Estuary Keeper

Grade Level

4th - 10th

Objectives

* To build an understanding of population dynamics.

* To evaluate living and non-living things that affect fish populations.

* Learn how to be a better steward of the environment.

N.C. Standard Course of Study

Grade 4
(4.L.1.1)

Grade 6
(6.L.1.3, 6.L.2.2)

Grade 8
(8.E.1.2, 8.E.1.4)

Biology
(Bio.2.1.3, Bio.2.1.4)

Environmental Science
(EEn.2.3.2, EEn.2.4.1)

Overview:

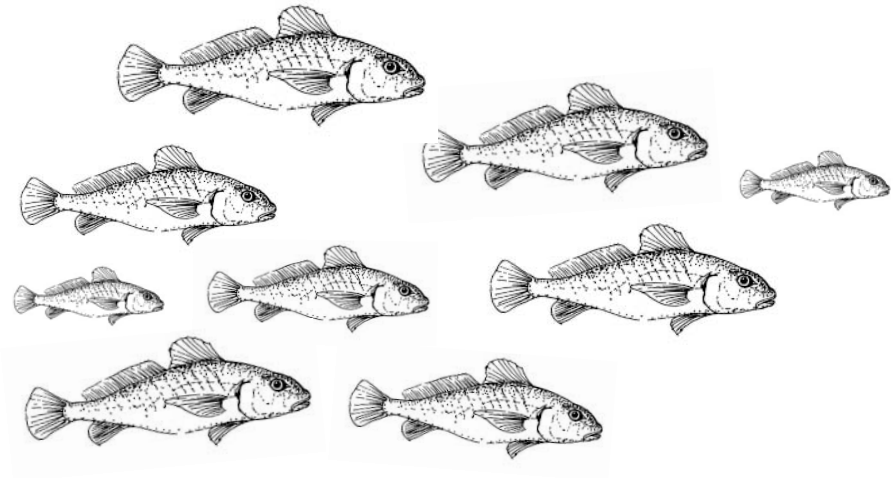
In this activity students will learn about the many factors, both man-made and natural, that affect fish populations in the estuary. By learning how humans have a negative influence on estuarine fish populations, students will learn how to become better stewards of the environment.

Materials:

- Napkins
- Goldfish crackers
- Set of ecological change cards (included)

Background:

Estuaries are dynamic places where fresh and salt water meet. There are many different habitats that make up the estuary, including salt marshes, sand flats, mud flats, oyster reefs, and the water column. These habitats are nursery areas to many young animals like fish, shrimp and crabs because they offer good places to hide from predators and supply an abundant amount of food. More than two-thirds of the nation's commercial fish and shellfish use estuarine habitats for spawning grounds and nursery areas.



Unfortunately, pollution from human activities often ends up in the estuary. Increased pollution, in the form of stormwater runoff, can enter the estuarine waters and cause a phytoplankton bloom. Phytoplankton are microscopic algae whose numbers increase uncontrollably when nitrogen and phosphorus (from pollution) are added to the water. The problem comes when the tiny bacteria that feed on the algae use up

all of the oxygen in the water. Like us, fish need oxygen to breath. When there is not enough oxygen in the water many fish die. This is called a “fish kill.”

Stormwater runoff comes from rainwater that runs off of impervious surfaces such as roads and parking lots. Substances such as oil and other vehicle fluids, as well as sediment, can be picked up by the water as it flows to the waterways.

Good things happen too. People can clean up the waterways, set aside good habitat for wildlife, and make sure to only keep a reasonable number of fish when fishing.

Activity:

In this activity you will learn about different man-made and natural factors that lead to changes in the estuarine fish population. Divide students into groups of four. Each person in the group gets a napkin with 10 goldfish. A pile of goldfish is placed in the middle of the table and is used by the group to draw from when they need to add to their fish population. Have the students eat the subtracted fish instead of throwing them away. Each group of four students also gets a set of ecological cards. Students take turns drawing from the card pile and following the directions on the cards. When all cards have been drawn, the game is over, and all players should count their population of fish.

Discuss your results.

Questions:

1. Name several species of fish that live in the estuary that could be the fish population that was studied.

2. What are some things that affect the estuaries in a good way? In a bad way?

3. What kinds of things can we do to help preserve and protect estuaries?

4. Did your population completely die off? Why? Do you think that in real life this would happen? Why or why not? How long do you think it would take in an estuary for a population of fish to no longer be there?

Extension:

1. Have students develop more ecological change cards.

2. Have students mathematically track their population on a chart.

3. Study the life cycles of some fish that use the estuary (flounder, red drum and menhaden are some examples). Determine at what times of the year they use the estuary.

4. Study some of the ways that fish are harvested. Compare how efficient they are and if the gear damages the habitat.

5. Study and discuss the rules on harvesting certain fish and discuss why there are certain rules. How do they benefit the fish population? (Rules can be found on N.C. Division of Marine Fisheries webpage: http://www.ncfisheries.net).

Vocabulary:

- population
- non-point source pollution
- stormwater
- spawn
- phytoplankton
- impervious
- point source pollution
- nursery areas
- runoff
- habitat
- algal bloom
- fish fry

References:

National Science Standards:

Content Standards *Unifying concepts and processes [1-4] [5-8] [9-12]*

Life Science [1-4] [5-8] [9-12]

Science in personal and social perspectives [1-4] [5-8] [9-12]

Ocean Literacy Principles:

Essential Principle #5. *The ocean supports a great diversity of life and ecosystems. (Fundamental Concept – d, f, i)*

Essential Principle #6. *The ocean and humans are inextricably interconnected. (Fundamental Concept – e, g)*

Teachers page:

1. Name several species of fish that live in the estuary that could be the fish population that was studied.
   Blue fish, red drum, croaker, mullet and killifish are some examples.

2. What are some things that affect the estuaries in a good way? In a bad way?
   Good things include land preservation, buffer rules for development and good stewardship. Some harmful things include careless pollution, uneducated practices (too much fertilizer for example) and land use practices such as farming too close to waterways.

3. What kinds of things can we do to help preserve and protect estuaries?
   Learn about good practices in waterways and near estuaries such as not overfilling boat gas tanks, using only prescribed amounts of fertilizers on yards and gardens and leaving vegetated buffers adjacent to waterways to help absorb excess water that may carry sediment and pollution from roads and yards.

4. Did your population completely die off? Why? Do you think that in real life this would happen? Why or why not? How long do you think it would take in an estuary for a population of fish to no longer be there?
   Certainly in real life this can happen. If waterways and estuaries are filled in, polluted or damaged so that animals aren't able live there, it will happen. This can be a quick event or a slow event. Short term effects can come from improper dredging or filling of estuaries, and oil or pollution spills.

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Ecological change cards

A bluefish closes in on a school of smaller fish.

Lose 3 fish

Mr. Farmer sprayed his corn crop for insects. When it rained the runoff ran into the estuary and killed 3 fish.

Lose 3 fish

State rules are updated for fishing. This gives additional protection for your fish species.

Add 5 fish

A salt marsh is set aside as a nature reserve.

Add 4 fish

Ms. Farmer expanded her goat pen near the water. Extra algae grew in the water because of the runoff.

Lose 2 fish

Three fish are caught in a gill net set by Ms. Fisherman.

Lose 3 fish

Ecological change cards

“Clean Sweep” was held to collect debris in the watershed. **No fish lost**	Dolphins feed in the estuary. **Lose 2 fish**
The nursery has lost 3 fry (fish babies) because bulldozing a nearby road caused mud to wash into the water. **Lose 3 fish**	All the roadway storm drains are funneled into a holding pond with lots of plants to absorb the runoff and chemicals. **Add 4 fish**
A pelican flies over. It eats 1 fish for dinner. **Lose 1 fish**	A fisherman dropped a can of oil in the water. **Lose 3 fish**

Ecological change cards

A new marina attracts 30 new boats to the estuary.

Lose 2 fish

The salt marsh is left undisturbed.

Each player add 4 fish

A fish ate a piece of plastic packing material that was blown into the water.

Lose 1 fish

A red drum catches a fish for dinner.

Lose 1 fish

Jimmy threw his fish back when he was fishing. It was smaller than the legal limit.

No fish lost

Something mysterious in the water kills fish.

Each player loses 3 fish

Ecological change cards

A vacationing family of 4 went fishing and each caught a fish. None were released.

Lose 4 fish

A polluting factory closes. The water is now cleaner.

Add 4 fish

A shark ate 2 fish.

Lose 2 fish

New fry (baby fish) swim into the estuary from the ocean.

Add 6 fish

Area closed to fishing. Three fry (baby fish) hatch.

Add 3 fish

Someone builds a new dock across the salt marsh without a permit. Two fish are killed when pilings damaged their habitat.

Lose 2 fish

Ecological change cards

A large algal bloom occurs. Bacteria feed on the algae and use up all of the oxygen in the water causing a fish kill.

Lose all your fish

No dredging is allowed in the estuary for harvesting clams or scallops. Fish habitat is healthy.

Add 5 fish

The town establishes a buffer rule so no one can cut the vegetation (grass) within 20 feet of the water. The water is now cleaner.

Add 3 fish

Mr. Fisherman checks his gill net often and frees the fish he is not going to keep to eat.

Lose no fish

A motorboat speeds through the estuary but not in marked channels. The propellers drag bottom and destroy fish habitat.

Lose 2 fish

Septic tanks near the water have not been pumped out in over 10 years and pollute the estuary.

Lose 3 fish