

The breath of the Earth – carbon dioxide as a mediator between inorganic and organic life

The Dragonja River, located in southwestern Slovenia, flows through a karst landscape before reaching the Adriatic Sea near the Slovenian coast. This region is shaped by porous limestone, where water infiltrates underground, creating complex karst hydrology with springs, disappearing streams, and underground flow paths.

The karst terrain strongly influences the Dragonja's flow, especially in dry and wet periods. Due to this, we conducted measurements at different locations, including the delta, to understand how water behaves in this system — such as changes in discharge and water quality.

This study helps reveal the interaction between surface and underground water in a coastal karst environment and shows how sensitive rivers like the Dragonja are to seasonal and geological changes.

WATER LIFE

The Slovenian Sea is a small but extremely important part of the Adriatic Sea. Although it only reaches about 20 meters in depth, it is home to numerous marine species that together form a diverse and delicate ecosystem.

In these shallow yet life-rich waters, scientists have recorded over 1,400 different marine organisms. Among them, many fish species stand out, such as sea bass, gilt-head bream, and mullet, along with various shellfish, crabs, and mollusks. These fish are not only a valuable catch for local fishermen, but also play a vital role in the food chain and in maintaining ecological balance.

One of the highlights of the Slovenian sea is the Piran Aquarium, where visitors can observe the richness of the Adriatic Sea up close. The aquarium features only native species, such as seahorses, cuttlefish, black scorpionfish, starfish, sea urchins, jellyfish, and crabs. But this is more than just an exhibit – the aquarium also serves as an educational and conservation center. Special attention is given to the protection of endangered species, especially sea turtles, which are often affected by bycatch in fishing, plastic pollution, coastal development, and even illegal trade in turtle eggs and meat.



Figure 2: Aquarium Piran



Figure 1: Aquarium Piran



Figure 4: Aquarium Piran



Figure 3: Aquarium Piran



Figure 6: Aquarium Piran

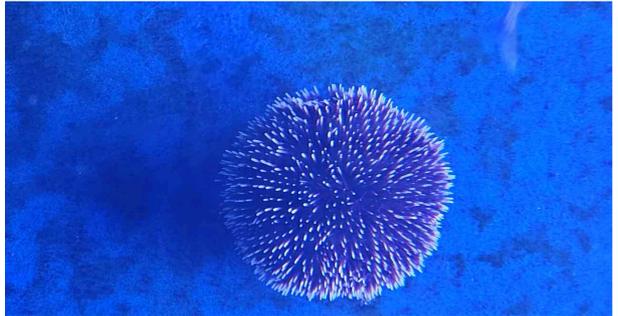


Figure 5: Aquarium Piran

From time to time, bottlenose dolphins can also be spotted in Slovenian waters. According to estimates by the non-profit organization Morigenos, which conducts scientific and field research on these dolphins, about 70 individuals live permanently in the Gulf of Trieste, with the total population in the area reaching around 150 dolphins. As top predators, dolphins play an essential role in maintaining healthy marine ecosystems. Besides their research, Morigenos also runs various education and conservation programs to help people better understand the importance of a healthy sea.



Figure 7: Dolphin

Often overlooked but critically important are seagrasses. While they might not be popular among swimmers due to their slimy texture, they serve a crucial role in the ecosystem: producing oxygen, offering habitats for young fish and microorganisms, protecting the seabed from erosion, and even capturing carbon from the atmosphere, which helps combat climate change.



Figure 8: Life in seagrass

The Slovenian Sea is truly a natural treasure. Though small, it is rich in life and full of natural wonders that deserve our attention, respect, and protection. By visiting places like the Piran Aquarium or supporting organizations such as Morigenos, each of us can contribute to the preservation of this extraordinary marine world – not just for future generations, but already for today.

WATER/NOISE POLLUTION

On a daily basis, marine animals are not only faced with global warming, but also with water pollution and noise pollution. Microplastics and plastic in general threaten the lives of marine animals, especially turtles, which often get entangled in plastic bags. Noise pollution includes underwater industrial activities and maritime traffic.

One of the endangered species particularly affected by noise pollution are dolphins. These marine creatures communicate using echolocation. This is a process in which an organism—in this case, a dolphin—produces sound that bounces off objects in the environment, and the organism then interprets the echoes to determine the shape and position of those objects around it. The main problem comes from massive cargo ships, which produce deeper (vibrational) sounds that disturb toothed whales, a group that includes dolphins. The sound of cargo ship engines interferes with dolphin communication, sometimes with tragic consequences.



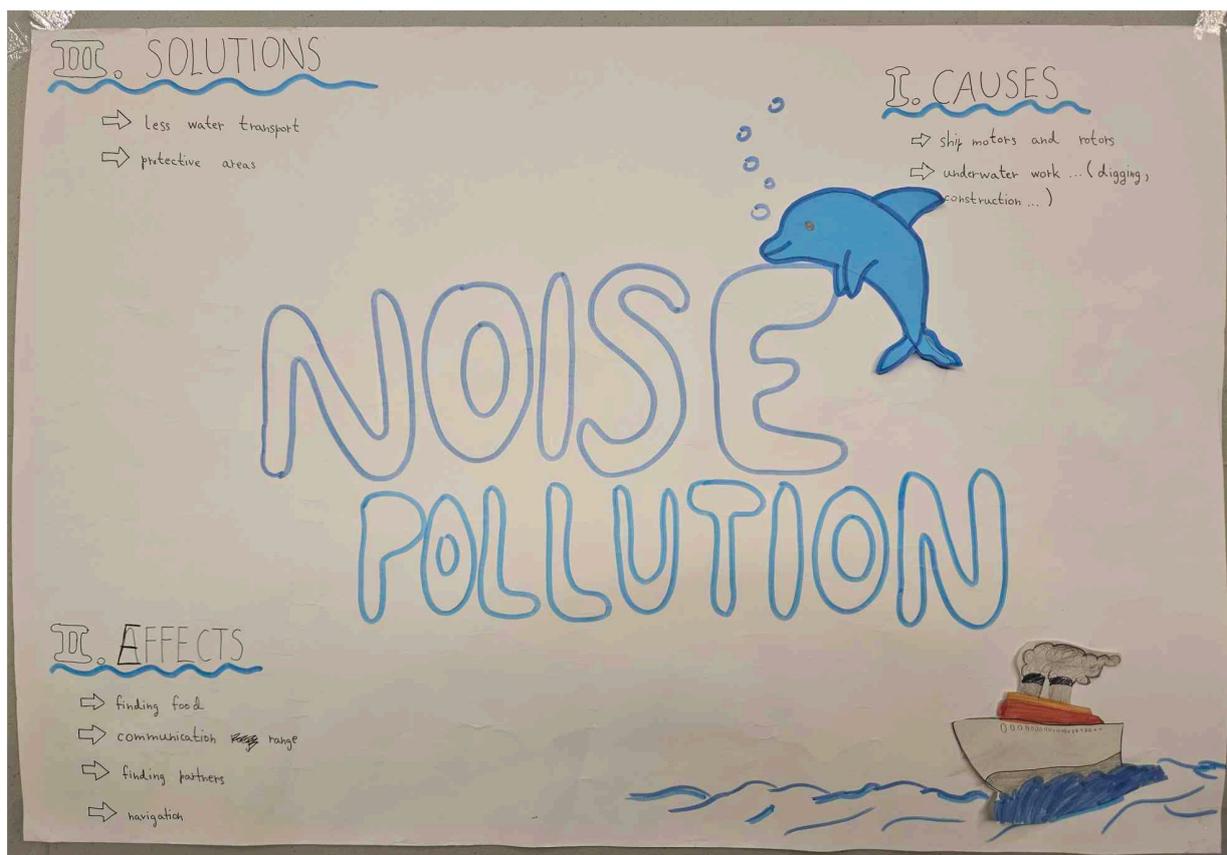


Figure 10: Noise pollution problems

SEČOVLJE SALT PANS

The tradition of salt production in the Sečovlje Salt Pans has a long history. The past plays an important role in the production of salt, as the methods have changed very little from then until today. This is also one of the key factors contributing to the rich biodiversity of the landscape park.

Traditional salt production in the Sečovlje Salt Pans is carried out in a natural and sustainable way, without the use of modern technology. The process is based on the evaporation of seawater with the help of the sun and wind. Salt workers manually direct seawater through a system of channels into shallow basins called crystallization fields. A crucial part of the process is the special biosediment base called *petola*, which prevents the salt from mixing with mud. Salt begins to crystallize after several days of evaporation, depending on weather

conditions. Once the salt solidifies, it is collected manually by the salt workers using special tools. Harvesting takes place during the summer months, when weather conditions are most favorable. Animal and plant species also play an important role in salt production. Among the plants, halophytes—salt-loving species such as sea purslane, marsh savory, and glasswort (*Salicornia*)—predominate. These plants are essential for the stability of the salty soil and provide habitat for many animals. The park is also an important refuge for birds, with over 270 species nesting or resting there. Particularly important are species such as the tern, the little ringed plover, and the common redshank, which either nest in the area or stop there during



Figure 11: Sečovlje salt plant



Figure 12: Wooden tool for gathering salt

migration. Among amphibians, reptiles, and mammals, we find species typical of Mediterranean wetlands, such as the beewolf (*Philanthus triangulum*), the European pond turtle, and the otter. The marine and wetland ecosystems of the park support numerous invertebrates, including endangered species of crustaceans and mollusks.

The park's biodiversity plays a vital role in maintaining natural balance and serves as a genetic reservoir for rare and endangered species. Protecting these species is essential for the sustainable development of the park, as well as for educational, scientific, and tourism activities in the region.



Figure 13: Sečovelje salt plant

ROCKS

The karst landscape along the Slovenian coast is a natural phenomenon strongly shaped by the Dragonja River. The region of Slovene Istria is mainly composed of limestone and flysch, two rock types typical of karst areas. Limestone was formed from the remains of marine organisms and contains a high amount of calcium carbonate (CaCO_3). These mineral binds carbon dioxide (CO_2) from the atmosphere and the sea into solid rock, making karst an important natural carbon reservoir.

Over thousands of years, the Dragonja River has helped shape the karst terrain through erosion and chemical weathering. Rainwater, enriched with dissolved CO_2 , seeps through limestone and forms sinkholes, caves, underground channels, and other karst features. In this process, a portion of atmospheric carbon dioxide becomes permanently stored in rock, contributing to the reduction of greenhouse gases in the atmosphere.

A particularly striking geological feature can be observed in Strunjan, where the collision of two lithospheric plates is clearly visible along the coast. Here, the rock layers are folded, fractured, and tilted evidence of the ongoing movement between the African and Eurasian plates. This natural "geological map" tells the story of millions of years of tectonic activity and gives the area immense scientific and natural value.

The combination of karst processes, the influence of the Dragonja River, and tectonic activity creates a remarkably diverse and dynamic landscape. The Slovene Istria region is not only a natural classroom for geology but also plays a significant role in the global climate system through carbon capture and storage.



Figure 14: Karst rock bubbling when in touch with HCl



Figure 15: Layers and layers of Karst rock

PIRAN

Piran is one of the most beautiful and colorful coastal towns in Slovenia. It lies on the far western edge of the Slovenian coastline, on a narrow peninsula that stretches into the Adriatic Sea. Its narrow streets, medieval buildings, and stunning sea views attract numerous local and international visitors every year.

The town has strong historical ties with the Republic of Venice, which are still clearly visible in its architecture – the most iconic



Figure 16: Piran

example being the Venetian House (Benečanka) located in the heart of the town. In the past, Piran was an important center of trade and marine activity. Its strategic location along the coast connected it with the wider Mediterranean world, which contributed to the development of fishing, seafaring, and commerce.

Today, tourism is the town's most important economic activity, thriving throughout the entire year. Piran is known for its rich cultural offerings, traditional cuisine, and music events. One of its central attractions is Tartini Square (Tartinijev trg), named after Giuseppe Tartini, the famous 18th-century violinist and composer who was born in Piran. His statue stands proudly in the middle of the square, and just nearby, visitors can explore Tartini's House, where he was born.

Among the town's most notable landmarks are the city walls, offering one of the best panoramic views of the town and the coastline, the Church of St. George, the Maritime Museum, Piran Aquarium, as well as many small shops and artisan boutiques that add to the charm of the old town.

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