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Chapter 13.2: Eurasian Watermilfoil

Myriophyllum spicatum L.; submersed plant in the Haloragaceae (watermilfoil) family
Derived from *myrios* (Greek: numberless), *phyllon* (Greek: leaf) and *spica* (Greek: spike)
"plant with many leaf divisions that bears flowers in a spike"

Introduced to several locations in the US from Europe in the 1940s
Present throughout the continental US and Alaska

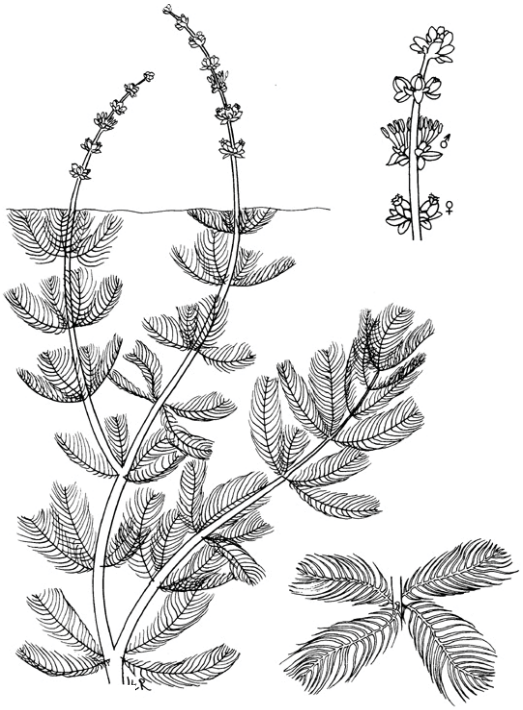
Introduction and spread

Eurasian watermilfoil (*Myriophyllum spicatum*) is one of fourteen species of *Myriophyllum* present in the US. Most species of this genus in the US are native, but two (*M. aquaticum* and *M. spicatum*) are exotic species that have been introduced to North America. Of these two exotic species, Eurasian watermilfoil is much more widespread and more problematic. The species was first reported in the US in the 1940s and spread rapidly into the mid-Atlantic and midwestern states in the 1960s and 1970s. Eurasian watermilfoil also became a serious problem in the hydropower and flood control reservoirs of the Tennessee River, where large-scale applications of herbicides were used in an attempt to eradicate the weed. Eurasian watermilfoil is still present in the TVA (Tennessee Valley Authority) system but has largely been displaced by hydrilla (Chapter 13.1). More recently (from the 1980s until 2009) the species has invaded lakes in Idaho, Minnesota and Maine and continues to expand its coverage throughout the northern US. Eurasian watermilfoil is now the most widespread submersed aquatic weed in the northern half of the US.

Eurasian watermilfoil has been introduced to the US multiple times and was likely first brought to North America in ship ballasts or as an ornamental plant for aquariums or water gardens. Accidental spread of Eurasian watermilfoil within the US is due primarily to transportation of contaminated boat trailers, boat parts and bait containers, but the species is also spread through the aquarium trade. Once Eurasian watermilfoil is introduced to a water system, it spreads prolifically by stem fragments that are produced both naturally (when stem sections detach from the plant at abscission sites) and as a result of mechanical breakage (when plants come into contact with boat motors and intense wave action). Some researchers speculate that Eurasian watermilfoil may be spread by wildlife or waterfowl; however, no direct evidence exists to support this theory. Eurasian watermilfoil produces numerous viable seeds, but the seeds contribute little to the propagation and spread of the plant. Eurasian watermilfoil was too widespread to be listed as a Federal Noxious Weed when the list was first developed; however, the species is listed on numerous state noxious and prohibited plant lists.

Description of the species

Eurasian watermilfoil is rooted in the sediment and grows completely underwater as a submersed plant that forms a dense canopy on the water surface. The species is commonly found in water from 1 to 15 feet in depth but can occur at depths of up to 30 feet if the water is extremely clear. Eurasian watermilfoil is an evergreen perennial plant that produces persistent green shoots throughout the year and overwinters as root crowns. Leaves are pinnately compound (feather-like), with each leaf composed of 14 to 24 pairs of leaflets arranged in whorls (groups) of four at the nodes of the stem. Stems and plant tips may appear reddish, but color is not consistent and may vary based on a number of factors, including environmental conditions. Flowers form on short aerial stems that hold them above the water and have both pollen-bearing ("male") and seed-producing ("female") flowers. Flowers are wind-pollinated and produce up to four nutlets per flower. Eurasian watermilfoil is difficult to identify and is often confused with several native species of *Myriophyllum*, including northern watermilfoil (*M. sibiricum*) and whorled watermilfoil (*M. verticillatum*). Hybridization between Eurasian and northern watermilfoils reportedly occurs in the field and the seedlings produced from these cross-pollinations often have features that are intermediate to the parental plants.



Reproduction

Eurasian watermilfoil produces a significant number of viable seeds and plants can be propagated from seed in the laboratory or greenhouse. However, successful colonization of new plants from seed in nature has not been documented. As a result, sexual propagation is generally thought to play an insignificant role in the spread of Eurasian watermilfoil. The species reproduces predominantly by vegetative means through fragmentation, which occurs when stems are broken mechanically (from wave action or contact with boat motors) and when stem sections naturally abscise or detach from the plant. Stem sections that result from natural breakage have high concentrations of starch and are likely responsible for most of the spread of the species. Eurasian watermilfoil can also spread by forming new root crowns on runners, which are produced when stems arch down, come into contact with the sediment and form roots that create a new root crown. Root crowns can also spread through the formation of rhizomes under the sediment, although detailed studies of this process have not been conducted. Root crowns overwinter and produce new shoots every year. As a result, more stems are added to root crowns each year, which increases stem density in the water column.

Problems associated with Eurasian watermilfoil

Because Eurasian watermilfoil grows entirely underwater as a submersed aquatic plant, the range of water depths the species can inhabit is limited by light penetration and water clarity. A dense canopy often forms at the surface of the water, which interferes with recreational uses of water such as boating, fishing and swimming. Dense growth of Eurasian watermilfoil may also obstruct commercial navigation, exacerbate flooding or clog hydropower turbines. In addition, excessive growth of the

species may alter aquatic ecosystems by decreasing native plant and animal diversity and abundance and by affecting the predator/prey relationships of fish among littoral plants. A healthy lake is damaged because heavy infestations of Eurasian watermilfoil lower dissolved oxygen under the canopy, increase daily pH shifts, reduce water movement and wave action, increase sedimentation rates and reduce turbidity.

Management options

Prevention is always the best option to avoid infestations of Eurasian watermilfoil. Posting signs at boat launches and requesting that lake users watch for Eurasian watermilfoil and remove all plant material from boats before launching can be a successful strategy. When prevention methods are unsuccessful, early detection and rapid response to new infestations have been shown to reduce management costs over the long term.

There are currently no biological control agents that effectively control Eurasian watermilfoil. For example, grass carp (Chapter 10) do not feed on this species. Numerous studies have been conducted to evaluate the utility of native insect herbivores as potential biocontrol agents of Eurasian watermilfoil, but none have proven to be predictable and effective to date. Also, if native insects were able to effectively control introduced populations of Eurasian watermilfoil, new introductions of the weed would not result in population development and expansion to weedy proportions. Historical accounts of the introduction and spread of Eurasian watermilfoil suggest this is has not occurred. In addition, the use of native insects as biocontrol agents remains controversial (Chapter 8).

Several herbicides can be used to effectively manage Eurasian watermilfoil. Contact herbicides – including diquat and endothall – provide good control, whereas systemic herbicides such as 2,4–D, fluridone and triclopyr provide excellent control. Herbicides should be selected based on site size and conditions, water exchange characteristics, potential water use restrictions, federal, state and local regulations and economic considerations (Chapter 11).

Mechanical controls (Chapter 7) are also widely used to control small infestations of Eurasian watermilfoil. Mechanical harvesting and raking provide temporary but fair control in bodies of water that are small to moderate in size, whereas hand harvesting and suction harvesting provide longer term control than mechanical harvesting or raking. None of these mechanical methods alone results in long-term control of Eurasian watermilfoil; as such, these methods should be employed as part of an integrated weed control strategy.

Physical control techniques such as drawdowns, dredging and bottom barriers (Chapter 6) can reduce or prevent growth of Eurasian watermilfoil by altering the environment. Drawdowns require dewatering of the affected lake or pond and are particularly effective during the winter. Draining the water out of the system exposes the root crowns of Eurasian watermilfoil to the air and results in desiccation and death of the plants. Dredging is expensive but results in water depths too great for plants to grow. Dredging provides multi-season control but should only be used as part of a broader lake restoration effort. Bottom barriers are semi-impermeable sheets of synthetic material that are placed over the plant bed, which kills the plants underneath. Bottom barriers are expensive but can provide effective control of Eurasian watermilfoil in small areas.

Summary

Eurasian watermilfoil is an exotic aquatic weed that is widely distributed throughout North America. The species is most commonly associated with problems in temperate lakes, but invades tidal estuaries, saline prairie lakes, rivers and southern reservoirs as well. Although the economic impact of Eurasian watermilfoil is not as great as that of hydrilla or waterhyacinth (Chapter 13.5), its geographic and ecological distribution surpasses that of other North American aquatic weeds. In fact, problems associated with Eurasian watermilfoil are significant enough that states such as Idaho, Minnesota, Vermont and Washington have developed specific management programs to control invasions of Eurasian watermilfoil.

For more information:

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