

## Luronium – 2021



### 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).

**After the reconstruction of the Breisjøen dam, when the water level was reduced by 6.5 m from mid-April to the end of October 2020, in this year 2021, precise boat and diving observations were made on Breisjøen and Alunsjøen. The work was carried out with the same method as in the 2018 mapping process and resulted in two maps of the current distribution of the *Luronium* population in these lakes. The comparison of maps from 2018 and 2021 allows the assessment of the effectiveness of the conservation activities carried out in 2019 and 2020 in Breisjøen and Alunsjøen.**

**In the other lakes: Dausjøen, Maridalsvannet observations were carried out as in previous years only from the shore and in Svartkulp from the shore and pontoon.**

**Location: 1. DAUSJØEN**

**Individuals:** Very abundant, sometimes as many as 200 (500 – 700)\* individuals / 1m<sup>2</sup>. If we estimate as average: 30 individuals /m<sup>2</sup> x 20223 m<sup>2</sup> = **606 690 individuals** (for 200 individuals / 1m<sup>2</sup> = 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. / m<sup>2</sup>

**Area:** Sum = 20223 m<sup>2</sup>. (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:** In the summer 2021 the observation was only carried out on one day (18.07) from the shore. At that time, there was a very low water level on the lake - about 40 cm below the maximum level. In the coastal zone emerged from the water, single *Luronium* plants began to produce the first land leaves and in the shallow water there were very few floating leaves and flowers. At places deeper than 20 cm (actual depth), clusters of vegetative rosettes were visible, but without floating leaves and flowers. A lot of detached plant remains (also *Luronium*) floated on the surface of the water. It is possible that it was damage caused by feeding ducks.

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

**Date of watch:** 18.07.2021

**Photos:** R. Gramsz

**Observer:** R. Gramsz



Photo 1. Low water exposed the entire coastal sedge belt. 18.07.2021.



Photo 2. In the shallow water *Luronium* produced very few floating leaves and flowers. 18.07.2021.

## Location: 2. BREISJØEN

*Luronium natans* monitoring was carried out this year using a boat and a diving method. Its task was to accurately map the distribution of the *Luronium* population after the reconstruction of the dam last year and the related reduction of the water level in the lake by 6.5 m in the period from April to the end of October 2020. Field research and cartographic works were carried out using the same method as in 2018. Thus, the comparison of maps made in 2018 and in 2021 gives the opportunity to assess the effects of draining the lake during the reconstruction of the dam on the range of the *Luronium* population and the effectiveness of the protective measures taken at that time.

**Individuals:** The number of individuals was already difficult to determine with a stable population in previous years. This year's research and mapping allowed to determine the size of the area occupied by the *Luronium* population. It turned out that it is ca. 1/4 smaller than before the reconstruction of the dam: - in 2018 it was an area of 37 716 m<sup>2</sup> and - 27 746 m<sup>2</sup> in 2021. The density of plants on the currently occupied area has also significantly decreased, especially in the zone up to 1.5 m deep. Table 1.

Therefore, if the area currently occupied by the *Luronium* population in Breisjøen is 73% of the area occupied in 2018, the number of individuals must be estimated at **less than 50%** compared to 2018.

**Area:** The area occupied by the *Luronium* population is **27,746 m<sup>2</sup>**, which is 73% of the area occupied in 2018.

The exact data are presented in Table 1 and Maps 1 and 2.

### Description for table 1 and maps 1 and 2:

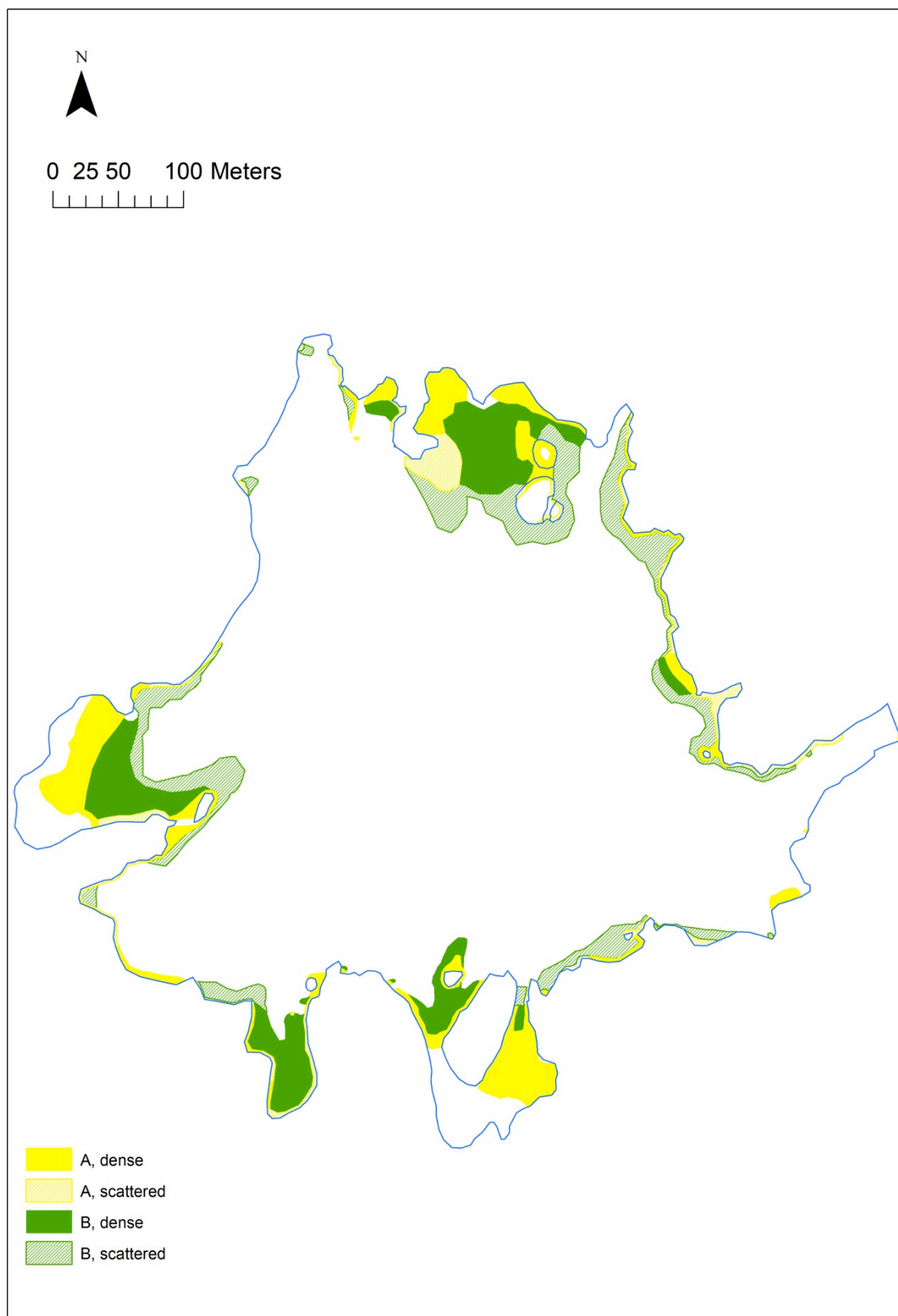
A: form with floating leaves and flowers. Usually growing to a depth of 0 - 1.5m

B: submerged vegetative form. Usually growing to a depth of 1.5 – 4m

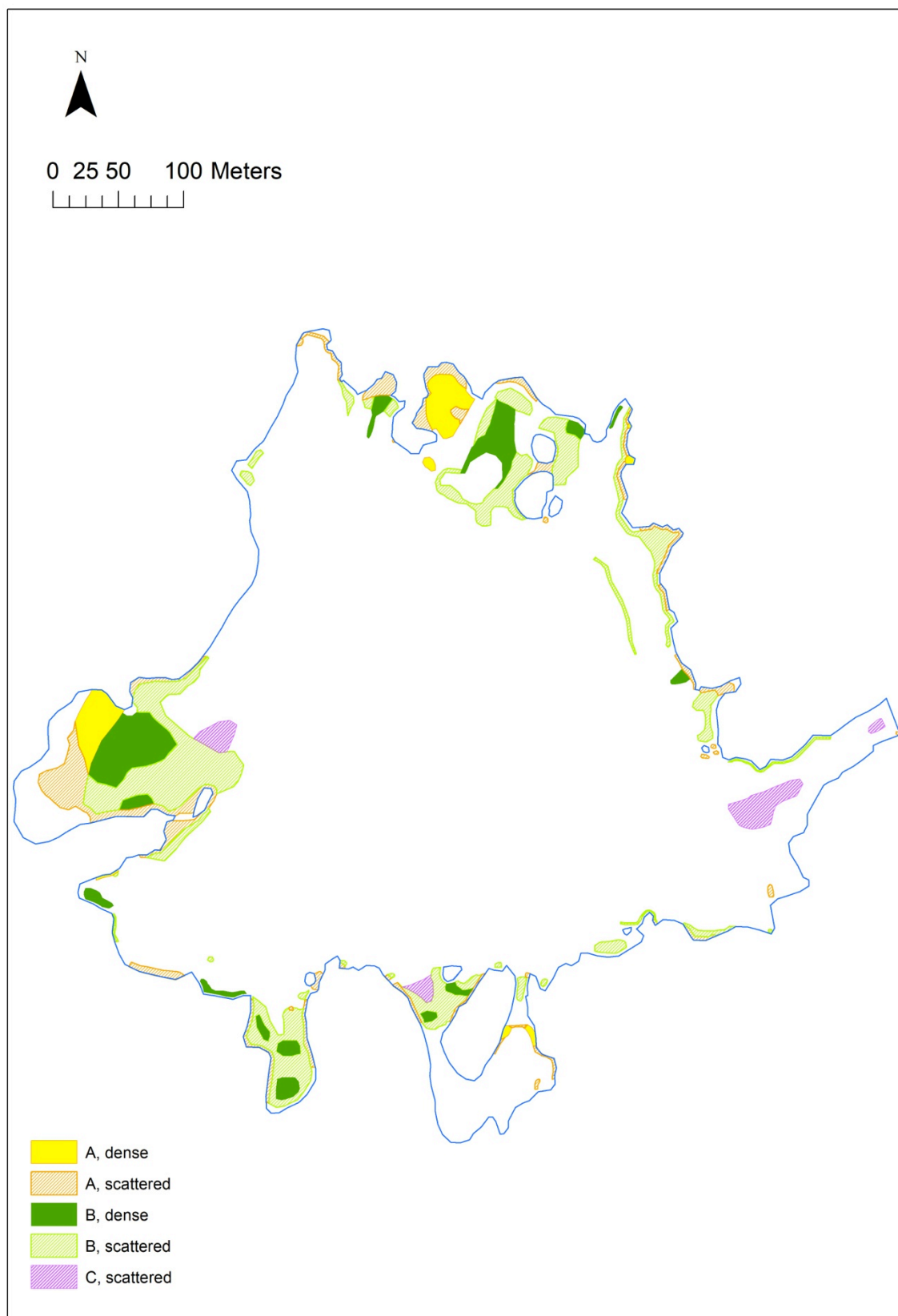
C: plants from seeds germinated in the summer of 2020 in a moist mud at a bottom depth of 4 - 6m, below the depth at which *Luronium natans* grew under normal conditions.

<i>Luronium</i> forms	2018 area/m <sup>2</sup>	2021 area/m <sup>2</sup>	% of 2018 area	
A dense	11296	2587	< 23 %	< 54 %
A scattered	3683	5448	> 148 %	
B dense	10999	5225	< 47 %	< 78 %
B scattered	11739	12635	> 107 %	
C scattered	-	1850	>	>
Sum	37716	27746	< 73%	< 73 %

Table 1. Areas occupied by *Luronium* forms before (2018) and after (2021) the reconstruction of the Breisjøen dam.



Map 1. Breisjøen. Distribution of the *Luronum natans* population in 2018. Authors: Katarzyna Bociąg & Roman Gramsz.



Map 2. Breisjøen. Distribution of the *Luronum natans* population in 2021. Authors: Katarzyna Bociąg & Roman Gramsz

**Environment (habitat):** This lake has variable water level. Plants can grow both on the exposed 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 thyrsoiflora*. 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.

The drainage of the lake last year resulted in major changes to the habitat occupied by *Luronium*. These are:

- erosion, washing out of clay-organic sediments, especially from steep parts of the bottom near the shores which resulted in the disappearance or significant thinning of the plants in this zone
- change of sediment properties where they have not been rinsed (flat parts of the bottom in lake bays) - overdrying and oxygen access
- changed species composition of plants on some surfaces. Some of these changes may be long lasting and these species compete with *Luronium*, e.g.: *Juncus bulbosus*, *Potamogeton alpinus*, *Glyceria* sp.
- appearance of plants that germinated from seeds during the summer of 2020 on the then exposed bottom with moist silt at a depth of 4 - 6m. This is a depth that the *Luronium* in Breisjøen did not grow at. These plants survived until 2021 in the form of small vegetative rosettes. On map 2 marked in pink as form "C".

**Condition:**

Underwater vegetative rosettes of *Luronium* are perennial and can grow up to 30 cm if they are constantly under water. However, they are very delicate and prone to desiccation, so 100% of the *Luronium* population in Breisjøen lost their vegetative rosettes within days, sometimes hours, after emerging from the water in 2020. Plants to survive on wet mud or shallow flooded with water (our protective measures - dams) had to rebuild their photosynthesis apparatus in the land form or in the form with floating leaves. However, after flooding the water again, both the landform and floating leaves die and the plant must begin to rebuild the rosette of underwater vegetative leaves. Plants had rebuilt their vegetative rosettes by the summer of 2021, although they were small, up to 10 cm in length. In places up to 1.5 m deep, they often produced shoots with flowers and floating leaves.

Overall, the population is weakened and sparse and in some places dominated by plants that have germinated or developed better there during the summer of 2020.

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

**Date of watch:** 1.07, 19.07, 22 – 30.07, 5.08. 2021

**Photos:** R. Gramsz **Observer:** R. Gramsz and Katarzyna Bocią





Photo 1. West Bay - one of the places where *Luronium* has best survived. From a depth of about 1 m, flower shoots with floating leaves grow profusely. 22.07.2021.



Photo 2. *Glyceria sp.* this year can dominate in places where *Luronium* is present. 19.07.2021.



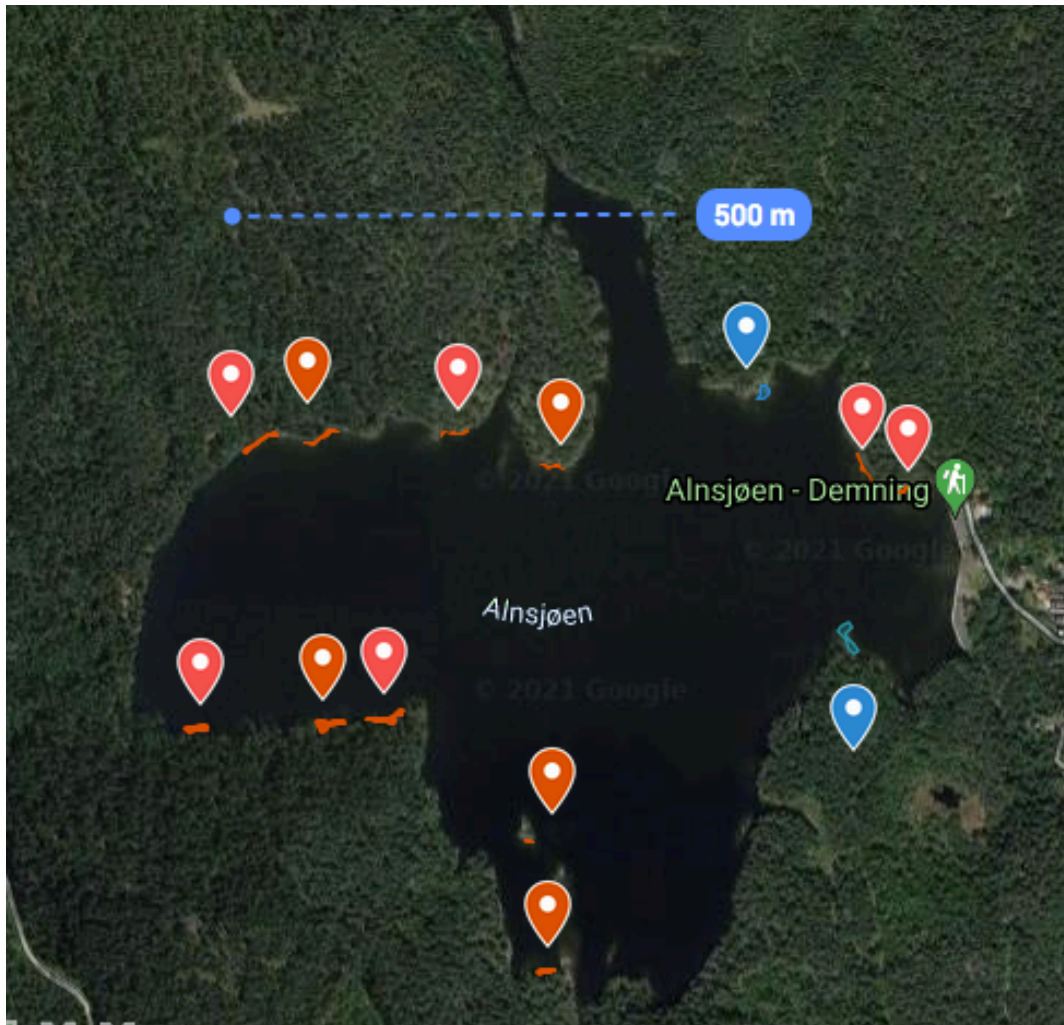
Photo 3. A small vegetative rosette pulled out from a depth of 5m - from the location where plants sprouted in summer 2020. Form "C". 23.07.2021.



Photo 4. Diver, Katarzyna Bociag prepared for deep diving. 25.07.2021.

### Location: 3. ALUNSJØEN

*Luronium natans* monitoring was carried out this year using a boat and a diving method. The main goal of this research was to check exactly on which sites and how many plants have adapted as a result of replanting in 2019.



Map.1. On the map - Locations of *Luronium natans* in 2021.

- blue areas and points – natural sites
- red areas and points – planted sites

**Individuals:** The presence of plants on 2 natural locations was confirmed during observations in 2021. 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. This year, no plants were found at the other natural sites near the dam and in the N part of the lake, (location 5 and location 6 from last year).

Of the 25 sites where *Luronium* was planted, 11 of them were confirmed that plants have survived. However, only single plants grew on these sites and only about 100 plants were adapted in total

**Area:** Sum = ca. 600m<sup>2</sup>.

**Environment (habitat):** The littoral belt of Alunsjøen is still very pure with vegetation after dam rebuilding in 2007 -2008. In the last 2 years, I have noticed a massive development of Characeae algae - *Chara virgata*. In many places of the lake, especially in Mjøservika, it covers the bottom on the depth of 0.5 - 2 m. It often forms a compact carpet up to 50 cm thick, which prevents other plants from growing. 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 natural locations plants were better visible.

**Care:** Checking the effectiveness of transplanting plants to Alunsjøen in 2019 was carried out with a diving method on July 26 – 30.2021.

The result was not very impressive - for 25 planting places only in 11 of them we confirmed the presence of *Luronum* ... Map 1. Only a few or a dozen plants were adopted at the sites, mainly in the form of small vegetative rosettes. Also, the hopes that a better result would be achieved by replanting the *Luronium* landforms with a dense clump of the substrate in which they were grown, did not come true. Such transplanted plants developed well immediately after transplanting in the summer and fall of 2020, but this year, none of them have been found.

**I expected a better result, but on the other hand, there is a certainty that at 11 sites, in different parts of the lake, *Luronium* has adopted and there is a chance that it will develop there.**



Photo 1. *Chara virgata* started to grow en masse in Mjøservika. 1.08.2020.



Photo 2. A well-developed concentration of *Luronium* in a natural site. 20.07.2021.



Photo 3. Alunnsjøen. Searching for *Luronium* by diving. 26.07.2021.

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

**Date of watch: 20.07; 26 - 30.07; 21.08.2021**

**Photos: R. Gramsz**

**Observer: R. Gramsz and Katarzyna Bociąg**

#### 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:** *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 m<sup>2</sup>. That means (if we use 10 individuals/1 m<sup>2</sup>) = 16000 individuals.

**Area:** Ca. 1600 m<sup>2</sup> – 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.

At the day of observation 4.08. Temperature of water was 19<sup>0</sup>C and pH 6.5. Water was brown and little transparent.

**Condition:** This year observations, **with use of pontoon** and water binoculars (vatenkikare) could hardly confirm *Luronium* existence only in few places. There were few floating leaves and flowers. Only on a shallow places (low transparency of water) vegetative rosettes could be noticed. Several of them were floating in the water detached from the bottom. In the coastal vegetation zone, the mallard duck (*Anas platyrhynchos*) was feeding with young. In such a small lake, this family could eat all the soft plants floating by the surface of the water. (!?)

**Care:**

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

[Luronium-Svartkulp4](#)

**Date of watch:** 4; 21.08.2021.

**Photos:** R. Gramsz

**Observer:** R. Gramsz



Photo 1. Svartkulp. Low water transparency hinders observations. Some of a submerge *Luronium* plants were floating in the water detached from the bottom. 4.08.2021.





Photo 2. Family of the mallard duck (*Anas platyrhynchos*) was feeding in the coastal vegetation zone. 4.08.2021.

## **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 =  $29650 \text{m}^2$ . (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*, *Isoetes lacustris*, *Equisetum fluviatile*, *Carex vesicaria*, *Lysimachia thyrsiflora*, *Nuphar luteum*, *Myriophyllum alterniflorum*, *Potamogeton natans*, *Sagittaria sagitifolia*, *Sparganium sp div.*

**Condition:** Summer 2021, similar to the previous years was relatively cool and rainy so the water temperature in the lake was relatively low. At 18.07. the level of water was about 20 cm lower. This made it possible to confirm the presence of *Luronium* in the NE bay of the lake at the mouth of Dausjøelva and at the N shore in the bay at the water gauge. At the mouth of the Dausjøelv in the water 20 - 30 cm deep, behind the sedge belt, there was visible a few floating leaves and flowers. In the bay, near the water gauge, two small patches with floating leaves and flowers were visible. During the observation of 5.08. in the bay in W part of Maridalsvannet, due to the maximum water level, access to the shore was very difficult and *Luronium* was not visible on the water surface. 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.

**Care:**

**Date of watch:** 18.07, 5.08. 2021

**Photos:** R. Gramsz,

**Observer:** R. Gramsz

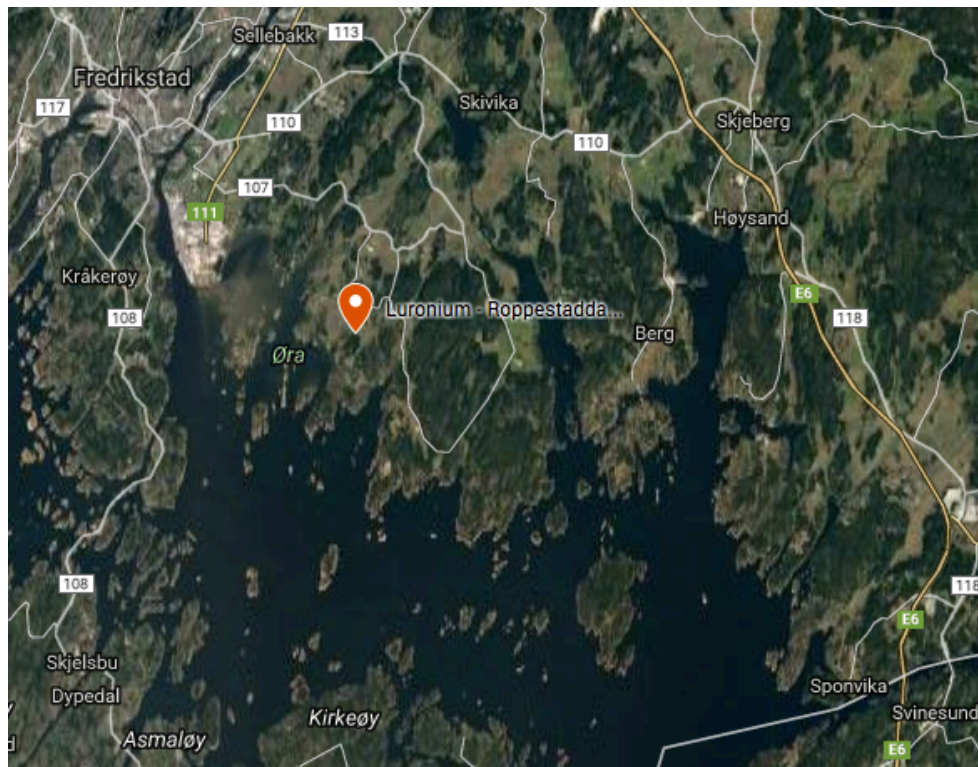


Photo 1. Maridalsvannet, location near the outlet of the Dausjøelva. Behind the sedge belt, there was visible a few floating leaves and flowers. (but not in this photo)18.07.2021.



Photo 2. Maridalsvannet, N shore in the bay at the water gauge. 20 cm lower water at 18.07.2021.

## 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.

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

**Condition:** This year's observations were conducted only at the beginning of June and the end of September so I failed to observe *Luronium* at its best stage in the summer. Anyway it seems that the *Luronium* population is slightly decreasing in competition with *Juncus bulbosus*, *Utricularia sp. div.*, *Nymphaea alba* and *Sphagnum sp.* strongly overgrowing this pond.

**Care:** *Luronium* was planted in those ponds.

**GPS-coordinates:** 59.1667, 11.02638

**Date of watch:** 8.06, 20.09.2021.

**Owner:**

**Photos:** R. Gramsz and Sebastian Gramsz (photo 2)

**Observer:** R. Gramsz



Photo 1. Røpestaddammen. The first floating leaves and flowers appear on the surface of the water. 8.06.2021.



Photo 2. Roppestadmyra. The pond is gradually overgrown and the organic matter is filling up. *Luronium* floating leaves visible in the foreground. 20.09.2021.