



Water ecosystems in Europe

Project of

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ERASMUS WATER ECOSYSTEMS IN EUROPE



Introduction

The project is focused on joint research in hydrology, meteorology and biology, as well as the exchange of experiences and mutual learning in the course of scientific measurements and activities related to them. The students carried out identical hydrological measurements of the quality of freshwater surfaces and observed aquatic animals and plants that grow in and around freshwater surfaces. The project contributes to a better understanding of how the quality of freshwater surfaces affects their biodiversity and whether it is similar in the regions of the partner schools.

The project book is divided into several parts, natural – geographical features of each country, a description of the measuring station, and a short description of the macrozoobenthos of the freshwater surface where the measurements were made.

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THE REPUBLIC OF LATVIA

Natural – geographical features

The Republic of Latvia encompasses 64,589 square kilometres and is an extension of the East European Plain. Latvia's only distinct border is the Baltic Sea coast, which extends for 531 kilometres. Its neighbours include Lithuania in the south (453 km of common border), Estonia in the north (267 km), Russia in the east (217 km), and Belarus in the southeast (141 km).

Plains cover 75% of Latvia's territory; 25% of the territory lies in uplands of moderate-sized hills.

About 27% of the total territory is cultivable, with the central Zemgale plain south of Riga being the most fertile and profitable. The three main upland areas, in the provinces of Kurzeme (western Latvia), Vidzeme (central Latvia) and Latgale (eastern Latvia), provide a picturesque pattern of fields interspersed with forests and numerous lakes and rivers.

About 10% of Latvian territory consists of peat bogs, swamps, and marshes, some of which are covered by stunted forest growth. Forests are the outstanding feature of Latvia, claiming 52% of the territory. More than half of the forests consist of Scots pine or Norway spruce.

The variegated and rapidly changing physiography of glacial moraines and lowlands has also allowed temperate flora, such as oaks, to grow within a few hundred metres of northern flora, such as bog cotton and cloudberry.

The Latvian western seacoast used to be a carefully guarded border region during Soviet times.

As a result, about 300 km of undeveloped seashore are graced only by forests of pine and spruce and ecologically unique sand dunes.

Latvia has an abundant network of rivers, contributing to the visual beauty and the economy of the country. The largest river is the Daugava. With a total length of 1,020 km, the Daugava (or Zapadnaya Dvina in its upper reaches) originates in the Valday Hills in Russia, meanders through northern Belarus, and then winds through Latvia for 352 km before emptying into the Gulf of Riga. It is about 200 m wide when it enters Latvia, increasing to between 650 and 750 m at Riga and to 1,5 km at its mouth.

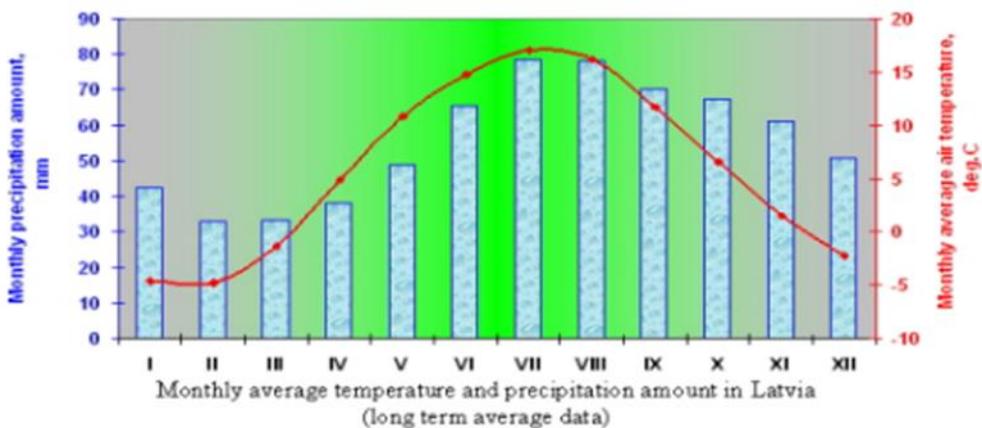
Smaller rivers include the Lielupe, in central Latvia, with an average annual flow of 3,6 cubic km; the Venta, in the west, with 2,9 cubic km; the Gauja, in the northeast, with 2,5 cubic km; and the Aiviekste, in the east, with 2,1 cubic km.



<https://cdn.britannica.com/57/6257-050-227FDC08/Latvia-map-features-locator.jpg>

The climate of Latvia is a temperate maritime with mild summers and moderate winters. The average annual air temperature in Latvia is +5.9°C. The year's warmest month is July; its average temperature is +17.0°C and average maximum temperature +21.5°C. The coldest months are January and February, when the average temperatures are -4.6 and -4.7°C, and average minimums -7.5 and -7.9°C.

The average annual precipitation in Latvia is 667 mm. The months with most precipitation are July and August, in each of which average rainfall is 78 mm. The least precipitation is in February and March – each of which has on average 33 mm.



<https://www.meteo.lv/en/lapas/environment/climate-change/climate-of-latvia/climate-latvia?id=1471&nid=660>

Annual average relative humidity is 81%. The lowest moisture content in the air is in May - 71%, the highest in November and December - 88%.

Measuring station

The measurements were taken in Dundagas pond and it is located at Dundaga village. Dundagas pond is situated nearby Dundagas park, and close to Dundagas castle. Dundaga is a village in Talsi Municipality in the Courland region of Latvia. The pond is very overgrown. It also has an island with an area of 0,7 ha.

- Area of water surface - 10.3 hectare
- Mean depth - 1.3 metre(s)
- Maximum depth - 3.3 metre(s)



Macrozoobenthos

River Snail (Viviparus viviparus)



This species will attain a maximum height of 40 mm, with 5 or 6 whorls.

The shell is yellow-green with three distinct brown spiral stripes. The shell is opaque and slightly glossy and has an operculum. The umbilicus (navel) is inconspicuous, occurring only as a groove or notch.

Habitat: This snail is found in lakes and slow-moving rivers with mud bottoms.

Distribution: can be found in almost any freshwater habitat, including ponds, streams, lakes, and rivers.

*whorls- a pattern of spirals or concentric circles.

Hydra (Genus)



Hydras resemble tiny, delicate, elongated sea anemones.

Hydras wave their tentacles slowly in the water. Colors vary with species; they can be gray, brown, tan, cream-colored, green, orange, whitish, pinkish and "clear." In our pond, we saw hydras only in the summertime.

Feed: When food touches a tentacle, special stinging cells discharge to help subdue the prey. Hydra mainly feed on aquatic invertebrates such as Daphnia and Cyclops.

Habitat: they occur in freshwater, either flowing or standing waters.

Distribution: can be found in temperate and tropical regions.

Great diving beetle (Dytiscus marginalis)



The great diving beetle is an aquatic diving beetle, which stays true to its name, is a rather large insect.

The larvae can grow up to 60 millimeters in length, while the adults are generally 27-35 millimeters.

Feed: A voracious predator, this beetle hunts a wide variety of prey including small fish.

Habitat: The beetles live in freshwater, either still or slow-running, and seem to prefer water with vegetation.

Distribution: They are dark-coloured (brown to black) on their back and wing cases (elytra) and yellow on their abdomen and legs. The male's wing cases are shiny, while those of the female are finely grooved.

Buzzer midge (Chironomus plumosus)



The buzzer midge is a species of a non biting midge.

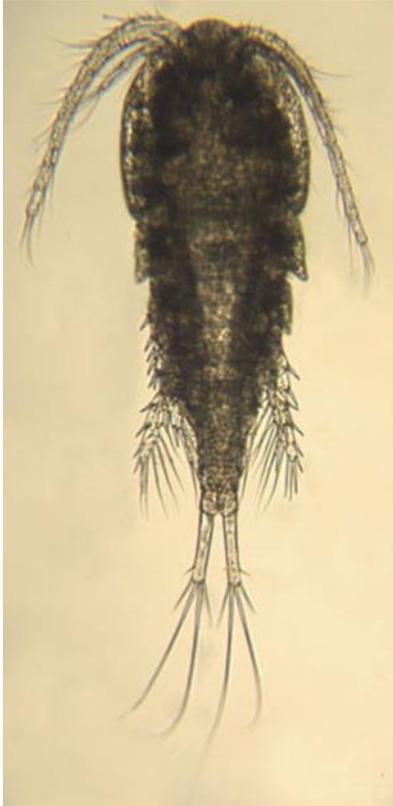
Adults are pale green with brown legs and grow to 12 mm. Males have feathery antennae, while females' antennae are sleek. A dark brown band is seen at the end of each abdominal segment. The larvae are called bloodworms because some larvae are bright red, but they can also be found in brown and almost black.

Feed: The adults don't bite nor feed. The larvae feed on organic material.

Habitat: Can be found in streams, rivers or ditches.

Distribution: They occur throughout areas in the Northern Hemisphere.

Cyclops (Copepod)



Cyclops is one of the most common genera of freshwater copepods.

Cyclops individuals may range from ½–5 mm long and are clearly divided into two sections. The broadly oval front section comprises the head and the first five thoracic segments. The hind part is considerably slimmer and is made up of the sixth thoracic segment and the four legless pleonic segments. Cyclops has 5 pairs of legs.

Habitat: found in freshwater and is less frequent in brackish water all around the world.

Water Flea (Daphnia)



Daphnia is a genus of small planktonic crustaceans, 0.2–6.0 mm (0.01–0.24 in) in length. Daphnia are members of the order Anomopoda, and are one of the several small aquatic crustaceans commonly called water fleas because of their saltiness. Swimming style resembles the movements of fleas.

Habitat: Live in various aquatic environments ranging from acidic swamps to freshwater lakes and ponds.

Distribution: Live in other wetlands, ponds and even roadside ditches (in the winter).

Sideswimer (Amphipods)



Amphipoda is an order of malacostracan crustaceans with no carapace and generally with laterally compressed bodies. Amphipods range in size from 1 to 340 millimeters and are mostly detritivores or scavengers.

Habitat: Scuds mostly occur in shallow regions of both running and still waters.

Distribution: They are mostly marine animals, but are found in almost all aquatic environments.

Swan Mussel (Anodonta cygnea)



This aquatic bivalve mollusc is a large species of freshwater mussel. The shell is thin but large (approximately 10 to 20 cm) and rather flat, even at the umbo. The shell color is often pale greenish or brownish.

Habitat: Rivers and lakes.

Distribution: Its native distribution is European-Siberian. The geographical distribution of this species is from the British Isles east to Siberia, and south into northern Africa.

Keeled Ramshorn (Planorbis carinatus)



The shell width of this species is 9 to 15 mm. The shell has a noticeable keel at the center of the periphery of the body whorl.

Habitat: Freshwater ponds, lakes and slow moving streams with muddy bottoms.

Distribution: In Northwest Europe.

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THE REPUBLIC OF CROATIA

Natural - geographical features

Croatia is located in southeast Europe at the touch of Central Europe and the Mediterranean. It is part of the lowland, mountainous and coastal Croatia. More than half of the territories occupy the plains and hills of the Pannonian Basin in the north. In the east are the lowland provinces of Srijem and Baranja, which continue to the west in Slavonia, and the wide plains along the Sava and Drava river. In western and central Slavonija stands the mountains of Papuk, Psunj, Dilj, Krndija and Požeška gora. The mentioned hills close the Požega valley. Towards the west, the mountains descend into the broad, slightly humid plains along the Ilova, Česma and Lonja River, over which the 60 km long Bilogora and the Moslavačka Gora are rising in the north. In the far northwest, there is a flatland Međimurje between the rivers Drava and Mura and the hilly Croatian Zagorje, where the most eco-friendly forests of the Prealpine Mountains (Žumberačka Gora, Ivanščica, Medvednica) are located. The plains along the lower course of the Kupa River extend southwestward into the Karlovac Bay, which in the south passes into the low karst of Kordun with Petrova Gora and in the southeast into the low mountains of Banija (Zrinska gora). Gorski Kotar includes a part of the Dinaric Mountains and a distinct geographical division between continental and Mediterranean Croatia. Most of it lies at an altitude of between 500 and 1000 meters. In the northwest there is a gorgeous Gorski Kotar, a southeastern sloping Lika with Ličko, Gacko and Krbavsko karst fields and a 145 km long mountain range of Velebit, which separates it from the Adriatic Sea. Along the border with Bosnia and Herzegovina rises the 80 km long mountain range Dinara with the highest peak of Croatia (top of Dinara). In the coastal Croatia there are flaut areas such as Vinodol, Ravni Kotar and Konavle, and karst fields in the interior of Dalmatia such as Imotski, Sinj, Petrovo and Vrgorac. Since the limestone mountains like Velebit, Mosor and Biokovo rise just above the shore, the shoreline is very narrow. The islands are also limestone, and on some islands there are flywaters. The larger islands are Krk, Cres, Brač, Hvar, Pag, Korčula, Dugi Otok, Mljet, Rab, Vis, Lošinj, Pašman, Šolta and Ugljan. The coast is very indented.



<https://croatia.eu/index.php?view=article&id=6&lang=1>

Croatian rivers belong to the Black Sea and Adriatic waters. Inland are the largest river Danube and its tributaries Drava and Sava. Greater tributaries Drava River are: Mura, Bednja and Karašica. The bigger are Sutla, Krapina, Lonja, Ilova, Pakra, Orłjava, Bosut, Kupa and Una. The largest rivers of coastal Croatia are Neretva, Cetina, Krka and Zrmanja. Of the natural lakes are the largest 31 Vransko Lake in Biograd, Vransko Lake on the island of Cres and Prokljansko Lake on the Krka River. There are four types of climate in Croatia. Moderate warm wet climate with warm summer (beech climate) have relief reliefs of the Istrian peninsula, mountainous Croatia and Pannonian and Peripanone Croatia. The average temperature in January ranges from 0 to -3 degrees Celsius while the mean July temperature ranges from 20 to 22 degrees Celsius. The moderate warm wet climate with the hot summer has a large part of Istria and the Kvarner coast with the islands of Krk, Rab, Cres, Lošinj and Pag. Over northern Dalmatia, this type of climate lies in the broad hinterland of Central Dalmatia. The average temperature in July is greater than 22 degrees Celsius. The Mediterranean climate with dry hot summer (olive climate) has its ends along the Adriatic Sea coast to the south of Lošinj and west of Pag. Winters are relatively high temperatures caused by the advent of hot air from the Mediterranean Sea and frequent clouds. The mean July temperature is equal to or higher than 22 degrees Celsius. Boreal or snow-forest climate have the highest mountain parts. Winters are cold and snowy. Temperatures in January are lower than -3 degrees Celsius. Medium July temperatures range between 15 and 20 degrees Celsius. The summers are fresh and short-lived.

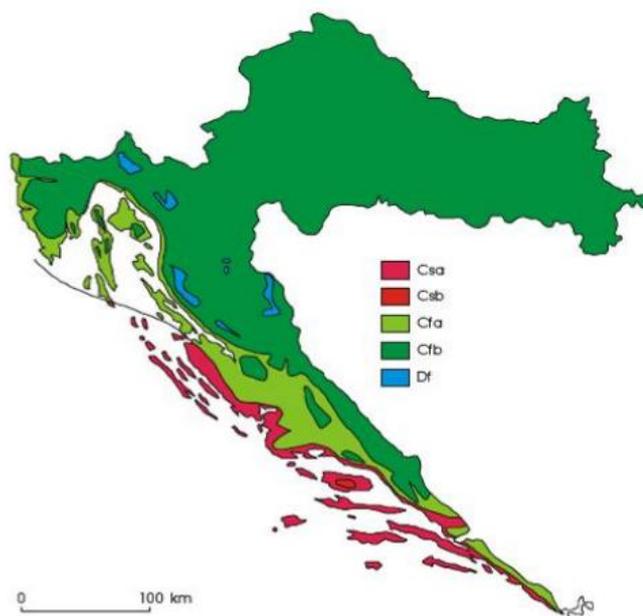


Figure 2. The geographic distribution of climate types in Croatia according to W. Köppen in the standard period 1961-1990: Cfa, moderately warm and humid climate with hot summers; Cfb, moderately warm and humid climate with warm summers; Csa, the Mediterranean climate with hot summers; Csb, the Mediterranean climate with warm summers; Df, boreal climate (Šegota, Filipčić, 2003) [7],

<https://www.h-a-d.hr/pubfile.php?id=553>

The most prosperous soils are in the southwestern part of Srijem and Baranja (Black), while in other parts of the Lowlands Croatia is dominated by brown soils, glaciers and fluvial soils. In the mountains dominate rocky, rhizome, brown soil, and in the coastal part of the red, and brown soil. In lowland Croatia natural vegetation is a deciduous forest. Stems of oak in the flood plains, oak wit and plain grab in the remote areas and beech forests in higher areas. In the mountains predominate beech forests up to an altitude of 700 meters, 700 - 1200 meters prevail over the mixing of beech and fir trees and 1300-1,500 meters of mountain beech forests. Forests cover 37% of the total area of Croatia. In the lower part of the coastal area, the evergreen vegetation (macchia and garrigue) is degraded on the islands, while on the upper and in the interior degraded deciduous forests of oak, white and black grappa. In some places in Dalmatia on the islands the terrain is completely naked with humble grass.

Measuring station

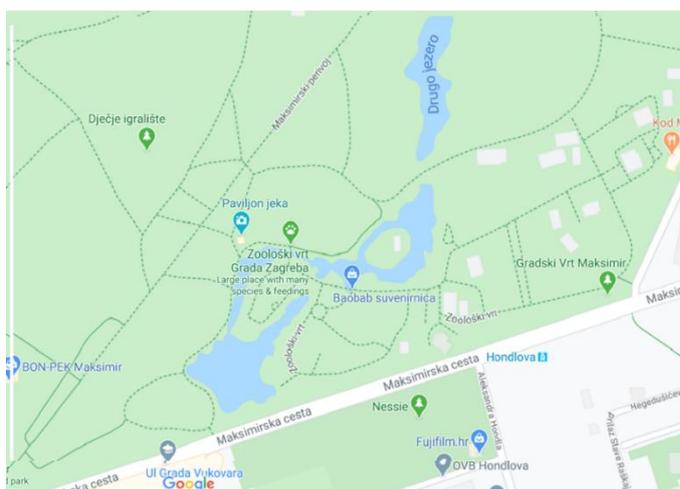
Maksimir Park is the most important Croatian landscape park, a natural rarity, a monument of garden architecture and a very important cultural and historical park landmark. Maksimir Park is located at a distance of about 2.5 km from our school.

Description of the hydrological station - Second Maksimir Lake

Over time, six lakes have been formed in Maksimir Park, of which there are five today - FIRST, SECOND, THIRD, FOURTH AND FIFTH. In 1839, the first lake was built along Maksimirska Street, two years later the second, then the third, which is now the dried-up fourth lake. Artificially shaped lakes are supplied with water from the Bliznec stream, which directly affects the second and fifth lakes.

The second lake is located north of the first lake at 122 m above sea level. It covers an area of about 0.7 hectares and is 0.5 to 1.5 meters deep and is the smallest lake in the lake system of Maksimir Park. The water of the Bliznec stream brings a significant amount of suspended inorganic and organic substances into the lake, and during intense rains, substances from catchment areas are introduced into the lake by rinsing.

The First and Second Lakes are connected by a kinet, which flows like a decorative stream through the park from Fakultetskog dobro Street to Drugi Lake. From the Second Lake, water flows through the waterfall into the First Lake.



<http://park-maksimir.hr/prirodna-bastina/>

Geological features of Maksimir Park and lakes

Pliocenary sediment and Holocene sediment, which predominate in Maksimir Park, have a lithologically similar composition. Together they form mixed sediments composed of unsorted gravel, coarse-grained and medium-grained sand, and silt and clay. The main feature of this sediment is water impermeability thanks to clay and silt. The impermeability of the substrate enables the maintenance of Maksimir artificial lakes.

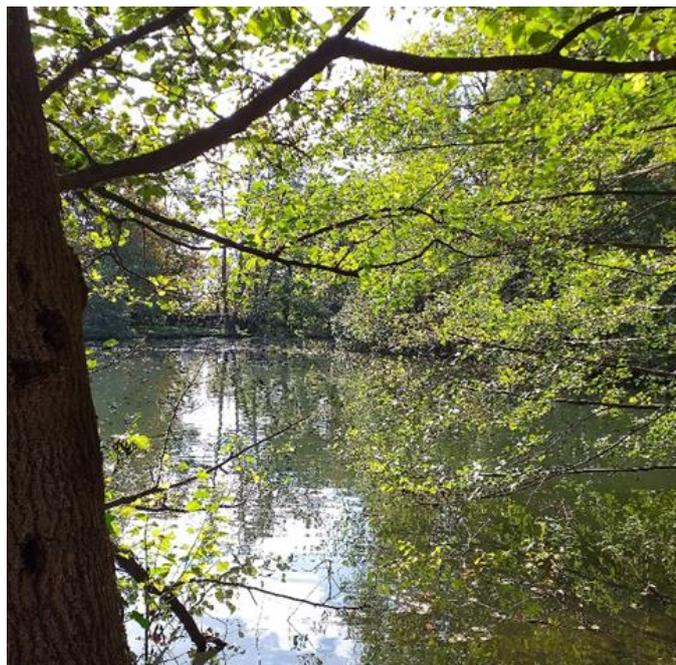
http://digre.pmf.unizg.hr/5430/1/Vanja_Njegovan_diplomski%20rad_finalna_verzija.pdf

Flora and fauna of the Second Maksimir Lake

Around the Second Maksimir Lake, along the shore, there are several specimens of *Populus nigra* and *Populus nigra* cv. *italica* (black poplar and apple), *Acer* sp. (maple), as well as *Carex vesicaria* (sedge) and *Alopecurus aequalis* (red-yellow turnip), while *Quercus petrae* (sessile oak) and *Quercus robur* (pedunculate oak) predominate in a slightly more remote area from the coast.

In the Second Lake of Maksimir, as part of macrozoobenthos, we found members of the order Trichoptera (tulari), Ephemeroptera (aquatic flowers), Coleoptera (beetles), Oligochaeta (small beetles), Plecoptera (shorebirds), Odonata (dragonflies), Odonata (dragonflies), Diptera, tricycles)...

<https://repositorij.pmf.unizg.hr/islandora/object/pmf%3A4092/datastream/PDF/view>



Macrozoobenthos

Macrozoobenthos is a community of macroscopically visible aquatic invertebrates that spend most of their lives on and in the bottom of a body of water. Within this group of animals, we distinguish between immobile, attached to the bottom - sessile and mobile - vaginal organisms. In addition to this, there is also a division based on the position of the organism in relation to the substrate. According to her, we distinguish between animals that live attached to the bottom, that bury themselves in the substrate or that crawl on it (Kerovac Met al., 2008). Depending on the stage of life, the same individual through life can belong to different groups according to the above divisions. This living community is an important member of the food chain of aquatic habitats because it is a source of food for fish and significantly participates in the processing and circulation of organic matter in aquatic ecosystems. Furthermore, this group of organisms is an important indicator of the state of water quality because it consists of several different taxonomic groups sensitive to different fluctuations in the environment. Therefore, biomonitoring of aquatic habitats is performed by researching the state of macrozoobenthos.

Hydra

Phylum: Cnidaria

Class: Hydrozoa

Order: Hydro

Suborder: Hydrariae

Family: Hydridae

Genus: Hydra

Hydra are small animals up to 2 cm long that live mainly in freshwater (ponds), and exceptionally in brackish water. They are often kept attached to plants and feed on plankton.

These animals have a very low level of tolerance of heavy metals, especially cadmium, so their absence in some waters is considered a significant natural indicator of pollution of these waters.

The body wall of the hydra consists of three layers: the outer layer, the inner layer and the middle layer in which the sensory cells are located. Stimuli from the environment are transmitted to nerve cells that are like a network located within the middle layer.

They are in the bulbs next to the sensory and incandescent cells which, by ejecting the filament, inject nerve poison into the prey. Hydra feed on small animals that live like plankton and other small animals that live in water. They catch them with the help of tentacles. He hunts small shrimp.

The green color of the hydra comes from small algae of the genus *Chlorella*, which have settled in entoderm cells.

It multiplies sexually and by budding. Polyps can move by shrinking and stretching. The body is tilted to the side until the area around the mouth and the tentacles touch the ground. Green hydra is an experimental object for studying regeneration, because it regenerates the whole organism from the smallest parts (1/200 of the body).

Hydra are simple animals, common in fresh clear waters. Mercury attached to a twig, a stone, catches prey with tentacles on which are burning cells. Glow cells serve to defend, capture, proliferate and kill prey.



Aquatic flatworm

Phylum: Platyhelminthes

Class: Turbellaria

Family: Dendrocoelidae

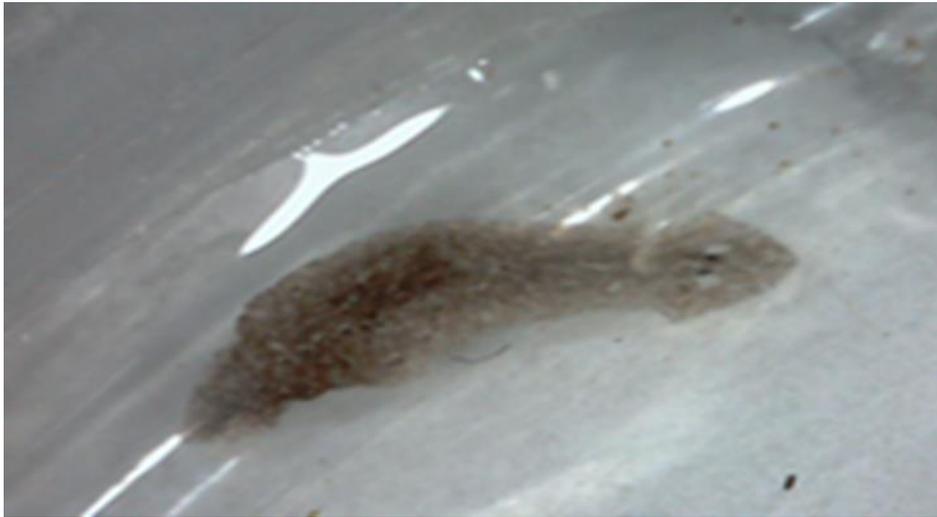
Species: *Dendrocoelum lacteum*

Aquatic flatworms are a class of free marine or freshwater, less common terrestrial flatworms (Platodes), 0.2 mm to 35 cm long.

Virnjaci are bilaterally symmetrical animals that do not have a body cavity, intestinal opening, vascular or respiratory system. The cavities between the organ systems are filled with connective tissue, they do not even have a solid support system. They are bisexual. Indicators are water purity.

Their body is elongated, striking in color, especially in marine forms, covered with ciliated epithelium (hence the name). They move with the help of eyelashes and tightening the skin-muscle layer. They breathe exclusively through the skin, in which many mucous glands are invested. Their mouths are on their stomachs. Their hose is either a simple straight pipe (isosceles) or it is more or less branched (tricycles and polychaetes) or it does not exist (non-intestines).

They mostly live freely, less often they are parasites. They have a great ability to regenerate: in individuals cut into two parts, one half will develop a new front end and the other a new rear end.



Snails

PHYLUM: Mollusca

CLASS: Gastropoda

SUBCLASS: Pulmonata

ORDER: Basommatophora

GENUS: Lymnaea

Lymnaea stagnalis is a large snail that lives only in fresh water.

Snails are animals of a soft body protected by a spiral, limestone house secreted by a mantle. On the abdominal side is the muscular foot by which they move. In the pharynx is

the cartilaginous elevation of the rafters by which they grind food. Their bloodstream is open, they have a ganglionic nervous system.

They are the most numerous group of invertebrates, widespread because they tolerate water pollution well. We will find them in ponds, lakes, lowland rivers and streams.



Shellfish

PHYLUM: Mollusca

ORDER: Eulamellibranchiata

SPECIES: *Anodonta cygnea*

Swan mussel is a freshwater bivalve mollusk. Shells about 20 cm long do not have locks (teeth). It is spread all over Europe.

She is buried in the sand and mud of the freshwater bottom with her foot. He crawls on the bottom with his foot. It feeds on water filtration. The larvae develop from fertilized eggs and float until they attach to the gills of the fish. The mature individual falls to the bottom and continues with a sedentary lifestyle.



Crabs

PHYLUM: Arthropoda

SUBPHYLUM: Crustacea

CLASS: Branchiopoda

ORDER: Cladocera

FAMILY: Daphniidae

GENUS: Daphnia

Water buffalo (Daphniidae), a family of freshwater planktonic shrimps from the suborder Cladocera, about 1 mm long. They have a two-part chitinous shell and a distinctly developed second pair of tentacles, in the shape of branches, which are used for swimming.



Both laterally composed eyes are joined into one larger highly pigmented eye in the middle of the head. They reproduce sexually and asexually (parthenogenesis). They are widespread in freshwater, where they feed mainly on algae, and are themselves almost the most important food of young fish and hydras.

Of the many species, the most famous are the common water flea (*Daphnia pulex*), the large water flea (*D. magna*) and *D. longispina*.

Asellus aquaticus

PHYLUM: Arthropoda

CLASS: Crustacea

SUBCLASS: Malacostraca

ORDER: Isopoda

FAMILY: Asellidae

GENUS: *Asellus*

The common water louse (*Asellus aquaticus*) is a freshwater shrimp resembling a bean. It inhabits temperate climates, including Europe, Russia, and North America. It lives in rivers, streams and stagnant places, especially in places with a lot of stones under which it hides. The common water beetle is omnivorous. Shrimp is relatively resistant to a number of harmful substances and is also an indicator of water quality. His lifespan varies. He lives from 9 months in South Africa to 20 months in northern Europe.



Bugs

PHYLUM: Arthropoda

CLASS: Insect

ORDER: Diptera

FAMILY: Chironomidae

Chironomid midges (Chironomidae) are small to medium-sized insects with slender bodies. They often sting. The larvae cannot swim, so they live at the bottom of brackish, sulfuric and polluted waters, hot springs and glaciers, and adults fly in large swarms. They feed on detritus, and there are predators. Fish foods are common. 1404 species are known in European inland waters. The representative is the feathered pick (*Chironomus plumosus*). Indicative organisms are important, the presence, absence or large amount of certain species in the water can indicate whether the water is polluted. Also their fossils are widely used as indicators of recent environmental changes, including recent climate change.





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THE REPUBLIC OF SLOVAKIA

Natural - geographical features

Slovakia lies in the eastern part of Central Europe. Most of the country is occupied by the Western Carpathians. In a wide arc they stretch from the Danube in the southwest to the border with Ukraine in the east.

The western part is dominated by low wooded hills (Little Carpathians, White Carpathians), and in the central part of the High Tatras. In the eastern part there are forested Beskids.

Slovakia has a temperate continental climate.

In the Carpathians, up to 1400 mm of precipitation falls, in the lowlands 500 - 700 mm, mostly in summer.

The largest river is the Danube. It receives numerous water-rich tributaries from the Carpathians.

The largest tributaries are Váh, Nitra, Hron, Ipel', Morava, Bodrog and Ondava across the Tisza (Hungary) in the east. The lakes are numerous in the Low Tatras and the Slovak Karst, and especially in the High Tatras. The most fertile soils are in the plain along the Danube (brown soil) and in the east, while in the lower parts there are less fertile brown soils and podzols.

Forests occupy 41% of the area, and are most significant in the hilly areas of the northern part of the country. Of the conifers, spruce is the most common, and of deciduous trees, beech and oak, which predominate in the lower regions. Grass formations of the lowland part in the south and southeast of the country have been mostly turned into agricultural areas.



Measuring station

Our measurements location is called the Croatian Canal, it is excavated in the former branch of the Danube in Petržalka in Bratislava. It was made artificially for the ground water level regulation. The length is 5 138 m and a maximum level - 1.5 m. The bottom is made of clay and sand, under which there is sandy gravel. The area is located in a warm to slightly warm area. Average annual temperatures range from 9.0 to 10.5 ° C. The coldest month is January, the warmest is July. The area is one of the warmest in the Slovak Republic.

The surrounding area is formed by vegetation - the trees: *Populus nigra*, *Populus alba*, *Salix alba*, then herbs: *Typha latifolia*, *Iris pseudacorus*, *Myosotis*, *Carex*, *Juncus*, *Mentha*, *Veronica*. There are some protected and endangered species, like *Nuphar luteum*, *Nymphaea alba*, *Batrachium aquatile*, *Groenlandia densa*, *Hippuris vulgaris*, *Sagittaria sagittifolia*, *Utricularia vulgaris*.

When it comes to fauna, 7 protected and 6 endangered animal species registered in the Red Book were identified. They are mainly amphibians, 1 species represents fish.

The most common and richest occurrences are representatives of insects. Particular attention is drawn to various types of dragonflies, punches, grasshoppers and butterflies.

From macrozoobenthos we can find Mollusca, Oligochaeta, Crustacea, Insecta.

The Croatian Canal is nowadays used as a place of relaxation, sport and fishing. Along its length there is a cycling route that joins the Danube cycling route.

Place of measurements



Plants



Animals



Students making measurements



Macrozoobenthos



Dragonfly



Gammarus pulex



Leech



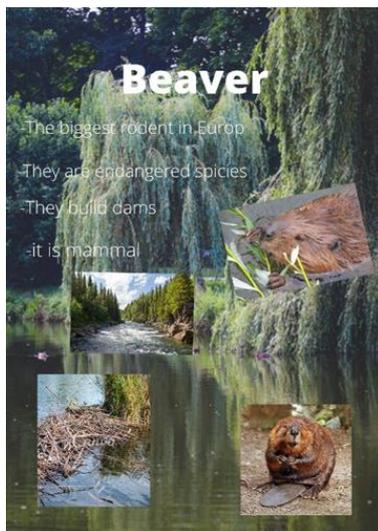
Tubifex tubifex

<https://www.biolib.cz/en/image/id10870/>

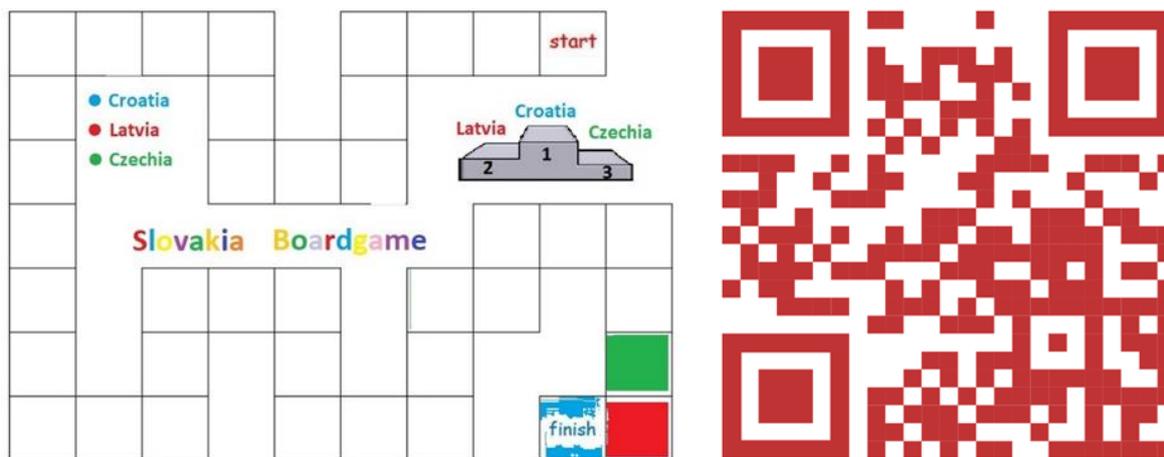
During our measurements we found so many species or taxa, for example: Odonata, Diptera, Turbellaria, Oligochaeta, Hirudinea, Gastropoda, Amphipoda, Ephemeroptera, ... The most dominant were: Tubifex tubifex (Annelida), Dragonfly (Odonata), Leech (Hirudinea), Asellus aquaticus (Crustacea), Chironomid larvae (Diptera), Gammarus pulex, Gastropoda... Almost every time we measured we found larval stages of Chironomidae. They are an important part of macrozoobenthos in most freshwater ecosystems. They are often associated with disturbed or low-diversity ecosystems, as some species have adapted to virtually oxygen-free conditions and dominate polluted waters. Tubifex tubifex was more often found in water with a lower oxygen content. Gammarus is most abundant in the fall, when it has enough food - mostly fallen leaves. We also found Plecoptera - they are excellent indicators of water purity.

Activities

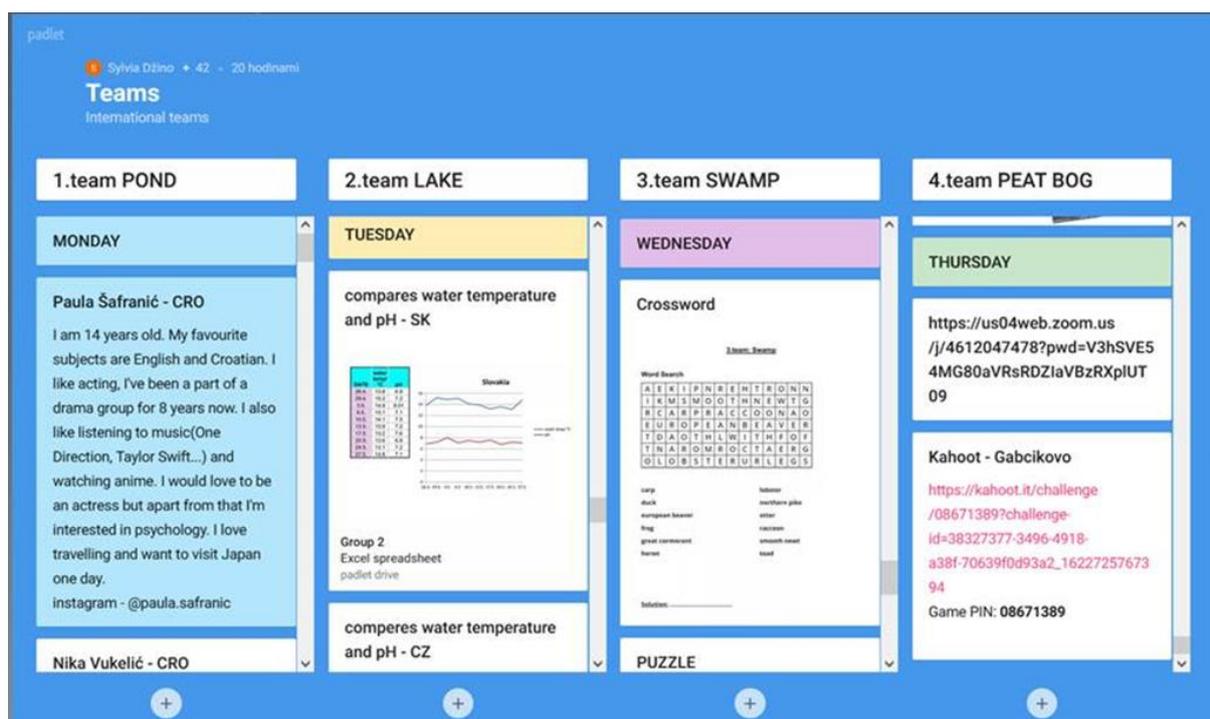
During the project students did different activities. They used IT tools like Padlet, Lionit, Kahoot, Canva poster... They learned how to work with graph editor, text editor, edit videos. They also learned how to cooperate with other students, and discovered many possibilities of internet communication.



Posters that students made during online meetings.



When Slovakia was hosting the online meetings everyday after program students received daily task. They could complete it by opening QR code (example in the picture). The board game was also part of the program of online meetings. Students had to answer questions about Slovakia to win.



Padlet is a program students used the most during online meetings. They used it to introduce themselves, share their conclusions from activities and for communication. Here they were sorted into 4 teams in which they cooperated when doing tasks such as crosswords. Here is an example from one of the teams.

4.team: Peat bog

Word Search

O	A	N	I	L	O	B	S	T	E	R	M	A	L
T	W	C	I	W	I	L	D	D	U	C	K	T	H
T	N	A	W	S	N	A	K	E	H	O	U	T	L
E	U	R	O	P	E	A	N	B	E	A	V	E	R
R	E	P	R	E	D	I	P	S	R	E	T	A	W
G	R	E	A	T	C	O	R	M	O	R	A	N	T
G	S	N	O	R	T	H	E	R	N	P	I	K	E

carp

european beaver

great cormorant

heron

lobster

northern pike

otter

snail

snake

swan

water spider

wild duck

Solution:

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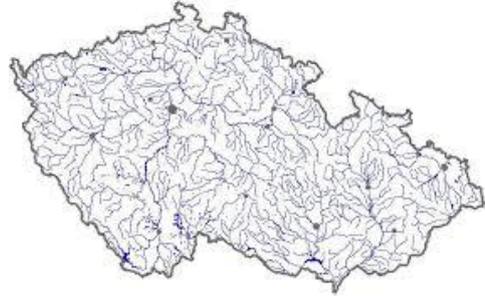
ADAM ZAKLAI

THE CZECH REPUBLIC

Natural - geographical features

The Czech Republic is a state in Central Europe bordered by Germany to the west, Austria to the south, Slovakia to the east and Poland to the northeast.

The Czech Republic includes the territories of [Bohemia](#) in the west, [Moravia](#) in the east and [Czech Silesia](#) in the northeast. Bohemia is surrounded by the Šumava Mountains, the Bohemian Forest (Český les), the Ore Mountains (Krušné hory) and the Sudetes with the Giant Mountains (Krkonoše) as the highest mountain range. The fertile lowland of Elbe (Polabí) lies in the central part of Bohemia. The Bohemian-Moravian Highlands (Českomoravská vrchovina) is an extensive range of hills and low mountains over 150 kilometres long, which runs in a northeasterly direction across the Czech Republic and forms the border between Bohemia and Moravia. The mountains mentioned above and the Bohemian-Moravian Highlands form the Bohemian Massif. The Moravian basins and Moravská Brána is an area between the old Bohemian Massif in the west and the younger peninsula of the Carpathian Mountains in the east. The valley of river Odra separates the Jeseník Mountains (Jeseníky, the Bohemian Massif) from the Beskids (Beskydy, Western Carpathians). The Western Carpathians are located along the Czech-Slovak border.



The Czech Republic mostly has a temperate oceanic climate with warm summers and cold, cloudy and snowy winters. The western direction of air flowing is predominant. The temperature difference between summer and winter is relatively high, due to the landlocked geographical position. At the highest peak - Sněžka (1,603 m, Krkonoše), the average air temperature is only $-0.4\text{ }^{\circ}\text{C}$, whereas in the lowlands of the South Moravian Region, the average air temperature is higher about $10\text{ }^{\circ}\text{C}$. The coldest month is usually January, followed by February and December. Average air temperature in January is between $-1,5$ and $-2,5\text{ }^{\circ}\text{C}$. During these months, there is usually snow in the mountains and sometimes in the major cities and lowlands. During spring in March, April, and May the temperature usually increases rapidly, especially during April, when the temperature and weather tends to vary widely during the day.

The warmest month of the year is July, followed by August and June. Average air temperature in July is between 17 and $19,5\text{ }^{\circ}\text{C}$. On average, summer temperatures are about $20\text{ }^{\circ}\text{C}$ – $30\text{ }^{\circ}\text{C}$ higher than in winter. Summer is also characterized by rain and storms. Autumn generally begins in September, which is still relatively warm and dry. During October temperatures usually fall below $15\text{ }^{\circ}\text{C}$ or $10\text{ }^{\circ}\text{C}$ and deciduous trees begin to shed their leaves. By the end of November, temperatures usually range around the freezing point. The coldest temperature $-42,2\text{ }^{\circ}\text{C}$ was measured in Litvínovice near České Budějovice in 1929

and the hottest temperature 40.4 °C was in Dobřichovice in 2012. Temperatures in the mountains are considerably lower than temperatures in the lowlands.

Annually amount of precipitations in the Czech Republic is between 450 mm and 1 500 mm. The most of precipitations fall in the mountains.

The longest rivers are the Elbe River (Labe) in Bohemia, the Morava River and the Odra River in Moravia.

The most fertile soils are found in lowlands of Elbe (Polabí) and Ohře (Poohří) and in Moravia lowland. Less fertile soils and brown forest soil prevail in the other parts of the Czech Republic.

Measuring station

Týnský stream is the main tributary of the water pond. Historically, the first water supply system in Trebic brought water from the Vodovodni Pond 134 years ago. Its area is 0.61 ha. We measured the water twice a week, and the things were pH, oxygen, alkalinity, ammonium, transparency, conductivity, 2020phosphates, nitrates and nitrites. Next we found the values of water temperature and air temperature. We also observed the weather.



Water ecosystem in Europe – about equipment we use for measuring

For measuring water from our pond we use lots of different equipments that are very useful. We don't use them only outside near the pond, but we also use them in school. We use non-electronical equipments that are based only on chemicalls but mostly we use electronical equipments (and some of them need chemicalls too).

Electronical equipments

For most of the electro equipments we use app called SparkVue. We connect electronics by bluetooth to tablet with app, then we choose what we want to measure and then we start the measurment (for some values we need chemicalls). Then we finally have measured our water. And for the rest of these we don't need any apps or bluetooth, we need only batteries and Colorimetr.

Colorimetr – for measuring with this we need chemicalls. When we got chemicalls, we have to find on colorimetr value, that we are measuring. When we find it, we calibrate it with water without chemicalls. After calibrating, we set up the filter for using, and then we measure.

Interesting fact: this device uses light to measure the values.

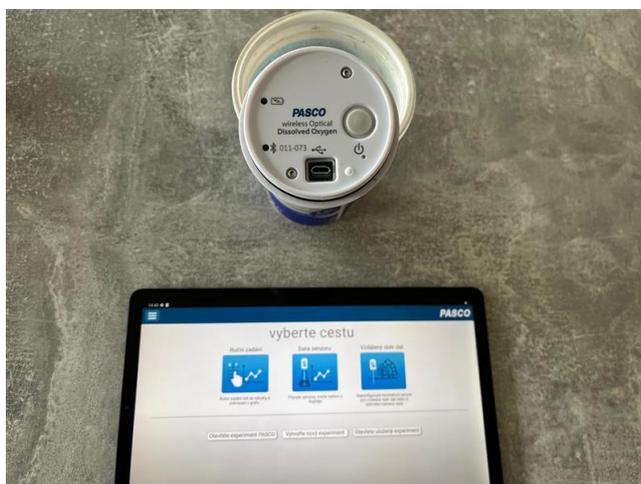


Sparklink – for measuring you'll need again chemicalls and then tablet. When we have chnchemicals, we connect Sparklink to the tablet (as you can see on photo) and add the chemicalls in the black device. Then we cover the chemicalls with black top (because it also, as the Colorimetr, uses light to measure, but kinda different) and find on tablet value, that we are measuring. Then we start measure.

Next three devices don't need any chemicals, but only water and tablet with SparkVue app. These devices are measuring very quick, but they need to be charged.

PASCO wireless Optical Dissolved Oxygen

– with this device we measure Oxygen. We turn it on, connect to tablet, find on tablet what we want to measure and start measuring.



PASCO wireless Conductivity – we measure with this conductivity of water. We do the same, as we did oxygen.

PASCO wireless pH – with this device we measure pH of water. Again, we do the same as we did with oxygen and conductivity.



Macrozoobenthos

Daphnia pulex - Water flea

Daphnia pulex is the most common species of water flea. It has a cosmopolitan distribution: the species is found throughout the Americas, Europe, and Australia. It is a model species, and was the first crustacean to have its genome sequenced.



Anisoptera – Dragonfly

Dragonfly is a flying insect belonging to the order Odonata, infraorder Anisoptera. Adult dragonflies are characterized by a pair of large, multifaceted compound eyes, two pairs of strong, transparent wings, sometimes with coloured patches, and an elongated body. Dragonflies can be mistaken for the closely related damselflies, which make up the other odonatan infraorder (Zygoptera) and are similar in body plan though usually lighter in build; however, the wings of most dragonflies are held flat and away from the body, while damselflies hold their wings folded at rest, along or above the abdomen. Dragonflies are agile fliers, while damselflies have a weaker, fluttery flight. Many dragonflies have brilliant iridescent or metallic colours produced by structural colouration, making them conspicuous in flight.



Lucilia sericata – Maggot

A maggot is the larva of a fly; it is applied in particular to the larvae of Brachycera flies, such as houseflies, cheese flies, and blowflies, rather than larvae of the Nematocera, such as mosquitoes and crane flies.



Annelida – Worm

The annelids, also known as the ringed worms or segmented worms, are a large phylum, with over 22,000 extant species including ragworms, earthworms, and leeches. The species exist in and have adapted to various ecologies – some in marine environments as distinct as tidal zones and hydrothermal vents, others in fresh water, and yet others in moist terrestrial environments.



***Cyclops strenuus* – Copepod**

It is characteristic of *Cyclops strenuus* that they do not have a carapace or a skin fold. The head, chest and the first torso form a wide thorax, the other 3 or 4 torso sections (the last one is sometimes stunted) are loose. The five-member buttocks are finished with a fork-shaped pendant with bristles, called furka. The forelegs are forked and torn and used for swimming. *Cyclops strenuus* occurs in temperate habitats. Normal activity occurs between 3 and 21 °C and temperatures above 26 °C are actively avoided.



Conclusion about project

In October 2019 was transparency significantly lower than in October 2021, but oxygen was higher in October 2019 than in October 2021. Ammonium was lower in October 2019 and in October 2021 was ammonium significantly higher. Nitrites was lower in October 2019 and higher in October 2021. The other values were similar in both years.

In September 2020 was transparency significantly lower than in September 2021, but oxygen was higher in September 2020 than in September 2021. Ammonium was higher in September 2020 and in September 2021 was ammonium significantly lower. Nitrites was higher in September 2020 and lower in September 2021.

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