2022 LEBANON COUNTY ENVIROTHON
ELEMENTARY & MIDDLE SCHOOL

AQUATIC OBJECTIVES

TESTING RESOURCES FOR LENTIC HABITATS:

1) Species List (See below)

2) PA FBC Amphibians & Reptiles Book (*ISBN 1-930369-00X*)
Hard copy, new teams should contact the Envirothon Coordinator to obtain a copy (if available)
The entire book has been scanned and is on the LCCD website as 7 PDFs:
https://www.lccd.org/envirothonobjectives/

1. PA AMPHIB & REP-INTRO
2. PA AMPHIB & REP-SALAMANDERS
3. PA AMPHIB & REP-FROGS & TOADS
4. PA AMPHIB & REP-TURTLES & LIZARDS
5. PA AMPHIB & REP-SNAKES (PART 1)
6. PA AMPHIB & REP-SNAKES (PART 2)
7. PA AMPHIB & REP-QUICK REF & GLOSSARY

3) PA Fish Book (Displayed as a gallery on PA Fish & Boat Website)
http://www.fishandboat.com/Fish/PennsylvaniaFishes/GalleryPennsylvaniaFishes/Pages/GalleryPennsylvaniaFishes.aspx

4) Allegheny College Creek Connections: http://sites.allegheny.edu/creekconnections/

Macro Id Game: http://sites.allegheny.edu/creekconnections/classroom-resources/macroinvertebrate-identification-game/

Damselfly Nymph: http://sitesmedia.s3.amazonaws.com/creekconnections/files/2013/12/damselfly.pdf

Dragonfly Nymph: http://sitesmedia.s3.amazonaws.com/creekconnections/files/2013/12/dragonfly.pdf

Fishing Spider: See article below.
Video: https://www.youtube.com/watch?v=CktmhnWnSJI

Leech: http://sitesmedia.s3.amazonaws.com/creekconnections/files/2013/12/leech.pdf

Mosquito Larvae: http://sitesmedia.s3.amazonaws.com/creekconnections/files/2013/12/mosquito.pdf

Water Strider: http://sitesmedia.s3.amazonaws.com/creekconnections/files/2013/12/waterstrider.pdf

5) Stream order:

Herp Sweet Home-The second page of the Herp Sweet Home resource has a stream order map and a detailed description of stream order. (Separate PDF)

6) Boating Safety:

Personal Flotation Devices Brochure **(MS ONLY)** (Separate PDF)

How to Boat Safely Brochure **(MS ONLY)**
https://www.safeboatingcouncil.org/wp-content/uploads/2020/09/boat-safely-national-safe-boating-council-uscg-brochure-web.pdf

7) Lake Stratification and Mixing **(MS ONLY)** (See Below)

8) Bullfrog Call:
http://www.paherps.com/herps/frogs-toads/bullfrog

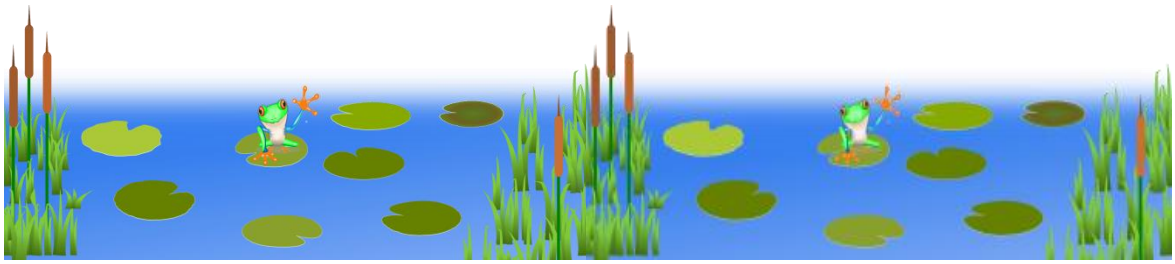
9) Northern Green Frog Call:
http://www.paherps.com/herps/frogs-toads/green_frog

10) Terminology & Concepts (See Below)

SPECIES LIST:

Amphibians/Reptiles (see PA FBC AMPHIB & REP PDFs)	**Fish** (See also, '2022 Fish" PDF)	**Macroinvertebrates** (see individual links above)
Blanding's Turtle	Chain Pickerel http://www.fishandboat.com/Fish/PennsylvaniaFishes/GalleryPennsylvaniaFishes/Pages/PikesandMudminnows.aspx	Damselfly Nymph & Adult
Bullfrog*	Yellow Bullhead Catfish http://www.fishandboat.com/Fish/PennsylvaniaFishes/GalleryPennsylvaniaFishes/Pages/NAmericanCatfishes.aspx	Dragonfly Nymph & Adult
Kirtland's Snake	Brown Bullhead Catfish http://www.fishandboat.com/Fish/PennsylvaniaFishes/GalleryPennsylvaniaFishes/Pages/NAmericanCatfishes.aspx	Fishing Spider (resource provided below)
Map turtle	Bluegill http://www.fishandboat.com/Fish/PennsylvaniaFishes/GalleryPennsylvaniaFishes/Pages/Sunfishes.aspx	Leech
Northern Green frog*	Grass Carp http://www.fishandboat.com/Fish/PennsylvaniaFishes/GalleryPennsylvaniaFishes/Pages/CarpsandMinnows.aspx	Mosquito Larvae & Adult
Northern Water Snake	Common Carp http://www.fishandboat.com/Fish/PennsylvaniaFishes/GalleryPennsylvaniaFishes/Pages/CarpsandMinnows.aspx	Water Strider
*** Must know calls** Calls may be studied at the links provided, the PA Envirothon App, or the PA Envirothon website; http://www.envirothonpa.org/station/aquatic-ecology/		

FOCUS:
- Know the characteristics of lentic systems such as lakes, ponds, and reservoirs.
- Understand the life cycle of a lake.
- Comprehend the differences between the littoral, limnetic, and profundal zones of a lentic system.
- Understand the biology of study species.
- Be able to identify study species by live sample, photo, drawing, or call.
- Grasp the concepts of Lake Stratification and mixing.



2022 LEBANON COUNTY ENVIROTHON

ELEMENTARY & MIDDLE SCHOOL
AQUATIC RESOURCES

TERMINOLOGY AND CONCEPTS

1) **Eutrophication** – the process by which a lake becomes rich in nutrients, which spurs algae growth. This leads to the eventual die-off of the algae, and their decomposition by bacteria. The bacterial decomposition uses up so much of the water's oxygen that fish and other aquatic organisms may suffocate. This may be triggered by pollution; fertilizer run-off, manure, sewage. (Sayre, April Pulley. (1996). Lake and Pond. Brookfield, CT: Twenty-First Century Books.)

2) **Lake Life Cycle** – Lakes are not permanent features of the landscape. Once they form, they start dying right away. They fill in with sediment from rivers and runoff, and the remains of dead animals and plants. Eventually, a lake becomes a plant-filled lake, then a wetland, and eventually dry land. This process of transformation is a form of **succession**. Succession occurs in a fairly orderly sequence. As the lake fills with sediment and decaying plants, plants near shore move inward, toward the center of the lake. They send out roots and shoots to colonize the newly created shallows. The open-water portion of the lake shrinks as the shore plants grow inward and the lake fills. How fast the lake fills depends on many factors, including the amount and kind of sediment flowing into it. The growth and death rates of plants and animals also affects the process, determining how fast dead matter piles up. Succession can happen to a small pond in a century or to a lake in a few thousand years. Siberia's Lake Baikal has existed for twenty-five million years. It is the world's oldest, deepest lake, plunging one (1) mile deep and holding one-fifth of the fresh water on earth. (Sayre, April Pulley. (1996). Lake and Pond. Brookfield, CT: Twenty-First Century Books.)

3) **Lentic** – a calm or slow moving aquatic habitat such as a lake, pond, or reservoir.

4) **Limnetic Zone**- the layer of open water where photosynthesis can occur, supporting plant and animal plankton.

5) **Littoral Zone**- the shallow-water zone in a freshwater lake or pond, with light penetrating to the bottom and supporting rooted plants and bottom-dwelling animals.

6) **Profundal Zone**- the bottom and deep-water area of a freshwater lake beyond light penetration, supporting dark-adapted organisms. In shallow freshwater systems, such as ponds, this zone may be missing.

7) **Vernal Pond** –a small pond that is ephemeral (existing only during the wet spring period and drying up during the summer.)

(Caduto, Michael J. (1990) Pond and Brook: A guide to Nature in Freshwater Environments. Hanover, NH: Prentice-Hall.)

SAMPLE QUESTION:

1) Lakes are not permanent. A lake becomes a plant-filled lake, then a wetland, and eventually dry land. What is this process called?

A. Succession B. Lake formation C. Lake destruction

Fish-Eating Spiders Can Catch Prey 5 Times Their Size

These semiaquatic spiders are found on every continent except Antarctica.

By **Katie Langin**, National Geographic

PUBLISHED JUNE 18, 2014

A fishing spider in French Guiana clutches its prey.

PHOTOGRAPH BY INGO ARNDT, NATURE PICTURE LIBRARY/CORBIS

It isn't easy being a little fish. Predators dart at them underwater. Humans try to snare them with hooks. And other species—more than we'd thought, it turns out—can pounce on them from above.

According to a new study, spiders in 8 of the world's 109 arachnid families can catch and consume small fish. Some of them can even subdue fish five times heavier than they are.

These arachnids are nearly everywhere. The study, published June 18 in the journal *PLOS ONE*, says fish-eating spiders can be found on every continent except Antarctica. They're especially prevalent in warm, oxygen-depleted bodies of water like the wetlands of Florida, where fish are more likely to come to the surface in search of oxygen-rich water.

At least 18 species have now been observed catching fish, including six-spotted fishing spiders (*Dolomedes triton*) in the United States, pond wolf spiders (*Pardosa peudoannulata*) in India, and great raft spiders (*Dolomedes plantarius*) in the United Kingdom.

These findings were pieced together by Martin Nyffeler at the University of Basel, Switzerland, and Bradley Pusey at the University of Western Australia in Albany. The two biologists first searched for published reports and Internet posts documenting spiders eating fish. What they found—89 records in total, half of which hadn't been published in the scientific literature previously—allowed them to paint a more complete picture of this unusual behavior.

"Fish predation by spiders has always been seen as a bit of an oddity," said Marie Herberstein, an expert on spider behavior at Macquarie University in Sydney, Australia, who was not involved in the study. "But the review makes a compelling argument that it is widespread, both taxonomically as well as geographically. This was certainly a surprise."

How It's Done

Fish-eating spiders live in freshwater environments like ponds and wetlands, where they hunt for meals on foot instead of using a web. Some can even swim, dive, and walk on the water's surface (see video below).

These semiaquatic spiders "anchor their hind legs to a stone or a plant, with their front legs resting on the surface of the water," the authors write. Then the arachnids wait to ambush their prey. The slightest ripple in the water, or anything that touches the spiders' outstretched legs, can trigger an attack.

That's because fish-eating spiders are generalist predators—they'll go for nearly anything that moves. Most of the time, that means their meals are insects that have fallen into the water. But occasionally they purposely attack larger animals like fish.

And they're well equipped to eat them, with mouths that can pierce flesh. They use those mighty maws to inject a lethal venom packed with powerful neurotoxins—chemicals that attack the nervous system—into their fish prey.

When the fish is dead, the spiders haul it to dry ground and administer chemicals that liquify its body tissues, making the meal easier to eat.

Outsize Accomplishment

In the animal world, the average predator is 42 times larger than the prey it's trying to subdue. Some fish-eating spiders, however, are actually smaller than their prey. (Watch videos of spiders catching bats, frogs, and mice.)

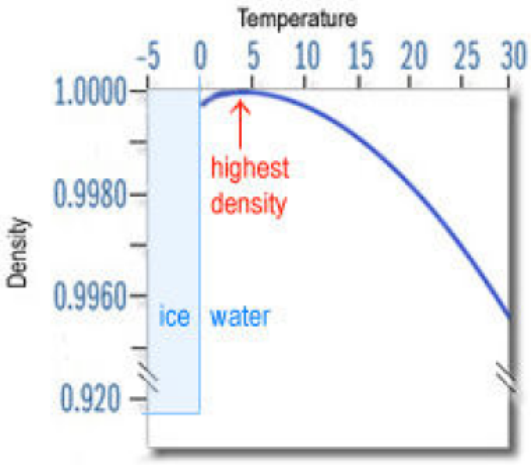
The authors speculate, for instance, that a giant fishing spider—weighing in at 7 grams (0.4 ounces)—would be capable of catching a 30-gram (1 ounce) fish.

Such supersize food sources could be critically important for females in the process of producing eggs, or for spiders that don't have access to enough insect meals.

One thing is for sure: It's more bad news for little fish.

MS ONLY:

Lake Stratification and Mixing

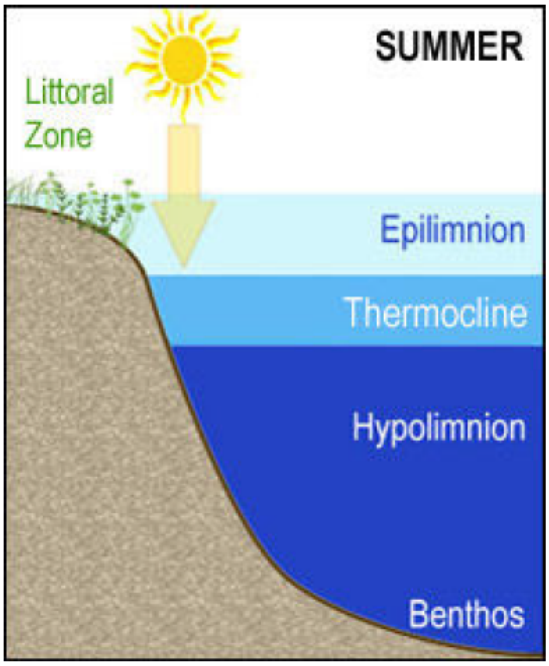


Water is most dense at 3.98 degrees celsius and gets less dense as it cools or warms.

WATER

To understand lake stratification, we first must address the relationship between water density and temperature. Water is unique in that it is denser as a liquid than a solid; therefore, ice floats.

Water is most dense at 39 degrees Fahrenheit. The denser water is heavier and will be at the bottom of a lake while the less dense water is lighter and will generally be at the top of the lake.

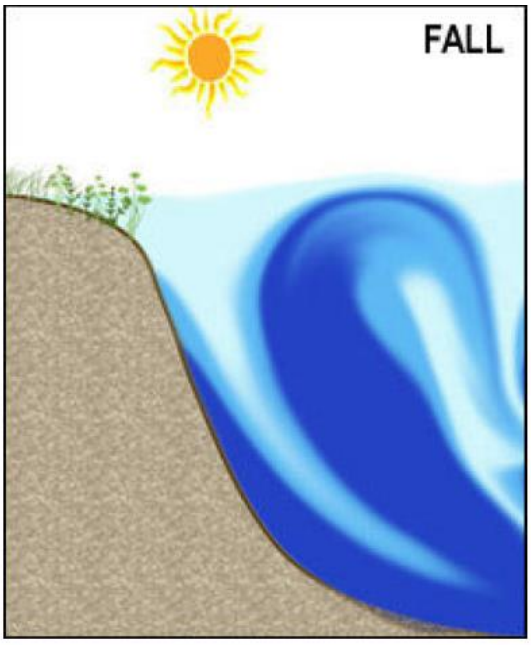


SUMMER STRATIFICATION

In the summer, the sun heats the top layer of a lake, the epilimnion, which causes it to become less dense. The bottom layer of the lake, the hypolimnion, does not receive sunlight and therefore remains cold. Since the epilimnion is less dense, it floats on top of the hypolimnion and the two do not mix. The thermocline is the dividing area between the top and bottom layers.

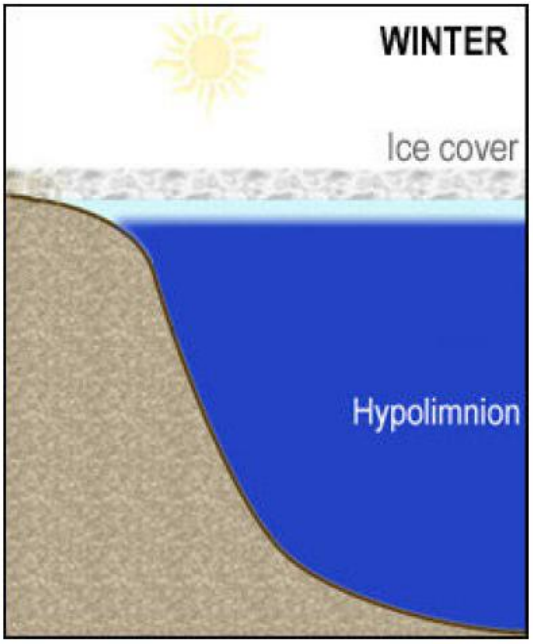
Since the epilimnion is the only part of the lake that sunlight can go through, it is where plants and algae grow. Around the shoreline of a lake, the area where sunlight goes through and vascular plants grow is called the littoral zone. In the middle of the lake, the epilimnion is home to algae and zooplankton.

When algae and zooplankton die, they sink to the bottom of the lake. Invertebrates and microbes living in the benthos recycle and decompose this dead material. This recycling process uses up oxygen. Since the lake does not mix during the summer, the hypolimnion is completely cut off from the epilimnion and does not receive a fresh supply of oxygen.



FALL MIXING

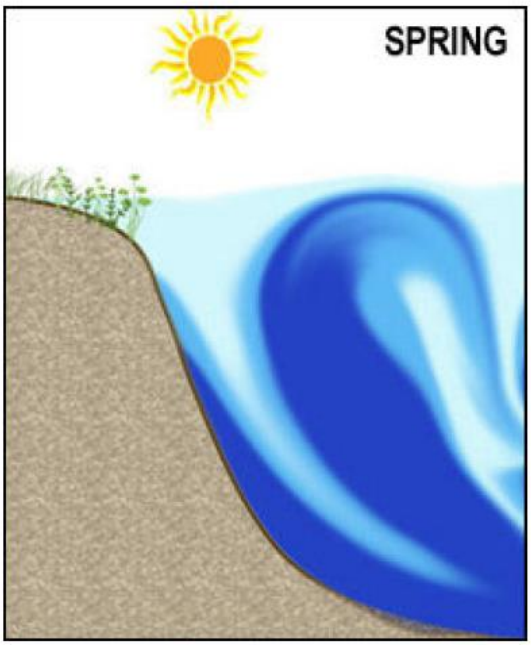
In the fall, the sunlight is not as strong and the nights become cooler. This change in season allows the epilimnion to cool off. As the water in the epilimnion cools, the density difference between the epilimnion and hypolimnion is not as great. Wind can then mix the layers. In addition, when the epilimnion cools it becomes denser and sinks to the hypolimnion, mixing the layers. This mixing allows oxygen and nutrients to be distributed across the whole lake.



WINTER STRATIFICATION

In the winter, lakes may be covered with ice. Under the ice, the water cannot mix because it is not exposed to wind. Most of the hypolimnion remains near 39 Fahrenheit. There is a thin layer of water under the ice that is colder than 39 Fahrenheit and therefore less dense. This thin layer of water floats on top of the hypolimnion throughout the winter, but this stratification is not quite as stable as in the summer because the density difference is much smaller.

As in the summer, the hypolimnion is cut off from oxygen, so as decomposition takes place in the benthos, oxygen gets used up.



SPRING MIXING

In the spring, the ice melts off the lake, the wind picks up and the lake mixes again. This is called spring turnover. Oxygen and nutrients get distributed throughout the water column as the water mixes. Then, as the weather becomes warmer, the surface water warms again and sets up summer stratification.