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MANAGING AND CONTROLLING ALGAE IN PONDS

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INTRODUCTION

When looking at the old fishing hole or stock tank, if there's a thick mat of bubbly yellow-green substance floating on the surface of the pond, or the pond appears to be colored bright green, blue-green, or sometimes even red, then there may be an algae problem. Algal overgrowth is one of the most common issues plaguing pond owners. The first step to effective algae management is to understand what type of algae resides in the pond. There are three different types of algae commonly found in farm ponds and small lakes: planktonic algae, filamentous algae, and macroalgae.

PLANKTONIC ALGAE (THE GOOD)

Planktonic algae are the microscopic, single-celled, and free-floating algae that exist in the top few feet of a pond or lake where the sunlight penetrates. This type of algae is what gives the water a green coloration, a plant mass does not have to be visible. Planktonic algae are normal and are in fact desirable, because they are essential to the pond's food chain.

Planktonic algae (phytoplankton) provide food for the microscopic animals (zooplankton) that are eaten by fish fry, baitfish, and other pond inhabitants, which ultimately support a larger fish population. They display seasonal abundance, with explosions of growth called 'blooms' in the spring or summer that often change the color of the pond. Planktonic algae are also important in oxygenation of the pond as they photosynthesize during the day creating oxygen as a byproduct. Rapid die-off due to algaecide treatments or natural degradation of algal blooms can lead to oxygen depletion and fish kills in the pond.

In some cases planktonic algae (more specifically, protists of the genus *Euglena*) can turn from green to red in the pond.

Planktonic algae are the kinds of algae pond owners actually want and the fish need. It is important to manage and promote planktonic algae to build good fish populations because they provide food and oxygen for fish.

Clear water is not good if pond owners desire a good fishery. Clear water is the equivalent of a disked, fallow field with little vegetation. Just like many cattle can't be raised well on a fallow field, fish can't thrive in clear water.

Now imagine a lush ryegrass field 12 inches tall. A lot more cattle can exist in this field because it has the food they need. The same is true with green water—many more fish can survive because it contains the food they need.

Quick Facts:

The quickest way to treat algae in ponds is with copper based algaecides such as chelated copper complexes or copper sulfate. However, integrated management practices are the most effective way to manage algae in ponds and prevent it from quickly returning after an algaecide treatment. A combination of the following typically produces more effective, long term algae control: aeration; creating a 10- to 20-foot buffer zone around the pond with taller vegetation to filter excess nutrients; decreasing the amount of fertilizer used on lawns and forage fields near the pond; preventing livestock from defecating in or near the pond; locating septic fields far away from ponds; deepening the edges to a slope of 2:1 decline; or a chemical treatment followed by a fertilization program for the good planktonic algae in the pond.

In order to properly manage planktonic algae, provide nutrients the same as one would for the grass used for cattle forage. Strive to maintain hardness and alkalinity above 30 ppm, which means agricultural limestone (ag lime) may need to be added to the pond every 3 to 7 years.

Pond owners might also want to fertilize their bloom, (similar to grass) but with very different nutrients. Nitrogen (N) is the most limiting nutrient for most land-based crops. However, nitrogen is fairly prevalent in water because it diffuses into water from the nitrogen found in the atmosphere.

Phosphorous is the limiting nutrient in water, since phosphorous precipitates in water and becomes locked in the pond sediments where planktonic algae cannot reach it.

In order to support the most fish possible, a pond should be somewhat green in color (above) and have visibility that allows a white (Secchi) disk to be seen between 18" and 24" deep. A good fertilization program will help to maintain the algal bloom. Clear water can actually be detrimental to a management goal that includes good fishing.

For new ponds, it is important to start fertilizing shortly after the pond begins to fill. This practice will promote the growth of planktonic algae and limit the growth of nuisance rooted vegetation. Existing ponds also benefit from fertilization, but there is a caveat.

Do not fertilize a pond if rooted aquatic vegetation is present or if the pond has extensive areas less than 30 inches deep. Fertilizing when rooted vegetation is present results in as much as four times the amount of rooted vegetation because they will utilize the nutrients before an algal bloom can become established.

Treating ponds with large areas less than 30 inches deep promotes the growth of unwanted rooted vegetation. Instead, first treat existing aquatic vegetation with an aquatically approved herbicide for the species present, and then fertilize.

See the AquaPlant website (*http://aquaplant.tamu.edu/*) for help with identification and management of aquatic vegetation or the Texas A&M AgriLife Extension publication Treatment Response of Aquatic Plants (*http://aquaplant.tamu.edu/download-tables-1-and-2/*) for help with picking the correct aquatic herbicide.

Generally, most recreational ponds receive the most benefit from two fertilizations per year when the management goal is to increase fish density. However, more frequent fertilizations may be required when the management goal is to prevent the establishment of rooted aquatic vegetation.

The first fertilization should be done in the spring when the water temperatures are between 55 and 65ºF, before rooted vegetation begins to recover from the winter and start growing. The second fertilization should occur in late spring to mid-summer as needed; i.e., as determined by the state and concentration of the algal bloom.

Oftentimes, ponds require the addition of 5 to 8 pounds of phosphorous per acre at the spring application while the summer fertilization is made at half to the full rate of the spring fertilization. It takes the addition of 6 pounds of phosphorous per acre to establish a good bloom during the spring fertilization.

Three to 6 pounds of phosphorous per acre is typically adequate for the summer fertilization. Seek fertilizers high in phosphorous content such as ammoniated polyphosphate (9-32-0), polyphosphate (11-37-0), orthophosphate (13-38-0) in liquid forms, diammonium phosphate (18-46-0), or triple super phosphate together with ammonium nitrate (0-46-0 + 34-0-0) in granular forms.

An alternative to the inorganic fertilizers (those that come in granular, powdered, or liquid forms) is to add an organic fertilizer. The aquaculture industry has been using cottonseed meal as an organic fertilizer in fish fry ponds for decades.

For most farm ponds, 150 to 250 pounds of cottonseed meal spread around the edge of the pond is sufficient to produce a good algal bloom. Organic fertilizers produce blooms more slowly because they release nutrients slowly over time as they decompose.

Remember, the right amount of fertilization is good, but a little extra can be very bad. Too much fertilization can lead to very dense blooms, which consume large amounts of oxygen through respiration during the night when photosynthesis is not occurring.

This can lead to early morning fish kills caused by low dissolved oxygen concentrations. Whether they cause a fish kill or not, extremely dense blooms will eventually die-off due to nutrient limitations, and sometimes collapse during massive algae die-offs. Massive algal bloom collapse can also lead to fish kills caused by low dissolved oxygen concentrations.

Sometimes planktonic algae can become a problem (above) on their own or after over-fertilization and may need to be treated with an algaecide. In these instances, treat no more that 20 to 25 percent of the pond at a time with 7 to 10 days between treatments, or a fish kill could occur due to low dissolved oxygen.

So how does one know if fertilizer should be used, if more fertilizer is necessary, or if too much has been added?

Bloom densities indicate if a pond owner needs to fertilize, and they are simple to determine. First, drill a hole in the center of a pie pan or gallon paint can lid. Then, paint the entire pie pan or gallon paint can lid white. Next, pass a close-fitting bolt (adds weight) through the hole and secure on the backside with a washer and nut. Finally, tie a string to the head of the bolt.

The above steps create a scientific instrument called a Secchi disk. How to work a Secchi disk: lower it slowly into the water until the edges of the white disk can't be seen. Then, slowly raise the disk until the edges of the disk can be made out again. Grab and hold the string at the water line, and raise the disk out of the water while keeping the hand on the string in place. Finally, measure the length of string from where the water line was to the disk—this is the Secchi depth.

The Secchi depth measures water clarity. If the Secchi depth is greater than 24 inches, then fertilizing is necessary. If the Secchi depth is between 18 and 24 inches, a good planktonic algae bloom is present and no action is required at that time.

If the Secchi depth is between 12 and 18 inches, the pond is over-fertilized (some ponds naturally have readings in this range without fertilization).

Cease all fertilization of the pond, and check the Secchi depth every few days to make sure the bloom is not becoming a critical mass.

If the Secchi depth is less than 18 inches, emergency aeration might be need to prevent a fish kill. When in doubt, go slow. Add some fertilizer and wait 6 to 7 days (7 to 10 days for organic fertilizers) before taking the next Secchi depth reading. Fertilizer can always be added, but it cannot be removed.

Filamentous algae, often referred to as "pond scum" or "pond moss," are the most common type of algae that people want to eliminate from their pond. Filamentous algae interfere with recreational activities such as swimming and fishing, and are aesthetically unpleasing.
Photo courtesy of AquaPlant, aquaplant.tamu.edu

FILAMENTOUS ALGAE (THE BAD AND THE UGLY)

Filamentous algae are made of single cells that form long visible chains, threads, and filaments that intertwine to resemble wet cotton or wool. This type of algae grows along the bottom of the pond in shallow areas (as deep as sunlight penetrates) and then floats to the surface to form bubbly looking mats that can sometimes cover entire ponds.

Filamentous algae are frequently referred to as "pond scum" or "pond moss." Filamentous algae are the most common type of algae that people want to eliminate. Filamentous algae are unsightly and may interfere with swimming, fishing, or other recreational activities, and in rare instances even livestock watering.

In the late spring or early summer, fisheries managers and Extension specialists receive frequent calls in which a pond owner states they just started having an filamentous algae problem because they started to see mats of floating filamentous algae.

Filamentous algae are typically bright green, cover pond bottoms to the depth of light penetration, and are found in ponds *throughout* the year. The yellow-green floating mats seen in summer are due to an intense growth cycle caused by warming water temperatures and increasing day length. The mats float because oxygen and other gases become trapped within the filaments.

This is not an entirely correct assumption. It may have just recently started being an aesthetic or recreational problem, but they had a filamentous algae problem long before they started to see floating mats form on the surface.

What pond owners or managers see in late spring or early summer when mats start to form is actually an intense growth cycle of the filamentous algae that were already present in the pond, caused by warming water temperatures and increasing day length.

The reason they float is the bubbly appearance that the mats often have. Those bubbles are actually oxygen expelled through photosynthesis and gas produced by decomposition of organic material from the pond bottom.

These gasses become trapped in the filaments and accumulate, causing the algae to float upwards from the pond bottom like a balloon underwater. An empty balloon will remain on the bottom, but as soon as it fills with gas (oxygen), it floats to the surface.

If the mats of filamentous algae are carefully examined during the summer, the tops appear yellowish-green or washed-out green. This is because the top of the mats are predominately composed of stressed or dying cells.

This is a side effect from floating to the surface. Exposure to surface air can lead to drying of the cells. Furthermore, increased exposure to direct sunlight cause the exposed cells to become stressed and decrease chlorophyll production.

However, the filaments remain afloat because the living cells below them continue to produce oxygen.

During late winter or early spring, the filamentous algae will appear much different. Looking down into clear water in the early spring, filamentous algae can be seen creating a thick carpet over the pond bottom and even over rooted vegetation.

This is when the filamentous algae problem began. Controlling it at this point can save a pond owner from the floating mats during the summer.

There are many species of filamentous algae. Some common genera can be distinguished by texture. *Cladophora* feels like wet cotton. *Spirogyra* is bright green and slimy feelings. *Pithophera* has a coarse texture feels like a wet horse's mane or fine steel wool.
Photos courtesy of AquaPlant, aquaplant.tamu.edu

Aside from aesthetic issues, filamentous algae can also be dangerous for fish. Filamentous algae do produce oxygen during the day through photosynthesis.

However, they consume oxygen at night through respiration, when photosynthesis is not occurring. Allowing filamentous algae to accumulate in a pond may lead to early morning fish kills caused by low dissolved oxygen concentrations.

MACROALGAE (THE WEIRD)

If a pond owner finds a submerged aquatic plant that smells like a skunk or garlic, or feels like it is covered in sand-like grit, they have most likely discovered a macroalgae. Although they may look like it, these are not true vascular or rooted plants.

They are a form of multicellular algae called macroalgae that come together to form a structure. Macroalgae have no roots, stems, or true leaves. They are primitive and do not have flowers, fruits, or seeds, but instead produce spores.

The two main kinds of macroalgae found in Texas belong to the genera *Chara* or *Nitella*. Species from both genera can be undesirable as a result of their tendency to grow quickly, carpet the bottom of the pond, and crowd out other aquatic plants.

Macroalgae look similar and are often confused with normal rooted pond vegetation, but are in fact a form of multicellular algae.

Chara, also known as skunkgrass or muskgrass, are gray-green, multicellular macroalgae with whorled branches (somewhat appearing as leaves). They do not extend above the surface of the water and many people mistake them for a typical rooted aquatic plant, but *Chara* can be distinguished from rooted aquatic plants by their lack of roots or flowers.

Chara prefer alkaline, hard water ponds high in calcium and pH. *Chara* grow in rows along muddy bottoms in calm waters.

They have a “grainy” or “crunchy” texture and a musty odor similar to a skunk or garlic. The grainy sand-like texture is present because *Chara* are covered in calcium carbonate deposits, which is the chemical name for limestone.

Chara are highly effective at utilizing bicarbonate as a carbon source during photosynthesis for sugar production, and forms calcium carbonate as a byproduct. *Chara* prefer alkaline, hard water ponds high in calcium and pH. *Chara* grow in rows along muddy bottoms in calm waters.

Nitella are sometimes referred to by the common name stonewort, but are never encrusted with calcium carbonate like *Chara*.
Photo courtesy of AquaPlant, aquaplant.tamu.edu/

Nitella are light to dark green in color with forked, bushy branches. Like *Chara*, they are branched, lack flowers, do not extend above the water surface, and grow in rows attached to muddy bottoms of calm waters. Unlike *Chara, Nitella* prefer low hardness (soft) waters that are more acidic.

Nitella have no odor and are soft to the touch. Unfortunately, *Nitella* are sometimes referred to by the common name stonewort. This is a misnomer as *Nitella* are never encrusted in calcium carbonate like *Chara*, which is where the common name stonewort originated.

CONTROLLING NUISANCE ALGAE

If a pond suffers from algal overgrowth problems, there are several possible approaches to controlling algae. Such methods include biological, physical and chemical controls; each of which has its own benefits and disadvantages.

Mozambique tilapia will consume some filamentous algae and macroalgae such as *Nitella*, but typically provide limited—if any—contro,l and begin to die-off at temperatures below 55ºF.

BIOLOGICAL CONTROLS

Biological controls involve introducing species that prey on algae. Because there is no practical way to increase the populations of organisms that feed on planktonic algae, biological controls only work on filamentous algae and macroalgae. Mozambique tilapia and triploid grass carp both only eat *certain types* of algae.

Mozambique tilapia will consume some filamentous algae and macroalgae such as *Nitella*, but typically provide limited—if any—control. Also, as a tropical to subtropical species, Mozambique tilapia cannot survive prolonged periods in water temperatures less than 55ºF. In all but far South Texas, they must be restocked each spring when water temperatures are consistently above 60º F. Mozambique tilapia is the only tilapia species that may be legally purchased in Texas for pond stocking.

Although triploid grass carp will consume filamentous algae when no other option exists, they prefer to eat other types of available submerged vegetation first, and thus are not a reliable control for filamentous algae.

On the other hand, triploid grass carp will readily consume macroalgae such as *Chara* and *Nitella*. Triploid grass carp are the only form of grass carp legal in Texas, and the Texas Parks and Wildlife Department requires a permit before purchasing them from a certified dealer.

Triploid grass carp will readily consume macroalgae such as *Chara* and *Nitella*, but will not provide adequate or reliable control for filamentous algae.
Photo courtesy AquaPlant, aquaplant.tamu.edu

For more information on grass carp in Texas, please call visit the Texas Parks and Wildlife Department at 512-389-4444 or visit *http://www.tpwd.state.tx.us/publications/fishboat/forms/* to fill out a permit application.

PHYSICAL CONTROLS

Physical control such as raking or seining is another option for filamentous or macroalgae, but it is not a viable approach for planktonic algae due to their microscopic nature. Physical management uses a rake, seine, wire screen, or other similar device, to pull or cut the algae and remove it from the pond.

Methods like this are generally laborious and short-lived as the algae will recolonize very quickly afterward. Many companies make cutters and rakes that can be used to remove algal material from ponds.

Another method of physical control involves non-toxic dyes and colorants to shade the pond and to limit the sunlight penetration on which algal growth is dependent. Dyes and shading products are made by many companies and available in a variety of colors ranging from red to black, although blue is the most common.

However, this kind of control method may suppress the natural food chain of the pond by reducing the planktonic algae that acts as the basis of the ecosystem. Shading the bottom of the pond can also be achieved by using physical barriers such as shade mats to prevent sunlight penetration.

CHEMICAL CONTROLS (ALGAECIDES)

Before discussing the chemical controls that work best for algae, the regulation of herbicides and pesticides must be addressed. Each state has its own agency or agencies that regulate the purchase, use, and application of pesticides/herbicides. Please consult with the appropriate state agency before attempting to purchase or apply aquatic herbicides or algaecides.

Under the Texas Center for Environmental Quality (*http://www.tceq.texas.gov/permitting/wastewater/general/pestgpair*) Pesticides General Permit TX870000, a level III operator is a private party applying general use pesticides to less than 1 acre of waters of the U.S. where there is public or private access. Level III operators are not required to fill out any form to obtain coverage under Pesticides General Permit TXG870000.

A level II operator is below the annual threshold (100 acres in water or 200 miles at the water's edge) and is a private party applying general use pesticides to 1 acre or more of waters of the U.S. where there is private access. Level II Operators are required to fill out and keep onsite a Self Certification Form (*http://www.tceq.texas.gov/assets/public/permitting/waterquality/forms/20605.pdf*) to obtain coverage under Pesticides General Permit TXG870000.

Currently, all algaecides discussed in this publication are listed as general use pesticides by the Texas Department of Agriculture. This means the general public in Texas may purchase and use these algaecides on an individual's property without a state pesticide applicator license.

The most effective and commonly utilized chemical controls for algae are algaecides containing copper such as copper sulfate or chelated copper complexes. Copper sulfate and chelated copper complexes have demonstrated excellent control (90 percent or greater) of all three types of algae when applied correctly at labelled rates. Copper sulfate and chelated copper complexes are contact herbicides that act as cell toxicants, and only kill algal cells that the copper contacts directly.

Therefore, they must be sprayed or broadcasted over the entire area where algae are growing to provide adequate control. In most cases, an aqueous form of copper is recommended because it is less complicated and easier to apply correctly. Effects of copper on algae can be observed in 3 to 10 days with the full effects of the treatment demonstrated in 4 to 6 weeks.

Copper sulfate is generally sold labelled as such, but may be sold under various trade names that do not immediately indicate the product is copper sulfate. Although granular forms such as crystalline copper sulfate may be cheaper, they require more effort because they must be dissolved in water prior to application by sprayer. Copper sulfate only works as long as the copper remains in the water column where it can come into contact with the algae. Crystals or pellets that are broadcast into a pond undissolved immediately sink to the bottom, where they provide much less control over algae.

Copper sulfate is not effective in hard or high alkalinity waters because it binds with the calcium in the water, forms a precipitate that drops out of the water column, and renders the copper ineffective as an algaecide. Extreme temperatures also affect the performance of copper sulfate.

It does not work well in cold water and should be applied at temperatures greater than 60°F to achieve the desired results. Copper sulfate's toxicity to fish increases with higher water temperatures, and it should not be applied during hot summer conditions.

Chelated copper complexes are more commonly sold under trade names such as Cutrine Plus, Nautique, Komeen, etc., than as copper sulfate. Chelated copper complexes are typically available in aqueous forms to be sprayed over or injected under the pond surface where algae control is desired.

Chelated copper can be used as an alternative to copper sulfate in many cases because unlike copper sulfate, chelated copper complexes precipitate at a much slower rate and are still potent in high alkalinity waters. They are also more effective in waters with colder temperatures. Chelated copper stays in solution and remains active for longer because it releases the copper ion more gradually than copper sulfate.

Although chemical controls may seem more desirable due to their convenience and effectiveness, there are many factors that must be carefully considered before using chemical controls.

Fortunately, at the time of this writing, copper sulfate and chelated copper complexes have no use restrictions and are safe for use to drink, swim, consume fish, water livestock and irrigate turf or crops. However, it is a good idea to consult the label each time after purchasing copper sulfate, chelated copper complexes, or any other herbicide, as labels can change over time.

Copper concentrations should be limited to 1 ppm or less, no matter the water chemistry, in order to safeguard fish. Therefore, it is necessary that an accurate determination be made of the water volume that will be treated to ensure the concentration remains at a safe level.

All copper compounds can be toxic to fish if they are used above the labeled rates. Be sure to test the pond water's alkalinity and adjust copper treatments to alkalinity concentrations. Be very cautious when treating a pond with an alkalinity of less than 50 ppm, as copper can be toxic to fish.

Never treat ponds with an alkalinity less than 20 ppm. Most importantly, follow all label instructions when applying chemical controls. Aquatic herbicides are not toxic to fish when properly applied according to the label. If the pond water's alkalinity is unknown and a pond owner wants to have it tested, submit the appropriate water testing forms (*http://soiltesting.tamu.edu/webpages/forms.html*) and the sample to Texas A&M Soil, Water, and Forage Testing Laboratory (*http://soiltesting.tamu.edu/*).

Aside from algaecides containing copper, there are a few other herbicides options that provide good control (75 to 89 percent) of one or more types of algae. Diquat, flumioxazin, sodium carbonate peroxyhydrate (best on blue-green algae) and endothall [*only* mono(N,N-dimethylalkylamine) salt of endothall formulations], provide good control of **filamentous algae**.

Sodium carbonate peroxyhydrate (best on blue-green algae) and endothall [*only* mono(N,N-dimethylalkylamine) salt of endothall formulations], provide good control of **planktonic algae**, while only endothall [*only* mono(N,N-dimethylalkylamine) salt of endothall formulations] provide good control of **macroalgae**.

Because these herbicides only provide good, not excellent, control of algae, they are often used in combination with low concentrations of chelated copper complexes. This practice often results in a synergistic effect and the two herbicides combined provide much improved algal control than either herbicide alone.

Diquat and endothall are two herbicides often mixed with copper compounds to enhance control of target species, including algae. Before attempting this control method, study the specimen label, literature, chemistry, and legality of mixing various herbicides. States have various restrictions and consultation with state management agency is encouraged.

Chemical control options provided here are for **private waters only**. Treatment of flowing or publically owned waters requires permits that must be obtained from the state or federal regulatory agency tasked with managing the specific body of water.

For Texas, these permits can be obtained from the Texas Parks and Wildlife Department by calling 512-389-4444 or visiting *http://www.tpwd.state.tx.us/publications/pwdforms/media/pwd_1029_t3200_exotic_species_app_aquatic_vegetation_removal.pdf* and submitting the permit application. Some waters in Texas are managed by the United States Army Corps of Engineers (USACoE). The USACoE Fort Worth District Regulatory and Permitting Office can be reached at 817-886-1731, and the USACoE Galveston District Regulatory and Permitting Office at 409-766-3982.

All copper compounds can be toxic to fish if they are used above the labeled rates. Be sure to test the pond water's alkalinity and adjust copper treatments to alkalinity concentrations.

Deepening the edges of a pond to a slope of 2:1 decline lessens the amount of shallow areas penetrated by sunlight and limits algal growth. This practice will not totally prevent algal growth, but as seen in the photo above, will help to limit growth to roughly 4 feet from the pond edge.

ALGAE PREVENTION

Prevention is usually easier and more practical than treatment. The most essential part of preventing algal growth is reducing the amount of nutrients that enter the pond. Possible methods include creating a 10- to 20-foot buffer zone around the pond with taller vegetation to filter excess nutrients, decreasing the amount of fertilizer used near the pond, preventing livestock from defecating in or near the pond, and locating septic fields far away from ponds. These methods can help keep excess nutrients from washing into the pond.

Deepening the edges of an existing pond or building a pond with incline of 2:1 also helps control algal growth. A 2:1 slope lessens the amount of shallow areas penetrated by sunlight and limits algal growth to an area roughly 4 feet from the pond edge.

A 2:1 slope is steep enough to lessen the amount of shallow areas penetrated by sunlight while still lengthening the amount of bank enough to allow fertilizers and other chemicals suspended in runoff to settle out and be absorbed into the ground instead of washing directly into the pond. A 3:1 slope is steep enough to limit algal growth to an area roughly 6 feet from the pond edge.

Another preventative option is to aerate the pond. Aerating the pond with a bottom diffuser injects more oxygen into the water at the bottom of the pond, which in turn increases the number of aerobic bacteria.

These bacteria feed on organic matter such as decomposing plants and reduce the amount of excess nutrients released into the water. Aeration also helps prevent fish kills, which occur when a buildup of deoxygenated water at the bottom of the pond mixes suddenly with the upper layers of water and suffocates the fish.

For more information on algae and other aquatic vegetation management, visit the AquaPlant website at *http://aquaplant.tamu.edu/*, the Texas A&M AgriLife Extension Aquaculture, Fisheries, and Pond Management website at *http://fisheries.tamu.edu/*, or download aquatic vegetation management apps.