# Common and Troublesome Weeds of Golf Course Ponds

Aquatic plants are familiar and beneficial components of pond systems. However, too much of a good thing can present management challenges.

## **BY ROB RICHARDSON**

t has been said that the two types of ponds are those that have weeds and those that will have weeds. Small ponds are a great environment for nuisance aquatic plant growth because they typically have a high proportion of shallow areas that can easily be invaded by aquatic weeds. Generally, small ponds also collect nutrients and receive high levels of sunlight, providing aquatic plants everything they need to survive and thrive. Many aquatic plants can be found in ponds, so correctly identifying aquatic plant species is critical to developing a management strategy. The species below are some of the most common and troublesome aquatic plants found across the different regions of the U.S.

# **FILAMENTOUS ALGAE**

Algae are found almost everywhere around the world, and there are an abundance of algal species in almost every pond. For management purposes, algae usually are grouped into categories: planktonic, filamentous, and macroalgae. The filamentous algae are more troublesome in most ponds and generally more difficult to control. Algae can rapidly grow, doubling their biomass in as few as two or three days. Filamentous algae can grow either on the bottom or surface of a pond and form sheets, clumps, mats, or other aggregations. There are a large number of filamentous algal species that can be troublesome, so proper species identification is important when selecting the most appropriate management strategy.

Limiting nutrient inputs is the best long-term strategy for controlling filamentous algae. Reduce direct nutrient inputs like grass clippings, leaves, and

 A boom of filamentous algae can create dense, unsightly mats on the surface of golf course ponds.



Filamentous algae can cause a variety of problems for golf course ponds, with aesthetic concerns being among the most significant issues.



Green Section Record Vol. 54 (11) June 3, 2016

©2016 by United States Golf Association. All rights reserved. Please see Policies for the Reuse of USGA Green Section Publications. Subscribe to the USGA Green Section Record.



Although it is the smallest of the duckweeds, watermeal is still able to cover ponds completely. The dense vegetation can prevent oxygen movement from the atmosphere into water, possibly resulting in oxygen depletion and fish kills.

other organic debris. Establish strong watershed management practices to reduce the flow of nutrients into ponds — e.g., establishing buffer areas and limiting fertilizer applied near water bodies. Also, there are <u>products</u> that can be applied that bind with phosphorus in pond systems and make it unavailable. A properly designed and installed pond aeration system can also cause phosphorus to precipitate out of the water.

Mechanical harvesting, dyes, and algaecides are methods that provide immediate control of filamentous algae. Mat-forming algae may be raked or otherwise mechanically removed from ponds, but this is only a temporary solution. However, one

©2016 by United States Golf Association. All rights reserved. Please see Policies for the Reuse of USGA Green Section Publications. Subscribe to the USGA Green Section Record.



Individual watermeal plants appear as green dots with no roots.

advantage of mechanical removal is that it removes the nutrients contained in the algal mats, helping control future algae growth by reducing the overall nutrient content in the pond. Dyes can help control algae by reducing the amount of light that penetrates the water. However, dyes only provide effective control when they are applied before algae become established and if dye concentrations are maintained. In many cases, algaecides are required for complete control. Copper is one of the oldest and most widely used algaecides. Available in many different formulations, copper may also

USGA

be used in combination with other algaecides to improve efficacy. When planning to use copper as an algaecide, it is important to note that some fish species are sensitive to copper. Make sure to have a good understanding of fish populations in any pond before using copper for algae control.

### **DUCKWEEDS**

There are at least 35 species of duckweeds in the world, with many native to the U.S. Duckweeds are monocots and, at less than 1 inch in size, are among the smallest vascular plants in

Green Section Record Vol. 54 (11) June 3, 2016



Large stands of water hyacinth can be particularly unsightly during winter.

ponds and can also be among the most troublesome. Due to their small size and free-floating lifestyle, all duckweeds prefer quiescent waters. Under good growing conditions, duckweed plants can double in biomass every one to three days. Their small size also means that they can be easily moved by water, boats, equipment, or even waterfowl. Although duckweeds can produce seed, they rarely do and most reproduction is through vegetative budding. In fall, duckweeds will sink and overwinter along the bottom of a pond. Dense mats of duckweed can deplete pond oxygen levels and cause fish kills.

Duckweeds can be frustrating to manage. For temporary suppression, surface skimmers can be used to remove some of the population. Small

©2016 by United States Golf Association. All rights reserved. Please see Policies for the Reuse of USGA Green Section Publications. Subscribe to the USGA Green Section Record.

grass carp also can be used to control duckweeds, but they quickly lose the ability to filter the small plants from water. Therefore, duckweed typically is controlled using herbicides, but control may not be long lasting because duckweeds can easily be transported back into the system.

#### WATER HYACINTH

Water hyacinth is one of the most popular plants for water gardens. It is a free-floating plant with spongy, waxy leaves, showy purple flowers, and dark purple, feathery roots that descend into the water. Water hyacinth is native to South America, prefers quiescent waters, and has limited ability to survive cold temperatures. Reproducing both vegetatively and from seed, water hyacinth has the potential to rapidly



spread and cover small ponds in a relatively short period of time. Populations of water hyacinth may double in size in as few as six days. The dense, floating biomass can dominate small ponds and may cause oxygen depletion.

Hand removal and mechanical harvesting can be used for short-term control of water hyacinth, but it is difficult and very labor intensive to remove all plants. Herbicides are a more common means of control, and there are many systemic and contact herbicides that provide good to excellent control of water hyacinth.

#### **EURASIAN WATERMILFOIL**

Eurasian watermilfoil is one of the most troublesome submersed plants across cooler climates of the U.S. It grows in water that is 15 feet or greater in depth and creates dense mats of stems near the surface. Eurasian watermilfoil has whorled, thin, and featherlike leaves and rapidly spreads via stem fragmentation that may occur naturally or with disturbance. The flowers of Eurasian watermilfoil are inconspicuous and occur on emergent spikes that protrude above the water.

Although they like many submersed plants, grass carp do not like to feed on Eurasian watermilfoil. Mechanical harvesting techniques provide temporary reductions but can hasten the spread of Eurasian watermilfoil by fragmenting stems. Lowering the water level and allowing the plants to desiccate after exposure can be an effective control measure. Dredging and <u>benthic</u> <u>barriers</u> may also provide effective control. Finally, several herbicides are available that can provide good control of Eurasian and other watermilfoil species.

# CATTAILS

Cattails are a familiar emergent aquatic plant found around the shallow margins of ponds and in wetland areas. These strong perennial plants can reach heights of 10 feet and spread via stout rhizomes and winddispersed seeds. There are three native cattail species in North America. In natural settings, cattails can provide important habitat and a food source for

Green Section Record Vol. 54 (11) June 3, 2016

a variety of wildlife. However, dense stands of cattails have the potential to dominate shallow ponds and wetland areas, causing functional and aesthetic concerns.

Mechanical controls can provide short-term to moderate control of cattails. Practices like mowing are reported to be more effective when cattails are flowering. Dredging can increase water depth and restrict the growth of cattails to shallow shelf areas around pond edges. Likewise, raising or lowering the water level of a pond by several feet during a growing season can reduce the viability of existing cattail stands. However, applying a foliar herbicide is the most widely used control strategy for cattails. The most effective control of cattails occurs when herbicides are applied during late summer when the plants are translocating sugars to the rhizomes.

#### **PONDWEEDS**

Most pondweed species found in the U.S. are native species. Typically, pondweeds are very desirable in natural settings. However, pondweeds can

become problematic in smaller ponds. Curly leaf pondweed is an exotic species that is especially troublesome in cooler climates. Unlike many other plants discussed in this article, curly leaf pondweed can actively grow under ice sheets, giving it a distinct advantage over other plants. Curly leaf pondweed typically reaches peak biomass in April or May, earlier than most other aquatic plant species, necessitating earlier implementation of management programs. Curly leaf and many other pondweeds produce winter buds called turions that aid in dispersion and reestablishment after disturbance.

Triploid grass carp are effective for managing pondweeds. Physical and mechanical methods may also provide short-term to moderate control, depending on the site and pondweed species. Water drawdowns can provide seasonal control, but many pondweeds will regrow rapidly from seed or turions once water levels are restored. Herbicides are also available for controlling pondweeds and should be applied early in the season before the plant produces new turions.

#### **SOUTHERN NAIAD**

Southern naiad, also referred to as bushy pondweed, is native to the U.S. and similar to native pondweeds. Typically, southern naiad is considered a very desirable plant in natural sites where it provides valuable habitat for aquatic organisms. Southern naiad has ribbon-like leaves and profusely branches to form dense stands of vegetation that can pose significant problems for ponds and canals. Naiads can be distinguished from pondweeds by their opposite leaf pattern and typically smaller leaves. Management of naiads is similar to that described for pondweeds.

#### **HYDRILLA**

This submersed plant is one of the most troublesome aquatic plants in the U.S. Currently, there are two biotypes of hydrilla in the U.S., each with distinct growing habits. A dioecious biotype of hydrilla was introduced to Florida in the 1960s and since has spread across warmer regions of the U.S. A monoecious biotype of hydrilla was introduced to the Potomac region and



This overhead view shows an area of dense hydrilla infestation.

©2016 by United States Golf Association. All rights reserved. Please see Policies for the Reuse of USGA Green Section Publications. Subscribe to the USGA Green Section Record.



Green Section Record Vol. 54 (11) June 3, 2016



Creeping water primrose is able to form a monoculture over large, shallow areas of water.

North Carolina in the mid to late 1970s. The monoecious hydrilla is rapidly spreading across the Northeast and into areas previously invaded by dioecious hydrilla.

Dioecious hydrilla typically overwinters, while the monoecious hydrilla behaves as a herbaceous perennial with stems that die off during winter. Both biotypes produce tubers that aid in persistence and dispersion. Hydrilla tubers essentially serve as a seed bank, allowing hydrilla to bounce back after disturbance or management.

Triploid grass carp have been widely used to manage hydrilla in the Southeast. Grass carp are long-lived and can effectively deplete hydrilla tuber banks over time. Other biocontrol agents have been released for hydrilla but generally they have been ineffective. The persistent tuber banks usually make drawdowns ineffective at controlling hydrilla. Mechanical harvesting can be used as a short-term control option, but fragmenting stems can spread hydrilla. However, several herbicides that effectively control hydrilla are available. Herbicides can control hydrilla biomass and prevent new tuber production, but tubers in pond sediment will be unaffected. Herbicide programs will need to be continued for several years to completely eradicate tubers.

#### CREEPING WATER PRIMROSE

An invasive emergent species, creeping water primrose is spreading across the southern tier of the U.S. This species roots in sediment and aggressively grows in shallow areas. It



may also be found in deep water with floating stems and leaves. Creeping water primrose stems can root at each node, helping the plant spread quickly. Creeping water primrose has alternate leaves, bright yellow flowers, and stems that become semi-woody as they mature. Growth of creeping water primrose is far more aggressive than native primrose species, and it can form dense monocultures that outcompete native vegetation.

Creeping water primrose can be difficult to manage. Mechanical removal techniques can provide short-term control; however, biocontrol agents, including triploid grass carp, generally are ineffective. Several herbicides are available to control creeping water primrose, but repeat applications over several years will be required to eliminate well-established stands.

Green Section Record Vol. 54 (11) June 3, 2016

©2016 by United States Golf Association. All rights reserved. Please see Policies for the Reuse of USGA Green Section Publications. Subscribe to the USGA Green Section Record.



Fences can be used to confine grass carp to desired areas. Notice that there is no submersed vegetation in the area below the fence where the carp are present, while Illinois pondweed and hydrilla are present above the fence where the carp are excluded.

#### MANAGEMENT PROGRAMS

There are many different options for managing aquatic plants. Rather than discussing every option, several common and relevant aquatic plant management options will be reviewed. As with any management option, check to ensure that the following techniques are applicable in your area and not restricted by law. Keep in mind that the specific use of a water body will influence the appropriateness of any management option. Also, consider integrating multiple management strategies into a comprehensive management plan, which usually provides the greatest long-term return on investment.

#### **TRIPLOID GRASS CARP**

Native to Asia, grass carp are herbivorous fish. Grass carp have been heavily stocked in the Southeastern U.S. for controlling submersed plants, primarily hydrilla. Grass carp feed on a variety of submersed plants, including hydrilla, pondweeds, and naiads. Small grass carp are able to feed on tiny plants such as duckweeds and watermeal, but as the fish grow they lose the ability to filter small plants from water and require larger vegetation. However, grass carp will not eat algae, do not prefer feeding on milfoils, and are poor feeders on emergent and floating vegetation. Furthermore, not all states

©2016 by United States Golf Association. All rights reserved. Please see Policies for the Reuse of USGA Green Section Publications. Subscribe to the USGA Green Section Record.

permit the use of grass carp. States that do permit the use of grass carp typically only allow sterilized — i.e., triploid — fish and restrict stocking to impounded ponds. Check with the appropriate authority in your state for procedures and regulations regarding the use of grass carp.

#### **HERBICIDES**

Currently, approximately 14 <u>herbicides</u> are registered for aquatic plant management, including fast-acting contact herbicides and slower-acting systemic products. Herbicides can be used to control a variety of species under many different site conditions. The spectrum of species controlled differs by product as well as irrigation restrictions, so care must be taken when selecting the most appropriate herbicide for the target species and site.

#### **MECHANICAL CONTROL**

Small- to large-scale mechanical implements are available for cutting and removing aquatic plant biomass. Mechanical control techniques can include diver harvesting, mowers, cutter bars, buckets, pulling chains or rakes, or large cutter barges that collect plants as they are cut. However, mechanical control techniques may fragment stems and cause some plants to spread. Furthermore, it is unlikely that mechanical control techniques will remove 100 percent of the aquatic plant biomass, meaning regrowth is likely and may be rapid.

# POND DYES

There are many pond dyes on the market. Some pond dyes are even registered for controlling certain aquatic plants and algae. Pond dyes suppress and control aquatic vegetation by blocking sunlight and reducing photosynthetic capacity. Plants that are already at or near the surface will not



Many golf courses use aquatic specialists and lake management companies to evaluate and manage aquatic weeds and algae.



Green Section Record Vol. 54 (11) June 3, 2016



Well-managed golf course ponds can be functional, visually attractive, and provide habitat for aquatic organisms and other wildlife.

be affected by the dye. Therefore, dyes must be applied and maintained before plant problems develop. It is also important to note that dyes will reduce photosynthesis in phytoplankton, the base of the food chain in aquatic systems. Any negative impacts on phytoplankton may eventually impact fish populations, a matter of particular concern to managers of ponds that serve as fisheries.

#### PHYSICAL CONTROL TECHNIQUES

Physical control techniques such as drawdowns, dredging, sediment

removal, and benthic barriers can be used to control some aquatic weeds. Pond drawdowns expose plants to desiccation and, in some climates, freezing temperatures if done during winter. Drawdowns are an effective control option for submersed plants that do not form seed or other propagules. Dredging and sediment removal can directly remove problem plants while also increasing pond depth. Increasing pond depth will limit the establishment of some aquatic plants. Benthic barriers are similar to landscape fabric in that they create a barrier that aquatic plants cannot grow through. Benthic barriers can be very effective but often are limited in scale to sitespecific applications.

# CONCLUSION

Aquatic plant management can be guite different from terrestrial plant management. Furthermore, there are specific laws and regulations that govern weed control in aguatic systems. Often, it is impractical for golf courses to maintain an individual on staff who has the necessary training and expertise to manage aquatic vegetation. When an on-staff expert is not available, courses should consider contracting the management of aquatic systems to a pond management firm. Professional pond management firms can offer effective solutions to aquatic vegetation problems and additional protection from potential liability. Pond management companies also can assist with developing comprehensive management plans that integrate multiple control strategies.

For additional information at no cost, the <u>Aquatic Plants app</u> is available from North Carolina State University for both Android and Apple devices. Another valuable source of information is the <u>"Biology and Control of Aquatic Plants – A Best Management Practices Guide"</u> produced by the Aquatic Ecosystem Restoration Foundation. For managing small ponds, the Council for Agricultural Science and Technology has another valuable resource, <u>"Benefits of Controlling Nuisance</u> Aquatic Plants and Algae in the United States."

ROB RICHARDSON is an associate professor and extension specialist at North Carolina State University, where he actively chases down hydrilla and other nuisance aquatic plants.



# GOLF'S USE OF WATER RESOURCE CENTER

LEARN MORE ABOUT SUSTAINABLE SOLUTIONS»

©2016 by United States Golf Association. All rights reserved. Please see Policies for the Reuse of USGA Green Section Publications. Subscribe to the USGA Green Section Record.



Green Section Record Vol. 54 (11) June 3, 2016