Limosella australis

Awl-leaf Mudwort

Scrophulariaceae

Limosella australis by Nate Marchessault, 2022

***Limosella australis* Rare Plant Profile**

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
Forests & Natural Lands
Office of Natural Lands Management
New Jersey Natural Heritage Program

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Life History

Limosella australis (Awl-leaf Mudwort) is a mat-forming annual plant in the figwort family. After genetic analyses resulted in fragmentation of the Scrophulariaceae numerous genera—including *Limosella*—were transferred to the Plantaginaceae, making that family very large and diverse. The expanded plantain family was subsequently divided into tribes but there was some debate regarding an appropriate placement for *Limosella* (Olmstead et al. 2001, Albach et al. 2005, Oxelman et al. 2005). Further analyses such as those by Schäferhoff et al. (2010) returned the genus to Scrophulariaceae. The redefined figwort family lacks a cohesive suite of morphological features that can readily distinguish it in the field (Struwe 2009). Clear distinctions within *Limosella* are also somewhat elusive: More than two centuries ago Brown (1810) pointed out that the genus needed to be reexamined and recently Barringer (2020) noted that *Limosella* still requires some revision because the features used to separate the species are too subtle or variable.

Diminutive size of the plants is shown relative to an herbarium sheet (Gray 1833, left) and grains of sand on a beach (Curtin 2021, right).

While there is some disagreement regarding the number of *Limosella* species in North America, only one occurs in New Jersey. *Limosella australis* typically has linear, awl-shaped basal leaves that lack petioles, although some morphological plasticity may occur in response to varying habitat conditions or water levels (Pennell 1935, Casanova and Brock 2000). The plants are tiny, with leaves often less than 3.5 cm in length and floral pedicels that are usually shorter (1–2 cm). The flowers are about 3 mm wide and solitary on the scapes. Each flower has 4–5 sepals and petals, four stamens, and a single capitate style. The petals are white or have a lavender tint, particularly along the outer edges. The fruit is a round, many-seeded capsule. (See Ives 1817,

Nuttall 1817, Pennell 1919a & 1935, Fernald 1918 & 1950, Fassett 1957, Gleason and Cronquist 1991, Tiner 2009, Barringer 2020).

Flowers and mat-forming habit by Lily M., 2020.

Although *Limosella australis* is an annual plant it proliferates rapidly and may form dense turf, spreading via creeping stolons or rhizomes. The growth form is typical of many species that occur in aquatic or semi-aquatic habitats (Affolter 1985). The recurving of floral stalks also contributes to the entanglement of ramets within a mudwort mat (Ives 1817, Fernald 1918). While *L. australis* usually completes its life cycle within a year, the rhizomes can occasionally persist and produce new growth the following year (Forbes 2024). In North America the plants generally flower and fruit from June through September (Nuttall 1817, Stone 1911, Fogg 1930, Hough 1983, Rhoads and Block 2007, Weakley et al. 2024). The fruits, which mature soon after flowering, can sometimes still be found in October or November (Pennell 1919b, Tiner 2009).

Pollinator Dynamics

Limosella species are pollinated by insects (Coleman 2016), although the particular insects that carry out this important function do not appear to have been identified. Some related members of the family that have modified tubular flowers are probably pollinated by moths or butterflies (Springer 2019). Available information about a similar species, *Limosella aquatica*, indicated that the flowers are cross-fertilized by unspecified insects and are capable of self-fertilization when pollinators are scarce (Fitter 1987, Forbes 2024). *L. aquatica* can sometimes develop underwater flowers but they are cleistogamous and water plays no part in their pollination (Cox 1988).

Seed Dispersal and Establishment

The seeds of *Limosella australis* are angular and somewhat asymmetrical (Nuttall 1817). A typical *L. australis* fruit contains 35–50 seeds (Salisbury 1967). The seeds can be dispersed over very long distances, as evidenced by the species' broad global distribution (Villaverde et al.

2017). It is likely that more than one dispersal mechanism has contributed to its unusually expansive range.

The name *Limosella* is derived from the word muddy, alluding to the environment favored by members of the genus (Pennell 1935). Experiments conducted by Darwin (1872), who germinated seeds from mud that he had collected and placed in a breakfast cup, led him to conclude that plants growing in muddy soils were likely to be transported over long distances on the feet of birds. Anton von Marilaun (1902) subsequently recovered *Limosella aquatica* seeds from mud on the beaks, feet, and feathers of birds, and avian species were also presumed to be the primary means of long-distance dispersal for *L. australis* (Lindroth 1957). Salisbury (1967) observed that *Limosella aquatica* had features which suggested it was well-adapted to water dispersal, and the same may be true of *L. australis*. Longitudinal ridges on *Limosella* seeds can trap bubbles, allowing the propagules to float and travel on water currents (Melcher et al. 2000). John and Richert (2011) characterized the seeds of *L. aquatica* as highly buoyant. Humans have probably also played a part in the dispersal of *Limosella australis*, as certain populations are thought to have been introduced via ship ballast (Morse and Treher 2020).

Limosella australis can form persistent seed banks in both intermittent and near-permanent wetlands. Seeds of the species can remain viable for years, either when maintained in dry storage or when exposed to alternately wet and dry conditions (Britton and Brock 1994, Casanova and Brock 2000, Brock 2011). Successful germination and establishment are probably dependent on suitable environmental conditions, as *L. australis* has fairly narrow habitat requirements (see next section). Studies of *L. aquatica* revealed that its seeds germinated best in bright light, and the seedlings quickly developed prop hairs at the base of the radicle to anchor themselves into the substrate (Salisbury 1967).

Habitat

Limosella australis is restricted to muddy or sandy open sites near the coast within 10 meters of sea level that have fresh to brackish water and saline or subsaline soils. Habitats include regularly flooded tidal flats or salt marsh borders, pools and ponds behind coastal beaches or dunes, and tidal river shores (Taylor 1915, Fernald 1918, Ferren and Schuyler 1980, Hough 1983, Tiner 2009, Barringer 2020, Weakley et al. 2024). Different coastal ponds where Awl-leaf Mudwort was recorded have had varying degrees of salinity (Schuyler 1981). As tides shift, the mudwort plants may be alternately inundated and exposed (Pennell 1919b, Sneddon and Lamont 2010). One pond in Massachusetts where the species was found was known to dry up every few years, although the substrate generally remained somewhat moist (Backus et al. 2002).

Historic populations of *Limosella australis* in eastern New Jersey were mainly associated with sand dune ponds, while those in the western part of the state were situated along the margins of the tidal portion of the Delaware River (Nuttall 1817, Stone 1911, Pennell 1919a, Ferren and Schuyler 1980, NJNHP 2024). Similar habitats have been utilized throughout the species' range (Long 1922, Sanford 1925, Fogg 1930, Svensen 1924 & 1935, Fernald 1935, Roland 1938, Smith 1959, Erskine 1960). *L. australis* is uncommon in Wales, where it grows on the edges of pools with standing water (Forbes 2024).

Limosella australis was noted to co-occur with Water Pygmyweed (*Crassula aquatica*) on the tidal riverbanks where it was first recorded in the northeastern United States (Ives 1817, Nuttall 1817). In some of the coastal communities utilized by *L. australis* the mudwort may be co-dominant with *Sagittaria subulata*. Other typical associates in those habitats can include *Eleocharis parvula, Lilaeopsis chinensis, L. carolinensis,* or *Spartina alterniflora* (Breden et al. 2001, Backus et al. 2002, Sneddon and Lamont 2010, Sorrie 2021).

Wetland Indicator Status

Limosella australis is an obligate wetland species, meaning that it almost always occurs in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2025)

LIAU6

Coefficient of Conservancy (Walz et al. 2020)

CoC = 5. Criteria for a value of 3 to 5: Native with an intermediate range of ecological tolerances and may typify a stable native community, but may also persist under some anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

The native range of *Limosella australis* is unusual because it occurs in scattered locations around the globe. Places where it has been found include parts of North and South America, Great Britain, southern Africa, Australasia, and some subantarctic islands (POWO 2025). The map in Figure 1 depicts the extent of *L. australis* in North America.

The USDA PLANTS Database (2025) shows records of *Limosella australis* in fourteen New Jersey counties: Atlantic, Bergen, Burlington, Camden, Cape May, Essex, Hunterdon, Mercer, Middlesex, Monmouth, Ocean, Passaic, Union, and Warren (Figure 2). The data include historic observations and do not reflect the current distribution of the species.

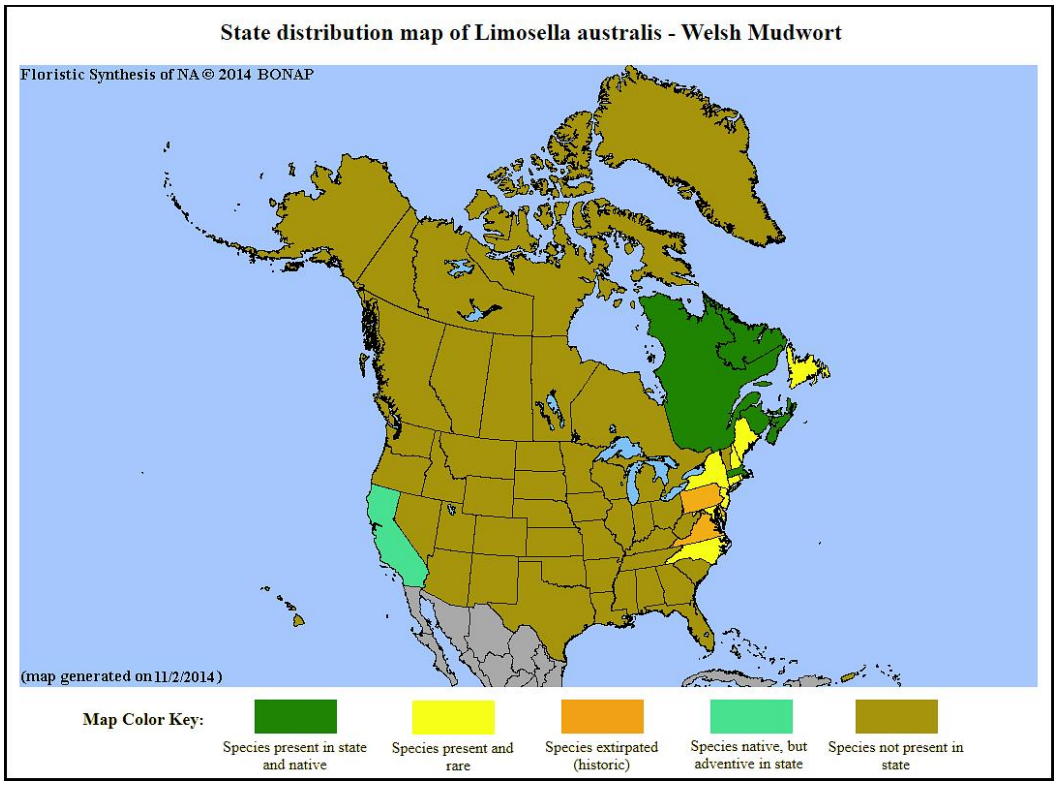

Figure 1. Distribution of L. australis in North America, adapted from BONAP (Kartesz 2015).

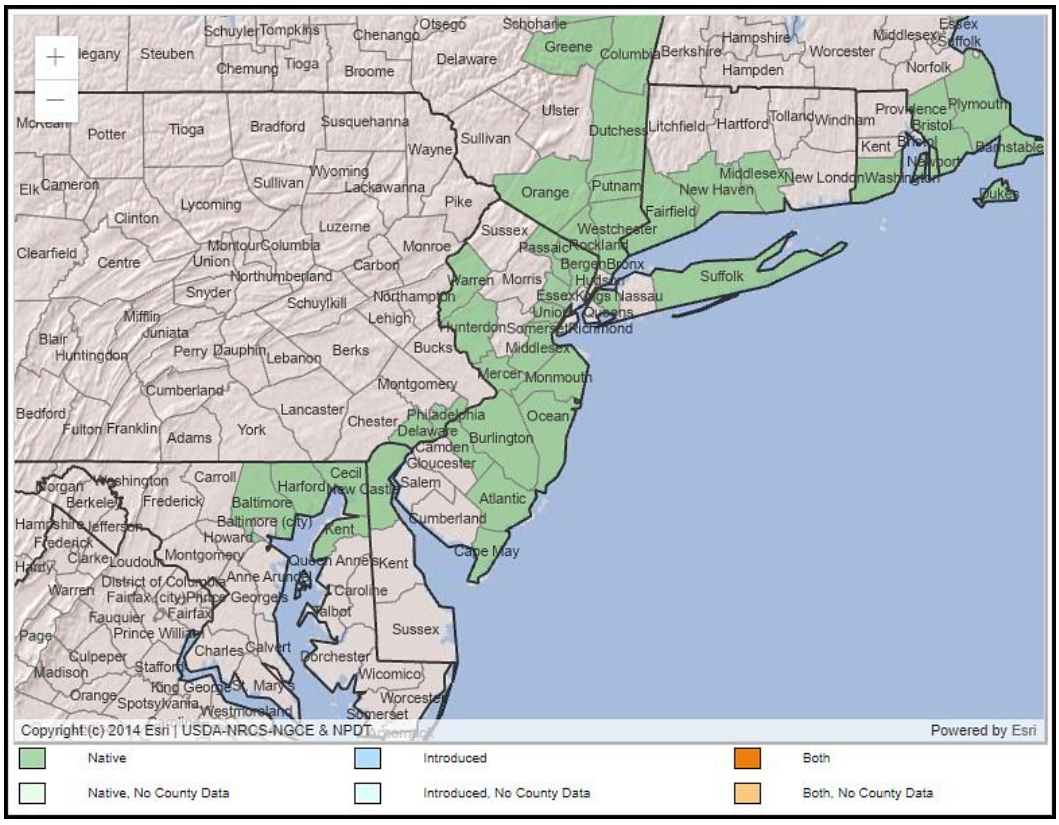

Figure 2. County records of L. australis in New Jersey and vicinity (USDA NRCS 2025).

Conservation Status

Limosella australis is considered globally secure. The G5 rank means the species has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats (NatureServe 2025). The map below (Figure 3) illustrates the conservation status of *L. australis* in North America. Awl-leaf Mudwort is vulnerable (moderate risk of extinction) in two states and three provinces, imperiled (high risk of extinction) in three states, critically imperiled (very high risk of extinction) in two states and one province, possibly extirpated in New Hampshire and Virginia, and likely extirpated in Delaware and Pennsylvania. Quebec is the only North American district where *L. australis* is ranked as apparently secure, and the species is unranked in Connecticut and West Virginia. Although the mudwort is identified as critically imperiled in California it is not clear whether it is native or introduced in that state (Morse and Treher 2020).

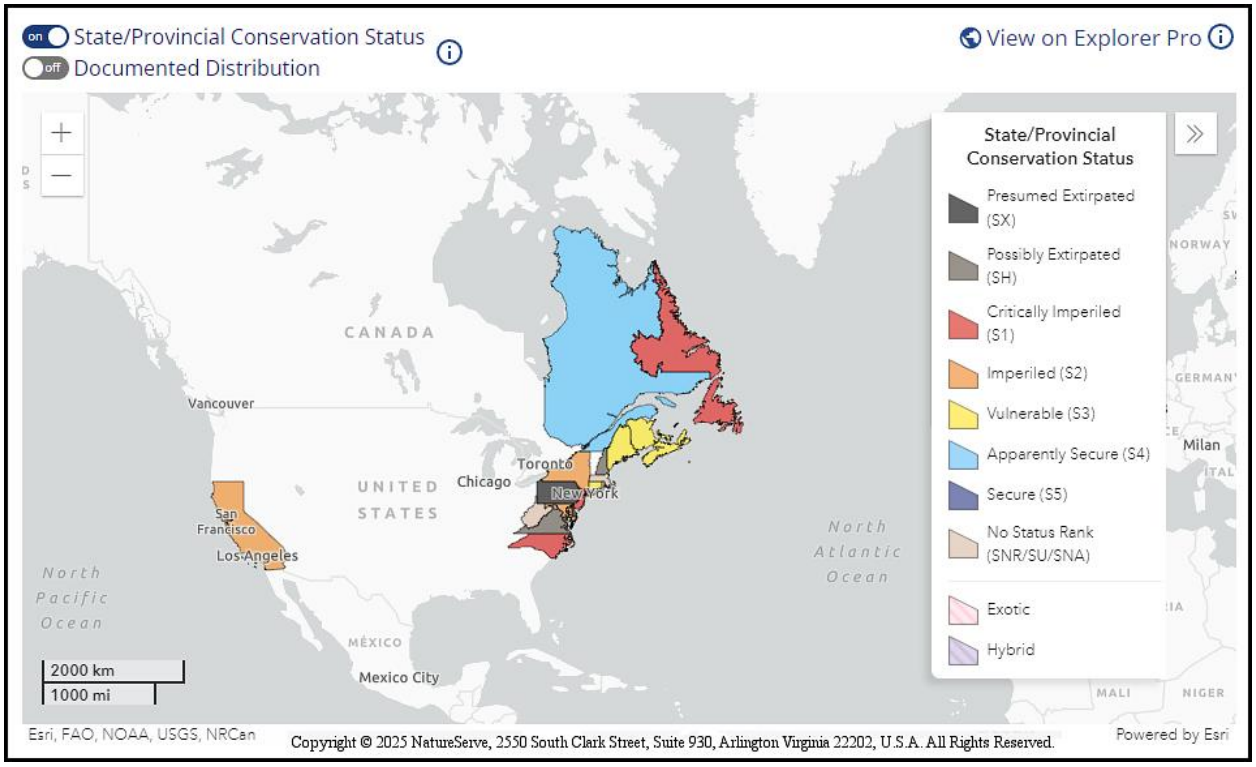

Figure 3. Conservation status of L. australis in North America (NatureServe 2025).

Limosella australis is critically imperiled (S1) in New Jersey (NJNHP 2024). The rank signifies five or fewer occurrences in the state. A species with an S1 rank is typically either restricted to specialized habitats, geographically limited to a small area of the state, or significantly reduced in number from its previous status. *L. australis* is also listed as an endangered species (E) in New Jersey, meaning that without intervention it has a high likelihood of extinction in the state. Although the presence of endangered flora may restrict development in certain communities such as wetlands or coastal habitats, being listed does not currently provide broad statewide protection for the plants. Additional regional status codes assigned to the mudwort signify that the species is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

Limosella australis was documented in two North American locations nearly simultaneously: In Connecticut by Ives (1817) and along the Delaware River by Nuttall (1817). Nuttall indicated that plants were found along the river's banks in both New Jersey and Pennsylvania. A herbarium sheet prepared by Asa Gray (1833) included a specimen of *Limosella australis* that he had collected in Monmouth County, New Jersey. Over the course of the next century the species was documented in many other counties around the state (Willis 1877, Britton 1889, Keller and Brown 1905, Stone 1911, Taylor 1915) although Taylor noted that it was rather rare. *L. australis* was one of the first plants to be listed in New Jersey: It was identified as an endangered species by Fairbrothers and Hough (1973). Foote (1981) indicated that there were 'fairly recent' observations of *L. australis* in Bergen County but Hough (1983) noted that records from all counties other than Bergen and Monmouth were more than 50 years old. Ferren (1982) observed that two extant occurrences in Monmouth County were probably the last ones left in the state. Those two populations were still present at the beginning of the present century (Breden et al. 2006). However, no *L. australis* plants were seen during a recent search of one of those sites, and the other has not been visited since 2005 (NJNHP 2024).

Threats

When Fairbrothers and Hough (1973) first designated *Limosella australis* as an endangered plant in New Jersey the primary threat they identified was development within tidal areas. Dredge spoils and landfills eventually eliminated all of the populations in the Delaware River watershed (Ferren and Schuyler 1980, Schuyler et al. 1993). At least five of the former occurrences in the state, including some along the Atlantic coast, were confirmed to have been destroyed by development, and a decline in habitat conditions was identified as the apparent reason for the demise of several others (NJNHP 2024).

Habitat degradation and loss resulting from anthropogenic activities have eradicated, or presently threaten, *Limosella australis* occurrences throughout North America and particularly in the United States (Morse and Treher 2020). Coastal storms or shifting dunes may eliminate certain populations; for example, tidal overwash filled in the site of one North Carolina occurrence (Sorrie 2021). Excessive herbivory by geese or crabs might also pose a threat to some *L. australis* populations (Morse and Treher 2020).

Climate Change Vulnerability

Information from the references cited in this profile was used to evaluate the vulnerability of New Jersey's *Limosella australis* population to climate change. The species was assigned a rank from NatureServe's Climate Change Vulnerability Index using the associated tool (Version 3.02) to estimate its exposure, sensitivity, and adaptive capacity to changing climactic conditions in accordance with the guidelines described by Young et al. (2016) and the state climactic computations by Ring et al. (2013). Based on available data *L. australis* was assessed as Moderately Vulnerable, meaning that it is likely to show some decrease in abundance or range extent in New Jersey by 2050. A similar assessment in California concluded that the mudwort

was highly vulnerable, although its native status in that state is uncertain (Anacker and Leidholm 2012).

A key factor contributing to the vulnerability of Awl-leaf Mudwort is the species' reliance on tidally-influenced habitats. New Jersey's coastal communities are already experiencing increasing rates of tidal flooding, and sea levels are rising faster in the region than in other parts of the world. Additional local effects of climate change include elevated temperatures and altered precipitation patterns that are resulting in more intense storms (Hill et al. 2020). When the saline coastal wetlands utilized by *Limosella australis* are altered or eliminated by storm activity or rising seas, opportunities for the species to establish at new locations are limited because intense development along New Jersey's shoreline has left little room for the formation of new salt marshes and flats. Sea level rise and storm-induced habitat changes have also been identified as threats to *L. australis* populations in other states (Sorrie 2021).

Management Summary and Recommendations

The lack of information about the pollination mechanisms of *Limosella australis* creates a critical gap in our understanding of the species. It is not clear whether *L. australis* is dependent on any particular insects, or whether it is capable of self-fertilization. While the species has strong dispersal capabilities those are dependent on the production of viable seeds. Research on this topic is needed, particularly in light of growing threats from climate change. Other areas where studies could provide clarity include the taxonomic status of the genus (Barringer 2020) and the origin of west coast populations (Morse and Treher 2020).

Twenty years have passed since New Jersey's only extant population of *Limosella australis* was last monitored and an updated status assessment of the occurrence is needed. Although suitable habitat no longer exists at many locations where the species was previously documented there are a few historic sites that could be revisited. *L. australis* may have been overlooked at some sites because the plants are very small and sometimes grow beneath other vegetation (Fairbrothers and Hough 1973, Weakley et al. 2024). Careful searches of suitable habitat during the late summer or early fall might turn up some additional populations.

Synonyms

The accepted botanical name of the species is *Limosella australis* R. Br. Some orthographic variants, synonyms, and common names are listed below (ITIS 2025, POWO 2025, USDA NRCS 2025). Numerous forms and varieties of the species shown were also described, mostly by the German botanist C. M. H. Glück during the early 1930s (POWO 2025).

Botanical Synonyms	**Common Names**
Limosella subulata Ives	Awl-leaf Mudwort
Limosella aquatica var. *tenuifolia* Hoffm.	Delta Mudwort
Limosella tenuifolia J. P. Wolff	Welsh Mudwort

Limosella americana Glück
Limosella brachystema Raf.
Limosella coerulea Burch.
Limosella lineata Glück
Limosella maritima Raf.
Limosella minuta Dinter & Suess.
Limosella monticola Dinter

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