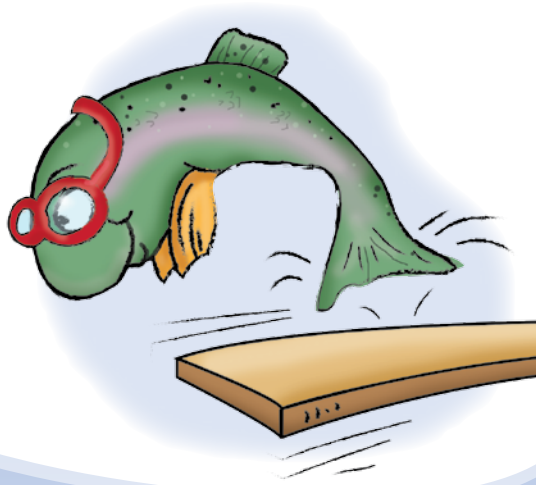
PLAY
Spring 2018
Pennsylvania • League • of • Angling • Youth

Water Water
Read All About It



Aquatic animals are not much different from other animals when it comes to survival. They have several basic needs and one of them is water. It protects organs and tissues. It regulates temperature. It dissolves and carries nutrients and oxygen to cells. It even flushes waste.

Aquatic critters live in the water. Anything that affects the water will affect them, so the quality of the water is important.

Understanding **water quality** will also make you a better angler.

Vocabulary *(Watch for these words!)*

- **Acid rain** - rainfall made acidic by atmospheric pollution, caused by burning of fossil fuels
- **Alkalinity** - measure of water's ability to resist a decrease in pH, also known as buffering capacity
- **Carbonates** - come from limestone and other rocks that contain calcium carbonate ($CaCO_3$) and that dissolve in water
- **Dissolved oxygen** - measure of how much oxygen is dissolved in the water
- **Organic matter** - debris from once living plants and animals
- **Water quality** - the healthiness and cleanliness of the water
- **pH** - measure of the water's acidity
- **Plankton -** microscopic plants (algae) and animals that drift in the water
- **Turbidity** - measure of how cloudy the water is depending upon suspended particles
- **Saturation** - when water dissolves all the oxygen it is capable of holding at a given temperature

Water Temperature

Water temperature affects the amount of oxygen that can dissolve in the water. It also affects the metabolism, reproduction and life cycle of an aquatic animal.

Different fish may need different water temperatures to stay healthy. Fish can be put into groups based on their preferences. Trout need cold water to survive. Sunfish prefer warmer water to reproduce.

If you want to catch a Brook Trout, travel to a stream on a shady forest mountainside. If you would rather catch a Bluegill, head to a local farm pond.

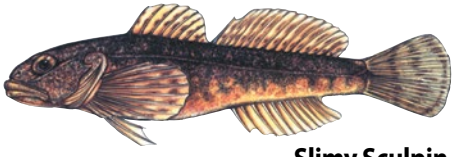
Temperature and Fish Communities

COLDWATER FISH

Fish that require water temperature **less than 70 degrees F** to grow and reproduce

Brook Trout
(Salvelinus fontinalis)

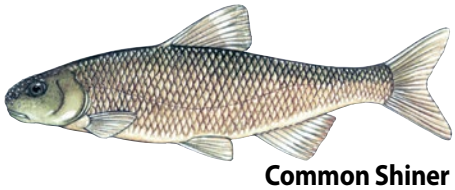
Blacknose Dace
(*Rhinichthys atratulus)*



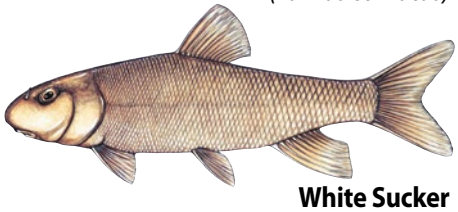
Slimy Sculpin
(Cottus cognatus)

COOLWATER FISH

Fish that require water temperatures **higher than 65 degrees F but less than 70 degrees F** to grow and reproduce



Common Shiner
(Luxilus cornutus)



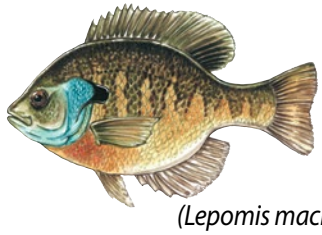
White Sucker
(Catostomus commersonii)

Smallmouth Bass
(Micropterus dolomieu)

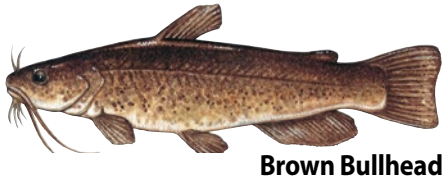
WARMWATER FISH

Fish that require water temperature **higher than 75 degrees F** to grow and reproduce

Largemouth Bass
(Micropterus salmoides)



Bluegill
(Lepomis macrochirus)



Brown Bullhead
(Ameiurus nebulosus)

Dissolved Oxygen

Some aquatic animals such as fish must use gills to absorb oxygen from the water around them. That oxygen is dissolved in the water. The amount of **dissolved oxygen** depends on many factors like temperature, turbidity, agitation and **organic matter**. Microorganisms consume oxygen when decomposing organic matter. Colder water holds more oxygen and warmer water holds less oxygen.

Pennsylvania Fish & Boat Commission (PFBC) Fisheries Biologist Steve Kepler (retired) taking water quality measurements in a stream with a handheld multiparameter meter.

Biologists measure the amount of oxygen dissolved in the water as milligrams per liter (mg/l).

See the chart below to get an idea of how temperature affects the maximum amount of oxygen that can be dissolved in the water. This amount is called **saturation**.

Dissolved Oxygen Concentration at 100% Saturation

Water Temperature (°C)	Dissolved Oxygen (mg/l)
1 (or 34°F)	14.2
10 (or 50°F)	11.3
20 (or 68°F)	9.2
30 (or 86°F)	7.7

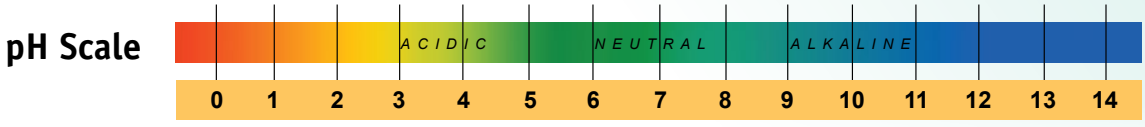
What does it mean?

Warmwater fish, like catfish, can tolerate living in water that has less oxygen. Coldwater fish, like trout, require more oxygen.

pH

You may have learned about pH at school or elsewhere. You also know water is H_2O. Did you know that H_2O = H+ + OH? **pH** measures the acidity or H+ part of that equation. An acid will have more H+ than OH. A base will have more OH than H+. A neutral solution has equal amounts of each part.

Scientists measure pH on a scale from 1 to 14. Each level on the scale changes by ten times. Check out the comparisons below. **Acid rain** is ten times more acidic than natural rain.



pH of Different Solutions

Lemon juice	2.0
Soft drink	3.0
Acid rain	5.0
Natural rain	6.0
Pure water	7.0
Baking soda	8.0
Toothpaste	10
Bleach	13.0

Why does it matter?

Low pH affects how substances dissolve in water. Some substances may be toxic to aquatic life. If metals like aluminum are released into the water, it harms the gills of fish. Low pH can also affect the reproduction of some aquatic animals.

Tolerant ranges for certain species

Mayfly	5.5 to 7.5	Brown Trout	5.0 to 9.5	Common Carp	5.0 to 9.0
Caddisfly	5.5 to 7.5	Brook Trout	4.5 to 7.5	Channel Catfish	5.0 to 10.0
Stonefly	5.5 to 7.5	Yellow Perch	4.5 to 7.5	American Bullfrog	4.5 to 7.5
Snails, Clams, Mussels	6.0 to 9.0	Smallmouth Bass	5.5 to 7.5	Wood Frog	4.0 to 7.5
Crayfish	5.5 to 7.5	Pumpkinseed	5.0 to 7.5	Eastern American Toad	4.5 to 7.5
Rainbow Trout	5.5 to 9.5	Fathead Minnow	6.0 to 7.5	Spotted Salamander	5.0 to 9.5

Alkalinity

Did you ever get an upset stomach? It happens when your stomach releases too much acid during digestion. One cure is an antacid tablet. An antacid tablet reduces the acidity and settles things down. Water can also become too acidic from things like acid precipitation or acid drainage from an old mine.

The **alkalinity** of water is its ability to resist a decrease in pH. It is known as buffering capacity. It measures the amount of **carbonates** in the water. Carbonates come from limestone and other rocks. Carbonates are the same as that antacid tablet in your stomach. They reduce the acidity of the water.

Why does it matter?

Water in an area with limestone will have a better buffering capacity to resist acid rain. These waterways are known as "limestone streams."

Water in other areas may have a low pH if there is no limestone around. These waterways are known as "freestone streams."

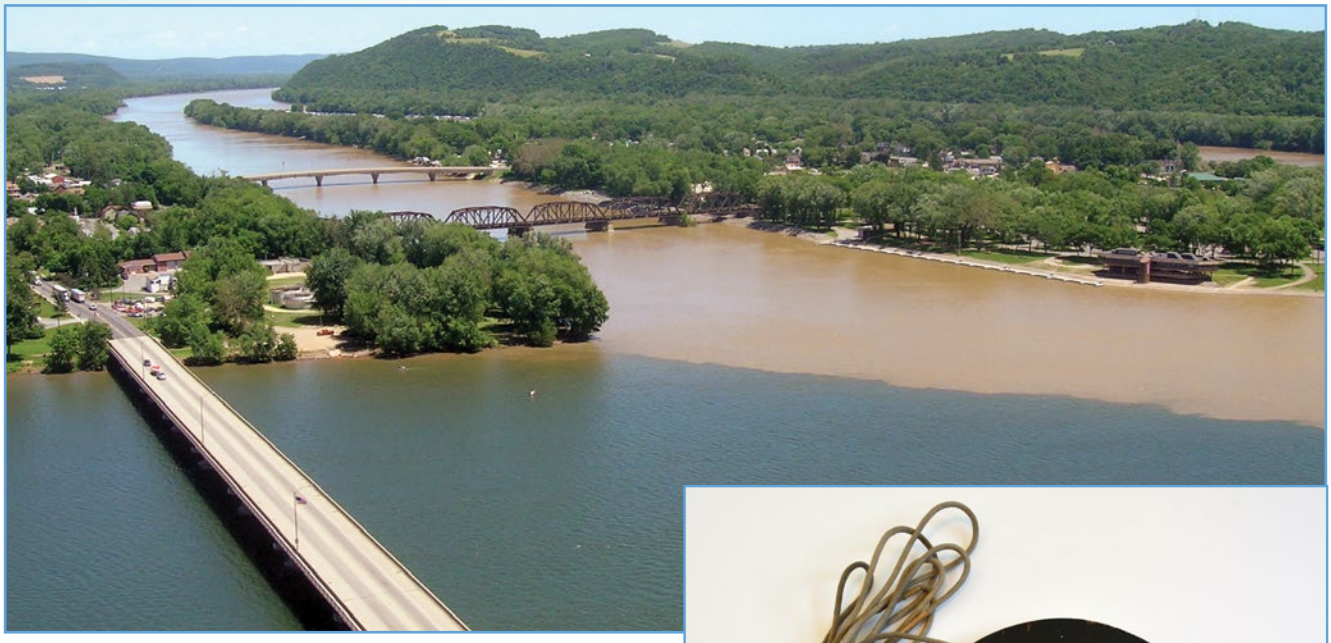
Former PFBC employee Sue Herzing taking a water sample from a lake.

Alkalinity (Calcium carbonate:) $CaCO_3$	
Freestone Streams	**Limestone Streams**
10 mg/l or less: Very sensitive to acid precipitation	75 mg/l or greater
10-20 mg/l: Somewhat sensitive to acid precipitation	
20 mg/l or greater: Not sensitive to acid precipitation	

WCO Vance Dunbar taking a water sample to test the water quality of a stream.

Turbidity and Transparency

You may have noticed that some streams are clear while others seem murky. Water carries particles like sand, silt, clay, **plankton** and pollution. The cloudy look from these particles and plankton is called **turbidity**. The clarity and how much light passes through is called transparency.



Clear and turbid branches of the Susquehanna River

Scientists have special tools to measure turbidity or transparency. A Secchi disk is one tool used in deep, slow-moving water. The depth when it becomes invisible is the Secchi depth. Shallow depth means unclear water, deeper depth means clearer water.

Secchi disk

Why does it matter?

Too many particles make it hard for fish to find food and avoid predators. Particles can block sunlight and affect plant growth. Also, particles absorb heat and increase water temperature. High turbidity can indicate pollution, because pollutants and bacteria can attach to particles.

Water Quality Word Search

C Y W L N H I D V Z K V R P A P
F M C C E N O T S E E R F K L A
J C G N C N X N N C N T U N I W
D W A Z E H O N I W A T E R R E
N L B R P R K P V L R U X F R E
O O J A B J A V N L Z P C U C N
T F S L S O A P I A A C T W O O
K H C K N E N I S Q G A M A M T
N O B A T R L A K N R P G Y M S
A I V L X X V N T E A A E V U E
L K I I K A E W P E C R P D N M
P K H N I A L M L I S E T E I I
W Q C I T Z E J D W X K S S T L
G H C T X T O U S O J M P O Y A
T A E Y Y N S J J O X Y G E N M
X N S Q B W P Y T I D I B R U T

Word List

ACID
ALKALINITY
BASE
CARBONATES
FREESTONE
LIMESTONE
OXYGEN
PH
PLANKTON
SECCHI
TEMPERATURE
TURBIDITY
TRANSPARENCY
WATER

*(**Hint:** Some words may appear backwards.)*

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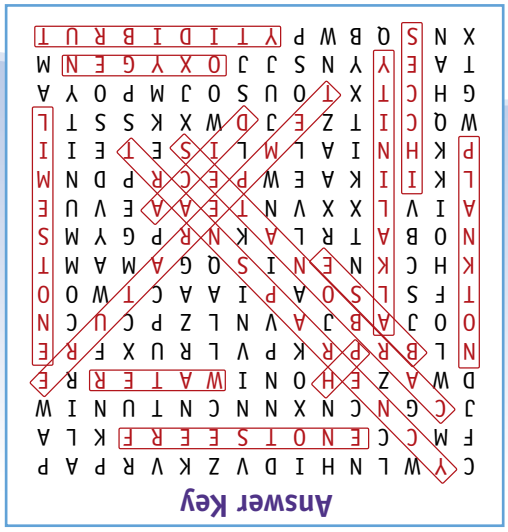

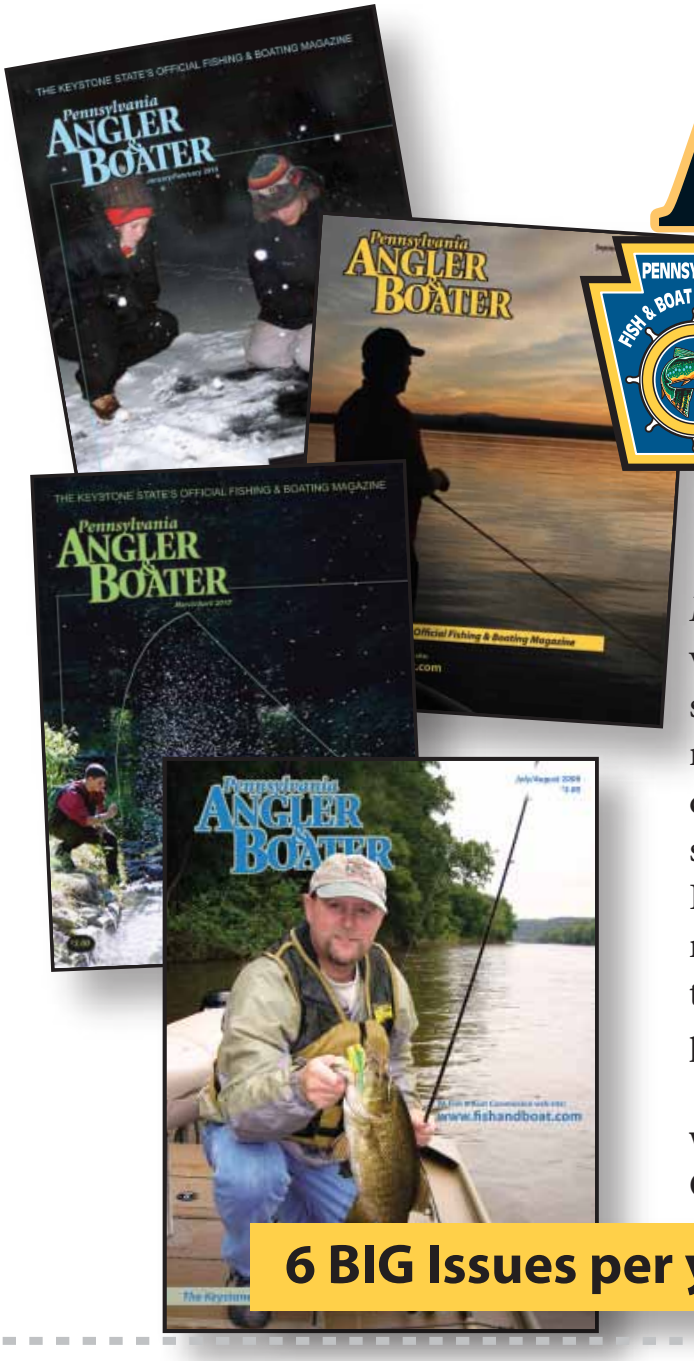

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