CHAROPHYTES

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Charophytes

Charophytes are a type of green algae. There are thousands of species of green algae, but only a few are advanced enough to be called "macrophytic algae"—this means they look (and sometimes act) like aquatic plants. These "plants" are found on all continents except Antarctica.

Charophytes have an important place in the history of plants on earth. Fossils of *Charophytes* have been found going back to the Silurian Period (443 million years ago). This was the period when plants moved from water to land—and *Charophytes* are considered the closest living relatives to land plants.

Basic Information

They have no true leaves, stems nor fruits. *Charophytes* are generally submergent and are loosely attached to the sediment by thin rhizome-like structures called 'holdfasts'.

Charophytes grow in silt, mud, peat or sand, often as the first plants to colonize newly-cleared areas. Seeds can remain dormant for years.

Charophytes have been found in water as deep as 213 feet. They are unable to grow or are restricted in growth in turbid or murky waters.

These species play multiple roles in an aquatic ecosystem as part of the food web, in providing habitat, and in increasing water quality.

FOOD WEB

Almost all groups in an aquatic food web benefit from the presence of *Charophytes.* Many ducks, amphibians and reptiles use them directly as food. In addition, *Charophytes* serve as an important grazing location for insects that in turn provide food for fish and other wildlife.

In particular, *Charophytes* support insects that provide food for game fish like bluegills, smallmouth bass and largemouth bass.

This vegetation is especially important in the winter when it provides habitat for the invertebrates that support good fisheries.

HABITAT

Besides providing habitat for important invertebrates and food for fish and wildlife, *Charophytes* also serve as protection and cover for young fish. They are important in the predator-prey ratio. Their presence has even been known to inhibit the survival of mosquito larvae.

Studies in some lakes in eastern Europe suggest that *Charophyte* beds can be important (and preferred) spawning areas for northern pike and walleyes. Similar studies indicated that the more *Charophytes* that were present, the healthier that aquatic ecosytem habitat was.

WATER QUALITY

Perhaps the most important role in an aquatic ecosystem that *Charophytes* serve is in water quality. They naturally filter the water and play an important part in nutrient cycling.

Charophytes hold massive amounts of phosphorus, serving as a phosphorus sink. This results in reducing and/or and blocking the availability of phosphorus for other less desirable algae and aquatic vegetation. In hard water systems, like those in Adams County, the calcification on *Charophytes* ties up even more phosphorus.

WATER QUALITY--2

Charophytes are known to play important roles in forming habitat and shaping an aquatic environment, influencing both abiotic (pH, water clarity) and biologic (structure of phytoplankton) factors.

Besides holding phosphorus, they also hold a lot of nitrogen, which is the second most influential factor in the presence of nuisance aquatic plant and excessive algae production. They deliver oxygen to sediments, enhancing the nitrogen cycle and preventing iron-bound phosphorus from being released into the water column.

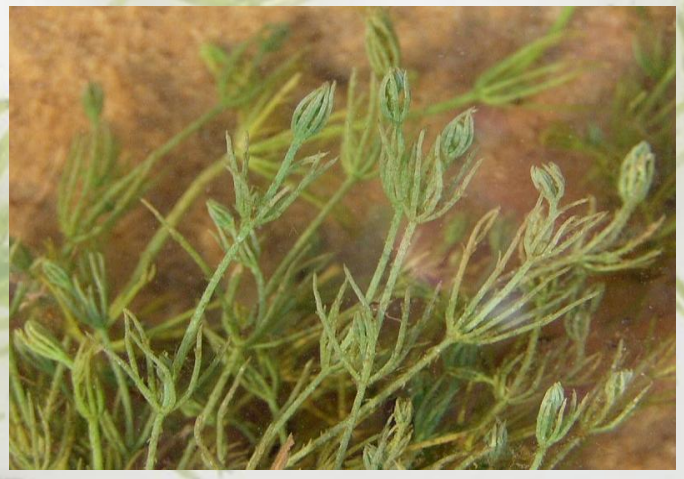
The dense mounds of *Charophytes* that can annoy people so much only occur in stable, mostly undisturbed, high-quality systems. Since *Charophytes* are so sensitive to water quality changes, their disappearance would suggest a degradation of water quality.

WATER QUALITY--3

Charophytes also hold onto metals like cadmium, zinc and chromium that could combine with other nutrients to form potentially-harmful ions.

Charophyte beds, with their high biomass, tend to decay very slowly, thus tying up the nutrients like phosphorus after The growing season, reducing the likelihood of late algae blooms.

Nitella flexilis, found in Adams County



Chara contraria, common in Adams County

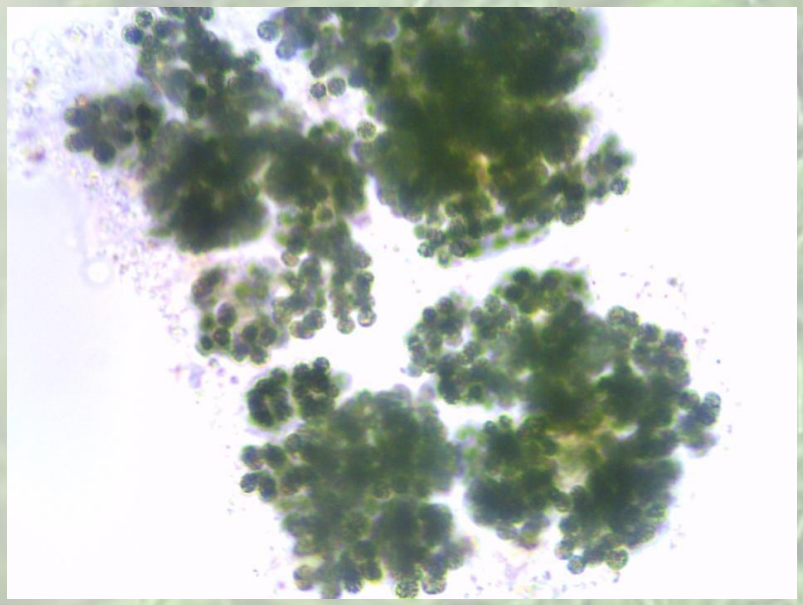
WATER QUALITY--4

One thing that happens when oxygen becomes low in a lake is the re-release of nutrients into the water column from the sediments, often resulting in algal blooms or a increase in nuisance plant growth. *Charophytes* stabilize bottom sediments, thus reducing the occurrence of this process.

Studies have shown that *Charophytes* restrict the resuspension of sediments up to 100 times more than other aquatic vegetation.

Chara globularis, common in Adams County

BLUE-GREEN ALGAE



Home-Grown *Microcystis*

Studies in China suggest that the alleopathic (inhibitory) aspects of *Charophytes* may discourage blooms of potentially-toxic blue-green algae like *Microcystis.*

Nuisance & Control

As you know, *Chara* can form dense mats. These are called "*Charophyte* meadows". Such mats prevent colonization by other aquatic plants. These meadows also often seen as a nuisance by boaters, anglers and swimmers.

Charophytes are the only algae type that are not affected by barley straw inhibition. Any control methods used on these species are short-lived. Control is required several times per year, every year.

Some places have tried pulling *Charophytes* out of the water, or raking them or cutting them. Once removed from the water, they usually dry out quickly and make great fertilizer. Once removed, these 'plants' can be used as cattle feed or fertilizers.

Chemical controls tend to be as short-lived as physical removal. Generally, to keep *Charophytes* low chemically would require multiple applications each year, every year, resulting in significant expense.

BEST CONTROL

Excessive growth of *Charophytes* is caused by excessive nutrients, especially phosphorus and nitrogen. Thus, the best control of nuisance *Chara* growth is to reduce or redirect nutrient sources. Some practices that help in this regard are reducing or eliminating the use of chemicals (including fertilizer) near the water and maintaining septic systems properly.

Other useful practices including redirecting nutrient/stormwater runoff away from the water and maintaining a vegetative buffer area.

The presence of *Charophytes* in a lake indicates both high water quality and high water clarity. They are signs that the aquatic ecosystem in that lake is healthy.

COMPARISON TO NEARBY LAKES

% of aquatic plant community

	Crooked	**Deep**	**Parker**	**Peppermill**
2004-2006	26.5%	29.0%	23.0%	19.0%
2009-2012	38.0%	18.0%	39.0%	30.5%
2013	32.0%	no data	39.0%	no data

Lychnothamnus barbatus

Peppermill Lake, along with a few other lakes in Adams and Waushara County, contains the rarest *Charophyte* in the world: *Lychnothamnus barbatus (*Bearded Stonewort).

In Europe, it is classified as threatened with extinction. In most of Europe, it has been found in rather large deep lakes with steep slopes and narrow shallow zones. But in Croatia, this genera was found most often in shallow zones. In Australia, it was found in shallow areas of lakes with clear, non-turbid alkaline water--which describes Peppermilll Lake.

Until discovered by accident in Wolf Lake in 2011, *L. barbatus* had never been found in North, Central or South America before. Sediment cores from Wolf Lake show it has been here since before pioneer settlement.

So far, in Adams County, it has been found in Deep, Fawn, Hill, Jordan, Parker, Peppermill, and Wolf Lakes. Three of these are fairly shallow man-made lakes with clear water. The other four are very deep lakes with clear water. It has also been found in three or four lakes in Waushara County.

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