

Fishy Who's Who

Adapted from: "Fishy Who's Who" Project WILD Aquatic Education Activity Guide. Council for Environmental Education, 1992. Activity 29, "To Each Its Home" Living In Water. The National Aquarium in Baltimore, 1997.

Grade Level: Intermediate

Duration: Two 45 minute periods

Setting: Classroom, Library, Computer Lab

Summary: Identification and research of fish.

Objectives: Students will be able to identify fish, their specific characteristics, adaptations and their habitats.

Vocabulary: ectotherm, preferred temperature, scatterers, brood hiders, guarders, external bearers, internal bearers, catadromous, anadromous, diurnal feeders, nocturnal feeders, light refraction, binocular vision, monocular vision, otoliths, lateral line, nares, olfactory, barbels, endangered, extirpated, extinct, threatened, niche.

Related Module Resources:

- The Fishes of the French Creek Watershed (orange booklet)
- Pennsylvania Fishes (green book)
- Peterson Field Guide to Freshwater Fishes
- Peterson First Guide to Fishes
- Fact sheets (in module binder)

Materials (Included in Module):

- Creek cross-sections
- Fishy name cards
- Fishy Quiz Activity

Additional Materials (NOT Included in Module):

- markers, crayons, colored pencils

ACADEMIC STANDARDS: ENVIRONMENT & ECOLOGY

7th Grade

- 4.1C Explain the effects of water on the life of organisms in a watershed
- explain how the physical components of aquatic systems influence the organisms that live there in terms of size, shape and physical adaptations
- 4.7A Describe the diversity of plants and animals in ecosystems
- identify adaptations in plants and animals
- 4.7B Explain how species of living organisms adapt to their environment
- explain how living things respond to changes in their environment

10th Grade

- 4.1C Describe the physical characteristics of a stream and determine the types of organisms found in aquatic environments
- explain the habitat needs of specific aquatic organisms
- 4.7A Explain the significance of diversity in ecosystems explain the role that specific organisms have in their ecosystem
- identify a species and explain how its adaptations are related to its niche in the environment
- 4.7B Explain how structure, function and behavior of plants and animals affect their ability to survive
- describe an organism's adaptations for survival in its habitat
 - compare adaptations among species

12th Grade

- 4.7B Examine the effects of extinction, both natural and human caused, on the environment
- identify species that became extinct through natural causes and explain how that occurred
 - identify a species that became extinct due to human actions and explain what occurred

BACKGROUND: In Pennsylvania there are 83,000 miles of streams and rivers and hundreds of lakes with 160 different species of fish from 24 families living in them (PA Fish & Boat Commission, 2000). Fish play many diverse roles in nature. They differ according to their habitats, (the environment where a plant or animal naturally or normally lives and grows), reproduction methods, and feeding methods.

There are several different habitats where fish can be found in Pennsylvania. Forty-one percent of all fish species worldwide are located in freshwater, and freshwater covers only about 1% of the Earth's surface (Moyle, 1993). Freshwater is a very diverse environment and geographically fragmented habitat. You may find a spotfin shiner in the cool, fast

headwaters of a stream and downstream in slower moving water the habitat is suitable for an entirely different type of fish. The temperature of the water is the main determinant of which fish species you will find living in a particular body of water. Fish are **ectotherms**, which means that the temperature of the surroundings influences their body temperature and functions. Each fish species has a specific range of water temperatures in which it can live and survive. Within each range of water temperature is a narrower range called the **preferred temperature**, this is the optimal temperature in which the fish can live, grow, and reproduce. It is the ideal temperature for the fish's survival. Fish with similar temperature preferences are separated into three groups: cold water (< 70°F), cool water (>60°F but <80°F) and warm water (>80°F) (PA Fish & Boat Commission, 2000). Fish in each group often have similar environmental needs. Transition waters occur because temperature preferences between groups overlap, so some fishes may be found in more than one group. The location within the water column also varies between fish species. Some fish live closer to the surface and others are better suited to live in the sometimes oxygen deficient, murky bottoms of streams or ponds.

Most fish use external-fertilization, in which the eggs or sperm are released from the fish's vent into the water. In all fish, females produce eggs in the ovaries and males produce sperm in the testes. The eggs and sperm combine and new fish life begins. The embryo grows as cells in the fertilized egg continually divide. A tiny fish develops inside the small sphere. After a time (shorter in warm water, longer in cold water) the rubbery, thin egg "shell" splits and the baby fish emerges. Most fish are live-bearers but there are no live bearing fish in Pennsylvania (PA Fish & Boat Commission, 2000). The baby fish is now known as a sac fry because its underbelly is swollen by a nourishing yolk sac. The young fish gradually uses up its food supply and then strikes out on its own. There are five categories of breeding behavior: scatterers, brood hiders, guarders, external bearers, and internal bearers (Moyle, 1993).

Scatterers are usually mass spawners such as minnows and suckers. They do not protect their eggs and young. Eggs may be scattered on the stream bottom, they may be attached to plants, or allowed to drift through the water.

Brood Hiders dig depressions (redds) in sediments where eggs are laid and then fertilized and buried. The females dig redds and the males defend them, but after spawning the adult fish either die or leave. Examples are salmon, trout and hornyhead chub.

Guarders are fish that protect their eggs and young after spawning. They produce fewer eggs than scatters or brood hiders. This protective parental care increases survival rate of the young. They are strongly territorial because they protect the spawning site and males practice elaborate courtship rituals to lure the females to the spawning site. There are two types of Guarders; those that build nests and those that don't.

External bearers are fish that carry the embryos with them after spawning. The embryos can be carried around in the mouth, in specialized pouches, or on the underbelly.

Internal bearers carry the embryos and/or young inside the female. Females have internal fertilization by the males. Some internal bearers deposit the

developing embryos in the environment shortly after fertilization. Males of internal bearers either have the anal fin (if it is a bony fish) or pelvic fins.

Along with spawning comes migration. American Eels devote so much of their bodily resources to migration and spawning that they die soon after. Some suckers migrate to previously used sites to spawn. Suckers survive spawning but their energy reserves are so depleted they are much more vulnerable to predators, environmental stress, and disease. **Catadromous** fish are fish that live in fresh water streams, but travel to the ocean to spawn such as eels. **Anadromous** fish, like salmon and shad, start their life in fresh water and travel to salt water to grow. They return as adults swimming upstream to flowing freshwater to spawn. Migrations of fish are not always induced by spawning; seasonal changes in water temperature cause some of the fish to migrate to find water in their temperature range.

Fish fit in many places on the food web and as a group may consume just about everything edible that is available in or on the water. Fish eat other fish as well as algae and other plants, insects, mollusks and crustaceans. They also consume organic bottom material and even eat birds and small mammals that get into the water (PA Fish & Boat Commission, 2000). The form of a fish's body, especially its mouth, is suited for obtaining the foods it prefers. Feeding behavior is largely determined by morphology (Project Wild Aquatic, 1998).

| Mouth Shape | Feeding Behavior | Examples |
|----------------------|---|---------------------|
| Sucker shaped mouth | feeds on small plants and animals from substrate bottom | Sucker, Carp |
| Elongate upper jaw | feeds on prey it looks down on | Spoonbill, sturgeon |
| Elongate lower jaw | feeds on prey it sees above | Barracuda, Snook |
| Duckbill jaws | grasps prey in jaws | Muskellunge, Pike |
| Extremely large jaws | surrounds prey with mouth | Bass, Grouper |

In addition to different mouth shapes there are also different times of day that fish feed. Some fish are **diurnal feeders**, or they feed during the day. **Nocturnal feeders**, such as walleye, eat during the night. Most fish feed during low light hours, dawn & dusk.

Fish have fine tuned senses. A fish's sight, hearing, smell (yes, they can smell!), and taste are achieved through specialized body parts. A fish does not have eyelids, tearducts, or irises like humans do. Instead, they have lenses in their eyes that move back and forth much like a camera lens (PA Fish & Boat Commission, 2000). Since fish live in the water they must adapt to a property of light called refraction. **Light refraction** occurs because when light travels from denser air into the water, it bends. So, to a trout, a mayfly at the surface appears higher than it actually is. Binocular vision helps to judge distances, but monocular vision is better because fish are near sighted and can see things close to them better than far away images. Fish have **binocular** (using two eyes) and **monocular** vision (using only one eye). They can see in almost all directions except for small blind spots

directly in front of and behind them. Fish can also see in three dimensions. Fresh water fish are thought to see in color and can tell the difference between light and dark (PA Fish & Boat Commission, 2000). Fish are also believed to have cones and rods in their eyes, which enable them to detect colors and ultraviolet light as well as seeing movement and contrast. Walleyes have a reflective layer in their eyes that helps them to see better in dark or cloudy water (PA Fish & Boat Commission, 2000).

Fish have internal ears, one inner ear on each side of their brain. This inner ear receives and interprets sound and helps the fish maintain balance. They also have **otoliths**, solid ear bones, which are surrounded by a fluid filled sac that is lined with tiny hairs. The sound waves penetrate the fish's body and vibrate the otoliths. This stimulates the hairs and attached nerves. Next, a signal is sent to the brain. The air bladder can also function as a resonating chamber in intensifying sounds. Another body part that aids in hearing is the **lateral line**. The lateral line is a line of tiny pores, which are openings to tubes, running from the head to their tail along the sides of the fish (PA Fish & Boat Commission, 2000). The tubes go through the scales to a large nerve. The fish receives sound waves or low frequency vibrations along the length of its lateral line. Fish can tell with great accuracy the location of the noise or disturbance. The lateral line also helps schooling fish keep together.

Nares, the name for a fish's nostrils, are located on either side of the snout. Water flowing through the nares circulates to the fish's **olfactory organ**, an organ for smelling. Nerves on the olfactory transmit signals that the brain reads. Fish also have tastebuds, sometimes as many as 10,000 that are located in the mouth, on the tongue, lips, and deep inside the mouth. Some fish such as catfish can even taste through their skin and **barbels** (fleshy whiskers found near the mouth).

Fish may be categorized as threatened, extinct, extirpated, or endangered due to human and/or natural causes. Fish populations and biodiversity are reduced as a result of these events.

| Natural causes | Human Causes |
|-------------------------------------|---------------------------|
| Predation by variety of animals | Thermal pollution |
| Changes in salinity and water level | Runoff |
| Abnormal temperatures | Obstructions to migration |
| Parasites and diseases | Over fishing |

- **Threatened** – might become endangered
- **Extinct**- No living species. The animal does not exist anywhere anymore.
- **Extirpated**- Are not found in Pennsylvania anymore, but might be found in other places.
- **Endangered**- May become extinct or extirpated

OVERVIEW:

Through research, presentation, and mapping students will recognize and identify species of fish living in their local watershed.

PROCEDURE:

Teacher Preparation:

**Teachers may choose to have the students read the background before researching their assigned fish. It may help them to write the biographies and organize their presentations*

1. Ask the students which types of fish they think live in the area. Also, ask what kinds of fish they have seen, caught, heard or read about locally. Make a list of their responses and keep it for future reference. You may want to construct a poster to display on a bulletin board.
2. Hang the creek cross-section provided in an easily accessible location in the classroom. The sections are numbered #1 through #6.
3. Divide the class into groups of four or five. Distribute the fish name cards provided, giving each group member a fish to research. Encourage the students to utilize a variety of resources. For example: The module resources, the Pennsylvania Fish and Game Commission, the library, the Internet, and fish experts.
4. Each group will use their resources to produce biographies for their assigned fishes. The biographies should include but not be limited to common name, scientific name, habitat location (warm water, cold water, etc.), habits such as food location, food sources, spawning, and migration. Information about ecological, scientific, recreational, economic, political, cultural, aesthetic, and intrinsic reasons why they are valuable may also be included.
5. Have each group present their data to the class. While each group is presenting have the other students fill in the provided data charts with the presenters' information.
6. After all groups have presented, attach original fish name cards to the river/creek cross section. An answer key has been provided. *The students should have discovered through their research their fish's location in the water column. When determining the habitat if the fish we are assuming they are in the adult stage of life.*

Student Activity:

1. Each of you has been given a fish to research and write a biography on the fish. Begin conducting your research by deciding which resources you want to use first. Start with the basics, **common name**, **scientific name**, and **habitat**. There are books available in the module, ask your teacher to borrow them. Also, use the Library, the Internet, check out the PA Fish and Boat Commission website, (www.fish.state.pa.us), or contact a fish biologist.

2. Next research the following topics:
 - ◆ Habits such as **food sources, spawning, migration (anadromous or catadromous?) temperature preference and adaptations to their environment** (mouth, body shape and coloration). Where in the creek or river can your fish be found (along the bottom, near running water, warm or cold water, among vegetation?)
 - ◆ Is your fish **threatened, extinct, extirpated, or endangered?** If yes, how or why do you think they have been classified as such? (Was natural extinction or human influence a factor?)
 - ◆ **Ecological, scientific, recreational, economic, political, cultural, and aesthetic reasons** why your particular type of fish is important.
3. After the biography is complete, you need to organize your information to present it to the class. The class will be filling out a chart with the information you give them, remember to speak slowly and clearly. You may want to have a group member assist you by writing some of your information on an overhead or chalkboard.

DISCUSSION:

Now ask the students to name fish that they **know** live in the area and compare it to the original list from the original poll. Discuss what they learned that was surprising, shocking, or out of the ordinary.

Ask the class about the diversity they found among their fish through the biographies. Why does such diversity exist? What adaptations or special abilities do some of the fish have that allow the fish to function more efficiently? In other words, how does their form fit their function (*i.e. The sucker shaped mouth allows the carp to feed on very small plants and animals or the torpedo shape of the trout allows it to move quickly*)? How have these adaptations helped the fish to survive? Talk about the mouth and body shape, the coloration, and the reproduction habits. Refer to the **Adaptation/Advantage/Example Chart** provided and the **Fact Sheets** in the binder.

Discuss the fish that were labeled as threatened, extinct, extirpated, or endangered. Begin by defining the difference between the categories.

- **Threatened** – might become endangered
- **Extinct**- No living species. The animal does not exist anywhere anymore.
- **Extirpated**- Are not found in Pennsylvania anymore, but might be found in other places.
- **Endangered**- May become extinct or extirpated

Ask the students what factors may have led their fish to be categorized as one of the above, was it a natural extinction or was human influence a factor?

EVALUATION:

- PA's Fish Facts Game (located in the Fact Sheet section of the binder).
- Fish Matching Game
- Fishy Quiz, 28 fish on color overheads located in the envelope

EXTENSIONS AND MODIFICATIONS:

- Construct three dimensional fish models and hang them from the classroom ceiling. Include appropriate plant life, food sources, and relative water depth (bottom feeders should hang lowest from the ceiling).
- Arrange to take a tour of your local fish hatchery or invite a guest speaker (fish biologist) to visit your class.
- Instruct the students to write a quick biography of the fish on the lined side of a 5x7-index card. On the blank side have them draw the fish and label its parts. These cards can be used as flash cards for a quick review of fish.

NOTES (PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):

