

# Resource Specialist Section

1. Review *Tips and Tricks for Resource Specialists* in the Appendix.
2. Read the entire *Fish Health* section to become familiar with the pre-work. Then you will have an idea of what the student knows. Always praise the classroom teacher for prepared and attentive students!
3. Checklist of equipment necessary for this station:
  - Computer with videos (downloadable from website), projector, screen, and video narratives (see teachers section)
  - Two fish dissection puzzles or two dissected fish
  - Fish Jeopardy questions (see teachers section)
  - Three tables, one for fish puzzles and two for the fish tanks
  - Four 10 gallon fish tanks
  - 5 bubblers or aerators
  - Two buckets (used to collect water and to keep fish not currently being used)
  - MS Triple 2 or another fish sedative for Tank D
  - Vegetation and rocks for Tanks C & D
  - Four small nets
  - Four stopwatches
  - Student field worksheet (see Student Section) provided by the teacher; (make and bring extra in case they are needed)
4. Procedure

As the students enter the area state the goals and objectives of the station. Introduce yourself and other staff. Lead the following discussions:

  - Ask students, “When developing a plot of land why would you consider the needs of fish or other animals?” and “What considerations need to be made?”
  - Define lethal and sub-lethal.
  - Show and narrate 2 or 3 videos that demonstrate sub-lethal effects of contaminants to fish. Have students predict which tank contains the contaminants and how the fish might be affected.
  - After discussions, divide students into two groups, one to each of the substations.

Make sure each substation gets equal time

### Substation 1

- Make sure all students have their Student Field worksheet for this station.
- Have students answer question 1 & 2 and determine which tank A, B, C or D has the best habitat for fish to survive and why. Do not let them know that tank “D” contains contamination.
- Ask two student volunteers to play the role of fisherman and timekeeper for each of the four tanks. Discuss why each fish may be easy to catch or not, predict catch times and determine the actual catch time for each tank. The timekeeper will use a stop watch to record catch times.
- Summarize the results of the experiment on the worksheet.
- If there is extra time before switching to the next substation, discuss ways in which developers may minimize disturbances to a stream as well as ways in which they may increase habitat health and water quality.

**MAKE SURE FISH IN THE CONTAMINATED AND TURBID TANKS ARE REMOVED AND REPLACED BETWEEN ROTATIONS**

### Substation 2

- Divide this group into two teams, one for each of two puzzles. The puzzles should be prepared ahead of time with all puzzle pieces arranged in random order around the outside of each puzzle.
- Define game rules, such as being careful with the puzzle pieces, waiting until questions have been fully asked before supplying answers, etc.
- Explore the internal questions and statements first so that the puzzle will fit together..
- If there is extra time before switching to the next substation, review commonly missed answers and discuss answers from the “Anatomy that is not part of Fish Puzzle” page.

## Video Narratives

### **Pesticide-chlorpyrifos**

The left aquarium has the control juvenile salmonid that has not been exposed to the pesticide chlorpyrifos, and the right aquarium contains a fish that has been exposed to chlorpyrifos for this experiment. In the beginning of the video both fish are swimming freely, but the pesticide treated fish seems to be more lethargic. Brine shrimp (fish food) are added to the tank (the green light on the top turns red) and both fish start feeding initially, however, the chemically treated fish quickly slows down and feeds less actively than the control fish.

#### Lesson:

Some chemicals, like the pesticide chlorpyrifos cause fish to be lethargic, slow moving, and malnourished, which could increase their risk of predation. Healthy fish are fast moving and able to feed properly which makes them more likely to survive and return to spawn as an adult.

### **Predation-Copper**

The top aquarium (left side and front views) has the control juvenile salmonid that has not been exposed to copper. The bottom view contains a fish that has been exposed to copper for 3 hours prior to this experiment. Both fish are swimming freely until the skin extract from another fish is added (green light on the top turns red). This fish skin extract is meant to represent a predator that has caught and broken the skin of another fish in the creek. Once the skin of a fish is broken by the predator, a pheromone (chemical signal) is released into the water that other surrounding fish can smell. When surrounding fish smell this, their natural tendency is to stop swimming, sink to the bottom, and take cover until the predator is gone (called the "alarm response"). Notice that the top fish does just that but the bottom fish (exposed to copper) is not able to detect the pheromone in the water, keeps swimming, and is more likely to be eaten by a predator.

#### Lesson:

Some chemicals, like copper, disrupt the fish's ability to smell and therefore the fish do not pick up important chemical signals that are in the water. Fish use their noses to migrate back to their natal streams to spawn (imprinting and homing), avoid predation (defense) and synchronize spawning times between males and females (mating).

### **Pesticide-Swimming Performance carbaryl**

Each swim chamber contains a Coastal Cutthroat trout (salmonid). The top fish is the control fish and the bottom fish has been exposed to the pesticide carbaryl for 2 hours prior to the experiment. When the flow is turned on in the swim chambers (a treadmill for fish), the fish must orient themselves so that they may swim against the flow of water. The bottom fish will be unable to do so because of the reaction it has had to the pesticide it was exposed to.

Lesson:

Some chemicals, like the pesticide carbaryl, affect a fish's ability to coordinate its nervous system and its motor skills, thus the exposed fish cannot swim as well as a fish that has not been exposed to the chemical.

**Predation-Habitat carbaryl**

This video shows predator prey interactions when half of the prey have been exposed to a pesticide called carbaryl. Chinook salmon are, in this case, the prey species and the Lingcod is the predator species. Twenty prey fish are placed in a large tank, ten of which have been exposed to the pesticide carbaryl and ten of which have not been exposed (control fish). Once the Lingcod is released in the tank it is allowed to feed until it preys on ten fish. The Lingcod is then removed and the remaining fish are counted to see how many pesticide treated fish survived versus how many control fish (we can tell the fish apart by marking them via fin clippings).

Lesson:

Some chemicals, like the pesticide carbaryl, affect a fish's ability to coordinate its nervous system with its motor skills. Therefore, the chemically exposed fish cannot swim as well as the fish that are not exposed to the chemical and are more likely to be eaten by a predator .

## Internal Fish Anatomy Jeopardy

This large organ helps in the detoxification of chemicals, heavy metals, drugs, pesticides and other compounds. It is also an accessory digestive organ which breaks down fats and neutralizes stomach acids.

**What is the \_\_\_\_\_?**

This organ lies along the backbone of a fish and filters liquid waste from the blood and its primary function is to maintain the internal salt/water balance of the fish.

**What is the \_\_\_\_\_?**

This small dark red organ produces blood and removes old blood cells which assists in the immune response. Viruses can attack this and other blood producing organs.

**What is the \_\_\_\_\_?**

These female and male reproductive products can be altered by contaminants which can then reduce the fish's fecundity.

**What are \_\_\_\_\_ and \_\_\_\_\_?**

This organ collects and releases excess fluids and helps in salt balance.

**What is the \_\_\_\_\_?**

These finger like projections are on the intestine near where it attaches to the stomach of most fish and produces enzymes that assist in digestion.

**What is the \_\_\_\_\_?**

This balloon like organ controls the salmon's depth in the water and can become damaged if nitrogen levels are too high from spilling water over dams.

**What is the \_\_\_\_\_?**

If there is too little oxygen in the water, this organ has to work hard to pump oxygen to the rest of the body. Did you know that 25% of fish kills are due to low oxygen?

**What is the \_\_\_\_\_?**

This body part transfers food from the salmon's mouth to its stomach. Fish *never* chew before they swallow, so whole food moves through this.

**What is the \_\_\_\_\_?**

In this organ, the salmon's food and some contaminants are absorbed into the body. This is a favorite place for parasites to live.

**What is the \_\_\_\_\_?**

Food is collected in this organ and broken down, some contaminants leaving this organ are expelled from the body and some are distributed in the blood. Medications that are flushed down the toilet are one thing that can be absorbed and affect the fish. Please throw unused medicines in the trash!

**What is the \_\_\_\_\_?**

## External Fish Anatomy Jeopardy

This exposed organ is a place that pollutants can enter the fish, a site for attachment of parasites, can be irritated by sediments, and has to work harder if oxygen levels are low.

**What are the \_\_\_\_\_?**

Brake pads in vehicles often shed copper as they wear down. This copper run's into our rivers. Dissolved copper affects this sense organ of the salmon.

**What are the \_\_\_\_\_?**

This stabilizing fin serves to protect the fish against rolling and assists in sudden turns and stops. It is located on the top of the fish.

**What are the \_\_\_\_\_?**

This fin is used to stabilize the fish while swimming and is located on the ventral surface behind the vent.

**What are the \_\_\_\_\_?**

This pair of fins is used for balance and are maneuvered back to help lift the fish forward to move down in the water column; they are located just behind the operculum.

**What are the \_\_\_\_\_?**

This fin is used for speed and thrust, it is like wearing rubber flippers, it propels the fish through the water and a strong thrust is used to help the fish jump waterfalls and other obstacles.

**What are the \_\_\_\_\_?**

These paired fins are analogous to legs and can be used for turning. They are located further back in salmon and minnows, forward in bass and perch. Salmon can survive if they lose one but will have problems steering.

**What are the \_\_\_\_\_?**

In hatchery fish, this small fin is often removed entirely. New studies show that it senses faster water which cues the caudal fin to work harder if needed.

**What are the \_\_\_\_\_?**

This body part protects the salmon's gills and helps move water over the gills to regulate oxygen intake.


**What are the \_\_\_\_\_?**

Just like in humans, this organ of the salmon's body is susceptible to sunburn:

**What are the \_\_\_\_\_?**

These two layers are the fish's defense against wounds that would allow bacteria and chemicals to enter and fungus to grow. It also secretes a substance to give further protection.

**What is the \_\_\_\_/\_\_\_\_?**



A tasty part of the fish, but be careful what you eat it. Predators and long lived fish may accumulate DDT, PCBs, mercury, and other contaminants in this tissue.

**What is muscle?**

These structural parts of a fish may be deformed especially in embryos exposed to chemical contaminants or low dissolved oxygen. Scientists can examine these parts to look for deformities, lesions, or weakness to assess exposure to pollutants.

**What are bones?**

This small green sac stores and releases bile used to emulsify fats.

**What is the gallbladder?**

This is the primary sense organ of fish. It detects the direction of underwater vibration.

**What is the lateral line?**

This slimy non-living layer helps fish slip through the water, keeps bacteria away from the live epidermal cells, and can tie up and slough off particulate irritants and some heavy metal salts.

**What is mucous?**