



Aquatics **in** Brief

Volume 12, Issue 2

Inside:

Page 2

**Invasive Plant Highlight:
Water Chestnut**

Page 3

**Case Study: Volumetric
Approach to Managing
Giant Salvinia Proves
Successful**

Page 4

**Mischievous Mammals:
Are Muskrats, Beavers
and Otters Harmful to
Lakes and Ponds?**

Big Fish Photo Contest

Page 5

New SOLs

Page 6

**Managing a Fishery
to Avoid Excess
Phosphorus Levels**

Page 7

**Before and After
Showcase**

Volunteer Spotlight

Check Us Out...



Breaking Through the Thermocline

The natural occurrence of fish kills and how to prevent them

By **Cory Smith, Aquatic Specialist & Regional Leader**

The long, warm days of summer provide the perfect backdrop for swimming, boating and fishing, but the last thing you want to encounter at your lake or pond is a summer fish kill. Fish kills are often a natural occurrence that can happen any time of year. However, they are especially common in the summer. As the weather changes, the surface and bottom of the waterbody form distinct layers containing different dissolved oxygen levels and temperatures.

This natural transitional area is known as the thermocline. What's so interesting about this liminal layer? The depth at which the thermocline occurs oftentimes helps determine what percentage of the aquatic resource serves as a healthy and ideal environment for fish. While the warmer water at the top of the waterbody remains oxygenated, the deeper, denser water does not interact with the atmosphere and can become devoid of oxygen.



Though a thermocline, in certain instances, can limit the productivity and overall health of a fishery, it does not directly cause fish kills. Fish kills often occur when the layers at the surface and bottom of the waterbody mix suddenly, eliminating this transitional layer.
Continued on page 2



*A Full Service Lake, Pond,
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Breaking Through the Thermocline *Continued from front cover*



Normally triggered by a significant change in the weather, or after a heavy rainstorm, this mixing can create insufficient concentrations of dissolved oxygen, killing fish in the process.

To help prevent a thermocline, and the possibility of a fish kill, the best strategy is always proactive management. Gaining an in-depth look at dissolved oxygen levels in your lake or pond's water column through consistent monitoring is the first step. Your lake management professional can routinely monitor your thermocline through water quality testing. It's also important to be observant. In low-oxygen environments, fish will often gather at inflow areas as well as near the surface of the water where oxygen is most saturated. If these signs are recognized early on, it is possible to take steps that may prevent an imminent fish kill.

The next step involves the installation of a bottom diffused aeration system. Properly sized and placed diffused aeration systems can help prevent thermoclines by encouraging water circulation. These systems release air bubbles that rise and oxygenate the existing thermocline. It's not

the actual bubbles, but their movement through the water column and to the surface, that circulates oxygen and helps improve the productivity of the entire waterbody. And while the introduction of a lake or pond aeration system doesn't completely eliminate the possibility of a fish kill, it certainly increases your chances of avoiding one.

Aeration systems provide other benefits as well. They can help impede the growth of algae by moving water and creating a non-stagnant environment. Increased oxygen levels at the bottom of a waterbody also help improve decomposition of organic material. The positive effects of aeration can be reinforced when paired with other proactive strategies, including the cultivation of a beneficial vegetative buffer, the application of nutrient-binding products or beneficial bacteria to limit the impact of excess nutrients, and the initiation of a water quality testing program to analyze trends and changes in the chemical makeup of the aquatic ecosystem. By taking steps to monitor water quality, dissolved oxygen levels and the thermocline, you can help support the health of your waterbody, and the species that call it home, all year round. ■

Invasive Plant Highlight: Water Chestnut

Water chestnut has invaded waterways from Canada to Virginia along the East Coast since its introduction in the 1870s. Water chestnut can be identified by its triangular serrated floating leaves arranged in a rosette pattern, radiating from a central stalk. The stalk is rooted to the bottom substrate and covered in feathery submersed leaves. These particular plants grow in extremely tight proximity to one another, crowding out desirable native plant species, negatively impacting the aquatic ecosystem and making it difficult to utilize waterbodies for boating and swimming. Preventative lake management tactics are recommended to help avoid water chestnut infestations as each rosette can produce up to twenty spiked nutlets which allow populations to explode in a few short seasons. There are, however, management options available for



helping control water chestnut. When the infestation is limited, it is possible to control it through hand pulling efforts. Larger infestation can be controlled via mechanical harvesting, ideally performed prior to nutlet formation and maturation to limit spread. However, if the growth is too extensive or access to the waterbody is limited, a herbicide treatment program performed by an aquatic management professional may be the preferred management approach. ■



Before



After

Case Study: Volumetric Approach to Managing Giant Salvinia Proves Successful

By **Paul Dorsett, Fisheries Biologist, and Keith Gazaille, Director of Lake Management – North and Mid-Atlantic**

Flag Lake is a 664-acre lake located on Barksdale Airforce Base near Bossier City, Louisiana. The lake is relatively shallow, averaging less than four feet deep, and serves as a valuable resource to the base and the surrounding communities by providing excellent fish and wildlife habitat, as well as important recreational opportunities in the form of fishing, waterfowl hunting and wildlife viewing. Historically, Flag Lake has suffered from the excessive growth of a variety of plant species, but most notably, invasive hydrilla (*Hydrilla verticillata*), American lotus (*Nelumbo lutea*) and water hyacinth (*Eichhornia crassipes*). In recent years, however, giant salvinia (*Salvinia molesta*) has dominated the plant assemblage, reaching problematic conditions in 2017 with an estimated 500 acres of water covered in this invasive aquatic plant. To combat this invasive species, SOLitude employed a volumetric management approach that was fairly experimental for an infestation of this magnitude.

Giant salvinia is considered to be one of the most invasive exotic plants threatening reservoirs and other waterbodies in the southern U.S. Salvinia is capable of spreading rapidly, often doubling its biomass in only a matter of days. If left unmanaged, it not only has the ability to impair ecological balance, but will readily spread to other waterbodies, as it can be easily transported by heavy downstream water flow and on the trailers of unsuspecting boaters.

Prior to the giant salvinia infestation, SOLitude managed this waterbody using a foliar treatment approach—where herbicide is sprayed directly on the emerged leaves of the target plants. However, with the rapid growth of giant salvinia, the team was fighting a losing battle while using foliar treatments. Because of the growth rate of the giant salvinia and limited long-term plant control being achieved by the foliar herbicide treatments, SOLitude worked closely with SePRO Corporation to design a volumetric treatment program that utilized a systemic aquatic herbicide.

As opposed to the foliar treatments, the volumetric management approach involved treating the entire lake with a properly

concentrated dose of the new herbicide (designed to specifically target the invasive plant species). The volumetric approach eliminated issues of inaccessibility and plant movement associated with foliar treatment. And although this strategy carried a higher upfront cost, it was the only management approach that effectively addressed the long-term reduction of the invasive plants, thus reducing the overall long-term cost.

Before the new management plan began, the water level was lowered to reduce the risk for herbicide loss due to downstream flow. From there, the volumetric management plan involved two applications. The initial application was made in July of 2017 to achieve a lethal dose, after which the herbicide concentration was monitored to ensure that residues were suitable for plant eradication. Sample analysis following the treatment indicated that the herbicide concentration was effectively established and holding well. A “booster” treatment was then added in early September, in response to heavy rainfall from Hurricane Harvey.

Approximately one month after the initial treatment, significant plant discoloration and biomass reduction were easily observable throughout much of the lake. The timing of the booster application in response to the recharge of the lake volume allowed for desirable in-lake herbicide concentrations.

As a result of this extended concentration exposure time, the treatment program provided almost 100% control of water hyacinth and greater than 95% control of giant salvinia.

The high level of plant control achieved by this volumetric treatment program will undoubtedly have benefits through 2018 and significantly improve the potential to sustain vegetative balance in Flag Lake. While preventative measures are the preferred management approach, success of this treatment demonstrates a new and exciting long-term focused management strategy that can be implemented throughout the country in areas where this highly invasive plant has already taken over. ■



Giant salvinia dying off after successful treatment.

Mischievous Mammals: Are Muskrats, Beavers and Otters Harmful to Lakes and Ponds? By Gavin Ferris, Ecologist

As an ecologist, I field questions on topics ranging from the lifespan of a tadpole to the best way to defend koi against the ravages of a great blue heron. Of all the animals I am asked about, however, three mammals probably produce the most concern and curiosity: the muskrat, the beaver, and the otter.

Each of these aquatic animals plays a unique role in the environment, fulfilling a niche that contributes to its ecosystem, and all three animals are frequently found together, thanks largely to the services provided by the beaver. Beavers are perhaps the world's first engineers, modifying their environment to suit their needs. Relying on deep water for safety, beavers have an innate drive to dam up moving water. When they see a stream, they want it to be a pond. As a result, they often create habitat for other aquatic wildlife, including fish, amphibians, waterfowl and, of course, muskrats and otters. In the wild, this makes them hugely beneficial as they provide so much habitat. In a man-made waterbody, however, where the water needs to be kept at its intended level, they can be extremely destructive. Also, their proclivity for felling trees both for timber and food can wreak havoc on expensive



Muskrat



Beaver activity

landscaping.

Muskrats, like most small rodents, serve as important prey for many predators, including mink, eagles, hawks and owls. They feed primarily on vegetation, though they do occasionally eat some shellfish, especially in the winter. In addition to ponds, muskrats will colonize any marsh, stream or river where adequate food can be found. Unfortunately, their burrows can cause tremendous damage to the shoreline. For some reason, they also like to chew through wiring, including the power cables of lake and pond fountains.

Otters are the only true predator of the trio, feeding primarily on fish but also settling for any other small animal they can catch in or near the water. Members of the weasel family, they are renowned for being playful and gregarious, and can be observed sliding on their bellies as if they were sledding. Otters are frequently found in and around ponds created by

beavers, and have been known to kick beavers out of their lodge and take it as their own home. Unlike beavers and muskrats, otters are unlikely to cause structural damage to a pond or stormwater basin. The main issue they pose, however, is fish predation. Otters, like human anglers, like to catch the biggest and tastiest fish. If you

value your sportfish, you should look for ways to limit the otter population in your waterbody.

For muskrats and beavers, prevention is far better than removal. Controlling shoreline vegetation like cattails and black willow seedlings will discourage muskrats, and removing woody vegetation from near the water will help to keep beavers from setting down roots. Otters, however, are not so easily discouraged. In the instance that any of these animals takes up permanent residence where they are not welcome, trapping or lethal control may be your only recourse. The options available for controlling muskrat, beaver or otter populations will vary based on the laws in your state and the individual situation. It's recommended to consult with your community and your lake management professional to determine the best management plan for these incredible creatures. ■

BIG FISH PHOTO CONTEST

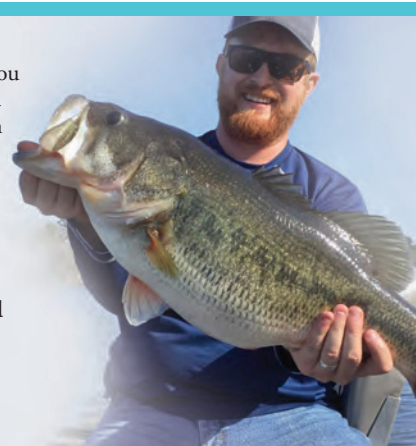
Do you have the BEST big fish photo?

PROVE IT! We're looking for your best freshwater fish photo. Have you had a catch approach a state record? Have you captured an action shot of a friend reeling in a lunker at the perfect moment? Have you taken a big fish photo with a beautiful backdrop? We want to see it all – and to find out what YOU think is your BEST big fish photo.

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FINALIST PHOTOS WILL BE CHOSEN BY SOLITUDE AND POSTED TO FACEBOOK FOR PUBLIC VOTING.

New SOLs

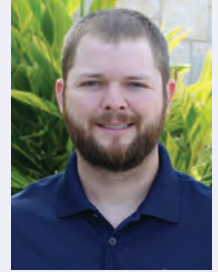
In each issue, team members from SOLitude are highlighted. It is our pleasure to introduce you to the incredibly talented members of our team and give you insight into the vast array of knowledge and experience they offer.

Bobby Rae Allen
Environmental Scientist
Fairfax, Virginia



Bobby Rae navigates both the private and public sectors of watershed management and is focused on creating sustainable solutions to preserve native plant species. Bobby Rae graduated from Longwood University in Farmville, VA, with a bachelor's degree in Integrated Environmental Sciences.

Chase Brown
Aquatic Biologist
Newport News, Virginia



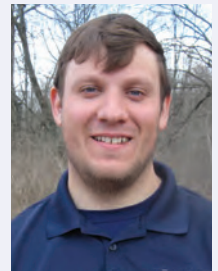
Chase has extensive experience identifying and managing nuisance and invasive plant species. He has a special interest in analyzing fisheries data to cultivate trophy bass, and managed fisheries for private clients for several years in Texas before moving back to Virginia. Chase has a Bachelor of Science degree in Biology from Bridgewater College in Bridgewater, VA.

Matthew Haupt
Aquatic Biologist
Shrewsbury, Massachusetts



Matthew is experienced in the treatment of nuisance aquatic vegetation using sustainable solutions and has a special interest in the design and implementation of integrated lake and pond management programs. Matthew graduated from the University of New Hampshire with a Bachelor of Science degree in Biology.

Chris Chick
Aquatic Biologist
Washington, New Jersey



Chris specializes in water quality sampling and analysis, and has extensive experience performing dissolved oxygen profiles in reservoirs and large waterbodies throughout the state. Chris has a degree in Environmental Studies from Stockton University in Galloway Township, NJ.

Trent Batson
Aquatic Specialist
Georgetown, Delaware



Trent is focused on the proper management of stormwater runoff. He specializes in water quality monitoring and the collection and study of aquatic plant life. Trent also has experience collaborating with the DNREC to analyze and record potential environmental issues. Trent earned his bachelor's degree in Environmental Studies from Virginia Wesleyan University in Virginia Beach, VA.

Ben Green
Service and Procurement Administrator
Virginia Beach, Virginia



Ben assists the SOLitude field teams and purchasing department through operational support and plays an integral role in the overall efficiency and success of the company. Ben received his bachelor's degree in Business Administration with a concentration in Finance from James Madison University in Harrisonburg, VA.

Karen Miller-Warwick
Regional Administrator
Tyler, Texas



Karen is a client relations professional with nearly 30 years of administrative and customer service experience. Karen has a bachelor's degree in Communications and Public Relations, as well as a Master's degree in Marketing Communications from Texas Tech University where her thesis was "Establishing a Customer for Life."

Regina Brimmer
Regional Administrator
Charlottesville, Virginia



Regina works closely with SOLitude's fisheries team to support property owners and trophy fishing enthusiasts. Regina serves as one of the first points of contact for clients, and also supports company leadership and staff. Regina studied Marketing and Human Resources Management at Virginia Tech.

Managing a Fishery to Avoid Excess Phosphorus Levels

By **Dave Beasley, Fisheries Biologist and Director of Fisheries**

As you may know, phosphorus is a nutrient that helps fuel the growth of aquatic plants and algae. The amount of phosphorus that waterbody owners and managers want or tolerate will vary significantly depending on goals. For example, a community manager seeking clear water with minimal aquatic growth in their stormwater pond will have a much lower tolerance for phosphorus than a private landowner whose goal is to produce trophy bass or attract waterfowl. Depending on these goals, along with your budget and the characteristics of your waterbody, the maximum amount of phosphorus that is considered desirable or acceptable will vary.

From a fisheries perspective, phosphorus is important, since it plays a leading role in how productive a waterbody can become (productivity refers to the movement of energy up the food chain, starting with microscopic algae species and ending with predator fish). And although phosphorus is critical to the productivity and success of a fishery, it can also be detrimental if levels become excessive. Too much phosphorus can contribute to overabundant aquatic plant and algae production, which typically leads to poor water quality, loss of habitat and unhealthy fish.

Another negative and more serious impact of excessive phosphorus is the increased odds of promoting cyanobacteria blooms. Cyanobacteria, commonly called blue-green algae, thrive in phosphorus-rich environments. Not only are blue-green algae blooms unsightly, but they can also pose a serious threat to the health of humans, pets and wildlife. Additionally, new research suggests that exposure to potentially toxic blue-green algae blooms may be connected to the development of neurological diseases like Alzheimer's, Parkinson's and ALS.

Properly managing phosphorus levels and maintaining an optimal level of productivity is an ongoing process that requires



Automatic feeder being loaded with fish feed



Healthy Largemouth Bass

monitoring water chemistry and making routine visual observations. Preventative management strategies may include the installation of a bottom diffused aeration system, maintenance of beneficial in-water vegetation and use of low-phosphorus fish feed. Fisheries management technology is continually improving, and low-phosphorus fish feed is a great example of a new and potentially game-changing product. This new type of feed produces less phosphorus waste than traditional feeds, without compromising fish growth or fish health. With technology of this nature, fisheries biologists are able to more easily reach fish growth goals, while contributing less phosphorus to the waterbody.

One of the primary reasons why phosphorus is challenging to manage is because it naturally accumulates over the years, resulting in elevated levels. When phosphorus levels exceed a desirable threshold, it can become necessary to implement control measures in order to bring levels back into a desirable range. Nutrient mitigation products like Phoslock can be utilized to bind with phosphorus, effectively removing free reactive phosphorus (FRP) from the water column. At times, it may make sense to treat the symptoms of the phosphorus levels using herbicides and algaecides. Knowing

when to mitigate phosphorus and when to only treat the symptoms will depend on management objectives, water quality data and the time of year.

Understanding and managing phosphorus levels is an important, yet oftentimes overlooked aspect of a Fisheries Management Plan. A fisheries biologist can help you understand what your current phosphorus levels are, and then determine where they should be relative to your goals, budget, waterbody and watershed. At that point the appropriate management strategy can be executed, helping create a productive and sustainable fishery that will exceed all expectations. ■

Before and After Showcase

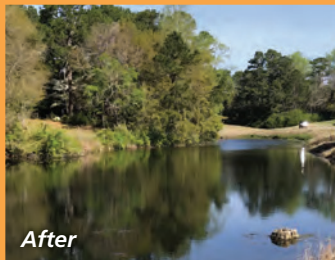
Excellence in Water Quality Treatments



Location: Fort Myers, FL
Surface Area: 1.65 acre retention pond
Primary Target: Water lettuce
Restored By: Jim Dougherty, Regional Leader



Location: Hope, NJ
Surface Area: 0.25 acre community pond
Primary Target: Floating filamentous algae
Restored By: Carl Cummins, Environmental Scientist



Location: Wilmington, NC
Surface Area: 1.15 acre golf course irrigation lake
Primary Target: Lyngbya
Restored By: Nic Butler, Aquatic Specialist



Location: Annapolis, MD
Surface Area: 2.07 acre stormwater pond
Primary Target: Pithophora and lyngbya
Restored By: Wes Allen, Environmental Scientist and Regional Leader

Check Us Out

SOLitude will be participating in the following events over the coming months. Come visit us!

58th Annual Meeting of the Aquatic Plant Management Society

July 15-18
Buffalo, NY

North Carolina Chapter of Community Associations Institute Annual Conference and Expo

July 19-20
Concord, NC

Community Associations Institute Virginia Leadership Retreat

July 26-29
Hot Springs, VA

Austin Chapter of Community Associations Institute Conference and Expo

August 16
Austin, TX

The Special District Association of Colorado Annual Conference (SDA)

September 12-14
Keystone, CO

Rocky Mountain Chapter of Community Associations Institute Mountain Conference & Tradeshow

September 17
Vail, CO

Volunteer Spotlight

Through our corporate volunteering program, The SOLution, we are delighted to share that Alberto Florez, Regional Leader in Southeast Florida, was named Volunteer of the Quarter for the first quarter of 2018. Alberto is passionate about supporting his local community and kicked off the New Year by participating in the Palm Beach County Trash Cleanup, alongside his wife, son and daughter. They helped collect 700 pounds of trash from the Pine Glades Natural Area, a wildlife sanctuary that spans nearly 7,000 acres.

Alberto and his wife also spent time volunteering with the Palm Beach Food Bank,

which partners with 170 companies and organizations and feeds more than 100,000 Palm Beach residents each year.

Alberto also successfully mobilized members of his team, family and friends to join the Palm Beach County Department of Environmental Resources Management for a trash and debris removal at the Juno Dunes Natural Area. Together, they removed 450 pounds of trash from the preserve area, helping to reduce nutrient loading and restore balance to the habitat.

To learn how you can join Alberto and others at SOLitude in making a difference in your local community, visit solitudelake-management.com/volunteer. ■



Alberto (center) and his family helped collect 700 lbs of trash at the Palm Beach County Trash Cleanup



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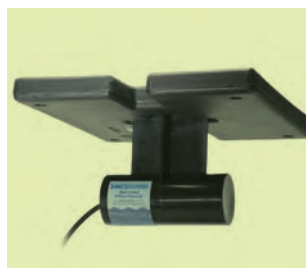


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