

Luronium – 2020



2.1. Latinsk navn (Latin name)

Luronium natans (L.) Rafin.

2.2 Rødlistestatus (redlist status)

Sterkt truet - Endangered (EN)

2.3 Utbredelse (spreading/place)

Luronium natans is an European endemic. It occurs in Western and Central Europe, southern part of Scandinavia, in the range of the Atlantic and Subatlantic climate. The Oslo populations seems to be the northernmost in the whole range (and the only natural sites in Norway). The main range of distribution of this plant is Western and Central Europe, including Poland.

2.4 Lokalteter i Norge (locations in Norway)

In Norway *Luronium natans* is known from 5 lakes in Oslo municipality where their occurrence were noticed during last 100 years. Information about *Luronium* in “Kinnhalvøya i Brunlanes, Larvik i Vestfold” was based on the false identification of the species. The location of Oppedgård given in 1999 is not confirmed and “Roppestaddammen” from Fredrikstad was implanted.

2.4.1. Lokalteter i Oslo (locations in Oslo)

5 known locations:

- Alunsøen, Breisjøen, Dausjøen, Maridalsvannet, Svartkulp.

2.4.2. Location in Fredrikstad – Roppestaddammen.

***Luronium natans* growth forms and Methodology.**

According to the English botanical literature, *Luronium natans* has two distinct forms: *submersum* - with submerged linear-lanceolate leaves, which are flat and only grow in water, and *repens* - with “expanded” leaves. Expanded leaves have petioles and blades, and may float or be submerged (WILLBY & EATON 1993, LANSDOWN & WADE 2003). Thus, the division line is between forms having only submerged leaves and forms having both submerged and expanded floating leaves. Forms growing on the not flooded, exposed substrate, are not described in details.

In turn, in Polish botanical literature (f.e. SZMEJA 2001) there are described two forms either. The division line is between submerged plants (even they have expanded floating leaves) and terrestrial forms. The latter grow on the exposed substrate, not in the water, and they have aerial ovate leaves, sometimes with remnants of a rosette of submerged leaves. However, the causes of variation in growth form are apparently environmental rather than genetic, and these forms are not consistent.

So, we distinguish three forms for the purposes of this study - it makes it easier to inventory *Luronium* in the field and better shows the diversity of the population of this plant in the area of research although these forms are often a continuum in space or in time:

(i) **Submerge vegetative form** - completely submerged form with rosettes of linear-lanceolate leaves connected with white or green stolons but without “expanded” floating leaves. It occurs in deeper water – one to several meters.

(ii) **Form with floating leaves*** - form with submerged leaves rosettes, stolons and with “expanded” floating leaves (elliptical to ovate, on long petioles which grow out of underwater leaves rosette); white flowers (~1 cm of diameter) occur on the water surface (on long pedunculates); forms grow in not very deep water, usually up to 1 m depth.

*I decided to shorten the name of the "**Submerge form with floating leaves**" category by removing the term "**submerge**". It is more correct in the light of the hydrobotany definition. A plant with some organs on the surface of the water is no longer strictly "submerge".

(iii) **Terrestrial form** - with “expanded” aerial leaves, elliptical to ovate shape, on short petioles, sometimes with white flowers; they occur on exposed muddy bottom or in not very deep water (up to several centimeters).

Due to the reconstruction of the Breisjøen dam, the water level was reduced by 6.5 m from mid-April to the end of October 2020. During this period, work was carried out to prevent the drying out of as much of the *Luronium natans* population as possible.

In the other lakes: Dausjøen, Maridalsvannet and Svartkulp observations were carried out as in previous years only from the shore and in Alunsjøen also by using boat.

Location: 1. DAUSJØEN

Individuals: Very abundant, sometimes as many as 200 (500 – 700)* individuals / 1m². If we estimate as average: 30 individuals /m² x 20223 m² = **606 690 individuals** (for 200 individuals / 1m² = over 4 millions! Individuals).

* Under favorable conditions, *Luronium* can produce a lot of progeny plants growing on the stolons during the season. Then their number, together with progeny plants, may reach 500 - 700 pcs. / m²

Area: Sum = 20223 m². (The size of set surfaces - see map 1. And data from 2018 report.)

We estimate that *Luronium* is present on ca. 70% of the lake shoreline. The most abundantly it grows in Northern bays of Dausjøen with the exception of very muddy bays and in places where the water is immediately very deep -as along a steep cliff in the southern part. Maximum depth where *Luronium* is growing in Dausjøen – 2,2 m

Environment (habitat): Lake with stable (not regulated by dam) water level. Plants which are growing on the depths between 10 -100 cm, usually with floating leaves and flowers could be visible from ashore. **In summer of 2018 we discovered the area which is covered by submerge vegetative form of *Luronium*. Appears that it makes up 87% of the entire population in Dausjøen.** *Luronium* grows preferably on empty sandy and clayey (mineral) bottom with a thin layer of organic sediment, but also together with: *Lobelia dortmanna*, *Juncus bulbosus*, *Equisetum fluviatile*, *Carex vesicaria*, *Lysimachia thyrsiflora*, *Alisma plantago –aquatica* (rarely), *Nuphar luteum* and in deeper parts with *Isoetes lacustris*, *I. echinospora*.

Condition: Except some hot days in June, summer 2020 was relatively cold and temperature of water seldom exceeded 20°C. In the beginning of July some plants growing not deeper than 20 cm scarcely produce floating leaves and flowers. During summer no more floating leaves and flowers appear on the surface of water. Instead the plants seemed to reproduce more vegetatively by progeny plants growing on stolons.

GPS-coordinates: 60° 0'31.70"N 10°47'23.08"E

Date of watch: 1.07; 4.08; 9.09.2020.

Photos: R. Gramsz

Observer: R. Gramsz



Photo 1. Even in very shallow water, *Luronium* only produced rosettes of underwater leaves.
9.09.2020.



Photo 2. Vegetative rosettes connected with stolons. They were growing on depth 40 – 60 cm.
4.08.2020.

Location: 2. BREISJØEN

Due to the reconstruction of the Breisjøen dam, the water level was reduced by 6.5 m from mid-April to the end of October 2020. During this period, work was carried out to prevent the drying out of as much of the *Luronium natans* population as possible.

Individuals: The most abundant population in Norway. In some places can grow as much as 200 individuals/m². After our research (2018) it turned out that *Luronium* is growing on an area of 37 716 m²! Even if we accept as average only 30 individuals / m², we will receive more than 1 million individuals.

* *Luronium* can produce a lot of progeny plants growing on the stolons during the season. Then their number, together with progeny plants, may reach 500 - 700 pcs. / m²

Area: Sum = 37716 m². (The size of set surfaces - see map 1. And data from 2018 report.)

Luronium is present on ca. 70% of the lake shoreline. It does not grow only in shallow, very muddy bays and where the water is immediately very deep and bottom stony.

Maximum depth where *Luronium* is growing in Breisjøen – up to 4m (according to observations in 2020).

Environment (habitat): This lake has variable water level. Plants can grow both on the expose shore and submerge in water. *Luronium* grows preferably on empty sandy and clayey (mineral or mix mineral-organic) bottom. Observations from 2020 confirmed that the most favorable substrate for *Luronium* is possibly a thick organic-clay layer covered with a thin, liquid organic layer. Such conditions occur on the flat fragments of the bottom. *Luronium* can also grow on underwater rocky shelves and on not very steep slopes if it is covered with a layer of silt. On the depth of water to about 1m *Luronium* grows together with: *Lobelia dortmanna*, *Juncus bulbosus*, *Ranunculus reptans*, *Isoetes echinospora* (?), *Equisetum fluviatile*, *Carex vesicaria*, *Lysimachia thyrsoflora*. Vegetation at a places deeper than 1.5m is very pure so, it is less competition for *Luronium*. The water in the lake is very transparent which allows the plant to grow to a depth of 4 m.

Condition: Lowering the water level by 6.5 m in the second half of April caused the entire emerged *Luronium* population to lose all delicate, underwater leaves (they dried up within a few days) and thus all their photosynthetic apparatus.

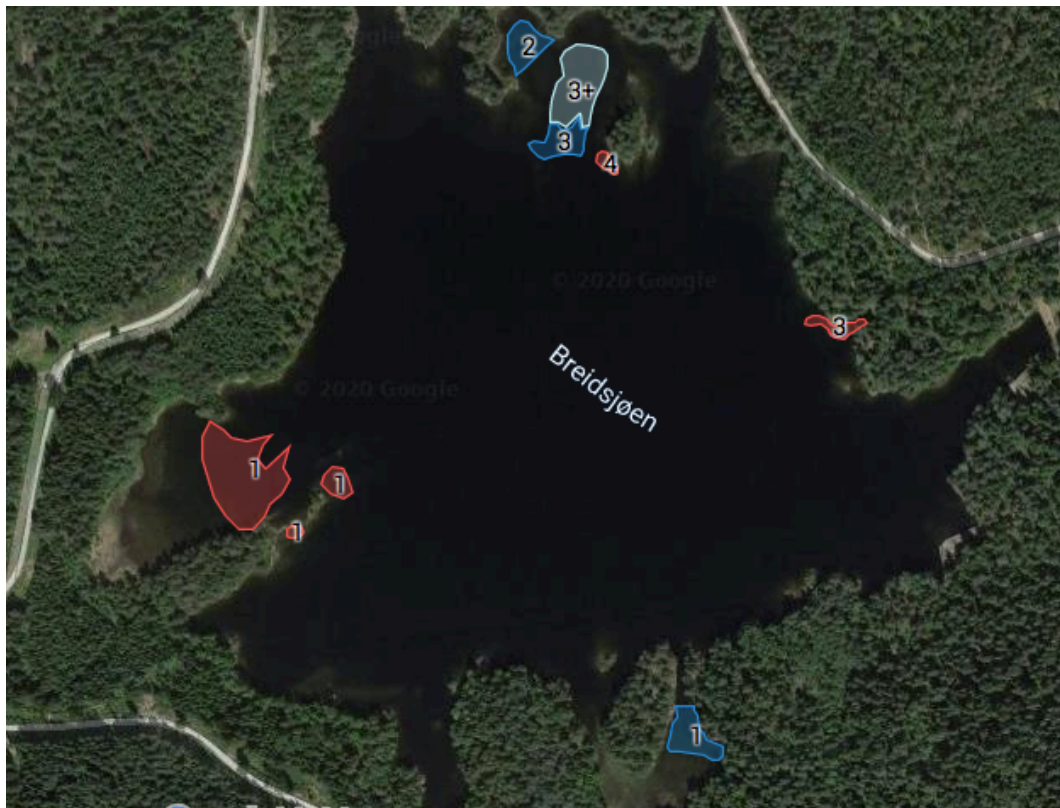
During the lowering of the water level, intense erosion and washing out of the layer of silty substrate in which *Luronium* was rooted took place. Photo 1 and 2. On the bottom slopes thin layer of silt was wash away together with *Luronium* plants or revealing their roots. Plants so exposed to desiccation had little chance of survival even if irrigated.

On the vast flat bottoms of the bays in the northern and western parts of the lake, however, a thick layer of organic and mineral sediments remained, which kept the moisture well and gave the plant a chance for survival.

In such places, irrigation systems were installed that gave the plant the possibility to rebuild and survive as a landform.

Three dams were built in the northern and southern parts of the lake. The water pumped into them created 3 small ponds in which the plants could rebuild the rosettes of underwater leaves and / or floating leaves.

Care: The following irrigation systems and dams were built: (see Map 1.)



Map 1. Map of the distribution of irrigated areas (red) and flooded after construction of small dams (blue).

1. No 1 (red) Photo 3. Irrigation of the bay and peninsula in the Western part of the lake. This vast bay with a slightly sloping, silty bottom and abundant flytegro occurrence could ensure the survival of the plants if it could be kept wet or at least moist. An irrigation system was installed across the bay so that the sprinkled was a 20m wide strip and excess water flowed down below, moistening the rest of the exposed bay bottom. (Photo 1.) In this boggy bay, plank footbridges had to be built to provide access to the sprinklers. 3 sprinklers were placed higher on the peninsula to support plants in other habitats (at a depth of about 50 cm and 2 m from the normal water level) This system worked well - it allowed most of the plants on the irrigated surface to survive and grow as a terrestrial form. (Photo 7.) Some plants have been destroyed or damaged by grazing of the Canadian goose family and ducks. The system was dismantled on 21.10.2020 when most of the plants were already under water again.

2. No 3 (red) Photo 4. Irrigation of the small bay and the slope of the bottom in the eastern part of the lake. Plants growing on the bottom slope with a small layer of clay and silt at a depth of 30 cm to 1.5 m were to be protected here. There were 3 sprinklers here. At this place, it was necessary to made the tape fence due to the frequent visits of people and the trampling of the plants. This system worked well - it allowed most of the plants on the irrigated surface to survive and grow as a terrestrial form.

3. No 4 (red) Irrigation of the shores of the island in the northern part of the lake. Similarly to site "3", plants growing on the slope of the bottom with a small layer of clay and silt at a depth of 30 cm to 1.5 m were to be protected here. There were also 3 sprinklers here. This system worked well but relatively few plants survived here due to the washing away of the clay and silt.

4. No 1 (blue) Photo 5. Dam in the southern part of the lake. This dam was supposed to keep the plants shallow (20 -30 cm deep) what should enable their survival and cause a strong development of floating leaves and flowers. This dam did not have the expected effect. Only the plants on the shores of the pond survived.

5. No 2 (blue) Photo 6. Dam in the northern part of the lake. This dam was to provide the plants with "normal" living conditions throughout the reduced water level in Breisjøen. At the end of May, when the water level was already 5 m below normal and all flytegro occurrences were exposed, we decided together with Bjørn Smevold that it would be worth building one more dam below the dam no.2. It would flood a large flat area of the bottom with abundant flytegro occurrence. With the approval of the Vav administration, we built this dam (no 3) out of plastic sandbags with the help of volunteers from Norsk Botanisk Forening. These dams and irrigation system (no 4) in N Breisjøen has ensured the protection of the flytegro in a variety of habitats and throughout its depth zone. Many means of protection have been used here and it was a great success:

Dam no 2 with a water depth of up to 60 -80 cm enabled the plant to rebuild an underwater, vegetative rosette of leaves. "Our dam" no 3, with a depth of up to 20 -30cm allowed the lush growth of the form with floating leaves and flowers. The deliberately overflowing water from dam no. 2 irrigated the surface of a large flat area (no 3+) of the bottom above "our dam" contributing to a very lush growth of the flytegro terrestrial form, and sprinkling on the slope of the island (no 4 (red)) kept some plant alive in terrestrial form.

Unfortunately, this area suffered from bird feeding.

Some damage was done by the Canadian goose family in May and June, but the ducks feeding here at night did a great deal of damage already during the filling of Breisjøen in October. Almost 100% of plants with floating leaves and a large part of the terrestrial form were destroyed.

The good news is that thanks to the relatively cool and rainy summer, *Luronium* has survived as a terrestrial form in many places at the bottom of the lake where we have not carried out any protective measures. They were usually depressions of the bottom with a layer of silt and clay, often additionally fed with periodic streams or exudations of groundwater

GPS-Coordinates: 59°58'47.17"N 10°51'38.11"E

Date of watch: 22.04 - 15.11.2020 (at least once a week and almost every day in summer)

Photos: R. Gramsz

Observer: R. Gramsz



Photo 1. Erosion of the silty-clay layer depending on the intensity of waves during lowering the water level. 19.05.2020.



Photo 2. After rinsing the silt-clay layer and exposing the roots, *Luronium* had no chance of surviving. 19.05.2020.



Photo 3. No 1 (red) Irrigation on the western bay. 16.07.2020.



Photo 2. No 4 (red) Irrigation of the small bay and the slope of the bottom in the eastern part of the lake. 28.06.2020.



Photo 5. No 1 (blue) Dam in the southern part of the lake. 11.06.2020.



Photo 6. No 2 (blue) Dam (on right), “our dam” no 3 and wet area no 3+ (center), No 4 (red) Irrigation (far left) in the northern part of the lake. 11.06.2020.



Photo 7. Terrestrial form of *Luronium* in irrigated part of Western bay. 31.07.2020.

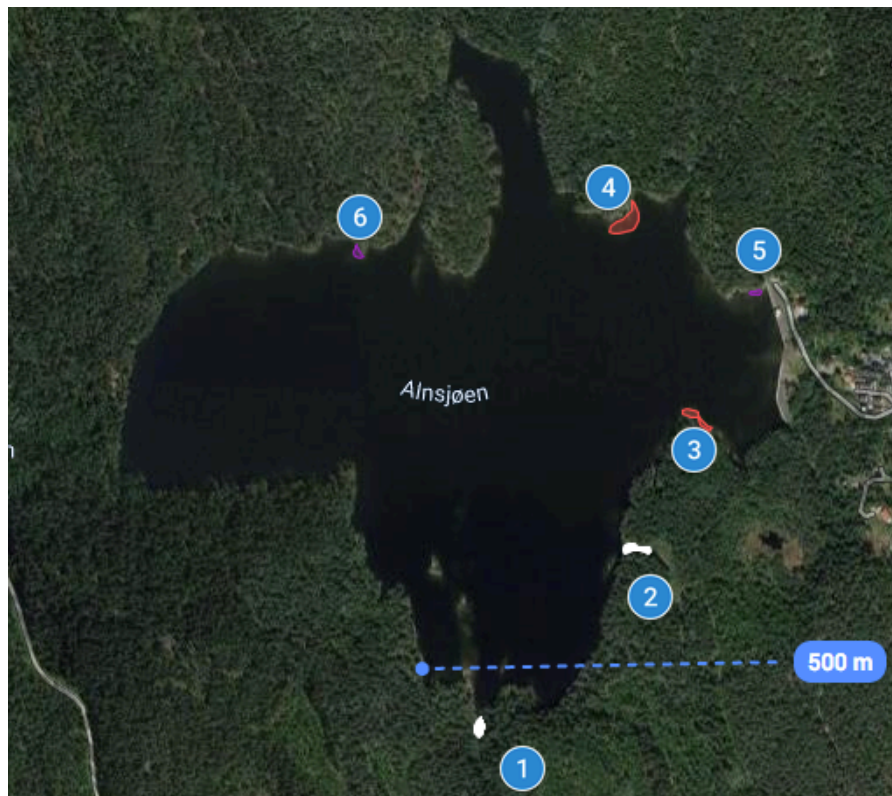


Photo 8. *Luronium* form with floating leaves and flowers luxuriantly developed at dam no.3. 19.08.2020.



Photo 9. *Luronium* form with a rebuilt rosette of underwater leaves and flower buds in dam no. 2. 21.07.2020.

Location: 3. ALUNSJØEN



Map.1. On the map - Natural location of *Luronium natans*:

- No 1, 2 – extinct locations observed only in 2008 and 2009
- No 3, 4 – locations observed after 2014 (3) and after 2017 (4)
- No 5, 6 – locations observed after 2019

Individuals: The presence of plants on natural locations was confirmed during observations in 2020. Plants are spread in locations creating one bigger and a dozen or so small concentrations (clusters) with a 100 – 200 as a sum of individuals. On the small locations there were only about 20 plants (location 5) and just 1 in location 6.

Area: Sum = ca. 600m².

Environment (habitat): The littoral belt of Alunsjøen is still very pure with vegetation after dam rebuilding in 2007 -2008. So, *Luronium* behaves a little as pioneer plant. In a days of observation (and in most of summer) water level was at maximum.

Condition: Plants were hard to see, they produced few floating leaves and flowers only at locations 3 and 4.

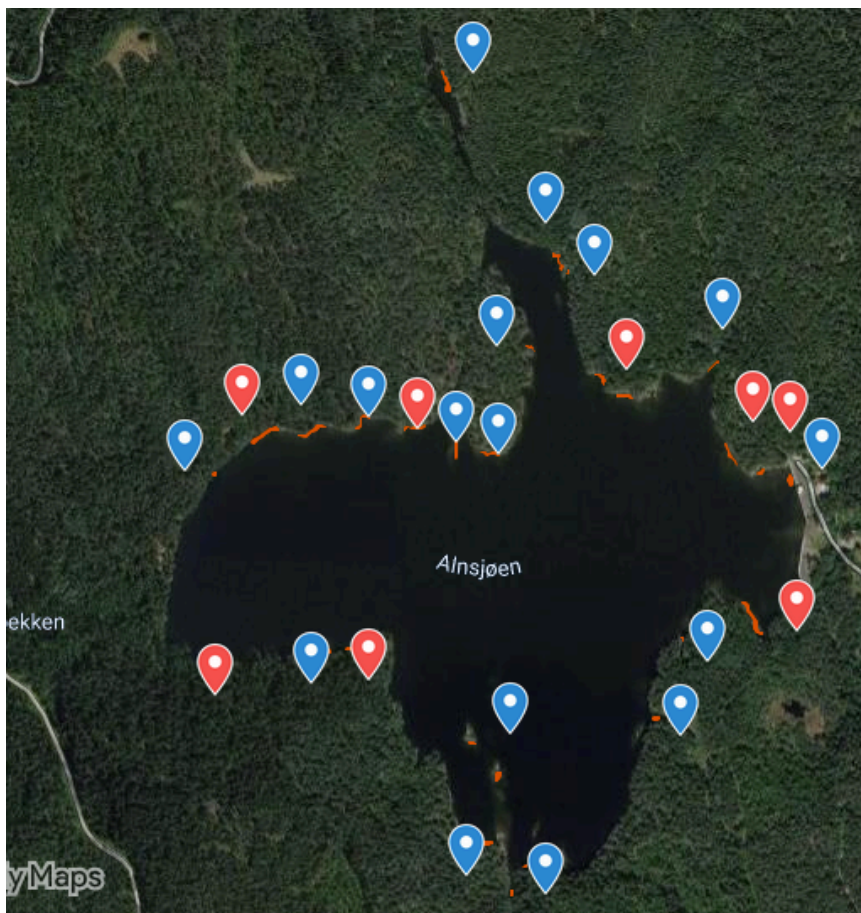
Care: Checking the effectiveness of transplanting plants to Alunsjøen in 2019 was carried out on July 23 and July 31 and August 1 2020 with the use of a pontoon and a tube for underwater observation (vattenkikare).

The result was not very impressive - for 25 planting places only in 8 of them I confirmed the presence of *Luronum* ... Map 2.

This year's relatively cold and rainy summer meant that *Luronium natans* in natural habitats produced very few floating leaves and flowers, mainly in the shallow places up to a water depth of about 20-30 cm. It means that plants have not been visible on the surface of water when they grow deeper than 30 cm. Most of plants were planted last year in Alunsjøen on the depth 40 – 80 cm and some of them even deeper. (At planting, the water level in Alunsjøen was 35-40 cm below the maximum.)

It is very difficult to identify the underwater form of *Luronium* from the surface of the water, especially if it grows dispersed and together with a similar species as *Juncus bulbosus*. It is therefore possible that I may not have noticed the plant. Next year may be better for these observations, because plants that managed to establish themselves there will develop better and will be more visible.

I expected a better result, but on the other hand, there is a certainty that at 8 sites, in different parts of the lake, *Luronium* has adopted and there is a chance that it will develop there.



Map 2. Result of transplanting *Luronium* to Alunsjøen. As of August 1, 2020. The 2019 planting locations (areas) are marked in red. Places where the presence of *Luronium* has been confirmed in 2020 - red points. Blue points - not confirmed.

In July and August, the plants were transplanted around Breisjøen to better survival sites and to Alunsjøen.

It seems that transplanting plants in a terrestrial form with a compact lump of the substrate gives better results than transplanting forms growing in water. (as was done last year).



Photo 1. Well developed terrestrial form with stolons ready for replanting.



Photo 2. These plants were transplanted to Alunsjøen with good results. 23.08.2020.

GPS-coordinates: 59°57'57.94"N 10°51'4.54"E

Date of watch: 23.07; 31.07; 1.08; 23.08; 14.09.2020

Photos: R. Gramsz

Observer: R. Gramsz

Location: 4. SVARTKULP



Map.1. Diving observation of *Luronium* in Svartkulp **from the year 2016.**

- white marked places - **form with floating leaves** (growing in depth 0 – 0.5m) possible to observation from ashore.
- **red marked places** - **submerge vegetative form** (growing in depth 0.5 – 1.5m, dense concentration) not possible to observation from ashore.
- **yellow marked places** - **submerge vegetative form** (growing in depth 0.5 – 3m, scattered concentration and individual plants) not possible to observation from ashore.

Individuals: This year observations, **only from ashore**, confirm *Luronium* existence only in few places on Northern and Eastern shore. Only underwater, vegetative rosettes were noticed. There were no floating leaves and flowers. *Luronium* is not growing so abundant in Svartkulp as in Breisjøen and Dausjøen but after our underwater observation we estimate that it is growing on area of about 1600 m². That means (if we use 10 individuals/1 m²) = 16000 individuals.

Area: Ca. 1600 m² – as found out by diving in year 2016. (with submerge vegetative form)

Environment (habitat): This lake has rather stabile water level. Is relatively small and surrounded by forest and high, steep rocks on Eastern side. Western and North - Western shallow shore is overgrown by mire vegetation. *Luronium* plants are growing preferably on

empty mix mineral/organic) bottom, but also together with: *Nuphar luteum*, *Potamogeton natans*, *Juncus bulbosus*, *Equisetum fluviatile*, *Carex vesicaria*, *Lysimachia thyrsiflora*, *Sparganium* sp. Observations with the help of diving discovered the occurrence of single-growing, large rosettes also opposite the muddy western shore.

Condition: Only a few underwater rosettes were visible on Northern and Eastern shore.

Care:

GPS-Coordinates: 59°58'30.95"N 10°50'51.30"E

[Luronium-Svartkulp4](#)

Date of watch: 4.08; 30.08.2020.

Photos: R. Gramsz

Observer: R. Gramsz



Photo 1. Svartkulp. Only underwater rosettes of *Luronium* this year. 30.08.2020.

Location: 5. MARIDALSVANNET

Individuals: *Luronium* in most places is growing spread, not as dense as it can grow in Breisjøen and Dausjøen. So, if we estimate $20 \text{ individuals/m}^2 \times 29650 \text{m}^2 = 593\ 000$ individuals. Maximum depth – 2m.

Area: Sum = 29650m^2 . (The size of set surfaces - see map 1. And data from year 2018 report.)

Environment (habitat): Big lake with variable water level. The spots with *Luronium* we have found at Maridalsvannet are less abundant than in Dausjøen or Breisjøen. Surface of water in the lake can strongly wave because of its size. *Luronium* avoids exposure to waves and it is possible to find it only in sheltered bays, behind rocky spurs or protected against waving by other plants and in places located deeper than 30 cm. Transparency of water is smaller than in Breisjøen and Alunsjøen. Typically, *Luronium* were found at a depth of 30 to 150 cm (max. 2m) from maximum water level. In a slow flowing estuary part of Dausjøelva (during researches in 2018) we have found a few small locations of *Luronium* and some interesting plants like: *Limosella aquatica*; *Subularia aquatica* and other most common plants in Maridalsvannet: *Alisma plantago aquatica*, *Lobelia dortmanna*, *Litorella uniflora*, *Juncus bulbosus*, *Heleocharis acicularis*, *Ranunculus reptans*, *Isoëtes lacustris*, *Equisetum fluviatile*, *Carex vesicaria*, *Lysimachia thyrsoiflora*, *Nuphar luteum*, *Myriophyllum alterniflorum*, *Potamogeton natans*, *Sagittaria sagitifolia*, *Sparganium sp div.*

Condition: Summer 2020, similar to the previous one was relatively cool and so the water temperature in the lake did not reach 20°C. At 4.08. it was maximum level of water. Several well-known on the occurrence of *Luronium* places on the N and W shore of the lake were checked but the floating leaves or flowers were not noticed. It is a typical situation for Maridalsvannet that with maximum water level for most of the summer and relatively cool water *Luronium* very rarely or does not produce floating leaves and flowers at all, so observing plants from the shore is practically impossible. At 8.09. I visited a shallow bay on the W shore of the lake. At that day water level was 15 – 20 cm lower and some plants from the depth ca. 30 cm start to produce floating leaves.

Care:

Date of watch: 4.08; 8.09. 2020.

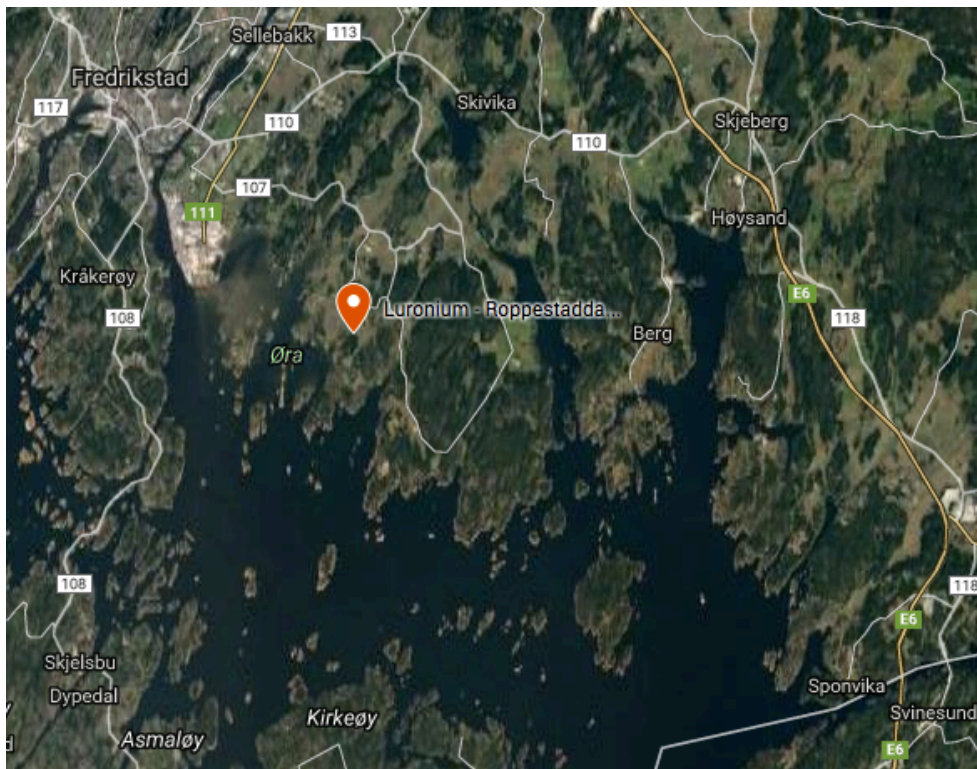
Photos: R. Gramsz,

Observer: R. Gramsz



Photo 1. Maridalsvannet, location near the outlet of the Dausjøelva. There were no floating leaves and flowers but behind the sedge strip you could see rosettes of underwater leaves.
4.08.2020.

Location 6: FREDRIKSTSD - ROPPESTADDAMEN



Map 1. General localization of Luronium site – Roppestaddamen.

Individuals: Very abundant

Area: *Luronium* occurs in two small ponds.

- Roppestaddammen with a size ca. 60m x 15m. *Luronium* covers about 30% of the reservoir surface, grows in large dense clusters (20%) and dispersed (10%).
- Roppestadmyra ca. 20m x 40m with *Luronium* growing on at least 40% of it area in this year (less than estimated in last year).

Environment (habitat): Both ponds are located on the site of a small, disused granite quarry or close to it. Roppestaddammen fills irregular rock cavity and this place is quite well sunlit. Roppestadmyra has an oval shape and looks as if it was dug in the peat. This pound is surrounded by forest and shaded. Both ponds are not deeper than 1m (Roppestaddamen) and maybe 1.5m (Roppestadmyra).

In Roppestaddamen besides *Luronium natans* is possible to find: *Acorus calamus*, *Baldelia (ranunculoides?)*, *Calla palustris*, *Carex acutiformis*, *C. rostrata*, *C. pseudocyperus*, *C. stellulata*, *Comarum palustre*, *Equisetum fluviatile*, *Glyceria fluitans*, *Juncus conglomeratus*, *J. effuses*, *J. ensifolius?* *J. bulbosus*, *Lemna minor*, *Lysimachia vulgaris*, *Menyanthes trifoliata*, *Nymphaea alba*, *Ranunculus flamula*, *R. lingua*, *Utricularia vulgaris*, *U. intermedia*,

In Ropestadmyra: *Luronium natans*, *Carex rostrata*, *C. stellulata*, *Comarum palustre*, *Glyceria fluitans*, *Juncus effusus*, *Nymphaea alba*, *Utricularia sp.div*,

Condition: This year's observations were conducted twice at the beginning and end of summer. It seems that the *Luronium* population is slightly decreasing in competition with *Juncus bulbosus*, *Utricularia sp. div.*, and *Sphagnum sp.* strongly overgrowing this pond. *Luronium* still produces floating leaves and flowers growing among *Utricularia* but it has a harder time surviving among Sphagnum. The growth of Sphagnum also contributes to lowering the pH of the water (pH 5 in Roppestaddammen).

Care: *Luronium* was planted in those pounds.

GPS-coordinates: 59.1667, 11.02638

Date of watch: 24.06; 30.09.2020

Owner:

Photos: R. Gramsz

Observer: R. Gramsz



Photo 1. Roppestaddammen. Still a picturesque view, but the pond is getting more and more overgrown. 24.06.2020.



Photo 2. *Luronium* is in competition with *Nymphaea alba*, *Utricularia* sp. Div. and *Sphagnum* sp. 24.06.2020.



Photo 3. Roppestaddammen, pH 5 close to *Sphagnum* cluster. 30.09.2020.



Photo 4. *Luronium* among *Utricularia*. 24.06.2020.



Photo 5. *Luronium* among *Sphagnum*. 24.06.2020.