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Ohio Shorelines

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Newsletter of Ohio Lake Management Society
Division of Water Management Association of Ohio

Reality Science for Lake Management

By Jeff Gray, Grays' Aquatic Services, JeffGray@GraysAquatic.com

What happens when you present the science of Limnology to a diverse lake community in search of an aquatic plant management program? How do you re-educate an entire lake association that is accustomed to ecologically unsound but effective nuisance aquatic plant and algae control? This article is part of an ongoing lake restoration and protection success story that began in 2009 at Lake Mohawk, Malvern, Ohio. It involves "reality lake science" combined with leadership, cooperation, and compromise on the part of an entire lake association. The purpose of this article is to share an experience that will hopefully make it easier for other lake management specialists to introduce the value of academia to real world applications.

Historical Lake Management of Lake Mohawk

Lake Mohawk like many lakes has experimented with a variety of techniques to manage their nuisance aquatic plant and algae issues. From 1963 to 1988, a variety of "do it yourself" chemical control methods were utilized for aquatic plant and algae control. The "grass carp" (White Amur) was introduced into the lake in 1989. A dredging project was completed in the early 1990's. The introduction of the selectively herbaceous Amur combined with the dredging project resulted in a significant increase in Eurasian watermilfoil and blue-green algae blooms. To address these issues, the Lake Mohawk Property Owners Association (L.M.P.O.A.) hired an outside consultant that initially recommended a whole lake treatment with the systemic herbicide Sonar (fluridone). Under the continued guidance of the consultant, the lake preceded with a "do it yourself" aquatic plant and algae control program until 1999. Frustrated from the varied results of the professionally guided "do it yourself" program, the L.M.P.O.A. decided to hire an out of state chemical application firm to manage the lake. From 1999 through 2008, this company proved very effective in controlling nuisance aquatic plants and algae. Unfortunately, in mid-summer of 2008, a significant number of the bass population died from what some believe was LMB (Largemouth Bass Virus). The Lake Mohawk Sportsman Club which is the primary group of serious fishermen had growing concerns about

Landsat Satellite Image: Lake Mohawk, Malvern Ohio.

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Dana Oleskiewicz, Editor

Inside this issue:

Robert Carlson, OLMS President

Presidential Address

It's Fall, and the leaves are starting to fall, the squirrels are playing Dodge 'Em on city streets, and our thoughts would normally be turning towards holiday activities. But, this is also the political season, when our thoughts turn to questions about future of the world, our nation, and our pocket books.

Curiously, neither of the two major parties have much to say about the health of our environment. The implications of global climate change, whether caused by human actions or natural factors, seem to have disappeared from the conversation. Both parties now tell us that coal is clean, and energy independence in the form of natural gas is just under our feet, just waiting to be extracted by this process called hydraulic fracturing. "Regulation" has become a dirty word and jobs in abundance simply await release from stifling regulations. One does have to wonder what the implications of easing these unnamed regulations might turn out to be. Some of us remember the "good old days" when the lack of environmental regulation resulted in polluted, burning rivers. Fish advisories on Lake Erie and some of our inland lakes are a continuing legacy of dumping of toxic chemicals into our rivers and lakes.

> "...protection and management of our lakes are the reasons why we are involved in OLMS."

You would think that the issues of conservation of our resources and protection of our environment would at least be part of our political discussion. Instead it has been viewed as such a polarizing issue that it is too hot for either party to raise as an issue. I would think that both liberal and conservative could at least agree that health and safety of citizens is important, while the means of dealing with the problem, not its reality, would be open to discussion.

Environmental problems have a way of ignoring political philosophies. The continuing existence of toxic algae in Lake Erie and Grand Lake St. Marys is a public health issue that cannot be ignored or minimized. Either someone will have to develop the political will to deal with the cause or we may have to close our waters.

This summer I regularly met with several groups of cabin owners to talk about various subjects ranging from the impact of invasive species to leaking septic tanks. What impressed me was that the politics of the individuals involved was not discussed, largely because they shared a common interest in protecting their lakes. These groups were concerned about their drinking water supply, their source of recreation, their property values. These concerns superseded any political differences.

In a real sense, OLMS is just such an interest group. Our own political philosophies are important, but protection and management of our lakes are the reasons why we are involved in OLMS. Our recent incorporation into WMAO gives each OLMS member a larger voice within the state to express our concerns about the management and protection of *our* lakes. I hope that you will attend the WMAO conference in Columbus next month to participate in the discussion.

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the use of chemicals in the lake and believed that chemical use was to blame for the summer fish kill. It was at this time that the L.M.P.O.A. decided to reevaluate their nuisance aquatic plant and algae control program.

In the spring of 2009, the L.M.P.O.A. began a search for a lake management company that would provide a "greener" approach to nuisance aquatic plant and algae control. It was at this time my company was selected to provide that "greener" approach. The following is a brief summary of my past four years at Lake Mohawk with emphasis on the human aspect of what makes a "green approach" to lake management successful. For more detailed scientific information about methods and data, please visit www.Lake-Mohawk.us .

Year 1 - 2009 – The Importance of Supportive Board Members and Lake Manager

As a lake management specialist, your first season with any body of water is always the most difficult. Faced with a steep learning curve and many lake residents that have no tolerance for aquatic plants or algae, you have very few allies to defend your "green" program. Limited budgets and patience often prevent the funding and time necessary to make a proper evaluation of a lake. It is at this point that you rely heavily on the support of your Board members and Lake Manager, as you will see.

I quickly became aware that Lake Mohawk had a wide variety of recreational uses which included water skiing, fishing, boating, jet skis, etc.. In any mixed recreational lake, you often have a conflict between fishing enthusiasts and recreational skiers and boaters. The fishing enthusiasts appreciate the ecological value of aquatic plants while the skiing and recreational boat users often find them a nuisance.

My first on-site visit to Lake Mohawk was in early May of 2009. Much of the lake had already established a significant population of Curlyleaf pondweed (CLP). Although CLP is known to naturally senesce by the end of June, Lake Mohawk residents have no tolerance for this exotic plant and prefer to control it in early May. Unfortunately, many residents had already become extremely upset about the fact that CLP was at the surface in many parts of the lake. Needless to say, the May Board meeting was filled with anxious residents. Although these types of situations are extremely uncomfortable, it is very important to face your most critical audience and explain your program. These people understandably have NO reason to be confident in a different approach to lake management, especially considering the fact that they just had 10 years of weed and algae free lake conditions.

The Blue-Green surprise of 2009

Due to years of intense chemical treatment that included the use of copper sulfate, many Lake Mohawk residents had never experienced a blue-green algae bloom. Little did they know that they were about to observe their first ever bloom.

> **"...growing concerns about the use of chemicals in the lake and believed that chemical use was to blame for the summer fish kill..."**

Lake Mohawk has very unique water quality for a northern Ohio lake. Although it is situated in agricultural based Carroll County, it receives very little agricultural input from its small watershed. Lake Mohawk has typical reservoir characteristics consisting of a shallow south end and a deeper north end. Internal phosphorus loading is therefore limited to the northern basin of the lake. External phosphorus loading is minimal. In-lake

"The formation of this committee (Lake Mohawk Restoration and Protection) is perhaps one of the best consequences of the blue-green algae bloom."

phosphorus concentrations were most often in the mesotrophic range. Water hardness was relatively low. Secchi disc visibility ws nearly 14 feet through June 2009. Starting in July 2009, the visibility began to decline rapidly. (14 ft. to less than 2 ft. by the end of July)

Considering the fact that this was my first season with Lake Mohawk and the fact that I was there to implement a "greener" approach to nuisance aquatic plant and algae control, I had totally refrained from adding any copper based products to the lake. I was in the "scientific…..wait and observe mode". After all, most all lakes in Ohio have increased productivity in the summer months with associated declines in visibility. It became apparent to me that by mid-July that something was very different about this bloom. This bloom continued to intensify rather than level off like most blooms I had experienced over the years. It was at this point that I decided to apply a chelated formulation of copper (Cutrine) to selected shoreline areas. I noted that this blue-green algal species was very sensitive to low doses of copper. The lysis of the algal cell (now cyanobacteria) produced dramatic aqua blue coloration of the water within minutes. Despite my efforts, the bloom continued to intensify through the entire 507 acre lake by the end of July. Concerns over blue-green algae toxins were at their peak. There was discussion on whether or not to close the lake.

My academic education from some of the most well known Limnologists in the world (Dr. Carlson, Dr. Cooke, Dr. Olive) along with advice from other professional colleagues was preventing me from doing the unthinkable which was treating the entire lake with copper. By the end of July, the entire city of Malvern could smell the unpleasant odor of blue-green algae. The entire lake was a bright fluorescent green. This event was quickly becoming a disaster for both the "greener" approach and me. Strike one for academia.

It was this event that caused me to be forever grateful to the past Lake Mohawk Board President, Mr. Charles Leonard. As I was loading a boat at the ramp, Mr. Leonard drove up and asked me what I thought about the blue-green algae issue in the most kind and gentle manner. After a short discussion, we decided that it would be in the best interest of the entire lake community to have the PREVIOUS out of state lake application firm come in and control the algal bloom. At that time, I simply could not risk treating an entire lake with copper sulfate at the end of July. I also could not go against the side of academia; the side that promotes the "greener" approach that I knew given time would be successful.

The Formation of the Lake Committee

It was not long after the blue-green algae bloom of 2009 that the Lake Mohawk Restoration and Protection committee was formed. The committee formed as a result of "vocal inputs" from a number of residents around the lake. Those residents that were most vocal about lake conditions were invited to be on the lake committee. The formation of this committee is perhaps one of the best consequences of the blue-green algae bloom. The committee consisted of skiers, recreational boaters, and fishermen. Professionally, these people were CPA's, Engineers, medical providers, water quality and environmental specialists, etc. Today, this committee continues to be the best ally in the continuation of ecologically sound lake management practices. While there are sometimes heated (and entertaining) arguments, a significant amount of important information is disseminated and decided upon at these meetings.

When Science Becomes an Ally

The May 2009 monthly Board meeting was difficult considering the Curlyleaf pondweed issues. The July 2009 meeting was even more difficult considering the intense blue-green algae bloom that almost closed the lake. Through all of this, the Lake Mohawk Board members put their community reputations at stake by continuing to back my lake management program. In order to provide support for a "green" lake management program, you must provide scientific data that will support your approach to nuisance aquatic plant and algae control.

In order to demonstrate to the Lake Mohawk community that copper was not good for aquatic ecosystems, I decided to conduct extensive sediment tests for copper. The results proved to be invaluable as it provided a significant inspiration for the L.M.P.O.A. to

keep focused on finding alternative solutions for blue-green algae control. Dr. Robert Davic, formerly of the O.E.P.A. and former President of OLMS, was hired by Lake Mohawk to examine and report on my copper test results and 2009 lake report. Dr. Davic's report to Lake Mohawk was extremely helpful in providing information on the negative impacts of copper in lake sediments. These findings set the stage for my next "selling point" of the "green" lake management program.

The "selling" of a "green" lake management program becomes much easier as you provide incentive for people to do so. For example, blue-green algae have been shown to be potentially toxic to humans, pets, and wildlife. By presenting these facts, we provide an incentive for people to control blue-green algae. While many people believe copper may be their first choice for doing so, we provide data to show that high levels of copper in their lake sediments is not good for the aquatic ecosystem or their property values. The next step in our "selling" process is to find the primary causes of the blue-green algae blooms and to present a "greener" solution to the problem.

Finally, the Primary Source of Phosphorus

After examining a list of lake management priorities, it was decided by the Lake Committee that controlling blue-green algae was the most important objective. After all, blue-green algae can close down a lake. Aquatic plants in comparison to blue-green algae are a minor nuisance.

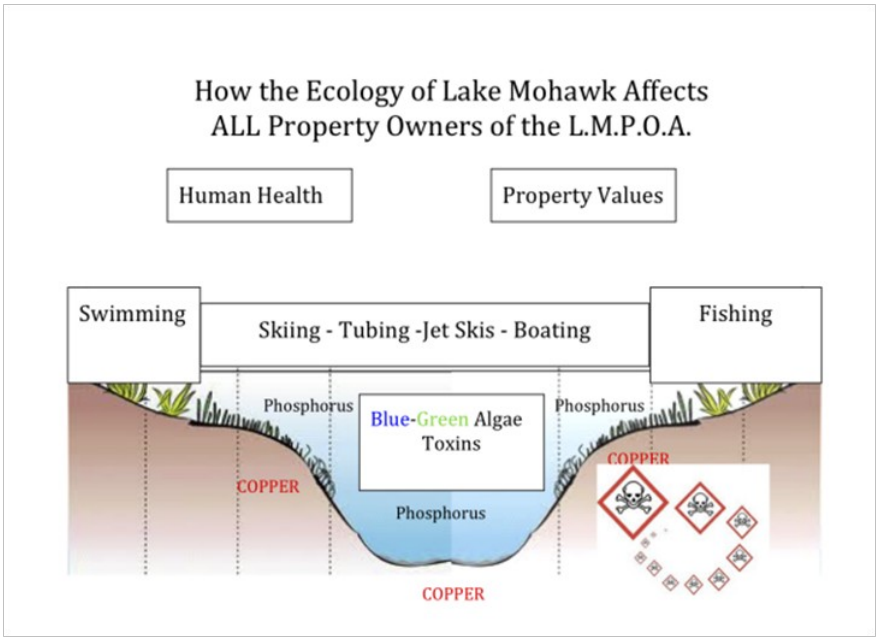
Knowing that copper was no longer the primary method of choice in controlling blue-green algae, other more eco-friendly options were presented and explored. Phosphorus tests were conducted to determine the primary sources of phosphorus. While there was some internal loading of phosphorus,

"....copper was no longer the primary method of choice in controlling blue-green algae, other more eco-friendly options were presented..."

this in my opinion was not the significant and sudden source of phosphorus that was causing blue-green algae blooms. External sources were minimal even when there was water flow into the lake, which was minimal in 2009. The lake community in general has a ban on phosphorus containing fertilizers. So, where was all this phosphorus coming from so quickly that was fueling blue green algae blooms in mid-July? The answer came to me one day while I was on the lake observing boating recreation in the bays. I noticed trails of sediment suspension coming up behind the boats. I realized then that boats with unlimited horsepower combined with shallow conditions were re-suspending sedimentary phosphorus. These boating related phosphorus "spikes" were confirmed through testing and bottom sonar images. July 4th marks the start of intense recreational boating activity at Lake Mohawk. Although zoning the lake in shallow areas to "no wake" zones seems like an easy answer, it is NOT an option at Lake Mohawk. Restricting horsepower was also not an option.

The "Green" Approach to Controlling Blue-green algae at Lake Mohawk

Implementing the "Green" approach to blue-green algae control at Lake Mohawk was simple. Let the aquatic plants grow. Aquatic plants as many of you know provide excellent competition for nutrients in addition to stabilizing the sediments. Biomanipulation of the aquatic plant community through selective chemical control rather than total eradication assisted in the growth of native aquatic plants. Low growing aquatic plants do not interfere with skiing or recreational boating. While going "Totally Green" is not an option at Lake Mohawk, using far less chemicals, some of which are totally biodegradable is significantly better than some of the less eco-friendly alternatives.



Summary - Years 2010, 2011, & 2012

Each year since the introduction of a "Greener" lake management program that works with "Mother Nature" rather than against Her, Lake Mohawk has improved in terms of aquatic plant diversity and natural suppression of blue-green algae blooms. Lake Mohawk residents have become more confident in the "green" approach as each year passes. A potential Eurasian watermilfoil problem was specifically targeted and eliminated rather than treating the entire lake with an expensive dose of fluridone. Native aquatic plant competition is utilized wherever possible. Blue-green algae are targeted at times when it is concentrated in the upper 1-2 acre-ft. of water and before it reaches bloom levels. Although chemical use cannot be entirely avoided, it can be greatly reduced and used in a positive way to selectively treat exotic species of aquatic plants while allowing the native plants to flourish. Extensive areas of Chara and Nitella now grow on the lake sediments that once were devoid of all forms of plant life. Previous high levels of copper from algae treatments would kill these advanced forms of algae.

"Reality Lake Science" is a term that I like to use to describe the entire process of managing a lake, which includes the affects that you and I have on human lives and health. Reality Lake Science is as much an art as it is a science. It encompasses the entire interactions of Limnology, Psychology, interpersonal communication, dissemination of information, etc.. Our job as applied aquatic ecologists is to educate entire lake communities, which in most cases do not consist of scientific minds. As my main contact and extremely supportive Lake Mohawk Board member Eric Howland put it, "please keep everything to a 5th grade level".

As part of the continuing education process at Lake Mohawk, I have created an informational lake web site for the community at www.Lake-Mohawk.us . Information combined with a supportive Board, lake manager, and members of various key clubs within the lake community are the key ingredients in presenting and implementing an ecologically sound lake management program at any lake association.

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Asian Carp in Ohio and Lake Erie

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Most readers of this newsletter will be familiar with the dread "Asian carp," potentially invasive species occupying headlines throughout the Great Lakes and Mississippi regions in recent years that threaten to wreck the sport fishing industry of the Great Lakes, an industry with an estimated value of approx. $7 billion (Southwick Assoc. 2007). Some may have seen the press release jointly issued by the Ohio (ODNR) and Michigan Departments of Natural Resources (MDNR) on 13 July 2012 announcing six positive environmental DNA (eDNA) hits for silver (*Hypophthalmichthys molitrix*) and bighead carp (*H. nobilis*) among 417 water samples collected from western Lake Erie in August 2011 (ODNR & MDNR 2012). More positive eDNA hits followed for Lake Erie water samples collected in summer 2012: 20 of 150 samples collected from the Sandusky Bay and River in late July 2012 (ODNR et al. 2012) and three of 350 samples collected from the Maumee Bay in early August 2012 (MDNR et al. 2012) tested positive for silver carp. Not many seem to be aware that there have been a handful of collections and/or sightings of bighead carp around Lake Erie spanning the mid 1990s into the early 2000s (Morrison et al. 2004, Kolar et al. 2005). In addition, there were a handful of bighead carp captured on the upper Ohio River in the early 2000s (Kolar et al. 2005) and silver carp near Cincinnati in June 2012 (Jeff Thomas, Ohio River Valley Water Sanitation Commission, personal communication, 2012).

"...been a handful of collections and/or sightings of bighead carp around Lake Erie spanning the mid 1990s into the early 2000s..."

More soon, but if you will permit me to air this slight pet peeve… In North American applications, "Asian carp" has evolved into a popular-press term of convenience, but doesn't add much to discussion. A fish name to include "carp" implies an animal of the cyprinid (i.e., minnow) family that has a relatively large adult size. There are also groups of carp species that can be described as Indian or African. Technically, the Asian carps are a relatively diverse group of animals that includes now widespread nonnatives like common carp (*Cyprinus carpio*) and goldfish (*Carassius auratus*), even though those species are typically deliberately *not* referred to by North American uses of the term "Asian carp." The US Fish & Wildlife Service specifically uses the term to reference only four species: black (*Mylopharyngodon piceus*), grass (*Ctenopharyngodon idella*), silver, and bighead carps (e.g., Conover et al. 2007). Popular-press uses can imply any subset of 1–4 of those species (either deliberately or in ignorance), sometimes possibly others, and you would need to glean which from context. "Asian carp" in the recent popular press is most often in reference to two species of the same genus: silver carp (the "flying" carp famous for spectacular leaps) and bighead carp (the alleged 100-pounder). No carp is native to North America, and every carp species to have established a population here is of the larger Asian group. Thus, "Asian carp" in discussing North American populations at this time is equivalent to simply "carps." The erroneous impression that the blanket application of "Asian carp" has given the public is that only one potentially invasive species is being discussed. Personally, I would prefer that each species be discussed on its own merit and using its own name.

"The erroneous impression that the blanket application of 'Asian Carp' has given the public is that only one potentially invasive species is being discussed."

Silver and bighead carps are the Asian carp species of greatest current concern and have become widespread throughout much of the Mississippi system, including the lower Ohio River. They are filter feeders of plankton and are even able to consume and use the cyanobacteria species that cause harmful algal blooms. As such efficient planktivores, the fear is that establishment of these two species has the potential to crop the very base of the food web, potentially thinning the flow of energy throughout the system and reducing productivity all the way up to the sport and commercial fisheries that people value.

The US Army Corps of Engineers (USACE) is currently evaluating potential connections for the transport of aquatic invasive species between the Mississippi and Great Lakes watersheds (USACE 2010). They have identified 18 potential connections for study in the US. The two of greatest concern are the Chicago Sanitary and Shipping Canal system and Eagle Marsh, a site in Indiana that often connects the headwaters of the Wabash River (part of the Mississippi watershed) with headwaters of the Maumee River (a tributary of Lake Erie) in flood conditions. Some form of electric, fish-repelling barrier has been in operation to protect the Chicago connection against invasive fishes since 2002, and a substantial chain-link fence was built in 2011 to prevent the passage of adult carps at the Eagle Marsh site. The ODNR further analyzed three potential connections within Ohio and determined that none were likely to permit the movement of silver or bighead carp at this time because 1) each features water-control structures and/or head differentials and 2) no populations are yet established in any Ohio waters (ODNR 2010).

Silver and bighead carps are large warmwater planktivores. To reproduce, they require high or rising flowing water with sufficient temperature to trigger spawning and develop embryos and a length of turbulent flow sufficient to keep eggs suspended in the water column until hatching. To feed and grow, they require warm, plankton-rich waters.

Because the upper Great Lakes tend to be colder oligotrophic systems, are rather plankton-poor, and feature a generally narrow watershed fed by rivers that are relatively cold in their ordinary high-water seasons, there has been a great deal of debate regarding whether or not these animals could reproduce and thrive in Great Lakes waters. If there is an exception to the above, it is likely to be the western basin of Lake Erie: relatively warm, productive, plankton-rich, and fed by the Great Lakes' largest tributary, the Maumee River. Adding to this concern, Kocovsky et al. (2012) created some basic ecological models to analyze six Lake Erie tributaries. They determined that the Maumee, Sandusky, and Grand

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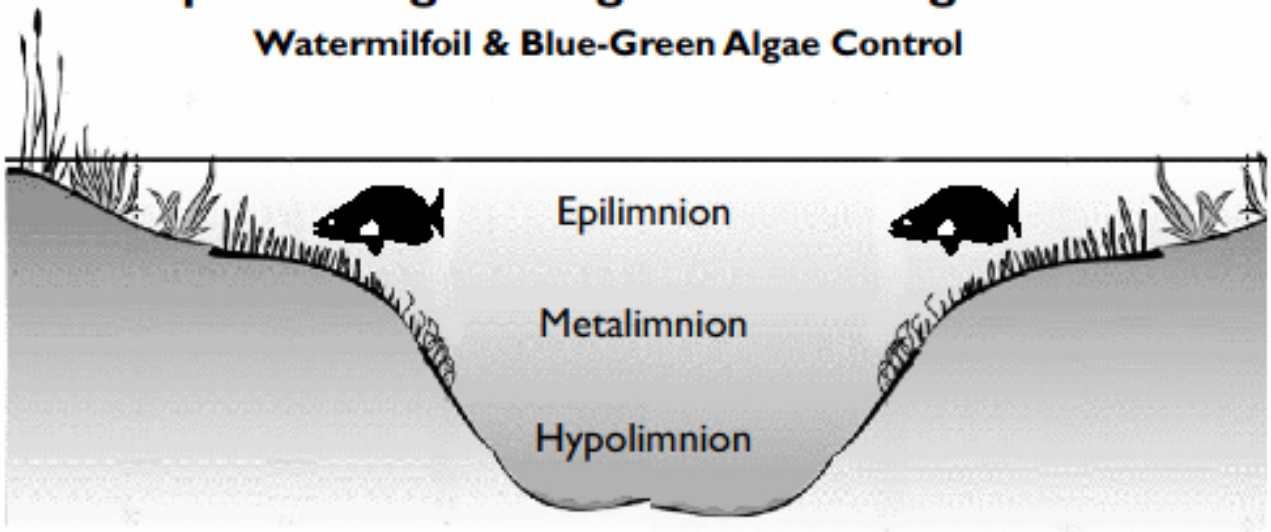

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Note: Lake Mohawk located in Malvern Ohio is one of the most prestigious lake communities in Ohio. Pristine lake conditions provide excellent conditions for a wide variety of recreational water sports such as fishing, skiing, boating, etc..
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Rivers were most likely to be suitable for spawning and that the Maumee may crest its dams and produce suitable conditions in many or most years.

So, what do the recent detections of silver and bighead carp DNA in Lake Erie mean? There simply isn't enough evidence to know at this point. The several individual bighead carp collected in the mid 1990s to early 2000s were all large, adult fish that exhibited early-life growth patterns consistent with the expectations of southern hatcheries (Morrison et al. 2004); i.e., they almost certainly did not originate from a Lake Erie population, but were likely individual escapes or releases: possibly deliberate (and thus illegal) releases from shipments of live fish for food or escapes from culture operations, misidentified shipments of pond stockings, etc. Unless more evidence surfaces to the contrary, the fish responsible for the eDNA detections in 2011 and 2012 samples may have had similar origins. ...possibly fish released more than a decade before their detection in this manner, possibly even released back when live shipments were still legal (although intentional live releases never have been). Transport of occasional adults via flood water at Eagle Marsh before the fence barrier was constructed may even be a possibility (John Stark, The Nature Conservancy, personal communication). There simply is no way to confidently guess at an origin for this eDNA without more information.

While concerning, these newest press releases for Lake Erie really amount to more of what we've known for the last decade or so (excepting the new detections of silver carp DNA). If larvae or juveniles are ever collected in the lake—i.e., evidence of successful reproduction and the prelude to self-sustaining populations—that becomes a much more serious concern. Still, I do hope these recent news releases prompt some urgency in actions taken. Whatever threat silver and bighead carps may pose to the Great Lakes and Lake Erie simply isn't worth the risk. The Great Lakes have already suffered more than 180 documented and economically costly biological invasions; any more are too many more.

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