

Protective action – Transplanting *Luronium natans* from Breisjøen to Alunsjøen - Report 2019. (Draft for internal use)

Introduction.

During 10 years of observations conducted by Norsk Naturarv in 5 lakes in Oslo municipality I acquired some knowledge of *Luronium* ecology in those lakes. A summary of these observations was published in the NBF magazine "Blyttia" 2/2018.

Preparations for works related to the protection of the *Luronium* population during the reconstruction of the dam in Breisjøen began in the summer of 2018.

Together with Katarzyna Bociąg - hydrobotanist and experienced diver, we conducted research and prepared maps of the distribution of *Luronium* in all 5 lakes where it occurs. Based on that knowledge and maps of *Luronium* population distribution, already in Autumn 2018 I proposed to the lakes administrator the following measures to prevent the destruction of the entire *Luronium* population in Breisjøen:

(E-mail from 17.10.2018 - to Camilla D. Volnes, Vassdragsteknisk ansvarlig (VTA), Oslo kommune, Vann- og avløpsetaten.)

"I do not know if anyone anywhere tried to save populations of this species on such a large scale - therefore, there are no good, proven methods of these activities. It looks like we will be the pioneers of this type of action!"

That's why I think we should at the same time test several methods.

1. Transplanting plants. *(A good way to save a relatively small number of Breisjøen individuals and enrich the population destroyed in Alunsjøen 10 years ago.)*

As it is difficult to transplant from water to water I propose to do it in spring 2019 when you start to empty Breisjøen and plants appear on exposed bottom. If it is possible at the same time to reduce the water level in Alunsjøen by about 40-60 cm, it would be possible to replant the plants from Breisjøen to Alunsjøen in a few days. After that, you can quickly complete the water level in Alunsjøen with the Breisjøen tunnel. (?)

2. Irrigation of plants. *(This method, if it works (?!), can save the largest part of the population in Breisjøen.)*

You could "rain" (with a watering system farmers use(?)) two large areas of flytegro occurrence in the northern and western bay of the lake.

Flytegro can grow as a landform. The plant is then deprived of rosettes of delicate lance-shaped leaves but produces oval areal leaves and can even bloom profusely. But the condition for survival of this landform is a constantly moist substrate!

I have no imagination how plants will react for frost. But I hope that they can manage if snow covers them before the big frosts. Probably plants tolerates freezing if frost does not dehydrated them only freezes.

3. Maintenance of small water reservoirs on the drained area of the lake. *(It would*

be the best, surest way to keep plants alive in Breisjøen.)

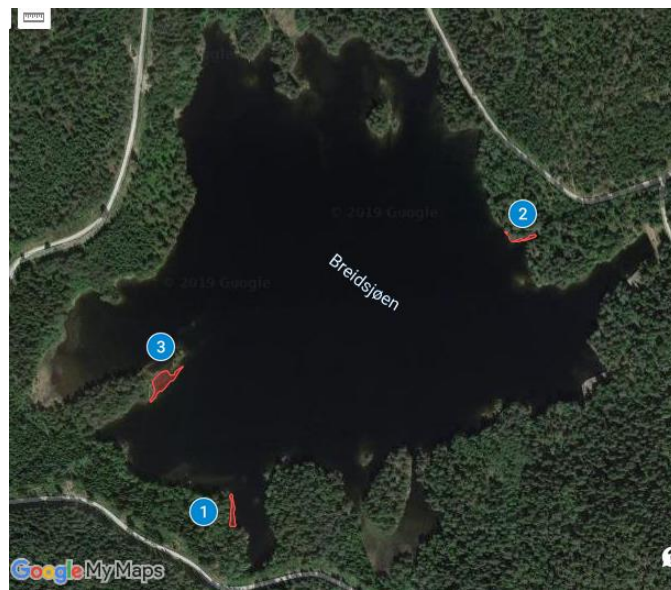
Here and there the configuration of the bottom creates such reservoirs but you can also create them by building small dams. (I think you are experts in the construction of dams and dikes :)) Maybe it would be possible to stop the water in the southern bay, blocking its outflow on both sides of the island (?)”

Vann og Avlopsetaten did not start lowering the water level in Breisjøen as planned in early April of 2019. In the beginning of May I was informed that the new date for starting work was set for April 2020. It was a very favorable decision for activities related to the protection of *Luronium* - we received an additional season for replanting a large number of plants from Breisjøen to Alunsjøen.

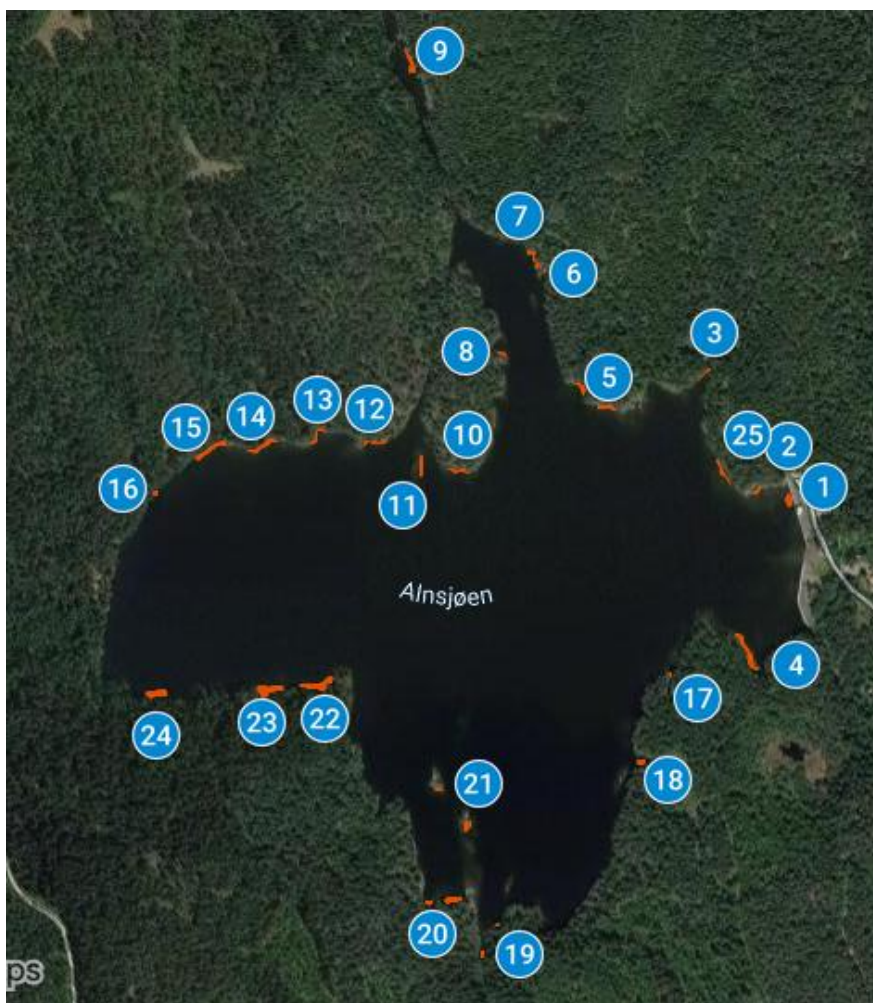
The second article containing maps of the distribution of *Luronium* populations and some additional observations was published in "Blyttia" 2/2019.

In this situation, the main task for the summer of 2019 was to replant as many plants as possible from Breisjøen to Alunsjøen.

Transplanting *Luronium natans* from Breisjøen to Alunsjøen. 19.07 - 08.08.2019.



Map 1. Places of plants collection from Breisjøen. Marked red.



Map 2. Planting places in Alunsjøen along with the numbering of these stands. Planting places are marked in red.

Places of plant collection from Breisjøen.

There was maximum water level during all July until 28.07. During the days 29 – 31.07. water level has been reduced by **40 -45 cm**. That gives better access to plants growing on the depth 40 – 80 cm (from max level) and allow to use better technic of picking them.

Plants were taken from 3 places on the shores of Breisjøen. Map 1.

Location 1.

West side of small bay in SW part of lake.

Luronium grows here on a slightly sloping stony-clay bottom. Plants were collected here from the depth of 20 - 50 cm, with a maximum water level in the lake. Photo 1.

Attempts were made to dig up individual plants along with as many as possible clay and organic deposits they were rooted in. After taking from the water they were planted in small biodegradable pots and placed in transport boxes.



Photo 1. Breisjøen, location 1, with the maximum water level. Start of work. Attempts were made to dig individual plants into biodegradable paper pots. 19.07.2019.

Location 2.

Very small, shallow bay on the Eastern shore of the lake, North from the dam.

Luronium grows very abundantly on the clayish bottom of the bay and stony –clay and sandy bottom slopes. From this location plants were taken from a depth of 20 - 50cm during the maximum water level in the lake and up to 1m when the water level was lowered.



Photo 2. Breisjøen, location 2, with 40 cm lower water. With such a lowered water level, it was possible to dig large clumps from the loamy bottom with plants rooted in them. 8.08.2019



Photo 3. Breisjøen, location 3, with 40 cm lower water. 1.08.2019.

Location 3.

Between the tip of peninsula and small island in Western part of Breisjøen.

Luronium grows abundantly on shallow bottom, mainly in filled with clay flat depressions between the rocks. The same as in location 2 plants were taken from a depth of 20 - 50cm during the maximum water level in the lake and up to 1m when the water level was lowered.

Plants collection methods.

Paper pots.

In the initial phase of work, attempts were made to dig from the bottom single *Luronium* rosette using a small spatula. Single rosettes often grew on the stony-gravelly bottom with a small amount of clay and it was difficult to dig them out with the lump of substrate in which they grew. Plants were planted into small, biodegradable paper pots together with couple of small stones (that the pots do not flow out after planting) and clay taken from nearby bottom. The size of pots was 5.5 x 5.5 cm top opening, and 5.5 cm deep. Photo 4. These were the optimal dimensions for individual *Luronium* rosettes. Plants rooted in a layer of clay were easier to extract along with the roots and lump of this clay. But on the clay, the plants grew very densely, entwined with many stolons of offsprings. It was virtually impossible to pull out a single rosette along with a clod of substrate so as not to damage many daughter rosettes. Bigger clump of clay with many rosettes of *Luronium* in it was too big to put it into our pots.

Usually in one pot was one *Luronium* rosette with some daughter rosettes on stolons, sometimes few other rosettes. I count one pot as one individual.



Photo 4. Biodegradable pots and spatula used for *Luronium* transplantation.



Photo 5. Planted in pots single *Luronium* rosette with daughter plants on stolons. 19.07.2019.



Photo 6. Planted in pots small clump with more than one rosette, daughter plants and floating leaves on long petioles. 26.07.2019.

Clumps.

The patches with densely growing *Luronium* rosettes on clayey grounds were usually deeper than 40 cm. It was difficult to dig out plants from that depth. Lowering the water level in Breisjøen has facilitated access to the surface with clayey bottom and the process of collecting plants.

The best way to get large clumps of plants was to cut out with our hands a piece of clay bottom of the size of 15 x 15 cm with the rooted plants. After pulling the clump on the surface, as much water as possible should be squeeze out - then the clumps did not blur during transport in boxes.



Photo 7. Collecting clumps from location 2. Breisjøen. 3.08.2019.

10 to 30 plants (stem rosettes together with young ones) were found in large clumps harvested in this way.

I count one clump as 10 individuals



Photo 8. Collecting ca. single plants to paper pots. Breisjøen, location 3. 26.07.2019.



Photo 9. Big clumps collected with 40cm lower water level. Breisjøen, location 2. 8.08.2019.

Planting methods.

Water level in Alunnsjøen was **30 -40 cm** lower than the maximum throughout the transplanting period of *Luronium*. It was a very favorable situation because it facilitated planting at the optimum depth for *Luronium* 40 - 80 cm.

Both plants in biodegradable pots and clumps were planted manually on the bottom 5 - 50 cm deep. (40 - 85cm at max level). A clay or sandy-clay bottom was the best place for planting. In the soft ground, a hole was dug in the bottom by hand or with a small spatula and a pot or clump was placed there.

On the hard and rocky bottom only clumps were planted and pressed against the sides with stones so that they did not flow out.

In a few places, pots with plants or clumps of clay laden with pebbles were sunk to a depth of about 1 m from the boat. (locations 1; 9; 11; 21.)



Photo 10. Alunnsjøen, location 8. Sebastian planting pots with *Luronium* on depth about 10-20cm (45-55cm with max. water level). 26.07.2019.



Photo 11. Alunnsjøen, location 7. Bjørn planting pots with *Luronium* on depth about 30- 50cm (65-85cm with max. water level). 24.07.2019.

Planting places in Alunsjøen.

At the most careful counting not less than 5000 plants were planted in 25 places along the shores of the Alunsjøen. Map 2. Table 1.

Two boxes with very big clumps (ca.500 plants) have been delivered to Oslo Botanical Garden. (16.08.2019)

Table 1. The number and form of plants planted in Alunsjøen at specific locations from 19/07/2019 to 08/08/2019. The planting depth was determined in relation to the maximum water level in Alunsjøen.

Location. Alunsjøen Map 2.	From location in Breisjøen Map 1.	Date.	planting depth in cm (+35 cm)	number of plants in pots	number of plants in clumps (x10)
1.	1.	19.07.2019	100-150	25	-
2.	1.	20.07.2019	55-65	50	-
	3.	25.07.2019	65-80	20	-
3.	1.	20.07.2019	65-85	-	50
	2.	07.08.2019	55-75	-	200
4.	1.	20.07.2019	45-85	20	50
	3.	01.08.2019	50-80	-	400
5.	2.	24.07.2019	40-80	20	50
	2.	08.08.2019	55-85	-	300
6.	2.	24.07.2019	75	-	50
7.	2.	24.07.2019	40-85	20	30
	2.	08.08.2019	50-80	-	200
8.	3.	26.07.2019	35-65	40	-
9.	3.	26.07.2019	30-60	30	-
	3.	29.07.2019	80-100	-	100
10.	3.	27.07.2019	50-70	20	-
11.	3.	27.07.2019	100-140	-	100
12.	3.	27.07.2019	60-75	40	-
13.	2.	28.07.2019	60-90	10	300
14.	2.	28.07.2019	50-80	60	300
15.	3.	29.07.2019	50-90	60	400
16.	3.	29.07.2019	60-80	-	100
17.	3.	01.08.2019	60-80	-	50
18.	3.	01.08.2019	60-70	5	50
19.	3.	01.08.2019	60-70	15	100
20.	3.	01.08.2019	55-70	-	200
21.	3.	02.08.2019	55-130	-	300
22.	3.	02.08.2019	55-70	-	200
	2.	03.08.2019	55-70	-	150
23.	3.	02.08.2019	55-75	20	300
24.	2.	03.08.2019	55-80	-	700
25.	2.	07.08.2019	55-65	-	200
				455	4880

Some observations of the *Luronium* response to water level changes.

Summer 2019 was relatively cool and so the water temperature in the lakes.

At such surface water temperatures not exceeding 20°C, even in mid-July, only the shallowest growing to ca. 20 – 25 cm *Luronium* plants produced floating leaves and flowers. Photo 12.

A few hot days at the end of July warmed up the surface of the water a little, which caused more rapid growth of floating leaves and flowers from rosettes growing up to 60 cm deep.

The lowering of the water level in Breisjøen at the turn of July and August accelerated this growth. Cold deep water was drained, through the tunnel to Alunsjøen, but warm surface water lowered into deeper growing plants. This first caused rapid growth, elongation of petioles and flower shoots to the water surface and then lying on the long shoots on the lowered water surface. Photo 13.

Very interesting is the plants reaction for emersion.

Within 2-3 days after emersion, the plants completely lose delicate, underwater rosette leaves.

If before emerging the plants managed to form floating leaves with long petioles then these leaves live longer but after a few days also die. Instead, if the substrate is sufficiently wet, the plants can start produce land leaves on short stiff petioles soon after emersion. Photo 14.

Existing flowers persist after plants emerging exceptionally well for a long time. Photo 15.



Photo 12. Only plants growing to a depth of ca. 20 cm scarce produce floating leaves and flowers. 26.07.2019.



Photo 13. Luxuriantly grown floating leaves and flowers with shoots lying on the lowered water surface. 31.07.2019.



Photo 14. After emersion, delicate underwater leaves die and the plant produces land leaves on short stiff petioles. 3.08.2019.



Photo 15. Existing flowers persist after plants emerging exceptionally well for a long time.
3.08.2019.



Photo 16. If the substrate is continuously wet *Luronium* can live as a terrestrial form.

On the shore of a shallow bay, in the western part of Breisjøen, in the accumulation area of organic matter pushed from the lake surface by waves and wind, considerable clusters of small rosettes with land leaves were found. Probably they are clusters of plants germinating from seeds that abundantly grew last summer.



Photo 17. An accumulation zone of organic matter on the shore of Breisjøen. 5.08.2019.



Photo 18. Cluster of young seedlings of *Luronium*. 5.08.2019

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