Country Club Ichthycide
LESSON 2
Pollutant Investigation

Overview
In this activity, students use the map of Country Club Creek with identified possible pollution source sites from Lesson 1, information from the The Ichthycide Story, and pond test descriptions to hypothesize about what killed the fish. Potential contamination sources are tested and the pollutant is discovered. Students record this water test information for later use.

TEKS (7th grade Science)
7.1A-B, 7.2E, 7.4A, 7.5C, 7.8C, 7.10B

Time
One class period

Purpose
The students will:
1. Work with multiple hypothesis.
2. Develop skills in identifying key information and using the information to formulate hypothesis.
3. Differentiate point source and non-point source pollution.
4. Understand different types of water quality tests.
5. Apply their understanding of water flow patterns developed in Lesson 1.

Materials
For each student:
Student worksheets:

- ☐ 1.2-Map of Country Club Creek Ichthycide (1 set/class to be re-used)
- ☐ 2.1-Pond Test Descriptions (1 set/class to be re-used)
- ☐ 2.2-Fish Kill Lab Report (to be turned in as assignment)

Lab materials for each group of 4-5 students:

- ☐ Chemplate
- ☐ Pond sample in dropper bottle, 8 "water quality tests" in dropper bottles, Universal Indicator in dropper bottle
- ☐ Paper towels or sponge, as needed

For the teacher:
Overhead transparencies:

- ☐ The Ichthycide Story (from lesson 1)
- ☐ Student Sheet 1.2- Map of Country Club Creek Ichthycide (from lesson 1)
- ☐ Land Use Chart
- ☐ Biological Magnification graphic
- ☐ Student Sheet 2.2-Fish Kill Lab Report

Getting Ready

1. Make a class set of student sheet 2.1 to be re-used for each class (you should already have a class set of student sheet 1.2).
2. Duplicate copies of student sheet 2.2 for each student.
3. Set up the overhead projector.
4. You may wish to collect relevant newspaper articles on surface water contamination to use for discussion (or contact the City of Austin and we will provide them).
5. If you have not already done so, divide the class into groups of 4-5 students (maximum of 7 groups).
6. Distribute the materials packet to each group. Each material packet will contain one "fish kill" pond sample bottle, 8 "water quality test" bottles, one universal indicator bottle, and one chemplate (the chemplates may be equipped with a tear-away stirring stick, which should be removed before the beginning of the activity for later use).

6. Write vocabulary terms on the board or transparency.
    - **Biological Magnification**- the process where certain substances such as pesticides or heavy metals move up the food chain, work their way into rivers or lakes, and are eaten by aquatic organisms such as fish, which in turn are eaten by large birds, animals or humans. The substances become concentrated in tissues or internal organs as they move up the chain.
    - **Land Use-**The way the land has been changed for human use. Ex. Road, housing
    - **Non-Point Source Pollution**- Pollution that cannot be detected from a specific point or any specific land use. They are usually pollutants that are on the ground and get washed into lakes, streams and ponds when it rains.
    - **Point Source Pollution**- Water pollution sources that may be traced to a specific source, such as a sewer line or a discharge pipe of an industrial facility.

THE ACTIVITY

1. Introduction

☛ Begin the activity by telling students that they are ready to investigate the problem in Country Club Creek and pond and will be gathering more evidence. They will use what they have learned in the previous activity to carry out the investigation. In addition, they will need to act as good scientists and detectives, paying attention to what is implied, as well as to what is directly stated.

2. Review the Story

☛ Display overhead transparency of The Ichthycide Story (from lesson 1). Review and identify clues from the story that will help guide testing. Ask the following questions:

- The story says it takes place in 1979. Explain that this was an actual event that took place at Mabel Davis Park in 1979, however the story is fabricated.
- Why is it relevant that it has been raining? (rain would cause runoff of pollution)
- How many fish were dead? (200)
- Is that a sign of major contamination? (yes, especially for a small pond)

- Could 200 fish die from a disease (ie. virus) rather than pollution? (yes) How would you determine the difference? (Pathology-test fish tissue or water for viruses, pathogens, or other biological agents that may have caused the fish to die of disease (or test for chemical agents that may have been introduced from running off the land if it was from pollution). Point out that a chemical odor was observed so this suggests that a chemical killed the fish.

- What other risks could be associated with the fish kill? (human health risks)
- Mr. Newell found no dead fish in his pond, but he is still concerned. Why?

Explain how water pollution affects ecosystems (show graphic):

An entire ecosystem may suffer from the effects of water pollution. When toxic material settles to the pond bottom, some types of toxins enter the bodies of tiny bottom-dwelling organisms. A hundred of these organisms may be eaten by one small fish. A hundred of these small fish may be eaten by a big fish. A human may eat 5 big fish. Each organism stores the toxins in its tissues, so at each step along the food chain the amount of toxin passed on to the next "eater" increases. This increase in concentration is called **biological magnification**.

3. Relate Land Use and Test Parameters

Define **Land Use, Point Source** and **Non-Point Source Pollution.**

☛ Display SS1.2- Map of Country Club Creek Ichthycide from Lesson 1. Review the identified land use sites that drain to the pond and rule out sites that do not runoff to the pond (Linder Elementary, most of the houses, church, farm north, etc)

☛ Display transparency "Land Use Chart" and distribute Student Sheet 2.1. Complete the chart with the students. Explain the difference between point source and non-point source pollution and give an example (fertilizer runoff from lawns vs. a sewer leak).

- Ask students which would be easier to trace; point source or non-point source pollution? (point source). Which is more common in Austin? (non-point source)

Because non-point sources are diffuse, they are often difficult to identify or locate precisely, and thus pollutants from them cannot be controlled easily. Most of the pollutants listed are non-point sources (landfill, spills and sewer lines are point source). Place a check in the boxes if the land use could be a source of the pollutant. For example, houses might contribute fertilizers, pesticides, household chemicals, oil…to the creek when it rains.

Possible answers:

Land Use	Source of pollution
Houses/duplexes/Apartments	fertilizers, pesticides, herbicides, household chemicals (detergents, cleaners), oil and gasoline, bacteria from pet waste, etc.
Gas station	leaking gas tank or spilled oil
Storage units	chemical spill
Railroad tracks	Chemical spill, oil
IRS buildings	oil, fertilizers, pesticides, herbicides
Church	oil, fertilizers
Mabel Davis Park	fertilizer, pesticides, herbicides, pet waste
Landfill	everything
Ben White or I-35	spill
Linder Elementary	fertilizer (not a source-downstream)
Farm	fertilizers, pesticides...
Creek	Nutrients and chlorine from a broken sewer line running through the creek

4. Water Quality Tests Used in this Lab

☛ Hand out and go over student sheet 2.1 and discuss the water quality tests.

☛ Ask students to identify and justify some water quality tests they think should be tested in the Country Club Ichthycide. For example, a test for fertilizers (nitrate or phosphate) could determine if fertilizer runoff killed the fish. Tell students they will be conducting 7 tests on the pond sample to determine which contaminant killed the fish.

☛ Tell students the liquids they will use in this lab are not solutions of actual test chemicals but are nontoxic substances that simulate the tests. This is not how samples are tested in the real world, this is for demonstration purposes. Ask the students why a real toxin is not included in the module. Some may mention cost and convenience. These factors are considered; however, the lab contains nontoxic substance for safety reasons. A toxin represents a health risk and requires special handling procedures. In this activity, the universal indicator test is used as an alternative to actual testing procedures requiring very specialized equipment and technically trained individuals.

5. Lab: Water Quality Testing of the Country Club Ichthycide Pond Water

☛ Instruct the students that they will be testing the pond site to decide what caused the fish kill.

☛ Hand out Student Sheet 2.2 to fill out their hypothesis.

☛ Demonstrate the lab procedure:

- Choose one of the water quality tests (NOT pesticide).
- On the overhead projector, squeeze two drops of the "fish kill pond water" into one of the cups in a Chemplate. Add two drops of indicator to the cup. Add one drop of the water quality test (ex. ammonia)
- Ask students to describe the color of the solution in each cup, comparing it to the chart on Student Sheet 2.2 transparency.

- Note that the chart correlates color with the concentration range and contaminant effect level. For example, if the color is yellow-orange then the concentration range is 0.11-0.8 ppb, which would have no effect on the fish. So nitrate is not the cause of the fish kill.
- Explain that in this study the contaminant effect level is the level of contaminant (i.e. ammonia) that would have a harmful effect on fish or aquatic life. In other words, if the sample turned blue-green, this would have a medium affect on fish (i.e. affect the gills or reproductive system of fish), but would not kill the fish.
- Students data will vary, but they will discover that only the pesticide test was in the lethal range. If they determine this early on in their testing, tell them to continue testing as there could be more than one contaminant in the lethal range.

Note to teacher: Contact City of Austin-Watershed Protection Department, 974-3540 if you run out of test chemicals

Clean Up:

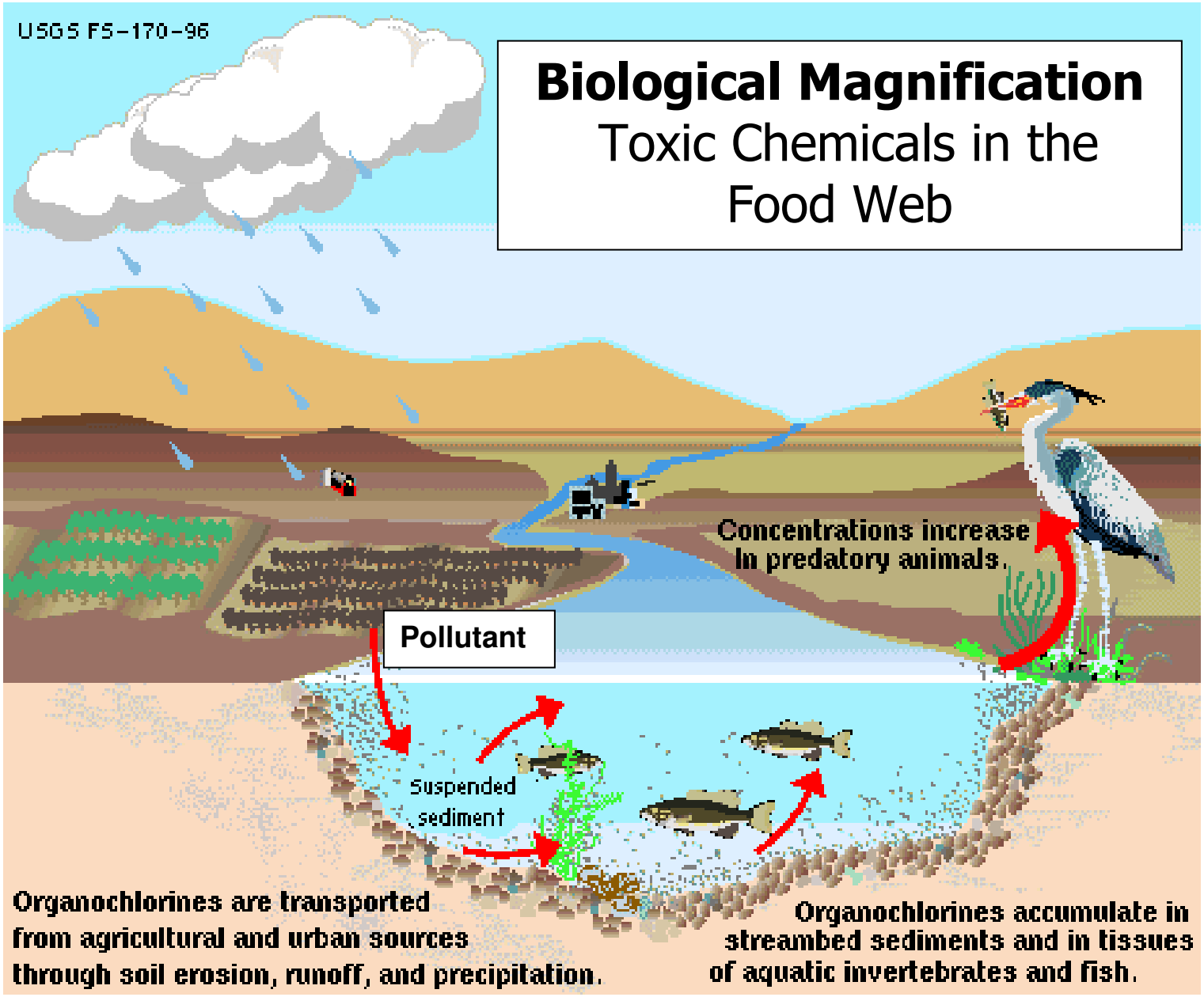
The last tester from each group has the responsibility to rinse out the Chemplate with tap water, then rinse again with deionized water. Distribute paper towels or rags to clean out the Chemplate. Distribute the towels to clean up any spills at the tables. Collect lab materials and students sheets for later use.

6. Conclusions and Analysis

☛ Use transparency Student Sheet 2.2 to go over all the groups results. The class will discover that pesticides were the only toxin discovered. Ask why some of the other tests (ie. nitrate) had levels in the low to medium range. Explain that these pollutants usually come from non-point sources so they are typically higher in our creeks after it rains.

☛ Discuss possibilities for the next steps to be taken in this investigation.

	Check the box if the land use could be a source of the contaminant						
LAND USE	**Fertilizer**	**Pesticides & Herbicides**	**Sewage Leak**	**Cleaning agents**	**Metals**	**Gas or oil**	**Other:**
Gas station				✓	✓	✓	
Homes							
Storage Units							
Railroad tracks							
IRS Building							
Mabel Davis Park							
Landfill							
Ben White							
Farm							


USGS FS-170-96
Biological Magnification
Toxic Chemicals in the Food Web
Concentrations increase in predatory animals.
Pollutant
Suspended sediment
Organochlorines are transported from agricultural and urban sources through soil erosion, runoff, and precipitation.
Organochlorines accumulate in streambed sediments and in tissues of aquatic invertebrates and fish.