



Borden Park Natural Pool, Edmonton Polyplan-Kreikenbaum GmbH

## NEWS+FACTS ON NATURAL POOLS



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Introduction

**Introduction to Natural Pool Info**

Dear reader,

we are very happy to present the first English version of our „Naturbadinfo“ or as of now „Natural Pool Info“. Due to ongoing discussions with our partners around the globe, we decided to publish this collection of maintenance and operational experience to share them with everyone interested. The booklet presents a platform for recent findings and developments in the field, hopefully with some useful information for all of you. This first current issue of course includes the topic of Covid-19 along with the evergreen of natural pool maintenance and cleaning. We are planning to continue the publication of the „NP Info“ on an annual basis and are looking forward to your feedback, as well as your ideas for further topics.

A good, healthy season 2021 to all of you.

Hannes Kurzreuther, Janne Baden, Nina Röttgers, Antje Kakuschke, Inga Eydeler and Dr. Jürgen Spieker for the „Arbeitsgemeinschaft Badeseen und Schwimmteiche“ (ABS) and the Polyplan-Kreikenbaum International Network



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Biology

**Cercarias – Pathogen of Cercarial Dermatitis (Swimmer’s Itch)**

**Lifecycle and possible remedies**

In recent years, cases of Swimmer’s itch (Cercarial dermatitis) have increased in occurrence during the warm summer months. This article will give an overview of the parasites, their development cycle and possible countermeasures. The pathogens are trematodes (sucking worms) belonging to the family Schistosomatidae. This family includes numerous medically important species, such as the pathogens of schistosomiasis (including *Schistosoma mansoni*, *S. japonicum*, *S. haematobium*), which have humans as their final host and can cause intestinal and bladder schistosomiasis. This human schistosomiasis is mainly prevalent in Africa, East Asia, and South America. However, species from the Schistosomatidae family which can cause symptoms of disease in humans are also found in temperate climates. These are the so-called Avian schistosomiasis. Their pathogens are characterized by a host switch from Aquatic birds to water snails. Several species of different schistosome genera can cause Swimmer’s itch, but there is still a great need for research in this field. The following is an overview of the species that can potentially cause swimmer’s itch [1].

The representatives of the genus *Trichobilharzia* have so far been identified in connection with swimmer’s itch. The best known in Central Europe is the pathogen of the native duck schistosomiasis, *Trichobilharzia szidati*, whose development cycle is explained in more detail in Fig.2.

Trematodes are exclusively parasitic and are characterized by generational and host alternation. The adult sucking worms are gender-differentiated and live as a pair of flukes in the mesenteric veins of the final host, in the case of *Trichobilharzia szidati* in those of ducks.

Some of the Eggs laid by the female worms pass from the vascular system into the duck’s intestine and are excreted into the water with the feces. The essential passage through vascular walls and tissues is facilitated by proteolytic enzymes of Miracidia which diffuse through pores in the eggshell. The remaining eggs remain in the body and can pass through the vascular system into the tissues of virtually every organ in the body. Miracidia represent the first larval stage. They develop within the eggs over a period of 4-5 days. The Miracidia leave the egg shell 5-10 minutes after the eggs enter the water [3]. A suitable intermediate host must be found within 12-14 hours, otherwise the Miracidia

perish [4].

When searching for a host, miracidia are oriented positively photo- and chemotactically and negatively geotactically. Once in close proximity, miracidia are attracted to an intermediate host by its metabolites. If they encounter a freshwater snail as a suitable intermediate host, the miracidia invade it and develop into Sporocysts (mother and daughter sporocysts) in its organs. In the sporocysts, unfertilized germ cells give rise to numerous embryos that develop into infective fork-tailed cercariae (2nd larval stage) within 2-3 months. During this process, the reproductive stages of the parasites induce the production of the snail-specific neurohormone Schistosomine, which promotes the growth in size of the snail while inhibiting gonadal growth [5]. The cercariae accumulate mainly in the snails’ midgut gland and can hibernate there through the winter. In summer, when water temperatures reach about 20°C, they leave their intermediate host and seek a suitable final host. The survival time of the cercariae depends on the water temperature and is approximately between 48 and 60 hours at 20°C. At 35°C and above, the cercariae become incapable of invasion and at 45°C they die [6]. The extent of cercariae production is determined by the number of successfully penetrated miracidia: assuming that an adult trematode produces about 1 million eggs, of which 10,000 miracidia successfully infect an intermediate host, there could be a population explosion of up to 10 million infective cercariae per infested snail [7].

Similar to miracidia, cercariae orientate themselves positively photo-, thermo-, and chemotactically when searching for a host. The cercariae stay predominantly at the water surface using their ventral sucker and respond to sudden shade (approach of a potential final host). Substances (e.g., cholesterol and ceramide) excreted by the skin of ducks attract the cercariae and cause them to penetrate the skin of the final host [6]. With the influence of proteolytic enzymes of their penetration glands, the cercariae penetrate the skin of the ducks. They transform into schistosomules, losing their tails, and enter the portal vein system via the lungs. There they grow into the adult worms, unite in pairs, copulate, and migrate to the mesenteric veins where the females begin egg production. With this the life cycle of *Trichobilharzia szidati* begins anew. At optimal water temperatures, the parasite completes its cycle in 90-110 days [4].

In addition to aquatic birds, humans can also be infected by fork-tailed cercariae while bathing in natural waters. The main swarming season of cercariae begins with the general pool season in early

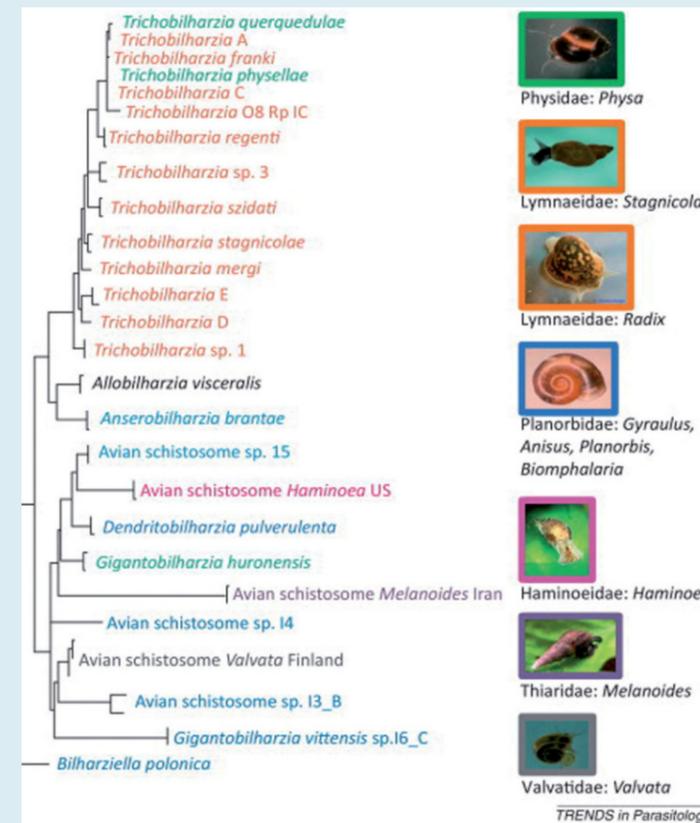


Fig.1: Trematodes from the family Schistosomatidae, whose development cycle includes aquatic birds as final hosts and snails as intermediate hosts (figure from Brant et al. 2013, [1]). These species are or can be causative agents of swimmer’s itch.

summer and reaches a second peak in late summer. Cases of swimmer’s itch are especially clustered after periods of pleasant weather.

Humans are however unsuitable hosts for *Trichobilharzia szidati* and interrupt the development cycle of the parasite. Although the cercariae penetrate the skin of humans, the non-specific immune defense of humans eliminates them in the subcutaneous connective tissue. The invading cercariae cause an erythematous, edematous welt on the skin, the shape and size of which is comparable to that of a mosquito bite.

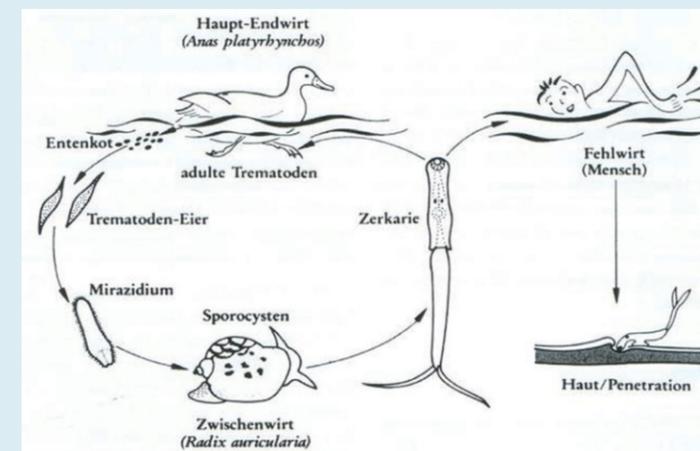


Fig 2: Development cycle of the pathogen of indigenous swimmer’s itch (adapted from ALLGÖVER, 1990, [2]).

The extent of dermatitis depends on the individual's immunological defenses. In some individuals, the penetration of cercariae into the skin may be distributed over the entire body and result in severe itching. Other individuals are not affected at all or only very slightly and hardly feel any itching. In hypersensitive individuals, fever and shock may occur. Usually, the welts heal within 10-20 days. Based on current knowledge, no serious health consequences arise from infection with avian trematodes. However, secondary infections with disease pathogens may occur if the welts are scratched open. In cases of severe infestation and itching, the use of

- Cooling gels and ointments to relieve itching
- Personalized prophylaxis with protective creams
- Consult a doctor in case of severe infection

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fig 3: Fork-tailed cercaria (red coloration due fixation, (photo KLS).

antihistamines and the application of cooling and antiseptic gels may provide relief from symptoms. Sensitivity to the cercariae antigens persists for a period of two years and can be serologically detected [8]. In outdoor swimming pools where swimmer's itch has been reported, the question of what measures should be taken to reduce the incidence of this disease is a recurring one. The aim here should be to interrupt the development cycle of the trematodes. Therefore, the proliferation of aquatic birds as final hosts and of water snails as intermediate hosts of the parasites in the system must be prevented. General measures should therefore be:

- Reduction of water snail population by collection, use of natural predators e.g. Tench and avoiding low-flow shore areas where water snails are more abundant. Reduction of nutrient inputs.
  - Regularly check the prevalence of aquatic birds and, if necessary, scare them away.
- If cases of swimmers' itch occur in the pool, users should be informed immediately:
- Post warning notices
  - Advisable to refrain from long stays in shallow water areas
  - Information on countermeasures e.g. taking off wet bathing suits quickly, drying the body immediately vigorously with a towel, do not shower first

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[KLS]

**Building Materials**

**Kebony Wood**

**An alternative for wooden decks in Natural swimming pools?**

Time and again, planners and users are faced with the problem that **wooden decks in natural swimming pools splinter over time and begin to rot**. The currently popular types of wood such as Larch and Oak usually do not last longer than 10 to 15 years and problems often occur even before that.

**WPC – Boards**

An alternative is the composite material WPC. However, there are often problems with this material pertaining to **the build-up of heat**. The material becomes very hot when exposed to sunlight and also expands significantly. **In addition, the material can accumulate a static charge**. Furthermore, due to it being an artificial material, WPC is usually perceived as less aesthetic than wood. **Concerns about sustainability and disposal exist as WPC is a plastic material.**

**Pressure impregnated softwood**



Kebony - Private Pool - Tegernsee Photo: kebony.com



Kebony - Bexhill Pavillion Photo: kebony.com



Bexhill - 3 years later Photo: kebony.com

In addition, there is the option of pressure-impregnating softwood to improve the durability of the wood. This is a chemical wood preservation process. The moisture escapes from the wood through a vacuum created in a boiler, into which wood preservative salts are subsequently pressed. Thus, the pressure-impregnated wood is protected against insects and fungi after a fixing period. This process improves the durability tremendously, but **there is a risk that the chemical salts will leach out of the wood and get into the environment with time passing by**. These chemical salts contain substances that serve as pest control and can therefore also be toxic to other animals and humans. Furthermore, the material is hazardous waste and has to be disposed of specially.

**Thermowood**

Another modified wood is the so-called Thermowood. This is the name given to wood that has been thermally treated by heating it up to 230°C in the absence of oxygen. This makes the wood more **resistant to pests and can thus increase its durability**. Unfortunately, however, the process, especially in the case of coniferous woods, mainly reduces the compactness and, consequently, the strength of the wood due to the release of resin.

**Kebony**

A comparatively more promising material for the construction of wooden decks outdoors and in proximity to water - and as a result in natural swimming pools - is Kebony, a modified softwood. The patented technology from Norway makes the wood particularly durable. Two species of wood are used for Kebony, *Pinus radiata* and *Pinus sylvestris*. *Pinus radiata* is used to make "Kebony Clear" (almost branchless), while *Pinus sylvestris* is used to make "Kebony Character", the wood with the somewhat more distinctive wood look - here healthy branches are visible. Both Kebony variants initially have a dark

brown color and develop a silver-gray patina over time. The modification of Kebony wood is done in two steps, the first step is impregnation with bio-alcohol and the second step, drying. During impregnation, the wood is completely immersed in Furfuryl alcohol. This penetrates into the cells and forms polymers which become very stable as it dries and does not leak out of the wood. In Kebony, grooves are completely eliminated from the wooden planks. As part of an extensive research project conducted by the Holzforschung Austria, it was determined that not only does grooving in decking boards not have a significant impact on their slip resistance, it also adversely affects wooden boards in various aspects. Kebony feels very soft and pleasant on the feet. In addition, rain and spray water can run off more easily without grooves.

**Thus, Kebony seems to be a reasonable and sustainable alternative as a material for wooden decks in outdoor swimming pools.** While it is true that Kebony is about three times more expensive per m<sup>2</sup> than a wooden deck made of larch, it is noteworthy to point out the difference in durability. While the Larch deck usually has to be replaced after 10 - 15 years, the deck made of Kebony has a durability guarantee of up to 30 years.

In principle, the importance of the supporting structure should be pointed out in this case. The sub-structure must be durable and well ventilated. The deck should be built with a slope, construction timbers should be fitted with spacers and screw holes should be made as shallow as possible.

Basically, for the longevity of the wooden deck, make sure that water does not accumulate anywhere and that the wood can always be allowed to dry thoroughly.

The decision as to whether Kebony is the more economically and ecologically sustainable alternative compared to other woods must be made on a case-by-case basis. Ultimately, the specific wood prices, life cycle comparison and also factors such as transport routes and, if necessary, a comparative CO2-balance analysis all play a part in the decision-making process.

[PK]

Further Information: [www.kebony.com](http://www.kebony.com)

Research & Development

### Comparison of bird deterrence methods

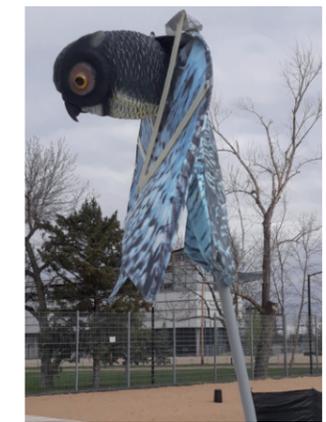
#### What keeps birds away from Natural Swimming Pools?

Whether geese or mallard ducks - the presence of birds in many waterbodies leads time and again to inevitable fecal discharges. This is likely to lead to the limit values for hygiene parameters being exceeded and to the spread of cercaria. The possible measures for the expulsion of birds are manifold - however, the experience of different pools shows that there is no "one-size-fits-all" solution. Therefore, decisions must be made on an individual basis. To help with decision-making, the following table summarizes and evaluates the most commonly used deterrent measures.

[PK]



Methods of bird deterrence (3 Photos: PK)



Method	Mode of operation	Advantage	Disadvantage	Birds' reaction	Price
Water jet with motion detector	Installed at the edge of the pool, as soon as a bird triggers the motion detector, it is chased away by a jet of water	Really simple method, can be powered by solar panel, no harm to birds, can be placed in areas preferred by birds	Very limited radius, connection to pressure line necessary.	Seek out areas beyond the water jet's range.	From around 35 € per piece
Hawk Kites	In principle, a scarecrow; kites on pole - often in the shape of a hawk or similar are permanently installed on the site	Simple, inexpensive method without technical requirements, can often be visually well integrated into the pool's décor. Often works well.	In some locations birds get used to the scarecrow.	Widely varying effects have been observed here. In some cases a very efficient measure, in other locations hardly any effect.	Depending on the design very wide price range From 20 € to 200 €
Dummies	E.g., mallard or heron dummies; area appears already colonized.	Easy to set up, no special maintenance required, can be used permanently	Possible acclimatization effect on birds, limited range depending on terrain.	Very different reports on efficacy, in many cases only good results for a short time, birds tend to later acclimatize.	Also wide price range from about 15 € upwards
Covering	Covering filter areas with netting to prevent access and nesting.	Can be deployed over a large area. Very efficient with good sealing.	Complex installation tend to be aesthetically unpleasant, must be very tightly sealed to surface. Trees above the filters attract birds, resulting in bird droppings on filter.	There are known cases when the birds slip under the nets. Very effective if the net is well installed.	Approx. 2 €/m <sup>2</sup> , depending on the type of net and fastenings + installation costs.

Method	Mode of operation	Advantage	Disadvantage	Birds' reaction	Price
Falconer	Introduction of Falcons as they are natural predators of aquatic birds.	Nature-oriented, can be integrated into the operation, e.g. via patronages.	Lack of sanctuary during bathing season, risk that the falcons will migrate.	No empirical data.	No information as no empirical data is available yet
Flapping tape and whistling tapes	Optical and acoustic effects lead to the displacement of birds.	Quite inexpensive solution, can be easily built and rearranged if necessary.	Needs wind and in the case of the whistling bands, quite a large span is required, can be visually distracting in practice.	Not much proven in practice.	Flapping tape: 0,10€/meter Whistling tape: 35€/reel
Dogs	Dogs as natural enemies of birds can be unleashed on the site prior to the start of operations.	Easily integrated into the operation if there are dog owners among the personnel, simple nature-based solution.	Dog are not allowed to be in the swimming area during business.	There is good record of using Border Collies, as well as others, against geese and aquatic birds both in pool areas and in large premises such as airports.	Personnel deployment which, however, can be well integrated into normal operational procedures
Ultrasound	Acoustic signal in the ultrasonic range serves as a deterrent.	Enables the coverage of a vast area	A lot of the devices available in this area are not suitable for installation in residential areas, May be partially heard by children.	The hearing range of birds is limited at up to about 8000Hz. Ultrasonic frequencies are close to 20'000 Hz. The actual effect of ultrasound on birds is quite controversial.	Wide price range from about 50 € upwards
Combination of visual and acoustic deterrence	Activated via motion sensor and combines visual signal (flashing) with acoustic (e.g. cries of birds in distress)	Easy to place on the site and move if necessary	Limited range, must be disabled during bathing operation	To date, experience with the use before the start of the season is positive	Wide price range Approx. 150 €

Cleaning technology

**Clean!**

**Cleaning outdoor pools - reports from the pools**

Late in the summer of 2020, a survey was conducted asking various natural swimming pools about their current time allocation, experiences, and difficulties with cleaning. The range of results is surprising and shows how significant the differences can be from one pool to another.

Obviously, the pools cannot be directly compared with each other; the difference in flooring materials, various pool designs, the use of different and/or several water filtration systems, the difference in cleaning equipment, some pools even employ divers - all these have some influence on the cleaning effort and its implementation. The reported daily time spent ranges from less than 5 hours to more than 15 hours per day. Additional cleaning requirements were reported, most notably in regards to sand and gravel areas, which are not always part of the regular work. In order to be able to make a comparison despite the very different circumstances, an overview of the cleaning workload per m<sup>2</sup> of water surface is given as a reference value in Figure 1.

the amount of work varies enormously. The principal difficulties reported are algae and limestone as well as the shape of the pool. In individual cases, the influx of gravel from the filters also leads to additional work.

**Experience and routine as key factors**

In spite of the significant improvements which have been made in the field of pool hygiene in recent years via the deployment of numerous technical equipment, a lot of manual work remain central to ensuring the pool is kept in pristine condition. Regular cleaning routines and experienced personnel have been reported by experienced stakeholders as essential. Regularity has been shown to be the underlying crucial factor in reducing the daily workload and facilitating cleaning work, especially as the season progresses, contributing immensely to preventing hygiene problems in a pool facility. This way, visitors can look forward to a unique natural swimming pool experience without encountering algae carpets or surfaces that become slippery due to the biofilm.

[PK]



Safety measures for Covid19 - Outdoor Pool Schladen Entrance (PK)



Blocked wooden tower - Natural Pool Ennigerloh (PK)

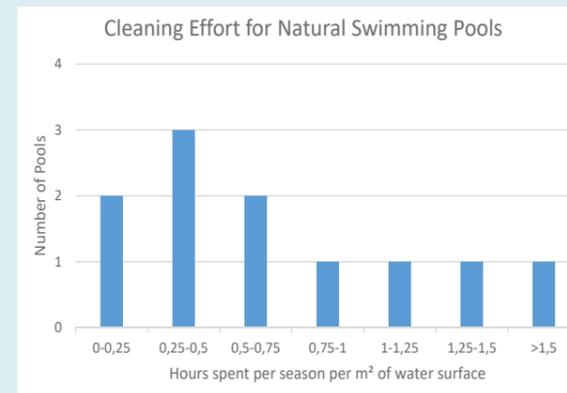


Fig.1: Cleaning Effort for Natural Swimming Pools (PK)

**Average of 0.7 h of cleaning time per sqm and season**

The majority of the pools reported that are dedicating between 0.25 - 0.75 h to cleaning for each sqm area per season. Thus, for a pool with a usable water area of 1200 sqm, between 300 - 900 hours will be spent cleaning the pool per season. While sand and gravel areas outside the pools lead to a significant increase in the amount of work, it can be noted that both materials - when used as flooring in the pool - are significantly easier to maintain than classic foil pool linings.

High-pressure cleaning equipment and extractors are used in almost all of the surveyed pools with foil linings. Despite similar equipment in many cases,

Current news on Natural Pools

**Covid 2020**

**Swimming pool operation under pandemic conditions - A report from Germany**

A turbulent 2020 - The Corona Virus held many surprises in store and called for a high degree of flexibility from all swimming facilities and teams of workers.

**A short review...**

**January- March 2020**

The virus initially only ravaged China, but it did not take long for the first cases and thus the first restrictions on everyday life to emerge in Germany.

**March - April 2020**

In fact, the swimming pools were just about to commence the new season, but the first lockdown was enforced in mid-March. All indoor swimming pools, sports facilities, schools etc. had to close. Major parts of everyday life were also restricted with immediate effect.

**May 2020**

The opening of swimming pools doesn't look likely. We're stuck in the middle of a two- to three-month lockdown which varies by state.

**June 2020**

The first swimming pools are permitted to open - but only under strict, regionally varying conditions and with a hygiene policy. Coordination with the health authorities, setting up the pools in accordance with the hygiene policies and training the staff (if there are enough people available at all) had to be completed within extremely short time periods. For many operators, this was a real challenge which could not be resolved overnight. Spit protection, payment system modifications, hygiene measures, pathways, swimmers' supervision, and so on and so forth. All these had to first of all be put in place. For some pools who due to the unforeseen circumstances were still stuck in winter operations or in the middle of preparing for the season, this was a double challenge.

**July 2020**

Corona continues to dictate many aspects of our daily lives. Depending on the location, the pools are busy implementing the concepts/measures. The uncertainty of whether the relaxations will be rescinded constantly lingers. Last but not least, the question: Is it even worth opening so late and under these conditions? In the end, optimism prevailed for many, which meant even the last pools managed to start the season at the end of July.

**August-September 2020**

The weather is good and the Natural swimming pools are taking advantage of the remaining weeks of the season to maintain operations as best they can, considering the circumstances. Many customers are happy to swim and sunbathe and enjoy the good weather in the swimming pools, which are less crowded this year.

**Summary of the pandemic season:**

The extremely short-term implementation and monitoring of hygiene measures and concepts presented a major challenge to everyone involved. Planning developments over the season was barely possible. Most of the pools worked for about 1-1.5 months with two to three people on preparing for the season under Corona conditions (pool equipment, hygiene concept, staff organization, etc.) be-

fore the facilities could be put into operation after approval by the health department. 2020 was an operating year with significantly limited customers, without showers, slides and the use of diving platforms, splash fields and other playground equipment. Hopefully, this will not be the case in 2021.

Current news on Natural Pools

**Covid 2021**

**Swimming pool operation under Corona - What does the future hold?**

Due to the rapid changes in the pandemic situation, it is currently difficult to predict how the 2021 season will unfold. The key question will be how the risk of transmission is assessed on the basis of the positive experience gained so far during 2020's operations and what new risks may arise as a result of mutations.

During the 2020 season, no case of Covid-19 infection has come to our attention from the pools. Thus, the existing hygiene concepts seem to be successfully safeguarding operations. Even though transmission via the water in a natural swimming pool is considered extremely unlikely, a Corona - investigation program for the 2021 season has been initiated by Polyplan-Kreikenbaum and the DgfnB to augment the measures from 2020. In the event of a Corona infection at a pool, operators have the option to have a water sample from both the pool water and clean water tested for Corona. There is also the option to have surfaces tested if needed. In case of a known infection in your swimming pool, please contact Ms. Röttgers

roettgers@polyplan-kreikenbaum.eu

[PK]

Current news on Natural Pools

**Give Viruses No Chance**

**Viruses in Natural swimming pools**

The degradation of viruses and bacteria in natural swimming pools takes place within the pool water owing to zooplankton [1], competitive pressure from other organisms, possibly allelopathic mechanisms (release of growth-inhibiting substances) and UV radiation (IOB 2013). Outside the pool, degradation occurs via external filtration systems [2].

**The aforementioned mechanisms can be supported by the establishment/new implantation of planting zones in the pool edge areas as well as on the wet filter surfaces.** This creates growth and protection spaces for zooplankton and results in higher biodiversity, which leads to the support

of ecological competitive pressure and a promotion of allelopathic mechanisms. The elimination of viruses and bacteria by filters can be effectively enhanced by increasing circulation rates, as germs are eliminated during each filtration cycle. The Federal Ministry of Environment requires a reduction of indicator parameters (E. coli, enterococci, Pseudomonas aeruginosa) by one log level (90%) for filters in natural swimming pools after a filtration cycle (UBA 2003). Bacteria are the selected indicator parameters. The reduction of viruses was investigated in the latest study carried out at the University of Alberta (Canada). In the model studies, mean reduction efficiencies of a Neptune filter of 1.35 log levels were

[1] Virus elimination by zooplankton depends essentially on the species present (different zooplankton have different filtration capacities) and the quantity present. The quantity in turn depends on the ecological conditions (available food supply, ecological environment of the pool, presence of planting zones as sanctuaries). It is assumed that zooplankton can filter an average of 4% of the pool water per day, eliminating viruses and bacteria (FLL 2011). Depending on ecological conditions, filtration efficiency may exceed 80% of pool water/day. [2] While the elimination capacity of zooplankton can sometimes be lower, depending on the ecological situation, the degradation capacities of soil filters are significantly higher and more constant. Here, the estimated elimination rates range between 90-99.9% (IOB 2013, BRUNS/PEPLER 2019).

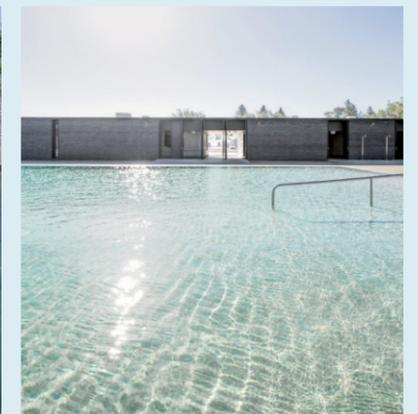
Public Natural swimming pools

**First outdoor pool with biological water treatment in Canada**

**Borden Park Natural Swimming Pool**

The Borden Park Natural Swimming Pool is the first public outdoor pool with biological water treatment in Canada. It is located east of the Rocky Mountains in the city of Edmonton, Alberta. There was already a bathing area on the site of the pool in the 19th century and by the beginning of the 20th century, the first heated outdoor pool in Canada was built there. Thus, even in times past, the pool was a pioneer.

In addition to these special features, the remarkable architecture of the Borden Park Natural Swimming Pool, which was completed in 2018, has also been attracting considerable attention. **The pool has already received various architectural awards, such as the 2019 "Awards of Excellence" from the Royal Architectural Institute of Canada. The choice and composition of construction materials used and the design concept are intended to evoke the feeling of taking a dip in the middle of the Rocky Mountain landscape, 200 km away.** Since its opening, the facility is operated with great enthusiasm and visited by its guests with delight. Queues of visitors often form at the entrance to the



Alle fünf Fotos: Borden Park Natural Swimming Pool, Edmonton (Fotos: PK)

measured with respect to noroviruses. In a combined hydro-botanic and wet filter, the degradation efficiencies were as high as 2.35 log levels - i.e., over 99% (Petterson 2019) and thus well above the reduction required by the UBA. Coronaviruses are about 4 times larger than noroviruses and thus are likely to be more easily retained in the filter. If they unexpectedly survive in the water, they are very likely to be well degraded. **A risk assessment for noroviruses showed that a pool circulation rate of 2 circulations per day should be maintained in order to keep them within the tolerable range (Bruns 2020). As a preventive measure, this value could also be applied to coronaviruses.**

Even when, according to current knowledge, the bathing water in natural swimming pools is well protected against all viruses, including coronaviruses, the following measures can be taken to improve the depletion efficiency:

- Extension and intensification of planting in the relevant areas (hydro-botanic and wet filters)
- If necessary, increase the filter capacity to two tank circulations/day.

Should you require assistance with these measures, please do not hesitate to contact us. [PK]

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In the search for an environmentally friendly and innovative solution for the renovation of the pool, the city decided in 2014 in favor of biological water treatment and commissioned Polyplan GmbH, among others, for the planning of the pool. Due to the very strict guidelines for public swimming pools in Canada, a lot of modeling and risk assessments had to be carried out as part of the approval process. As a result, the planning was based as closely as possible on the German FLL guidelines, and a design approach adapted to these requirements was developed in collaboration with architects and hygienists.

**As the first swimming pool of its kind -it was to be planned as a pool with biological water treatment-** but with the possibility of converting it in a worst-case scenario with minimal effort into a pool with physical-chemical water treatment in accordance with Canadian planning laws. In addition, a UV disinfection system was installed in case the biological treatment did not meet the hygienic requirements. To date, there was no need to use the UV due to the good water quality. Discussions about conversion to a chemically disinfected facility have been shelved for good.

pool. The Canadians spend the waiting time on the lawn in front of the entrance chatting, playing and sitting together in the folding chairs, which they usually bring along as part of their luggage. The natural swimming pool consists of two swimming sections, namely an 860m<sup>2</sup> swimmer's and non-swimmer's area, as well as a 100m<sup>2</sup> toddlers' pool, with an interspersing fountain field. In addition, visitors are more than welcome to use the pool's volleyball court to engage in sports outside the water. The showers, a sandy beach, picnic areas as well as other spaces for recreational activities are located in the areas surrounding the pool. The biological water treatment consists of two filters; a Neptune filter and a hydro-botanical filter. They are located on the site and their positioning is such that here, too, the landscape of Canada and the Rocky Mountains with its mountains, valleys and prairie are all recognizable.

[PK]