WATER QUALITY STATION

GOALS:

- To introduce students to the Watsonville Wetlands water system
- To help students identify sources of water pollution and learn how they can avoid polluting the environment
- To discuss the importance of protecting slough water from pollution.
- To introduce students to technology used in the field of environmental science.

MATERIALS (for 2 stations):
2 turbidity tubes
1 dissolved oxygen meter
2 thermometers
8 data collection sheets (1 for each group of students)
2 buckets
1 water dipper
1 pair of rubber boots (to collect water)
Box of rubber gloves

BACKGROUND:
The following is adapted from the Watershed Cruzin' Guide:

<u>Dissolved Oxygen</u>
Humans and other nonaquatic animals breathe oxygen from the air. Fish and other aquatic life use oxygen that is dissolved in the water. Fish and some insect larvae breathe through gills; other aquatic insects absorb oxygen directly through their body surfaces. Concentrations of dissolved oxygen in water range from 0 to 18 parts per million (ppm)**. In general, the higher the dissolved oxygen, the more different species of plants and animals the water can support. Water temperature, stream velocity, aquatic plant life, and the levels of pollutants in the water affect the amount of oxygen that is dissolved in water.

How does the oxygen get into the water?
There are three methods by which oxygen gets absorbed by the water.

1. Photosynthesis of aquatic plants: oxygen is one of the byproducts of photosynthesis.
2. Water Movement: due to wind, tide or current- air gets mixed in the water
3. Diffusion: is when a substance in a higher concentration environment transfers to a lower concentration environment. Since there is more oxygen in the air then the water will absorb oxygen from the air.

Effect of Water Temperature on Dissolved Oxygen

The cooler the water, the more oxygen it can hold. As water temperature rises, the amount of space available for dissolved oxygen diminishes so less water is available for animals.

Turbidity

Turbidity, or cloudiness in water, is caused by suspended solid matter that scatters light passing through the water. Turbidity can be caused by sediment from disturbed or eroded soil from agricultural lands, construction sites, or stream banks. Microscopic plankton contributes to high turbidity when their numbers increase owing to excess nutrients and sunlight. A high population of bottom-feeding fish, such as carp, can stir up sediments and cloud water.

Effect of Turbidity on Aquatic Ecosystems

Suspended sediments block out the light that submerged aquatic vegetation needs for photosynthesis. Habitat for benthic (bottom-dwelling) organisms is greatly reduced as fine sediment settles between rocks and stones in a stream or river. Sediments can bury eggs of fish and invertebrates and smother benthic creatures. If the gills of some organisms, such as mayflies or fish, become clogged with sediments, the organisms may be unable to extract enough dissolved oxygen from the water.

In addition, suspended particles near the water surface absorb heat from sunlight, raising surface water temperature and thus decreasing the amount of dissolved oxygen that the water can hold. Clarity of water is related to turbidity. It can be measured in a lake or pond using a Secchi disk, a flat metal or plastic plate. The alternating black and white sectors provide contrast, making the disk visible in water. This "Secchi depth" can be used to compare turbidity between sites or sampling dates.

INSTRUCTIONS:

1) Begin by giving a brief introduction to students (5 minutes). You may use the following as a guide:

This water in front of us looks like a lake, but it isn't. It's called a slough. Does anyone remember what a slough is? (A shallow pond that sometimes dries up.)

Where do you think the water comes from?

- The Watsonville sloughs aren't fed by streams, but by rainfall, springs, and run-off from streets and fields.

What is water pollution?

- Harmful materials that make the water less healthy for plants and animals.

What things might pollute the sloughs?

- Garbage and trash
- Oil and soap from drains (car washing, etc.)

- Chemicals from fertilizer and pesticides that run-off into the sloughs from farmlands and home gardens
- Excess dirt and soil particles from places where plants have been removed

<u>How can we find out how polluted the sloughs are?</u>

- Scientists run different types of tests to monitor water quality of our streams and wetlands. Today we will be using the same kinds of equipment that scientists use everyday in their jobs.

<u>If your house became a dumping group for garbage and pollutants what would you do?</u>

- You would have to move away or you might become sick from the pollutants

2) Tell the students that you will begin by testing the dissolved oxygen (D.O.) in the wetlands. You will need 3 volunteers (5 minutes).

- Ask 1 volunteer to read the dissolved oxygen card. Elaborate on the reading and answer any questions briefly.
- Turn on the D.O. meter and ask for a 2nd volunteer to place the D.O. probe into the bucket of water. Do not submerge the entire probe into the water- just the first few inches. Ask the student to swirl the probe around until the number stabilizes.
- Ask a 3rd student to read the result off of the D.O. meter and the 4th student to write down the result on the data collection sheet.
- Also have the student read the temperature reading on the meter (you will compare this reading to the thermometer reading that will be taken later in the session).
- As a group interpret the results using the reference guide on the data collection sheet.
- Talk about trout and why having a defined indicator species is helpful. As the students, "If you were out fishing and caught a trout what does that tell you about the aquatic environment?"

3) Next measure the turbidity of the water (5 minutes).

- Ask 1 student to read the water turbidity card.
- Show students the turbidity tube and the black and white secchi disk on the bottom
- Explain to them that you will be measuring the water turbidity by pouring slough water into the tube.
- Ask 1 student to scoop water from the bucket using the dipper and slowly pour the water sample into the tube, waiting for air bubbles to rise if necessary, until the mark on the bottom of the tube just disappears.
- Stop pouring the water sample into the tube and look at the level of water in the tube.
- If you over-poured, you may slowly let water out the spout on the bottom of the tube.
- Ask students to read the measurement on the side of the tube
- Ask 1 student to record result on the data collection sheet

- As a group interpret the results using the reference guide on the data collection sheet.

4) Next measure water temperature. You will need 3 volunteers (5 minutes).
    - Ask 1 student to read the water temperature card
    - Ask one student to measure the water temperature using the thermometers.
    - Compare the thermometer temperature to that reading you took from the meter while you were getting the D.O. level.
    - Ask 1 student to record the data
    - As a group interpret the results using the reference guide on the data collection sheet.

5) Close the activity with a brief discussion.

    - Remind students that there are many niche species that do well in low oxygen environments or turbid environments.

<u>What can you do to help prevent water pollution?</u>

- Don't throw garbage or trash into the environment
- Use public transportation, walk or ride a bike
- Don't let chemicals get into our storm drains
- Use bio-friendly household products
- Don't use chemical fertilizers or pesticides, try compost and other natural solutions
- Help restore the wetlands
- Tell your friends and family

* <u>Note</u>: If you run short on time, feel free to skip a testing parameter. Be sure to leave a minute or two to talk about what students can do to help prevent water pollution in the Watsonville Wetlands.

**Good way to explain PPM to students is to tell them to imagine a jar with a million white marbles in it. Now tell them that you are going to take X-amount out (you can use the number that you get from your testing) and replace them with red marbles. The red marbles are your parts per million.

TIPS FOR WATER QUALITY STATION:

- Use the cards to guide the station. Ask the students to read each card before testing.

- Students often read quietly and don't always know how to pronounce words. None-the-less, it's good practice for them.

- Repeat what the student read in your own words to get the message across.

DATA COLLECTION Names:_____Date:_____

Dissolved Oxygen

0-3 mg/l (ppm): most aquatic life cannot survive
3-4 mg/l (ppm): most fish cannot survive
>4 mg/l (ppm): minimum amount for most fish to be healthy
7-18 mg/l (ppm): amount of oxygen necessary for sensitive fish and invertebrates to be healthy

OUR RESULTS:

Temperature

< 16 degrees C (60°F) for cold water species
< 32 degrees C (90°F) for warm water species

OUR RESULTS:

Turbidity

Length-to-Turbidity Conversion

Centimeters		NTU
6.5	=	240
7.0	=	200
9.0	=	150
11.5	=	100
18.0	=	50
20.5	=	40
25.5	=	30
33.0	=	21
35.5	=	19
38.0	=	17
41	=	15
43.5	=	14
46.0	=	13
49.0	=	12
51.0	=	11
53.5	=	10
85.5	=	5

If turbidity stays above 10 NTU's for several hours, fish start to become stressed out and that can make them sick. If turbidity stays above 10 NTU's for several days the fish will begin to eat less and my leave the area.

If turbidity stays above 50 NTU's for several weeks, fish will stop growing and slow down reproduction.

If turbidity stays above 500 NTU's for several months, fish will die.

OUR RESULTS in NTU:

What do today's results tell us about the health of our wetlands?

What can you do to help prevent water pollution?

Water Quality Sampling Instructions

1. When you arrive at your site, record arrival time, station ID and HACH meter ID.

2. To take air temperature, hang the thermometer in the shade and leave for 5-10 minutes while you are taking other measurements. Record thermometer ID.

3. When using the HACH meter:

    a. For water temperature, pH, dissolved oxygen, and conductivity, record the PROBE COLOR rather than the meter ID.
    b. Connect the probe, push read, and stir the probe in the water while the meter stabilizes.

4. For transparency, fill the long tube by dipping it directly in the slough or by using a dipper. Let water out of the bottom of the tube until you can view the black white pattern at the bottom of the tube. Record the water height at eye level.

5. Be sure to circle all water quality observations.

6. You do not need to fill out the back of the data sheet unless you are taking water samples.

Supplies list

- Rubber gloves
- Distilled water bottle. If the small bottle is low, refill with large jugs in the bottom of the white cubbies.
- Transparency tube
- Water dipper
- 1 pair of boots
- Plastic bottles and/ or whirlpaks if collecting water samples for lab analysis
- Sampling kit (navy tote)