

ATTACK AND A

AQUATIKA GUIDE



Image 0. Green roof gardens of Aquatika, located next to the Korana river in the heart of Karlovac

The Public institution AQUATIKA – FRESHWATER AQUARIUM KARLOVAC is a result of a project "FRESHWATER AQUARIUM AND RIVER MUSEUM – KAQUARIUM", cofinanced by the European Union, from the European Regional Development Fund in the amount of 36.2 million kunas. The value of the project was 36.7 million kunas.

The aquarium layout in AQUATIKA follows the flow of a typical karst river and provides a detailed, interesting, educational and exciting insight into the amazing freshwater world. Every visitor can experience the river flow from its source to the river mouth. The aquarium represents the flora and fauna of Croatian rivers and lakes, geological past, traditional culture and history of the basins of Karlovac's four rivers – the Korana, the Kupa, the Mrežnica and the Dobra.

The story with the river

AQUATIKA – FRESHWATER AQUARIUM KARLOVAC is located on the right bank of the Korana river, which comes from Plitvice lakes. The Korana flows into the Kupa in Karlovac, the Kupa flows into the Sava, the Sava into the Danube, and the Danube into the Black Sea. Besides the Black Sea (Danube) basin, some of our rivers flow into the Adriatic Sea and therefore belong to the Adriatic basin.



Image 1. The Kupa river rapids, near Karlovac



Image 2. The rivers Kupa, Korana, Mrežnica and Dobra meet in Karlovac. On the river Korana, there is a popular Foginovo beach

AN INTERESTING FACT ABOUT THE KORANA

It was either named after the Croatian name Gorana, since it comes from the hills (note: Gora in Croatian means hill, or mountain), or after the Croatian word for the crust, for its stony bottom. It has healing effect due to iodine in the water, which was proven in chemical institutes in Vienna and Zagreb.



Image 3. The Sun rises again and is mirrored in the Korana river

Introduction

- AQUATIKA FRESHWATER AQUARIUM KARLOVAC represents freshwater fish and plants of Croatia, and their habitats. It is based on the division of a river flow into the upper stream, middle flow and lower stream.
- The cave system shows the endemic species of fish, mostly connected to karst and underground habitats.
- The largest aquarium contains migratory species which originate from the time of the dinosaurs. Most of them are considered to be extinct in Croatia.
- Standing water is represented by ponds and swamps which abound with different plant and animal life.

- After the standing water aquarium, there comes an aquarium with non-native fish species, most of which are invasive, and endanger our native species.
- The final aquarium represents the karst phenomenon of creating tufa waterfalls and the importance of their preservation.
- The laboratory and support facilities contain modern and computerized aquarium technology.
- The other contents are a meeting room, playroom, scientific library, gift shop, caffe bar, central square and children's playgrounds.



Image 4. The aquarium display of the flow of the karst river the Korana



Image 5. The upper river flow is characterized by speed and low water temperatures

Upper stream

The upper flow is located in the higher areas, closest to the river source, where the water is fast, cold and rich in oxygen. The bottom is rocky and overgrown with moss and diatom algae.

The fish species in the upper flow are adapted to these environmental conditions with their elongated and spindly bodies, such as the brown trout and huchen.

✤ The brown trout has a large mouth and well-developed teeth. It has black spots on its back and red spots on its sides. The colour of its body adapts to the environment. It usually grows up to 50 centimetres in length. It feeds on



Image 6. The grayling is easily recognizable by a large and colorful dorsal fin



Image 7. The huchen in the branch shelter is expecting its prey - a greyling



Image 8. The minnow is an important part in the fish food chain from the trout family

water invertebrates, like caddisflies or amphipods, and small fish.

✤ The huchen is the largest fish in the trout family, and can grow up to 150 centimetres in length, and weigh up to 50 kilograms. It can live to be 100 years old. Most of its body is covered in dark spots. It is an endemic species of the Danube basin, and it is also called the Danube salmon. It mostly feeds on fish,



Image 10. The sunset placed a transparent courtain of tranquility over the Kupa river

but it also attacks rodents and birds on the surface of the water.



Image 11. A Danube roach male in spawn is recognized by spawn tubercles on its head and body

Middle flow

The middle flow has a higher average temperature, and less velocity of water, with a smaller oxygen share. The bottom contains gravel and sand. The vegetation contains green algae, filament bacteria and fungi, and along the river banks, we can find the black alder, poplar and willow trees. Insect larvae and snails represent the water invertebrates in this area.

The middle flow contains the largest number of fish species, such as bleak, chub, barbel, nase, and the asp.

✤ The bleak is a species-typical for slower waters. Like chub and barbel, it mainly lives in schools. Unlike the barbel, it has a small head with an upper jaw, so it mainly feeds on insects from the surface of the water. It can grow up to 20 centimetres in length and 50 grams, so it is often food for other, larger fish. Fishermen use it as bait.

The chub is one of our most widespread fish species. We can find it from



Image 9. Depths and logs are fish hideouts in winter months



Image 12. The nase charge to spawn in spring months



Image 13. A school of bleak from the Dobra river

the mountain parts, all the way to the lowland parts of rivers, due to its exceptional adaptability. It can grow up to 80 centimetres in length, and 6 kilograms, with a diverse diet of zooplankton, water invertebrates, algae, plant seeds, water herbs and fish.

✤ The barbel has a strong and spindly body and lives at the river bottom. It has a characteristic lower jaw, with two pairs of whiskers. It feeds similarly to chub and can live up to 15 years of age. Even though its eggs are poisoned and resistant to thermal processing, the barbel is a favourite in certain countries' cuisine.

Image 14. The water lilly is a water plant with roots in the bottom, and with leaves and flowers on the water surface





Image 15. Lower stream of the river is characterized by a wide and deep riverbed, and therefore low water speed

Lower stream

The lower stream has wide and deep riverbeds, the water is slow, and the average temperatures are higher than in the middle flow. The bottom is sandy and muddy, which creates ideal conditions for invertebrates like shellfish and worms. The plant life is diverse. Water plants such as water lilies are rooted into the bottom and have leaves and flowers developed on the water surface.

Larger fish species are characteristic for the lower stream, such as the carp and the catfish.

The zander has large eyes, and elongated thin teeth on its jaw. It has



Image 16. Older perch specimens are single



Image 17. A pike swimming among water plants searching for prey



Image 18. Zander's dorsal fins do not touch, unlike the perch's



Image 19. The whiskers of a catfish contain sensory cells, which makes them a sense in searching for food



Image 20. Carps live in the peaceful and deep part of the Mrežnica river

a spindly body, with clear dark stripes. The male uses plant materials to build a nest in which the female lays eggs. The males guard the eggs and the hatched larvae. It is a quick fish which hunts in schools and feeds on smaller fish. It is very appreciated in gastronomy.

✤ The carp is a robust fish, with a horizontal mouth with two pairs of whiskers. During the cultivation of the carp, there came about a change in the number of scales – from the original one completely covered in scales to a carp without scales. The carp is an omnivore who can weigh up to 50 kilograms and live up to 50 years of age.

✤ The pike has an elongated spindly body, typical for a predator. The front part of its head is flattened like a goose's beak, and it has around 700 teeth in its mouth. The location of the dorsal and anal fin close to the tail fin enables it to achieve a great starting speed. The pike hunts from ambush and can swallow a prey of its own size. Cannibalism was noted with some pikes.

✤ The catfish usually rests in the deep during the day and is active during the night. Its vision is weak, but its taste receptors on its lips and whiskers are well-developed. It is also very sensitive to sound. Its skin is thicker, and it has no scales. It is our largest fish, which can grow up to five meters in length, and weigh up to 300 kilograms. It feeds on fish, birds and smaller mammals.



Image 21. In the lower stream, the bottom is sandy and muddy and therefore great for the development of special invertebrate communities, such as shellfish

INTERESTING FACT

Water plants convert inorganic substances dissolved in water or in the bottom, into organic matter – a plant. This creates conditions for the survival of water animals that are fed on plants, which are the main food for many species of fish.

Image 22. Yellow water lily is only one species of the two water lilies that grow in Croatia





Endemic species

Endemic species are located on a certain, often small, area, and do not appear elsewhere. If that surface is extremely small, we call such species steno-endemic.

Among 150 species of fish which live in Croatian rivers and lakes, 52 are endemic. Forty of those belong to the Adriatic basin, which puts Croatia at the very



Image 23. A Padanian goby stays on the rocky bottom and uses mimicry to hide

Image 24. A display of a cave system in the unique Aquatika

top of Europe. Such biodiversity came about because of a smaller influence of the last ice age on our areas, and because of the two different basins.

Endemic species are mostly tied to karst areas, caves, smaller rivers and lakes, such as the Mirna and Šmit Lake.

The Mirna is the longest river in Istria, whose source is near Hum, and it flows

into the Adriatic Sea near Novigrad. In it, we can find endemic species such as the **Padanian goby** which is a species up to 9 centimetres in length. The male makes noises to attract a female into its nest under a rock, where she lays eggs during the night.

The Ogulin area, where lake Šmitovo is located, is rich with underground, karst habitats. Here we can find steno-en-





Image 25. The fairytale canyon of the Zrmanja river

dems such as **Croatian dace** and **karst dace**. Their differences were recently established by precise morphological and genetic analyses.

The Krbava, the Lika and the Jadova are karst subterranean rivers. During the summer months, their riverbeds dry out, so the fish like the **Croatian minnow**, **Krbava minnow** and **Jadova minnow** retreat underground. Because of the lack of sunlight, the karst subterranean systems are poor in phytoplankton, zooplankton and other water invertebrates, so the fish are adapted to a longer period of hunger. When the water level rises, the fish return



Image 26. Spotted minnow in the Aquatika's cave system

Crveno jezero (Red Lake) is a karst pit filled with water near Imotski. According to legend, it was made long ago when Gavan's castle sunk. It is considered the deepest lake in Europe, with a depth of 245 meters. Here we can find the spotted minnow, which can grow to be only 12 centimetres long, and whose biology is mostly unknown. It is the first species for which underground migration was proven. in the riverbeds to feed and mate.

The Zrmanja is a karst river with a canyon, whose water level greatly varies during the rainy and dry seasons. Her most important tributary is the river Krupa, with which it creates the famous waterfall Visoki Buk. The interesting species there are **Balkan brook trout** and **Zrmanja chub**. The Balkan brook trout live in the Adriatic Sea and goes to spawn in freshwater. Not much is known about the biology of the Balkan brook trout and the Zrmanja chub.

The Krka is the second longest river of the Adriatic basin, after the Neretva. Its special features are the travertine barriers, the most famous of which is Skradinski buk, 45.7 meters tall. The river is rich with fish species **Adriatic barbel**, **Tursky's dace**, **Dalmatian barbel gudgeon**, and **the Cikola minnow**. The



Image 27. The marble trout is one of the most endangered trout species, and is rare in Croatia



Image 28. The Krbava minnow retreats underground

Dalmatian barbel gudgeon was named after a sharp spike in its dorsal fin. It is considered to have been unchanged for millions of years, and it is a special genus.

The Neretva is considered the coldest river in the world. After 203 kilometres in Bosnia and Herzegovina, its flow in Croatia has only 22.5 kilometres and is a wide delta which is for the most part meliorated and dried out. By the number of endemic species, it is one of the most interesting locations in Croatia. We can name the marble trout. basak. Neretva spined loach, Norin goby and Dalmatian nase. Marble trout, unlike the other species from the trout family, does not have spots, but irregular dark stripes. It can grow up to 140 centimetres in length and weigh up to 30 kilograms. It is a migratory species, mostly endangered by construction of hydropower plants, which prevented it from spawning in upper, colder parts of the river.

Migratory species

The most common reason for fish migration is spawning, as well as searching for food or habitat. There are species from the sturgeon family which live in the sea but spawn in a river. The building of Đerdap hydropower plant prevented the migration of sturgeons from the Black Sea through the Danube. Out of the six species of this family in Croatia (beluga, Russian sturgeon, stellate sturgeon, ship sturgeon, Atlantic sturgeon, sterlet), only the sterlet is present in our freshwater ecosystems. It is interesting that **sturgeons** existed during the time of the dinosaurs.

✤ The stellate sturgeon has an elongated and cylindrical body, and its head and body are covered with bony shields. It can grow up to a maximum length of 220 centimetres. It lives in the Caspian and the Black Sea, and the rivers of their drainage basins. It can live up to 35 years of age. It feeds on water



Image 30. River regulation resulted in disappearance of numerous hatcheries of the sturgeon family of fish

invertebrates and smaller fish.

✤ The European eel has a small head, and a snake-like body covered in small scales. Its colour depends on the degree of its development. Unlike the sturgeon, it lives in rivers, and breeds in the Sargasso Sea. After spawning at the depths up to 1000 meters, the Golf stream carries the larvae towards the European mainland. They are transparent and shaped like a willow leaf. The European eel feeds on water invertebrates and smaller fish.



Image 29. The stellate sturgeon used to swim in our rivers before the Derdap hydro power plant was built



Image 31. Lakes are by their surface and depth the largest stagnant waters

Standing waters

They are divided into puddles, ponds, fishponds, swamps and lakes. They are favourite habitats of plants, insects, fish, amphibians, reptiles, birds and mammals. The more representative examples of well-kept swamp habitats of Europe include Kopački rit and Lonjsko polje. These areas have the characteristics of natural filters and keep water during the flood period. Since they have a lot of positive effects on the environment, they are considered the keepers of biodiversity. Fish which live in standing waters, such as tench, rudd, crucian carp and weather loach, is adapted to



Image 32. The roach lives in standing waters, but also in running waters from the upper to the lower stream



Image 33. Lower air temperatures in the autumn cool the top layer of the lake which becomes denser than the warmer and rarer lower part so it start to sink



Image 34. Except fish there are also reptiles, such as pond turtle which feeds on frogs, fish and other small animals that live in stagnant waters and the land

great changes in physical and chemical parameters of water.

Crucian carp is a fish with a tall, short, and laterally flattened body. It grows slowly and can grow up to 60 centimetres and three kilograms. It can stand very low concentrations of oxygen, and can even survive if the water dries out, by digging itself into the mud. After the Prussian carp was introduced, its population began to decrease.

▶ The tench has a compact and tall body, protected by small scales. Its back is dark, sides are green, and the belly is yellow. It can stand low concentrations of oxygen, high water temperatures up to 30 degrees Celsius, and sour water with a pH value of 4.6. The largest noted mass was 7.5 kilograms.

Non-native species

A non-native species does not naturally belong to a certain area but was brought there, intentionally or accidentally, by a human activity. When non-native species in a certain area cause changes and endanger biodiversity - they become invasive. It is possible for them to take over an area and take food from a native species, to cross with a native species and introduce new diseases and parasites. Invasive fish species, along with pollution, regulating water flows, building dams and melioration, are considered one of the main reasons for the extinction of native species. Out of 30 introduced fish species, 21 adapted to new habitats. It is prohibited by law to introduce non-native fish species into open waters.

The Prussian carp is a fish from China, which quickly spread through Europe's freshwaters through Russia. In

INTERESTING FACT

Image 35. The pseudorasbora is an agressive species which attacks fish by pushing them from their habitats



The paddlefish has a large mouth and an extended upper jaw that accounts for one third of the total length of the body. No type of a shark has such a long upper jaw.

Image 36. The possibility of the negative impact of the paddlefish is currently unknown



Image 37. The pumpkinseed was introduced from North America into Europe as an aquarium fish

our country, there are mostly females, whose spawn can be stimulated by males from other carp species. It is an omnivore who can reach a length of up to 45 centimetres, and a mass of over two kilograms. It is interesting that, besides the Prussian carp, there also exists a sub-species of our oldest aquarium fish – the goldfish.

The grass carp is a fish who lives in schools, inhabiting middle and lower



Image 38. The grass carp has a robust body covered with large scales, regardless it is a timid fish which jumps high above the water if being startled

flows of rivers. It was named after the Asian river of Amur, where it is a native species. During the 1970-s it arrived in our areas, mostly because of the reduction of water vegetation on which it feeds. Because of this, water plants necessary for spawning of native species were in some areas completely destroyed.



Image 39. The beautiful and seductive Krupa river, dressed in tufa barriers



Tufa

A sediment which mostly consists of calcite minerals which are bound to tufamakers, such as some species of algae and invertebrates. Their dying and sedimentation create a soft and porous rock, which in the form of barriers serves as a hideout for different species of fish and crabs. Nice examples of tufa barriers can be found in Plitvice Lakes National Park, the Slunjčica in Rastoke and the Mrežnica and the Korana rivers.

Image 40. It is assumed that the monkey goby has been introduced into Serbia by ballast waters and migrated to the Sava basin in Croatia

Aquarium technology

Thanks to the water cycle in nature and its geographic position, Karlovac is rich in subterranean waters. A well was dug in close proximity to the aquarium, and it supplies the aquarium tanks with water without chlorine. Natural water is therefore pumped into the aquarium technological system. Through a mechanical filter which stops larger particles such as algae or sand and a biological filter which removes harmful substances such as ammonia, water enters the cooler, where its temperature is regulated. Water is enriched with oxygen and additionally sterilized, which removes viruses and bacteria. As in nature, this hydrological cycle is constantly repeated.



Meeting room

The meeting room with a special entrance, with a maximum capacity up to



Image 41. The meeting room is perfectly equipped for hosting symposiums, lectures and workshops

Image 42. The playroom is an interesting place for different workshops for children and learning through game

120 people in a cinema setting, with two integrated aquariums within the room. The room can be rented without entering the aquarium exhibition. The rent includes the equipment: a projector, screen, loudspeakers, microphone, podium, pointer, wi-fi, 120 chairs and 10 congress tables.

Playroom

Playroom with a special entrance and a maximal capacity of 50 people in a cinema setting can be adjusted to event needs, such as educational workshops and learning through game. Renting includes the equipment: projector, screen, loudspeakers, microphone, speaking podium, pointer, wi-fi, children's furniture or congress chairs and tables.

Library

The library which hosts the Speleoteka, a collection of 5,000 copies of rare and valuable books from speleological societies of Karlovac and surrounding areas. Aquatika constantly works on acquiring its own book fund from the natural sciences area. This space can be rented, regardless of entering the aquarium exhibition. The equipment includes screen, projector, wi-fi, 15 chairs and two large tables.



Image 43. The library contains educational and interesting literature about natural sciences



Image 45. The caffe bar as a contemporary designed space with a view of the central square offers a wide selection of beverages and a children's corner

Souvenir shop

A large selection of reasonably priced souvenirs from the Karlovac county area. In this way, we encourage the economy and contribute to the development of the local community and ensure that our visitors can get unique products to remember their aquarium visit.

Caffe bar AQUATIKA

Caffe bar AQUATIKA is within the aquarium complex, with a contemporary designed interior, a rich selection of warm and cold beverages, and a children's play corner.

The central square

The square is a central part of the complex, with three entrances and a beau-



tiful view of the Korana waterfall and Foginovo beach. The building of the aquarium exhibition, the caffe bar and the library all face the square, which is the gathering place and a setting for many events.

Children's playgrounds

Within the aquarium complex, there are two children's playgrounds with modern playing equipment.

Aquatika is an attraction in architectural, tourist, educational and scientific sense. As a freshwater aquarium unique in this part of Europe, it has greatly enriched the tourist offer of Karlovac and Karlovac county.

Image 47. The central square is a pleasant place for gatherings and many events for children, youth and adults IMPRESSUM Publisher Public institution AQUATIKA- FRESHWATER AQUARIUM KARLOVAC For the publisher Margarita Maruškić Kulaš Authors Goran Jakšić, Margarita Maruškić Kulaš, Ivana Kaleb Vuletić, Krešimir Kuri, Alen Pajtak, Dario Olrom, Mirna Matijević Danilović, Helena Dobrosavljević, Natalija Kosanović, Dubravko Halovanić, Josip Šut Photography Marin Jarniak: 1, 3, 6, 8-22, 31-35, 37-38, 40: Denis Stošić: 23-24, 26-30, 36, 41-47; Goran Jakšić: 5, 7; Jure Živković: 0, 4; Dario Olrom: 25, 39; Anđelka Mađar: 2 Sketches Maia Spoia Translation Minimondo Graphic design Ivana Šimunović Print Pečarić & Radočai Ltd.

If you would like to know more about systematics and anatomy of fish as well as ecology of inland waters, we recommend the book "The Freshwater fish of Aquatika" by Goran Jakšić, PhD.

> With its contemporary architecture and computerised aquarium technology, Aquatika resembles a spaceship from Sci-Fi novel. Therefore, it seemed logical to start this book with the Big Bang that created our Universe and particles that result from it. The particles create stars, the ground we walk on, the rain, and rivers that flow. At the end, fish are also created and it is particularly them that this book is dealing with.

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deals with the ecology of inland waters, the second with the basic fish anatomy, all written in the educational, and yet simple and direct style understandable to all readers. The main content deals with the main zonation of the flowing waters with their dominant fish species and the description of the typical representatives that live in each zone. The data are not boring because they point out the most interesting facts about each fish species. All of that is accompanied with magnificent graphics and photographies. In the last chapters, a reader can also learn about the controversial attitude about the "catch and release" fishing principle, but also about the sense of pain at fish, the topic that is constantly being argued by scientists, experts in the common worldview debates. In the very end of the book, explanations of the crucial terminology and the overwiev of the studied literature are presented.

Thanks for visiting!

The first part of the book

SLATKOVODNE RIBE AQUATIKE



Image 46. Children's playgrounds are equipped with modern equipment for exercising and fun





www.aquariumkarlovac.com