Water Column

Spring 2014
Vol. 26, No. 1

The "Birds and the Bees" of *Daphnia*

~ *Melissa Clark*

With warming temperatures and school out, many of you are exploring the lake and hopefully discovering new and familiar biota. Unfortunately, many of the predominate life forms get overlooked. They are either very small or too deep in the water column for us to observe. The Indiana Department of Natural Resources (IDNR) reported an interesting article on one resident from Yellow Creek Lake in Kosciusko County and his unique observations of *Daphnia* eggs (see "Tiny black 'specks' prompt lake concern at first").

Daphnia are tiny transparent animals or zooplankton commonly referred to as "water fleas" because of their body shape and jerky swimming (Figure 1). Because they are so small, they are usually overlooked, but I highly recommend exploring the surface waters with a viewing scope or float with some goggles and you'll see the microscopic animals jumping through the water.

While they are tiny, *Daphnia* are actually rather large compared to other microscopic zooplankton and are therefore easy to study. *Daphnia*, along with many insects and arthropods, have interesting life histories in that they can

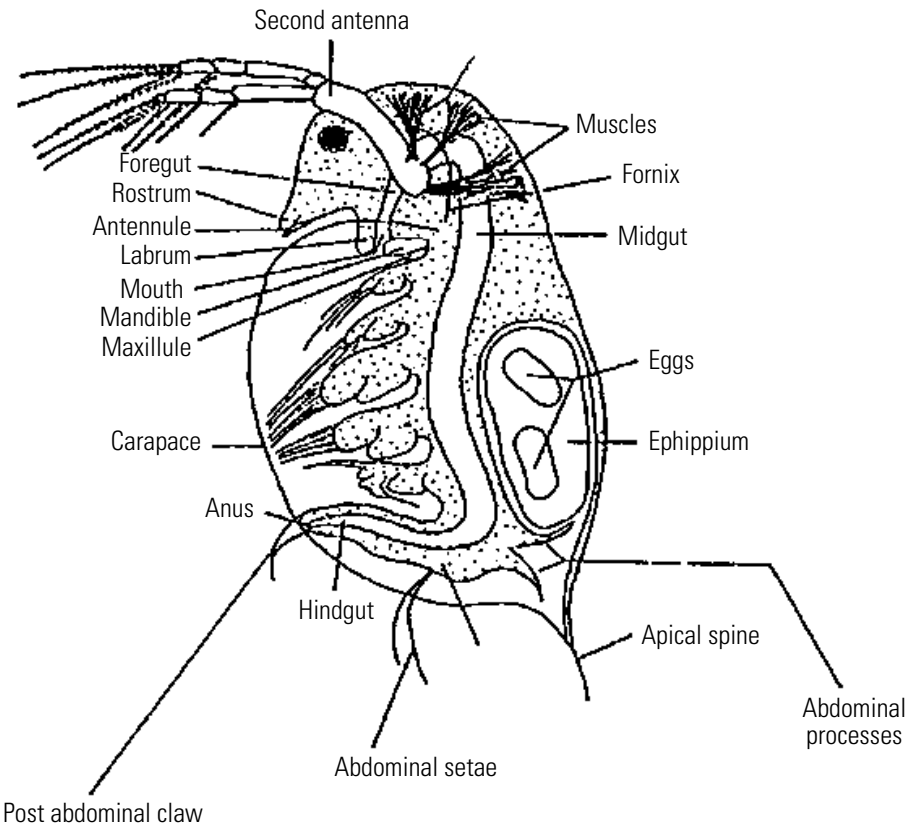


Figure 1. Female Daphnia

reproduce sexually and asexually (Figure 2). Through the asexual reproduction, *Daphnia* create clones or unfertilized eggs that develop into a new individual. Asexual eggs form in the brood chamber of the *Daphnia* and develop into neonates, which are then released when the mother molts. The neonates look just like the mother but smaller. Because the *Daphnia* are transparent you can easily see the neonates in the brood chamber (Figure 3a).

When *Daphnia* reproduce sexually, the fertilization results in resting "eggs" that are protected within a modified carapace or the shell of the female *Daphnia* in the ephippium (Figure 1 and 3b). The ephippium is thicker and darker. If they are still transparent, they aren't fully developed. Ephippia are resistant to freezing and drying, aiding in the "resting" stage (Figure 4). Depending on the species, they continue to develop based on various factors like thermal or light cues.

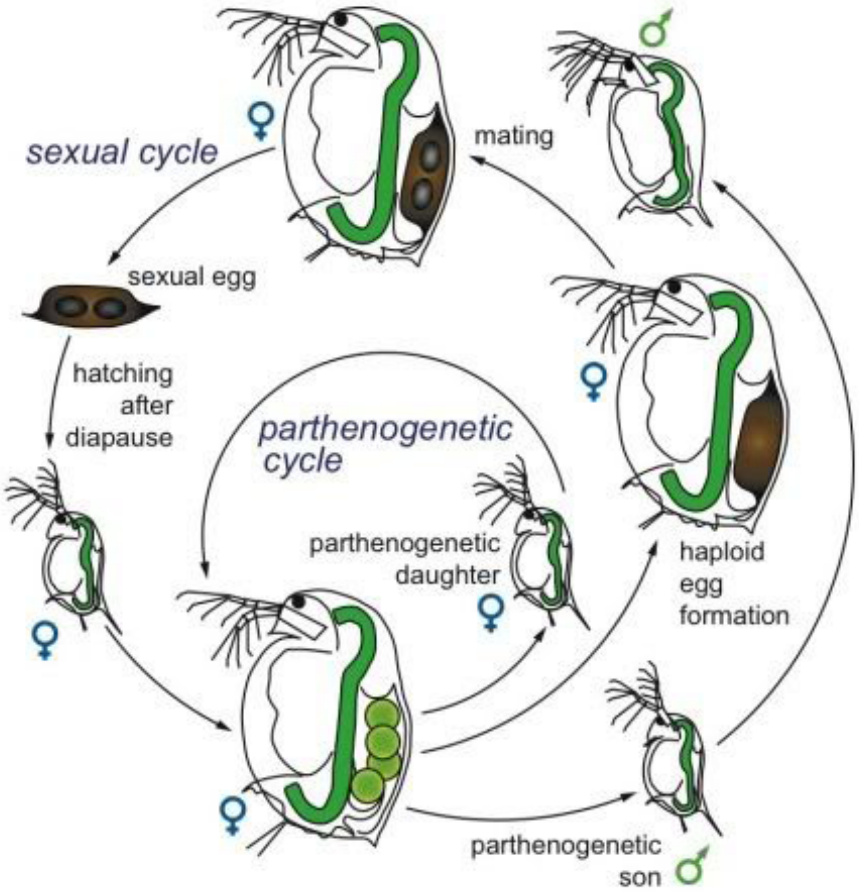


Figure 2. Reproductive cycles of Daphnia*, sexual and asexual.*

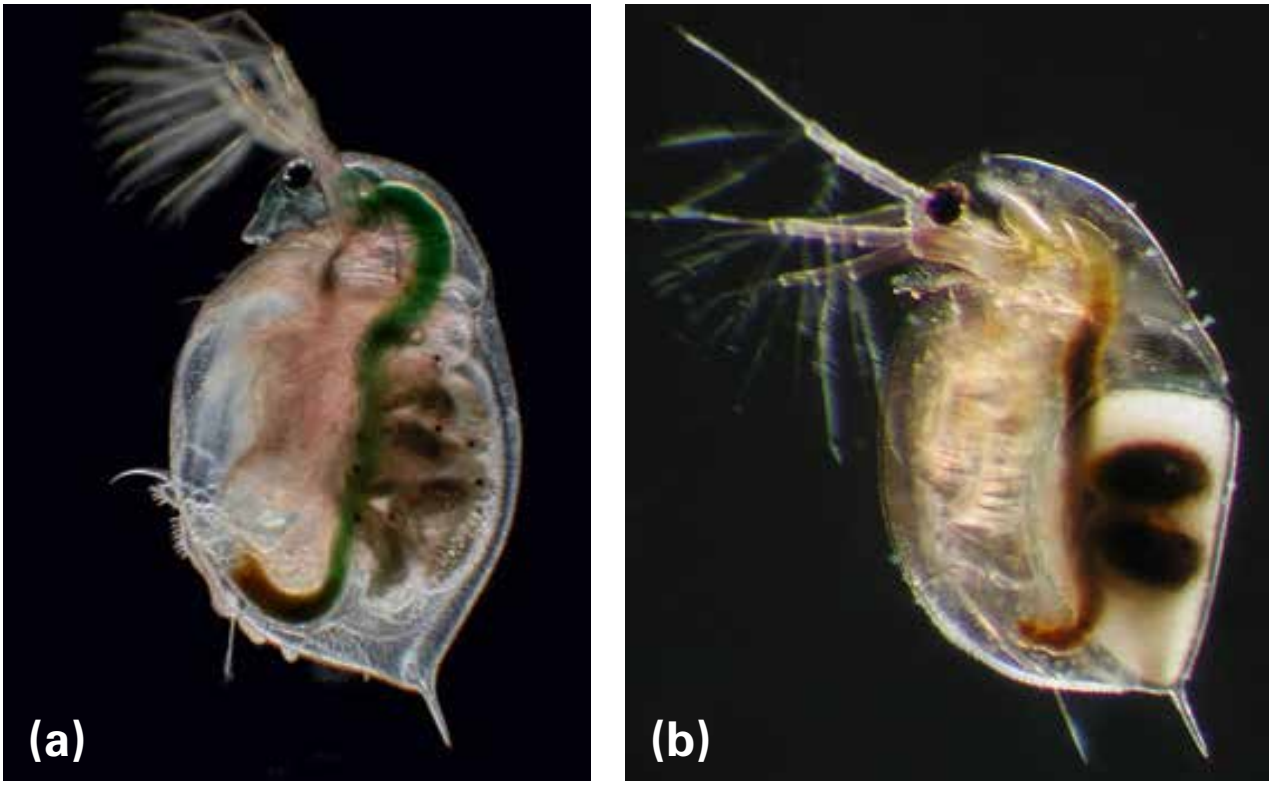


Figure 3. (a) Female Daphnia *with neonates visible in the brood chamber; (b) Female* Daphnia *with an ephippium that is still partially clear and developing.*

Figure 4. Daphnia *ephippia.*

Depending on the *Daphnia* species, asexual reproduction is optional and for some it is necessary. One advantage to the asexual reproduction is that the population growth rate is maximized, which is great for controlling algal densities.

Like cows grazing in the field, *Daphnia* are the most efficient algae grazers helping to control algal densities and blooms. So, get out the swim goggles and quietly take a float on the lake and you'll see the *Daphnia* swim around in their jumpy jerky fashion!

"Tiny black 'specks' prompt lake concern at first"

When Jack Sutton noticed a dense cloud of tiny black specks along his frontage at Yellow Creek Lake in mid-May, he thought it was the start of another algae bloom on the surface of the 151-acre natural lake in southern Kosciusko County.

But these specks were different. Turns out they weren't even plants.

They were *Daphnia* eggs, what biologists call ephippia.

Daphnia are microscopic animals that are a favorite food of small fish. They feed on algae and are a natural part of the aquatic food chain.

Daphnia can produce large numbers of ephippia in the spring when the water is clear, often when adult populations are most dense.

"I was looking outside my window and saw what looked like a film on the water," Sutton said. "I've been here for 40 years and never seen anything like it."

Sutton grabbed a water sample and contacted DNR biologist Jed Pearson.

Like Sutton, Pearson had no clue what the tiny specks were. To him, they looked like little bits of pepper.

"I thought they may have been small seeds, pollen or some form of plant," Pearson said.

Back in the lab and under a microscope, the specks appeared to be encased in a clear protective covering. But Pearson still couldn't identify them.

So he sent a close-up digital photo to Dr. Bob Gillespie at Indiana-Purdue Fort Wayne and Dr. Nate Bosch at Grace College.

Both came back with the same response – *Daphnia* eggs – ephippia.

When told the specks were ephippia, Sutton's first response was: "How do you spell that?"

After hearing that *Daphnia* are a prime food item for fish, Sutton added, "No wonder a lot of fish have been hitting the top."

Now if he can only figure out to get them on a fish hook and use them for bait.

Alternative Lawn Care Practices

~ *Modified from* Lake Tides *by Doug Soldat, UW-Extension Turfgrass Specialist, Dept. of Soil Science, UW-Madison*

Ask a lake ecologist what a shoreland homeowner should do with their yard to help protect their lake and the response will likely be "protect or restore the native buffer, don't grow lawns on slopes that drain to the lake, and do all you can to infiltrate runoff." This advice is sound, but looking around our lakes there appears to be a deep affinity for grass lawns among property owners, one that science will not sway. The question then becomes: What lawn care practices should homeowners use to minimize their impact on the lake? It's an important question, since whatever is on and in those lawns (i.e., fertilizers, pesticides, herbicides, etc.) will be carried by stormwater to the lake. This article highlights some of the key steps that homeowners can take to attain a healthy lawn without placing their lake in jeopardy.

When you go to the grocery store, you can find USDA Organic versions of all kinds of foods. Organic producers use methods that foster cycling of resources, promote ecological balance, and conserve biodiversity. While organic products tend to be a bit more expensive, the quality is equal to, or better than, conventionally-grown products, and consumers have come to expect and appreciate having the choice. Unfortunately, the same choices are not yet available for your lawn. The primary obstacle to a healthy organic or alternative lawn is a healthy soil. If you ask an organic farmer or gardener the secret to growing organic food, s/he'll tell you it's all about the soil. But our lawn soils were heavily disturbed when our homes were constructed. Chances are the original 12 inches of topsoil

was stripped and sold and the basement clay was spread around the property and compacted. Then, two inches of topsoil was spread around and a cheap species of turf was planted. It's no wonder many people constantly struggle with weeds, insects, and drought.

The turfgrass research program at UW-Madison has been investigating ways to maintain healthy grass with fewer inputs for decades. In fact, they've earned a national reputation for leading the way in environmental turfgrass research. Drawing on that wealth of knowledge, two new publications are available at the UW-Extension Learning Store: *Do-it-yourself Alternative Lawn Care* (A3964) and *Organic and Reduced Risk Lawn Care* (A3958). The former is intended for homeowners and the latter for lawn care professionals.

It should come as no surprise to learn that focusing on soil health is the first key to success for alternative lawn care. The best defense against weeds, insects, and diseases is a healthy plant; and healthy plants need a good soil. For new areas, we recommend planting into at least six inches of good topsoil for roots to thrive. If the roots can only explore the top few inches, turf density suffers, weeds encroach, and the lawn goes dormant at the first sign of drought. If you are dealing with an already established lawn on a poor soil, you can core aerate each fall and add compost in the spring and fall each year to slowly build up the root zone.

Another important consideration is grass type. Some grasses are better suited for low-maintenance situations than others. For example, fine and tall fescue do very well with little fertilizer and water. They both are acceptable under shade. However, fine fescue will not tolerate much traffic, or wet, compacted soils. Tall fescue will not tolerate ice cover. Talk with a turfgrass specialist to determine which grass species and cultivars are right for your specific situation. After you have a good soil and the right grass, mowing it properly will ensure its continued success. Mowing is a stressful event for grass, so make sure the mower blades are sharp to minimize injury to the grass blades and try not to mow more than one-third of the grass blade off at any one time. Finally, the grass clippings should be mulched back to the lawn to provide nutrients. Returning grass clippings to the soil is usually equivalent to one or two fertilizer applications.

Speaking of nutrients, fertilizing the lawn can be important to maintain good density. A dense lawn will slow the flow of water across the surface and encourage infiltration into the soil. Also, dense lawns leave few opportunities for weed seeds to find the soil and germinate. Many alternative and organic fertilizers are produced as byproducts of the agricultural industry. One drawback is these products often contain phosphorus, which is usually not required for established lawns – and a good way to increase algae growth in your lake.

Organic or alternative pest control relies on the use of hand-pulling weeds or the use of products with limited efficacy like corn gluten meal for pre-emergent weed control or products containing chelated iron that control (but may not eliminate) many broadleaf weeds. The optimum time to apply corn gluten meal is when soil temperatures reach 55˚F. If you don't have a soil thermometer, it's about the time Forsythia are blooming or when the leaves emerge on the invasive and ubiquitous honeysuckle.

Finally, irrigation may be important during extreme dry spells. While most grasses can survive all but the most extreme droughts by going dormant, weeds can proliferate while the grass is temporarily brown. By keeping the grass green and growing, weed invasion will be minimized. Keep in mind that the deeper and healthier the soil, the longer your turf will stay green during the year.

WATER COLUMN
Published quarterly by the Indiana Clean Lakes Program as a medium for open exchange of information regarding lake and watershed management in Indiana.

Address all correspondence to:
Melissa Clark, Editor
SPEA 445, 1315 E. Tenth Street
Indiana University
Bloomington, IN 47405-1701

E-mail: mlaney@indiana.edu
Phone: (812) 855-6905
FAX: (812) 855-7802

CLEAN LAKES PROGRAM

DNR to Conduct Fish Surveys at 16 Northern Indiana Lakes

DNR fisheries biologists will conduct standard fish surveys at 16 northern Indiana natural lakes this month as part of an annual project to monitor the long-term status and trends of fish populations in the region's lakes.

Lakes to be surveyed are:

Lake	***County***
Indiana Lake	Elkhart
Hill Lake	Kosciusko
McClure Lake	Kosciusko
Waubee Lake	Kosciusko
Adams Lake	LaGrange
Royer Lake	LaGrange
Crooked Lake	Noble
Gordy Lake	Noble
Miller Lake	Noble
Flint Lake	Porter
Riddles Lake	St. Joseph
Arrowhead Lake	Steuben
Hamilton Lake	Steuben
Little Lime Lake	Steuben
Silver Lake	Steuben
Little Cedar Lake	Whitley

During the surveys, biologists will use electrofishing boats, gill nets, and trap nets to capture fish. Each fish will be identified, measured, and released. Scale samples are taken from popular sport fish to determine their growth rate. The surveys are conducted over two days.

"Our sampling gives us a basic picture of the fish species, their number, and their size," said Steve Donabauer, a DNR research biologist who is overseeing the project. "Because the lakes are chosen randomly and represent a variety of lake habitats, we can put together a composite view of how fish populations are changing through time."

Donabauer has already identified some trends based on earlier results. "Since the mid-1980s, we've seen a two-fold increase in the number of 14-inch and greater legal-size largemouth bass and a threefold increase in bluegills greater than 8 inches," he said.

Donabauer thinks the increase in bass numbers is due to larger minimum size limits established in the late 1990s and an increase in catch-and-release fishing. This has led to greater bass predation on bluegills. As a result, fewer bluegills survive but those that do have more food and grow larger.

In contrast, the survey results indicate some fish are declining.

"There has been a subtle decrease in species richness," Donabauer said.

"Our data suggest that the loss of one species from a lake over a 15-year period is the new norm."

Species showing the largest declines are those that Donabauer describes as "cool-water" fish. These are generally found in clean lakes where oxygen is present in deeper, cooler water.

"Northern pike is a good example of a cool-water fish," Donabauer said. "They survive, grow, and reproduce best where water temperatures are less than 73 degrees and at least 3 parts per million of oxygen occur." As lakes age and become nutrient enriched, they can lose their layer of cool-water habitat and stress fish that depend on it.

FISH SURVEY TECHNIQUES

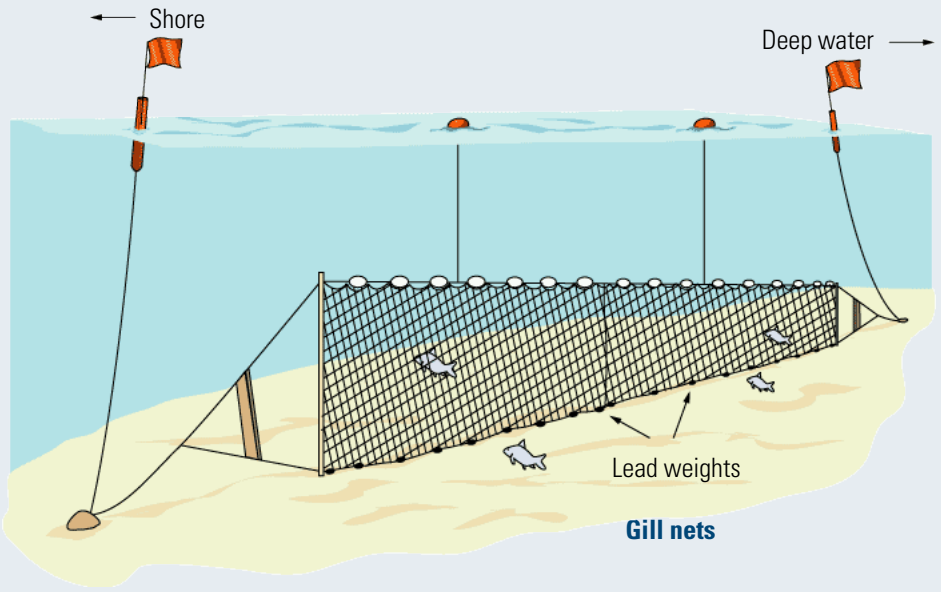
Electrofishing boats: Electrofishing involves generating electrical field that stuns the fish for easier collection for biologist during fish surveys. "Electrofishing relies on two electrodes that deliver current into the water to stun fish. A high-voltage difference causes a current to flow from the anode to the cathode, when a fish encounters a large enough potential gradient on this path, it becomes affected by the electricity. Usually pulsed direct current (DC) is applied, which causes galvanotaxis in the fish. Galvanotaxis is uncontrolled muscular convulsion that results in the fish swimming toward the anode. At least two people are required for an effective electrofishing crew: one to operate the anode, and the other to catch the stunned fish with a dip net" (Wikipedia).

Electrofishing boats

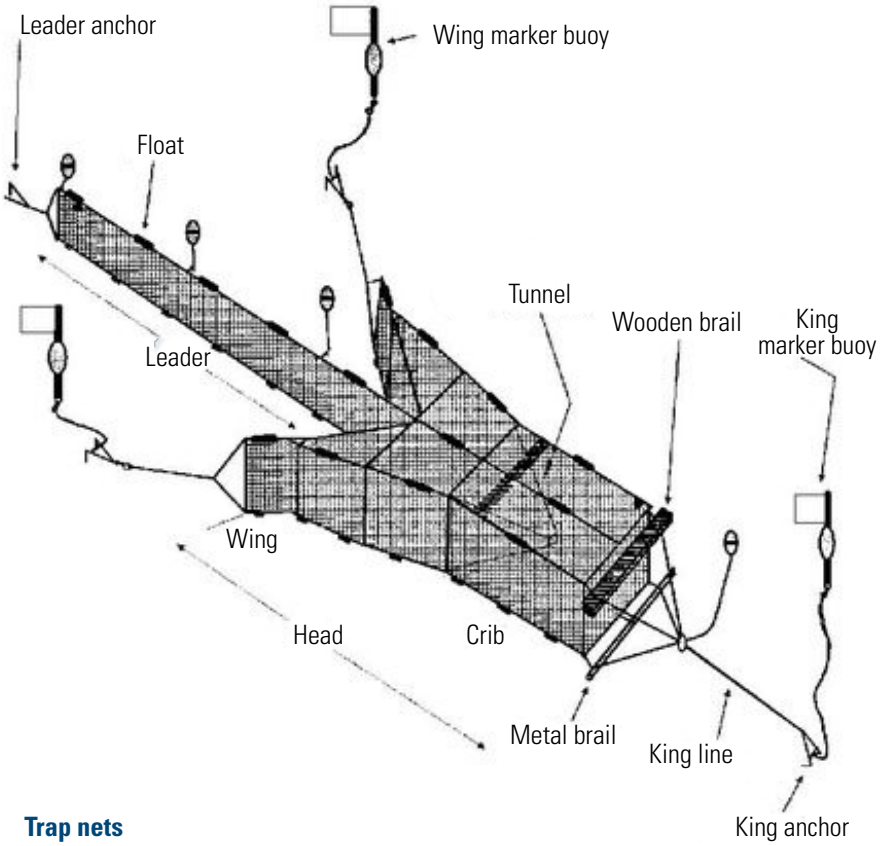
Gill nets: "Gill nets are vertical panels of netting normally set in a straight line. Fish may be caught by gill nets in three ways : (1) wedged – held by the mesh around the body (2) gilled – held by mesh slipping behind the *opercula*, or (3) tangled – held by teeth, spines, maxillaries, or other protrusions without the body penetrating the mesh. Most often fish are gilled. A fish swims into a net and passes only part way through the mesh. When it struggles to free itself, the twine slips behind the gill cover and prevents escape" (Murphy and Willis 1996).

Trap nets: Trap nets sit on the bottom of the lake, generally starting at the edge of the shoreline and angled perpendicular out into deeper waters. Fish encounter the thick and visible mesh and swim down along the long lead and are diverted into the trap or the heart of the trap at the end of the long lead. Before getting into the heart there is a series of tunnel or cone-shaped mesh sections which make it difficult for the fish to escape. Biologist then retrieve the trap from the lake to collect and measure the live fish. Fish can then be returned to the lake.

Since different fish live and occupy various habitats of the lake, one specific survey technique will not sufficiently capture a representation of the whole lake community. Therefore, biologist use a combination of the above techniques. Fish surveys are strictly regulated and monitored for state licensed anglers, so while this information might stir up some exciting fishing adventures, leave it to the professionals!



Gill nets



Trap nets

Pike were found in 40 percent of our lakes in the 1980s. Now that figure has dropped to 30 percent, Donabauer said.

"This is the type of information we get from surveys and is crucial for us to understand what's going on in lakes," Donabauer said. "More important, it serves as a basis for taking corrective management actions and provides a way to measure their success."

For information contact: Jed Pearson, (260) 244-6805, jpearson@dnr.IN.gov.

Aquatic Invasive Monitoring Plant Highlight

This will be the eighth 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 plant identification skills.

Horned pondweed (*Zannichellia palustirs),* NATIVE

Horned pondweed is a common submerged plant that grows all over the world. It is often confused with pondweeds and naiads as many have similar leaf shapes. However, pondweeds have opposite rather than alternate leaves and naiads tend to have more dense short leaves. The most distinct characteristic of the horned pondweed is the fruit which is very different from the other plants. The persistent beak like structure is very distinct.

You can find more information about our Invasive Species Monitoring Program, this plant and many others on the Clean Lakes Program website at **www.indiana.edu/~clp**. If you have a plant that you need identified or have a question about a particular plant please send those to us.

Identification tips

- Slender stems along a rhizome with long narrow leaves
- Leaves alternate along the stem, but sometimes appear to be whorled
- Small flowers produce a flattened fruit with a beak

Volunteer Corner

~ Sarah Powers

Spring is one of my favorite times of the year. The Indiana Lake Management Society's annual conference kicks of the beginning of spring and helps us gear up for spring training and the summer sampling season. The conference allowed us to train new volunteers for the Aquatic Invasive Monitoring program and find more people interested in becoming volunteers.

Spring is always a busy time for us in the Clean Lakes Lab. As we wrap up the school semester and begin the summer sampling season we are always challenged to train new volunteers and a summer crew to sample Indiana's lakes. While we are always busy, this spring has brought a new set of challenges. Due to construction we have relocated our lab for the summer for renovations. Packing the 25 years of accumulated supplies, materials and equipment has taken a great deal of time, but we have now settled in to our new summer home. We will be operating out of the Geological Sciences building this summer and while that will not change anything for the volunteers it has created a few challenges for us. We have overcome many of these challenges and are now in full operation and ready for a busy summer.

As we move from spring to summer in the coming weeks we will be out sampling and hope you will be too. We look forward to all the data we will be receiving in the coming months and encourage our volunteers to get out as often as possible to sample. Whether you are taking Secchi disk readings, collecting chlorophyll and phosphorus samples, or searching for invasive plants please keep us up to date on your progress and use our data entry forms if possible.

We have some great students in the lab this summer working on several projects we hope to share with the volunteer community soon. Look for future announcements online and in the mail! We look forward to a busy and productive summer and hope you do too! Happy sampling!

If you have something you would like to share in the volunteer corner please let us know. This is our primary avenue of information sharing with your volunteer network!

2014 Secchi Dip-in

Volunteers have been submitting information during the annual Dip-In snapshot since 1994.

Please join in the international effort to track changes in water quality.

Any data that you collect from June 28th to July 20th can be submitted to the Secchi Dip-In in addition to your regular data entry with the Clean Lakes Program.

It is a great way to share Indiana's love of lakes with the international lake community.

Perspectives

"Human nature is like the water. It takes the shape of its container."

~ Wallace Stevens