Water Column

Spring 2019
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# Summer Fish Kills

*~ Austin Linville*

Fish kills are not a new problem for pond owners and lake resource managers. Large-scale kills can occur at any time during the year for a variety of reasons. This article will focus mostly on summertime fish kills as a result of hypoxia, which is a common occurrence for many temperate lakes. There are many anthropogenic sources that contribute to fish kills, such as organic and inorganic pollution, release of toxic materials, fertilizers, large amounts of organic matter, or excess diversions. Most of these situations can be controlled or restricted with adequate permitting and monitoring water bodies, but localized fish kills can also occur due to a wide array of naturally occurring processes that cause hypoxia.

Lake turnover, the natural phenomenon where the upper oxic (oxygenated from atmosphere and photosynthesis of in-lake plants and algae) water mixes with the lower anoxic water, can also contribute to lowering oxygen levels throughout the whole water column (Figure 1). Many fish populations are able to survive most dissolved oxygen (D.O.) swings between night (only respiration) and day (respiration and photosynthesis) and during turnover events in the spring and fall. However, high water temperatures and low water levels in the summer can exacerbate D.O. swings and result in largescale fish kills.

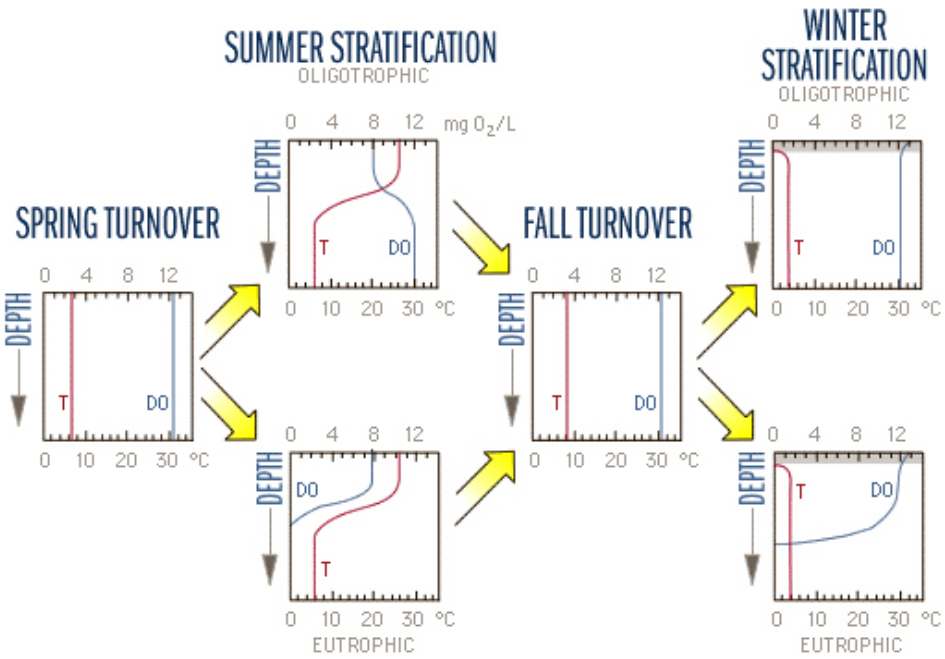


*Figure 1. Thermal stratification and turnover events for oligotrophic (low productivity) and eutrophic (high productivity) lakes in temperate regions.*

Whether caused by natural or anthropogenic inputs, in-lake processes will naturally incorporate those resources and consequences. Eutrophication is a perfect storm of events that occurs when nutrient (primarily phosphorus and nitrogen) levels in the water are high, temperatures are favorable, the water is clear, and sunlight is abundant. Algae in the water column seize the opportunity and begin to rapidly increase their population – i.e., an algal bloom ensues. Dissolved oxygen levels increase in the water as a result of the increased photosynthesis. However, as the weather changes or dissolved nutrients are used up or light is blocked out by the bloom itself – or a combination of these – the algae begins to die and sink. Microbes and bacteria populations thrive in the lake beds as they consume the excess organic matter through aerobic decomposition. If the rate of decomposition is sufficient this process will end up depleting D.O. in the lake, leaving other aerobic species in the lake to suffocate. Eutrophication is widely accepted to be a natural occurrence in some lakes, but many instances of extreme eutrophication are a result of cultural (human-induced) eutrophication. Cultural eutrophication rapidly accelerates this process, causing lakes to visibly change in a decade what might otherwise have taken thousands of years.

Excess nutrients from fertilizers, sewage, and other human activities is the most widespread problem, but weather and climate conditions can also cause hypoxia in water bodies during summer. Today, many areas of Europe are currently experiencing prolonged drought as well as one of the warmest summers of record, which has resulted in rivers running dry and large-scale fish kills becoming more common. Particular areas of Germany's Rhine River have had excessive fish kills that have anglers panicking. High water temperatures and unfavorable cloudy weather conditions have cause populations of coldwater fish, particularly grayling and trout, to decline drastically. Literal tons of dead and dying fish have been removed from German rivers and lakes as anglers and fishery managers race to capture and transfer the remaining coldwater species to adequately cold and oxygenated waters. (See Figure 2.)

This narrative can be found in Switzerland, the UK, and across the world, as accelerated climate change increases the chance of extreme temperatures and unanticipated weather conditions. The rapid decline of affected fish populations can result in the increase in undesirable "trash" fish such as bighead, black, grass, and silver carp, as well as chubs and other generalist species. These species are slightly more resilient and can tolerate lower D.O. levels and quickly changing D.O. levels. The problem occurs after the more desired coldwater fish decline. These "trash" fish are able to utilize empty niche space. This process can wreak havoc on a fishery and cause unrepairable

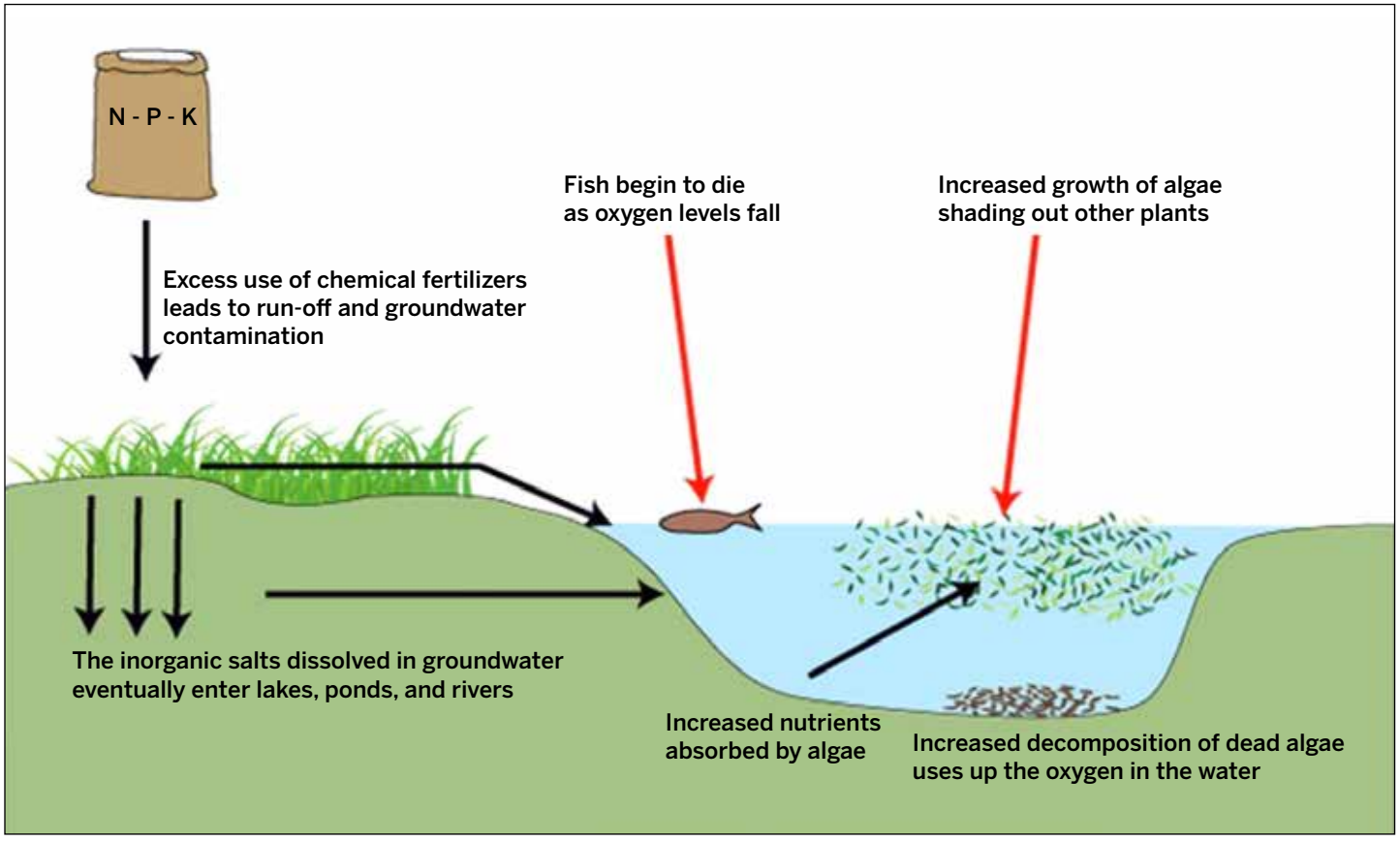


*Figure 2. Depiction of cultural eutrophication.*

damage to the ecosystem settings and natural processes.

So, what can be done to keep oxygen levels at an adequate level? Management techniques should be prescribed on a case-by-case basis and look not only at the lake environment but what's outside the lake. A lake owner or manager must assess the particular environmental components of the lake such as the macrophyte community, the algal populations, turbidity, bathymetry, fish feeding regimes, nutrients levels, the watershed usage, waterfowl usage, designated uses, and the desired goal. For example, a lake that lies in a heavily farmed watershed should focus on reducing fertilizer runoff reaching the lake, therefore, reducing the effect of cultural eutrophication and keeping algal and macrophyte growth in check.

There have been many techniques and tools fashioned to manage lakes. Artificial aeration of lakes has been used to keep the water column temperature and oxygen level ubiquitous and support single-story fisheries. Dyes and shade can also be used to control the photosynthesis rate of lakes and in turn reduce the growth of algae and littoral macrophytes. Mowing or using herbicides/algaecides to regulate primary production can be used but the effort required to treat a symptom rather than the problem directly should be carefully considered. Large-scale herbicide use can kill excessive macrophytes and could in fact fuel eutrophication, resulting in accelerated oxygen depletion in the water column. Furthermore, photosynthesis is a major source of oxygen in lakes during the day and by removing plants from the water column the D.O. levels may plummet. Natural phenomena like lake turnover is an immense event that would take monumental effort to control in large lakes. Biocontrols such as stocking lakes with herbivorous or planktivorous fish can also assist in keeping plant and algal biomass in check. Efforts to reduce incoming pollution is likely the most cost effective approach to reducing anthropogenic influence on a waterbody.

The next time you see struggling fish floating near the surface of a lake, first identify the situation. The local weather, water temperatures, algal population, and a littoral community assessment can assist in diagnosis the source of oxygen depletion. Has the lake had a recent algal bloom? Would we expect runoff to contain excessive nutrients? Has the level of the lake dropped significantly? What types of fish are dying? By answering these questions, one can begin to understand the processes governing hypoxia in the lake, the potential source(s) of the problem, and prescribe a tool to fix it.


## *July is Lakes Appreciation Month! ~ NALMS*

*You work and play on them. You drink from them. But do you really appreciate them? Growing population, development, and invasive species stress your local lakes, ponds, and reservoirs. All life needs water; let's not take it for granted!*

**Help make Lakes Appreciation Month great this year!**

- Get your governor to proclaim July as Lakes Appreciation Month.
- Pursue media coverage for your local Lakes Appreciation events.
- Join the Secchi Dip-In and help track water quality trends in your local lake or reservoir.
- Utilize the fun, kid-friendly BINGO sheet (partnership with Earth Science Laboratories)! A perfect teaching tool that can be used year-round.
- Utilize the media packet for your events, social media, and local marketing.
- Share your stories, events, photos, videos, etc. on social media! Be sure to use the hashtag #LakesAppreciation and tag NALMS! (We love to see your stories and lake photos.) Have you followed NALMS on Facebook and Twitter yet?
- Order your own tee-shirt Color-Ons! Simply color the image, iron it onto a shirt, and wear to events and to your favorite lake to educate your friends and family about Lakes Appreciation Month. Please visit the manufacturer's website to place your order.

## *Secchi Dip In! ~NALMS*

It's officially summer ... and that means it's time to head to your favorite lake or pond! What better way to kick things off than to take part in the annual Secchi Dip-In?!

**YOU'RE INVITED** to celebrate Lakes Appreciation Month in July by participating in the 2019 Secchi Dip-In! This year marks the 26th anniversary of the Dip-In and the 154th anniversary of the first use of the Secchi disk by Father Pietro Angelo Secchi.

**WHAT YOU CAN DO:**

- **ORGANIZE** – Work through your local lake or watershed association or use **SciStarter** to plan a social event. Create and distribute advertisements locally.
- **PREPARE** to take measurements by watching the NALMS student-produced "**How to Take a Secchi Depth**" video.
- **SHARE** your activities on social media! Make sure to use our hashtags - #SDI2019, #LakesAppreciation
- **SUBMIT YOUR DATA** to the Secchi Dip-In Database. There are a few ways you can do this (more info about all of these methods are available online):
  - **Secchi Dip-In Spreadsheet**: The folks at Gold Systems/AWQMS have developed a spreadsheet template that can be downloaded, filled in, and returned to NALMS via email.
  - **Lake Observer App**: You can also participate in the Secchi Dip-In and support lake-monitoring efforts by submitting your data through the Global Lake Ecological Observatory Network's (GLEON) **Lake Observer App**.
  - **Secchi Dip-In Paper Form**: If you prefer the old-fashioned way of entering your data on a paper form, you can **download a copy of the form** and send it to us via email or regular mail
- **FEEDBACK** –Share your thoughts and photos! Email **secchidipin@nalms.org**.

# Volunteer Corner

Hello to all of the Indiana Clean Lake Program Citizen Scientists!

We hope things are going well out there on the lakes! We wanted to include a few notes for this time of the year.

- Please remember to submit your Secchi data online! Please let us know if you need any assistance.
- If you have not already, please send in May and June samples as soon as they are frozen so we can get you your new bottles.
- We have had a few coolers arrive with fairly warm samples. Please confirm the pickup time for Express Mail at your post office to avoid to avoid samples sitting for long periods of time before shipping and ensure samples arrive as cold as possible.
- We would love to see your photos! It's been fun to see people tagging the Indiana Clean Lakes Program on Facebook, but we would also love to see photos/hear stories over email if you are not on social media.

***July is Lake Appreciation Month!!!***

Governor Holcomb has officially declared the month of July as Lake Appreciation Month in the state of Indiana! If you are able, it would be great if you could help us work with the Secchi Dip-In and submit your Secchi data to them as well!

- See further instructions from the North American Lake Management Society here: https://www.nalms.org/secchidipin/
- If you submit your data to the Lake Observer App, it will also make it to the Secchi Dip-In. See their website here: https://www.lakeobserver.org/

Thank you all for your hard work. We hope you had a wonderful 4th of July holiday!

**Have you checked out the Indiana Clean Lakes Program Web page lately? Take a look at www.indiana.edu/~clp/ and see what's new and happening with the program and with Indiana lakes!**

# Aquatic Invasive Monitoring Plant Highlight

This will be the 24th plant in the plant highlight series. We will be featuring one aquatic plant in each *Water Column* issue. We will feature both native and invasive plants to improve our plant identification skills.

**"Water pineapple" (*Stratiotes aloides*), INVASIVE**

**COMMON NAMES**: Water soldiers, water pineapple

**DISTRIBUTION**: Native to Europe and northwestern Asia. Found particularly in wet ditches and ponds

**DESCRIPTION**: *Stratiotes aloides* is a submerged aquatic perennial plant that becomes buoyant during the summer. It produces stolons, which is a creeping horizontal plant stem or runner that takes root at points along its length to form new plants making it very easy to spread and difficult to eradicate! *S. aloides* has bright green sword-shaped leaves with serrated margins. The leaves that can grow up to 16 in. (40 cm) long grow into stalkless rosettes. The flowers have three white to pinkish petals.

*S. aloides* can form dense mats of floating vegetation that crowds out native plant species. It can change water chemistry. The large dense mats and the serrated sharply pointed foliage of *S. aloides* can restrict recreational use of the water and pose a danger to swimmers and other people that handle the plant.

**Identification tips:**

- Stalkless rosette of green leaves, like a pineapple top
- Green serrated leaf margins
- Three white petals on flower



***WATER COLUMN***

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## *Perspectives*

"Rest is not idleness, and to lie sometimes on the grass on a summer day listening to the murmur of water, or watching the clouds float across the sky, is hardly a waste of time."

*~ John Lubbock*