

Hydrology - An Explanation of Whitewater

A journey through the New River Gorge is a journey through time that began over 300 million years ago. That's when the youngest rocks of the gorge were formed and water and erosion began to carve this thousand-foot canyon. Considered one of the oldest rivers in the world, it makes an ideal "classroom" for exploring first-hand how the waters on our planet cycle through the environment and sustain life as we know it.

As part of this full-day hydrology study, students will raft the New River Gorge, a section appropriate to their age range. In this floating classroom, students will learn about how water, the landscape and human activity are interconnected. They will explore why water is a precious resource and how they can become part of the solution to its preservation by participating in a stream survey.

Objectives/Understandings:

- Review the water cycle and understand why water is a precious resource
- Understand what a watershed is and how human activity affects water resources
- Learn how the New River Gorge was formed
- Learn the names of water features and how they are created
- Practice debating skills by discussing river damming from the perspective of different users and their needs
- Explore prehistoric life by hunting for and observing fossils

Essential Questions/Guiding Questions:

- How do humans affect water resources?
- How does water affect all other parts of an ecosystem?
- Why should we use water wisely?
- How can we tell if a water source is healthy?

Activity Descriptions

Drop in the Bucket – A Project Wet activity demonstrating that of all the water on the planet, only .01% of it is potable (drinkable).

Water Cycle Dramatization – Students will review the water cycle by playing roles in a narrated drama.

River Anatomy – An active game where students learn the parts of the river including rapids, hydraulics, strainers and other river features.

White water Rafting – Students will raft the New River (section determined by age of participants) while learning about how water helps form the landscape and watersheds.

Watersheds & the New River – As students descend through the New River Gorge, they will learn what makes a watershed and what part this river plays in its local drainage system.

To Dam or Not to Dam – A Project Wild Aquatic activity where students practice their debating skills using the topic of dams and water use.

Activity Descriptions (continued)

Macro Mayhem – A high energy game where students become the macroinvertebrates they are studying in order to grasp the concept of how living organisms can indicate the health of an ecosystem.

Water Quality Survey – Students will have the opportunity to positively affect water resources and practice using the scientific method water survey that will be submitted to the Department of Environmental Protection (DEP).

Background

A Time to Fish

Spring and fall are the best times of the year to fish the New River. During these seasons, water temperatures are in transition between cold winter temperatures and warm summer temperatures. Most fish species are more active in cooler water and are more aggressively feeding during the spring and fall.

The best times of the day to fish are early morning and late evening. Most fish prey is much more active at these times; therefore, more fish are out feeding. Some species of fish feed at night, providing anglers an opportunity for night fishing.

Source: West Virginia DNR

What is Watershed?

A watershed is an area of land which drains (sheds) water into a stream or river. It is also known as a drainage basin. The system of streams that transports water, sediment and other materials from a watershed is called a drainage system. A watershed catches water that falls to the earth as precipitation; a drainage system channels the water and substances it carries to a common outlet.

The watershed is the drainage basin of a river; the area through which all waters flow from their highest source before draining naturally to the sea. In the broader ecological sense, the term watershed includes not only the land and water but the mountains and forest, floodplains and valleys, as well as the communities of plants, animals and people who live there.

A watershed is "that area of land . . . within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of the community," John Wesley Powell.

Watersheds come in all sizes and shapes depending the topography or lay of the land. Each stream or river comprises a watershed (drainage basin) and is separated from other drainage basins by divides. Divides are the highest topographical points surrounding a stream or river causing water to drain into one stream or another. In every watershed, small streams flow into larger streams, which flow into river, lakes, and bays. Smaller streams are tributaries of a larger mainstream river and each is a sub-watershed of a larger watershed. For example, Piney and Glade creeks and the Greenbrier and Bluestone rivers are tributaries of the New River. They are also sub-watersheds of the New River watershed.

Hydrologic Cycle

Water is always on the move through the environment. The hydrologic cycle (water cycle) transports water between earth's watersheds, atmosphere and oceans. Rain falls upon the land and either runs off or soaks into the earth.

Background (continued)

Hydrologic Cycle (continued)

Some of the rainwater is used by plants and animals in their life processes, some is used by humans, and some seeps underground to be stored or to reappear at another place to feed streams and rivers. Much of it goes back into the atmosphere through evaporation and transpiration. Clouds form and, when conditions are ripe, the water is released to earth again in the form of rain or snow.

The water cycle plays an important role in resupplying water to a watershed. It is the water cycle at work through evaporation, transpiration and precipitation that gives us the seemingly endless supply of water flowing within the New River and the New River watershed.

People and Watersheds

Every person on Earth lives within a watershed. A watershed is our home; it is where we are born and raised, where we learn and grow, and where we work and play. Our watershed contains mountains and plateaus, valleys and gorges, forests and wildlife, as well as our yard or farm and our neighbor's woodlot.

Within our watershed we are connected to everything and everybody. It is the watershed, itself, that connects us to one another. What we do and how we treat our watershed impacts the watershed and effect things downstream. Our daily activities can have a negative impact on the quality and quantity of water available to us and other living creatures for survival.

As water is shed off the land, the soil and plants collect large amounts of water. This process prevents flooding and makes more fresh water available by slowing its flow and allowing it to seep underground. When watershed lands are stripped of vegetation or replaced with concrete or houses, the watershed can no longer function to prevent floods and replenish the freshwater supply.

Water moving through the hydrologic cycle picks up pollutants left behind by our activities. In the atmosphere pollutants from factory smokestacks, car exhaust and wood smoke are picked up as water vapor condenses and falls back to earth as acid rain. Rainwater runoff picks up surface pollutants from farms, streets and roadways, lawns and gardens, etc. Chemical spills, leaky landfills, and illegal dumps pollute water as it moves through the ground and re-surfaces in springs and streams.

Many watersheds have been altered as a result of human needs for water, food, recreation, transportation, manufactured goods, etc. These growing demands have led to unwise land uses within watersheds that have degraded water quality in our streams and rivers. Diking, damming and straightening of streams is done for flood control; streams are put into underground pipes to make more land available for homes, malls and roads; streams are polluted by dumping storm water runoff and factory and sewage treatment plant discharges.

Everyone living in a watershed relies on the natural resources of the watershed to exist. All life forms (plants, animals, and humans) depend on water within the watershed they live in for survival.

A healthy watershed is vital for a healthy environment and economy. People must take a "watershed approach" to managing natural resources. This implies a way of looking at things as a whole, of seeing people and not just the trees but the forest, not just the river but all that creates and diminishes its flow. Therefore, maintaining the water quality of a watershed is essential to maintaining life on earth.

Background (continued)

New River Watershed

The New River watershed covers a portion of three states – North Carolina, Virginia, and West Virginia. With its headwaters beginning on the western slopes of the Blue Ridge Mountains in North Carolina, the New River flows approximately 320 miles to the north. Along the way, many creeks, streams, and smaller rivers empty into the New River. These tributaries and the New River make up the drainage basin of the New River watershed.

The watershed encompasses an area of 6,964.6 square miles or approximately 4,457,369.5 acres. This is an area five and a half times larger than the state of Rhode Island, 3.4 times larger than Delaware, and 1.4 times larger than the state of Connecticut. There is approximately 9,000 miles of streams and rivers in the New River watershed. A total of 114 ponds and lakes, covering approximately 11,3289 acres of land, are within the watershed.

There are more than 165 cities, towns, and communities within the watershed. Towns with a population of 5,000-10,000 include Galax, Pulaski, and Wytheville, Virginia, and Oak Hill and Princeton, West Virginia. Boone, North Carolina, Radford and Christiansburg, Virginia, and Bluefield and Beckley, West Virginia, have populations of between 10,000-20,000. The city of Blacksburg, Virginia, has a population of over 30,000. There are two forks of the New River in North Carolina, the south fork bubbles from the ground near the community of Blowing Rock. The north fork of the New River begins along the North Carolina/Tennessee state line near Trade, Tennessee. Both the north and south forks meander through a rural mountain farm setting. At the North Carolina/Virginia border, the two forks join and continue a northeasterly flow across the valley of Virginia. North of Pulaski, Virginia, the river has cut several gaps through the ridge and valley province of the Appalachian Mountain region.

At the West Virginia/Virginia state line, the New River leaves the mountains behind and enters the Allegheny Plateau. Over time, the New River and its tributaries in West Virginia carved the landscape of the Allegheny Plateau into the deep meandering gorges as we see today. The New River watershed is a sub-watershed to a much larger drainage system. At Gauley Bridge, West Virginia, the New River joins with the Gauley River to form the Kanawha River, which flows into the Ohio River. At this point, Pt. Pleasant, West Virginia, the New River watershed becomes part of the Ohio River watershed. Eventually the Ohio River empties into the Mississippi River and the New River watershed becomes a part of the Mississippi River watershed, which empties into the Gulf of Mexico.

1. Firehock, Karen. **Hands On Save Our Streams: The Save Our Stream Teacher's Manual**. Gaithersburg, MD: The Izaak Walton League of America, 1994.
2. Murdoch, Tom, Martha Cheo, and Kate O'Laughin. **Streamkeeper's Field Guide**. Everett, WV: The Adopt-A Stream Foundation, 1996.
3. **Watershed**. the TERRA (Toward Ecological Recovery & Regional Alliance) Bulletin, Thailand, July 1995.
4. **Water Cycle and Water Supply**. Washington, DC: U.S. Department of Agriculture, Forest Service, July 1967.
5. **Environmental Action: Water Conservation**. Menlo Park, CA: The Tides Center/E2: Environment and Education, 1998.
6. **Adopt-A-Salmon Family: A Watershed Education Program for Middle School Students**. U.S. Fish and Wildlife Service.

Background (continued)

The State of the Lower New Watershed

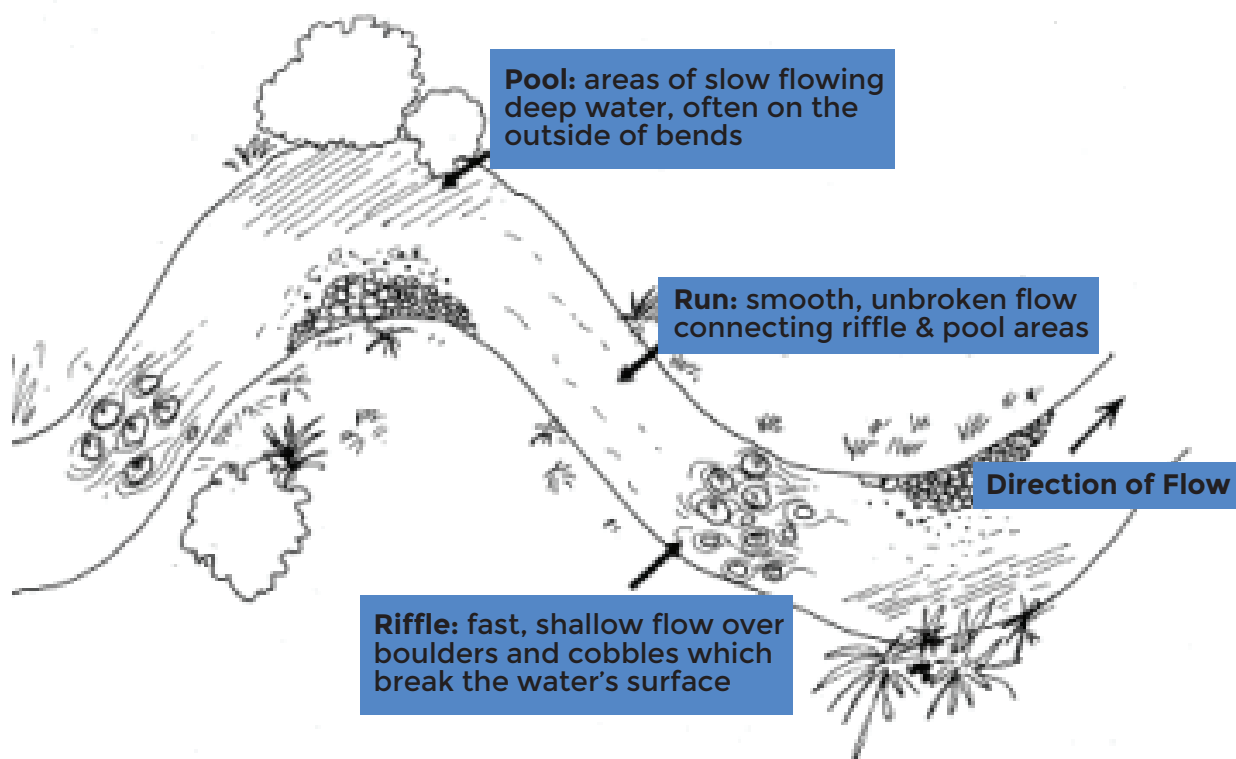
See the report below for information about the state of the Lower New River Watershed. (The Executive Summary on page 6 is a good place to start).

http://www.npca.org/assets/pdf/NewRiverState_ScreenView_Full.pdf

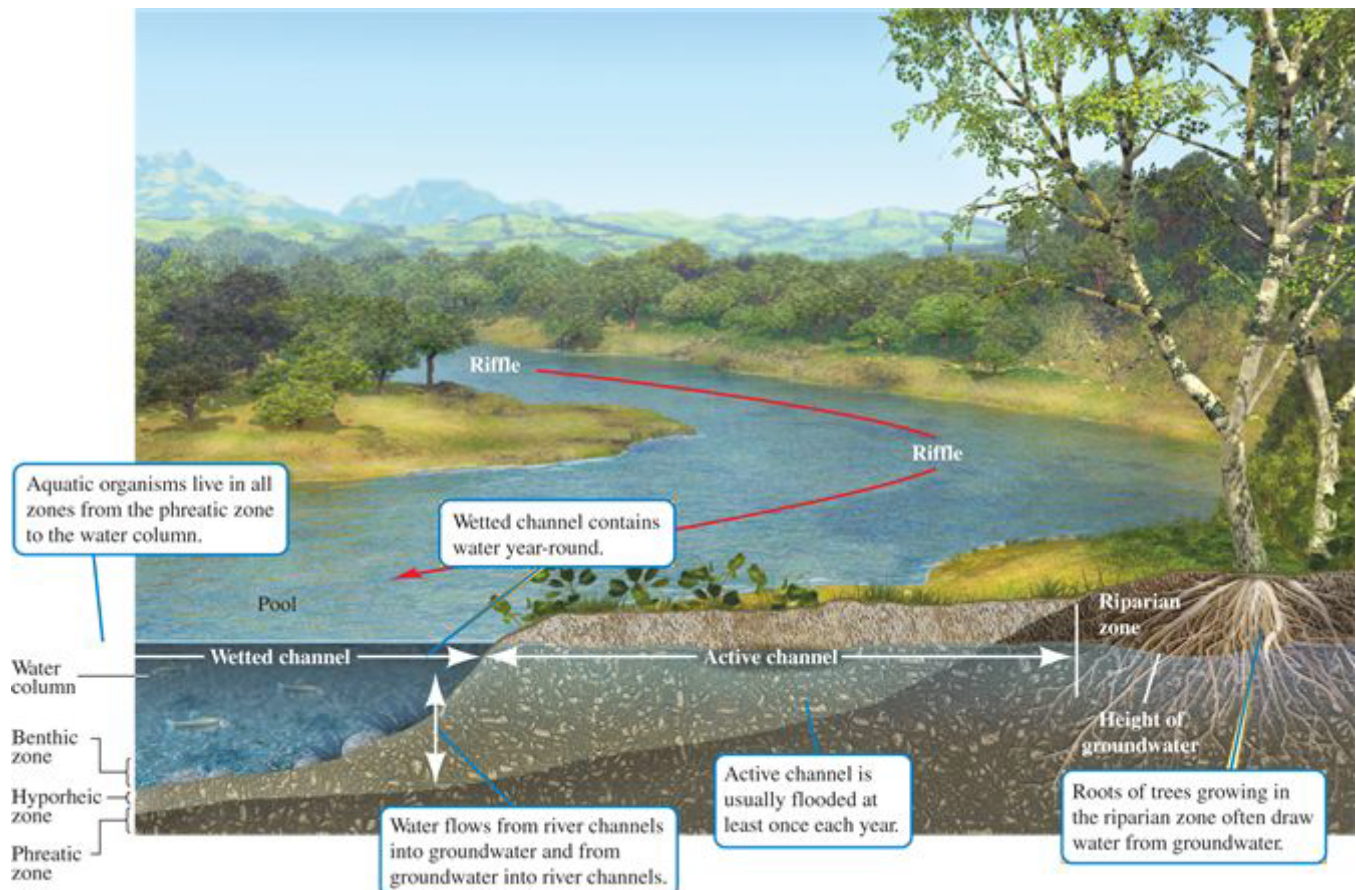
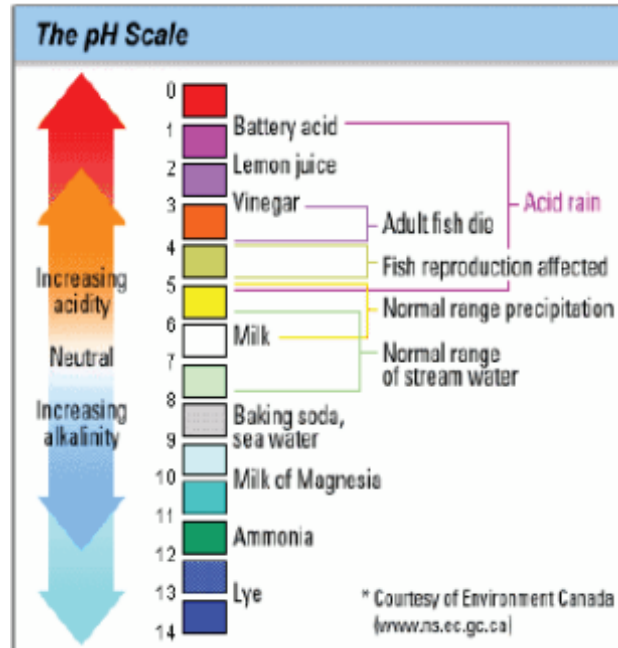
Stream Survey Information

All images in this section were pulled from "West Virginia Save Our Streams Program Level-One Standard Operating Procedures Manual" (see link below) unless otherwise cited.

<http://www.dep.wv.gov/WWE/getinvolved/sos/Documents/SOPs/LevelOneSOPs.pdf>



Stream Survey Information (continued)



S.T.E.M. Lesson Plan

Hydrology

Stream Survey Information (continued)



Paddlefish	
Northern Pike, <i>Esox lucius</i>	O,P
Muskellunge, <i>Esox masquinongy</i>	O,N,P
Chain Pickerel, <i>Esox niger</i>	O,N,P
Hybrid Tiger Musky, <i>Esox lucius</i> x <i>E. masquinongy</i>	O,N,P
UMBRIDAE-Mudminnows	
Central Mudminnow, <i>Umbra limi</i>	O
SALMONIDAE-TROUTS	
Gulthroat Trout, <i>Oncorhynchus clarki</i>	P
Rainbow Trout, <i>Oncorhynchus mykiss</i>	O,N,J,P
Brown Trout, <i>Salmo trutta</i>	O,N,J,P
Brook Trout, <i>Salvelinus fontinalis</i>	O,N,J,P
PERCOPSIDAE-TROUT-perches	
Trout-Perch, <i>Percaopsis omiscomaycus</i>	O
FUNDULIDAE-Killifishes	
Northern Studfish, <i>Fundulus cataractus</i>	O
Banded Killifish*, <i>Fundulus diaphanus</i>	O,P
Mummichog, <i>Fundulus heteroclitus</i>	O,P
POECILIIDAE-Livebearers	
Western Mosquitofish, <i>Gambusia affinis</i>	O,N,P
ATHERINIDAE-Silversides	
Brook Silverside, <i>Labidesthes sicculus</i>	O,N,P
GASTEROSTEIDAE-Sticklebacks	
Brook Stickleback, <i>Culaea inconstans</i>	O
COTTIDAE-Sculpins	
Mottled Sculpin, <i>Cottus bairdii</i>	O,N,J
Blue Ridge Sculpin, <i>Cottus caeruleonigritum</i>	P,J
Slimy Sculpin*, <i>Cottus cognatus</i>	P
Potomac Sculpin, <i>Cottus gyrinus</i>	P
Kanawha Sculpin*, <i>Cottus kanawhae</i>	N
Bluestone Sculpin, <i>Cottus</i>	
PERCICHTHYIDAE-Temperate Basses(3,1)	
White Perch, <i>Morone americana</i>	O
White Bass, <i>Morone chrysops</i>	O,N
Striped Bass, <i>Morone saxatilis</i>	O,N

Hybrid Striped Bass <i>Morone chrysops</i> x <i>M. saxatilis</i>		O
CENTRARCHIDAE-Sunfishes		
(14)		
Rock Bass, <i>Ambloplites rupestris</i>	O,N,J,P	
Redbreast Sunfish, <i>Lepomis auritus</i>	O,N,J,P	
Green Sunfish, <i>Lepomis cyanellus</i>	O,N,J,P	
Pumpkinseed, <i>Lepomis gibbosus</i>	O,N,J,P	
Warmouth, <i>Lepomis gibbosus</i>	O,P	
Orangespotted Sunfish, <i>Lepomis humilis</i>	O	
Bluegill, <i>Lepomis macrochirus</i>	O,N,J,P	
Longear Sunfish, <i>Lepomis megalotis</i>	O,N,P	
Redear Sunfish, <i>Lepomis microlophus</i>	O	
Smallmouth Bass, <i>Micropterus dolomieu</i>	O,N,J,P	
Spotted Bass, <i>Micropterus punctulatus</i>	O,N	
Large-mouth Bass, <i>Micropterus salmoides</i>	O,N,J,P	
White Crappie, <i>Pomoxis annularis</i>	O,N,P	
Black Crappie, <i>Pomoxis nigromaculatus</i>	O,N,P	
PERCIDAE-Perches		
(32,1)		
Eastern Sand Darter, <i>Ammocrypta pellucida</i>	O	
Western Sand Darter*, <i>Ammocrypta clara</i>	O	
Diamond Darter, <i>Crystallina cynocta</i>	O	
Greenside Darter, <i>Etheostoma biemnotides</i>	O,N,P	
Rainbow Darter, <i>Etheostoma caeruleum</i>	O,N,P	
Bluebreast Darter, <i>Etheostoma caeruleum</i>	O,N,P	
Fanail Darter, <i>Etheostoma flabellare</i>	O,N,J,P	
Longfin Darter*, <i>Etheostoma longimanum</i>	J	
Spotted Darter*, <i>Etheostoma maculatum</i>	O	
Johnny Darter, <i>Etheostoma nigrum</i>	O,N,J	
Tessellated Darter, <i>Etheostoma olmsted</i>	P	
Candy Darter*, <i>Etheostoma osburni</i>	N	
Snubnose Darter, <i>Etheostoma simoleum</i>	N	
Tipecanoe Darter, <i>Etheostoma tipecanoe</i>	O	
Variagate Darter, <i>Etheostoma variegatum</i>	O,N	
Banded Darter, <i>Etheostoma zonale</i>	O	
Yellow Perch, <i>Perca flavescens</i>	O,N,P	
Logperch, <i>Perca caprodes</i>	O,N	
Channel Darter, <i>Perca capelandi</i>	O,N	
Gilt Darter*, <i>Perca eudes</i>	O	
Appalachian Darter*, <i>Perca gymnocephala</i>	N	
Longhead Darter, <i>Perca macrocephala</i>	O	
Blackside Darter, <i>Perca maculata</i>	O,N	
Striped Darter*, <i>Perca nigrimaculata</i>	J	
Sharptooth Darter, <i>Perca oxyrinchus</i>	O,N	
Shield Darter, <i>Perca pelata</i>	P	
Slenderhead Darter, <i>Perca phoxocephala</i>	O	
Roanoke Darter, <i>Perca roanoka</i>	N	
Dusky Darter, <i>Perca sciera</i>	O	
River Darter, <i>Perca stromboli</i>	O	
Sauger, <i>Sander canadense</i>	O	
Walleye, <i>Sander vitreum</i>	O,N,P	
SCIAENIDAE-Drums		
(1)		
Freshwater Drum, <i>Aplodinotus grunniens</i>	O	

Don't Move Fish,
It's Against the Law!
Protect your resources by
never moving fishes or
releasing bait or aquarium fishes.

Suggested literature for further information:

The Fishes of West Virginia
by Jay R. Stauffer, Jr., Jeffrey M. Boltz,
and Laura White
Peterson Field Guides:
Freshwater Fishes
and

The Audubon Society:
Field Guide To North American Fishes,
Whales and Dolphins



Published by the
Division of Natural Resources
Wildlife Resources Section
Wildlife Diversity Program
P.O. Box 67

(304)637-0245
www.wvdnr.gov

Revised 1/2009



FISHES
of
West
Virginia



A Field Checklist



Division of Natural Resources
Wildlife Resources Section
Wildlife Diversity Program

S.T.E.M. Lesson Plan

Hydrology

Stream Survey Information (continued)

Fishes of West Virginia



West Virginia is blessed with a variety of fish resources, including 184 species and 3 hybrid sport fishes distributed among 24 different families. Interestingly, approximately 20 percent are sport fishes, 80% are nongame fishes and 73% are found in just five families: carps/minnows (63 species), perchies (32), suckers (19), basses/sunfishes (14), and catfishes (12).

The list of fishes that follows is a compilation of the presently known species in West Virginia and where they are generally found. The drainage abbreviations are for the greater Ohio River basin (O), which includes the Monongahela, Little Kanawha, Kanawha, Guyandotte, and Big Sandy rivers; New River (N), & all waters in the state above Kanawha Falls.

PETROMYZONTIDAE-Lampreys

(6)

- Ohio Lamprey*, *Ictalhyomyzon dobellum*..... O
- Northern Brook Lamprey*, *Ictalhyomyzon bosseri*..... O
- Mountain Brook Lamprey*, *Ictalhyomyzon greenei*..... O
- Silver Lamprey*, *Ictalhyomyzon unicuspis*..... O,N
- Least Brook Lamprey, *Lampetra aepyptera*..... O,N
- American Brook Lamprey*, *Lampetra appendix*..... O

ACIPENSERIDAE-Sturgeons

(2)

- Lake Sturgeon*, *Acipenser fulvescens*..... O
- Shovelnose Sturgeon, *Scaphirhynchus platyrhynchus*..... O

POLYODONTIDAE-Paddlefish

(1)

- Paddlefish*, *Polyodon spathula*..... O

LEPISOSTEIDAE-Gars

(1)

- Longnose Gar, *Lepisosteus osseus*..... O

Scientific names taken from *Common and Scientific Names of Fishes from the United States and Canada*, 2004. AFS special publication 39

including the Gauley River; Potomac River (P); and James River (J). The drainage indicated for each species does not necessarily mean that it is found in all minor or major tributaries. Different habitat preferences, such as warm or cold water, fast or slow moving streams, or sand or rock bottoms, will dictate where the fishes will be located.

This extensive checklist illustrates the abundance and diversity of West Virginia's fishes. The WV DNR is committed to preserving and maintaining their existence for future generations.



***Rare** (uncommon, undetermined status or limited VT range)
****Extirpated** (native to VT, but no recent records)

AMIIDAE-Bowfins

(1)

- Bowfin*, *Ambloplites caelus*..... O

HODONTIDAE-Mooneyes

(2)

- Goldeneye*, *Hiodon alosoides*..... O
- Mooneye, *Hiodon tergisus*..... O

ANGUILLIDAE-Freshwater Eels

(1)

- American Eel, *Anguilla rostrata*..... O,N,P

CLUPEIDAE-Herrings

(4)

- Shad, *Alosa sapidissima*..... O
- Striped Herring, *Alosa chrysops*..... O
- Atlantic Herring, *Alosa pseudoharengus*..... O,N,P
- Gizzard Shad, *Dorosoma cepedianum*..... O
- Threadfin Shad, *Dorosoma petenense*..... O

CYPRINIDAE-Minnows, Carps

(63)

- Central Stoneroller, *Camptostoma anomalum*..... O,N,P,J

- Goldeneye*, *Hiodon alosoides*..... O
- Striped Herring, *Alosa chrysops*..... O
- Atlantic Herring, *Alosa pseudoharengus*..... O,N,J,P
- Whitefish, *Coregonus artedii*..... O
- Whitefish, *Coregonus hoyi*..... O
- Spotfin Shiner, *Cyprinella spiloptera*..... O,N,P
- Steelhead Shiner, *Cyprinella whiffle*..... O
- Common Carp, *Cyprinus carpio*..... O,N,P
- Grass Carp, *Ctenopharyngodon idella*..... O,N,P
- Bighead Carp, *Hypophthalmichthys nobilis*..... O
- Streamlined Chub, *Entostomus lineatus*..... O
- Tonguehead Minnow*, *Exoglossum laurae*..... O,N
- Callis Minnow, *Exoglossum maxilligera*..... N,J,P
- Eastern Silvery Minnow*, *Hybognathus regius*..... P
- Mississippi Silvery Minnow*, *Hybognathus hutchinsii*..... O
- Bigeye Chub, *Hypoglossus ambloplites*..... O
- White Shiner, *Luxilus albeolus*..... O,N
- Striped Shiner, *Luxilus chrysocephalus*..... O,N,P

The candy darter is truly special to the Mountain State, because, with the exception of a small portion of the New River in Virginia, it is found exclusively in West Virginia.

- Common Shiner, *Luxilus cornutus*..... O,J,P
- Roseline Shiner*, *Lythrurus ardens*..... J
- Scarlet Shiner*, *Lythrurus fasciatus*..... J
- Redfin Shiner, *Lythrurus umbratilis*..... O
- Shad Chub, *Macrhybopsis hyostoma*..... O
- Silver Chub, *Macrhybopsis storeriana*..... O
- Pearl Dace*, *Margariscus margarita*..... O,P
- Honeyhead Chub*, *Moxostoma digitatus*..... O
- Bluehead Chub, *Moxostoma leptocephalus*..... N,J,P
- River Chub, *Moxostoma valenciennesi*..... O,J,P
- Bigmouth Chub, *Moxostoma platyrhynchus*..... N
- Golden Shiner, *Notemigonus crysoleucas*..... O,N,J,P
- Cornely Shiner, *Notropis cornutus*..... O
- Pokeye Shiner*, *Notropis anogenus*..... O
- Emerald Shiner, *Notropis atherinoides*..... O,N,P
- Shiner Shiner, *Notropis biennis*..... O
- Bigeye Shiner*, *Notropis boops*..... O
- Ghost Shiner, *Notropis buchanani*..... O
- Silverjaw Minnow, *Notropis buccata*..... O,N,P
- Bluntnose Shiner*, *Notropis decussatus*..... O
- Pugnose Minnow*, *Opsopoeodus emiliae*..... O
- Spotail Shiner, *Notropis hudsonius*..... O,N,P
- Sand Shiner, *Notropis stramineus*..... O,N
- Silver Shiner, *Notropis photogenus*..... O,N
- Swallowtail Shiner, *Notropis procerus*..... P
- Resplendent Shiner, *Notropis rubellus*..... O,N,J,P
- New River Shiner*, *Notropis scallopius*..... N
- Telescope Shiner, *Notropis telescopus*..... O,N,J
- Mimic Shiner, *Notropis volucellus*..... O,N,P
- Channel Shiner, *Notropis wickliffi*..... O

ACE

ADVENTURE RESORT

- Suckermouth Minnow, *Pimephales notatus*..... O
- Kanawha Minnow*, *Pimephales notatus*..... N
- Southern Redbelly Dace, *Prooximus erythrogaster*..... O,N,J
- Mountain Redbelly Dace, *Prooximus oress.*..... O,N,J
- Bluntnose Minnow, *Pimephales notatus*..... O,N,P
- Fathead Minnow, *Pimephales promelas*..... O,N,P
- Bullhead Minnow*, *Pimephales vigilax*..... O
- Eastern blacknose dace, *Rhinichthys atratulus*..... O,J,P
- Western blacknose dace, *Rhinichthys obtusus*..... O,N
- Chestnut Minnow*, *Parachanna boweri*..... O
- Longnose Dace, *Rhinichthys cataractae*..... O,N,J,P
- Rudd, *Scardinius erythrophthalmus*..... N
- Creek Chub, *Semotilus atromaculatus*..... O,N,J,P
- Fallfish, *Semotilus corporalis*..... O

CATOSTOMIDAE-Suckers

(19)

- River Carpsucker, *Carpodacus carpio*..... O
- Quillback, *Carpodacus cyprinus*..... O
- Highfin Carpsucker*, *Carpodacus velifer*..... O
- Longnose Sucker*, *Catostomus commersoni*..... O
- White Sucker, *Catostomus commersoni*..... O,N,J,P
- Blue Sucker*, *Cyprinostomus elongatus*..... O
- Creek Chubsucker, *Entomyzon oblongus*..... P
- Northern Hog Sucker, *Hypentelium nigricans*..... O,N,J,P
- Snailmouth Buffalo, *Ictalurus bubalus*..... O
- Bigmouth Buffalo*, *Ictalurus cyprinellus*..... O
- Black Buffalo*, *Ictalurus niger*..... O
- Spotted Sucker, *Myoxocheilus melanops*..... O
- Silver Redhorse, *Moxostoma valenciennesi*..... O
- River Redhorse, *Moxostoma valenciennesi*..... O
- Black Redhorse, *Moxostoma valenciennesi*..... O
- Golden Redhorse, *Moxostoma valenciennesi*..... O,N,P
- Smallmouth Redhorse, *Moxostoma valenciennesi*..... O
- Shorthead Redhorse*, *Moxostoma valenciennesi*..... P
- Torrey Sucker, *Thoburnia thoburni*..... N,P

ICTALURIDAE-Freshwater Catfishes

(12)

- White Catfish, *Ameiurus catus*..... O
- Black Bullhead, *Ameiurus melas*..... O,N
- Yellow Bullhead, *Ameiurus natalis*..... O,N,P
- Brown Bullhead, *Ameiurus nebulosus*..... O,N,P
- Blue Catfish, *Ictalurus punctatus*..... O
- Channel Catfish, *Ictalurus punctatus*..... O,N,P
- Mountain Madtom*, *Noturus eleutherus*..... O
- Stoneroller, *Noturus flavus*..... O,N
- Margined Madtom, *Noturus insignis*..... O,J,P,N
- Brindled Madtom, *Noturus milvus*..... O
- Northern Madtom*, *Noturus stigmosus*..... O
- Flathead Catfish, *Pylodictis olivaris*..... O,N

ESOCIDAE-Pikes

(4,1)

- Redfin Pickerel*, *Esox americanus americanus*..... O,P
- Grass Pickerel*, *Esox americanus vermiculatus*..... O

S.T.E.M. Lesson Plan

Hydrology



Links:

National Park Service Watersheds Lesson Plan:

Additional materials teachers may want to use in their classroom.

<http://www.nps.gov/neri/forteachers/upload/Ribbon%20of%20Life.pdf>

New River Watershed:

Follow The New River from its origin in the mountains of North Carolina to the Gulf of Mexico.

<http://www1.hollins.edu/classes/hesit/Journey%20of%20New%20River.pdf>

River Introduction Video:

This video introduces the study of rivers.

<http://youtu.be/jSL9nQb-ohM>

Water Survey:

This is the water survey we will be using during the trip.

<http://www.dep.wv.gov/WWE/getinvolved/sos/Documents/Surveys/Level1.pdf>

Fishes of West Virginia Brochure:

<http://www.wvdnr.gov/Wildlife/PDFFiles/fishbrochure.pdf>

Department of Environmental Protection Educational Resources:

<http://www.dep.wv.gov/WWE/getinvolved/Pages/default.aspx>