

OHIO STATE UNIVERSITY EXTENSION

Top Five Pond Inquiries

...or is that seven?




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Eugene Braig, Program Director, Aquatic Ecosystems Extension | COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES | School of Environment & Natural Resources

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Some Pond Management References

- Austin, M. et al. 1996. Ohio pond management handbook: a guide to managing ponds for fishing and attracting wildlife. Ohio Department of Natural Resources, Division of Wildlife, Columbus, OH.
 - <http://wildlife.ohiodnr.gov/species-and-habitats/pond-management>
- Many older pond-management fact sheets available via correspondence (revisions pending):
 - braig.1@osu.edu
- Occasional newsletter articles:
 - <http://senr.osu.edu/YourPondUpdate>
- My listserv:
 - <https://lists.osu.edu/mailman/listinfo/pond-management-news>




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Consultations with my office

General topic	Percent frequency			
	2015 (N = 247)	2016 (N = 294)	2017 (N = 278)	2018 (N = 253)
Aquatic plant management	14	18	19	21
General pond/lake management	17	12	7	13
Filamentous green algae	6	13	9	7
Harmful algal blooms	15	8	7	—
Wild aquatic organisms	—	—	9	10
Fish kills	—	10	—	7
Fisheries management	6	—	—	—

- Top five per year.




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Relatively high rankers that didn't quite make the cut

- Aquatic invasive species
- Construction/Dredging
- Pond leaks/Levee erosion
- Persistent muddy water
- Specifically, *Euglena* blooms (recent, substantial upswing)


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Top Five (Seven?) Pond Inquiries

The Outline (and ranking):

- Managing aquatic plants (1)
- Filamentous green algae (3)
- Harmful algal blooms (4)
- Fisheries management (7)
- Fish Kills (6)
- Wild aquatic organisms (5)
- General pond/lake management (2)


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Managing aquatic plants

The essence:

- Prevention:
 - Pond construction: max depth (typically at least 8 or 12 feet) and slope (3:1).
 - Manage nutrients proactively (external vs. internal sources).
 - Dyes applied in early season (greatest benefit with increasing depth and retention time).



(Eugene Braig 2016)



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Managing aquatic plants

The essence:

- Tolerance:
 - Beneficial competition against nuisance organisms and serves as valuable habitat (two considerations: 1. species diversity and 2. natives).
 - Ordinarily **5-20% in ponds with fisheries considerations** (higher is possible for ponds without fisheries concerns and much higher is possible for ponds without fish).
 - Drawback: excessive coverage contributes to wide oxygen fluctuations and can stunt fish.
 - Drawback: requires active management and some savvy.




(Eugene Braig 2016)


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Managing aquatic plants

- Treatment:
 - Warm-water caveat.
 - **Only use herbicides specifically labeled for aquatic applications.**
 - **Read, understand, and strictly adhere to the label, including use restrictions and safety info.**
 - Whole water vs. spot treatments.
 - Treat as early (1. target present and 2. effective temperature reached) and conservatively as possible.
 - **Triploid Grass Carp/white amur (2-10 per acre)** are not silver bullets.
 - Diet preference.
 - Relationship to nuisance algae.
 - Long lived.
 - Dense stocking and beneficial vegetation.




(Scott Heidrich 2011).


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Aquatic herbicide chemical Name	Absorption	Selectivity	Water-Use Restrictions
Copper (copper sulfate and copper chelates)	Contact	Broad	Minimal
Sodium carbonate peroxyhydrate	Contact	Broad	Minimal
Diquat	Contact	Broad	Moderate
Flumioxazin*	Contact	Broad	Moderate
Carfentrazone-ethyl*	Contact	Broad	Moderate
Endothall (amine salt and potassium salt)	Contact	Broad	Moderate
Glyphosate	Systemic	Broad	Minimal
Imazamox	Systemic	Broad	Moderate
Topramezone*	Systemic	Selective	Moderate
Fluridone	Systemic	Selective	Moderate
Florpyrauxifen-benzyl*	Systemic	Selective	Moderate
Bispyribac*	Systemic	Selective	Extensive
Imazapyr	Systemic	Selective	Extensive
Penoxsulam*	Systemic	Selective	Extensive
Triclopyr	Systemic	Selective	Extensive
2,4-D	Systemic	Selective	Extensive

For details, see OSU fact sheet "**Chemical Control of Aquatic Plants**" (Lynch 2009) excepting *.

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Contact herbicides

- **Copper sulfate** and **copper chelates** (a vast many: e.g., Cutrine brands, etc.): mostly algae (some submersed).
- **Sodium carbonate peroxyhydrate** (e.g., GreenClean, Pak 27, Phycomycin, etc.): near-surface and shallow algae.
- **Diquat** (e.g., Reward, Weedtrine-D, Aquastrike [Endothall-dipotassium blend], etc.): submersed plants and some filamentous algae.
- **Flumioxazin*** (e.g., Clipper, Pond-Klear, Propeller, etc.): misc. submersed and free-floating plants, especially **duckweeds** and **watermeal**.
- **Carfentrazone-ethyl*** (e.g., Stingray): misc. floating and emergent plants.
- **Endothall** (e.g., Aquathol [dipotassium], Hydrothol [mono-amine], Evac Biocide, Aquastrike [Diquat blend]): submersed plants and algae.

- **Karmex*/Diuron***, etc.: **Do not use!** Not labeled for aquatic applications.

For details, see OSU fact sheet "**Chemical Control of Aquatic Plants**" (Lynch 2009) excepting *.


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Systemic herbicides

- **Glyphosate** (e.g., Rodeo, Aquamaster, AquaPro, Eraser AQ, etc.): emergent plants.
- **Imazamox** (e.g., Clearcast): very broad effectiveness, including several submersed invasives.
- **Penoxsulam*** (e.g., Galleon): emergent and some floating weeds including on exposed pond sediments.
- **Topramezone*** (e.g., Oasis): Select submersed, floating, and emergent species including several grasses.
- **Fluridone** (e.g., Sonar, Avast, Whitecap, etc.): primarily submersed and free-floating plants.
- **Florpyrauxifen-benzyl*** (e.g., ProcellaCOR EC): Select free-floating, emergent, and submersed species, especially **watermilfoils** and several invasives.
- **Bispyribac*** (e.g., Tradewind): misc., esp. floating and submersed.
- **Imazapyr** (e.g., Habitat, Arsenal, etc.): emergent (esp. grasses) & some floating weeds.
- **2,4-D** (e.g., AquaKleen, Navigate, Aquacide, Sculpin G, Weedar 64, etc.): specific plant species such as Eurasian watermilfoil, coontail, and limited effectiveness on waterlilies.
- **Triclopyr** (e.g., Renovate, Vastlan, Garlon 3A, Navitrol, etc.): selective aquatic effectiveness similar to 2,4-D.

For details, see OSU fact sheet "**Chemical Control of Aquatic Plants**" (Lynch 2009) excepting *.

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Useful plant management references

- For ID and management recommendations (common things only):
 - Texas A&M: aquaplant.tamu.edu/
- For herbicide detail:
 - University of Arkansas—Division of Agriculture, Research and Extension. 2017. Recommended chemicals for weed and brush control, MP44. Cooperative Extension Service, University of Arkansas System, Little Rock, AR.: <https://www.uaex.edu/publications/pdf/mp44/mp44.pdf> (vast, comprehensive, and requires a bit of savvy to digest).
- For new developments and current info:
 - Aquatic Plant Management Society (APMS): <http://www.apms.org/>
 - Midwest Aquatic Plant Management Society: <http://www.mapms.org/>



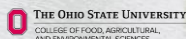
Top Five (Seven?) Pond Inquiries

The Outline (and ranking):

- Managing aquatic plants (1)
- **Filamentous green algae (3)**
- Harmful algal blooms (4)
- Fisheries management (7)
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Filamentous green algae (Don't call it "moss"!)




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Filamentous green algae

(Don't call it "moss"!)

The essence:

- Prevention:
 - Manage nutrients: fertilize watershed conservatively or not at all (avoid P), manage against Canada Geese, aerate with diffusers (i.e., bottom bubblers: reduces the ability of phosphorus to dissolve), etc.
 - Provide competition (i.e., tolerate plants in watershed and within pond).




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Filamentous green algae

(Don't call it "moss"!)

The essence:

- Treatment:
 - Elemental copper is standard algaecide (**copper sulfate** or **chelates**): follow label.
 - Some herbicides are effective on some algal species (**diquat** or especially **endothall** or **flumioxazin**).
 - Copper-resistant algae (especially *Pithophora* spp.) are less common and difficult to manage.
 - Often treated with **copper chelates** blended with **diquat** (1:1, 2 gallons/acre-foot) or **endothall** (2:1, 1 gallon/acre-foot) with nonionic surfactant (1–2 gallons/surface acre).
 - Warm-water caveats apply to algaecide applications.
 - Blue tilapia (a tropical fish) increasingly commonly used in Ohio.
 - Assuming Largemouth Bass present, stock 7"–10" tilapia at 10–100 lbs./acre (depending on algae coverage).
 - Harvest fish in fall as metabolism slows.

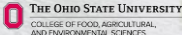


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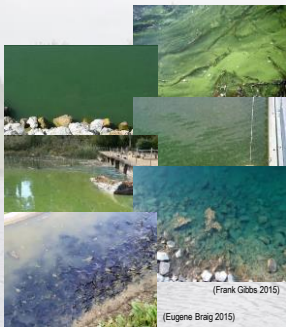
- Managing aquatic plants (1)
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Harmful algal blooms

(Cyanobacteria or "blue-green algae" aren't really algae)



(Frank Gibbs 2015)


(Eugene Braig 2015)

Common planktonic taxa:

- *Microcystis*
- *Planktothrix* (cold-blooming sp. looks reddish brown)
- *Aphanizomenon*
- *Dolichospermum* (prev. *Anabaena*)

Common benthic taxa:

- *Oscillatoria*
- *Microseira* (prev. *Lyngbya*)




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Harmful algal blooms

(Cyanobacteria or "blue-green algae" aren't really algae)

- Often indicate nutrient enrichment (especially by excessive phosphorus or a low N:P ratio).
- Many species can produce toxins, but variably so.
 - Single point-in-time tests don't reveal much; meaningful toxin monitoring of a bloom site over time becomes prohibitively expensive.
 - Give monitoring priority on sites used for commercial purposes (like irrigation or aquaculture), domestic water supplies, or with public contact/access.
 - Less so (like probably not at all) on sites used for casual recreation or aesthetics (instead, limit human contact and restrict access by domestic animals).



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Harmful algal blooms

(Cyanobacteria or "blue-green algae" aren't really algae)


The essence:

- Prevention:
 - Manage nutrients and provide competition (as previously discussed).
 - Aerate! ...with diffuser aeration (i.e., blowing bubbles from deep water).

Maximum depth:	6 feet	8 feet	12 feet	16 feet	20 feet	24 feet
Approx. coverage*:	1/8 acre	1/4 acre	1/2 acre	1.0 acre	1.5 acre	2.0 acre

* Per diffuser plate: can vary with atypical diffuser designs.

- For example, a 2-acre site with a maximum depth of 12 feet should consider installing up to 4 diffuser plates. A 2-acre site at 16 feet deep can probably get by on 2 diffusers.
- Seasonal operation (ordinarily warm months only).
- Target two turnovers/day for ponds; perhaps one turnover/day for small lakes.

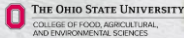


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Harmful algal blooms

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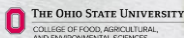
- Treatment caveats:
 - Tend to be late-season bloomers...
 - Standard warm-water caveat applies.
 - Cyanotoxins will ordinarily be both in solution and contained within particulate organisms.
 - Treatment won't add additional toxins, but can lyse cells placing more of the concentration in solution.
 - It's easier to filter out particulate organisms than to treat water to remove soluble chemicals.
 - Successful application of algaecides to kill a bloom will end the production of additional toxins.
 - If present, toxins will persist for some time after the bloom is eliminated. You can't know the toxins are gone unless you test for them.



Harmful algal blooms

(Cyanobacteria or "blue-green algae" aren't really algae)

- The essence:
- Treatment:
 - Apply algaecides as necessary (with caveats).
 - Typical/Planktonic blooms: formulae of **copper** or **copper chelates**.
 - Tricky benthic blooms:
 - **Sodium carbonate peroxyhydrate** followed the next day (or so) by **copper chelates + surfactant** or...
 - **Copper** (or **chelates**) + **diquat** + **surfactant**.
 - Surface scums concentrated by breeze: repeat treatments with **sodium carbonate peroxyhydrate**.



Top Five (Seven?) Pond Inquiries

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Pond fisheries

- The essence is the nature of smallness: limited space and lack of habitat diversity. **A pond cannot function like Lake Erie in supporting a self-sustaining fishery!**
 - Very small areas (perhaps less than 1/2 acre) are likely to require more active management, possibly supplemental feeding.
 - Keep fisheries extremely simple! ...Usually a single level of predator-prey interaction.
 - Largemouth Bass-Bluegill (supplementing with Channel Catfish if desired) is our region's tried and true.
 - Alternative species not necessarily appropriate for the pond novice. Ask questions if ya gots 'em.



A Delaware Co., OH pond (Steve Collignon 2014).


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Pond fisheries

Stocking new or renovated ponds

Stocking strategy	Number to stock per acre			
	Bass	Bluegill	Redear	Catfish
Largemouth Bass-Bluegill Sunfish	100	500		
Largemouth Bass-Bluegill-Channel Catfish	100	500		100
Largemouth Bass-Redear Sunfish	100		500	
Largemouth Bass-Bluegill and Redear Sunfish	100	350	150	
Largemouth Bass-Bluegill-Redear-Catfish	100	350	150	100
Recommended size (can go larger):	3-5 in.	2-3 in.	2-3 in.	3-5 in.

- New-pond ideal: Stock with Fathead Minnows and spawning habitat in spring. Follow with game species in fall.



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Pond fisheries

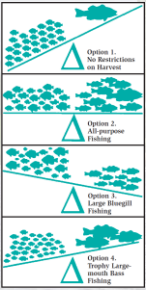
The self-sustaining-pond-fishery quiz:

- Do you get to have both lots of fish and big fish?
- Do you get to have both trophy-sized Bluegills and trophy-sized Largemouth Bass?
- Not likely, eh?


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Pond fisheries



Common management strategies:

- 1. **Do-nothing** option rarely yields good fishing.
- 2. **Balanced/All-purpose** populations provide fair numbers across different size classes for both species. (Surprisingly fleeting.)
- 3. **Big-Bluegill strategy** is excellent for families and children.
- 4. **Big-bass strategy** is really for the fishing purist; not necessarily a child- or family-friendly option.

Image credit: Austin et al. 1996


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Fish kills on Ponds

- The essence: almost always caused by low-oxygen events.
 - Following the event, determine cause and mitigate against repeats in future.
 - If restocking is needed, allow time for pond to recover and wait for a cool season to follow.


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Fish kills on ponds

- **Warm-season kills caused by low-oxygen stress:** usually occur at night, often observed in early morning.
 - Excessive area vegetated by plants or algae in excessively shallow water.
 - Complete cover by duckweeds or watermeal.
 - Treating too extensive an area with herbicide/algaecide.
 - Prevention:
 - Tolerate *moderate* vegetative cover.
 - Treat vegetation as early in season and conservatively as possible.
 - Aerate.



Yes, that's total coverage by duckweed. fish = dead (Eugene Braig 2017).

Fish kills on ponds

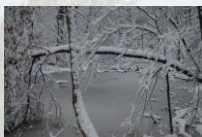
- **Classic summer kill:** usually follows premature turnover induced by late-summer rain.
 - Can be indicated by opaque, grayish water.
 - Prevention:
 - Plan new-pond construction to allow input of wind energy and delay sunlight exposure (align fetch with prevailing wind, trees to the east and north, etc.).
 - Manage to slow pond aging and muck accumulation.
 - Aerate throughout warm months, beginning before onset of warm-season stratification.



Storm's a brewer! (Eugene Braig 2011).

Fish kills on ponds

- **Winter kill:** caused by prolonged cover by opaque or snow-covered ice.
 - Prevention:
 - Shovel snow from 1/4 of pond surface.
 - Aerate from shallow water to erode a hole in ice (with waterfowl caveat).
 - ...But not both!
 - Tolerate *moderate* vegetative cover.
 - Avoid large herbicide/algaecide treatments late in the previous season.

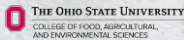


Brrr... (Donna Braig 2013).

Fish kills on ponds

Misc. causes:

- Low-oxygen stress will affect all fish species (albeit differentially).
- Spawning is hard work! Resultant stress will cause some mature fish to die, especially in late spring. That's totally natural.
- Substantial kills resulting from disease are relatively uncommon and may only affect a single species.
- Substantial kills resulting from toxic events are downright rare to ponds: toxins will affect all species (albeit differentially), typically affecting small fish (susceptible to lower effective doses) first.



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Wild organisms to commonly colonize ponds

- These dudes are cool and can indicate healthy oxygen concentrations.

Giant floater *Pyganodon grandis* (OSU Museum of Biological Diversity 2018)



(Non-native, but harmless) freshwater jellyfish *Craspedacusta sowerbii* (Great Lakes Scuttlebutt 2018)

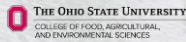
Freshwater bryozoan *Pectinatella magnifica* (Ohio Dept. of Natural Resources 2018)



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Questions?



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Eugene Braig,
Program Director,
Aquatic Ecosystems
614-292-3823
braig.1@osu.edu

Pond Clinics,
a smattering of virtual
locations around the
state of Ohio,
Spring–Autumn 2020