

VALUABLE

Importance of microorganisms for water quality

EFFECTIVE

Art in natural pools enhances the quality of stay

SUSTAINABLE

Natural pools meet high standards in construction and operation

NATURAL POOL INFO



Conferences and congresses

The following organizations organize conferences and congresses on natural swimming pools that are highly recommended:

IOB – International Organization for Natural Bathing Waters
www.iob-ev.com

DGfnB – Deutsche Gesellschaft für naturnahe Badegewässer
www.dgfnb.de

ABS – Arbeitsgemeinschaft Badeseen und Schwimmteiche
www.abs-naturbad.de

DGfdB – Deutsche Gesellschaft für das Badewesen
www.dgfdb.de

Editorial

Dear Readers,

It is with great pleasure that we present the 8th edition of the annual **Natur Pool Info**. At first glance, it is immediately clear: something has changed. After many years in our familiar format, we have redesigned the layout because we believe that good content deserves a contemporary, fresh look. We hope that the new design makes reading even more enjoyable and presents the topics in a clear and lively manner.

What remains unchanged is the variety of topics presented, which clearly demonstrate **the complex and interdisciplinary nature** behind **the concept of natural** swimming pools. Likewise, the unique feature of **Natur Pool Info** remains intact: the authors are firmly rooted in their respective professional and expert fields and draw on many years of practical experience. The selected specialist articles therefore present the **latest developments and findings** from the planning, operation, and research of natural swimming pools.

In this edition of **Natur Pool Info**, we discover fascinating and informative insights:

- about microorganisms in bathing water: **leeches and zooplankton**
- about experiments to determine the turbidity equivalence per bather
- about sustainability requirements for the **planning and operation of natural swimming pools**
- about new developments in **measurement and control technology**
- about the use of surplus water from chlorine-free pools for irrigation
- about the impact of artworks and art projects involving youth participation

As diverse as these topics are, they all share a common thread: the potential for **further development of natural swimming pools is far from exhausted**, as the **innovative approaches** presented demonstrate. Just as experiments and research form the basis for innovations, sustainability requirements lead to optimizations in pool planning and construction, while the incorporation of art enhances the quality of stay in natural swimming pools.

We wish you much enjoyment in reading.

Warm regards,

Antje Kakuschke, Inga Eydeler, Imke Petersen, David Kory, Otto Hoffmann, Robin Bruns, Hannes Kurzreuther, Nina Röttgers, Sebastian Flohre, Petra Hüge, Jakob Stocker, Maren Schwacke, Leon Müller, Jenya Lübben, Jesko Braun.

Edition at a Glance

- 4 Sustainable Swimming at the Natural Pool Winsen
- 8 No Aversion to Leeches
- 10 A Zooplankton's Life
- 16 The Three Women at Naturbad Maria Einsiedel
- 18 Art in the Outdoor Pool: Photographic Art Exhibition at Strandbad Farnen
- 19 Podcast Recommendation: "Water Arts"
- 20 Where Swimming Occurs, Does Turbidity Rise?
- 23 Using Operational Water from a Chlorine-Free Pool for Irrigation
- 26 Polycontrol – The Simple Solution for the Pool
- 27 New Training Course for Pool Operation Supervision
- 28 Art in the Outdoor Pool: When Walls Tell Stories



The planning and coordination team for the natural outdoor pool in Winsen (Luhe) at the opening ceremony on May 2, 2025 (Photos © Gregor Szielasko)

POOL PRESENTATION

Sustainable Swimming at the Natural Pool Winsen

by Nina Röttgers and Sebastian Flohre, Polyplan-Kreikenbaum GmbH

After a construction phase of around 18 months and despite a fire damage to the sanitary and gastronomy building, the **natural outdoor pool in Eckermannpark in Winsen (Luhe), Germany** was able to open in May 2025. The ambitious goal of the new facility: **climate-neutral operation**.

The newly built pool has a **water surface of approximately 3,600 m²**, divided into sports, swimming, and non-swimming areas, and is designed for 35,000 visitors per season. The adjacent beach area covers 1,800 m², and water treatment is carried out using **biological purification** in accordance with FLL guidelines, employing hydro-botany as well as a Neptune filter. With a **66 kWp photovoltaic system** on the roof of the gastronomy building, a heat pump, integrated **heat recovery**, and the use of highly efficient pumps, the pool is operated in a decentralized manner.

During normal operation, an **energy surplus** is generated, which can additionally be used to power electric vehicle charging stations and charge energy storage systems. **Pool management is dynamic**: for example, the pumps for swimming operations automatically reduce performance during bad weather.

Equally important for sustainability as pool operation is the construction itself, in terms of soil and groundwater as well as the building materials used. **Higher requirements** applied in Eckermannpark due to the immediate proximity to the **protected floodplain area of the Luhe**, whose **groundwater regime must not be affected** by construction measures. To ensure this, the water level of the pools was raised above the terrain level, and excavation depths were minimized.

In **selecting building materials** for the design of the pools and outdoor areas, particular attention was paid to minimizing the use of concrete, a very energy-intensive material. The approach aimed to set new technical standards in construction; however, it could not be implemented in all areas—for example, the pool floor construction with foam glass panels, which were tested as an ecological alternative to concrete during the planning phase. Looking ahead, the field of construction technology holds significant potential for optimizations and savings in resources and environmentally relevant emissions through the further development of ecological building materials.

An equally important aspect of sustainability is the **integration of rainwater**. With the goal of contributing to **flood protection** and avoiding additional load on the drainage system of the city of Winsen (Luhe), a **rainwater management concept** was implemented. This concept provides for comprehensive retention and infiltration of rainwater on the property while complying with all water protection area regulations. A special role is played by the so-called Weiherbogen—the upgraded existing pond from the former garden show park—which now functions as a retention basin during heavy rainfall and flooding events.



All photos © Gregor Szielasko

Not only were the pool construction and water technology at the Naturfreibad Winsen optimized with sustainability in mind, but the **building structure** also followed this principle. The functional building, housing the gastronomy area, sanitary facilities, and operational rooms, not only looks innovative thanks to its circular design and floating roof but is also **resource-efficient**, constructed using timber.

A special feature is that outside the swimming season, **the building can be heated using heat pumps that extract warmth from the bathing lake**. This allows a portion of the energy required for year-round use of the building to be generated directly on-site. Due to the fire damage to the functional building, an assessment of the actual energy generation and demand will only be possible after the 2026 season.

Finally, a notable recognition of the project should be mentioned: **the Naturfreibad Winsen was selected as a “Best Practice” example by the federal program “Adaptation of Urban and Rural Areas to Climate Change.”**



No Aversion to Leeches

by Antje Kakuschke and Inga Eydeler, KLS Gewässerschutz GmbH

A natural outdoor pool is a habitat for many benthic (substrate-dwelling) organisms. They can be found on the walls, on the bottom, or in the filtration systems. Some of these organisms regularly cause discomfort for swimmers, even though most of them are harmless to humans and have significant ecological importance. This group includes invertebrates such as sponges, cnidarians, bryozoans, flatworms, nematodes, oligochaetes, leeches, snails, mussels, crustaceans, water bugs, water beetles, as well as the larval stages of many insect groups. Their natural habitat is freshwater ecosystems, and therefore natural swimming pools as well. However, in pools, they often encounter skeptical swimmers. In particular, leeches frequently meet with aversion, which is why this animal group will be examined in more detail here.

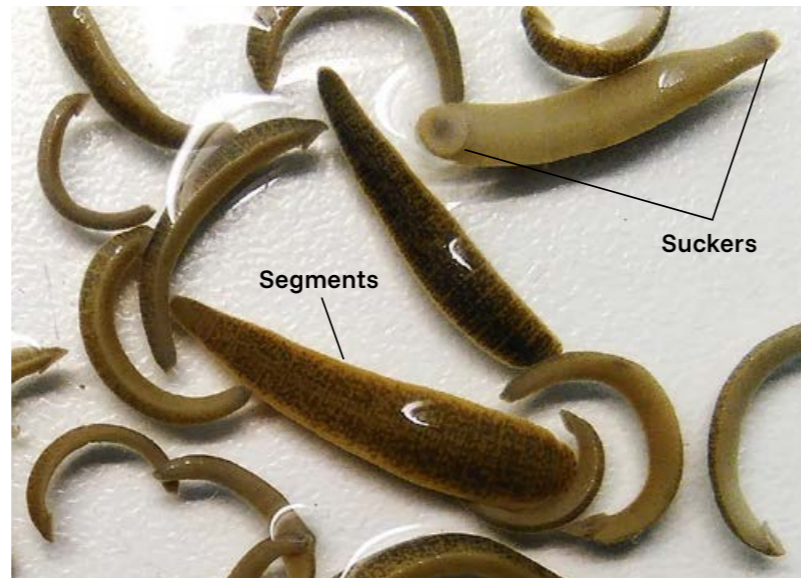


Figure 1: Eight-Eyed Jawless Leech from a Natural Swimming Pool (Photo © Inga Eydeler)

Leeches, like earthworms, belong to the phylum of segmented worms (*Annelida*). Of the approximately 300 species, most live in freshwater. They are characterized by 33 segments, some of which in the anterior third of the body are swollen to form a “girdle.” Leeches have two suckers, one at the front and one at the rear, which allow them to move in a stretching, inchworm-like manner. Using their strong longitudinal muscles, however, they can also swim quickly through open water.

The 25 native species in our region can be grouped into four leech families:

- Fish leeches (*Piscicolidae*): attach themselves to fish,
- Leaf and flat leeches (*Glossiphoniidae*): possess a protrusible sucking proboscis,
- Jawless leeches (*Erpobdellidae*): lack both a proboscis and toothed jaws, and
- Jawed leeches (*Hirudinidae*): have three toothed jaw plates in the pharynx.

All leeches feed exclusively on animal matter: they either live as predators on insect larvae, worms, and other small animals, or they suck blood. In natural outdoor pools, several species of leeches have been found, but none of them were blood-feeding on vertebrates.

For example, in several natural swimming pools, the **eight-eyed jawless leech** *Erpobdella octoculata*, also known as the “Rollegel,” is frequently observed (Figure 1). The Rollegel belongs to the jawless leeches and is one of the most common leech species in Germany. It inhabits both still and flowing waters of all kinds, typically found on stones, branches, or aquatic plants.

The Rollegel is an excellent swimmer and predator. It feeds on various insect larvae (e.g., midges, caddisflies), small crustaceans (e.g., water lice), worms, and detritus (dead organic material). Its feeding activity is highest at night. The Rollegel itself is preyed upon by fish and water birds.



Figure 2 (left and below): Two-Eyed Flat Leeches from a Natural Swimming Pool (Photos © Inga Eydeler)



The Rollegel measures between 30 and 70 mm in length. It has two suckers: the posterior one is noticeably larger than the anterior one, though neither is wider than the body. Its body is relatively soft, and when threatened, it secretes a large amount of mucus.

For humans, they are completely harmless. It may occasionally happen that a leech attaches to a swimmer’s skin, mistaking it for a stone, branch, or plant. Leeches can be easily removed by hand.

Another leech commonly found in natural swimming pools is the **two-eyed flat leech** *Helobdella stagnalis* (Figure 2). At rest, it has a flat, broad body. The head, with its anterior sucker, is barely distinguishable from the body. This species belongs to the proboscis leeches. However, it does not feed on vertebrates, only on small midge larvae, snails, and other invertebrates. These leeches live among the roots of alder and willow trees, on underwater plants, and on stones.

Unlike other leeches, flat leeches exhibit parental care. Fertilized eggs are laid in a cocoon, which the leech carries with it. After a few days, small leeches hatch from the cocoon and attach to the mother’s posterior sucker, being carried around in this way. The juveniles feed on the small animals caught by the mother and grow quickly. Flat leeches reach up to 12 mm in length, making them significantly smaller than the Rollegel.

In Europe, the **medicinal leech** *Hirudo medicinalis* is the only species that may feed on humans (Figure 3). Its occurrence in a natural swimming pool has not yet been recorded. Also known simply as the “blood leech,” it belongs to the jawed leeches and attaches to the skin, biting it with sharp calcified teeth. Salivary glands between the jaws secrete, among other substances, anticoagulants. In about 30 to 60 minutes, a leech can consume up to five times its body weight in blood. Once fully



Figure 3: Medicinal Leech (Photo © Holger Krisp, Wikipedia)

engorged, the leech detaches on its own. The ingested blood is preserved in the leech’s body with the help of specialized gut bacteria, allowing the leech to go without food for up to a year.

For centuries, medicinal leeches have been used for medical purposes. Adults can reach up to 150 mm in length when fully stretched, making them significantly larger than the species mentioned above.

Further Reading

Spieker & Eydeler (2005) What Lives in the Natural Swimming Pond – Part 3: Zoobenthos: Crustaceans, Snails, Mussels, Leeches, in DER SCHWIMMTEICH 2/2005
Spieker & Eydeler (2005) What Lives in the Natural Swimming Pond – Part 4: Zoobenthos: Sponges, Cnidarians, Bryozoans, in DER SCHWIMMTEICH 3/2005

BIOLOGY

Zooplankton: From the Life of the Floating Little Animals

by Imke Petersen, KLS Gewässerschutz GmbH

Rotifers, water fleas, and copepods are zooplankton commonly found in natural swimming pools. They primarily feed by filtering phytoplankton and bacteria from the pool water. Their lifespan ranges from a few days to several months. Rotifers and water fleas can reproduce rapidly through parthenogenesis, while copepods typically reproduce sexually. By producing resting eggs, these organisms can also survive frost and dry conditions.

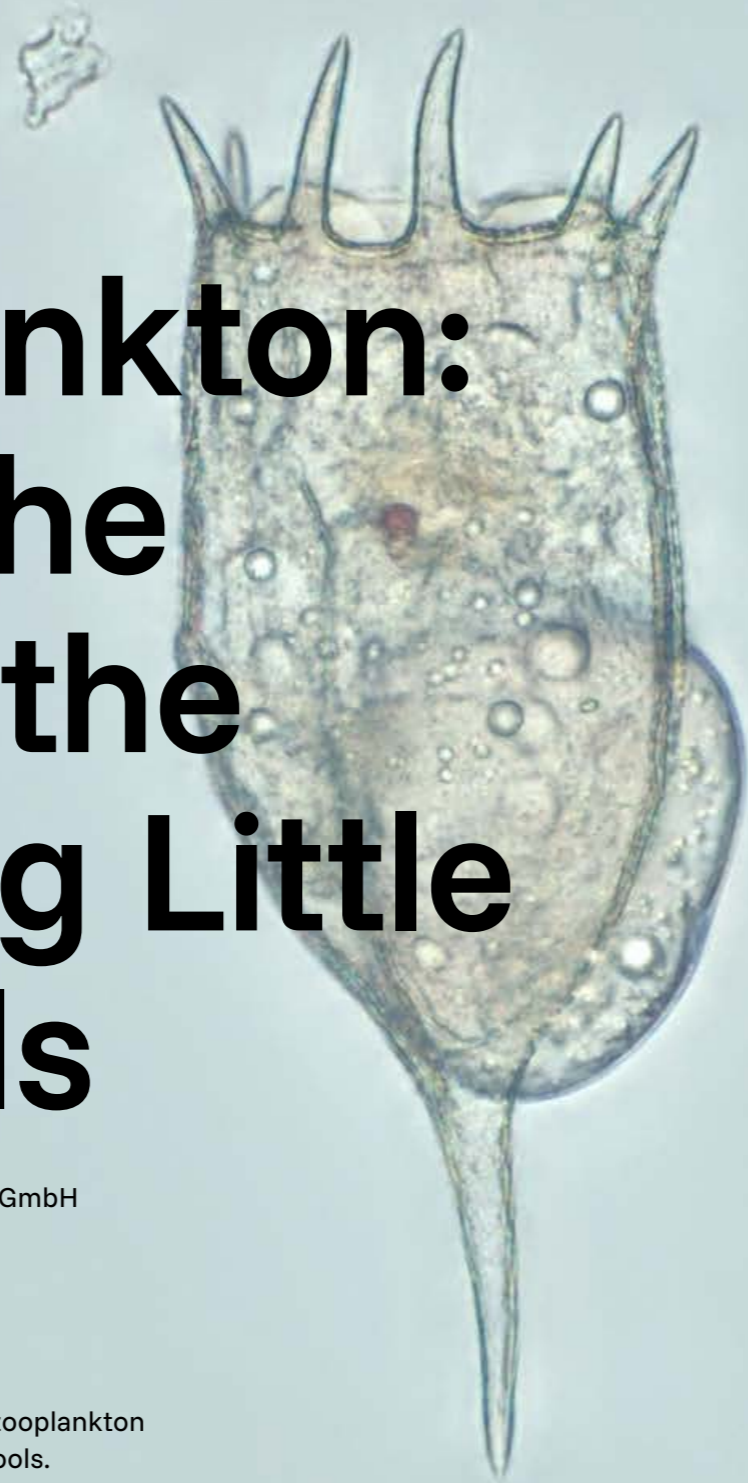


Figure 1 (left): The rotifer *Keratella cochlearis* with an egg. In the middle of the body, the red eyespot is visible. The body is enclosed by a shell, which is equipped with several spines at the front and one large spine at the rear.
(© Photo KLS Gewässerschutz)

Zooplankton organisms are small animals that float in the water column and are carried along by currents because they are too small or immobile to resist them. They often feed on phytoplankton (microscopic algae that also float in the water column), bacteria, and even other smaller zooplankton. Some species are cannibalistic and may eat each other in extreme situations.

In natural swimming pools, zooplankton plays an important role in water purification, as it removes phytoplankton and bacteria from the water. This increases water clarity and reduces microbial load (see Archiv des Badewesens 03/2010, p. 163 ff.: “Microbe Elimination by Zooplankton”).

The forms and lifestyles of zooplankton are highly diverse. There are tiny, single-celled organisms, such as ciliates, flagellates, and amoeboid forms, as well as larger multicellular animals—in freshwater, particularly water fleas (Cladocera), rotifers (Rotatoria), and copepods (Copepoda). These three larger groups are especially important for water purification due to their greater filtration capacity and will be examined in more detail below.

Portrait of a Rotifer

A rotifer has a ciliated wheel organ at its anterior end, which is a crown of cilia surrounding the mouth. By beating these cilia in a wave-like motion or using other sophisticated movements, the rotifer directs fine particles toward its throat, where they then move into the stomach. Depending on its size and species, a rotifer can filter approximately 0.01 to 16 ml of water per day while searching for food. The wheel organ also aids in locomotion. The body is very flexible and, in some species, is enclosed in a protective shell into which it can retract. The body ends in a foot. Many rotifers have one or two eyespots that allow them to sense light. In the water column, mostly female rotifers are encountered, reproducing through parthenogenesis. During parthenogenesis, the females produce eggs that contain an identical complete set of genetic material as the mother and are not fertilized. The eggs hatch into small

clones of the female. This method of reproduction is very time-efficient, allowing populations to increase rapidly within a short period. Under favorable water temperatures, females can produce one or more eggs every few hours, often incubating them inside their body or carrying them externally. The eggs hatch into small rotifers within about a day, and these juveniles can become reproductively active within just a few hours or days. The lifespan of rotifers is usually a few days to a few weeks. At irregular intervals—often triggered by high population density—many species switch to sexual reproduction. Females produce eggs with only a single set of chromosomes. Unfertilized eggs develop into males, which then inject sperm into the females’ body to fertilize the eggs. These fertilized eggs become resting eggs. Resting eggs sink to the bottom of the water body and can survive unfavorable conditions such as frost or drought. When conditions improve, new female rotifers hatch from these eggs. Reproduction through fertilized resting eggs also increases the genetic diversity of the population, enhancing its ability to adapt to changing environmental conditions. Resting eggs are an important dispersal mechanism, as they can be transported from one body of water to another via dust, runoff water, currents, or by animal feces, feathers, and fur.

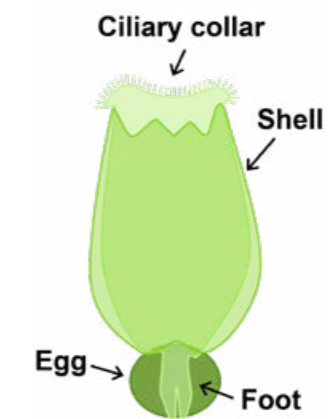


Figure 2:
Body structure of a rotifer
(© Diagram Imke Petersen, KLS Gewässerschutz)

Portrait of a Water Flea

Water fleas belong to the crustaceans and display several typical features: they have **two pairs of antennae at the head**, possess gills, and have a distinctive segmentation of their legs. One pair of antennae is highly developed and functions as **swimming appendages** for locomotion. At the front of the body, they have many small **leaf-like appendages** that move a water current to direct food particles toward the mouth. Depending on their size and species, they can filter approximately **0.1 to 66 ml of water per day**. A few species are predatory, feeding on rotifers and small crustaceans that they grasp. Under severe food scarcity, they may even consume their own juveniles or eggs. The body of water fleas is enclosed by a **front-open shell (carapace)**. They store their eggs in a brood chamber at the back of the body, protected by the carapace. Eggs develop in the brood chamber until small juveniles hatch and are released into the open water. As they grow, water fleas molt several times. Water fleas have a **compound eye**, which allows them to detect fast movements, and sometimes an additional small **nauplius eye** that helps them perceive light intensity and direction. Just like rotifers, water fleas resort to efficient **parthenogenesis** under favorable conditions. Most of the population consists of females producing clones. Depending on the species, a female can produce **one to about a hundred eggs**

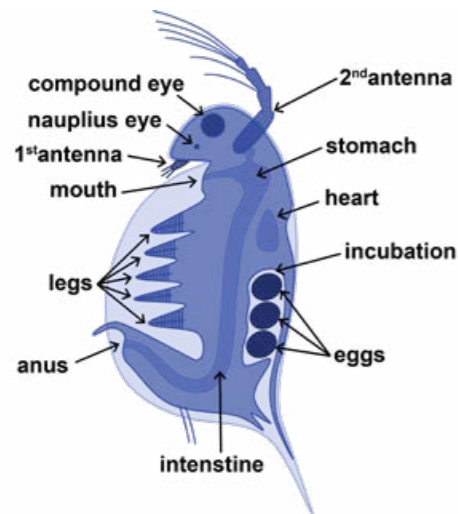


Figure 3: Body Structure of a Water Flea
(© Diagram Imke Petersen, KLS Gewässerschutz)

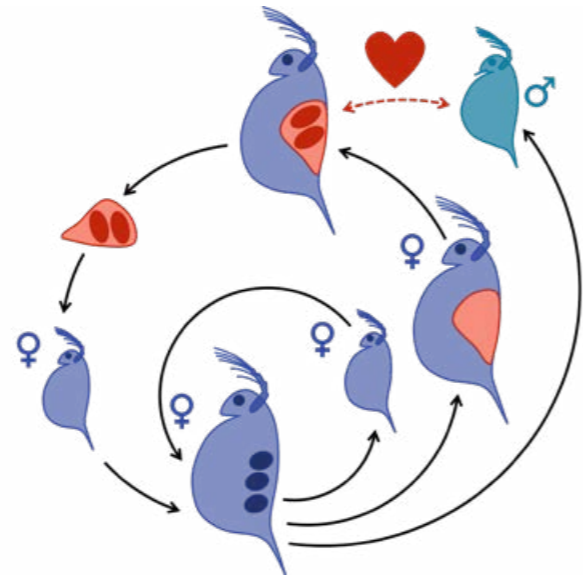


Figure 5: Life Cycle of a Water Flea
(© Diagram Imke Petersen, KLS Gewässerschutz)

every few days under optimal environmental conditions. These eggs develop into reproductively capable offspring within a few days. The **lifespan** of a water flea varies: for smaller species, it is typically **one to two weeks**, while larger species may live for a few months under favorable conditions. When environmental conditions worsen, males are produced, and **sexual reproduction** occurs, leading to the formation of **resting eggs**. These eggs are often enclosed in a thick, resistant shell called an **“ephippium”** (Latin for “saddle”). Under good conditions, female water fleas usually hatch from these resting eggs. In temperate regions, many water fleas overwinter in the form of resting eggs. Resting eggs also serve as an important **dispersal mechanism**, allowing water fleas to colonize new habitats.



Figure 4 (right): Water fleas of the genus *Daphnia* at different reproductive stages. a) *Daphnia* embryos in the incubation chamber b) *Daphnia* has produced resting eggs in an ephippium
(© Photos KLS Gewässerschutz)

Portrait of a Copepod

Copepods are also **crustaceans** and are widespread in both freshwater and saltwater. They do not have a compound eye but often possess a **well-developed nauplius eye**, which allows them to detect light direction and intensity. The **first pair of antennae** is highly developed, forming long suspension appendages equipped with tactile and olfactory sensors. In males, these antennae transform into **grasping organs** used to hold females during mating. The **thoracic legs** serve for locomotion and for directing food to the mouth, where it is captured and shredded by **mouthparts**. Many copepods feed by filtering algae, bacteria, and particles from the water, and can filter approximately **0.5 to 130 ml of water per day** depending on the species. Some species are additionally **predatory**, feeding on rotifers and ciliates. **Cannibalism** has also been observed, where adult copepods can drastically reduce the number of nauplius larvae or eggs.

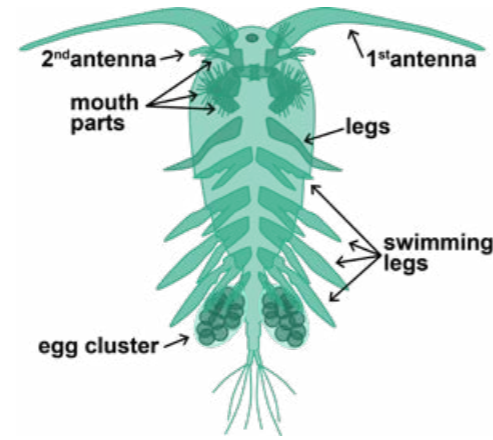


Figure 6: Body Structure of a Copepod
(© Diagram Imke Petersen, KLS Gewässerschutz)

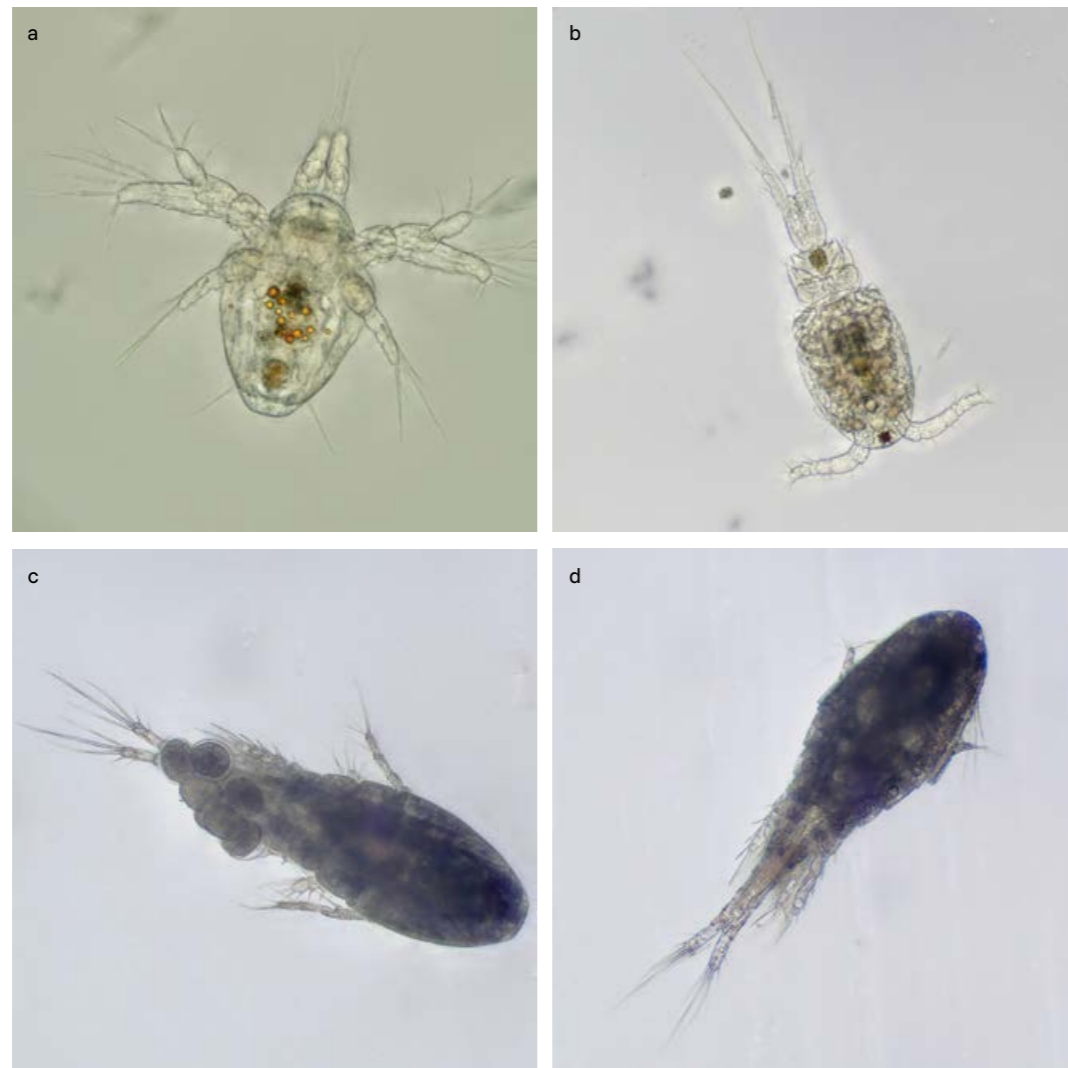


Figure 7 (left): Different developmental stages of a copepod: a) Nauplius larva, b) Copepodid stage, c) Adult female with an egg sac, d) Adult male with folded antennae transformed into a grasping organ (© Photos KLS Gewässerschutz)

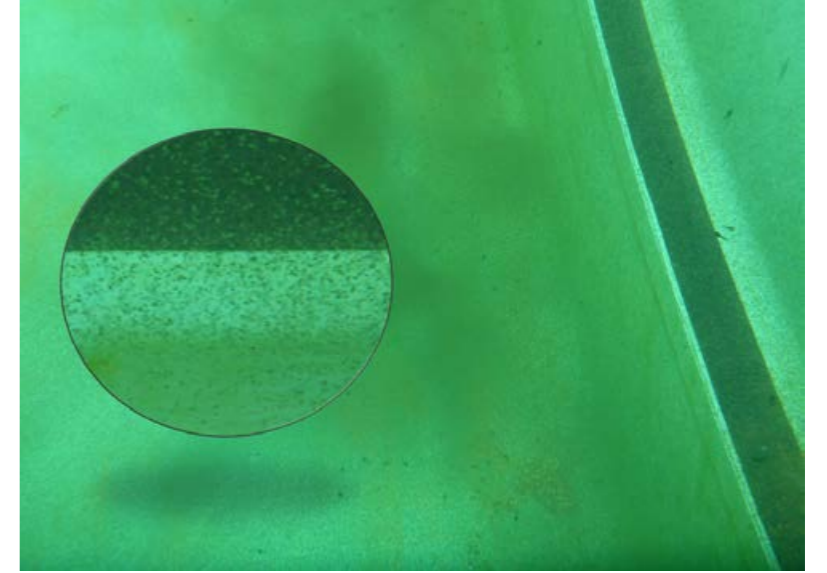


Figure 8: Large zooplankton swarm in the swimming pool of a natural swimming facility (© Photo KLS Gewässerschutz)

Copepods reproduce almost exclusively via **sexual reproduction**. Typically, both males and females are present. Development begins with an **egg**, from which a **nauplius larva** hatches. This larval stage is characteristic of crustaceans. The nauplius molts several times as it grows and develops into a **copepodid**, the next larval stage, which already resembles the adult form. After multiple molts, **adult males and females** emerge. Development from egg to adult takes **one to several weeks**. For fertilization, the male attaches a **sperm sac** to the female, which fertilizes her eggs. After fertilization, the female produces **egg sacs**, which she carries with her. A single female can produce about **six to ten clutches** during her lifetime. Some copepod species also produce **resting eggs**, which can survive **several years of dryness**. The **life cycle** of copepods varies widely. Many species in temperate zones overwinter as resting eggs, hatch in spring, grow over the summer, and die in autumn. Others overwinter as juveniles or adults in a dormant state. Many species live only one or a few months, while some can reach up to **three years** if dormant stages are included.

In natural swimming pools, zooplankton can be observed in different areas, for example in wetland filters, among filamentous algae on pool walls, or sometimes in large **swarms in open water**.

Because of their crucial role in **regulating phytoplankton density**—thus improving water clarity—and their in situ disinfection of pathogens through filtration directly at the bathers, zooplankton are an important parameter for **ecological monitoring** of natural swimming pools and must be regularly studied.

Further Reading

1. Eydeler, I., Spieker, J., 2010. Pathogen elimination by zooplankton – Water purification in swimming and bathing ponds. *Archiv des Badewesens*: 03/2010, pp. 167 ff.
2. Petersen, I., Kakuschke, A., 2025. Between pumps and plankton: Long-term study of zooplankton in pools with biological water treatment. *Archiv des Badewesens*: 07/2025, pp. 472 ff.

The Three Women at the Maria Einsiedel Natural Pool

by Dr. Antje Kakuschke, KLS Gewässerschutz GmbH

The Maria Einsiedel natural swimming pool, with its idyllic location near the Isar River and its beautiful lawns with mature trees, is a unique facility and the oldest of its kind in Munich. The pool also serves as a small sculpture park, as three “sirens” attract art enthusiasts to the park-like swimming area.

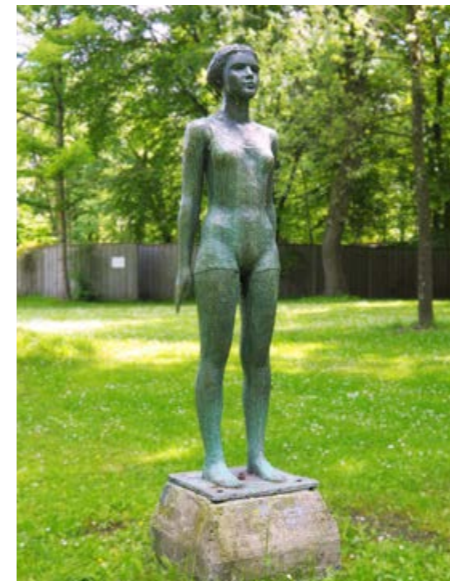
In the series “Art in Baths,” three sculptures will be presented today at the Maria Einsiedel natural outdoor pool, each completely different from the others. Three depictions of women from various art periods span a temporal arc from classical antiquity to contemporary art. Even though there is not much information available about the sculptures, they still point to a long history of the bath. The original bathing facility dates back to 1890 and at that time belonged to the then-independent municipality of Thalkirchen. With the first structural expansions and new buildings in the spring of 1899, the bath was reopened on July 8, 1899, as a municipal bathing facility. Since 2008, “Maria Einsiedel” has been Munich’s first natural outdoor pool.

On the sunbathing lawn to the left of the entrance area, the first sculpture can be found (Figure 1). It recalls an ancient depiction of a woman. The nude beauty sits on a pedestal, one hand touching her head, the other her neck. She appears relaxed, yet somewhat contemplative. Her posture and nudity resemble representations of Aphrodite, the Greek goddess of love and beauty. Such sculptures were typical of the romanticized landscape designs of the 19th century and served as decorative elements. Unfortunately, it is not known



Figure 2 (left): Female sculpture by the sculptor Emil Julius Epple, 1936, located in the nudist area of the pool.

Figure 3 (below): Bronze sculpture of a young woman by the sculptor Hans Stangl.



when or by whom the sculpture was created, nor how it came to the natural outdoor pool. In any case, the relaxed demeanor of the woman is a fitting characterization of a stay at the pool.

In 1912, a women’s swimming area was established at the Maria Einsiedel natural pool. To this day, in addition to a mixed nudist area, there is also a ladies-only nudist section. Here, one finds the second female sculpture, also a nude representation (Figure 2).

On the pedestal of this figure is the inscription “E. Epple, 1936.” It is very likely that the sculpture was created by the German-Dutch sculptor Emil Julius Epple (1877–1948). Epple attended the Stuttgart Art School before transferring in April 1896 to the Academy of Fine Arts in Munich. A longer stay in Rome shaped his preference for classical art treasures. His sculpture, therefore, also resembles ancient depictions of women. With one arm raised and the hand resting at the nape of her neck, the woman appears relaxed, slightly introspective, yet wears a smile on her face. Completely different from the first-mentioned sculpture is the rough, scarred surface texture.

Epple was known for his “Direct Carving” technique, in which the sculptor works directly into the stone with hammer and chisel, without a prior artistic model. Traces of stone carving are clearly visible on the sculpture. After Hitler’s rise to power and the ensuing changes in Germany, Epple left Munich in 1937 and moved to the Netherlands, where he died in The Hague in 1948.

To the right of the main entrance, one finds the third female sculpture of the natural outdoor pool (Figure 3). It depicts a young girl wearing a swimsuit. The bronze statue was created by Hans Stangl (1888–1963), a German sculptor and academy professor. He studied from 1916 at the Academy of Fine Arts in Munich and later with the sculptor Ignatius Taschner in Berlin. From 1939 to 1943, he directed the German Academy in Rome. The girl depicted may be a swimmer. Her body tension and focused posture suggest that she is standing on a starting block, just about to dive into the water. Perhaps she is taking part in a competition. In any case, it is a very fitting motif for a pool with a 50-meter swimming lane, where one can leisurely swim laps.

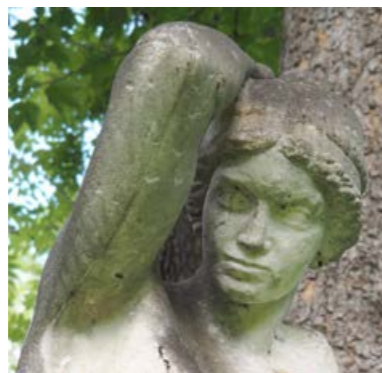
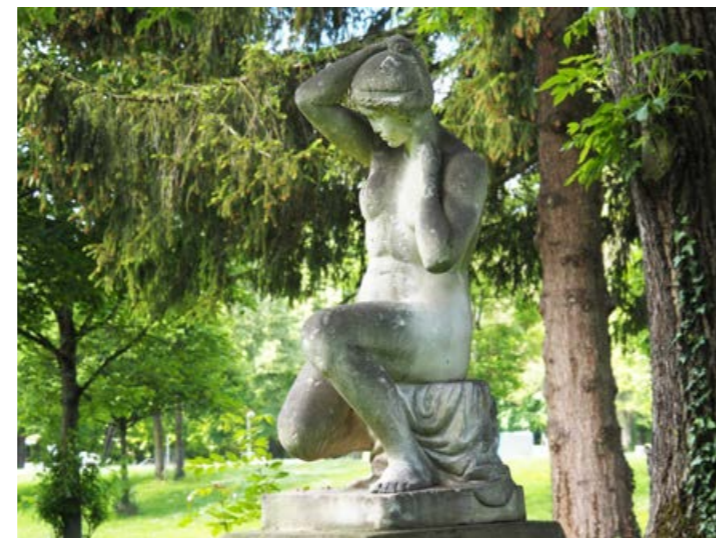


Figure 1: Sculpture of a nude beauty, reminiscent of depictions of Aphrodite. (All photos © Antje Kakuschke)



ART IN NATURAL SWIMMING POOLS

Photographic Art Exhibition at Strandbad Farmsen

by Dr. Antje Kakuschke, KLS Gewässerschutz GmbH

The exhibition “The Invisible Life in the Natural Outdoor Pool” will open in spring 2026 in Hamburg on the grounds of the Verein Strandbad Farmsen e. V. Using large-format, microscopic art photographs, it illustrates the diversity of plankton organisms found in the waters of a natural pool and highlights their importance for the functioning of the ecosystem.

The thoughtfully designed exhibition vividly conveys the diversity of these tiny creatures as well as their ecological significance for a nature-oriented swimming experience. It aims to show how extraordinarily important and aesthetically fascinating this micro-universe is. However, this beauty only becomes visible under a microscope and thus remains hidden to most people. Both aspects—the ecological importance and the aesthetic appeal of these tiny plankton organisms—will be made understandable and tangible for visitors through an information panel and 20 large-format, artistic photographs, displayed outdoors on the pool grounds. QR codes will link to a website with scientific information about the featured organisms. The “informed swimmer” will then appreciate the value of chlorine-free swimming and be motivated to help preserve it.

The exhibition will be open throughout the 2026 swimming season. If there is interest, it can also travel to other natural outdoor pools. For inquiries, please contact: antje.kakuschke@kls-gewaesserschutz.de

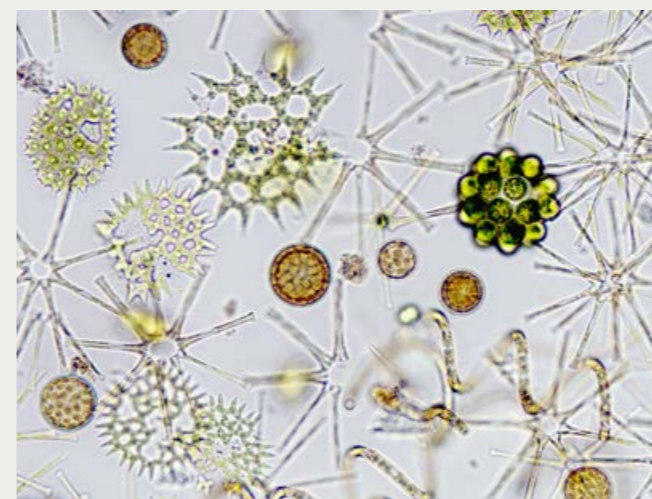


Figure 1 (left and above): Microscopic photographs of phytoplankton organisms for the photographic exhibition “The Invisible Life in the Natural Outdoor Pool” (Photos © KLS Gewässerschutz).

PODCAST RECOMMENDATION

Water Arts

The “Wasserkünste” podcast brings together the worlds of art, culture, and nature. The audio channel seeks out inspiration, exciting stories, and adventures. Through conversations with engineers, biologists, artists, and entrepreneurs, listeners are immersed in the world of people who are fascinated by water in all its forms.



Figure 1: Podcast Wasserkünste (Photo © Jörg Baumhauer & Antje Kakuschke, mural design by the artist Alfred Hesse).

In the episode “Addicted to Ice and the Forgotten – Expeditions into the Ice and Old Baths,” art and bathing culture meet a biologist and photographer. In the interview between Jörg Baumhauer from the podcast channel and Dr. Antje Kakuschke from KLS Gewässerschutz GmbH, exciting topics related to the ecology of water bodies—from northern Germany to the cold regions of the Arctic and Antarctic—are discussed. A key point during the conversations natural outdoor swimming pools with their microscopically small but important phytoplankton and zooplankton. We hear about the impressive forms and functions of various plankton groups and KLS’s efforts to combine this biological diversity with an artistic approach—an outdoor photo exhibition featuring the planktonic minuscule organisms in a natural swimming pool. Photography and art are another focus of the discussion, whether it involves searching for motifs in abandoned, ruined swimming pools, documenting artworks in indoor and outdoor pools, or the search for the lost mural by artist Alfred Hesse (see Natural Pool Info 2024). 40 minutes of excitement are guaranteed. For anyone who has become curious:



<https://wasserkuenste.letscast.fm/episode/wk-024-suechtig-nach-kaelte-und-vergessen-interview-mit-dr-antje-kakuschke>

Where people swim, the turbidity increases?

by Team Polyplan-Kreikenbaum GmbH

Rising turbidity values on warm days with high visitor numbers are familiar to many bathing facilities from practical experience. Bathers contribute additional nutrients, which promote algae and general phytoplankton growth, leading to increased water turbidity. So far, the causal relationship seems logical and seemingly straightforward. To make better predictions for optimizing bath operations and facility management, this relationship was studied in various pools and swimming ponds supervised by Polyplan-Kreikenbaum. The goal was to develop a turbidity equivalent that describes the average turbidity caused per person.

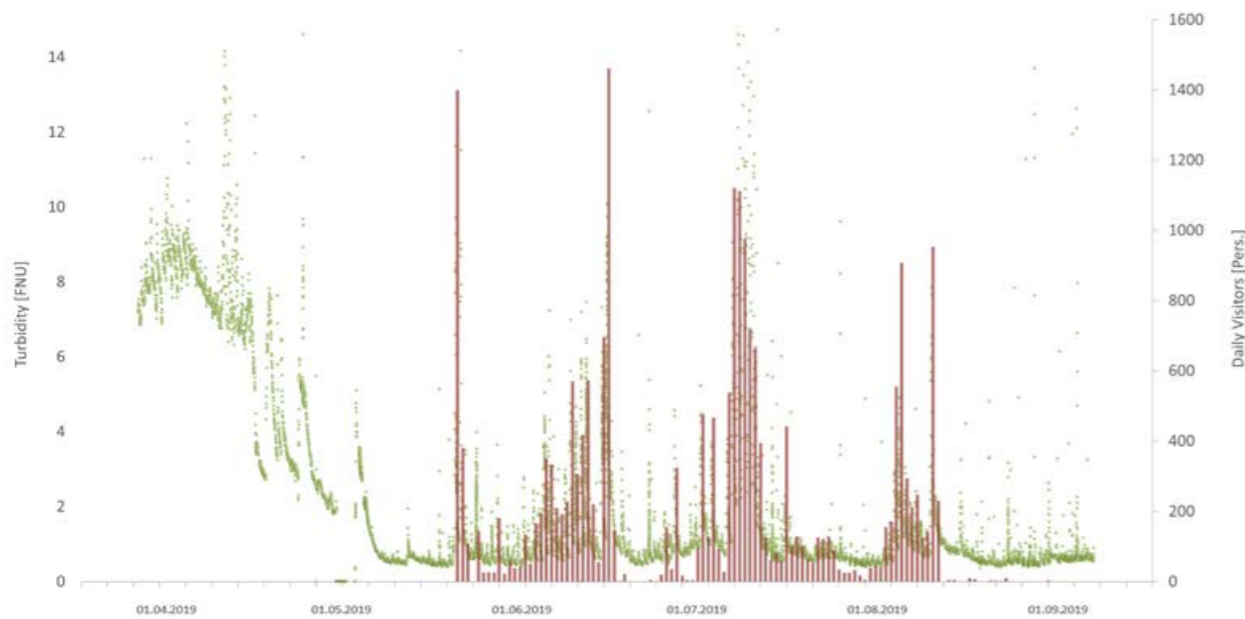


Figure 1: Turbidity and visitor numbers in one of the studied pools, shown as an example of the raw data used.



Figure 2: Annual turbidity equivalents: each bar represents the yearly average of the summed daily mean values per total number of visitors, with one bar corresponding to a project in a given year. Some projects appear multiple times across different years. The respective standard deviation is indicated by the gray error bars.

Turbidity Measurement in Bathing Operations

Water turbidity is one of the most important parameters in the operation of pools with biological water treatment. A high proportion of suspended solids and algae can not only diminish the enjoyment of the bathing experience but, more importantly, endanger water rescue in critical situations. Therefore, in bathing operations, turbidity is recorded and documented daily using **Secchi disk measurements** to determine water visibility. Many facilities also have **permanently installed turbidity probes** that continuously transmit measurement signals to the system control, enabling dynamic operation adapted to the turbidity levels. The measurement principle of these probes is based on nephelometry, an **optical method** that detects the scattering of incident light by particles in the water. The measured value is expressed in FNU (Formazine Nephelometric Units).

Data Basis and Calculation of the Turbidity Equivalent

To investigate the relationship between visitor numbers and turbidity values, ten pools supervised by Polyplan-Kreikenbaum were analyzed. The prerequisites were the **presence of a turbidity probe and regularly recorded visitor numbers**. The data were taken from the database of the operational management and monitoring software **DANA2.0** and spanned between 1 and 7 years, depending on varying usage and recording periods (Figure 1).

To create a **valid data basis**, outlier values with turbidity greater than 10 FNU and **general measurement errors** were excluded from the calculation after being compared with photos and on-site Secchi disk measurements. Days without recorded visitor numbers or simply without bathers were also excluded, as were days without turbidity data due to technical failures of the probe.

From the processed data, the **daily turbidity per person** was first calculated. For this purpose, the arithmetic mean of the turbidity values over 24 hours was used. From the summed daily mean values, an annual mean value was calculated, representing the **annual turbidity equivalent** (Figure 2).

Looking at the results, it is noticeable that the year- and project-specific turbidity equivalents range approximately **between 0.02 and 0.6**, spanning an entire order of magnitude. The standard deviation of the raw data averaged 0.37 and varied widely between 0.03 and 1.5, indicating a high heterogeneity of individual values as well as a variable and **widely scattered data basis**. If the mean of all annual turbidity equivalents is used as a plausibility check, the resulting turbidity values do not fall within a plausible range of what would be expected even in pools with high turbidity. But why is this the case?

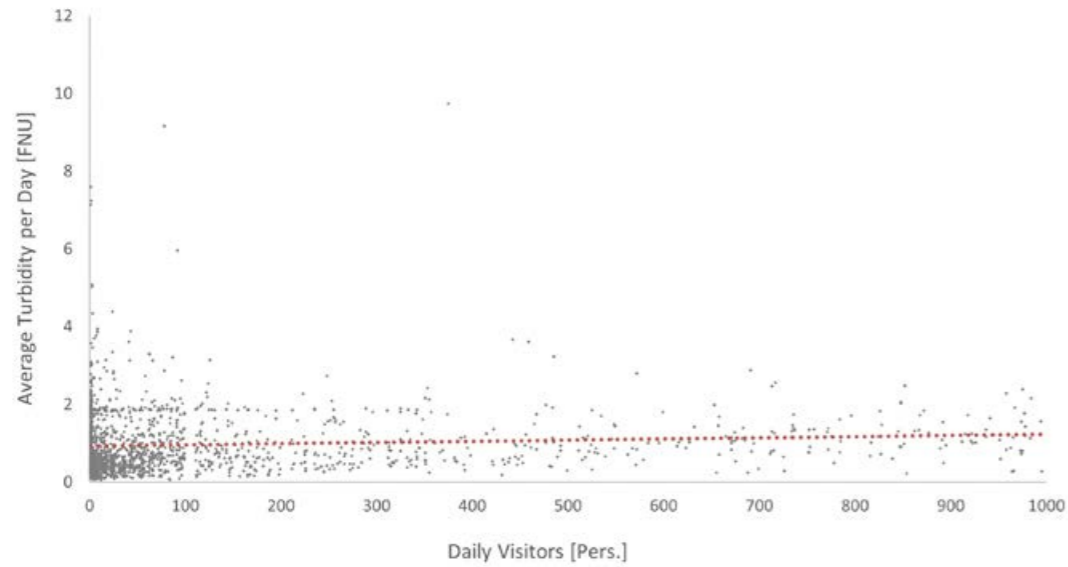


Figure 3: Correlation between the daily mean turbidity values and the number of visitors in all studied pools.

More Bathers – Cloudier Water?

Looking at the data and considering only the relationship between average turbidity and daily visitor numbers, the clear correlation one might initially expect does not appear. The trend line in Figure 3 shows only a slight positive trend. In most pools, there are only a few peak days per season when the nominal visitor numbers are reached. As a result, the majority of data points—and thus most of the erroneous measurements below 10 FNU—fall within the range of lower visitor numbers. This unequal data distribution amplifies the influence of measurement errors and strongly affects the correlation between turbidity values and visitor numbers (Figure 3).

To reduce the impact of individual peak values, the calculation of annual turbidity equivalents was also performed using daily minima instead of daily means. For this, the mean of the ten consecutive minimum values of the daily turbidity data was calculated; however, no significant qualitative difference in the results could be observed.

Another reason for the ultimately limited explanatory power of the results is the partially inaccurate measurements from the turbidity probes. Contamination from deposits and biofilm, or the obscuring of the probe's measurement window by larger particles, can distort the turbidity readings. Therefore, turbidity probes should be cleaned regularly, either automatically or manually. Depending on the installation conditions and water quality, however, measurement values may still show occasional falsely elevated spikes or increasing values in the period before cleaning.

Other influences on water turbidity—such as annual climate and weather conditions, operational procedures and cleaning intensity, coagulant dosing, and the inherently different baseline turbidity levels at each location—are not accounted for in the visitor-specific

turbidity equivalent. The assumption was that most of these pool-specific influencing factors would balance out across the full dataset, but their exact impact cannot be precisely quantified. Due to this mono-causal, yet in this case necessary approach, the variability of the turbidity data has an especially strong influence.

Conclusion

In summary, visitor numbers do not have such a strong impact on turbidity values that a single, uniform turbidity equivalent could be derived for all pools and swimming ponds based on this relationship alone. While the expected correlation can be observed in the data, the influence of other factors on turbidity, along with partially erroneous measurements and the highly uneven distribution of visitor numbers, cannot be easily removed from the dataset. A positive interpretation of the results is that the pools studied generally function as intended: system controls dynamically adjust operations to maintain the lowest possible turbidity, even on days with high visitor numbers. Otherwise, as is often the case in research, no (definitive) result is also a result.

Feasible?

FEASIBILITY STUDY

Use of pool water from a chlorine-free pool for irrigation of green spaces

by Nina Röttgers, Polyplan-Kreikenbaum GmbH and Juls Klomfaß, oikotec

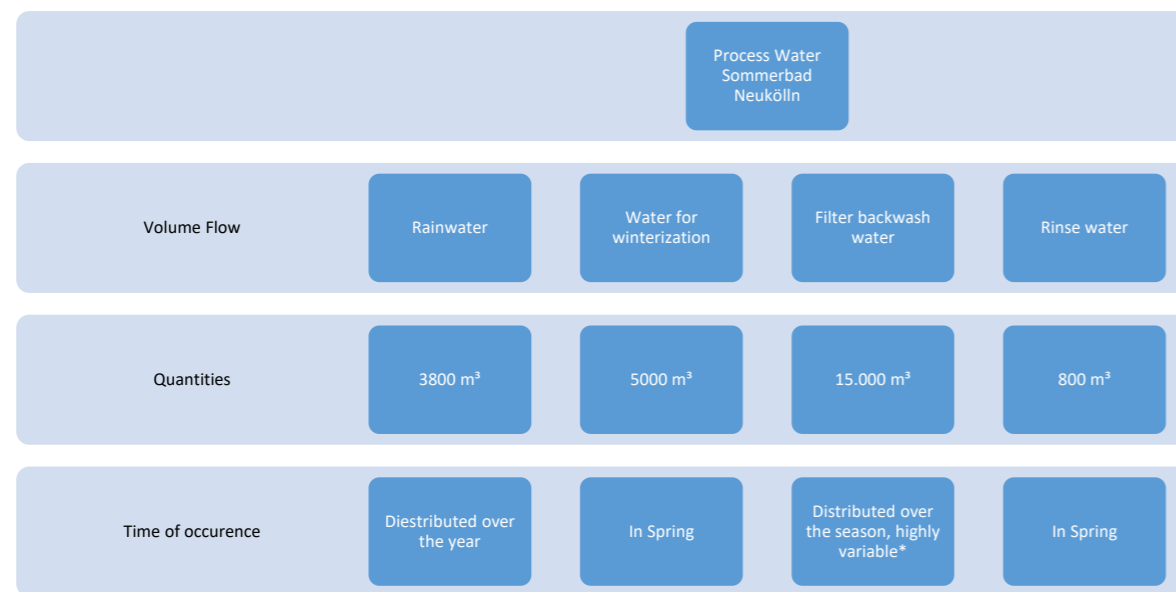
The use of water from the operation of a conventional outdoor pool for irrigating green spaces may seem somewhat unusual in Natural Pool Info. However, the significant potential for water savings and the complex questions regarding regulatory approval are likely of interest to many operators. At the time of the feasibility study, no chlorine-treated pools could be identified where discharged operational water was permanently used for irrigation of green areas. The potential and possible limitations are illustrated using the example of Sommerbad Neukölln (Berlin).

Initial Situation

The green area “Hasenheide” in the Neukölln district of Berlin has suffered from acute water shortages for years. During the summer months, only minimal irrigation can currently be maintained, which—due to a lack of alternative options—is carried out using drinking water. As part of the “Climate-Resilient Hasenheide” project, it was investigated to what extent operational water from Sommerbad Neukölln could contribute to securing the water supply.

The outdoor pool, opened in 1951, is located in close proximity to the public park and is maintained by the Berliner Bäderbetriebe. It features a swimming pool with a diving tower and a large multi-purpose area. From pool operations, four water streams relevant for potential reuse are generated: rainwater, wintering water, filter backwash water, and rinse water. The quantities involved are shown in Figure 1. Under normal operation, these volumes are discharged into the sewage or stormwater system.

The combined volumes could potentially make a significant contribution to irrigating Hasenheide, whose annual water demand is approximately 20,000 m³. This demand could theoretically be met entirely from the pool’s operational water.



*approx. 200 m³ per Flush. During the peak season, daily; otherwise, weekly depending on occupancy.

Figure 1: Water streams from pool operations potentially suitable for use in irrigation

Water Quality Requirements

Since Sommerbad Neukölln is a chlorine-treated pool according to DIN 19643, the water contains corresponding chemical loads. In particular, AOX and chloride concentrations, as well as conductivity as an indicator for salts, must be considered with regard to its use for irrigation. Depending on the method of application, hygiene parameters may also need to be taken into account. For the intended use of operational water as irrigation water, there is no standardized approval procedure in Berlin, so all relevant requirements and limit values must first be clarified.

For assessing suitability, the limit values of DIN 19650, DIN 19684-10, as well as the TLL (2004) and the guidelines from the leaflet on groundwater use during construction projects in the State of Berlin, are used.

In addition to these requirements, it must be demonstrated that all substances hazardous to groundwater and their degradation products are removed or broken down before there is any potential entry into the groundwater. This results in limit values for any active ingredients from pesticides and biocidal products. Figure 2 shows the relevant entries into the operational water.



Figure 2: Relevant inputs from pool operations (Source: aerial photograph, Google Maps)

Suitability of Operational Water

Existing water analyses indicate that the concentrations of suspended solids (AFS), AOX, and chloride would need to be further reduced for use as irrigation water, which is considered technically feasible. In the case of wintering water, algicide is additionally used, primarily to minimize cleaning effort on the tiles. For the affected water volumes of approximately 5,000 m³, it would need to be demonstrated that, after appropriate technical treatment, no biotoxic effects remain. In this specific case study, no regulatory guidelines for implementation are known. As indicators, tests on algae, daphnia, duckweed, and luminous bacteria are proposed. For this purpose, samples of the wintering water were taken in the fourth quarter of 2025. As expected, the effect of the algicide was observed in the inhibition of algae and duckweed growth as well as effects on daphnia.

For the treatment of wintering water, the feasibility study proposes filtration using activated carbon and zeolite. The effectiveness of this measure was tested in a model experiment. While treatment with either activated carbon or zeolite alone did not sufficiently reduce toxicity to the indicator organisms, the combination of both adsorbents proved effective. The inhibitory effects on algae, daphnia, and duckweed could be largely eliminated in the model experiment. Therefore, the proposed procedure is considered fundamentally suitable for water treatment.

Conclusion and Outlook

In principle, the operational water streams from Sommerbad Neukölln could cover the irrigation needs of the Hasenheide green space. By constructing a cistern and integrating technical treatment, rainwater and backwash water could be made available while complying with existing limit values. Since the use would be of a pilot nature, intensive monitoring of the relevant parameters would initially be required. The potential use of wintering water containing algicide could not be definitively clarified regarding regulatory approval. Treatment using activated carbon and zeolite appears promising.

The feasibility study made it clear that questions of regulatory approval and authority responsibility cannot be easily resolved, although they are central to implementation. Establishing a pilot site could create a reference point to demonstrate the potential for reusing operational water from a chlorine-treated pool.

Basis: Climate-Resilient Hasenheide Feasibility Study – Use of Operational Water from Sommerbad Neukölln for Irrigation of Hasenheide
Client: SGA Neukölln

Polycontrol – The Simple Solution for Your Pool

by Petra Hüge und Jakob Stocker, PPK and Robin Bruns, Polycon GmbH

At Polyplan Kreikenbaum, we look back on a long history in measurement and control technology. Since the company was founded in 1991, we have been working on the control and operation of filtration systems for lakes and pools. We record water levels, temperatures, turbidity, and water-chemical parameters. These measurements are transmitted to our own cloud solution, **DANA 2.0**.

Depending on the requirements, systems are either operated entirely locally or send all data—including alarm management—to DANA. In this case, web-based control is also possible.

Planning and implementing measurement and control technology for public pools is always done individually. Every pool is different. Variations in hydraulic conditions, pump concepts, and fill water characteristics mean that while systems may be similar, planning is always project-specific.

Today, all our public systems are connected to **DANA 2.0**, allowing our experienced remote maintenance team to access the systems and provide tailored support and advice to customers. Pool operators can also monitor the behavior of their systems themselves. This is often very insightful and helps them better understand and learn the system. Additionally, maintenance teams can prioritize their interventions and detect faults early.

At recent IOB congresses, we have shared insights on **DANA Polycontrol and LoRa systems**, which have been successfully implemented from Canada to Lithuania in recent years. However, we have also encountered their limitations. LoRa systems, due to limited bandwidth, cannot provide a sufficiently robust and fast connection for live pump control. As sensor networks, however, they are extremely reliable and cost-efficient. **BlueConnect sensors** operate on a non-public network (Sigfox), whose coverage and availability were limited in some countries and did not allow further analysis by our measurement and control (MSR) team.

Some software solutions—often open-source systems running on microcontrollers rather than PLCs—have

proven insufficiently robust for long-term use in filtration systems. The continuous need to maintain internet-based systems at the latest security standards repeatedly led to version conflicts and connection failures. From these experiences, we have learned a great deal about the strengths and weaknesses of common software and cloud solutions.

Within our network of planners for private systems, criticism has increasingly been expressed regarding the complexity of highly individualized MSR technology and the associated costs. For this reason, since early 2024 we have been intensively developing and testing a significantly more cost-effective, standardized compact solution for small and private systems.

From March 2026, **Polycontrol and Polycontrol+**, distributed by Polycon GmbH, will be available. Further information can be found at <https://shop.polycon-gmbh.de/>. Thanks to the modular standard concept and the existing IT infrastructure for remote maintenance and DANA 2.0, costs are kept low.

The system consistently uses industrial-standard hardware and software. In a compact control cabinet (height 500 mm, width 350 mm, depth 200 mm), four load outputs and eight digital signals are available, freely configurable via a Siemens touch display.

Polycontrol+ Features and Remote Management

The **Polycontrol+** additionally includes four short-circuit-proof sensor inputs. These allow, for example, real-time control based on water levels or precise, automatic filling. This enables implementation of all scenarios for pump protection, filling, flow or water meter monitoring, and filter operation via timers or cycles.

Polycontrol is suitable for rapid sand filters, drum filters, Neptune filters, and other substrate filters, as well as for additional water treatment systems with UV lamps.

Our experienced remote maintenance team can access the controllers remotely to support maintenance or implement custom functions afterward. This draws on years of experience and in-depth knowledge of filter system operation. The remote maintenance system is continuously updated and meets the highest security standards, ensuring reliable and secure access at all times.

Upon request, the system can be easily and reliably connected to **DANA 2.0**, allowing platform-independent monitoring and control via smartphone, tablet, or computer. All live data, as well as full alarm management, are available within a continuously developed system. If additional sensors are required, we recommend using **BlueConnect buoys**. In cases of reception issues or more complex requirements, **LoRa sensors** can alternatively be integrated.



Source: Polycon GmbH

New Training Course for Pool Operations Supervision

by Otto Hoffmann, German Society for Natural Swimming Waters (DGfNB)

A new training course for pool operations supervision has been developed as a result of the cooperation between the German Society for Natural Swimming Waters (DGfNB) and the German Society for Bathing (DGfDB). The course, titled “Traffic Safety, Supervision, and Organizational Duties in Pools with Biological Water Treatment according to DGfDB R 94.05”, trains personnel in the safe operation of pools.

In March 2023, the new version of the guideline DGfDB R 94.05 “Traffic Safety, Supervision, and Organizational Duties in Public Pools during Operation” was published. Due to the significant technical differences between conventional pools and those with biological water treatment—such as the absence of a chlorination system and the complexity of the water treatment system—operators of biologically treated pools had sometimes not realized that this guideline also applied to their facilities.

This 20-year-long misunderstanding led to considerable discussion and uncertainty. As a result, the German Society for Natural Swimming Waters (DGfNB) initiated talks with the German Society for Bathing (DGfDB) to discuss whether the requirements for traffic safety obligations and, among other things, operational supervision are identical for these types of pools.

After intensive consultations, it was decided to offer a dedicated training course. Since 2025, a two-part course has been offered jointly, consisting of Part A (task catalog for organizing traffic safety obligations in public pools) and Part B (basic course on biological water treatment).

The next course will take place from October 12–16, 2026, in 34608 Willingen.

Program, further information, and registration: www.dgfnb.de/lehrgang-betriebsaufsicht

Requirements for participation in the course:

- Minimum age: 18 years
- Technical training with journeyman’s certificate or master/technician qualification in any other profession
- Experience in handling and managing staff



DESIGN & COMMUNITY

Art at the Outdoor Pool: When Walls Tell Stories

by David Kory, die Urbanisten

Artistically designed walls in natural swimming pools are much more than mere decoration: they transform functional spaces into emotional places. Especially collaborative art projects with young people foster a sense of identity, promote awareness of sustainability, and strengthen community spirit. In this way, a visit to the pool becomes an experience for the eyes, heart, and soul – and a wall becomes a piece of living culture.



All photos: Die Urbanisten

Places that Tell Stories – Cool Water Meets Art

An artistically designed wall can do far more than just look attractive. At its best, it reflects the identity of the place, telling stories of nature, water, summer, and community. Natural swimming pools that emphasize ecological sustainability particularly benefit from an aesthetic concept that makes these values visible. Colors, shapes, and motifs create atmosphere—they invite visitors to linger, marvel, take photos, and maybe even snap a selfie. A well-designed wall thus becomes a space for communication, connecting people and sparking conversations. Research has long shown that public art enhances the perception of a place, increases the sense of safety, and strengthens social bonds^{[1][2]}.

Young People as Artists – Participation That Lasts

A special added value arises when children and young people are actively involved in the design process. In cooperative art projects, they learn to take responsibility for “their place” and express themselves creatively. Under the guidance of professional artists, they also acquire artistic skills—from concept and surface preparation to execution. For many young participants, this is often their first meaningful encounter with artists and artistic craftsmanship.

Working with brushes, rollers, or spray cans opens up a whole new world for most participants, and



Art at the Outdoor Pool: When Walls Tell Stories

cooperative projects provide the space to explore it. Together with professional artists, murals, mosaics, or wooden sculptures are created that address themes such as environmental protection, water, or biodiversity. The outcome: pride, belonging, and identification with their own swimming pool and living environment. Visitors experience not only an aesthetic work but also feel the community’s engagement behind it. Cultural participation by young people strengthens self-efficacy and social skills^{[4][5]}, while also providing significant added value for the places and their visitors.

Sustainable Impact – Art as Part of the Overall Experience

In today’s world, where many leisure activities compete for attention, artistic design can make a decisive difference. Research shows that public art enhances spaces emotionally and creates lasting experiences^[6]. A natural swimming pool that incorporates art projects offers not only relaxation but also inspiration.

Guests take away impressions that last beyond the day—and return gladly, as studies on art and nature experiences show^[7]. In addition, such projects promote regional identity: public art increases



All photos: Die Urbanisten

visibility for local actors and strengthens social networks by involving schools, clubs, and artists[8][9]. Even in the international context of natural bathing waters, it is increasingly emphasized that the combination of ecology and culture can engage visitors in the long term. The German Society for Natural Swimming Waters (DGfNB) and international networks such as the IOB highlight that these facilities can serve as ecological and cultural meeting places^{[10][11]}.

A Gain for All the Senses

Whether purely artistic or collaborative in nature, art in natural swimming pools offers aesthetic appeal, fosters a sense of identification, and can strengthen social cohesion. It makes visible what many natural bathing areas already stand for: joy of life, naturalness, and community.

Sources list

- [1] Urban Institute (2022): How Public Art Can Improve Quality of Life and Advance Equity.
- [2] Americans for the Arts: Why Public Art Matters (Public Art Network Green Paper).
- [3] Kühnapfel, C. (2025): On the impact of public art... (ScienceDirect).
- [4] Kulturelle Bildung NRW (2023): Themenheft Partizipation – Kulturelle Jugendarbeit.
- [5] Keuchel, S. u. a. (2023): Potenzialstudie zu Kinder- und Jugendkulturprojekten. PwC-Stiftung Deutschland.
- [6] The ART of Engagement: Placemaking for Nature and People in Cities (2019).
- [7] Asking questions of nature: Art as a catalyst for ecological consciousness (2024).
- [8] Public Art for Placemaking and Urban Renewal (2020).
- [9] The Role of Public Art in Community Identity and Urban Development (2023).
- [10] DGfNB – Deutsche Gesellschaft für naturnahe Badegewässer: Naturfreibäder.
- [11] DGfNB / IOB: Kooperations- und Best-Practice-Berichte zu naturnahen Badegewässern.

Imprint



English edition of German original: 'Naturbad Info 2026'

Publisher

Arbeitsgemeinschaft Badeseen & Schwimmteiche
 Überseetor 14
 28217 Bremen, Germany
www.abs-naturbad.de
info@abs-naturbad.de
 Phone: +49 421 17876-11

Responsible for content

Stefan Bruns, Petra Hüge

Graphic design and layout

Anna Behrendt, Lüneburg, Germany

Printing

Drucktechnik Altona, Hamburg, Germany

The contents of the professional articles published here have been created with the utmost care. However, no guarantee can be given for the accuracy, completeness, or timeliness of the information.

The published works, including images and text, are protected by German copyright law. Reproduction, adaptation, distribution, or any form of use beyond the limits of copyright law requires the written consent of the respective authors.

Members of the ABS



www.polyplan-umwelt.de



www.kls-gewaesserschutz.de



www.asa-enzyme.de



www.wasserwerkstatt.com

International Network



www.gartenart.co.uk



www.phillipjohnson.com.au



www.geonet.be



www.aqua-rain.ch

