FISH FOR OUR FUTURE!

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CONTENTS

JUST FOR TEACHERS

UNIT ONE — ALEVIN — for Elementary Students

An ALEVIN, such as a newly hatched salmon or trout, (pronounced 'ALE VIN) remains buried in the streambed gravel until the attached yolk sac is absorbed. When the young fish emerges from the gravel and begins to feed, it is called a "fry."

UNIT TWO — SMOLT — for Middle School Students

A young salmon (or sea-going trout) is called a "SMOLT" when it is ready to leave fresh water for the sea. Smolts have lost the dark "parr" markings on their sides and turned silvery

UNIT THREE — SALMON — for High School Students

EXTRA RESOURCE SHEETS

FISH FOR OUR FUTURE!

ALEVIN

TEACHER: FISH TALES

Overview:

Students will be encouraged to share their observations and knowledge about fishes through discussion, personal writing or storytelling and illustrations. This lesson serves as a basis for other lessons in this unit.

Objectives:

Students will be able to:

- create a fish from art material
- describe/explain at least three characteristics of a fish

Subject Links:

- science
- language arts
- visual arts

Time:

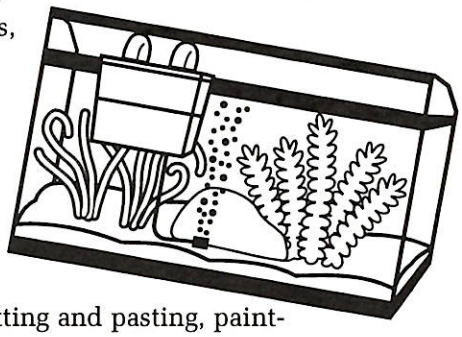
one to one and one-half hours

Materials:

a variety of paper (including coloured tissue, paint, crayons, shoe boxes, etc.)

Advance Preparation:

A few days before the activity, place something visible such as an aquarium, a fishing rod, tackle box, etc. in the classroom. This will serve to generate student questions and discussions about fish and fishing. If possible, have students bring in things they have that relate to the theme of fish and fishing (i.e. books, pictures, toys, etc.).



Process:

1. Use the object you brought into the classroom as a discussion starter. What is it used for? What other uses might it have? Allow time for students to share personal "fish-related"24 stories.
2. Have students create an image of a fish by drawing, cutting and pasting, painting or creating a three dimensional model. You may then wish to challenge your students to write a story about their fish. Students might then be video-taped reading or performing their story. ***They usually love this!***
3. Once students have had an opportunity of showing their fish to their classmates and sharing their story, record information students know about fish as a list or as an idea web. This will serve as a basis for future lessons.
4. Display the students' fishes and stories in a place where they can be viewed by other students. You may wish to use the student information for additional display ideas.

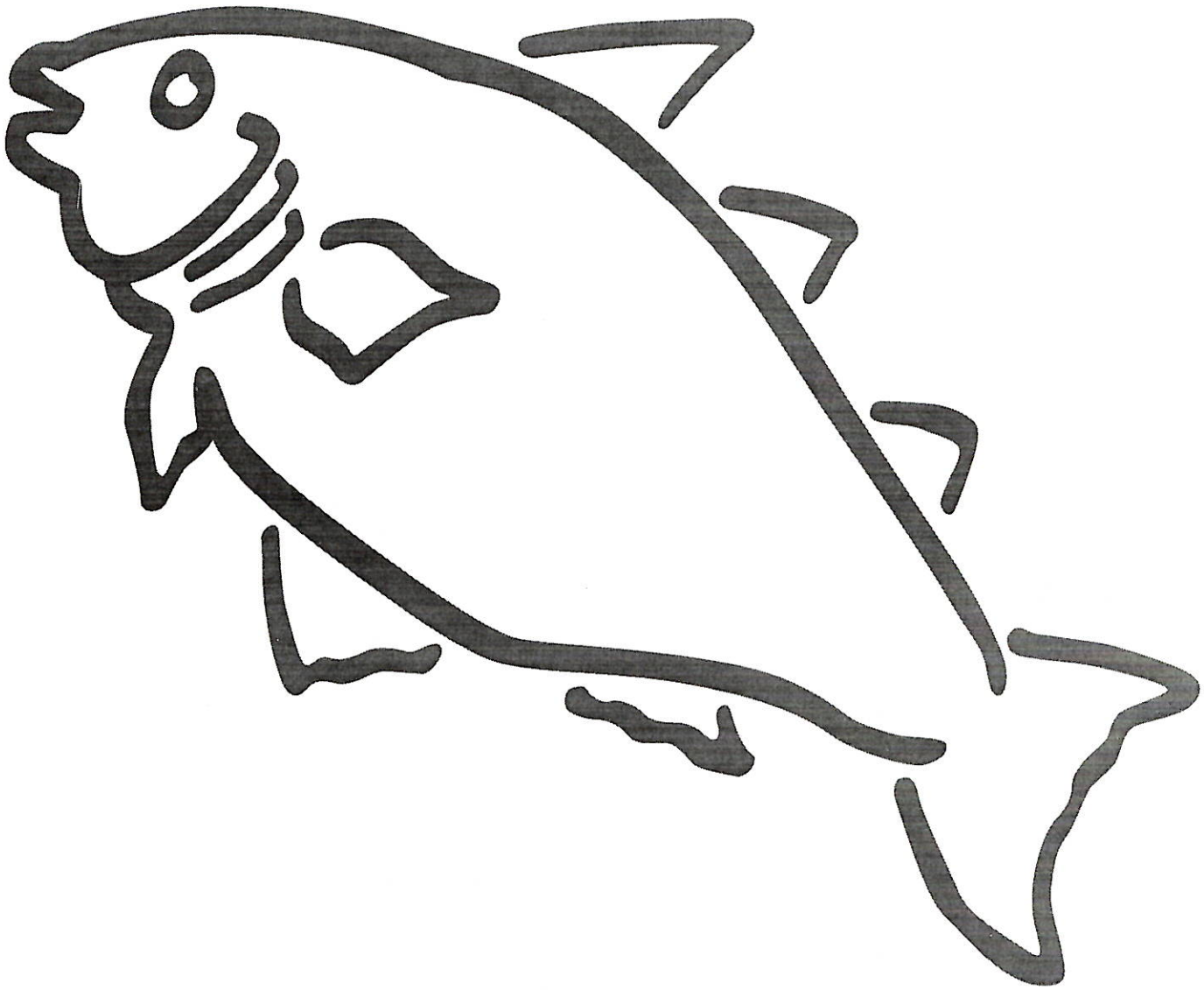
Evaluation:

Evaluation may be based on the following questions:

- were the students willing to participate in the activity?
- what was the extent of the information shared by the students?
- how much detail did they include in their picture and/or story?
- did they include habitat? another fish in the water? a school of fish?

Possible Extensions:

1. Have students write a poem about fish. Encourage them to use ideas listed during the brainstorming session.
2. Read a fish story to your students.
3. Have students write a story about fish on a fish-shaped sheet of paper.
4. Invite a guest speaker to come to the class to talk about his/her fishing experiences.



TEACHER: "REDD" ALL ABOUT IT!

Overview:

Students will read and listen to at least one of a wide variety of stories, books and poems about fish.

Objectives:

Students will be able to:

- retell a story in sequence
- express at least four facts about fish

Subject Links:

- science
- language arts
- visual arts

Time:

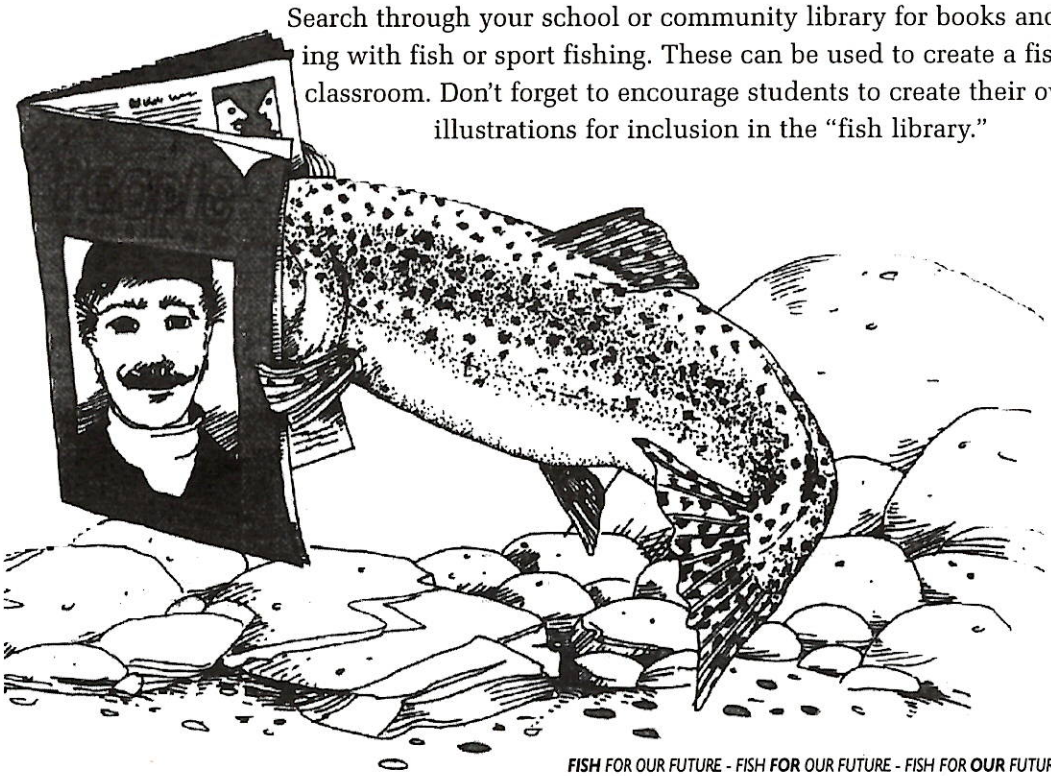
one to one and one-half hours per story

Materials:

- books
- stories
- poems - both commercial and student-made
- art materials
- writing materials

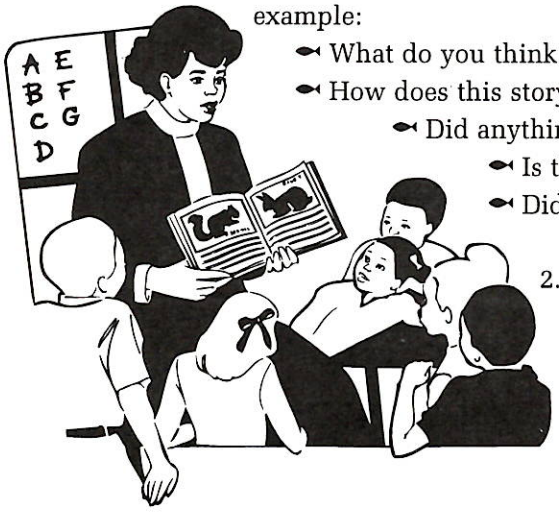
Advance Preparation:

Search through your school or community library for books and magazines dealing with fish or sport fishing. These can be used to create a fish library in the classroom. Don't forget to encourage students to create their own stories and illustrations for inclusion in the "fish library."



Process:

1. Choose a story or poem about a fish and read it to the class. As you read, ask questions, for example:



- What do you think will happen next?
- How does this story make you feel?
- Did anything like that ever happen to you?
- Is that what you would have done?
- Did you hear a word that you have never heard before?

2. After finishing the story, have the class brainstorm a list of new, difficult or fish-related words, then find their meaning.

3. Allow students to respond to the story/poem. Some possible ways include:
   - Discussion: small group, large group, cooperative learning group, etc.
   - Visual Arts: painting, drawing, diorama, modelling
   - Writing: personal response, reports, factual story, imaginative story, poetry, riddle

4. Encourage students to explore their feelings about fish and whether the story or poem helped them see fish in a new or different way.

Evaluation:

Evaluation may be based on questioning, or having students draw four pictures about a story and put them in sequence.

Possible Extensions:

1. Have students write a poem about fish. Encourage them to use ideas listed during the brainstorming session.

2. Have students interview an elderly person about his/her fishing experiences, then write a story.

3. Allow students to record their story on audio tape and work in sound effects.

CAUTION: UNDER CONSTRUCTION

Overview:

Students will "construct" a New Brunswick fish species and place various body parts on the "fish" after viewing live fish or looking at pictures.

Objectives:

Students will:

- become familiar with all the external body parts of a fish

Subject Links:

- science
- visual arts

Time:

one-half to one and one-half hours

Materials:

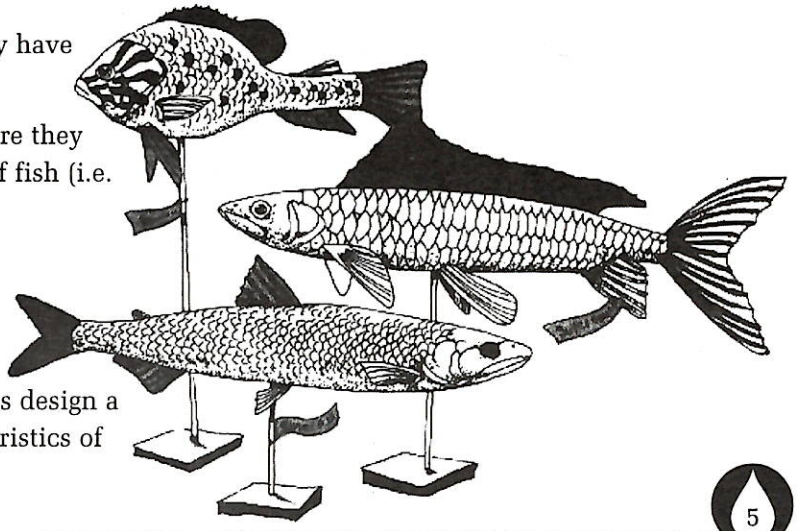
- classroom aquarium with fish (if possible)
- fish posters
- modeling clay and art materials

Advance Preparation:

Provide time for students to view live fish in a classroom aquarium or look through books and magazines with fish pictures, or browse the Internet, before they construct a fish.

Process:

1. Once students have had the opportunity to view fish, have them construct a fish using modeling clay and/or construction materials. Ask that they include all of the external body parts that they observed.
2. Discuss with students the basics of fish anatomy (i.e. fins, shapes, eyes, nostrils, mouth, etc.). Have students examine their model and include any parts that they may have missed.
3. Have students decide how and where they would like to display their school of fish (i.e. school lobby, table outside classroom, etc.).



Evaluation:

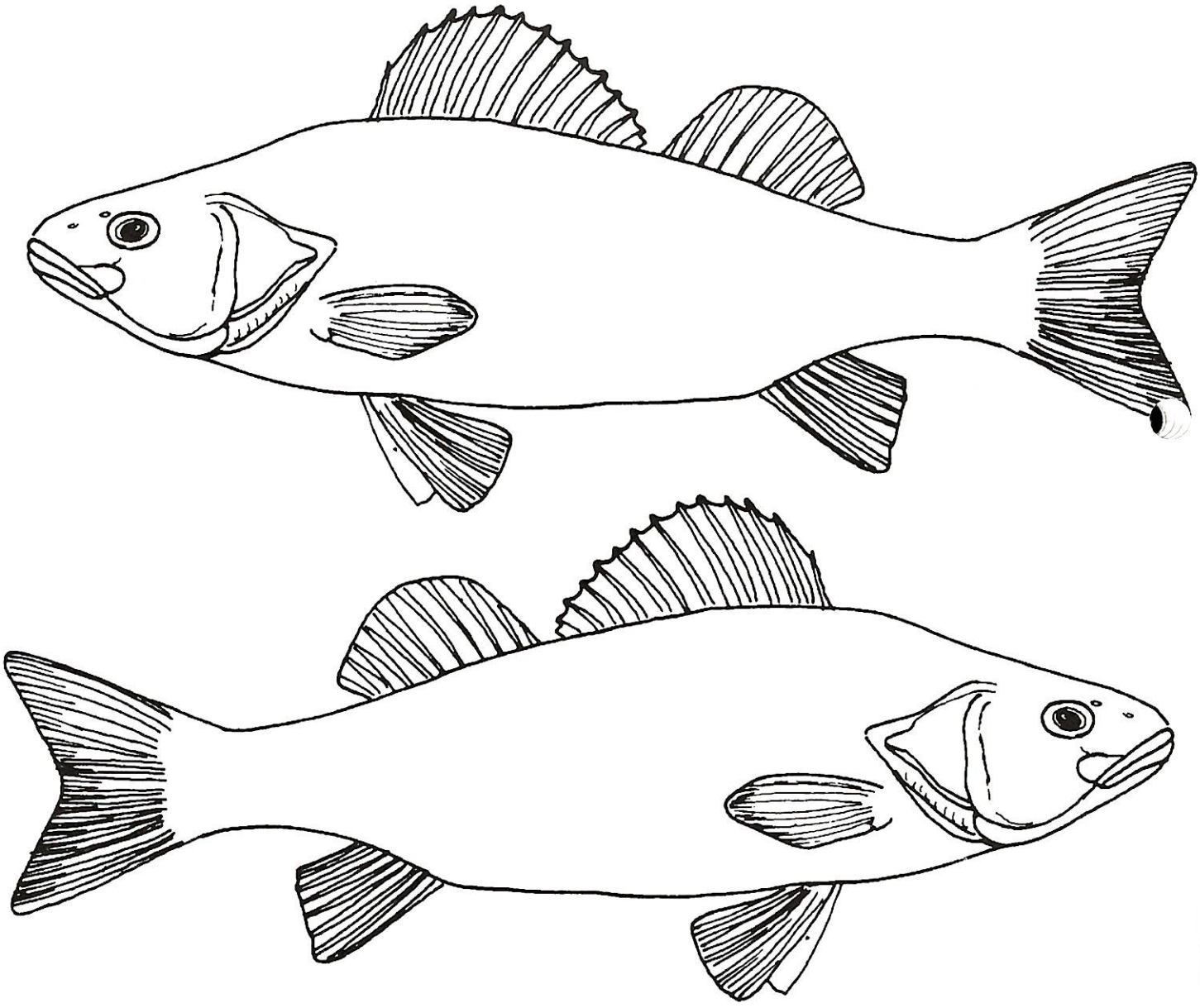
Evaluation may be based on the "finnished" product, or by having students design a "super fish" and describe the characteristics of its body parts that make it "super".

Possible Extensions:

1. Have students colour their fish in the colour and pattern of fish found locally.

2. Have students construct a fish body made from sandpaper since it would feel like some "real" fish.

3. Have students stuff their fish with newspaper and hang them in front of a window covered in blue cellophane to simulate an underwater scene. Students may wish to make underwater plants using construction paper and crepe paper, to make the underwater scene more realistic. The plants could then be suspended from the ceiling.



CAUTION: UNDER CONSTRUCTION

Overview:

Students will identify their own needs and how they differ from things they may want, but can live without, such as music, TV, games, etc. They will then compare their basic needs with those of a mystery animal. They will discover through group work that the animal is a largemouth bass, and that all living things have similar needs.

Objectives:

Students will be able to:

- determine the difference between a need and a want
- list at least three basic needs that all animals have
- show how those needs are met for both people and at least one kind of fish

Subject Links:

- science
- language arts

Time:

one to one and one-half hours

Materials:

- student worksheets 1, 2 and 3; teacher resource sheet

Advance Preparation:

Copy student worksheets 1 and 2 (one for each group of students). Cut along the lines and put each set of needs cards in a separate envelope.

Process:

1. Have students hold their breath. **(Don't let anyone pass out though!)** As they hold it, ask them what their body is telling them they need to do.
2. Ask what other things they need to live. Accept and record answers. Go through the list and eliminate things they can live without, even though they may not want to. Have them group the remaining things into the smallest number of categories, under the title **Basic Needs**. (The three general categories will probably be ***food, shelter/space, water***.)
3. After stating that all living things have similar needs, divide the students into groups of four or five, and give each group an envelope containing the squares from worksheet 1.

   As an Individual: Each student is to find one card from each of three different needs (food,water, shelter/space). With their three cards, the student is to guess what kind of animal needs the items on their cards and draw the animal.

   As a Group: Compare answers and agree on a common answer. Once they agree on an animal, distribute the envelopes containing worksheet 2. Have each group assemble the picture and attempt to identify what kind of fish it is.

Evaluation:

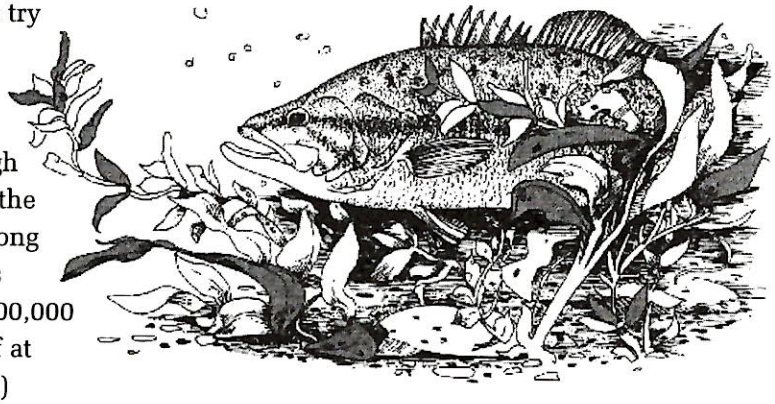
Have students draw and explain similar human and fish needs using student worksheet 3. Each set of needs should be drawn side-by-side, for example, human and fish needs for food, water, shelter, etc.

Possible Extensions:

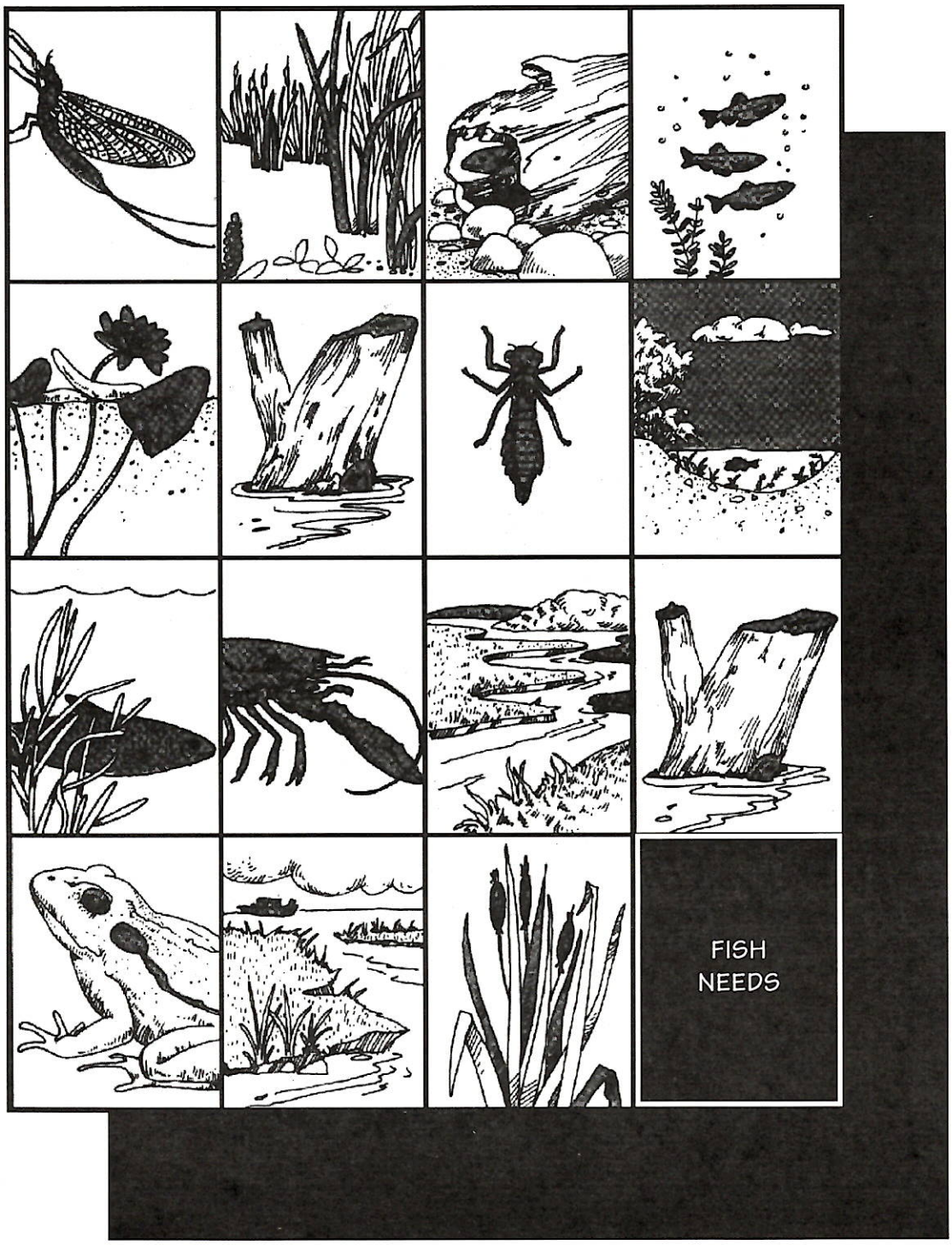
1. If you have an aquarium in your classroom, discuss how you help meet the basic needs of the fish in it.
   - FOOD: What do we feed the fish? How often are the fish fed?
   - WATER: What do we do to keep the water clean? How do we keep the water at the correct temperature?
   - SHELTER: How do the fish use the rocks, plants and ornaments? Do they hide from each other? Do they hide from you?
   - SPACE: How many fish are in our aquarium? Do they seem crowded?

2. After a female bass lays her eggs, the male guards the redd (nest) until the eggs hatch and the young are partly grown. Students can experience some of the difficulties a male has while guarding the nest in this fun game!

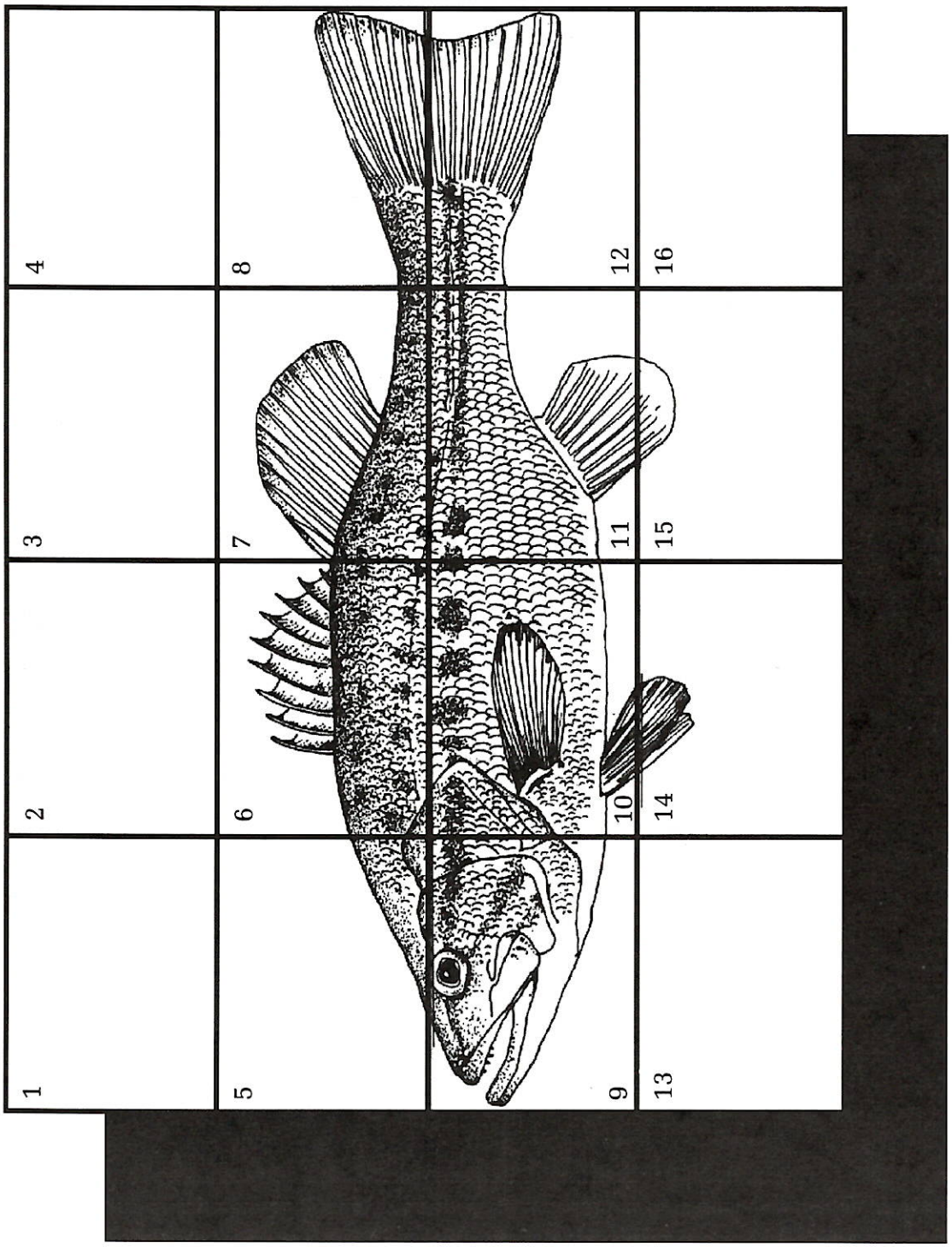
   Choose about one student in six to be a male bass. He must guard his "eggs" (a pile of stones or other small objects) from predators (the other students). When a predator steals an egg, the male bass must try to tag the predator. If the predator is tagged, he/she must drop the egg, retreat and try again. Allow enough space between the bass so the predators can circulate among them. As a closure, discuss why some bass lay up to 100,000 eggs. (To ensure survival of at least some of her offspring.)



STUDENT WORKSHEET 1



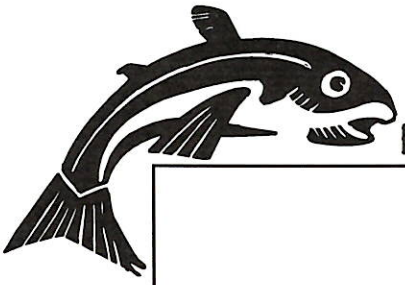
STUDENT WORKSHEET 2



STUDENT WORKSHEET 3

EVALUATION

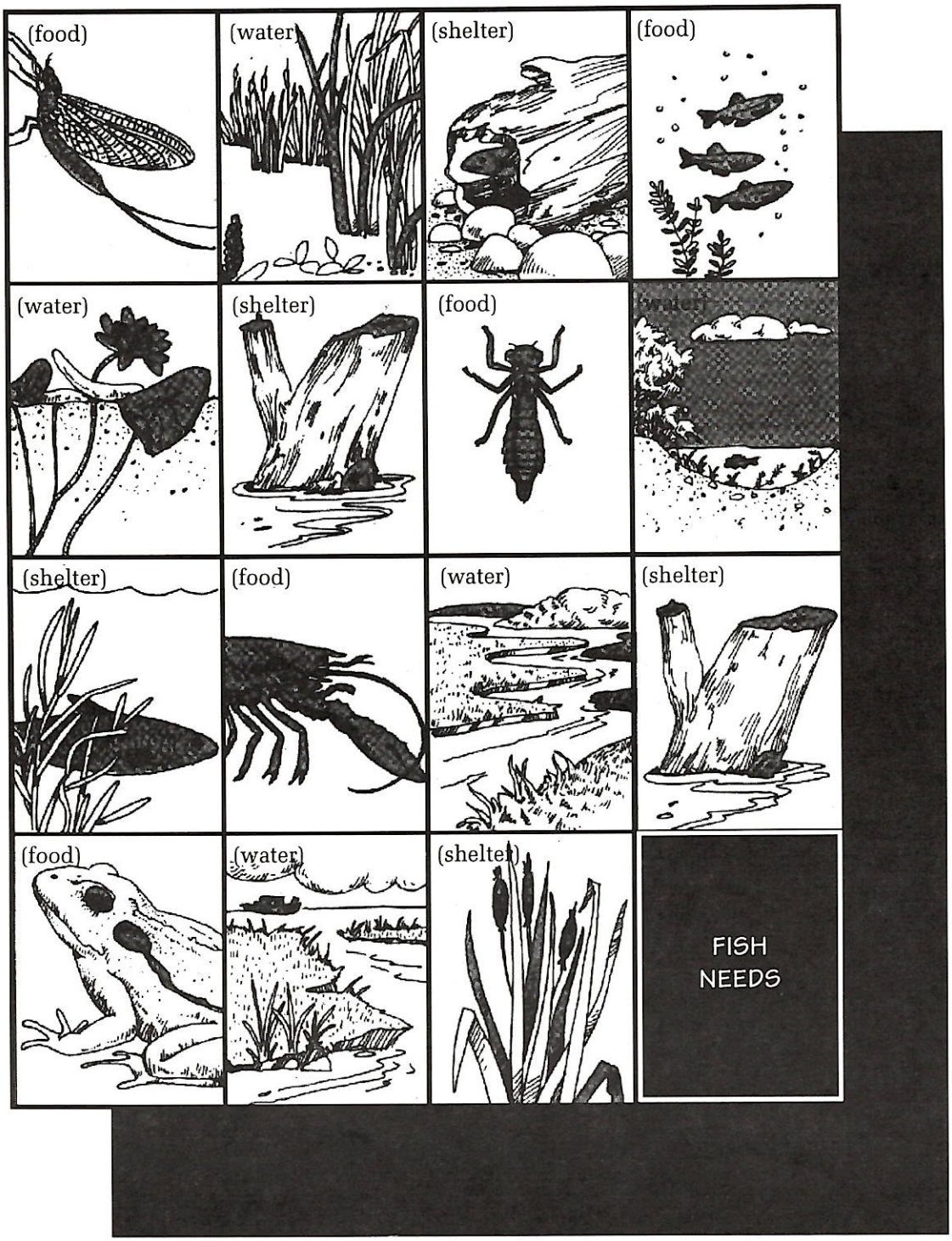
Name: _____



FISH

TEACHER RESOURCE SHEET

FISH NEEDS KEY



TEACHER RESOURCE SHEET

Overview:

Most students enjoy opportunities to "muck around" in streams and ponds. Opportunities to get their feet (and various other parts of their anatomy) thoroughly wet will undoubtedly arise. *(All part of the fun!)*

Objectives:

Students will be able to:

- demonstrate a basic understanding of healthy aquatic habitats
- perform a basic aquatic habitat assessment of a stream
- compare the aquatic habitat of one stream or pond to that of another

Subject Links:

- science

Time:

forty-five minutes to one hour at site

Materials:

- first aid kit
- rubber boots
- clipboards
- copies of student work sheet

Advance Preparation:

1. Stream or river access points should be checked out a few days in advance to ensure the river bank is not too steep and fast moving water is not more than knee deep. Remember, even slight rainfalls can make significant increases in water volume and velocity in streams and rivers.
2. Boundaries should be clearly established in advance to keep students away from deep water or other dangers.
3. Decide if more than one site will be visited to allow for a comparative study.
4. Remind students that shoes or boots are to be worn at all times to prevent cutting feet on sharp objects and to make footing easier.

Procedure:

1. Divide students into groups. Each group is to complete their habitat assessment form.
2. You may want students to sketch anything of significance on the back of the sheet, or use that area to list important factors such as: erosion problems, aquatic insects observed, pollution sources, the physical condition of the stream, etc.
3. As a whole class, discuss the results of the survey. Did most groups have the same answers? What condition is the stream in? What do you think could be done to improve the stream?
4. If possible, you may wish to do a comparative study between two streams or ponds, or a stream and a pond.

Evaluation:

Evaluation may be based on completed habitat assessment forms as well as verbal responses to questioning.

Possible Extensions:

1. Have students assess a stream near their home with the assistance of their parent(s). They could then write a short report on the condition of that stream and suggest improvements that might be made.
2. Students may be interested in visiting a site where habitat reconstruction has been/is being done. Information on site locations may be obtained by contacting the Department of Fisheries and Oceans. (See appendix.)

STUDENT: HOW HEALTHY IS YOUR STREAM?

Instructions to Students:

Visit a local stream, river, pond or lake. Shade in each row of this sheet based on what you see. Discuss your findings with your classmates.

Materials You Will Need:

- boots
- a change of clothing
- a magnifying glass
- clipboard
- pencil
- hat
- sunscreen
- container with a cover
- *A SNACK!*

	YUCK!	NOT TOO BAD	EXCELLENT
The air smells	totally gross	a little smelly	fresh and clean
The water looks	like a dump!	a little polluted	clear and clean
The stream bottom	is yucky and muddy: I'd sink to my knees	a little slimy: I'll keep my boots on!	gravel, some sand and big rocks
Bugs are	nowhere in sight, not even under rocks!	here and there, but mostly of one kind	all over the place, and lots of different kinds
Fish	live somewhere else (I can't blame them!)	can be seen now and then, but have no place to hide	there are lots, with many places to hide
Water Plants	only green or brown slime lives here, not much grows on the bank	very few plants live in the water, or on the bank	different types of plants grow in the water and on the stream bank

Results

Mostly Yuck!:

Your stream could be in serious trouble! Talk with your teacher about getting help for your stream before it's too late!

Mostly Not Too Bad:

Things are probably in pretty good shape. Some improvements could be made to make things better.

Mostly Excellent!!:

Your stream seems to be in excellent shape! It is important to make sure the stream stays this way! What can you do to help?

TEACHER: GONE FISHIN'

Overview:

Students will have the opportunity to explore and experiment with some recreational fishing technology (rod, reel, line, net) and be introduced to some of New Brunswick's fishing regulations.

Objectives:

- list the parts of a fishing rod and demonstrate its use
- list three different types of fishing rules
- find the fishing season in their area for one common fish using the provincial Sport Fishing Regulations Summary

Subject Links:

- science
- social studies

Time:

one hour

Material:

- fishing equipment (rods, reels, lines)
- nets
- hooks
- fishing license
- student resource sheet
- hip-waders
- tackle box
- lures
- sports magazines
- sportfishing regulations pamphlets

Advance Preparation:

1. If possible, make arrangements for students to visit a sporting goods store so students can see the equipment demonstrated or have someone come in with equipment and explain its use - along with some personal fishing stories.
2. Send a letter to parents and local outfitters asking for their assistance in providing some fishing equipment, or sharing their expertise with students.
3. If possible, obtain one copy of New Brunswick's Sport Fishing Regulations Summary for every three to four students.
4. You may wish to post a copy of the Fisherman's Creed and Prayer in your classroom, to help students consider fishing issues and ethics.

Procedure:

1. Discuss with students the need for safety when handling fishing equipment.
2. Ask students to brainstorm functions for each of the following parts.
   (Possible answers are provided.)

LINE:

- to let the bait or lure reach the fish
- to stretch a bit to absorb the shock of the fish hitting the bait/lure
- to help hold and tire the fish

REEL:

- to roll in the line quickly
- to keep the line from tangling
- to store long lengths of line
- to help cast the line out great distances

ROD:

- to give anglers a strong grip while pulling in the fish
- to help aim the cast
- to absorb some of the shock as the fish fights the hook

3. Discuss rules in general and the need for them. (This might be a logical link to the need for classroom rules!) This can lead to a discussion of angling rules and conservation of fish species. Depending on the interest and the abilities of your class, one of the following options may be used:
   a) Discuss with students what sport fishing regulations they think should be enforced in their area and why.
   b) Hand out copies of Sport Fishing Regulations to groups. Summarize. Have the students try to find examples of fishing rules and list four of them.

   Once students have completed the activity, help them rationalize why the rules exist. Examples of possible rules and their reasons are:

   - **CLOSED SEASONS:** to protect fish while they reproduce; to reduce overall fishing pressure
   - **SIZE LIMITS:** to let fish grow large enough to reproduce
   - **CATCH LIMITS:** to leave enough fish for others to catch; to let fish fulfill their role in the environment

4. Go out in the playground and provide students with time and space to experiment casting with rods. (Be sure that the hooks are removed. To make casting easier, weights or sinkers may be tied to the end of the line.)

5. Design some fishing challenges for the class:

   - who can cast the farthest?
   - who can cast the smoothest?
   - who has the most accurate cast?

Evaluation:

In partners or small groups, have students create some role-play dramas showing good fishing practices.

Possible Extensions:

1. Make some fish shapes and attach a paper clip or other metallic object to the mouth. Mark off an area of the playground as the "lake" or "river," and scatter the fish throughout the area. Attach a magnet to the end of each line and allow students to go "fishing." To make this exercise more realistic, limits may be placed on the species, size and number of fish caught.

2. Another variation of the above exercise is to use a children's plastic swimming pool as a lake. On the bottom, place some rocks and construction paper plants along with the construction paper fish with attached paper clips. Cover the surface of the lake with garbage bags, leaving narrow open strips between the rows. This makes it difficult, if not impossible for students to actually see what they are catching. Have students put their magnetic fishing lines through the cracks and try to catch a fish. Again, regulations regarding size, species and number may be used.

UNIT ONE: EXTENSION ACTIVITIES

Science	Social Studies	Math	Phys. Ed.
ecosystems aquatic animals pollution conservation versus misuse adopt a tree seasonal changes life cycles food chains	pollution use of waterways (past and present) mapping flora/fauna	measure current graphing measurement	movement • fish • water • waves • life cycles swimmers • animals • fish • people

UNIT ONE: EXTENSION ACTIVITIES

Language Arts	French	Fine Arts
stories, poems, talks research projects journals poem "Hurt No Living 'Thing'" (C. Rosetti) *The Gift of Tree*	names of common aquatic organisms hands-on activities "on-site"	videos, sketches, painting of area during seasons interpret music with painting seasonal changes

These suggestions were provided by ***School District 12 teachers*** *at a curriculum development workshop, April 1996*

UNIT ONE: LEARNING CENTERS

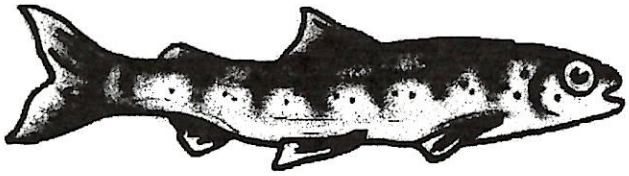
Math	Science	Art	Language Arts
• **measurement:** with string, compare relative sizes of fish • **graph:** order the string lengths on a graph • measure the mass and volume of a fish tank • take an area of lawn, put a string around it and graph all the living things in that area • after going on a hike, map out the route and include photos of specific sites • create a stream, dam or reroute water using puddles after a rain	• species: life in and around streams • texture rubbings: pennies, chairs, soles of sneakers, burlap, basket, cement blocks, leaves, etc.	• illustrating: one of the species from in or around the stream • draw the fish used in the math center • hand painting	• read and record information/facts about species • dramatize the meeting of two/three of one species • introduce oneself including specific info describing "what, who, where?" • develop a "Who am I?" game

UNIT ONE: LEARNING CENTERS

Social Studies	Physical Education
• mapping: follow a maze game & game board: rivers and paths, cards with various clues use an actual map map of a hike or walk map out a specific area and include the pictorial key to locate trees, plants, rock formations, etc. that have been observed	• game "Bombers" adapted to experiences of a fish: swim north, south, danger! freeze!, camouflage - hide, imitate plant life/movement • dramatize a story with movement, i.e. life cycle from egg to adult • movement with music: fish movements, water movements • "Underwater Tag": those "not tagged" must crawl between the legs of the "tagged" person to "un-tag" them. The "it" person could be a predator of fish, i.e. bear, osprey, etc.

FISH FOR OUR FUTURE!

FRY



TEACHER: HOME SWEET HABITAT

Overview:

This activity will encourage students to talk about their homes and discuss possible areas where a fish would make its home in the water. Students will then create a class mural to show all the possible places where a fish could live.

Objectives:

Students will be able to:

- list different fish habitats
- recall at least two New Brunswick fish species and where they live

Subject Links:

- science
- language arts
- visual arts

Time:

one to one and one-half hours

Materials:

- mural paper
- a variety of other papers for cutting and pasting (construction, crepe, tissue, shiny papers)
- glue
- scissors
- picture books on the topic of fish and fish habitats

Process:

1. Discuss with students where they live. The following questions might be useful:
   - What is your home like?
   - What things are outside your home?
   - What do you need your home for?

   Like people, fishes need places to live. Different fish species require different kinds of homes.

2. Ask students where a fish might choose to live within the pond, stream, river or lake. *Possible answers: an old log, pile of sticks or branches, between rocks, shells, under a dock, etc.* As you record the list, you may introduce the word "habitat" to explain that this is an area where a fish makes its home.

3. Have the students make a mural of fishes and their habitats. You might divide the class in half: one half showing natural habitats, the other half showing the effects of pollution (tires, bottles, cans, etc.). Ensure that each mural has a sloping bottom from shoreline to some depth to allow for different habitats. Have students colour or paint the bottom of the lake then cut out their fish homes from various paper. Some students may enjoy the challenge of making the habitat three-dimensional.

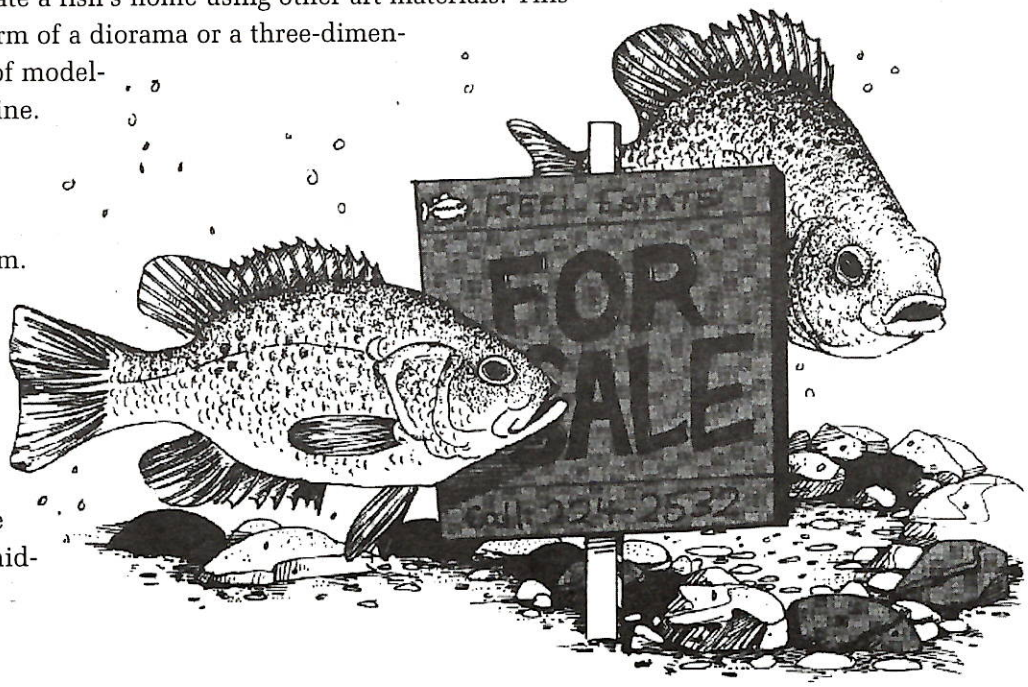
4. Have each student create and cut out a fish that they think would fit a particular home and place it in or near that home on the mural. Have students explain why they chose that particular place for a home and why their fish "fits" there.

5. Display the fish poster. Introduce common Maritime fishes to students. Emphasize the habitat of each fish species and the differences between the habitats of various species.

Possible Extensions:

1. Have students create a fish's home using other art materials. This might be in the form of a diorama or a three-dimensional model out of modeling clay or plasticine.

2. Have students observe the fish in an aquarium. Where do the fish like to spend the most time? Where do they go if they are chased? How does their behaviour change if the plants and other hiding places are removed?



TEACHER: HABITAT LOST

Overview:

Students will investigate the habitat needs of common Maritime fish species and then write stories based on changes to the fish's habitat.

Objectives:

Students will be able to:

- explain the difference between a need and a want
- identify three basic needs common to all New Brunswick fish
- explain how at least two New Brunswick fish differ in their specific habitat requirements
- describe the effects of habitat reconstruction on at least one of New Brunswick's fish species

Subject Links:

- science
- language arts
- visual arts

Time:

two or three hours

Material:

- fish poster

Advance Preparation:

Make arrangements for students to have library time to research their fish species.

Process:

1. Ask students what they ***need*** in order to live. List all their answers on the board. Discuss the difference between *needs* and *wants*. Cross all *wants* off the list. Try to organize the needs under main headings such as food, water, shelter, air, space, etc.

2. Discuss the similarities and differences between the needs of a person and a fish. If possible, tie in the idea that the quality of something is often more important than the quantity. For example, the quality of water may affect the survival chances of a fish more than the quantity of water (within reason).

3. Assign each student a fish to research. Allow students time to research their fish species at a library or resource centre. Particular attention should be given to food, water, shelter space, etc.

4. Ask students to write a short story based on what they now know about their fish. The story should be written from the ***fish's point of view***, and contain enough information to identify the fish without naming it.

5. Assemble students into groups of five or six. Have each student in the group read their story ***without naming*** their fish. The others in the group can guess the fish species when they think they know the identity of the fish in the story. *(**OPTIONAL:** Some students may enjoy the challenge of guessing, and the following may work; one point is awarded to the student who guesses correctly, one point is subtracted for each incorrect guess. When the last story has been read and the points totalled, the winner may get a small prize.)*

6. To bring closure to the groups, ask them to identify ways that fish habitats are threatened or lost. Give time for each group to quickly share their findings with the rest of the class.

7. As a whole class activity, discuss the connections between fish needs, habitat characteristics and habitat protection. Brainstorm a list of things that can be done to protect fish habitat, and/or restore lost habitat. Resolve, as a class, to do one of them.

Evaluation:

Have groups of students play the role of a sales team for a Fish Home Rehabilitation Company. Their task is to design a newspaper, radio or television advertisement for a fish habitat they have reconstructed. Have them draw, tape or videotape their advertisement and present it to the class.

Possible Extension:

1. Have each student write a description from the perspective of a fish about a home that they require. This description should be written in a format to insert in the classified section of the fictional newspaper ***The Toronto Glob and Scale.***

HOME WANTED

Young salmon requires a new home. Cool clear river with a gravel bottom preferred. Good supply of insects and small fish a MUST. Large rocks, logs and stumps would also be of benefit. If you can supply such a home, please contact Sylvia Salmon at 325-FISH.

2. Have students create pictures to illustrate their story. Place all of the stories in a binder, and have students present their stories to a primary class.

3. Have students construct dioramas (model homes) out of a shoe box or other small box to show fish living in their habitat. Aquatic plants and animals may be made by stretching and gluing crepe paper to strings or pipe cleaners, then mount them in plasticine or hang them from the box top. Sand, gravel, rocks and branches can simulate the lake bottom. Have students come up with "fishy" addresses for their fish homes.

TEACHER: A FISHY STORY!

Overview:

This exercise will allow students to investigate the food web in a river community through story reading and the construction of a mobile.

Objectives:

Students will be able to:

- explain what food chains and food webs are and how they function
- use a food web to explain the interrelationships of at least three members of a river community

Subject Links:

- language arts
- science
- visual arts

Time:

one hour

Material:

- a copy of student resource sheet for each student
- construction paper
- hangers
- paper plates
- string
- scissors
- crayons

Background:

Animals depend on other animals for food. A series of such dependencies is a *food chain.* When several food chains are linked together, they form a *food web.* In any community all the living things are linked together by what they eat, and who eats them.

Process:

1. Have students read aloud "A Fish Story" on the student resource sheet. You may wish to use "popcorn reading," where the student selected reads a paragraph and can then select another student to read the following paragraph.

2. As the story is being read, have students highlight all of the living organisms. When the story is completed, have the students draw the food chains and link them together into a food web.

3. Have students design a mobile showing the food web. Different organisms in the food web may be done in silhouette style. The highest organism on the mobile should be the organism that feeds at the top of the food chain, and so on until all the animals are included. Encourage students to construct it accurately based on the information in the story.

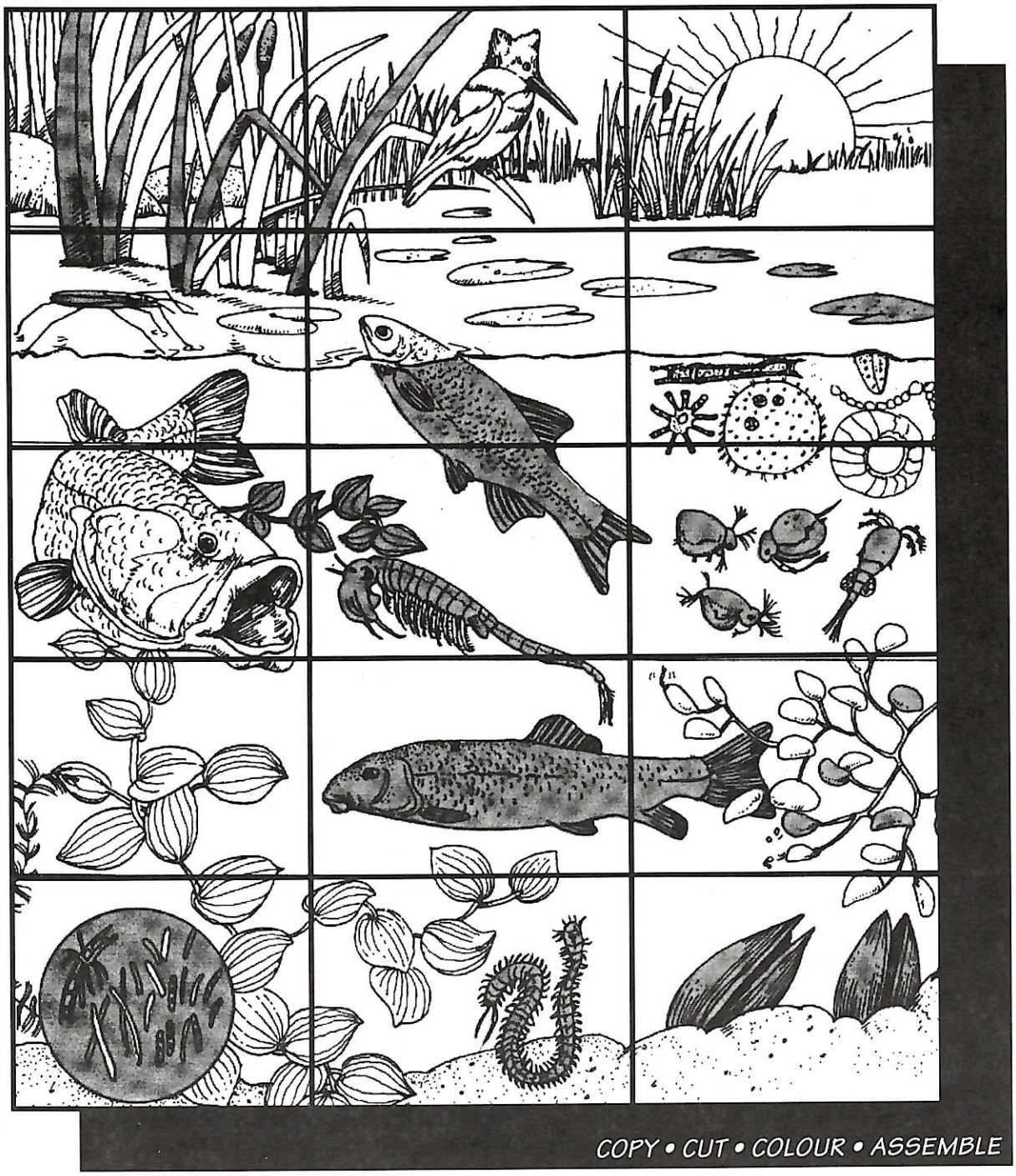
Evaluation:

Play the following linking game. The first student is given one river organism, and must name a living or non-living thing that is directly linked to it, and describe the linkage. The next student must name something that is in turn linked to the second object after repeating what the first student said, etc.
For example: *Student A is given the word worm. He responds by saying "the worm is eaten by a trout." Student B responds "the worm is eaten by the trout, which is eaten by a large bass." And on the story goes.*

NOTE: The song "The Green Grass Grows All Around" could be adapted nicely here by changing the lyrics to fit the theme.

A song about small fish being eaten by bigger fish by Charlotte Sigmond is available in both French and English.

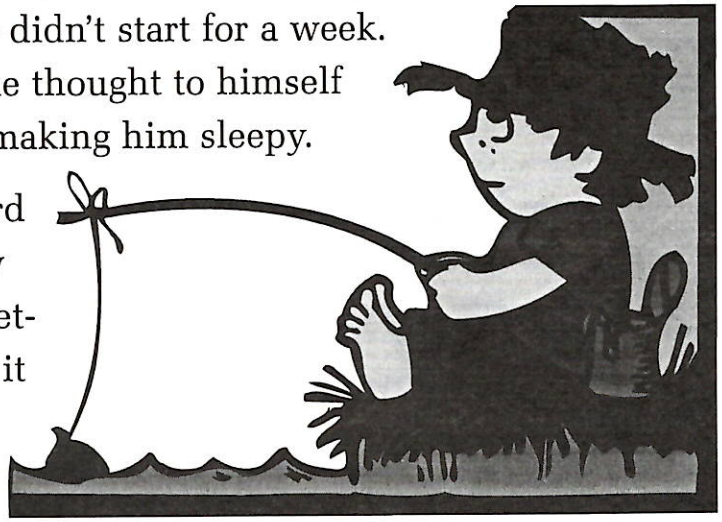
FOOD WEB



COPY • CUT • COLOUR • ASSEMBLE

STUDENT WORKSHEET: A FISHY STORY!

Bill yawned as the bright sunlight pushed its way through the leaves as he sat on the riverbank. What a perfect summer day! School was out for the summer, and baseball practice didn't start for a week. "Nothing better to do than fish!" he thought to himself as he smiled. The warm sun was making him sleepy.



As Bill baited his hook, he heard the cry of an osprey from a nearby tree. Although the sound was unsettling, he took comfort in knowing it was a sign that fish were nearby. Upstream he heard the splash of a duck as it surfaced with a mouthful of minnows. Yes, this was a perfect day!

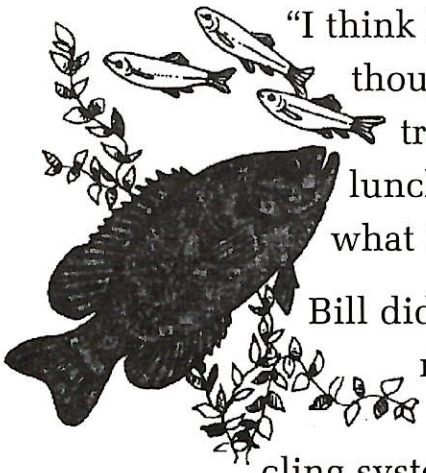
A large splash woke Bill. He felt somehow different; cool and surprisingly weightless. He tried to sit up but found it difficult. He lifted his hand to his forehead to see if he was suffering from sun-stroke. "I'm covered in scales!" he shrieked. "And I'm growing fins!"

Bill gave a strong push with his fins and with a flip of his tail he rocketed through the weeds and cattails, heading for deeper water. "Wow, this is really neat!" thought Bill.

As he neared the roots of the cattails, he saw a large number of snails feeding. The snails were eating algae that had collected on the stalks of the larger aquatic plants. Other algae seemed to be floating in the water. He remembered hearing how important plants are to fish and insects that live in the water. If he remembered correctly, plants give off oxygen when they make food, and some of that oxygen is used by fish and insects as they breathe.

Bill swam faster as he got to the grassy area. It seemed easier to swim here since he didn't have to worry about bumping into cattails and weeds. The grass tickled his belly though, and he couldn't help but smile.

Off in the distance he saw a bass darting out from behind some reeds. It shot forward and snapped up a couple of minnows from a school that was passing by. A sudden splash startled him as an otter dove into the water and snatched a crayfish. Bill could hear the crunch as the otter's jaws made quick work of the shell.



"I think I'll see if I can find the middle of the river," Bill thought. His mouth began to water as he saw some young trout feeding on caddisfly larvae. "I know I just ate my lunch, but maybe *just one* wouldn't hurt!" Bill wondered what type of fish he was.

Bill didn't have much time to think about it before he noticed another crayfish eating dead plant and animal matter at the bottom of the river. "Nature's own recycling system, with each doing its own job," he burbled. More activity near the bottom caught his attention. Yellow perch and pickerel were darting this way and that, snacking on different kinds of aquatic insects and clams. Without thinking, he flashed down and swallowed a perch. "I must be pretty big," he thought, moving his jaws.

"Well, I never knew there was so much action in this river." He noticed that the sun was getting low in the sky. In all the excitement, he had not thought about the time. "Dad will be out looking for me. It's almost time for supper." He quickly swam upwards, getting excited as he thought about all the fish stories he would now have to tell his neighbours. Who would believe him?

As he neared the surface, he recognized his Dad's boat and swam towards it. Then he heard his father shouting to his sister, "Look at that huge fish! It's coming for my fly! Bill will be surprised when we have fish for supper tonight!"

TEACHER: HOOKED ON YOU!

Overview:

With fish stocks on the decline, there is an increase in innovative ideas such as the use of barbless hooks and hook and release. The following activity will introduce both of these concepts to students.

Objectives:

Students will be able to:

- explain the advantages and disadvantages of using barbless hooks
- explain the advantages and disadvantages of hook and release as a fishing strategy

Subject Links:

- science
- language arts

Time:

forty minutes

Materials:

- a variety of barbed and barbless hooks
- cork test-tube stoppers or an old item of clothing
- *Hook and Release* video from the Atlantic Salmon Federation

Background:

BARBLESS HOOKS: Probably several students can identify with going on a fishing trip and during the course of that trip, someone solidly hooking their clothing or exposed flesh. If the hook still has its barb, the removal of the hook sometimes results in the ruin of an article of clothing, or a painful extraction process if the hook is lodged in flesh. If the hook were barbless, it would do far less damage to the clothing, and be far less painful to remove from flesh. It is the same with fish. Barbless hooks cause much less damage to the mouth of the fish when they are removed, thereby increasing the possibility of survival, and reducing the stress experienced by the fish. The disadvantage is that fish are more difficult to catch since they can become "unhooked" more readily.

HOOK AND RELEASE: At one time, people fished mainly to secure part of their food resources. With current lifestyles, many anglers fish as a means of enjoying beautiful physical settings, the "thrill" hooking and landing a big fish can bring, and relaxation from a hectic and stressful lifestyle. The desire for such experiences in the future provides motivation to practice hook and release fishing strategies.

Process:

1. Display barbed and barbless hooks. Have students identify the difference. (Restrict the handling of hooks to ensure that students do not prick their fingers, particularly with the barbed hooks.)

2. Demonstrate the difficulty of removing a barbed hook from the cork stopper or an old article of clothing. Repeat the activity using the barbless hook. Discuss the differences with students and how those differences would affect the well-being of fish.

3. Explain the process of hook and release to students (Hook and Release Video). Discuss some of the advantages and disadvantages. *POSSIBLE ANSWERS:* ***Advantages of hook and release:*** *Less harmful to fish, better survival rates, resource for the future, others can experience your experience.* ***Disadvantages of hook and release:*** *it's harder to land fish, what will I have for supper?, who will believe my fishing story?*

Evaluation:

Depending on how comfortable you are with fishing and taking students fishing, you may wish to plan a fishing trip with your students. In addition to parent volunteers, sporting guides from the local area may accept an invitation as well. If you would rather stay where the *terra* is *ferma*, you may wish to have students create posters advertising the benefits of barbless hooks and hook and release as a fishing strategy. These may then be displayed throughout the school or community.

Possible Extensions:

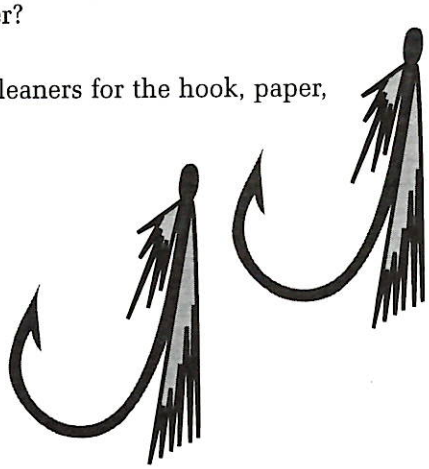
1. When demonstrating the benefits of using a barbless hook, you may wish to use an actual fish.

2. Invite an experienced angler or fishing guide to visit the classroom to provide assistance with class activities and demonstrate fishing techniques. This person may also demonstrate the art of fly-tying.

3. Have students keep a journal of their fishing activities during a specified period. Items could include the date, time of fishing, weather, name and location of fishing site, type of gear and bait used, number of fish caught and size, whether the fish were kept or released, interesting observations, etc.

4. Study and catch live bait. Which do most fish prefer?

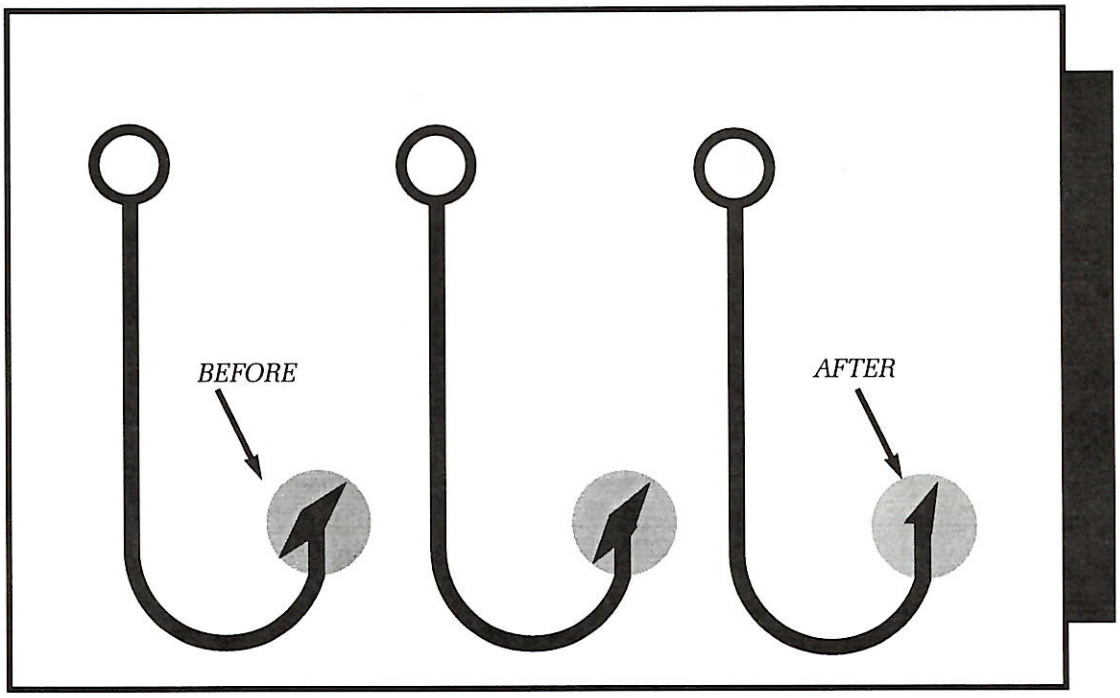
5. Have students make their own dry flies with pipe cleaners for the hook, paper, feathers, glue, etc. and display them on the wall.



STUDENT WORKSHEET: HOOKED ON YOU!

Instructions:

Using a pair of pliers, carefully crimp the hook with pliers, as illustrated in the diagram below. Barbless hooks cause less damage to the fish and heighten its survival chances. Remember, wet your hands with water before handling the fish. This helps protect the fish's natural coating that guards it against infection, etc.

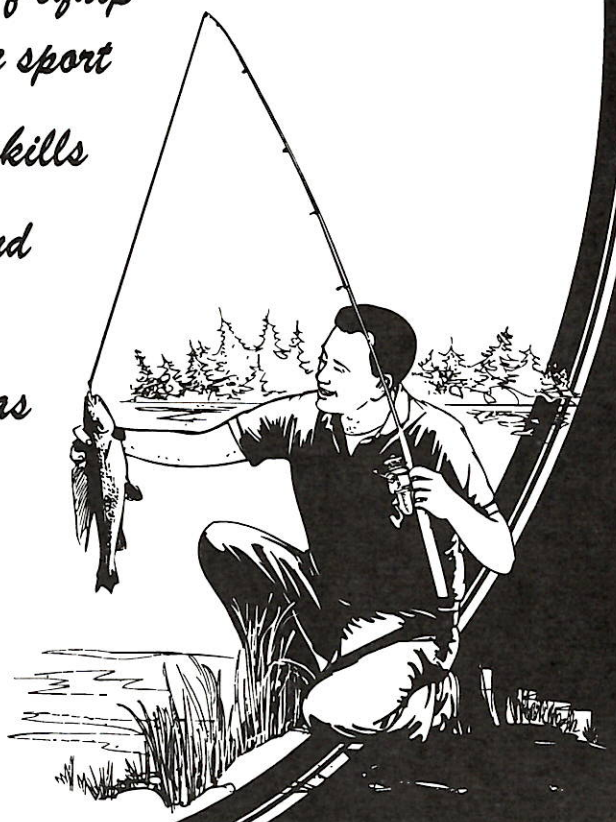


THE ANGLER'S CREED

As an angler in good standing,

I PLEDGE:

- *to respect private property and the rights of others*
- *to learn and obey fishing regulations*
- *to never take more fish than my legal limit*
- *to not damage fish habitat*
- *to put safety first in the use of equipment and the enjoyment of the sport*
- *to take pride in my angling skills*
- *to help others understand and enjoy the sport of fishing*
- *to leave the environment as clean as I found it*



The Angler's Prayer

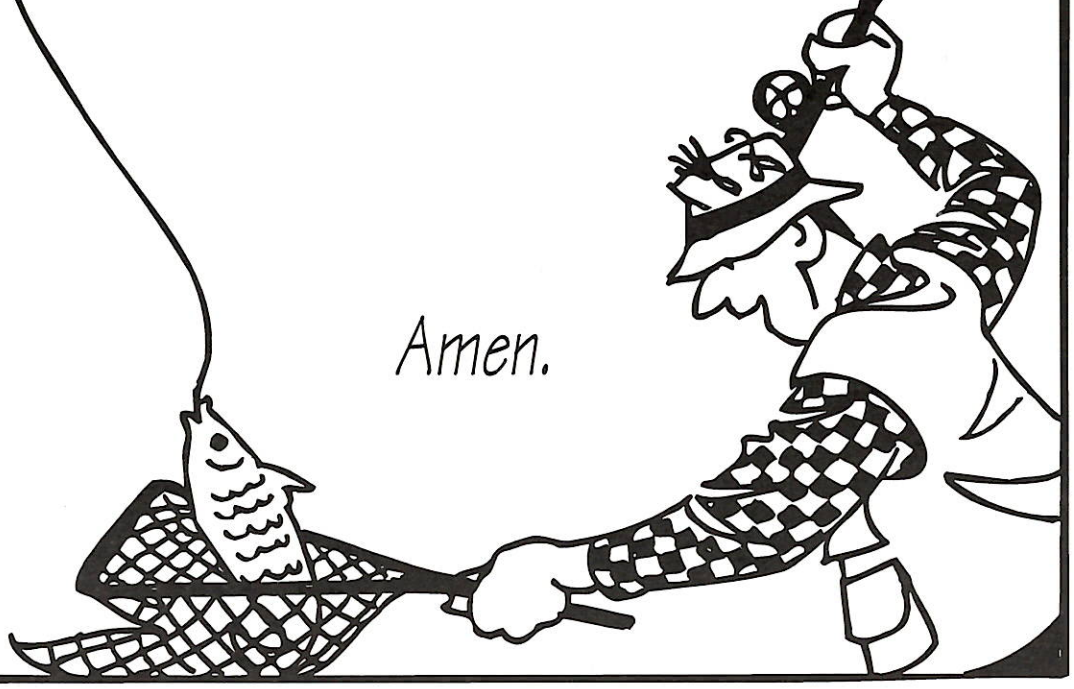
Lord grant me grace to catch a fish

So big that even I

When telling of it afterwards

May never need to lie.

Amen.



TEACHER: "LET'S PLAY TAG!"

Overview:

Students will have opportunity through the following simulation experiment to calculate the population of Atlantic salmon in a hypothetical river using tagging and a capture/recapture technique.

Objectives:

Students will be able to:

- estimate the size of a fish population
- explain how biologists trace the movements of fish

Subject Links:

- science
- math

Time:

approximately one hour

Materials:

- wall map showing salmon migration routes

For each pair of students:

- 1 spoon and paper cup
- small white beans (about 100 per cup)
- assorted markers
- calculators
- provincial road map

For each student:

- student worksheet

Background:

Movement of animals from one place to another on a regular basis is called **migratory behaviour.** Typical migratory behaviours are either **daily movements** or **seasonal migrations.** Daily migrations are often short and are usually for obtaining food, better habitat or avoiding predators. Seasonal migrations usually involve greater distances and result in the fish arriving at a particular location within a specific period of time. A main reason for such migration is reproduction. Salmon return to a specific river or stream to spawn (lay their eggs) at a time and in temperature conditions that allow the eggs to hatch and develop with the best chance of survival.

After the Atlantic salmon **smoltifies** (goes through a physiological change allowing it to live in salt water), it passes through the ocean until it arrives at its winter feeding ground off the west coast of Greenland. Here it will stay until it matures to spawning age. It then attempts to return to the exact area of its birth. This ability of fish to accurately navigate over thousands of kilometres is still somewhat a mystery. It is believed, however, that some fish use their ability to sense change in water temperature and chemical properties. Some fish may also orient themselves for travel by the position of the sun. The primary method of return for the Atlantic salmon appears to be its reliance on its sense of smell.

One method of keeping track of fish migration and estimating populations is through tagging. This process gives each fish its own number. One of the more common forms of tag is the "streamer" tag. This is an oval plastic disc which is attached to the fish by a nylon thread that has been passed through the muscle below the dorsal fin with a needle and knotted. The tag is easy to apply, and is small enough not to hinder the movements of the fish or get snagged. Whenever a tagged fish is recaught, factors such as change in location, time taken to travel to that location, etc. can be recorded. It is also possible to determine the success of stocking programs and/or estimate the rate of return of native stocks. By determining the percentage that have been tagged, an estimate of the number of fish in a local stock can be calculated.

Process:

1. Discuss the meaning of "migration" through determining what the word means, and the animals that migrate.

2. Ask students to list possible reasons for species to migrate. Explain that when fish enter or leave streams, biologists can easily tag them to study their numbers and movements.

3. Divide the class into pairs. Give each pair a cup half-filled with white beans. Explain that the cup represents a lake and the beans are a population of Atlantic salmon.

4. Without disturbing (touching) their "fish," students are to guess the population of their stream and record their guess on their student worksheet. Discuss the potentials for error.

5. Trace the migration route of the Atlantic salmon from Greenland to the mouth of the St. John River using the wall map. Explain that the salmon encounters one or more hydro-electric dams before reaching the river where it will spawn. When the fish are captured at the dam, it provides an excellent opportunity to tag some of the fish. Have students pour out about 30 beans to represent the portion of the fish to be tagged.

6. Using a coloured marker, have students count and "tag" each Atlantic salmon that was captured (poured out) and then record the number on the student worksheet. Explain the method of tagging fish as outlined in the ***Background*** section, pointing out that biologists may also collect information such as age, sex, size and evidence of parasites from each fish tagged.

7. Have students release their fish back into the river and simulate their daily movement and interactions with the rest of the population by shaking the cups (holding a hand over the opening so the beans do not spill out).

8. Ask the students to try to determine the total population of their lakes by taking a sample with a "net." Give each pair of students a spoon and have them scoop a sample of salmon from their river and record the total number of salmon trapped and the number of those that were tagged.

9. Explain that the total population of Atlantic salmon in the river may be estimated mathematically using the following formula called the Lincoln Index, which was designed by biologists to study wildlife populations.

$$\text{Population} = \frac{\text{Total Tagged} \times \text{Total Fish in Trap-Net}}{\text{Tagged Fish in Trap-Net}}$$

Have students substitute their data into the formula and using a calculator perform the first population calculation and record it on their student worksheet.

10. Have students return their Atlantic salmon to the river, mix the population as before, then take a second sample. They should record the new data on their student worksheet and perform a second population calculation.

11. Ask students to compare their two population calculations with their original estimate and discuss reasons for any differences. Have them determine the accuracy of their estimate and calculations by returning their second sample to the river and actually counting the fish. ***Stress that this is a luxury that biologists do not have in real-life settings!*** Ask students the following questions:
    - Which was the closest to the actual population, the estimate or one of the calculations? Why? (You may wish for students to work with the *average* of their calculations.)
    - Would repeating the tagging operation produce a more accurate population calculation?
    - What conditions in an actual river would affect the Atlantic salmon populations that were not accounted for in this experiment?

Evaluation:

Have students explain to each other, or another class, the benefits of tagging. If a biologist wished to study a population of salmon in a lake to estimate their numbers or trace their movements, give a sample outline of the steps that might be taken to conduct the research.

Possible Extensions:

1. Arrange for a field trip to a fish culture station or a fish hatchery. If possible, arrange for one of the technicians to demonstrate how to tag a fish.

2. Show a video or film to students dealing with fish migration.

3. Play the game "Smelling Your Way Home," found in the *Fish Friends* manual.

4. Present students with the following challenge: Some migrating fish travel through fishways at night. Since it would be expensive to have people checking fish 24 hours per day, design a fish tag that could be read mechanically as fish migrated upstream through a fishway.

STUDENT WORKSHEET: "LET'S PLAY TAG!"

Instructions:

Carefully follow the instructions provided by your teacher. You should be able to get a fairly accurate estimate of the "fish" population in your cup, without having to count all the "fish" first. Remember, scientists don't have the luxury of having all of the fish from an area to physically count in order to establish fish population numbers. *GOOD LUCK!*

FISH POPULATION ESTIMATES

	SAMPLE #1	SAMPLE #2
Estimate the number of "fish" in the cup		
Number of fish "tagged"		
Number "caught" in sample		
Number of tagged fish in sample		
Estimated total fish population		

TEACHER: ADOPT A FISH

Overview:

Students will become "experts" about one Maritime fish species through research, data organization and writing a report. Factors considered will be the fish's appearance, habitat, lifestyle and how to protect the fish's environment.

Objectives:

Students will be able to:

- carry out a simple research project
- organize information into a report
- list the key points about one Maritime fish species and make suggestions on how to protect it
- communicate the life and needs of that fish species to others

Subject Links:

- science
- language arts

Time:

One hour per day for three to four days, followed by presentation time.

Materials:

- duotangs
- loose-leaf paper
- computer disks

Advance Preparation:

Decide how you want students to do this research project: individual, partners or small groups. If possible, borrow books about Maritime fish species from a local or regional library. Discuss possible marking criteria with students. You may also want the class to have a small aquarium with their own fish. Keep a log of what the fishes' needs are.

Process:

1. Ask students about their personal, positive or enjoyable experiences with fish and any interests they currently have in fish. Ask them to imagine what the world would be like with no fish at all. Some fish species, like the Atlantic salmon (the "top" of the Maritime's fish food chain) may be extinct within a few years. How might this be prevented? Emphasize that the first step in preventing this is becoming knowledgeable about current fish species and the requirements to support their lives.

2. **Research: Beginning**

A. After students select one species to study, have them:

- Make a list of facts they currently know about their fish species, and general facts about fish that would also apply to their fish species.
- Write a list of questions that they would like to find out about the species.
- Help students organize their questions under subheadings.
- Discuss the importance of including the following questions in their research:
  - Is this fish species in danger of becoming extinct? How can I find out?
  - How can this species of fish and its habitat be protected?
  - How can this be accomplished?

3. **Research: In Progress**

A. Show the class how to use headings and point-form notes to organize the data collected from information sources. For example:

ATLANTIC SALMON

Appearance

- Young salmon have between 8 and 11 dark bars on each of their sides, with a red dot between each one. These marks are called "parr marks."
- When a young salmon is getting ready for life in the ocean, it loses its parr marks and becomes silvery in appearance. This helps it "hide" in the ocean.
- Atlantic salmon have eight fins.

B. Have students decide how they will present their information to the class. Will they use a diorama, poster, model and fact card, etc. Encourage students to try a presentation technique they may not have used before.

4. **Research: Completion**

A. Using the point-form notes they have made, have students:

- write their information to match their presentation technique (prose, fact sheets, information cards, etc.)
- assemble all the parts of the research into a presentation package
- practice the presentation

Evaluation:

Discuss the criteria that will be used for evaluation with students. Will their peers be included in the evaluation process? How much will the project be worth? Have students present their project to the class.

Possible Extensions:

1. Arrange to have a visitor who is knowledgeable about Maritime fish species to come and talk to the class. Possible guests include the local fisheries officer, a fishing guide, a local naturalist or a university biology student.

2. Have students come up with one thing that could be done to protect their fish. Students could then write a letter to the Federal Department of Fisheries and Oceans or the New Brunswick Department of Natural Resources and Energy suggesting that idea. *(Address is in the appendix.)*

TEACHER: "SURVIVAL OF THE FISHES"

Overview:

Statistically, the probability of a fish surviving to adult stage is very slim. (With some species, about 1 in 1000.) Factors such as the colouration of the fish matching its habitat greatly assist in heightening the fish's chances of survival. This concept is demonstrated in the following game.

Objectives:

Students will be able to:

- identify desirable colours and patterns of colour in fish that live among aquatic vegetation
- determine the effects of different amounts of cover on the ability of a predator to find food
- describe how it feels to search for food as a predatory fish

Subject Links:

- science
- language arts
- math
- physical education

Time:

one to one and one-half hours

Materials:

- Four gym pylons
- 25 metre measuring tape
- watch
- 160 toothpicks (various colours, if possible)
- markers
- student worksheets

Background:

The emphasis of this activity is colour. Many fish show definite colours and colour patterns related to their habitats. Most fish have the ability to see in colour, at least to some degree. This varies with species and the age of the fish. Patterns such as bars, dots, spots and shading may be as, or more important than colour, to breaking up the outline of a fish (hiding the fish among its surroundings). The upper areas (back) of a fish are usually darker in shade than the lower areas (belly). This makes the fish extremely difficult to see when looking down at the dark stream bottom, or looking up through the water.

Advanced Preparation:

One or two weeks prior to the activity ask the school caretaker to leave a 25 square metre or larger patch of grass uncut. Divide the toothpicks into two groups, each having an equal number of the various colours.

Process:

1. Use the pylons to mark out a 25 square metre (or larger) area of uncut lawn.
2. Randomly scatter all of the toothpicks from one group within the selected area. (Each colour of toothpick will represent a different species of fish.)
3. Have ten students play the role of "predator" and hunt for five minutes for the "prey."
4. Using the student worksheet, or one of their own design, students may record the number of each colour collected by all predators.
5. Repeat the activity with different students on grass that has been mowed, using 25 square metres. How do the results compare? What effect does the extra cover have on the ability of the predator to find and catch food? What effect does the extra cover have on the ability of the fish to "hide"?
6. Ask students if one colour seemed easier to find. What colour was hardest to find? Why?

Evaluation:

Have students draw and colour a minnow with colours and colour patterns to match the grass habitat.

Possible Extensions:

1. To make the above game more challenging, use brown and green markers to "camouflage" the toothpicks before repeating the activity. How do results change?
2. Repeat the same activity using yarn or macaroni along with the toothpicks to see if size and shape affect levels of predation.
3. Repeat the activity on a paved parking lot to show the effect loss of cover has on the prey's ability to survive.
4. Try the activity again using blindfolds or single eye patches to show how sight is important for finding prey.

STUDENT WORKSHEET: "SURVIVAL OF THE FISHES"

COLOUR OF FISH	NUMBER FOUND IN UNCUT GRASS	NUMBER FOUND IN CUT GRASS

1. Why was it more difficult to find the "fish" in the uncut grass? _____

2. What could you do to make it easier for the "fish" to hide in the short grass? _____

3. What have you learned about how fish are able to hide in a stream or river? _____

TEACHER: CAN ANYBODY TELL ME?

Overview:

Physical characteristics such as colour, shape, markings, number and shape of fins and type of mouth tell us something abut where the fish lives, and how it lives. A fish's colour helps it blend in with its surroundings, camouflaging it from predators. Trout, for example, are multicoloured, allowing them to hide among the leaves and gravel of the stream bottom. The colouration of other species allows them to blend in with aquatic plants and thereby hide. Body shape also reveals where they live and their life patterns. A fish with a streamlined body is capable of faster movements, quick attacks and survival in open areas with little cover, all important factors to predators. Fish living in heavily vegetated areas are usually short in length and have deep bodies. This allows them to make short, quick turns.

Objectives:

Students will be able to:

- describe the advantages and disadvantages of two major fish body shapes
- link body shapes to common Maritime fish species and their behaviours
- describe at least two common colour patterns of Maritime fish and the habitat types they most commonly reside in

Subject Links:

- science
- physical education

Time:

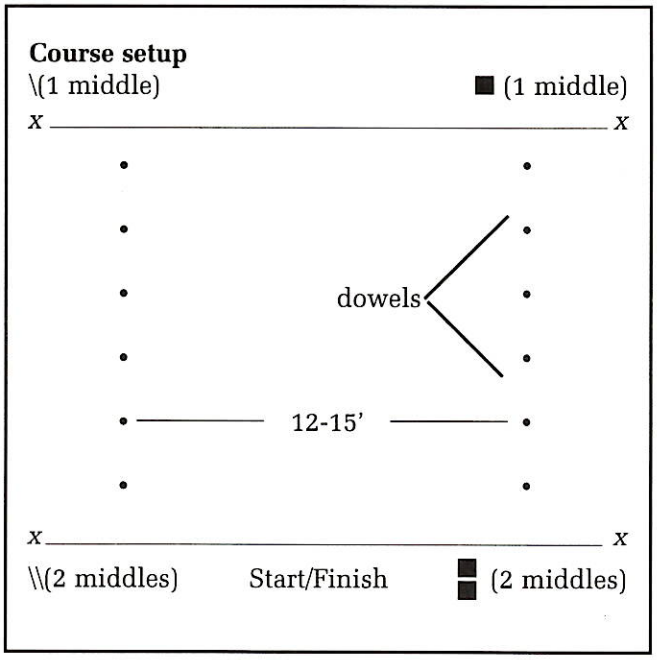
forty-five minutes to one and one-half hours

Materials:

- Fish poster
- two boards (1" x 4" x 6')
- two cardboard sheets (3' x 3')
- dowels or stakes to mark out an obstacle course
- student worksheets #1 and #2

Advance Preparation:

Set up the relay race course according to the diagram at right. Leave approximately three feet between the dowels, to allow for challenging, but workable movement.



Process:

1. Have students look at the fish poster and list the similarities and differences of the fish. Students should then attempt to establish categories for the differences. The two main categories to guide them to are ***shape*** and ***colour***.
2. Discuss sorting by the terms "fat" and "thin," and which shape they think is *best.* In the following activity they will become a fish and experience some of the advantages and disadvantages of each shape.
3. Once at the relay course:
    A. Divide the class into two groups, equal in size and running ability. If the groups do not have even numbers, compensate by having one child run twice. Identify one group as trout and the other as catfish.
    B. Create pairs of similar height in each group. Explain that each pair will be a "fish," one person the head, the other the tail. The trout will use the boards and the catfish will use the cardboard as middles.
    C. Demonstrate how to carry the middles, then let the students practice for a little while.
        TROUT: one on either side of the middle, wood held low in *one* hand.
        CATFISH: one student on either side of the middle, holding with both hands.
    D. Introduce the relay as a way to find out which species is fastest. One pair from each line races to the other line. Upon crossing the line, they must run back through the obstacle course (weaving through the obstacles). When they get to the starting line, the next pair begins, and this continues until all students have gone. *NOTE: The next pair may get ready to go before the previous pair crosses the line.*
4. Discuss the advantages and disadvantages of each body shape. When thinking about rivers, when and how would the shape of a trout be an advantage? *ANSWER: A short burst of speed to go straight ahead to catch prey.* How would the catfish's shape be an advantage? *ANSWER: The ability to manoeuvre and escape by twisting among rocks and weeds.*
5. Upon returning to the classroom, sort the fish on the fish poster *(see appendix for ordering information)* by colour and patterns. Lead students to realize that striping and speckling are the major differences. Pass out Student Worksheets #1 and #2, one set per pair of students.
6. Have students predict which fish will disappear first - the one on worksheet #1 or worksheet #2. Students then walk backwards from each set of pictures and see which fish disappears first. Were their predictions right? Which fish "fit" the background?

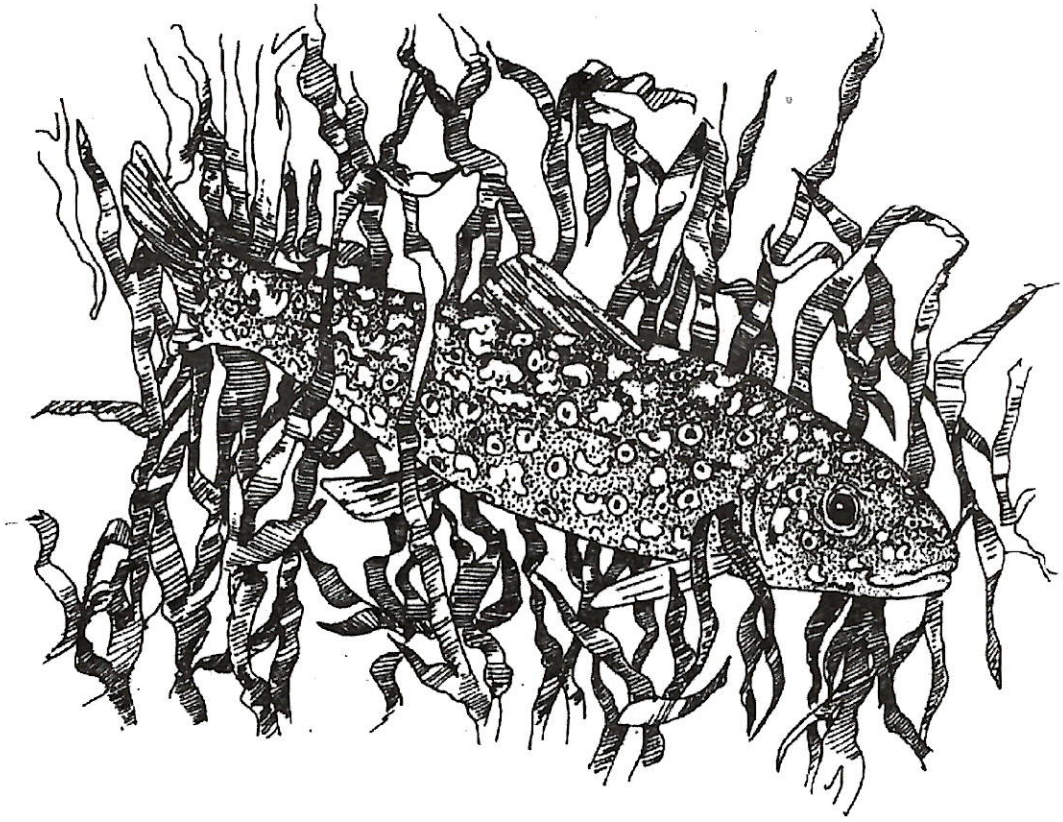
Evaluation:

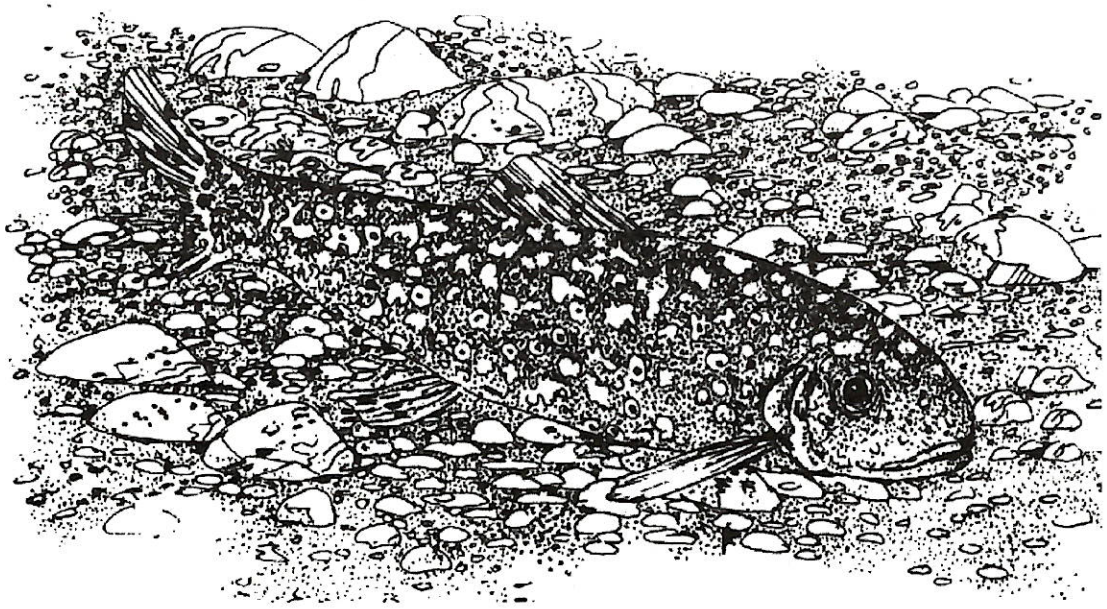
Using the fish poster, have students assess the shape and colour of several fish to determine the colour and type of surroundings each fish prefers. If possible, have students do research to check the accuracy of their predictions.

Possible Extensions:

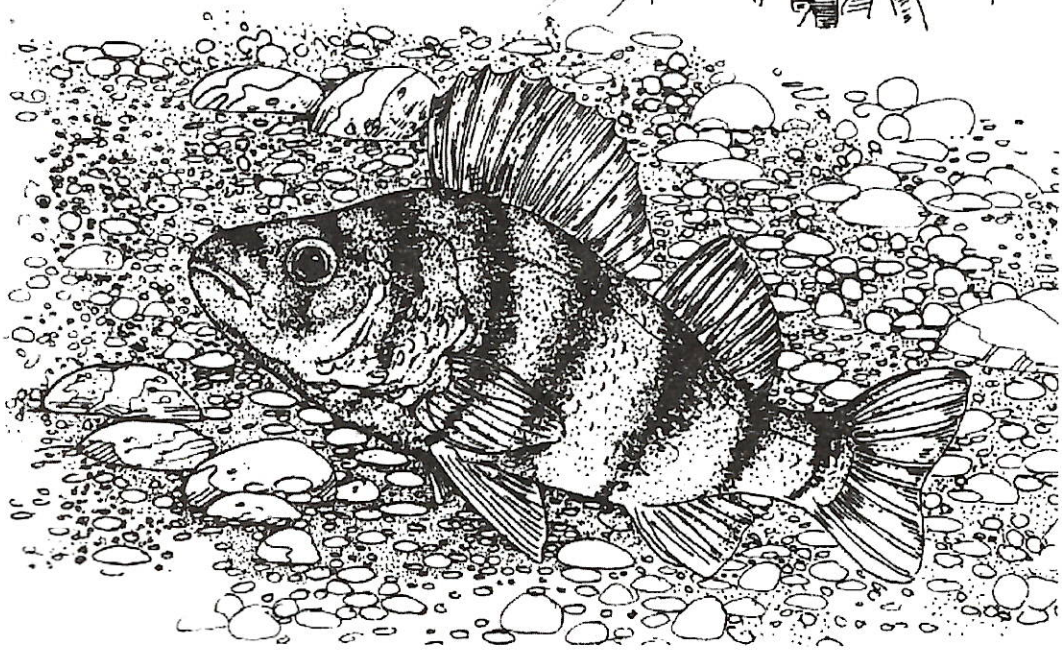
1. Have students visit a pet store and record which fish "stand out" and which "fit in" with the environment in the fish tanks.
2. Have students design a "super fish." Considerations may include: size, shape, colour, food, water temperature, etc. If time permits, students may make a clay model of their fish.
3. If there is access to an aquarium housing several different fish species, students may compare differences in shape, colour, fins, behaviour, foods, etc. Have students suggest reasons for the differences in physical attributes.

STUDENT WORKSHEET 1





STUDENT WORKSHEET 2



TEACHER: HOW DOES YOUR FISH MEASURE UP?

Overview:

Most provinces have records of the largest fishes caught. Through this activity, students will "recreate" some of New Brunswick's records, using common classroom objects.

Objectives:

Students will be able to:

- find the mass of objects using a classroom balance
- rank at least three New Brunswick record fishes by mass
- compare the mass of New Brunswick's record fishes using graph paper

Subject Links:

- math
- science
- visual arts

Time:

one forty-minute period

Materials:

FOR THE CLASS - Common objects such as:

- textbooks
- scissors
- glue bottles
- rocks
- gravel
- pieces of wood
- light material to fill out each fish, such as shredded paper or popcorn

FOR EACH GROUP

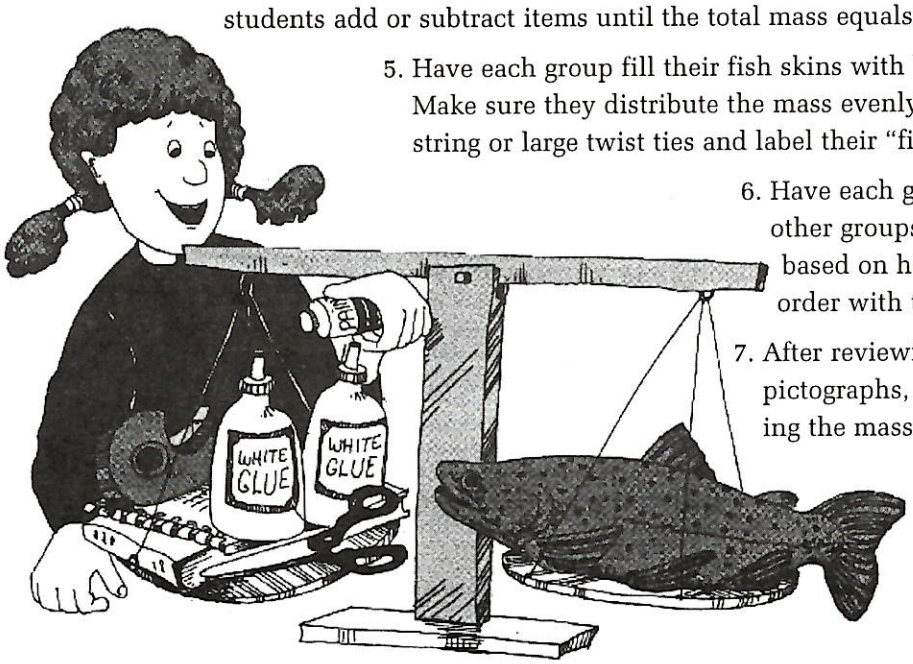
- balance or scales
- graph paper
- 1 "fish skin" (made from old nylons, heavy plastic bags, burlap, ski bags, etc.)

Advance Preparation:

Draw two side profiles of a fish for each group. (These may be drawn on the materials listed above.) These "fish skins" will be used in the second part of the lesson.

Process:

1. Divide the class into groups of three or four students.
2. Have each group design a worksheet to record the mass of their objects and fishes.
3. Have groups select one to three species of fish from the Teacher Resource Sheet and record the mass of their fish species on their worksheets.
4. Have groups select and find the mass of objects that they predict will be equivalent to the mass of the fish species. Have them measure and record the mass of the objects on their worksheets and compare the total to the mass of their fish. How accurate were their predictions? Have the students add or subtract items until the total mass equals the record for that fish.



5. Have each group fill their fish skins with both their mass items and light filler. Make sure they distribute the mass evenly. Have them tie off their skin with string or large twist ties and label their "fish."
6. Have each group lift their own fish and trade with other groups. As a class, order the fishes by mass based on how heavy they feel. Compare their order with the record list.
7. After reviewing skills for construction bar-graphs or pictographs, have students construct a graph showing the masses of three of the constructed fishes.

Evaluation:

Have students order any three created fishes by their mass.

Possible Extensions:

1. Have students locate where the record fishes were caught, using a map of New Brunswick.
2. Have students construct a time line and plot the dates on which the New Brunswick record fishes were caught. What is the oldest fish record? What is the most recent?
3. Have students write, using personification, to describe some events survived by the fishes in order to live long enough to grow so large.

LARGEST SPECIES LANDED
(1988 - 1994)

SPECIES	WEIGHT	YEAR	LOCATION
Brook Trout	2.68 kg	1991	Long Lake, Victoria County
Brown Trout	3.28 kg	1989	Meduxnekeag River
Landlocked Salmon	5.68 kg	1991	Long Lake, Victoria County
Lake Trout	5.35 kg	1990	Long Lake, Victoria County
Smallmouth Bass	2.2 kg	1990	Digdeguash Lake
Burbot	5 kg	1993	Grand Lake - ice fishing
White Perch	0.652	1993	Dead Brook - Oromocto Lake
Striped Bass	12.8 kg	1994	Reversing Falls - St. John River
Yellow Perch	0.4 kg	1994	Canaan River
Chain Pickerel	2 kg	1994	Harts Lake
Atlantic Salmon	10 kg	1994	Miramichi River - Doaktown

Information supplied by the New Brunswick Department of Natural Resources and Energy

TEACHER: CRITTERS IN THE CLASSROOM

Overview:

An interesting way to follow up a stream survey is to stock a classroom aquarium with native fish or insect species. Students become involved in the set-up, management and operation of the tank. In addition, simple experiments may be conducted to observe behavioural patterns in various conditions such as light, food, etc.

One of the most common problems associated with the operation of fish tanks is **overfeeding**. Remember, they are just little critters, and don't eat near as much as one might think! The main factors influencing the amount of food required are water temperature and the size/weight of the fish. In addition, the size of the food is relative to the size/weight of the fish. *(See appendix for more information.)*

Objectives:

Students will be able to:

- set up and manage a classroom aquarium
- perform behavioural experiments on fish species
- determine some factors that may influence fish diet and behaviour

Subject Links:

- science
- math
- language arts

Materials:

- student worksheet
- scales or pan-balances
- aquarium
- fish
- common classroom objects and capture permit *(see letter in Appendix)*

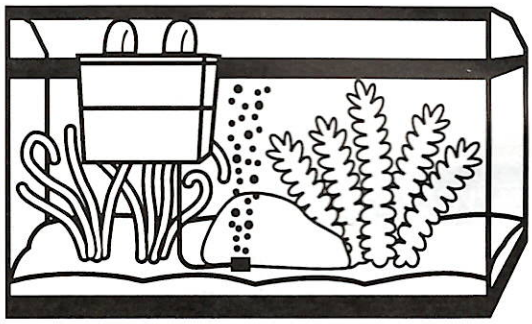
Background:

If native fish species are to be used, they should be captured through electro-fishing. This may be done through local Fisheries and Oceans staff, or Department of Natural Resources and Energy. Although stunning fish with electricity may seem cruel, it rarely hurts the fish, and is a common method of fish capture for scientific purposes. A permit is required to keep native fish species in a classroom setting. It's best to apply in lots of time (1-2 months before you want to start). When you are finished with the fish, they are to be returned to the same area where they were captured. Fish should be kept in captivity no longer than necessary (maximum target time two weeks).

Advance Preparation:

Apply for the permit to keep fish in the classroom well in advance. Also, make arrangements for someone to do the electro-fishing to capture the fish. It would make an interesting field trip for your students, if they could go to the electro-fishing site and watch the fish capture. Set up the tank about one week before the arrival of the fish, to ensure that the filter and chilling unit (if available) is working properly. If possible, regulate the tank's temperature close to that of the water from which the fish will come.

Process:



1. If possible, involve students in the tank set-up. This will begin to build their sense of ownership and responsibility.
2. Devise a daily monitoring sheet, or copy the one included in the appendix.
3. Simple experiments may be performed such as the one found on the student worksheet. Others include studying behavioural patterns when lighting varies, food types the fish prefer, response to various colours, etc. Artificial plants may be added to the tank to demonstrate how fish prefer cover to hide from predators.
4. Be careful not to overfeed the fish. Extra food will remain uneaten and will rot, causing the tank to get "scummy" and the filter will also get clogged. Such conditions will also add unneeded stress to the fish.

Evaluation:

Evaluation may be based on group cooperation, completed worksheet, etc.

Possible Extensions:

1. Have students design behavioural and conditional experiments that may be performed with aquatic insects.
2. Students may investigate how behaviours of aquatic animals differ from those of terrestrial animals.
3. What do the experiment results tell you about where the animal lives and what food it naturally eats?

STUDENT WORKSHEET: CRITTERS IN THE CLASSROOM

ARE you the same height as your classmates? The same size? Of course not! We are all different. Fish are different from each other too, although their differences are not as easy to notice. Try the following activities in groups of three or four.

Activity #1

Using a set of scales, find the mass of one shoe from each group member. Add the numbers together and divide the sum by the number of group members. This gives you the average mass. Can you calculate your average height? When you finish, compare your answers with those of your classmates.

WORK AREA

Activity #2

As a group, plan how to find the average mass and length of the fish in the aquarium. **Discuss your plan with your teacher *before you begin!*** When you have completed your work, compare your answers with those of your classmates.

WORK AREA

TEACHER: SCALE TALES: PART 1

Overview:

Students will examine the protective covering of scales and "the tales scales tell" through laboratory investigations.

Objectives:

Students will be able to:

- describe the function and general characteristics of fish scales and how they benefit fish
- explain the general arrangement of fish scales
- determine the age of a fish from a scale sample

Subject Links:

- science
- math
- visual arts

Time:

two to three forty-minute periods

Materials:

- fish scale samples *(see appendix)*
- microscopes
- magnifying glass
- fish specimens
- disposable gloves
- soap and paper towels *(for clean-up)*

Background:

The skin of fish, as on all animals, is a thin tissue layer that protects against disease and other potentially harmful elements in the environment. Embedded in the skin of most fish are hard bony scales, which overlap each other from the fish's head to its tail. These scales serve to minimize friction as the fish passes through the water, as well as protect the fish from small predators and injuries from rocks and obstacles. Scales are translucent, allowing the natural pigmentation of the fish's skin to be seen. The scales continue to grow throughout the life of the fish and are replaced when lost through injury.

Since the scales overlap, a fish is able to maintain great flexibility. This makes it easier for the fish to propel itself through the water. With increased size of scales, flexibility is reduced. Larger scales also create more friction with the water, therefore the fish must use more energy to move.

A fish's skin also secretes a mucus coating. This lubricates and heals the skin, as well as protecting against infestation of parasites. This is the "slipperiness" encountered when trying to hold fish, thereby helping many fish escape from predators. This also reduces friction as the fish passes through the water.

Advance Preparation:

Obtain a preserved fish specimen from a science supply company, or if you don't mind the smell, use a fresh fish from a local fish market or angler.

Process:

1. Divide the class into groups of three or four students.
2. Without mentioning fish or scales, have each group come up with a new kind of jacket that is:
   - tough, with a surface as hard as your thumbnail or harder
   - flexible enough to let you bend and move easily
   - light enough so you don't notice the weight
   - waterproof, yet the air is able to circulate in and out through the jacket
3. After 10-15 minutes, have each group share their creations. Accept all designs and use them as a bridge to examining one of nature's solutions: scales. Why do fish have scales? How do they help the fish?
4. Using the fish specimens, have students observe the colour and arrangement of the scales. Observations may be extended by:
   - running fingernails ***lightly*** from head to tail, from tail to head, then down and up the sides of the fish
   - using the tweezers to lift the edges of the scales and a magnifying glass to examine the scale patterns. Why do scales "open"? Have students gently bend the fish while watching how the scales respond.
5. Have students use the tweezers to remove three or four scales along the middle side of the fish. Students may then hold the scales between their fingers to see what they feel like. Compare the texture to that of a human fingernail.
6. Using the scales provided *(see appendix)*, compare the specimen's scales to those of other species. What similarities and differences are there? Why are scales important to fish?

Evaluation:

Occasionally, individual fish may be born with their scales reversed; opening towards the front of the fish rather than the rear. Based on their observations, have students list the problems this might cause fish. *POSSIBLE ANSWERS: Harder for the fish to move through the water, increased friction, water forcing scales to open, material getting stuck under the scales, scraping against objects may bend or rip scales, etc.*

TEACHER: SCALE TALES: PART 2

Background:

As a fish grows, its scales must grow as well in order to keep its body covered. When a scale is lost or removed, a new one grows in its place. As a scale grows, growth rings form, much the same way as a tree. The difference is that while trees grow only one ring per year, a fish scale may gain many rings per year. The key to determining the age of a fish is to look at the spacing of the rings. When water temperatures and food supplies combine to make ideal growing conditions (the summer months), growth is rapid and the rings are wide. When conditions are more difficult (the winter) and growth slows, the growth rings are closer together. The combination of wide and narrow growth rings therefore makes it easy to accurately establish the age of the fish.

In cultured or "farmed" fish, establishing age is not as easy. These fish are fed regularly for fast growth, therefore their growth rings are wide. If such fish escape or are released into the wild, it may take them several months to learn to find food on their own. This makes a unique pattern of wide interior rings and narrow "outer edge" rings, making the fish easily identified as coming from a fish culture station or fish farm.

As fish spawn, scales are often damaged as they come in contact with gravels, etc. These damages leave permanent scars on the scale, and may be used to determine how many times the fish spawned and when.

Process:

1. Discuss with students how to find out how old something is. Ask students how one might determine the age of a fish. Discuss growth rings on fish scales, and how they may be used to determine a fish's age.
2. Have students examine the scale samples under a microscope. Ask them to count the number of areas of compressed rings, (representing winters) and thereby determine the age of the fish.
3. Discuss why growth rings on scales from fish raised in culture stations differ from the rings on scales of wild fish. (Better food supply, controlled water temperatures, etc.)

Evaluation:

Provide groups with a scale sample and ask them to determine the age of the fish and whether the fish was wild or from a fish-culture station.

Possible Extensions:

1. Have students compare the annual growth rings of a tree slice to the growth rings from a fish scale. How are they alike? How are they different?
2. Have students draw a scale of a fish that is the same age as them.

TEACHER: WISHIN' I COULD GO FISHIN'

Overview:

It's a warm spring day. The sun gains strength as it pushes snowbanks to extinction. The wind brings the pungent odour of the warming earth intermixed with the birdsongs; a sure sign of spring. It's hard for the avid fishermen to not leave the task at hand and either go fishing or briefly visit memories of favorite fishing holes and their adventures. To the able-bodied, they can easily relive those memories, adding to their collection another year of fishing successes and disappointments. What about those who are physically less able to enjoy the sport of fishing? Through the following lesson, students will experience some of the problems that disabilities create for anglers, and design equipment to make angling for the disabled a possible and enjoyable activity.

Objectives:

Students will be able to:

- identify and explain from personal experience at least one disability-related angling problem
- create a possible solution to one disability-related angling problem

Subject Links:

- science
- visual arts
- drama

Materials:

- student worksheet
- materials to draw and make models with
- a rod and reel or metre stick with string for each student group
- adhesive tape *(to temporarily bind hands or fingers)*
- blindfolds
- wheelchairs *(if possible)*

Background:

Few products have been designed to help physically disabled persons to participate in the sport of angling. Some do exist such as braces to attach rod and reels to arms that lack mobility, attachments to wheelchairs or to the neck of a paraplegic. There are also motors to reel in fishing line that are operated by mouth controls and large knobs on reels for people who lack fine motor controls.

Process:

1. Discuss human disabilities and determine which could limit participation in angling. What problems do people with these disabilities face when they want to go fishing?
2. Divide the class into groups and have them complete the Student Worksheet. Assign each group one of the following disabilities:
   - must use a wheelchair to get from one place to another
   - has only one hand
   - have no hands
   - have no fine motor control
   - have no sight
3. Provide each group with a fishing rod and reel (or equivalent). If some students have never used one, provide basic instructions and allow students to practice casting with a weighted line. ***(Ensure that any hooks have been removed!)*** Once group members are familiar with the operation of the rod and reel, have students try out their disability by using the appropriate method: blindfolds, only one arm, taping thumbs and fingers together, etc. Have them invent solutions for their "disabled" angler. Ask students to create a picture or model of their inventions.

Evaluation:

Have students write an instructional manual for their invention. Students may also demonstrate their invention to the class, playing the role of a salesperson.

Possible Extensions:

1. Have other groups of students assume the disability and evaluate the effectiveness of the working models.
2. Invite a disabled angler to your class to discuss fishing and have him or her evaluate the students' inventions.
3. Have students plan a complete fishing trip for a disabled angler, taking into consideration all assistance or special equipment required.
4. Have students look through fishing magazines for advertisements or articles about new products. Informally, this may provide inspiration for their own projects, or as a formal assignment, data could be recorded in chart form comparing what problems the products solve, whether it would be useful to all anglers or just some, how much people would be willing to pay for it, etc.

STUDENT WORKSHEET: WISHIN' I COULD GO FISHIN'

DISABILITY: _____ **GROUP:** _____

FISHING STEP	POSSIBLE SOLUTION
Getting to fishing waters	
Getting to shore	
Launching boat from car roof or trailer into water	
Driving boat	
Attaching hook to line	
Casting the fishing line	
Feeling when the fish takes the hook	
Reeling in the line	
Landing the fish	
Removing the hook from the fish	

REMEMBER: ***Fishing is for EVERYONE!***

TEACHER: WHERE HAVE ALL THE FISH GONE?

Overview:

The collection of data about the population of a specie of flora or fauna over time may show positive or negative trends. Once the trends are identified, negative ones may often be reversed. With habitat reconstruction and preservation, for example, fish populations may be restored.

It would be an impossible task to count all fish in a sample area. Even with sophisticated equipment, some fish may elude capture. Population estimates are therefore based on the average number of fish captured in specific areas. These same areas are assessed over a period of several years to establish population trends. As a random sample, this information serves as a fairly accurate estimation of the overall population of a species.

Objectives:

Students will be able to:

- demonstrate their understanding of random sampling
- record data and make predictions about species populations
- analyze fish population statistics and make inferences through graphing

Subject Links:

- math *(interpreting data, problem solving, graphing and predicting)*
- science *(populations, classifying)*
- language arts *(reading, recording information)*

Time:

1-2 forty-minute periods

Materials:

- random numbers of white, red, blue and green chips *(NOTE: Marbles work equally well)*
- 1 wash tub
- blind-folds
- masking tape
- student worksheets

Process (part 1):

1. Have students use masking tape to divide the tub into 16 equal sections. (An easy way is to create a grid across the mouth of the tub using masking tape.) Assign various species names to the chips (i.e. red chips are cod, white are Atlantic salmon, etc.)
2. Blind-fold several students. They will be the fishing boats!
3. Scatter the chips across the bottom of the tub, ensuring that there is a fairly even distribution of chips in each section.
4. Have each blind-folded student select one square of the grid to "fish". They are to bring up as many fishes from their area as possible, with one try.
5. Using each "fishing boat" as a group leader, divide the class into groups. Each group is responsible for accurately recording the "fish" populations from their grid square on the Population Estimate Table. Students should then make population estimates for the entire area for each species.
6. Compare group results as a whole class activity. Group predictions may be compared with actual numbers of chips in the tub.

Process (part 2):

1. Have students produce a bar graph from the information contained in the Population Estimate Table. Students should be encouraged to use a different colour for each species.
2. Follow up questions *(may be completed through class discussion)*:
   - Which species has the greatest population?
   - Which species has the smallest population?
   - In an ocean or river, why might there be more of one species than another?
   - How might too many of one species and not enough of another affect the balance of nature?

Possible Extensions:

1. Check with the local Department of Fisheries and Oceans office and the Department of Natural Resources and Energy office to see what population studies have been done in your area. What trends are present?
2. Are any plant or animal species threatened in your area? If so, what steps can be taken to protect them to ensure their survival?

STUDENT: WHERE HAVE ALL THE FISH GONE?

Notes to Student:

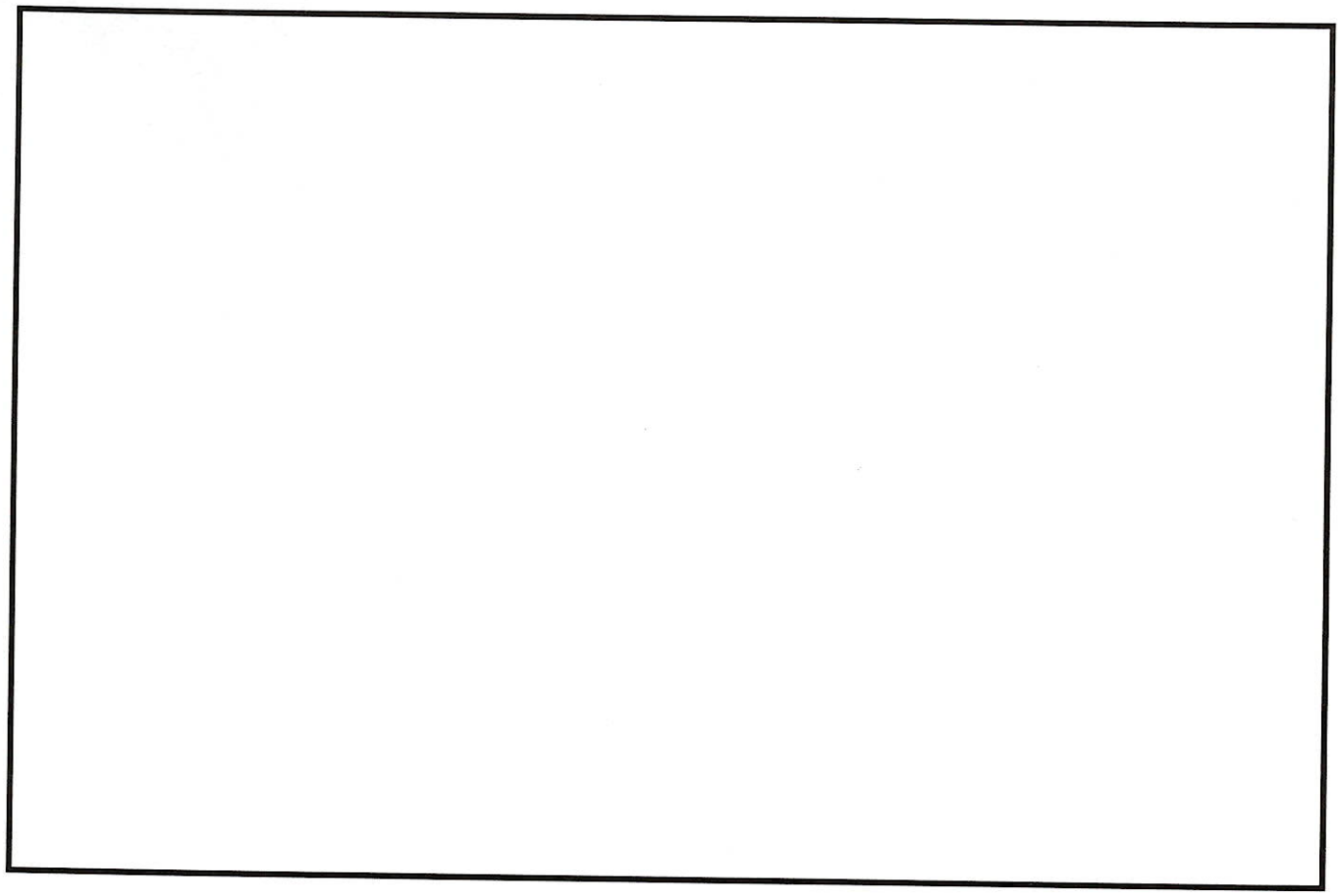
1. Fill in the table below after your team member has "fished." Be sure to accurately record all information following the example provided. If time permits, compare your estimated total numbers with the actual number of chips in the tub.
2. On the following page is a blank box. In that box, create a bar graph to show the population estimates of the fish species. Use different colours for each fish species, and *BE SURE TO LABEL YOUR GRAPH!*

POPULATION ESTIMATE TABLE

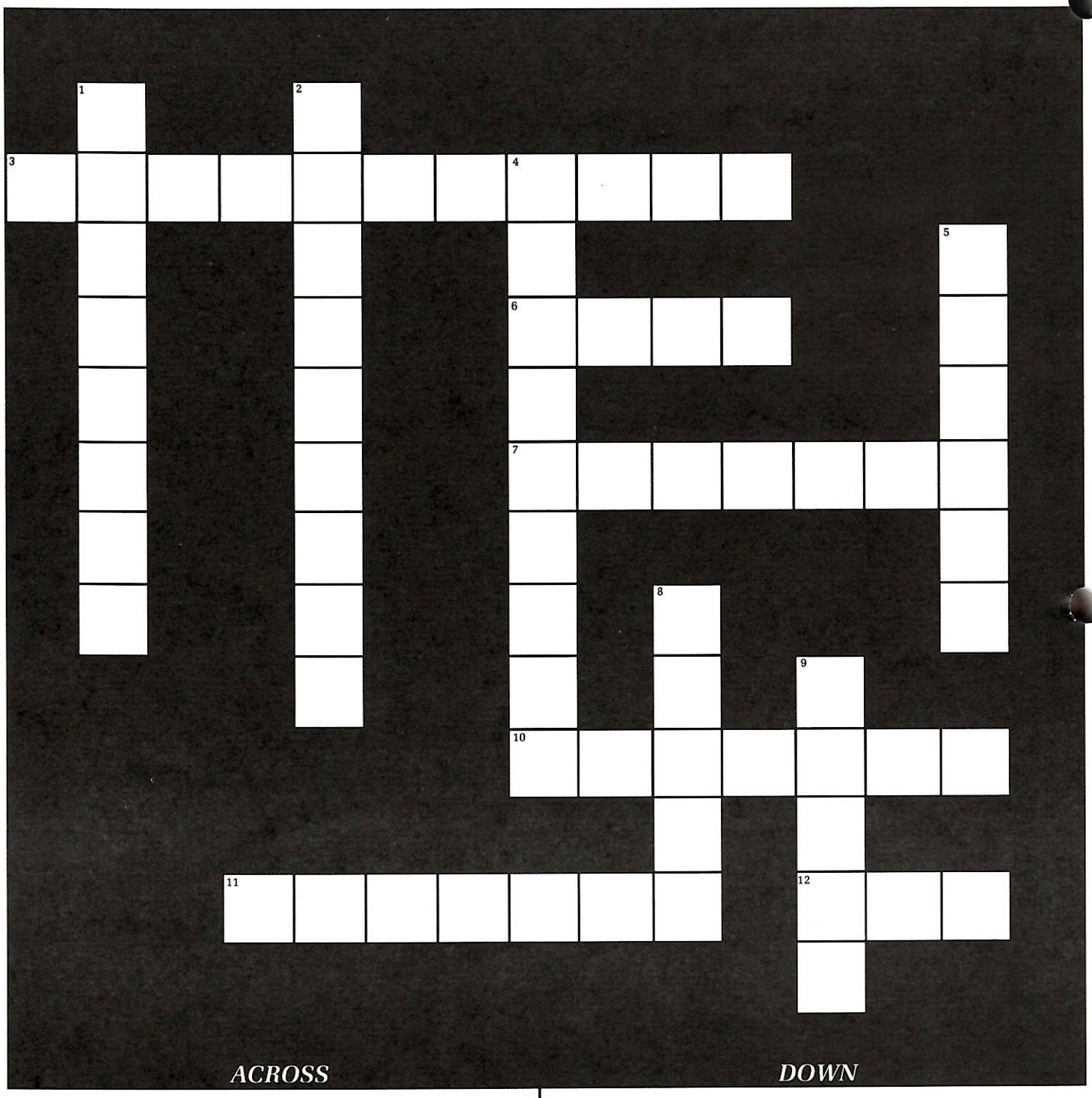
FISH SPECIES	NUMBER CAPTURED	ESTIMATED TOTAL POPULATION
winter flounder	7	7 x 16 = 112 *(number of grid squares)*

STUDENT: WHERE HAVE ALL THE FISH GONE?

POPULATION ESTIMATE GRAPH



SOMETHING'S FISHY!



ACROSS

3. Raising fish as a business.
6. We are on the outside of fish to help them swim.
7. Weather conditions (may change with the seasons).
10. The wearing away of stream and river banks.
11. I am another word for home; a place where something lives.
12. Most people don't like me. They think I look like a snake.

DOWN

1. A glass tank used as a fish's home.
2. An insect that builds its house out of sticks and little rocks on the stream bottom.
4. The process of being born, growing up, aging and dying.
5. I am smaller and usually cooler than a river.
8. Fishermen like to eat me. I have speckles on my sides.
9. Usually has more flowing water than a stream.

GRADES 4&5 EXTENSION CONSIDERATIONS

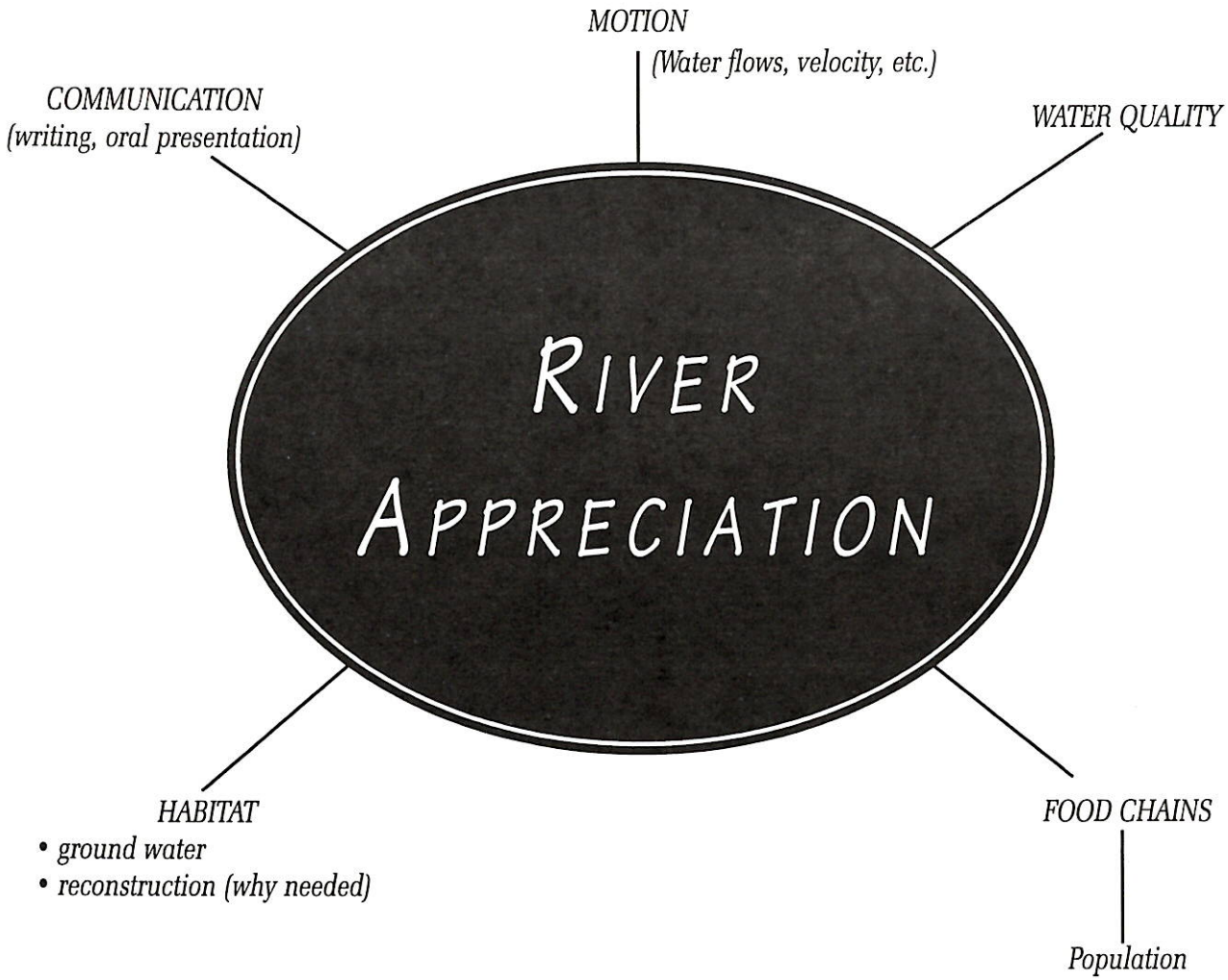
Water Quality/Motion

- pH tests
- temperature *(various locations, note differences and why)*
- average velocity
- water clarity *(before and after rainstorm or in-stream work)*
- need for plants and trees
- is the water drinkable?
- erosion/human impacts *(farming, industry, roads, litter)*
- regulations *(government)*
- uses of water
- sources of water

Habitats

- stream mapping
- water features *(pools, riffles, etc.)*
- bottom *(gravel, mud, ledge)*
- bank vegetation
- research habitat of fish, insects, plants, invertebrates
- different habitats, species that belong /do not belong there
- human impacts *(direct/indirect)*
- reconstruction *(why needed, awareness of work done/to be done)*
- clean up
- regulations

GRADES 4&5


MOTION
(Water flows, velocity, etc.)
COMMUNICATION
(writing, oral presentation)
WATER QUALITY
RIVER APPRECIATION
HABITAT
• ground water
• reconstruction (why needed)
FOOD CHAINS
Population