA, Order: DECAPODA
How is it identified? Typical crayfish shape, with two very long claws.
Alive: In the water it walks or swims rapidly using the abdomen as a propeller. The American crayfish may be out of the water, showing its claws menacingly.
Habitat and feeding mode: The native crayfish and the signal crayfish live among the stones in rivers of strong flow. The American crayfish can also be found in wetlands and ponds in tubes that it builds. They feed mainly on macroinvertebrates, although they may eat a bit of everything. The American crayfish collects everything available, eating macrophytes until its depletion. The signal crayfish is only found in very cold mountain waters. Both the signal and the American crayfish are invasive species that have led to the near extinction of the native crayfish, which is now only found in a few small Mediterranean rivers that have not yet been reached by the other crayfish species. They are not used as indicators in Riu.net.
Size: As new-borns they measure a few centimetres; adults can reach 30 cm. The native crayfish is somewhat smaller (maximum 20 cm).

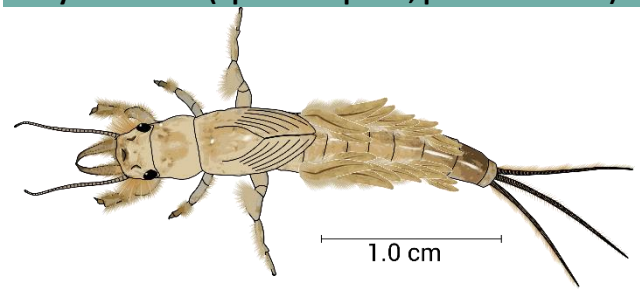
MAYFLIES

Efemeridae (ephemeroptera, mayfly)



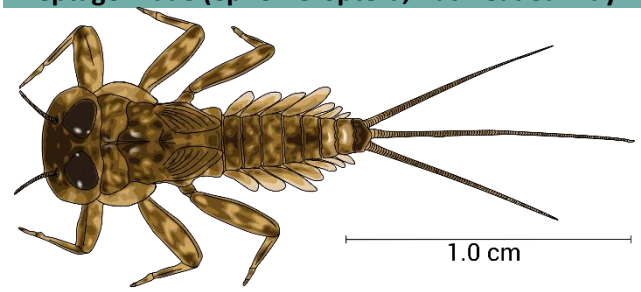
Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: EPHEMEROPTERA, Family: EPHEMERIDAE
How is it identified? Bifid feather shaped gills, located above the abdomen, very large compared to those of Ephemerellidae. They have some extensions in the jaw protruding beyond the margin of the head that look like long teeth, diverging at their end.
Alive: Beige colours with some dark spots. They are mostly found in the middle reaches of rivers (less abundantly in the lower parts) where they are replaced by Polymitarcidae.
Habitat and feeding mode: Living in areas with zero or low flow on gravel or sand where they build tubes. They generate current by moving the gills to filter particles carried by the river using the hairs of their long jaws.
Size: 0,5-2 cm.

Polymitarcidae (ephemeroptera, pale burrowers)



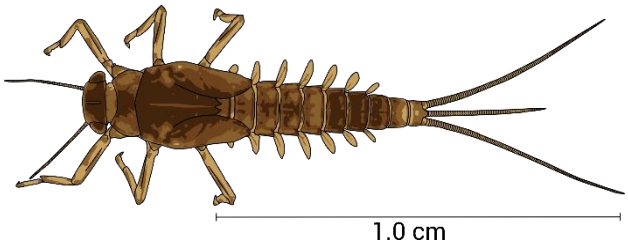
Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: EPHEMEROPTERA, Family: EPHEMERIDAE
How is it identified? They have bifid feather shaped gills located above the abdomen, very large compared to those of Ephemerellidae. They have some extensions in the jaw protruding beyond the margin of the head that look like long teeth, converging at their end (as opposed to Ephemeridae, in which they diverge).
Alive: They are coloured clear white. They are abundant in the lower parts of rivers, but they can also be found in the middle parts (where Ephemeridae tend to be more abundant).
Habitat and feeding mode: They live in areas with zero or low flow on gravel or sand where they build tubes. They generate current by moving the gills to filter particles carried by the river using the hairs of their long jaws.
Size: 0,5-2 cm.

Heptageniidae (ephemeroptera, flat-headed mayflies)



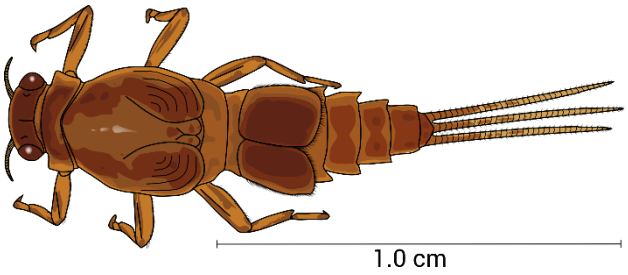
Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: EPHEMEROPTERA, Family: HEPTAGENIIDAE
How is it identified? Very flat body, with very large head and eyes and large lateral abdominal sheet-shaped gills. The genus *Epeorus* has only two tails at the end of the body, but cannot be mistaken with a stonefly because the latter never have side gills.
Alive: Colours usually contrasted with dark and light spots. They move quickly, swimming. When inmobile they move the gills frequently to avoid internal oxygen depletion.
Habitat and feeding mode: They live both in areas with strong and zero flow, among stones and pebbles, moving dorsoventrally thanks to its flat shape. They are grazers, feeding on the algal film that covers the stones.
Size: 0,5-2,5 cm.

Baetidae (ephemeroptera, blue-winged olives)



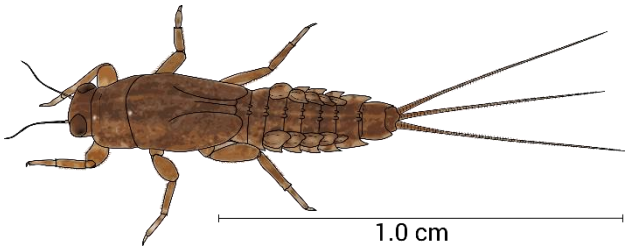
Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: EPHEMEROPTERA, Family: BAETIDAE
How is it identified? Body elongated and not flattened. Gills oval and positioned laterally to the abdomen. They usually have three articulated tails at the end of the body but they can have two, especially those of small size (in any case, they can not be mistaken for a stonefly because the latter never have side gills and do not move so quickly).
Alive: Swimmer, with very fast movements. It is propelled by moving the gills and the abdomen very quickly, stabilizing the movement by using its tails. Greenish, brownish or yellowish colours, often with darker spots.
Habitat and feeding mode: The genus *Baetis* likes the strong flowing rivers full of stones, while the genus *Cloeon* is typical of isolated ponds where it swims, actively foraging. They are mainly grazers, but they also collect any material they find. They are the most pollution tolerant ephemeropterans.
Size: 0,5-1,5 cm.

Caenidae (ephemeroptera, small squaregill mayflies)



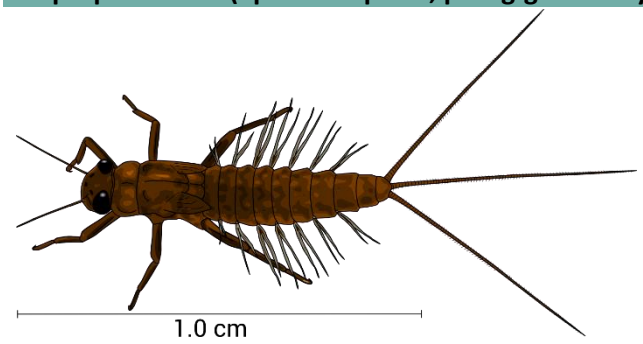
Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: EPHEMEROPTERA, Family: CAENIDAE
How is it identified? Gills located on the back of the abdomen; the first two are hard-plate shaped, protecting the rest. When it stops and breathes, it lifts the first pair of gills showing the ones located below, which are delicate and very divided and which it moves quickly to breathe. It has three tails, not very long, at the end of the body.
Alive: Walker. If necessary, it propels the abdomen moving up and down quickly, but not moving rapidly. It has brownish or yellowish colours.
Habitat and feeding mode: They live in low-flow areas, on all kind of substrates, where they collect deposited material. Sometimes they are completely hidden in the environment, since they have similar colours to that of the detritus upon which they feed.
Size: 0,5-1,5 cm.

Ephemerellidae (ephemeroptera, spiny crawler mayflies)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: EPHEMEROPTERA, Family: EPHEMERELLIDAE
How is it identified? Gills located on the back, not covered (unlike Caenidae). They can be easily observed in living individuals, since it moves them frequently and quickly.
Alive: Fast moving, it rapidly escapes if it is disturbed when at rest. Sometimes, instead of escaping it bends the abdomen so that the three remaining tails are positioned overhead. It has dark green or blackish colours.
Habitat and feeding mode: They live in places with high flow, on hard substrates. They are usually grazers, but they can also collect detritus.
Size: 0,5-1,5 cm.

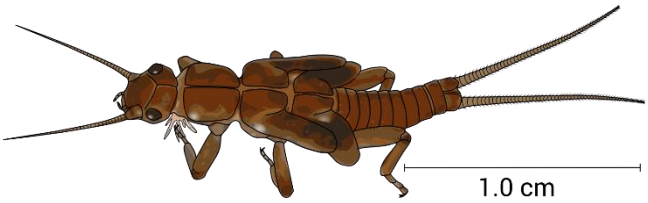
Leptophlebiidae (ephemeroptera, prong-gilled mayflies)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: EPHEMEROPTERA, Family: LEPTOPHLEBIIDAE
How is it identified? Elongated body and slightly flattened. Gills are positioned laterally and divides in two o more filaments. It has three tails at the end of the body.
Alive: Swimmer. It is propelled by moving the gills and the abdomen very quickly, stabilizing the movement by using its tails. It is dark brown, often with darker spots.
Habitat and feeding mode: They commonly live among the leaves, in low to moderate flow areas. They are shredders and collectors, especially of leaves falling in river.
Size: 0,5-1,5 cm.

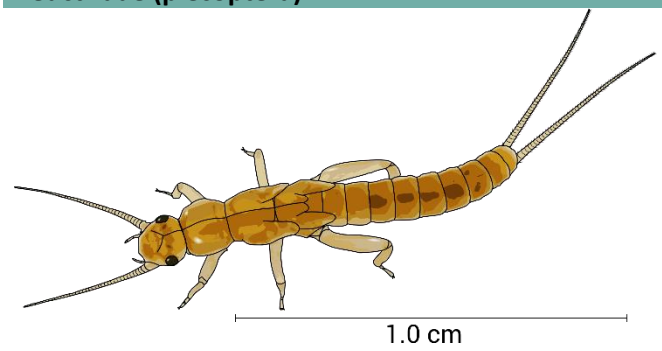
STONEFLIES

Nemuridae (plecoptera)



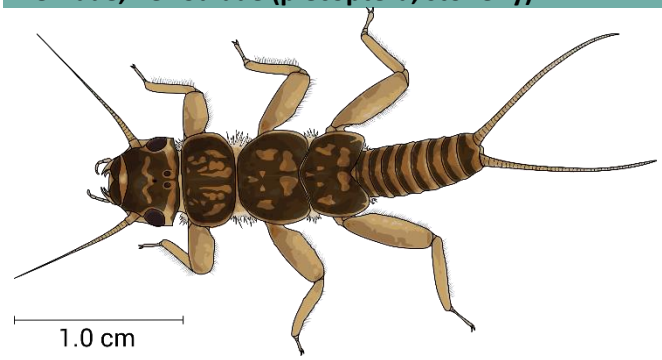
Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: PLECOPTERA, Family: NEMOURIDAE
How is it identified? Larvae with very long legs, when stretched they are longer than the abdomen. Wing pads (which are easier to see in larger individuals) divergent (i.e. directed outwards).
Alive: Walkes between the substrate. It is abundant when leaf litter is available. It hides quickly and swims clumsily. It has dark colours.
Habitat and feeding mode: It lives in areas of moderate to strong flow, feeding among the leaves. It is mostly a collector, feeding on particulate organic matter deposited in areas of litter accumulation (in fact, the particles stick to the hairs and spines that it has on the legs).
Size: 0,5-2 cm.

Leuctridae (plecoptera)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: PLECOPTERA, Family: LEUCTRIDAE
How is it identified? Insect of very elongated body at larval stage. The third pair of legs never exceeds the length of the abdomen. The wing pads are parallel, not divergent.
Alive: Mainly walker. If swimming, only with difficulty. Yellowish light colours, with some darker parts.
Habitat and feeding mode: It lives in areas of moderate to strong flows, between stones, leaves or vegetation. It is mainly a collector. More pollution tolerant than Nemuridae.
Size: 0,5-1,5 cm.

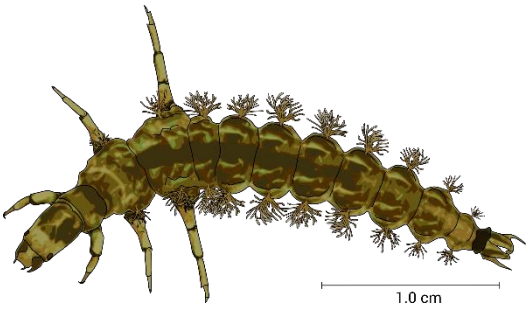
Perlidae, Perlodidae (plecoptera, stonefly)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: PLECOPTERA, Family: Perlidae, Perlodidae
How is it identified? Rounded head. The wing pads never diverge outwardly. They are distinguished from the other two plecoptera by its contrasting dark and light colours.
Alive: Very active animals that move quickly, even aggressive (if you put them in your hand they will try to bite you). Only found in mountain rivers with clean waters.
Habitat and feeding mode: Usually found among the stones in areas of moderate to strong flow. They feed on other invertebrates, and the larger ones may eat small tadpoles or amphibians and fish larvae.
Size: 1-3,5 cm

CADDISFLIES

Rhyacophilidae (trichoptera, caddisfly)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: TRICHOPTERA, Family: RHYACOPHILIDAE

How is it identified? Relatively large larvae, with only the first thoracic segment sclerified (it looks darker and with black spots, like the head). They have gills usually in the abdomen, never in ventral position (as *Hydropsyche*). Posterior nails are very strong and placed in long pseudopodia. Sometimes they have a deep green colour.

Alive: In the tray you will see them move quickly in search of prey; if left in the water column, they swim by repeatedly bending the body. If you put them in your hand, they will try to bite you.

Habitat and feeding mode: They live in areas with moderate to strong flow, in hard substrates such as stones. They move a lot between substrates looking for prey, since they feed on other invertebrates.

Size: 1-3 cm.

Hidroptilidae (trichoptera, caddisfly)

Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: TRICHOPTERA, Family: HYDROPTILIDAE

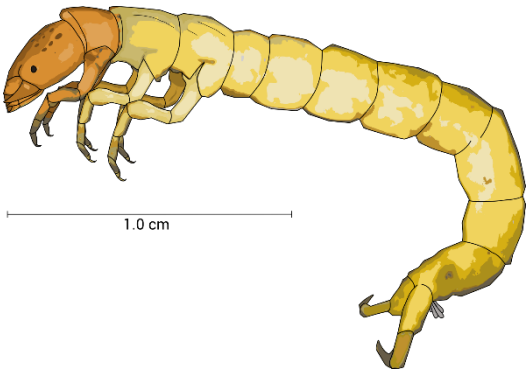
How is it identified? Case lentil-shaped or rounded, made of very small grains of sand or algal filaments. In some species the larva, observed without case, is wider in the abdomen than in the thoracic segments. Colour very light in the abdomen and dark in the thoracic segments.

Alive: They often go unnoticed, since the case is the colour of the stones in which they live. They may also be among the algae, having a greenish case. They are well hooked on the stones. When they move, they do so very slowly, dragging their case.

Habitat and feeding mode: They live in areas of moderate to strong flow, in hard substrates such as stones, where they attach their case. They also live among plants, eating small algae. They are herbivores; they eat plants and also graze the biofilm that grows on the stones. They often form groups of several individuals, which tend to aggregate.

Size: 0,5-1 cm.

Polycentropodidae (trichoptera, caddisfly)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: TRICHOPTERA, Family: POLYCENTROPODIDAE

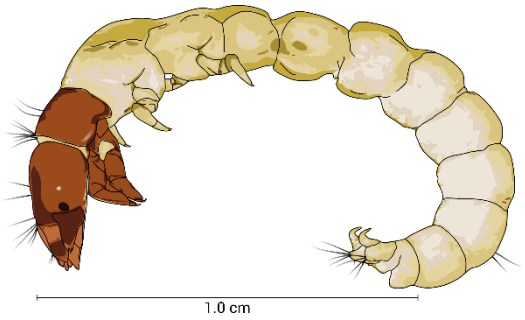
How is it identified? Body elongated, cylindrical, without case. They are intense yellow, with darker orange spots on its head (providing it a freckled appearance). Sometimes the abdomen is greenish. The last abdominal segment has two hook-shaped nails, with only the first thoracic segment strongly sclerified.

Alive: In the tray it will try to hide or stay still crawling inside the tubes that it makes. It has very visible orange nails, which it uses to attach to the substrate.

Habitat and feeding mode: It lives attached to the substrate, inside tubes that it makes on (sometimes under) the stones. It weaves a web of silk threads, which it uses to capture small animals. It prefers areas of little to moderate flow.

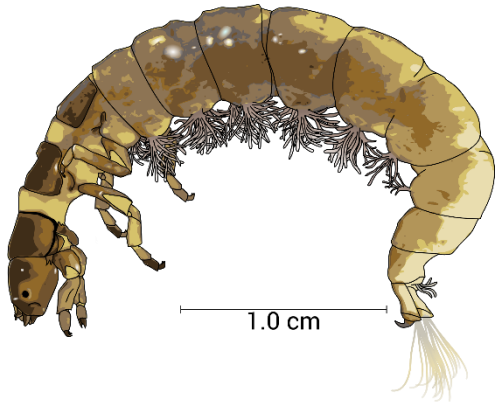
Size: 0,5-2 cm.

Psychomyiidae (trichoptera, caddisfly)



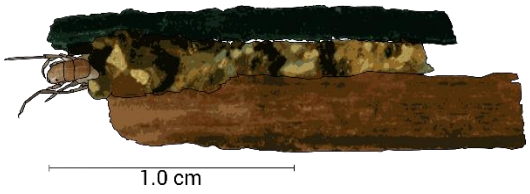
Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: TRICHOPTERA, Family: PSYCHOMYIIDAE
How is it identified? Light colours, especially in the abdomen. The first segment of the thorax (which is the only one sclerified) is usually red with a dark line on the back. The final hooks are small and the pseudopodia short. Their colour and size (smaller) distinguish them from Polycentropodidae, which are very similar.
Alive: They live in tubes made of sand or fine organic matter that they only leave if necessary. They never drag the tube, which is attached to the substrate, and it is difficult to separate them from it. Outside the tube they move very slowly and, if possible, they try to hide quickly.
Habitat and feeding mode: Fixed organism, living inside tubes on hard substrate (e.g. stones or slabs) in laminar flow or weak flow areas. It feeds by filtering very small particles.
Size: 0,5-1,5 cm.

Hydropsychidae (trichoptera, caddisfly)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: TRICHOPTERA, Family: HYDROPSYCHIDAE
How is it identified? Animals with compound gills (i.e. divided into many parts) located in the ventral abdomen. Head and three abdominal segments well sclerified and dark. It shows hooks and tufts of hair in its final part.
Alive: They live in places with strong flow, where they build cases of pebbles that are strongly fixed to the substrate. They do not carry the case when moving. Out of the case they move quickly, bending the body to avoid strong flow areas or to hide. They are aggressive (if you put them in your hand they will try to bite you). The thorax is dark, while the abdomen might be clear or sometimes greenish. They have dark and light spots on their head.
Habitat and feeding mode: He lives exclusively on hard substrates, like stones or slabs, in areas of strong flow (it needs strong flows to fill their nets with food). It feeds on anything, even small individuals of their own genus.
Size: 1-2,5 cm.

Leptoceridae (trichoptera, caddisfly)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: TRICHOPTERA, Family: LEPTOCERIDAE
How is it identified? The case is very long, made of plant material usually consisting of a piece of wood to which it adds irregular pieces of leaves, plant tissue or small stones. It is found in areas of low flow and especially among partially submerged aquatic plants (such as reed and cattail). The second and third legs are much longer than the former and they protrude above the case.
Alive: They move slowly amid the leafs and plant material and if they are disturbed they hide inside their case, hiding their legs with difficulty because of their length.
Habitat and feeding mode: They live in areas with little or no flow, when there is much litter or aquatic vegetation. It collects and shreds organic matter.
Size: 0,5-2 cm.

Sericostomatidae (trichoptera, caddisfly)

Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: TRICHOPTERA, Family: SERICOSTOMATIDAE

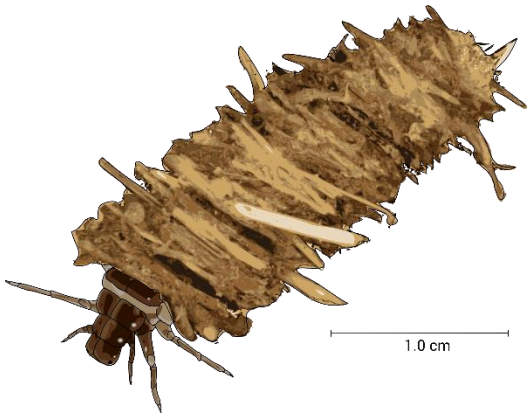
How is it identified? The case consists of well-structured small sand grains, forming a compact case (different from that of Limnephilidae). The head of the larva is very dark, and when it gets inside its case, the head serves as cover, since it is strongly sclerified.

Alive: They crawl on the substrate dragging their case.

Habitat and feeding mode: They live mainly on gravel or fine sand substrates, going unnoticed because of the composition of their case. They need moderate flows. They eat both algae attached to the substrate (grazers) and available particles (collectors).

Size: 0,5-1 cm.

Limnephilidae (trichoptera, caddisfly, northern caddisfly)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: TRICHOPTERA, Family: LIMNEPHILIDAE

How is it identified? It lives in a case made of stones, leaves and twigs of many forms. In calm waters the cases are usually made from plant materials. One of the most common species builds them out of small twigs arranged helicoidally. In strong flow areas, the case is made of pebbles (never of small sand grains as in Sericostomatidae), that help in not to be drag by the flow. In places with litter, the case can be build out of pieces of litter or small twigs. If the larva is observed outside the case, the contrast between the very dark colour of the segments of the thorax and the pale abdomen (which sometimes has gills) can be easily observed.

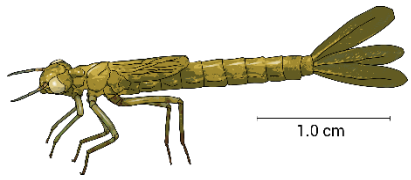
Alive: It walks over the stones, among leaves or between aquatic plants. It moves slowly, dragging its case, and it quickly hides inside its case of any disturbance.

Habitat and feeding mode: They live both in fast-flowing rivers (where they build their cases out of stones) and pools (where the cases are made of organic matter). In many river basins, when leaf litter accumulates, other genus may live that build their cases of leaves, twigs with distincive forms. Sometimes mixed cases can be found. They are shredders and collectors of organic matter.

Size: 1-3 cm.

ODONATES

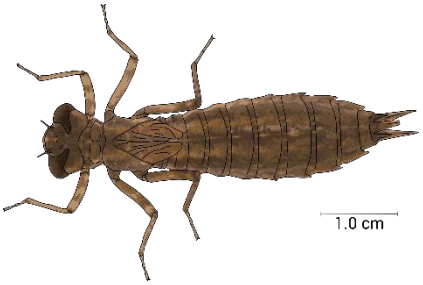
Zygoptera (damselfly)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: ODONATA, Suborder: ZYGOPTERA
How is it identified? Elongated. Cylindrical abdomen with three very long caudal lamellae at its end (not to be confused with the segmented tails of mayflies and stoneflies, especially in young individuals).

Alive: It moves slowly walking or swimming by swinging the abdomen, never propelled like *Anisoptera*.
Habitat and feeding mode: They live in all types of substrates, where they roam in search of prey (i.e. other invertebrates). They capture their preys lurking with their lower mouthparts, which look like a flat spoon with strong jaws at its end. They do not like strong flow areas.
Size: 1-3 cm.

Anisoptera (dragongly)

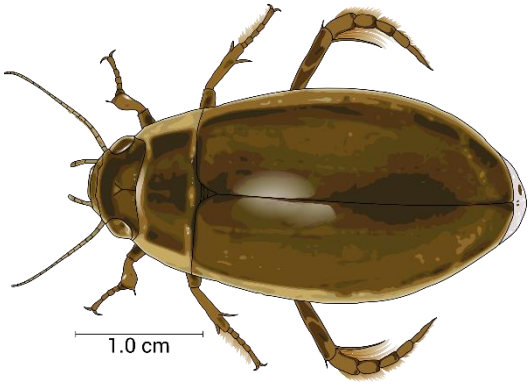


Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: ODONATA, Suborder: ANISOPTERA
How is it identified? Very large compound eyes. Mouthparts shaped like an articulated spoon. Compact body, never cylindrical and thin. Abdomen enlarged in the middle or end. The abdomen ending with very short and hard caudal lamellae. The family Gomphidae has mace-shaped and very short antennas.
Alive: Walker and also fast swimmer by propulsion. It ejects pressurized water from the rear of the abdomen, driving him forward at speed. Brown, yellow and green colours.

Habitat and feeding mode: They live in all types of substrates, where they roam in search of prey (i.e. other invertebrates). They capture their preys lurking with their lower mouthparts, transformed into a kind of flat spoon that has strong jaws at the end. They prefer low flow areas, although some of them (Gomphidae) can be found under stones in moderate flow areas.
Size: 1-7 cm.

BEETLES

Dytiscidae (coleoptera, diving beetle)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: COLEOPTERA, Family: DYTISCIDAE

How is it identified?

LARVAE**:** Animals with strong jaws, which are clearly seen in the front of the head. Some genera are very large. They have two long cerci (sometimes as long as the abdomen).

ADULT: Rounded beetle with relatively short legs. The last pair of legs are a like a flat shovel that they use for swimming. Large individuals are black, while the small can have stripes or spots on a lighter background, or other drawings.

Alive:

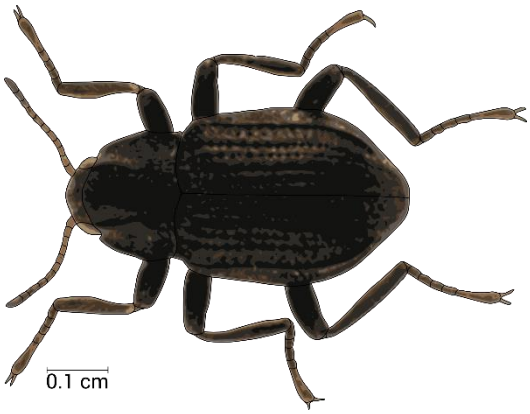
LARVAE: They move among the substrate looking for prey and they move quickly if disturbed. If you put them in your hand they will try to bite you.

ADULT: They swim fast throughout the water column (not just the surface). They feed on other aquatic organisms. They carry an air bubble at the end of the abdomen for breathing.

Habitat and feeding mode: Both the larvae and the adult are predators, eating all kinds of animals. Larger larvae can eat amphibians and small fish. The larvae live between the substrate, typically between stones, but also between vegetation and leaves. Adults are swimmers and have to rise to the surface to renew their air bubble. When no fish or crabs are present, they are the largest predators found in pools.

Size: 0,5-4 cm.

Elmidae (coleoptera, aquatic beetle)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: COLEOPTERA, Family: ELMIDAE

How is it identified?

LARVAE: Their body is cylindrical or rhomboid, in the latter case they are wider at the front and they become narrower towards the end. They never have long appendages at their end.

ADULT: Dark stripes on the thorax and elytra that give them a striped appearance. The palpi are short and they have long antennae, appearing as if the had two appendices at the front part when they walk (other families have long palps and apparently four appendices). Relatively long legs. They eat algae and detritus.

Alive:

LARVAE: They breathe through the final part of the abdomen; when they are alive a hairbrush retaining an air bubble can be observed. They are unable to swim, thus they slowly crawl along the substrate.

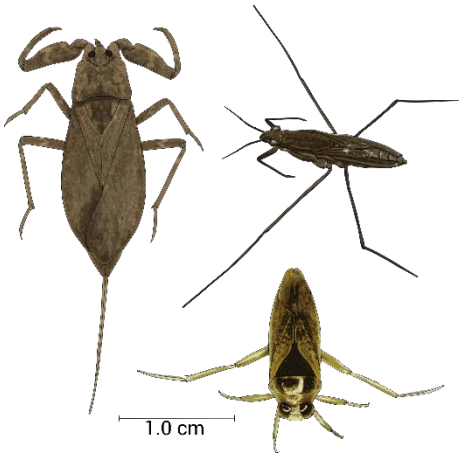
ADULT: They walk on stones and hard substrates. They move slowly. Sometimes their legs are reddish.

Habitat and feeding mode: Both the larvae and the adult are grazers, scraping the surface of stones or plants. They live on hard substrates, usually in areas of strong or moderate flow.

Size: 0,5-1 cm.

TRUE BUGS

Heteroptera (water bug, water scorpion)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: HETEROPTERA

How is it identified? Compound eyes. The mouth is shaped like a triangle or stylus, which is used to pierce and suck the contents of their prey and it is called rostrum or beak. Sometimes it is hardly visible because it is folded under the head.

- Surface swimmers have very long antennae: they are known as water striders (Gerridae, Veliidae and Mesoveliidae).
- Those living in the water have to come to the surface to breathe; among them the best known are the backswimmers, who swim ventral side surface (Notonectidae, Pleidae) and the small backswimmers, which swim with the dorsal side towards the surface (Corixidae).
- Water scorpions (Nepidae) have a siphon at the end of their body and their front legs are transformed into strong claws.

Alive: While water scorpions roam the riverbed, not too fast; backswimmers swim fast, "jumping" thanks to their long and strong hind legs. Small backswimmers swim continuously, while the water striders skate above water. Juveniles are similar to adults but wingless.

Habitat and feeding mode: They are all predators, being able to feed on animals of bigger size than their own size. They pick and suck their prey. They live mainly in the still waters, and especially in pools. Water scorpions are found mostly on the banks of rivers and ponds, among leaf litter or aquatic vegetation.

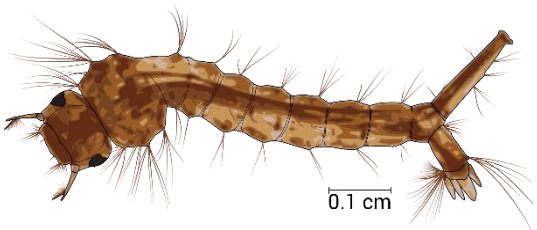
Size: Up to 7 cm.

FLIES

Blephariceridae (diptera)

Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: COLEOPTERA, Family: BLEPHARICERIDAE
How is it identified? The larvae have a flattened body with a distinct head capsule and the abdominal and thoracic segments rounded, usually very dark or black. They have six large suckers on the ventral part of the abdominal and thoracic segments to firmly attach to stones.
Alive: They are strongly attached to the stones. They do not move very much and very slowly.
Habitat and feeding mode: They are grazers. They are only found in very clean and cold-water rivers. They live only in stones or large blocks in places of strong or very strong flow, even just below falling water.
Size: 0,5-1 cm.

Cullicidae (diptera, mosquito)

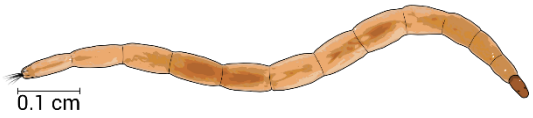


Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: DIPTERA, Family: CULICIDAE
How is it identified? Their thorax is swollen in regard to the abdomen, and they have a siphon at their end, which serves to breathe. The final part has also a longhaired appendix. They are the larvae of the biting mosquitoes.
Alive: Mosquito larvae may be quite on the surface with their siphon breaking the water film, or scrolling rapidly through the water bending their body. When immersed they must return to the surface very often to breath.
Habitat and feeding mode: They live exclusively in water without current (i.e. pools). They become very abundant when the pool is full of organic matter and without oxygen. They filter all kinds of particles.
Size: 0,5-1 cm.

Simullidae (diptera, black fly)

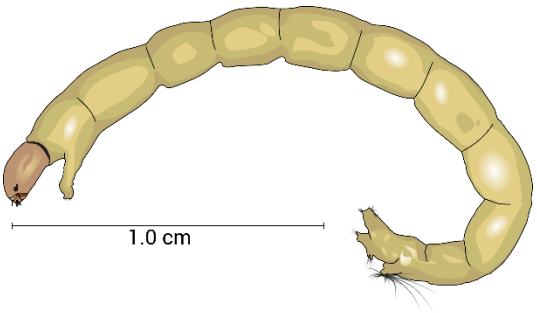
Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: DIPTERA, Family: SIMULIIDAE
How is it identified? Cylindric body with the abdomen is thickened at the end, which is a characteristic trait. They have a pseudopod in the first thoracic segment. The head has an eye and appendages (the premandibles) that look like silk fans which are used to filter food.
Alive: They are attached to any substrate (stones or plants), hooked by the end of the abdomen, where it has strong hooks. In low flow conditions they move crawling, moving the body in U-shaped fashion: first they attach the end of the body, then they lengthen their head and fix it, then they move the final part of their body towards the head (like a leech). They are usually dark brown or black.
Habitat and feeding mode: They live in areas of moderate, strong or very strong flow. They live on hard substrates such as stones, but also on aquatic plants such as *Potamogeton pectinatus*. The species *Simulium erythrocephalum* bites humans, and recently has become very abundant in the lower parts of the rivers, where it has caused major problems. They filter all kinds of particles.
Size: 0,5-1 cm.

Ceratopogonidae (diptera, biting midges)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: DIPTERA, Family: CERATOPOGONIDAE
How is it identified? They have a distinct head capsule. They do not have pseudopodia in the thorax or at the rear part of the body (only some hairs, eventually). The most common in rivers are very elongated, almost filiform, although different species can have different shapes.
Alive: They move snaking. The body has light colours; one of the most common taxa has a dark reddish head.
Habitat and feeding mode: They live in all types of water, from zero to strong flow, and on any substrate, preferably on thin substrates. They show different trophic strategies, from gatherers to predators.
Size: 0,5-1 cm.

Chironomidae (diptera, non-biting midges, bloodworms)

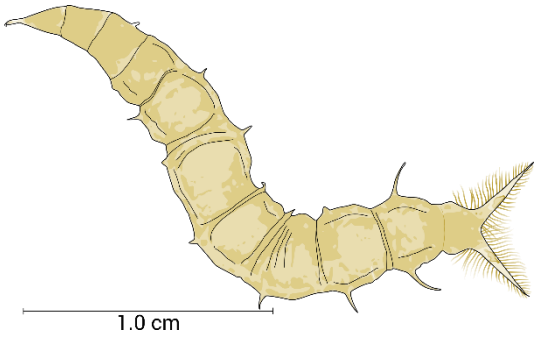


Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: DIPTERA, Family: CHIRONOMIDAE
How is it identified? They have a cylindrical and elongated body, with one or two eyespots on the head. Pseudopodia present; one on the first thoracic segment and two in the final part of the abdomen (this differentiate them from Ceratopogonidae, which are similar). They usually have two tufts of hair at the end of the body.
Alive: Very abundant in rivers, especially in polluted rivers. Many live in tubes made of detrital material, while others are free living. Their colour varies greatly, from white to dark brown but others are green and some yellow-orange colour. They may also have red colouring, which indicates that in the river where they live might register anoxic conditions (i.e. low oxygen dissolved in the water, a phenomenon that may be related to pollution).
Habitat and feeding mode: They live in all types of water, from zero to strong flow areas, and on any substrate; thus, they are almost ubiquitous in rivers. They show different trophic strategies, from gatherers to predators. The subfamily *Tanypodinae* is predatory and it is characterized by an intense yellow colour and a more orange head than the rest of Chironomidae.
Size: 0,5-2 cm.

Tipulidae (diptera, crane fly)

Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: DIPTERA, Family: TIPULIDAE
How is it identified? They have an elongated cylindrical body, without lobes or pseudopodia except in the final part. Retractable head. Tail with six or more lobes surrounding a respiratory dome.
Alive: They move slowly and do not swim. They move by stretching and contraction. They have dark colours.
Habitat and feeding mode: They live in areas of moderate or no flow. They are mostly found among the leaves and also on fine substrates; sometimes they live buried in the mud. Many species are shredders (eating leaves) or collectors.
Size: 1-3cm.

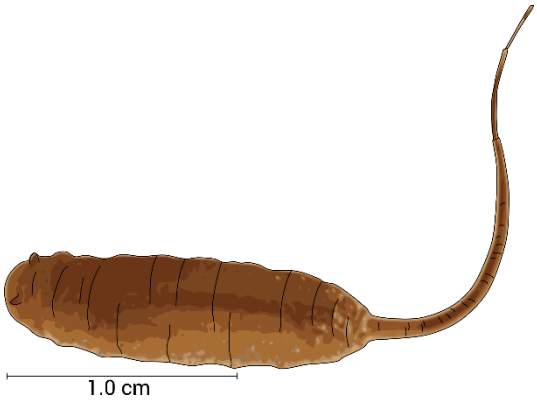
Athericidae (diptera)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: DIPTERA, Family: ATHERICIDAE
How is it identified? The larvae have no discernible head. They have abdominal pseudopodia, various appendices in the body (lateral and dorsal) and two elongated and feathery appendages located at the end of the body (i.e. last third of the body). It has dark yellow colours.
Alive: They move on the substrate, walking relatively fast.

Habitat and feeding mode: They are common in clean waters. They live in fast or very fast flowing water above or below hard substrates, especially stones. They are predators.
Size: 0,5-2 cm.

Syrphidae (diptera, flower fly)



Taxonomy: Phylum: ARTHROPODA, Class: INSECTA, Order: DIPTERA, Family: SYRPHYDAE
How is it identified? Larvae with no distinct head, with abdominal ventral pseudopodia and a long telescopic appendix in the final part of the body (siphon), which is longer than the body itself and is used for breathing. Light colours, whitish.
Alive: They move very slowly, crawling along the substrate. The siphon must be in contact with the surface almost constantly, since they live in low oxygen waters. They can be present in enormous densities in highly polluted sites, and when the waters are quiet the siphons, hooked to the surface, can be easily observed.

Habitat and feeding mode: They are very common in polluted or very polluted waters. They live in still or low flow areas, between fine sediment or under stones in moving waters. They collect particulate organic matter.
Size: 0,5-2 cm (without siphon).

Appendix 1 - Complete macroinvertebrate family list used to calculate the IBMWP index

TAXON	IBMWP	Abund
TRICLADIDA		
Dendrocoelidae	5	
Dugesiidae	5	
Planariidae	5	
OLIGOCHAETA	**1**	
HIRUDINEA		
Erpobdellidae	3	
Glossiphoniidae	3	
Hirudidae	3	
Piscicolidae	4	
MOLLUSCA		
Ancylidae	6	
Bithyniidae	3	
Ferrissidae	6	
Hydrobiidae	3	
Lymnaeidae	3	
Neritidae	6	
Physidae	3	
Planorbidae	3	
Sphaeridae	3	
Thiaridae	6	
Unionidae	6	
Valvatidae	3	
Viviparidae	6	
HIDRACARINA	**4**	
OSTRACODA	**3**	
AMPHIPODA		
Corophiidae	6	
Gammaridae	6	
ISOPODA		
Asellidae	3	
DECAPODA		
Astacidae	8	
Atyidae	6	
Palaemonidae	6	
EPHEMEROPTERA		
Baetidae	4	
Caenidae	4	
Ephemerellidae	7	
Ephemeridae	10	
Heptageniidae	10	
Leptophlebiidae	10	
Oligoneuriidae	5	
Polymitarcidae	5	
Potamanthidae	10	
Prosopistomatidae	7	
Siphlonuridae	10	

TAXON	IBMWP	Abund
ODONATA		
Aeshnidae	8	
Calopterygidae	8	
Coenagrionidae	6	
Cordulegasteridae	8	
Corduliidae	8	
Gomphidae	8	
Lestidae	8	
Libellulidae	8	
Platycnemididae	6	
PLECOPTERA		
Capniidae	10	
Chloroperlidae	10	
Leuctridae	10	
Nemouridae	7	
Perlidae	10	
Perlodidae	10	
Taeniopterygidae	10	
HETEROPTERA		
Aphelocheiridae	10	
Corixidae	3	
Gerridae	3	
Hydrometridae	3	
Mesoveliidae	3	
Naucoridae	3	
Nepidae	3	
Notonectidae	3	
Pleidae	3	
Veliidae	3	
NEUROPTERA		
Sialidae	4	
COLEOPTERA		
Chrysomelidae	4	
Clambidae	5	
Curculionidae	4	
Dryopidae	5	
Dytiscidae	3	
Elmidae	5	
Gyrinidae	3	
Haliplidae	4	
Helophoridae	5	
Hydraenidae	5	
Hydrochidae	5	
Hydrophilidae	3	
Hygrobiidae	3	
Noteridae	3	
Psephenidae	3	
Scirtidae	3	
LEPIDOPTERA		
Crambidae	4	

TAXON	IBMWP	Abund
TRICHOPTERA		
Beraeidae	10	
Brachycentridae	10	
Calamoceratidea	10	
Ecnomidae	7	
Glossosomatidae	8	
Goeridae	10	
Hydropsychidae	5	
Hydroptilidae	6	
Lepidostomatidae	10	
Leptoceridae	10	
Limnephilidae	7	
Molannidae	10	
Odontoceridae	10	
Philopotamidae	8	
Phryganeidae	10	
Polycentropodidae	7	
Psychomyiidae	8	
Rhyacophilidae	7	
Sericostomatidae	10	
Uenoidae	10	
DIPTERA		
Anthomyidae	4	
Athericidae	10	
Blephariceridae	10	
Ceratopogonidae	4	
Chironomidae	2	
Culicidae	2	
Dixidae	4	
Dolichopodidae	4	
Empididae	4	
Ephydridae	2	
Limoniidae	4	
Psychodidae	4	
Ptychopteridae	4	
Rhagionidae	4	
Scatophagidae	4	
Sciomyzidae	4	
Simuliidae	5	
Stratiomyidae	4	
Syrphidae	1	
Tabanidae	4	
Thaumaleidae	2	
Tipulidae	5	

Final score	

SHEET 1

SITUATION, TYPE OF RIVER, DESCRIPTION

River information

Coordenates: **X:** ..... **Y:** .....

River name: .....

River Basin District: .....

Town: .....

Aquatic phase:

○ Flowing water 

○ Disconnected pools 

○ Dry riverbed 

Hydrological regime:

○ PERMANENT

○ INTERMITTENT WITH POOLS

○ INTERMITTENT DRY

○ EPHEMERAL

Type of river <u>only if it is Permanent</u>:

○ HIGH-ALTITUDE RIVER

○ SMALL MOUNTAIN RIVER

○ LARGE MOUNTAIN RIVER

○ SMALL MID-ALTITUDE RIVER

○ LARGE MID-ALTITUDE RIVER

○ SMALL LOWLAND RIVER

○ LARGE LOWLAND RIVER

Short description:

User identification, Photo and assessment Date

RiuNet nickname .....

Picture name .....

Date and Time .....

Summary sheet of river hydrological status assessment

1 WHAT TYPES OF INFRASTRUCTURES AND WATER USES CAN YOU SEE AT THE RIVER?	**1.** Wells	**-1**
	2. Weirs	**-0.5**
	3. Bypass channel	**-1**
	4. Dams	**-2**
	5. Other water catchments or diversions	**-1**
	6. Livestock (farms)	**-1**
	7. Agriculture	**-1**
	8. Crops or small orchads	**-0.5**
	9. Golf coursses	**-1**
	TOTAL question 1, the maximal value of the sum of all *items* is (-5)	**5 +** (*sum)*
2 HOW MUCH WATER IS USED BY THE DIFFERENT TYPES OF INFRASTRUC-TURE OR WATER USE?	**1.** None (Natural river)	**5**
	2. Some	**3**
	3. Most or all	**0**
3 HOW HAS THE RIVER FLOW CHANGED IN THE RECENT YEARS?	**1.** The river flow has not changed significantly	**5**
	2. River flow has changed but the difference is small	**3**
	3. River flow has changed completely	**0**
	TOTAL	*Sum* **/15**

The score obtained yielded by the hydrological assessment reflects the hydrological status of the river, as summarized in the following table:

STATUS TEST
Hidrological
SHEET 2

HIDROLOGICAL QUALITY

Total:	
0-5	Poor
6-10	Moderate/ Impacted
11-15	Good

If a high mountain river (T1) is assessed, the questions A and B are replaced with the next AB question

AB IS IT LOCATED IN A HIGH-ALTITUDE AREA WITHOUT HUMAN ACTIVITY?	**1.** No impact due to human activity	**10**
	2. Moderate impact due to human activity	**5**
	3. High impact due to human activity	**1**

For temporary rivers (T8) with intermitent dry or ephemeral hydrological regimes, the questions A and B, F, G and H are replaced respectively with the the questions AB and FGH

AB HAS THE RIPARIAN AREA BEEN MODIFIED?	**1.** No impact due to human activity	**10**
	2. Moderate impact due to human activity	**5**
	3. High impact due to human activity	**1**

FGH WHAT ALTERATIONS CAN YOU DETECT IN THE RIVER AND IN THE FLUVIAL HABITAT?	**1.** Roads (asphalted or not) that cross the river	**-5**
	2. Arid extraction	**-5**
	3. Dump or rune piles in the fluvial habitat	**-4**
	4. Signs or wheel marks'- motorbikes or cars	**-3**
	5. Well in the fluvial habitat	**-2**
	6. Other constructions in the fluvial habitat	**-1**
	7. Livestock feces	**-1**
	8. Orchads on the river margins	**-1**
	9. River used as a walking path	**-1**
	10. Burned vegetation or agricultural leftovers	**-1**
	The maximal value of the sum of all *items* is (-15)	
	TOTAL question	**15 +** (*sum)*

For all rivers except high mountain rivers or with an intermitent-dry or ephemeral hydrological regime

A WHAT IS THE RIPARIAN FOREST LIKE ALONG THIS STRECHT RIVER?	**1.**	Riparian forest with native vegetation	**5**
	2.	Prevalence of bushes with scattered trees	**3**
	3.	Riparian forest with non-native trees or giant reed	**2**
	4.	Riparian forest with an absence of trees, and presence of giant reed or agricultural activity	**1**
	5.	Presence of buildings or agricultural activities	**0**
B IS RIPARIAIN FOREST CONTINOUS ALONG THIS STRECHT OF RIVER?	**1.**	Continous vegetation on both river banks	**5**
	2.	Disconnected patches of vegetation	**3**
	3.	Only isolated clutches or iindividual trees are present	**1**
	4.	The riparian zone lacks trees or shrubs	**0**
C WHAT KIND OF LANDSCAPE IS THERE ADJACENT TO THE RIPARIAN ZONE?	**1.**	Unchanged basin landscape	**5**
	2.	Modified basin landscape	**3**
	3.	Heavily modified basin landscape	**1**
	4.	Urbanized basin landscape	**0**
D HAS HUMAN ACTIVITY MODIFIED THIS RIVER CHANNEL?	**1.**	Human activity has not modified the river channel	**5**
	2.	Riparian area is modified by terraces	**3**
	3.	Partly channelized river	**1**
	4.	Channelized river	**0**
E IS THRE LITTER IN THE RIPARIAN ZONE?	**1.**	No, there is not litter	**5**
	2.	There is some litter, but it is not abundant	**3**
	3.	Yes, there is abundant litter	**0**
F HOW MANY HARD SUSTRATA DOES THE RIVER HAVE?	**1.**	5 difFerent	**5**
	2.	4 difFerent	**4**
	3.	3 diFferents	**3**
	4.	2 diFferents	**2**
Boulderss, stones, pebbles, gravels and sand, clay and silt	**5.**	Only 1	**1**
	6.	Rock slab or cemented bed	**0**
G ARE THERE AREAS OF VARYING WATER VELOCITY AND DEPTH?	**1.**	All options are observed	**5**
	2.	There are 3 options	**3**
	3.	2 options	**2**
Shallow and fast, deep and fast, shallow and slow, deep and slow	**4.**	Just 1 option	**1**
H BESIDE HARD SUSTRATA, IS THERE ANY OTHER TYPE OF SUSBTRATUM?	**1.**	6 or 5 different are observed	**5**
	2.	4 different	**4**
	3.	3 different	**3**
	4.	2 different	**2**
algae, tree roots, natural dams, leaf litter, mosses, branches and wood	**5.**	Only 1	**1**
	6.	None of these substrata	**0**
		TOTAL	

Finally, in order to assess the **biological quality**, the following table is used crossing the 2 values obtained: the total of macroinvertebrate families (column) and the number of indicator families that represent the best biological quality (row). The score on the biological quality test ranges from 0 to 10. A score of 9 or 10 indicates very good quality (blue); 7 or 8, good (green); 5 or 6, moderate (yellow); 3 or 4, poor (orange), and 1 or 2, very poor (red). No score indicates that the result is undetermined, you can continue looking for invertebrates until you find the ones that are indicators. If you have already looked and indicators macroinvertebrates are not found, the biological status of this river stretch cannot be assessed.

The **biological quality** is determined using the total numbers of **macroinvertebrate families and indicator taxa** according the next table.

TOTAL NUMBER of macroinvertebrate indicator taxa with highest biological quality	TOTAL NUMBER of macroinvertebrate families			
	1-2	3-8	9-15	>15
≥ 3 ●		8	9	10
2 ●		7	8	9
1 ●		6	7	8
≥ 3 ●		6	6	7
2 ●	5	5	5	6
1 ●	4	5	5	5
≥ 3 ●		4	5	5
2 ●	2	3	4	4
1 ●	2	3	3	3
≥ 2 ●	1	2	2	
1 ●	1	1	1	

In order to determine the macroinvertebrate families that are indicators used to assess the biological quality use the list of families represented in the next table. The indicator taxa, which vary according to the type of the river, are those that are represented in a colour representing the biological quality, from best to worst: blue, green, yellow, and orange. If a group of macroinvertebrate has no colour, indicates that they are not bioindicators for that type of river. Write a mark next on **the 3rd column (x)** in each macroinvertebrate group that has been identified in the river.

After selecting the correct colum for the type of river (T1= High-altitude rivers, T2= Small mountain rivers, T3= Large mountain rivers, T4= Small mid-altitude rivers, T5= Large mid-altitude rivers, T6= Small lowland rivers, T7= Large lowland rivers, T8= Temporary rivers), two values must be obtained based on the list fo river indicators in the ssample: firstly, the **total number of macroinvertebrate groups** (obtained as the sum of the whole list), and secondly, the **number of macroinvertebrate indicator of highest biological quality**. Indicator organisms, which

vary according to the type of the river, are those highlighted in a colour that indicates the level of biological quality: blue, green, yellow, and orange (from highest to lowest quality). If a group of macroinvertebrates has no colour, this indicates that they are not bioindicators for that type of river.

List of macroinvertebrate families indicator of the biological quality according the type of river.

T1= High-altitude rivers, T2= Small mountain rivers, T3= Large mountain rivers, T4= Small mid-altitude rivers, T5= Large mid-altitude rivers, T6= Small lowland rivers, T7= Large lowland rivers, T8= Temporary rivers.

Macroinvertebrate group		Indicator colour of biological quality according the type of river				
	X	T1	T2 T3	T4 T6 T8	T5	T7
 Heptageniidae						
 Polymitarcidae						
 Leptophlebiidae						
 Athericidae						
 Sericostomatidae						
 Blephariceridae						
 Nemouridae						
 Perlidae/ Perlodidae						
 Elmidae Larvae or Adult						
 Limnephilidae						
 Rhyacophilidae						
 Ephemerellidae						
 Hydroptilidae						
 Leuctridae						
 Gammaridae						
 Polycentropodidae						
 Neritidae or Melanopsidae						
 Baetidae						
 Caenidae						
 Simuliidae						
 Lymnaeidae						
 Hydrobiidae						
 Ancylidae						
 Physidae						

Macroinvertebrate group			Indicator colour of biological quality according the type of river				
		X	T1	T2 T3	T4 T6 T8	T5	T7
	Hydropsychidae						
	Erpobdellidae						
	Oligochaeta						
	Culicidae						
	Chironomidae						
	Syrphidae						
	Ancylidae						
	Planorbiidae						
	Dreissenidae						
	Corbiculidae						
	Assellidae						
	Cambaridae						
	Zygoptera						
	Anisoptera						
	Heteroptera						
	Ephemeridae						
	Leptoceridae						
	Psychomyiidae						
	Dytiscidae Larvae or Adult						
	Tipulidae						
	Ceratopogonidae						
	TOTAL NUMBER of macroinvertebrate groups						
	TOTAL NUMBER of macroinvertebrate indicator taxa of highest biological quality (0 – 5)						

SHEET 5
ECOLOGICAL QUALITY

SHEET 3

QUALITY TEST
Hydromorfological

The value obtained in sheet 3 determines the hydromorfological quality according to this table:

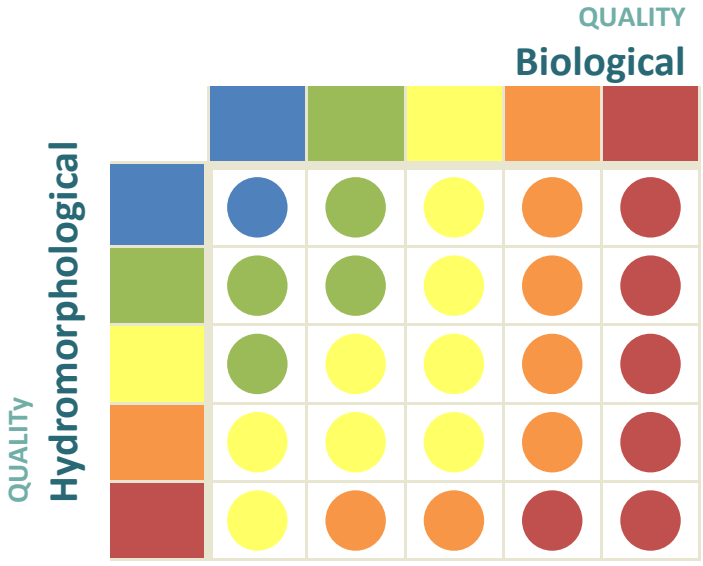
	Quality
0-10	
11-20	
21-28	
29-35	
36-40	

SHEET 4

QUALITY TEST
Biological

The value obtained in sheet 4 determines the biological qualitat according to this table:

	Quality
N/A	
1-2	
3-4	
5-6	
7-8	
9-10	



QUALITY ECOLOGICAL	Very good	Good	Moderate	Bad	Very poor
	accomplish the Water Framework Directive		DOES NOT accomplish the Water Framework Directive		

Select one or more of the following options concerning the social and cultural value of the river

○ Bathing ○ Aquatic sports ○ Fishing ○ Hiking ○ Research/ Educational ○ Beautiful/ Inspiring

Physicochemical data

Date	Time	Water temperature (°C) .....
Conductivity (µS/cm)	pH	Oxygen (mg/l i %) .....
Nitrates (mg/l)	Phosphates (mg/l)	Turbidity (Secchi disc) .....
Section: width x depth (m^2)	Velocity (m/s)	Flow: Section x Velocity (m^3/s) .....

Other physico-chemical data:

In RiuNet, physicochemical characteristics are not of great relevance because the possible impact of the different contaminants is already emcompassed in the list of organisms (bioindicators) that are used

Biodiversity data

Allocthonous observed species:

Other biodiversity data: