Lobelia lakes

By Ole Pedersen

Few men consider the possibility of natural aquascapes that are so beautiful that even Takashi Amano would find a challenge to mimic it in his studio. But the underwater landscapes of many lobelia lakes in the northern hemisphere are exactly like that – an aquascape that most people could only dream about. This article describes the fascinating flora and fauna of these lakes which are scattered all over Scandinavia. And did you know that one of the plant species has found its way into the planted aquarium hobby?

Nutrient-poor lakes are found scattered throughout Scandinavia. They are either rain-fed or fed by seeping groundwater or by a combination of both. They rarely receive water from inflowing streams and many have even no runoff; instead, the water level fluctuates according to the balance between precipitation and evaporation. Some lakes are nutrient-poor because they are formed directly on the inert bedrock and others because they found on sand and gravel deposits left behind by the receding glacier more than 10,000 years ago. These lakes are not only nutrient-poor, they are also very soft with a carbonate alkalinity of less than 0.1 m moles per litre (< 0.3 °KH). These nutrient-poor softwater lakes are termed lobelia lakes as the submerged rooted vegetation is often dominated by the otherwise rare plant, Lobelia dortmanna.

The common name of Lobelia

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Camera: Canon 450D, lens: Canon EF 100mm USM, aperture: 7.1, shutter speed: 1/125 and ISO: 100.

The key species in lobelia lakes is the Water Lobelia (Lobelia dortmanna). In shallow water, the peduncle elongates above water and pale-blue flowers are pollinated by terrestrial insects.
Camera: Canon G7, housing: Ikelite, lens: Ikelite W-20, aperture: 4.0, shutter speed: 1/125 and ISO: 200.

Often, there is only one species of fish present in lobelia lakes, the arctic trout (Salmo trutta alpinus). Adult specimens are found cruising around looking for larvae of May Flies or Stone Flies – or for terrestrial insects trapped on the water surface. Camera: Canon G7, housing: Ikelite, lens: Ikelite W-20, aperture: 4.0, shutter speed: 1/200 and ISO: 100.

The European Crayfish (Astacus astacus) is common in lobelia lakes. It is primarily detritivor and feeds on dead organic matter but occasionally also fresh plant material.
Camera: Canon G7, housing: Ikelite, lens: Ikelite W-20, stobe: Ikelite DS51, aperture: 2.8, shutter speed: 1/60 and ISO: 100.

In deeper water, the peduncle of the Water Lobelia (Lobelia dortmanna) never reaches the water surface. Instead, it stops elongating and the flowers are self-pollinating in these deep populations.
Camera: Canon G7, housing: Ikelite, lens: Ikelite W-20, aperture: 4.0, shutter speed: 1/60 and ISO: 100.

dortmanna is Water Lobelia and it belongs to a group of plants termed isoetids that dominate the vegetation in lobelia lakes. Isoetids share both morphological and physiological features even if some belong to the group of fern allies (a general term covering a somewhat diverse group of seedless vascular plants that are not true ferns) such as Isoëtes lacustris and Isoëtes echinospora), while others are true flowering plants such as Lobelia dortmanna and Littorella uniflora. Over million of years, the environment has shaped the plants in way so that they look almost the same although they are not genetically related at all. They are all small, rosette-forming species with short, stiff leaves and un-branched roots. Physiologically, they all depend on root-uptake of CO2 because the water column is so scarce in CO2 so that no plants can rely at this source for their photosynthesis. Instead, the isoetids tap into the rich source of CO2 which is always present in the sediment due to the microbial activity that constantly mineralizes organic matter and turns it into energy and CO2. Isoetids are weak competitors and thus, they are only found in these ultra nutrient-poor softwater lakes where no other aquatic plants present a competitive challenge.

All isoetids tolerate periods of desiccation. Water Lobelia rarely produces specialized aerial leaves, while both species of Isoëtes and Littorella uniflora produce leaves with stomata when in air. This allows them to gain access to the rich pool of CO2 in the atmosphere and they can grow for months on dry lake banks. Littorella uniflora only flowers when in air but it readily spreads via runners so the sexual reproduction is only needed to maintain a genetic diversity in the population. In contrast, Water Lobelia only reproduces by seeds and it normally attempts to put up a long peduncle with pale-blue flowers that are pollinated by insects. If the plants grow in too deep water, the peduncle stops elongating long before it reaches the surface and in this situation the flowers self pollinate.

Other plants do co-exist with the isoetids in the nutrient-poor softwater lakes. Examples are species of the carnivorous genus Utricularia (Bladderwort), the genus of Elatine (Waterwort) and several species of aquatic mosses. These plants all have in common that they are weak competitors as well and thus, they co-exist with the isoetids and

Elatine hexandra is found in very shallow water and even tolerates periods of desiccation. It flowers under water with tiny flowers which are only 1 mm in diameter. Elatine hexandra is quite similar to species of Glossostigma (a genus from Australia which is widespread in hobby) but Elatine hexandra is not really suitable in tropical planted tanks as it thrives best below 20 °C.
Camera: Canon G7, housing: Ikelite, lens: Ikelite W-20, stobe: Ikelite DS51, aperture: 2.8, shutter speed: 1/60 and ISO: 100.

In July, Water Lobelia (Lobelia dortmanna) produces hundreds of peduncles per square metre. Some of them reach the surface where they are pollinated by terrestrial insects while those who are growing in deeper water rely on self-pollination.
Camera: Canon G7, housing: Ikelite, lens: Ikelite W-20, aperture: 4.0, shutter speed: 1/100 and ISO: 100.

present no immediate risk in terms of over-growing the slow-growing isoetids. Bladderwort and species of aquatic mosses often form the depth limit of the aquatic vegetation. Neither bladderwort nor mosses form true roots and thus, they do not have to supply a significant belowground biomass with energy or carbohydrates; this is likely the reason why their light requirements are lower than those of the rooted plants. In contrast, Elatine is found in very shallow water and even tolerates periods of desiccation. It flowers under water with tiny flowers which are only 1 mm in diameter.

The nutrient-poor softwater lakes never support a huge amount of fish or invertebrates as the fauna is also nutrient limited. Often, there is only one species of fish present in these lakes, the arctic trout (Salmo trutta alpinus), which is a subspecies of the Brown Trout. Juveniles are rare but a few large adult specimens are often found cruising around looking for larvae of May Flies or Stone Flies – or for terrestrial insects trapped on the water surface. Perhaps a bit more common is the European Crayfish (Astacus astacus) which is a detritivor feeding on dead organic matter or even fresh plant material. However, the European Crayfish is highly threatened all over Scandinavia by the pathogenic mould fungus, Aphanomyces astaci, brought into Europe by the somewhat resistant Signal Crayfish (Pacifastacus

Aquatic mosses are often forming the depth limit of the aquatic vegetation in nutrient-poor lakes.
Camera: Canon G7, housing: Ikelite, lens: Ikelite W-20, aperture: 4.0, shutter speed: 1/100 and ISO: 200.

leniusculus), which is still used in aquaculture throughout Europe.

Lobelia lakes in Norway and Sweden often present astonishing underwater landscapes which remain hidden to people who prefer swimming in the sea. The bedrock forms a fantastic hardscape of beautiful colours and on the soft sand, isoetids and other rare plants thrive. Decomposing wood is often trapped in the lakes and forms attractive contrasts to the rocks and the green leaves. But the lakes as ecosystem are threatened by both eutrophication and global warming. Denmark has already lost more than 50% of the lobelia lakes that were present 100 years ago. This is due to extensive farming that results in heavy eutrophication by nitrogen and phosphorus fertilizers that are washed into the groundwater before seeping into the lakes where it results in phytoplankton blooms

Midnight in Southern Norway in July. The peduncles of Lobelia dortmanna are emerging and the flowers will soon open and be ready for pollination. Camera: Canon 450D, lens: Canon EF 100mm USM, aperture: 3.5, shutter speed: 1/15 and ISO: 100.

(green water). As for global warming, we still do not know how it will affect the lobelia lakes. So far, we can only speculate that the southern distribution of isoetids will move northwards resulting in total loss of habitats that are at present protected by the most extensive EU habitat regulations.

Plants from lobelia lakes are not widespread in the aquarium hobby. So far, only one species, Littorella uniflora, has found its way into our tanks. It was originally introduced by Tropica Aquarium Plants in Denmark but they discontinued the production a few years ago. Now, Littorella uniflora is only produced by the Italian aquatic plant nursery, ANUBIAS. Littorella uniflora can be an attractive plant. In nature, it is often found with dark red leaves but it seems that the red colour is caused by a combination of low temperature and low nitrogen availability; conditions that are hard to mimic in a tropical planted aquarium. In addition, various attempts with Elatine hexandra and the extremely rare Elatine hydropiper have been made but they do not really thrive well in water above 20 °C. Hence, lobelia lakes probably do not present an overlooked source of plants for tropical planted aquaria so we need other allies to maintain the political pressure that is needed in order to reverse the current trend where lobelia lakes are lost at an alarming rate all over the northern hemisphere.

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Photo by Jyllandsposten