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A Native Weevil Attacks Eurasian Watermilfoil

By Richard A. Lillie and Daniel Helsel

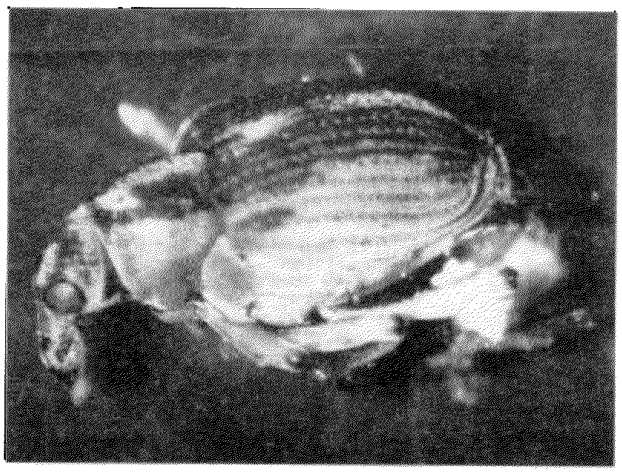
Background

Eurasian watermilfoil (*Myriophyllum spicatum* L.) is an exotic, submersed aquatic plant that was introduced into southern Wisconsin lakes sometime during the early 1960s (Bode et al. 1992) and has recently spread into northern Wisconsin lakes (Engel 1993). Eurasian watermilfoil is a tall (up to 15 ft long), heavily foliated plant with finely dissected leaves that form a dense canopy at the surface of the water, creating a severe nuisance to anglers, boaters, and swimmers. In extreme cases, Eurasian watermilfoil displaces native species, which are believed to provide better habitat for fish and fish food organisms. Consequently, Eurasian watermilfoil is a serious pest and a major concern to lake managers throughout North America. Efforts to control it have been only marginally successful. Currently available techniques, including mechanical harvesting, chemical treatments, and dredging, are expensive and generally effective for a relatively short time (Smith and Barko 1990).

Historically, Eurasian watermilfoil invasions exhibit a similar pattern. Upon introduction, milfoil may not be noticed immediately, but once it becomes firmly established in a lake, it rapidly expands and frequently becomes dominant, crowding out more beneficial native species. After a period of dominance, ranging from 10 to 15 years, the population often crashes. Usually this is followed by cyclic periods of partial recovery and subsequent crashes; however, in most cases the plant never reaches the level of dominance it once held. This sequence has been observed in many lakes across North America during the past 20 years. Despite serious efforts, investigators were not able to identify the exact causes of these population crashes. Everything from turbidity, sediment nutrient depletion, pathogens, and insects has been suspected.

Weevils Linked to Eurasian Watermilfoil Crashes

Recently, researchers from Middlebury College, Middlebury, Vermont, documented a milfoil crash in Brownington Pond, Vermont (Creed and Sheldon 1993, 1995). Remarkable as it may seem, the cause was identified as a tiny (less than an eighth of an inch in length) weevil known as *Euhrychiopsis lecontei* (Dietz), now commonly referred to as the milfoil weevil. Subsequent to this discovery, researchers in



An adult milfoil weevil, Euhrychiopsis lecontei.

Vermont and, more recently, in Minnesota have documented the biological control potential of this tiny creature. In what is a rare twist, this native animal has switched from feeding on its native host, northern watermilfoil (*Myriophyllum sibiricum* Komarov), to feeding on an exotic, Eurasian watermilfoil. The milfoil weevil and native milfoils apparently coexist: the weevil survives by feeding on native milfoils, but it does not cause extensive damage to the milfoil stand. However, when the weevil shifts to feeding on the exotic, the weevil's rate of reproduction increases, allowing the weevil population to expand rapidly. The exotic milfoil, possibly lacking the necessary evolved defenses, succumbs to the attacks by the voracious weevils! Apparently, the weevil has undergone this host switch in different places at different times. It should be pointed out that it is not certain whether all observed watermilfoil population crashes are attributable to the weevil. However, two lakes in Wisconsin that have experienced crashes, namely Devil's Lake (Sauk Co.) and Lake Wingra (Dane Co.), are known to harbor the milfoil weevil. Likewise, a milfoil crash in a northern Illinois lake during 1995 has been attributed to the weevil (R. Kirschner, Northeast Illinois Planning Commission, pers. comm.). The declines observed in the Madison area lakes, Whitewater Lake (Walworth Co.), and Lake Ripley (Jefferson Co.), among others, may also be due to the effects of the weevil.

Perhaps the best documented case of a milfoil crash in Wisconsin to date is Fish Lake in northwestern Dane County. Fish Lake has been the subject of an extensive fish research-management study monitoring Eurasian watermilfoil beds and associated invertebrates for the past five years (1991-95). Fish Lake has the dubious distinction of being the first lake in Wisconsin from which a herbarium specimen of *M. spicatum* was collected. Milfoil spread from its origin along the east shore in the mid-1960s to a peak abundance sometime around 1989-90. Beginning in 1992, researchers noticed a gradual reduction in the extent of the bed. By the summer of 1995, almost 50% of the milfoil bed was affected (Figure 1).

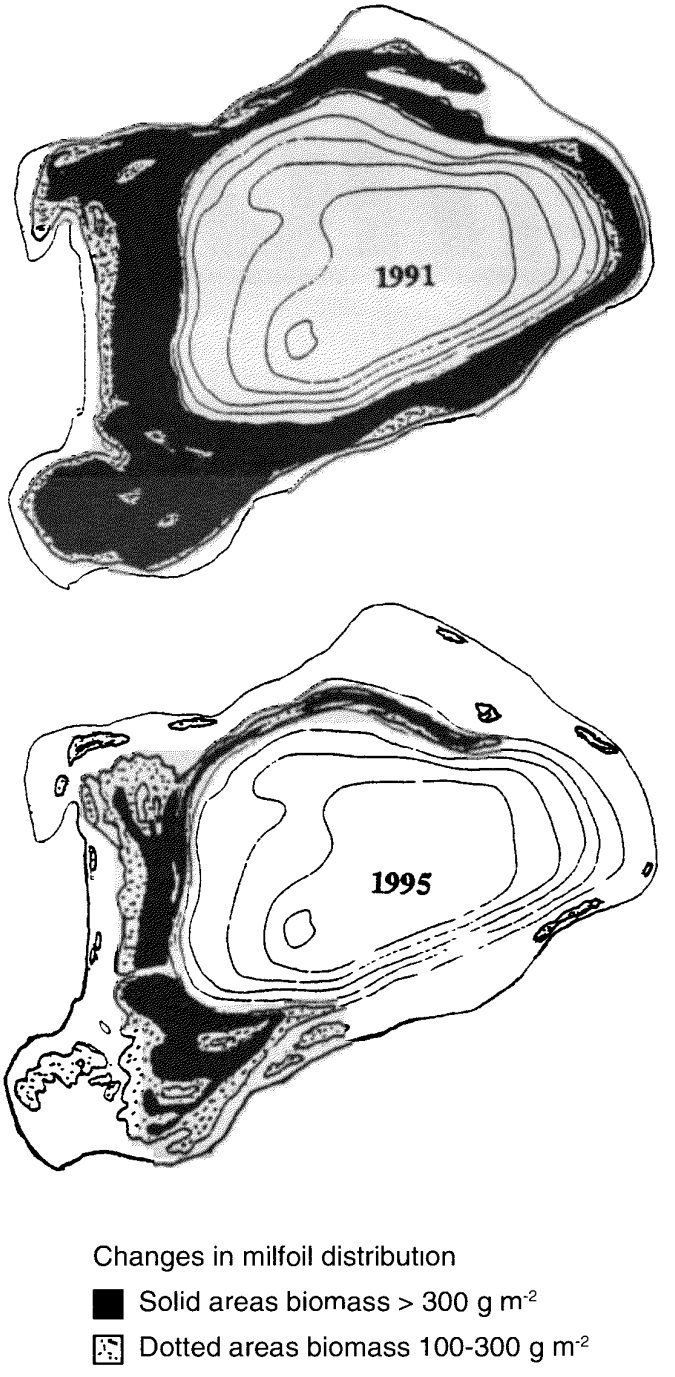


Figure 1. *Change in areal extent of Eurasian watermilfoil coverage on Fish Lake, Dane County, Wisconsin, from 1991 to 1995, believed to represent the impact of a weevil attack*

Weevil densities in Fish Lake, estimated by a series of collections made each year, were highly variable both among sites and sampling dates; however, weevil population densities appeared sufficient in some locales to produce serious damage to Eurasian watermilfoil beds. An estimate of the weevil population density needed to produce visible effects on Eurasian watermilfoil was provided by laboratory and field studies conducted in Vermont and Minnesota.

The Weevil's Life Cycle

The weevil's life cycle has recently been described (Sheldon and O'Bryan 1996): beginning in early spring the weevil lays its eggs on the growing tips of milfoil, generally near the shore. The eggs hatch, and the larvae begin feeding on the growing tips of the milfoil plant where they cause extensive damage. Older larvae burrow into the stems, gradually hollowing out the center of the stems. Entry and exit holes made by the larvae allow the escape of gases, primarily oxygen, causing the plant to lose buoyancy (Creed et al. 1992, Sheldon and Creed 1995) and sink to the lake bottom where light levels may be insufficient to permit photosynthesis. As a result, the plant often dies. Also, the excavation of the center of the stem disconnects the growing parts of the stems from the roots; the upper part of the plant can no longer depend on the root supply for nutrients, and this leads to either fragmentation or death. The actions of the larvae, together with feeding by adult weevils, also exposes the plant interior to fungi, viruses, and bacteria. The larvae eventually pupate within the interior of the stem, after which new adults emerge and begin feeding and reproducing. Long-term studies in Vermont showed that the weevil completes three generations each summer. In the fall, the adult weevil reaches shore by either swimming or riding rafts of fragmented milfoil plants, where it crawls out and seeks shelter in surrounding soil and leaf litter. Weevils are believed to be concentrated in the first several meters of shoreline (R. Newman, University of Minnesota, pers. comm.). The quality of overwintering habitat deserves more research since a combination of winter weather and available shoreline habitat may largely control survival rates and population growth.

Ongoing Research

The Wisconsin Department of Natural Resources, in partnership with local lake organizations, is cooperating with the University of Wisconsin-Stevens Point to further investigate the use of the milfoil weevil as a biocontrol agent in the state. The first phase of the study will document the distribution of *E. lecontei* in Wisconsin's lakes, with a special emphasis on lakes with historical Eurasian watermilfoil declines and lakes with milfoil dominance. To date, after a cursory inspection of a small number of Wisconsin lakes, the milfoil weevil has been found in four lakes, although its presence is thought to be statewide on both native and exotic milfoil. It is also present in the neighboring states of Minnesota, Iowa, Illinois, and Michigan.

Laboratory and some limited field work in other states have shown that the weevil can cause declines in Eurasian watermilfoil. During the second phase of the study, investigators will stock weevils at varying densities in selected Wisconsin lakes and monitor changes in milfoil condition and distribution. The results of these experimental introductions should provide some indication of whether weevils can be used as an effective biocontrol technique in the ongoing battle with Eurasian watermilfoil.

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