

The distribution of *Luronium natans* in Connemara in 2025



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March 2026



NPWS

An tSeirbhís Páirceanna
Náisiúnta agus Fiadhúlra
National Parks and Wildlife
Service

Citation: Roden, R., Green, P., Lansdown, R., Murphy, P. and Stewart, N. (2026) *The distribution of Luronium natans in Connemara in 2025*. Report to the National Parks and Wildlife Service.

Cover photo: *Luronium natans* in the stream flowing from Loch an Bhaile (Lough Aally) to Loch Inbhear Mór (Invermore Lough) in September 2024. Paul Green, NPWS.

The NPWS project officer for this contract was Áine O Connor, Scientific Advice and Research Directorate

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Introduction

The first confirmed record of *Luronium natans* in Ireland was of a flowering population at Invermore Lough (Loch Inbhear Mór) seen on 10 June 1994 (Rich *et al.*, 1995). It was recorded in the main lake and its outflow channels, and in flooded peat cuttings that adjoin the lake. The species was again recorded in the locality in 1997, 2000, 2004, 2007, 2008, 2012 and 2013. The 2012 survey found *Luronium natans* in Inverbeg Lough (Loch Inbhear Beag), the Invermore River (Abhain an Inbhear Mór), which links Lough Aliggan (Loch an Loigín) and Invermore Lough, and the inflow stream to Invermore Lough from Lough Aally (Loch an Bhaile) (Murphy and Roden, 2012). It was most recently recorded at all of its known sites in the Lough Aally and Invermore Lough area, as both flowering and vegetative submerged plants, on 01 September 2024 during a BSBI Targeted Aquatic Plants Project field outing.

Before 1994, based upon vegetative specimens, records of *Luronium natans* were made dating back to 1801 (Wade, 1801) from sites in Galway, Dublin, Down, Cork, Clare, Kerry and Leitrim. All were subsequently withdrawn, or rejected by other authors (see, for example, Colgan and Scully, 1898; Praeger, 1913; Scully, 1916; Preston and Croft, 1997). Many are now considered likely to have been the creeping form of *Baldellia ranunculoides* (L.) Parl., which is treated as a species, *Baldellia repens* (Lam.) Ooststr. ex Lawalrée, by Schou *et al.* (2023). The potential for confusion of vegetative *Luronium natans* with the creeping form of *Baldellia*, other Alismataceae and submerged leaves of other species has long been recognised (*e.g.* Jones and Rich, 1998). The expanded floating leaves and flowers of *Luronium natans* are unmistakable, but do not occur in British populations in deep or fast-flowing water (Preston, 2025).

Luronium natans is an Annex II and IV listed plant in the E.U. Habitats Directive and as such requires strict protection and monitoring by the Irish State if it is deemed to be native at its Irish stations. The purpose of the present survey is to establish the exact distribution of the plant and to consider evidence for native or introduced status.

Methods

Two survey methods were used

1. Shoreline survey for *Luronium natans* in the wider Invermore Lough area of south Connemara. Shorelines were walked and plants recorded by observation or by using grapnels in nearby shallow water. The following data were collected
 - Estimates of the population abundance (extent of population, approximate cover values, and any other relevant measurements),
 - Lists of associated macrophyte species,
 - Other relevant observations on the condition of the species and its habitat,
 - Evidence of human uses and possible vectors of introduction/spread,
 - Other information relevant to assessment of the species native/alien status.
 - Exact GPS determined co-ordinates expressed as Irish Grid references
2. Deeper water survey for submerged leaves and rosettes of *Luronium natans* at known and adjacent sites in the Invermore Lough area of south Connemara. Both snorkelling and boat and grapnel methods were used to investigate submerged populations of the species and the data noted above were collected. Note neither grapnel or snorkel methods allow precise GPS data to be collected.

Study area

The survey was conducted by first relocating records made prior to 2025. Surveys were then extended into neighbouring lakes and streams, until no further *Luronium natans* populations were found. Finally, adjoining catchments were sampled to see if other *Luronium natans* populations occurred nearby.

Surveyors

All authors took part in the field survey on 01-to-03 September 2025, along with two NPWS staff members, Á. O Connor and M. Wyse Jackson, on 02 and 03 September 2025. A calendar of the teams' activities and sites visited during the survey is shown in Appendix 1.

Results

The water bodies examined and the occurrence of *Luronium natans* are summarised in Table 1 below. Appendix 1 gives more detailed information on the dates, methods of survey and surveyor for each water body.

Table 1. Occurrence of *Luronium natans* in lakes and rivers surveyed in September 2025.

Water body name	Alternative name	Grid reference (approx. mid-point)	<i>Luronium natans</i> recorded
Loch an Bhaile	Lough Aally	L894393	yes
Loch an Loigín	Lough Aliggan	L894403	yes
Loch an Loigín Beag	Lough Acaringe	L900403	yes
Loch Inbhear Beag	Inverbeg Lough	L912394	yes
Loch Inbhear Mór	Invermore Lough	L900394	yes
Loch Inbhir	Lough Invernagleragh	L924398	yes
Loch Acahadh Bhuaille	Lough Aughawoolia	L975415	no
Loch an Logáin	Lough Alurgan	L819420	no
Loch an Oileáin	Loughanillaun	L895397	no
Loch an Oileáin (2)	Loughanillaun, Gowla Lake	L847417	no
Loch an Oileáin (3)	Loughaunanillaun	L914398	no
Loch an Phaiste	Lough Atriska	L917398	no
Loch an tSáile Thuaidh	Lough Ahalia North	L966397	no
Loch Beitheach Gaibhnín	Beaghgivereen Lough	L827416	no
Loch Bhun na hEasca	Lough Bunnahask	L898414	no
Loch Lathach na gCapall		L916392	no
Loch na gCreagán	Lough Creggaun	L916406	no
Loch Oiriúlach	Lough Aroolagh	L926385	no
Lochán Riabhach	Lough Duff	L891417	no

More detailed records of *Luronium natans* made during the survey are given in Appendix 2. In Figure 1, the survey results are summarised. Many plants and populations were encountered in the southern parts of the catchments of the Inbhear Mór River and the adjoining Inbhear Beag catchment; no plants were seen outside these catchments. Negative records, both from the present survey and previous surveys in 2013, 2021, 2024, are also shown in Figure 1. The plant appears to occupy a small area close to the sea in two catchments. It was recorded elsewhere in Connemara in the 19th Century (Wade, 1801) but no associated herbarium specimens are known.

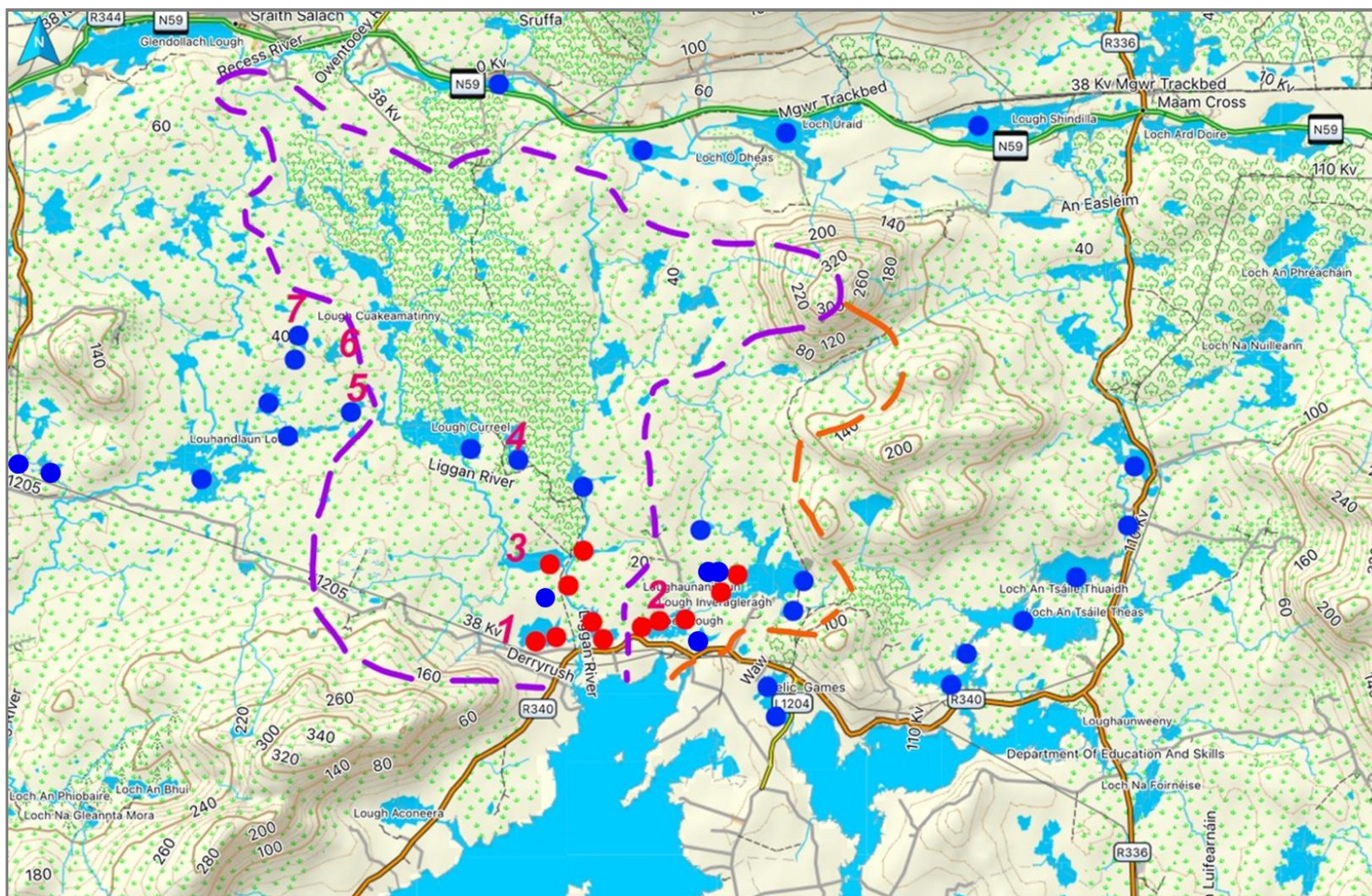


Figure 1. Location of *Luronium natans* populations (red) and sampled lakes where *Luronium natans* was not recorded (blue). Many negative records are based on previous surveys rather than the 2025 survey. Dotted lines show catchment boundaries. Numbers refer to gradient shown in Table 3.

The habitat of *Luronium natans* - Can a *Luronium* lake type be defined?

Table 2 shows species lists for all lakes known to contain *Luronium natans*, common species include *Eriocaulon aquaticum*, *Lobelia dortmanna*, *Isoetes lacustris*, *Littorella uniflora*, *Myriophyllum alterniflorum* and *Potamogeton natans*. Loch an Bhaile and Loch Inbhear Mór also contains species such as *Potamogeton perfoliatus*, *Potamogeton berchtoldii*, *Elatine hexandra*, *Callitriche hamulata* and *Nitella translucens*. In contrast, Loch an Loigín lacks these species.

Table 2. Whole lake species lists for the surveyed lakes. (D) indicates a plant that usually grows fully submerged. Data from Lough Adoolig Co. Kerry included for comparison.

Lake name	Inbhear Mór	Loch an Bhaile	Loch Inbhear Beag	Loch Inbhir	Loch an Loigín	Adoolig Co. Kerry
Date	03/09/25	03/09/25	03/09/25	02/09/25	01/09/25	2014
<i>Luronium natans</i>	1	1	1	1	1	
<i>Eleogiton fluitans</i>	1					
<i>Isoetes echinospora</i> (D)	1					
<i>Nitella gracilis</i> (D)	1					1
<i>Utricularia australis</i> (D)		1				
<i>Potamogeton perfoliatus</i> (D)		1				
<i>Callitriche brutia</i> subsp. <i>hamulata</i> (D)	1	1				1
<i>Elatine hexandra</i> (D)	1	1				1
<i>Nitella translucens</i> (D)	1	1	1			1
<i>Littorella uniflora</i>		1	1	1	1	1
<i>Eriocaulon aquaticum</i>	1	1	1	1	1	
<i>Isoetes lacustris</i> (D)	1	1	1	1	1	1
<i>Lobelia dortmanna</i>		1	1	1	1	1
<i>Myriophyllum alterniflorum</i> (D)	1	1	1	1	1	1
<i>Potamogeton natans</i>	1	1	1	1	1	1
<i>Potamogeton berchtoldii</i> (D)	1	1	1	1		1
<i>Sparganium angustifolium</i>	1	1	1	1	1	
<i>Juncus bulbosus</i>	1		1	1	1	1
<i>Nuphar lutea</i>		1	1		1	
<i>Phragmites australis</i>		1	1	1	1	
<i>Utricularia sp.</i> (D)	1		1	1	1	1
<i>Potamogeton polygonifolius</i>					1	
<i>Cladium mariscus</i>				1		
<i>Nymphaea alba</i>	1		1	1		
<i>Sphagnum sp.</i>	1			1		
<i>Utricularia minor</i> (D)			1	1		
<i>Nitella flexilis</i> agg.	1			1		1

In Table 3 lakes are arranged along a gradient running from the coast to the bogland interior, partly using data collected in the PeAT project¹ (Lally *et al.*, 2025). The inland lakes are more species poor. Absent or scarce species include those growing at depth

¹ <https://peatlakes.wordpress.com/>

such as *Myriophyllum alterniflorum* and *Callitriche hamulata*. This reflects the peaty bottoms and darker water of these lakes. A gradient in species diversity runs from Loch an Bhaile on the coast inland to Loch na mBreac Mór (Site 7 of the transect). All these lakes were examined by snorkel or boat and grapnel. A well-developed benthic sub-littoral vegetation was only found in Loch an Bhaile, Loch Inbhear Mór and Loch Inbhear Beag; the remaining lakes have little or no deep water vegetation. This gradient corresponds to a transition from oligotrophic lakes (Loch an Bhaile) to dystrophic lakes (Loch na mBreac Mór).

Table 3. Lakes arranged along a gradient from coast to bogland interior. See Figure 1 for positions. Note the absence of “deep water” (D) plants in the interior.

Position on transect	1	2	3	4	5	6	7
Lake	Loch an Bhaile	Loch Inbhear Beag	Loch an Loigín	Lochán Riabhach	PeAT Lakes CL5	PeAT Lakes CL5	PeAT Lakes CL2
<i>Luronium natans</i>	1	1	1				
<i>Potamogeton berchtoldii</i> (D)	1						
<i>Utricularia australis</i>	1			1			
<i>Potamogeton perfoliatus</i> (D)	1						
<i>Callitriche brutia</i> subsp. <i>hamulata</i> (D)	1						
<i>Elatine hexandra</i> (D)	1						
<i>Nuphar lutea</i>	1	1	1				
<i>Myriophyllum alterniflorum</i> (D)	1	1	1			1	
<i>Littorella uniflora</i>	1	1	1			1	1
<i>Isoetes lacustris</i> (D)	1	1	1			1	1
<i>Eriocaulon aquaticum</i>	1	1	1	1	1	1	1
<i>Lobelia dortmanna</i>	1	1	1		1	1	1
<i>Phragmites australis</i>	1	1	1	1	1	1	1
<i>Potamogeton natans</i>	1	1	1		1		
<i>Sparganium angustifolium</i>	1	1	1	1	1	1	
<i>Juncus bulbosus</i>		1	1	1	1	1	
<i>Utricularia</i> sp.		1	1	1			
<i>Potamogeton polygonifolius</i>			1	1			
<i>Nymphaea alba</i>				1	1	1	1
<i>Eleocharis multicaulis</i>					1	1	1
<i>Eleogiton fluitans</i>				1	1	1	1
<i>Cladium mariscus</i>				1	1	1	1
<i>Utricularia minor</i>				1			

It appears that *Luronium natans* populations are most abundant in lakes with deep-water vegetation and population size diminishes as lakes approach dystrophy. In the Inbhear Mór area, *Luronium natans* occurs, in some abundance at least, only where there is some degree of vegetation zonation, and vegetation grows to below 2 m. Very few *Luronium natans* plants occurred in Loch an Loigín and these were at or close to the surface, with vegetation only extending to 1.1 m depth. No *Luronium natans* populations were found north of Loch an Loigín. These limited data suggests that *Luronium natans* will most likely occur in oligotrophic lakes rather than peaty

dystrophic lakes. It should also be noted that it has never been found in the slightly more nutrient-rich, well documented “*Najas* lake” type (Roden *et al.*, 2021). So a potentially suitable *Luronium natans* lake type might be defined as less species- and nutrient-rich than *Najas* lakes but not dystrophic. We lack data that could help explain why the species is confined to so few sites and therefore cannot provide a more precise description of a lake suitable for *Luronium natans* in Ireland. However, in Britain, *Luronium natans* grows in more eutrophic canal sites and the Shropshire Meres, as well in oligotrophic lakes.

Four populations are known from running water in the Inbhear Mór Area: the Loch an Bhaile outflow stream, the stream connecting Loch an Loigín to Loch an Loigín Beag, Abhain an Inbhear Mór between Loch an Loigín and Loch Inbhear Mór, and the outflow from Loch Inbhear Mór. These presumably originate from upstream lake populations.

The unexpected discovery of a fifth Irish population of *Nitella gracilis* by NS and ÁOC in Loch Inbhear Mór during the survey highlights our lack of knowledge about the flora of oligotrophic lakes in Ireland. For comparison, the species list collected from the third Irish station for *Nitella gracilis*, Lough Adoolig in Kerry (Roden and Murphy, 2014), is shown in Table 2. The species lists are very similar, and differ both from the *Najas* lake type in the absence of many species but also from the dystrophic sites of the PeAT project by the presence of some “deep water” species. *Callitriche hamulata* is of interest as it rarely occurs in *Najas*-type lakes and may serve as a marker for a less nutrient-rich but clear-water type of lake that may host both *Luronium natans* and *Nitella gracilis*. In Wales, both species co-occur in 70% of known sites for *Nitella gracilis*.

In addition to the record of *Nitella gracilis*, other notable records during the survey include *Aristavena (Deschampsia) setacea* and *Rhynchospora fusca* (see Table 4).

Table 4 Some other notable records made during the survey.

Species	Date	Grid Ref (IG)	Location	Recorder	Notes
<i>Aristavena (Deschampsia) setacea</i>	02/09/2025	L9292439513	Loch Inbhir, Co. Galway, Lobe on south-eastern side	R. Lansdown; Á. O Connor; M. Wyse Jackson	Scattered clumps on peaty margin of lake, on north side of its south-eastern lobe.
<i>Aristavena (Deschampsia) setacea</i>	02/09/2025	L9279739523	Loch Inbhir, Co. Galway, Lobe on south-eastern side	R. Lansdown; Á. O Connor; M. Wyse Jackson	Scattered clumps on peaty margin of lake, on north side of its south-eastern lobe.
<i>Aristavena (Deschampsia) setacea</i>	03/09/2025	L90933946	Loch Inbhear Beag	N. Stewart; R. Lansdown	A few plants on peaty margin of lake.
<i>Rhynchospora fusca</i>	02/09/2025	L9292439513	Loch Inbhir, Co. Galway, Lobe on south-eastern side	R. Lansdown; Á. O Connor; M. Wyse Jackson	Dense swards on peaty margin of lake, on north side of its south-eastern lobe.

What microhabitats does *Luronium natans* occupy?

Luronium natans habitat is difficult to define as the plant occurs in a variety of forms including a deep-water, submerged, strap-leaved rosettes and a floating, broad-leaved type. The submerged leaf form is known from Loch an Bhaile, Loch Inbhear Mór and Loch Inbhear Beag, as well as Loch Inbhir and Loch an Loigín Beag. The former three lakes have well-developed deeper-water vegetation as noted above, but *Luronium natans* distribution is uneven. There are large populations in the south of Loch an Bhaile to a depth of 2.0 m but not in the north-eastern part of that lake. In Loch Inbhear Mór, large populations occur at depths between 1.5-2.1 m in the western part but not the south-east, while in Loch Inbhear Beag populations are sparse and confined to three or four bays in the west and east. This distribution may reflect variable morphologies with differing proportions of deep water among the sites. Deep-water populations appear to prefer soft sediment. Companion species include *Myriophyllum alterniflorum*, *Isoetes lacustris*, *Nitella translucens*, *Utricularia vulgaris* agg., *Potamogeton berchtoldii* and other deeper-water species. At present, we can say that *Luronium natans* does occur at depths up to 2 - 3 m along with other species of *Isoetes*-dominant lakes, but we do not have sufficient data to define a typical deep-water vegetation.

The floating-leaved form of *Luronium natans* has been encountered in some lakes surveyed but often as single plants. It is abundant on the south shore of Loch an Bhaile, the stream connecting Loch an Bhaile and Loch Inbhear Mór and parts of Inbhear Mór and Inbhear Beag lochs. Here it grows in dense colonies often intermixed with species such as *Eriocaulon aquaticum*, *Menyanthes trifoliata* and *Sparganium* sp. (see Appendix 3), however in shallow water the density of *Eriocaulon aquaticum* may be a limiting factor. In all cases, *Luronium natans* appears to grow on soft sediment. In contrast, the isolated plants often occur on essentially rocky ground where the plants perhaps find small pockets of suitable sediment.

Long submerged strap-leaved forms also occur in flowing water, where they may co-occur with floating-leaves. Submerged leaves were recorded in the stream between Loch an Loigín and Loch an Loigín Beag, the Inbhear Mór River and the stream connecting Loch an Bhaile and Loch Inbhear Mór.

Discussion

Are there other populations of *Luronium natans* in Ireland?

Rich *et al.* (1995) review previous records of *Luronium natans* in Ireland and discuss its similarity to vegetative plants of *Baldellia repens*. Only those *Luronium natans* records supported by herbarium specimens were accepted and some are now known to be *Baldellia repens*. Owing to the greater understanding of *Baldellia repens* since 1995 (see Schou *et al.*, 2023), T. Rich (pers. comm., 19/03/2024) recommends that all historic Irish specimens for *Luronium natans* be re-examined. Nevertheless, some of the older records are worthy of reconsideration. Based on Rich *et al.* (1995) and sources collated by ÁOC and MWJ, these include

- Ballynahinch area of Connemara – Wade (1801) said *Luronium natans* occurred “In a few of the lakes, Ballynahinch”, an area with many potentially suitable lakes roughly 15 km from Inbhear Mór.
- Lough Allua, Co. Cork - an unconfirmed 19th Century record by John Drummond and cited in Power (1845) as *Alisma natans*: “728. *A. natans*, L. *Floating Thrumwort*. Lough Allua at the source of the Lee: *Mr. J. Drummond*, in the Rev. Dr. Hincks’ notes.—*very rare*.”
- Upper Lake and Muckross Lough, Killarney - a variety of records exist for *Luronium natans* in the Killarney lakes, such as Moore and More (1866) “ditches near the Upper Lake of Killarney”, and the records of Linton and Linton (1886) that were later withdrawn, for Lough Leane and, possibly, Muckross Lake. Some records for the Killarney Lakes are known to be *Baldellia repens*, which is widespread in Lough Leane and the Long Range, and also known from Muckross Lake. The discovery of *Nitella gracilis* in the Upper Lake, however, strengthens the possibility of *Luronium natans* also occurring. Further survey of the Upper and Muckross Lakes is recommended. Linton and Linton (1886) specimens lodged in herbaria at **BM** and **OXF** should be re-examined and, if possible, attributed to a specific Killarney locality, which, based on available evidence, is most likely to be Lough Leane.
- West Clare – Rich *et al.* (1995) list a record by Bolton King and cited by Druce (1910) from “Dunbeg Lake, Co. Clare”. It seems unlikely this refers to Doonbeg Lough as it is nearly estuarine, however a poor herbarium specimen exists in **OXF**. Moore and More (1886) refer to a record by C. Carter for *Luronium natans* “In pools on Monmor bog, between Miltown Malbay and Kilrush, Clare”. Lakes in west Clare may, therefore, be worthy of survey.
- Lough Mask - an unconfirmed 19th Century record by “*Prof. Melville.*”, cited in Moore and More (1886). The more oligotrophic western arm of Mask and adjacent lakes may provide appropriate habitat.

At least some of these records seem possible, but confusion with *Baldellia repens* is a problem and no past records can be accepted without further survey and confirmation. As *Baldellia repens* is equally rare in Ireland, new records of either species would be of great interest.

A comparison with Welsh sites

Based on NS's knowledge of *Luronium natans* in Wales and the findings here, common companion species in Wales and the Inbhear Mór area include *Isoetes lacustris*, *Juncus bulbosus*, *Lobelia dortmanna*, *Myriophyllum alterniflorum*, *Callitriche brutia*, *Menyanthes trifoliata*, *Utricularia* sp., *Littorella uniflora*. Species not recorded in the Irish *Luronium natans* lakes include *Subularia aquatica*, *Ranunculus omiophyllus* and *Pilularia globulifera*, but these are not common in Welsh sites. Of great interest is the occurrence of *Nitella gracilis* at nine Welsh *Luronium natans* sites mirroring its occurrence in Loch Inbhear Mór. In general, it appears *Luronium natans* sites in Wales and Ireland share a similar flora and habitat.

A comparison with Scottish sites

Despite a multitude of apparently suitable sites for *Luronium natans* in Scotland, it is a rare species recorded from 11 sites and with no records before 1950. This has resulted in similar question marks over its status as in Ireland and, indeed in the BSBI Atlas (Preston, 2025) all Scottish records are marked as introductions. However, only two sites (in eastern Scotland) were noted by the original recorders as deliberate introductions, including the first record in 1953. It did not persist in either site although very recently it has been discovered two kilometres from its original 1953 site in Aberdeenshire. At other sites, the recorders have either made no comments on origin or suggested wildfowl as a vector. Four sites have documented records for over 20 years but there is a need for further survey to assess the current state of other populations (source: BSBI Distribution Database). Meanwhile its status is unresolved and warrants further study.

Is *Luronium natans* an introduced species in Ireland?

Evidence of an introduced plant population might include some of the following points:

- 1) A known history of introduction elsewhere: *Elodea canadensis* is a good example, the plant has a well-documented history of spreading throughout the British Isles.
- 2) A lack of any early records of the plant in Ireland, e.g. *Gonocarpus micranthus* first recorded in 1988 in west Connemara and unknown elsewhere in Europe.
- 3) A distant source population, native in another bio-geographical region. The currently expanding *Lagarosiphon major* from South Africa, for instance.
- 4) A rapidly expanding range in the country. An example is *Impatiens glandulifera*.
- 5) Occurrence in ecologically disturbed habitats. *Elodea nuttallii*, a known introduction from North America, is frequently found in sites disturbed by additions of large quantities of phosphorus and nitrogen, such as Lough Arrow.
- 6) New records in locations which have a well-known flora. The recent rapid expansion of the introduced *Nymphoides peltata* in Lough Leane is an example.

- 7) An understood mechanism of introduction or spread, e.g. weeds derived from garden centres; *Myriophyllum aquaticum* is the best known case.
- 8) A lack of genetic variation.

Luronium natans in Ireland does not appear to match these criteria and examples. There are no records of *Luronium natans* appearing suddenly in new regions although it is known to have spread in English canal and ditch systems, where there is the potential vector of fragmentation and transportation by boats and ditch clearance machinery. On the contrary, *Luronium natans* is thought to have limited competitive ability and, as noted in the introduction, is protected under the EU Habitats Directive.

It was recorded in Ireland over 200 hundred years ago, by Wade (1801) at Ballynahinch, less than twenty kilometres from its present populations. The plant is endemic to western or Atlantic Europe, so it is perhaps more surprising that it has not been recorded more frequently in Ireland than *vice versa*. To date the plant's Irish range includes two adjoining watersheds in a relatively remote region with no indications of recent ecological disturbance. As shown in the species lists, *Luronium natans* is confined to lakes with no other introductions nor evidence of eutrophication, although peat cutting may have caused water discolouration and reduction of the euphotic depth. The Irish habitat and companion species are very similar to Welsh populations even including the rare and undoubted native charophyte *Nitella gracilis*, a species unlikely to be found in habitats disturbed by humans. It is difficult to believe that a chance introduction of *Luronium natans* would occur in one of the only four Irish lakes where its Welsh companion species just happens to grow.

There are no older descriptions of the flora of the lakes and streams where *Luronium natans* now grows, consequently it is not possible to state if it arrived recently. It might be argued that the fishing lodge and gardens in Loch Inbhir could have been a source of introduced plants, however the species is rare and very localised in that lake and one would have expected it to be more frequent there if it were the source. This speculation also raises the question why the many other fishing lodges, gardens or hotels such as Kylemore Abbey or Ashford Castle did not act as sources.

A case for introduction might rest on the rarity of the plant and the unlikelihood of spread by natural means, but there are several water plants in Connemara deemed native with similar isolated and disjunct distributions, such as *Hydrilla verticillata* or *Eriocaulon aquaticum*. The only difference is that these species have been known since the 1930s or the 19th Century.

An obsolete model of plant colonisation in Ireland rests on the idea of most native species moving across a land bridge from Britain or the Continent but more recent geological studies apparently rule out this possibility (Edwards and Brooks, 2008). Despite the absence of a land bridge, an Irish native flora exists, therefore the sea must be seen more as a filter than a barrier to plant colonisation; a point of view consistent with the widely accepted McArthur Wilson theory of island biogeography. Consequently isolated populations remote from a species' centre of distribution is not

in itself proof of human introduction, though alien plants such as *Gonocarpus micranthus* will show a comparable distribution.

While seed bearing plants have not been seen in the wild in Ireland, plants collected by Paul Green in 2024 from Inbhear Mór did produce seeds in cultivation, proving seed production though rare, can occur in Ireland. However, most spread in Britain appears to be vegetative and this factor appears to limit the plant’s ability to colonise what seem to be numerous suitable sites. A similar limitation may help explain the plant’s scarcity in Ireland.

Webb (1985) discussed the problem of assessing whether a plant is native or introduced. He suggested eight tests for native status which are summarised in Table 5, where “yes” indicates likely native status. While five tests are in favour of native status, one is undetermined and two are uncertain. Geographical distribution is slightly ambiguous as the populations in the Inbhear Mór area are widely separated from other populations although other native aquatic plants (e.g. *Hydrilla verticillata*) have far more disjunct distributions than *Luronium natans*.

Table 5 *Luronium natans* assessed against D.A. Webb’s criteria for presuming native status

Webb’s “test	Result for <i>Luronium natans</i> in Connemara	Comment
Fossil evidence	None to date	
Historical evidence	Yes/No	Wade’s (unverified) 1801 record
Habitat	Yes	Same as native sites abroad
Rarity of naturalisation	Yes	Although a number of deliberate introductions have been documented in Britain, most have not persisted. Naturalised populations are known from England, including canals and a ditch system in the Norfolk Broads. It was also known from one lake in the Norfolk Broads from the 1950s to 1970s and has persisted in a pond in the New Forest since 1985.
Genetic diversity	Yes	Kay <i>et al.</i> (1999) distinguished Irish material from Welsh
Reproductive pattern	Yes	Green’s observations suggest seed production in Ireland
Human method of introduction	Yes	No mechanism demonstrated
Geographical distribution	Yes/No	Endemic to Western Europe but nearest native colony is in Wales

Conclusions and possible future work

At present, the evidence indicates that the Connemara population is most likely a result of non-human factors but it is not possible to suggest how or when the plant first arrived without further research. The only proof of native status, as opposed to informed opinion would be fossil evidence, through coring, or possibly an analysis of population genetic structure.

Kay *et al.* (1999) have shown that native Welsh populations can be distinguished from recently introduced English canal populations through isozyme analysis. They also showed that one sample from the Loch Inbhear Mór population could be distinguished from 16 Welsh samples. Isozyme analysis has now been, to some extent, replaced by other genetic analyses. A possible programme of genetic analysis would require up to ten samples from each population (lake) which would require boat access and might prove difficult in Loch an Loigín as the population appears small. Analysis should be delayed until a complete genome is available and microsatellite markers for the species are prepared, work that is fortunately ongoing.

Palaeoecological data could be obtained from a lake core, as *Luronium natans* pollen is distinctive, but coring could be challenging owing to the abundant rock, and a competent laboratory would need to be contracted to perform the analyses. Such an investigation might unambiguously determine the date of arrival of the species in Connemara.

There are a number of other unverified but credible records for the species in Ireland, and further fieldwork to confirm or exclude these records would be useful, especially if they also increased our knowledge of the distribution of *Baldellia repens*. A more general programme to survey oligotrophic lakes not examined in recent surveys of bogland (PeAT project; Lally *et al.*, 2025) or *Najas*-type lakes (Roden *et al.*, 2021) would be of value in defining the full range of lake types in Ireland and might lead to further records of both *Luronium natans*, *Baldellia repens* and *Nitella gracilis*.

A possible search or survey for further populations should be based on the main findings of the present survey:

1. *Luronium natans* is a plant of oligotrophic rather than dystrophic water bodies.
2. Its surface populations are most abundant near sheltered shores or back waters, rather than exposed areas, and it needs soft sediment rather than rocky ground.
3. Its deeper water populations occur in areas of soft sediment in oligotrophic water bodies.
4. Its known association with *Nitella gracilis* in Wales suggests that areas in Ireland with *Nitella gracilis* (Kerry and Wicklow) may hold *Luronium natans* populations.

A search strategy might start by selecting lakes on non-calcareous rocks, but not on blanket bog, in Kerry and Wicklow, then examining sheltered shores, connecting streams *etc.* for surface populations. Finally, a selected number of these lakes could be sampled by grapnel followed by snorkel dives to describe any populations located.

Possible sites might include lakes in Iveragh and Beara peninsulas and lakes in west Clare. Given Wade's records from Connemara, further Connemara populations may exist but it is difficult to suggest sites not already investigated in other surveys.

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Appendix 1 Calendar of survey team's activities

Date	C. Roden	P. Murphy	R. Lansdown	N. Stewart	P. Green	Á. O Connor	M. Wyse Jackson
Monday 21/08/2025, morning	travel to site						
Monday 21/08/2025, afternoon	<i>Luronium natans</i> present between Loch an Loigín and Loch an Loigín Beag and on east side of Loch Inbhear Beag						
Monday 01/09/2025, morning	Travel to site	Travel to site	Travel to site	Travel to site	Travel to site		
Monday 01/09/2025, afternoon	Survey of shore of Loch an Loigín. <i>Luronium natans</i> on SW shore and connecting stream to Loch an Loigín Beag. Survey of stream and south shore of Loch Bhun na hEasc: No <i>Luronium natans</i> found	Survey of shore of Loch an Loigín. <i>Luronium natans</i> on SW shore and connecting stream to Loch an Loigín Beag. Survey of stream and south shore of Loch Bhun na hEasc: No <i>Luronium natans</i> found	Survey of shore of Loch an Loigín. <i>Luronium natans</i> on SW shore and connecting stream to Loch an Loigín Beag. Survey of stream and south shore of Loch Bhun na hEasc, and Loch an Oileáin (3): No <i>Luronium natans</i> found	Survey of shore of Loch an Loigín. <i>Luronium natans</i> on SW shore and connecting stream to Loch an Loigín Beag. Survey of shores of Lochán Riabhach and Loch an Oileáin (3): no <i>Luronium natans</i>	Survey of shore of Loch an Loigín. <i>Luronium natans</i> on SW shore and connecting stream to Loch an Loigín Beag. Survey of shores of Lochán Riabhach and Loch an Oileáin (3): no <i>Luronium natans</i>		
Tuesday 02/09/2025, morning	Snorkel of Loch an Loigín. Very dark with little <i>Luronium natans</i>	Snorkel of Loch an Loigín. Very dark with little <i>Luronium natans</i>	Survey of shore of Loch Inbhear Beag: <i>Luronium natans</i> present	Survey of NW shore of Loch Inbhir: some <i>Luronium natans</i>	Survey of NW shore of Loch Inbhir: some <i>Luronium natans</i>	Travel to site	Travel to site

Date	C. Roden	P. Murphy	R. Lansdown	N. Stewart	P. Green	Á. O Connor	M. Wyse Jackson
Tuesday 02/09/2025, afternoon	Survey of Loch Oiriúlach and river north to Loch Acahadh Bhuaile. No <i>Luronium</i>	Survey of Loch an Oileáin (2) and Loch Beitheach Gaibhnín: no <i>Luronium natans</i>	Survey of east shore of Loch Inbhir: No <i>Luronium natans</i>	Survey of Loch Oiriúlach and river north from Loch an tSáile Thuaidh to Loch Bhuaile: No <i>Luronium natans</i>	Survey of Loch an Oileáin (2) and Loch Beitheach Gaibhnín: no <i>Luronium natans</i>	Survey of east shore of Loch Inbhir: No <i>Luronium natans</i>	Survey of east shore of Loch Inbhir: No <i>Luronium natans</i>
Wednesday 03/09/2025, morning	Snorkel east shore of Loch an Bhaile. <i>Luronium natans</i> in outflow	Snorkel east shore of Loch an Bhaile. <i>Luronium natans</i> in outflow		Survey of Loch Inbhear Mór using boat and grapnel: <i>Luronium natans</i> and <i>Nitella gracilis</i>	Survey of Loch an Oileáin and Loch na gCreagán: no <i>Luronium natans</i>	Survey of Loch Inbhear Mór using boat and grapnel: <i>Luronium natans</i> and <i>Nitella gracilis</i>	Survey of Loch an Oileáin: no <i>Luronium natans</i>
Wednesday 03/09/2025, afternoon	Snorkel east side of Loch Inbhear Beag, some <i>Luronium natans</i>	Snorkel east side of Loch Inbhear Beag, some <i>Luronium natans</i>	Survey of Loch Inbhear Beag using boat and grapnel: some <i>Luronium natans</i>	Survey of Loch Inbhear Beag using boat and grapnel: some <i>Luronium natans</i>	Travel home	Travel home	Travel home

Appendix 2 Records of *Luronium natans* made during the 2025 survey

Species	Date	Grid reference	Vice county	Location	Place	Recorder	Notes
<i>Luronium natans</i>	21/08/2025	L89824032	West Galway H16	Loch an Loigín	River just east of bridge	Cilian Roden	> 5 plants, floating leaves
<i>Luronium natans</i>	21/08/2025	L91383954	West Galway H16	Loch Inbhear Beag	East shore	Cilian Roden	1 plant with floating leaves
<i>Luronium natans</i>	21/08/2025	L89832931	West Galway H16	Loch an Bhaile	Outflow east of bridge	Cilian Roden	Floating leaves, flowers, abundant
<i>Luronium natans</i>	01/09/2025	L89634020	West Galway H16	Loch an Loigín	Bay north-west of house	Richard Lansdown; Paul Murphy; Cilian Roden	Isolated submerged plants
<i>Luronium natans</i>	01/09/2025	L8981540330	West Galway H16	Loch an Loigín Beag	North side of lough	Paul Green; Nick Stewart	Only submerged leaves seen with grapnel
<i>Luronium natans</i>	01/09/2025	L8993740352	West Galway H16	Loch an Loigín Beag	North side of lough, just west of river feeder	Paul Green; Nick Stewart	Only submerged leaves seen with grapnel
<i>Luronium natans</i>	02/09/2025	L89924033	West Galway H16	Loch an Loigín Beag	Along shore, east of the bridge	Cilian Roden; Paul Murphy	Many plants
<i>Luronium natans</i>	02/09/2025	L9135739236	West Galway H16	Loch Inbhear Beag	Eastern shore	Richard Lansdown	Soft substrate. <i>Luronium natans</i> local.
<i>Luronium natans</i>	02/09/2025	L9136039273	West Galway H16	Loch Inbhear Beag	Eastern shore	Richard Lansdown	Boulders and gravel. <i>Luronium natans</i> patchy around outflow.
<i>Luronium natans</i>	02/09/2025	L9135939313	West Galway H16	Loch Inbhear Beag	Eastern shore	Richard Lansdown	Soft substrate. <i>Luronium natans</i> abundant.
<i>Luronium natans</i>	02/09/2025	L9139239439	West Galway H16	Loch Inbhear Beag	Eastern shore	Richard Lansdown	Deep organic sediment. <i>Luronium natans</i> sparse.
<i>Luronium natans</i>	02/09/2025	L9070239321	West Galway H16	Loch Inbhear Beag	Eastern shore	Richard Lansdown	

Species	Date	Grid reference	Vice county	Location	Place	Recorder	Notes
<i>Luronium natans</i>	02/09/2025	L9087139150	West Galway H16	Loch Inbhear Beag	Eastern shore	Richard Lansdown	
<i>Luronium natans</i>	02/09/2025	L9093339465	West Galway H16	Loch Inbhear Beag	Eastern shore	Richard Lansdown	
<i>Luronium natans</i>	02/09/2025	L9181839732	West Galway H16	Loch Inbhir	South-west side	Paul Green; Nick Stewart	Floating leaves only. Two separate clumps. 20 leaves counted. Clear water, depth 1m
<i>Luronium natans</i>	02/09/2025	L9195539949	West Galway H16	Loch Inbhir	South-west side	Paul Green; Nick Stewart	Submerged material only. Water depth 2.3m
<i>Luronium natans</i>	02/09/2025	L9194639928	West Galway H16	Loch Inbhir	South-west side	Paul Green; Nick Stewart	Floating leaves only. 22 leaves counted. Clear water, depth 1m
<i>Luronium natans</i>	03/09/2025	L91353951	West Galway H16	Loch Inbhear Beag	Lake east of road	Paul Murphy; Cilian Roden	Submerged plants
<i>Luronium natans</i>	03/09/2025	L90703932	West Galway H16	Loch Inbhear Beag	Western bay	Nick Stewart; Richard Lansdown	Submerged plants
<i>Luronium natans</i>	03/09/2025	L90873915	West Galway H16	Loch Inbhear Beag	South-west bay	Nick Stewart; Richard Lansdown	Submerged and floating plants
<i>Luronium natans</i>	03/09/2025	L90933946	West Galway H16	Loch Inbhear Beag	North side	Nick Stewart; Richard Lansdown	Submerged plants
<i>Luronium natans</i>	03/09/2025	L89613920	West Galway H16	Loch an Bhaile	Outflow	Paul Murphy; Cilian Roden	Submerged plants
<i>Luronium natans</i>	03/09/2025	L900394	West Galway H16	Loch Inbhear Mór	Western part of lake	Nick Stewart, Áine O Connor	Submerged plants, frequent throughout except in South-eastern bay

Appendix 3 Associated species and other data for *Luronium natans* populations in shallow-water in the Inbhear Mór area

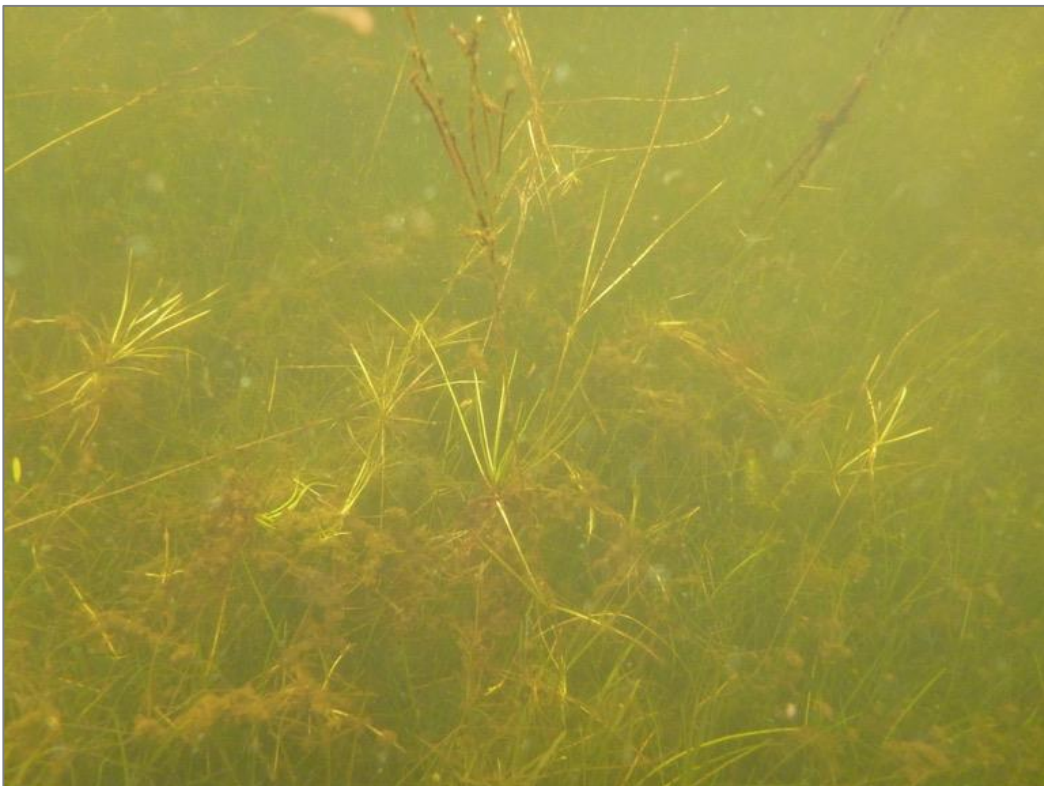
Lake	Loch an Loigín	Loch an Loigín	Loch an Bhaile	Loch an Bhaile	Loch Inbhear Beag	Loch Inbhear Beag	Loch Inbhear Beag	Loch Inbhear Beag	Loch Inbhear Beag
Locality	North side lake	North side lake	South shore	Stream outflow	East side lake	East side lake	East side lake	East side lake	
Notes	Submerged leaves	Peat and stones	Scraw, occasional	Soft sediment abundant	Soft substrate. <i>Luronium natans</i> local.	Soft substrate. <i>Luronium natans</i> abundant.	Boulders and gravel. <i>Luronium natans</i> patchy around outflow.	Deep organic sediment. <i>Luronium natans</i> sparse.	Soft
Date	01/09/2025	01/09/2025	03/09/2025	03/09/2025	02/09/2025	02/09/2025	02/09/2025	02/09/2025	03/09/2025
Grid reference	L8981540330	L89944035	L89652395	L89563919	L9135739236	L9135939313	L9136039273	L9139239439	L91383950
<i>Luronium natans</i>	1	1	1	2	2	4	1	0.1	1
<i>Myriophyllum alterniflorum</i>	1	1			1	1	1	1	3
<i>Juncus bulbosus</i>		1	1		1	1		1	1
<i>Ranunculus flammula</i>			1		1	1	1		
Filamentuous algae	1	1				1		1	
<i>Nuphar lutea</i>	1	1	1	0.1					
<i>Utricularia intermedia</i> agg.		1			1	1			3
<i>Eriocaulon aquaticum</i>		1		1	1	1			
<i>Isoetes lacustris</i>				3		1			1
<i>Potamogeton natans</i>			1					1	3
<i>Menyanthes trifoliata</i>			1	2				1	
<i>Phragmites australis</i>				2	1				
<i>Lysimachia tenella</i>					1				
<i>Littorella uniflora</i>				1					
<i>Potamogeton berchtoldii</i>				2					
<i>Elatine hexandra</i>				0.1					

Lake	Loch an Loigín	Loch an Loigín	Loch an Bhaile	Loch an Bhaile	Loch Inbhear Beag	Loch Inbhear Beag	Loch Inbhear Beag	Loch Inbhear Beag	Loch Inbhear Beag
<i>Sparganium</i> sp.				2					
<i>Potamogeton polygonifolius</i>		1							

Appendix 4 Photographs



Luronium natans growing in shallow water (50 cm), south shore Loch an Bhaile, 10/09/2013



Underwater rosettes of *Luronium natans* with “floating” stolons at 1.5 m depth in Loch an Bhaile, 10/09/2013



Flowering *Luronium natans* in channel between Loch an Bhaile and Loch Inbhear Mór, 21/08/2025



Luronium natans flower and floating leaves in the channel between Loch an Bhaile and Loch Inbhear Mór, 21/08/2025



Floating and submerged leaves of *Luronium natans* in flowing water in stream from Loch an Loigín



Loch Inbhear Beag; *Luronium natans* grows sparsely in bay



Loch an Loigín. Only a few plants of *Luronium natans* were seen in this lake.



Loch Bhun na hEasc. No *Luronium natans* was found in this lake using a grapnel.



Abundant *Luronium natans* in Loch an Bhaile



Luronium natans from Llyn Bodlyn in Wales showing the characteristic stolons. N.F. Stewart.

