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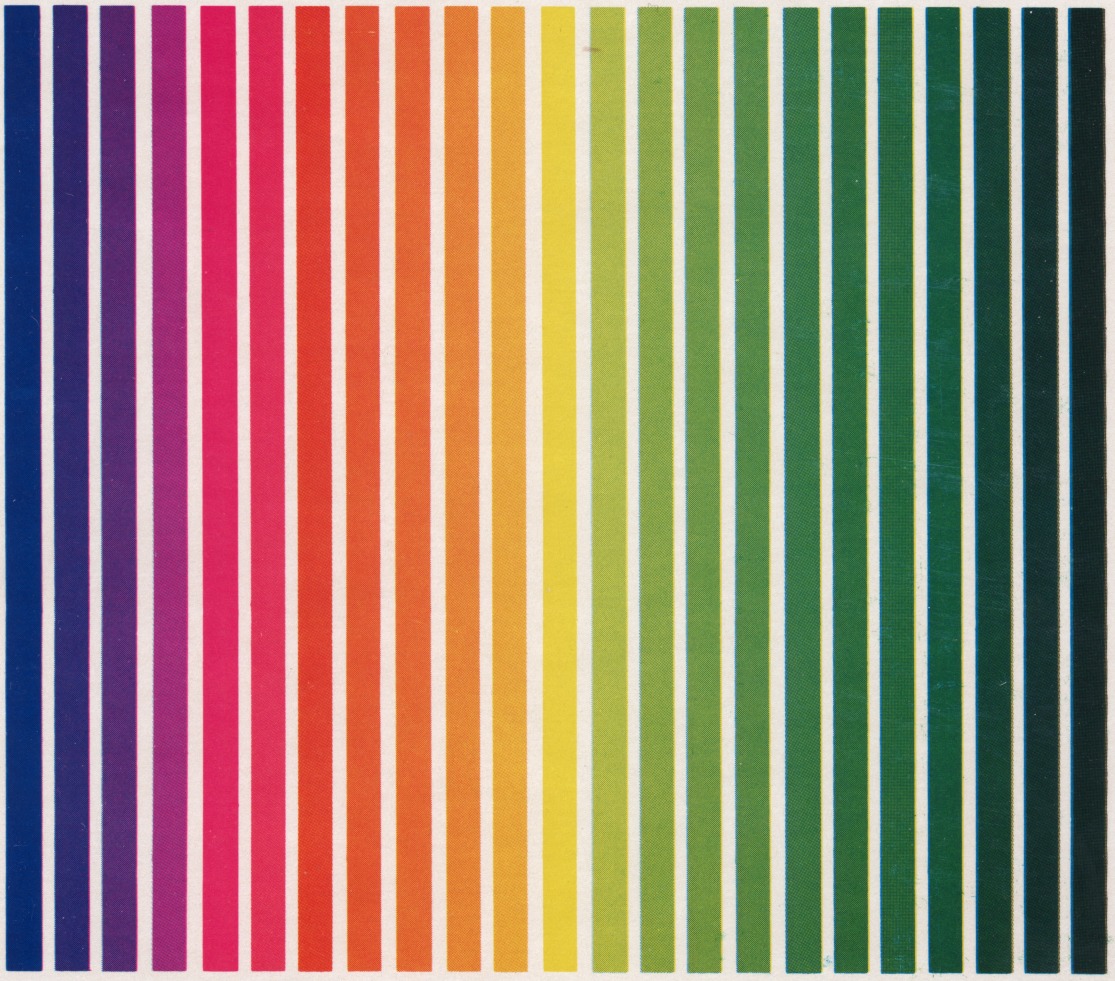

Minnesota Educational Computing Consortium

ELEMENTARY BIOLOGY

A circulatory system tutorial and
two ecology simulations (ages 9-14)

Diskette: 16K (APX-20136)

User-Written Software for ATARI Home Computers

Minnesota Educational Computing Consortium

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A circulatory system tutorial and
two ecology simulations (ages 9-14)

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ELEMENTARY BIOLOGY

by

Minnesota Educational Computing Consortium

Distributed By

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ELEMENTARY BIOLOGY

Version 1

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2520 Broadway Drive
St. Paul, Minnesota 55113

February 15, 1982

TABLE OF CONTENTS

INTRODUCTION

The Elementary Biology module has been designed for use in introductory biology classes at upper elementary through junior high school levels of instruction. The module diskette will operate on either an Atari 400 or Atari 800 computer. This support booklet provides information for using the diskette effectively in a classroom setting.

Ecological concepts of food chains and food webs are taught by the programs ODELL LAKE and ODELL WOODS, which use a simulation format. CIRCULATION is a tutorial on blood circulation in a two-chambered heart. Beginning biology classes typically cover this topic, often including the dissection of a two chambered heart organism such as a frog or fish.

Handout pages in this booklet may be duplicated for use with students. These pages are numbered sequentially in the upper right corner, for example, handout #1 - Name of Handout.

Code numbers following some objectives refer to sections in Some Essential Learner Outcomes (SELOs), produced by the Minnesota State Department of Education. The objectives in this booklet are taken from the Science and the Environmental Education SELOs.

INDEX TO PROGRAMS ON DISKETTE

TWO CHAMBER HEART

Specific Topic: Blood circulation in a 2-chambered heart

Type: Tutorial, Demonstration

Reading Level: 7 - 8 (Dale-Chall)

Grade Level: 7 - 9

DESCRIPTION...

CIRCULATION is a tutorial exercise on the circulatory system of a fish, which like several other animals, has a two-chambered heart. The program uses color graphics to show movement of a blood cell throughout the circulatory systems, therefore a color T.V. is recommended.

OBJECTIVES...

1. to learn the route taken by blood in the circulatory system of an animal which has a two-chambered heart.
2. to recognize that oxygen is removed from the blood as it travels to various organs and body parts.
3. to identify the organs which replenish oxygen and remove carbon dioxide from blood.
4. to identify the chambers of a two-chambered heart.
5. to identify and give the function of common structures that are related to living things (Science SELO I-A-3-17-d).

BACKGROUND INFORMATION...

Circulation of blood involves movement. The graphics on the computer simulate the movement of blood throughout the circulatory system. The outline of a fish is drawn on the screen, and symbols representing the vital organs, the muscles, the head, fins, and tail are drawn one at a time. A single blood cell travels through the fish's circulatory system to the various organs, muscles, and other body parts.

The program involves 3 options: a tutorial on blood circulation in a two chamber heart, a demonstration of blood movement throughout the system, and a simple quiz.

In animals with a two-chambered heart such as the salamander, toad, frog, and fish, the chamber which receives the blood is called the **auricle** and the chamber which sends the blood through the circulatory system is called the **ventricle.**

auricle - receives low-oxygen blood from the body and sends it to the ventricle

ventricle - pushes the blood to the gills or lungs and then throughout the circulatory system

gills or lungs - give oxygen to the blood and take carbon dioxide from the blood

From the gills or lungs the oxygenated blood goes to the organs and other body parts.

Blood moving from the ventricle section of the heart to the gills is blue in color because it is carrying carbon dioxide. The gills remove the carbon dioxide and provide the blood cells with oxygen. When this happens, the blood reddens.

Once the blood has been oxygenated, it travels to one of the other organs such as the stomach. As the blood cell passes through the stomach, it provides oxygen to the stomach.

The blood always flows from the heart to the gills, to an organ, muscle or body part, and finally back to the heart. The destination of the blood can vary with each cycle of the blood cell.

USE IN AN INSTRUCTIONAL SETTING...

Preparation

Before running the program, the students should understand that blood delivers oxygen to the body cells and to collect carbon dioxide from the body cells. The heart works as a pump to move blood throughout the circulatory system.

Using the Program

CIRCULATION works most effectively as a supplement to an instructional sequence on the circulatory system. To take full advantage of the features of this program, a color TV is recommended. It may be necessary to adjust your color TV/monitor so that the color on the screen matches the description (blue for deoxygenated blood, red for oxygenated blood). Since the program takes only 5 - 10 minutes to run, several students can use the program in an hour. As students finish running the program, handout #1 - Blood Circulation of Fish can be used to reinforce what has been learned from the program.

Follow-up

CIRCULATION is intended to supplement class work. Some activities which can accompany or follow the use of CIRCULATION are:

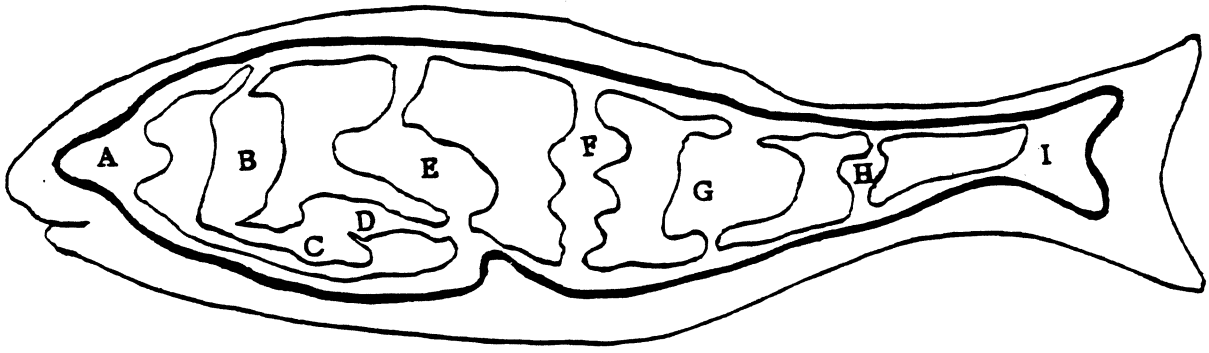
1. textbook work on the circulatory system.
2. comparison of the circulatory system of animals having two-chambered hearts with those having four-chambered hearts.
3. laboratory dissection of an animal with a two-chambered heart, such as a frog or fish.

A discussion of the following ideas would be interesting: What would you imagine the circulatory system of a less "advanced" animal look like? Would all the separate organs of the fish be present? ... in different form? What might the circulatory system of a slightly more advanced animal look like?

1

BLOOD CIRCULATION OF FISH

Name _____ Class _____ Date _____



A. HEAD

B. GILLS

C. HEART VENTRICLE

D. HEART AURICLE

E. FIN

F. DIGESTIVE SYSTEM (stomach and liver)

G. BODY MUSCLES

H. KIDNEY

I. TAIL

The diagram labels the various parts and organs of a fish. Show where the blood flows by filling the words in the blanks below:

Example: Heart to Gills to Fin

1. Heart Auricle to _____.
2. Heart Ventricle to _____ to Head.
3. Muscles to _____ to Heart Ventricle to _____.
4. _____ to Digestive System to _____.
5. Gills to _____ or _____ or _____ or _____ or _____ to Heart Ventricle.

ANSWER KEY

BLOOD CIRCULATION OF FISH

1. Heart Auricle to **Heart Ventricle.**
2. Heart Ventricle to **Gills** to Head.
3. Muscles to **Heart Auricle** to Heart Ventricle to **Gills.**
4. **Gills** to Digestive System to **Heart Auricle.**
5. Gills to **Head** or **Fin** or **Digestive System** or **Muscles** or **Kidney** to Heart Ventricle.

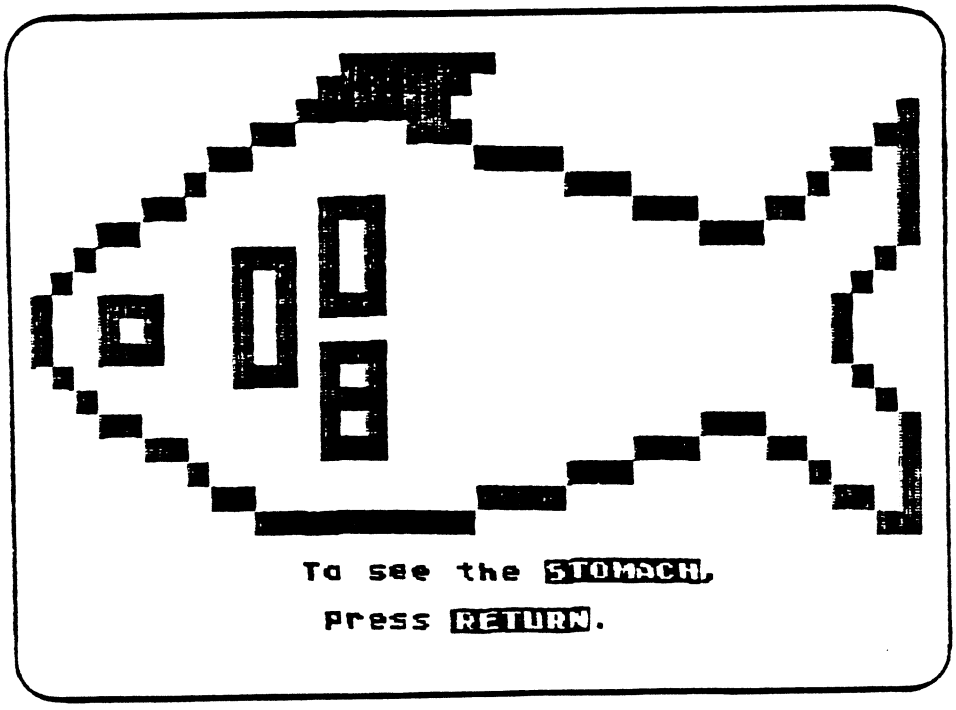
SAMPLE RUNS

```
Would you like to:
1)  See a lesson on blood circulation
    in a fish.
2)  Answer some questions about blood
    circulation in a two-chambered
    system such as that of a fish.
3)  See a demonstration of blood
    circulation in a two-chambered
    system such as that of a fish.
4)  End the program.

Enter 1, 2, 3, OR 4 ?
```

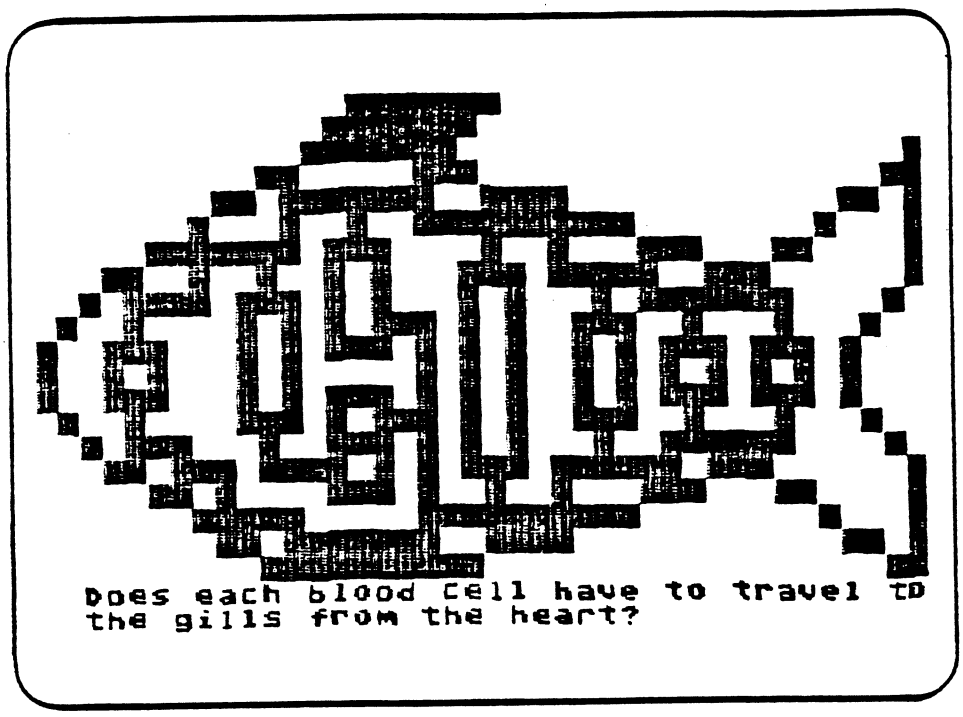
Students may choose to run a lesson, take a quiz, or view a demonstration.

EXAMPLES OF SCREEN OUTPUT



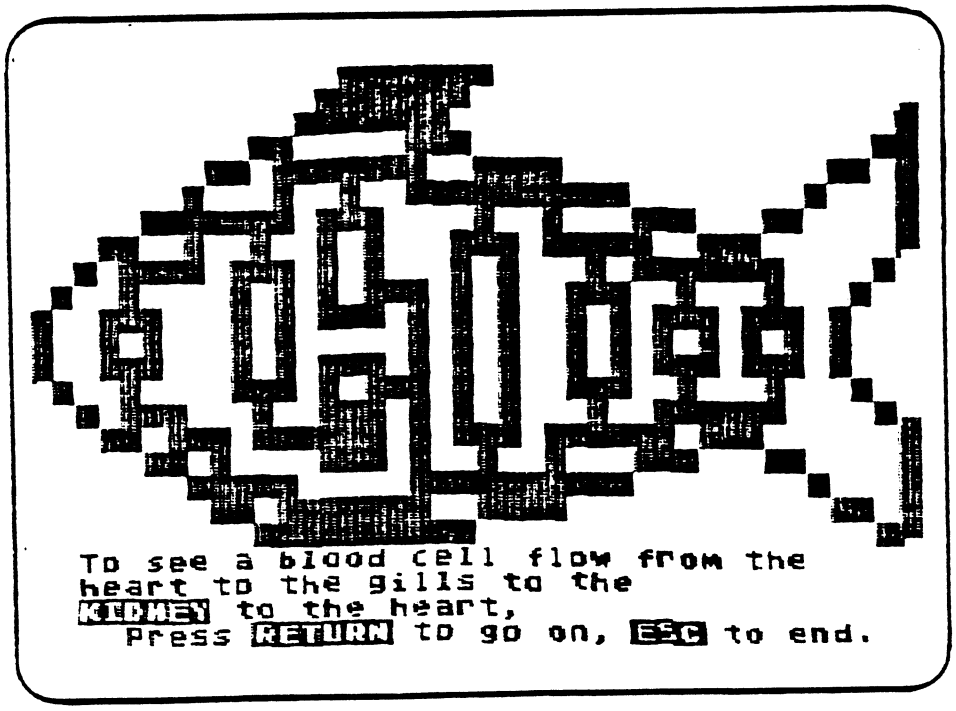
If students choose the lesson, the outline of a fish is drawn on the screen and one by one the other parts of the fish appear.

SAMPLE RUNS



If students choose to take a quiz, a series of questions are presented to reinforce what has been taught in the lesson.

EXAMPLES OF SCREEN OUTPUT



Students can review the flow of blood circulation by choosing the demonstration option.

UNDERSTANDING FOOD CHAINS

Specific Topic: Ecology, food chains, food webs

Type: Simulation

Reading Level: 3.2 (Spache)

Grade Level: 3 - 9

DESCRIPTION...

This simulation allows students to role play fish found in Odell Lake, an actual lake in Oregon. While running the simulation they discover the food web relationships by experimentation. Students are randomly presented encounters with other fish and organisms in their environment. They must select appropriate actions in order to survive.

OBJECTIVES...

1. to become aware of the animal life forms found in water.
2. to make the decisions necessary for the survival of a fish by role playing a fish.
3. to understand competition for food sources within a niche.
4. to demonstrate knowledge of basic predator-prey relationships (Science SELO I-A-13-e).
5. to understand ecological systems (Environmental Education SELO I-A-2-4).
6. to identify where a living thing can be found and describe why it is found there, as well as how a living thing moves in its environment and why it moves that way (Science SELO I-A-3-9-d).

BACKGROUND INFORMATION...

The fish in the Odell lake food chain are mackinaw trout, dolly varden, blueback salmon, rainbow trout, whitefish, and the chub.

The mackinaw or lake trout has an average size of 9 pounds. Twenty pounds is not uncommon. It has been known to reach 100 pounds. Preferring deep cool water, this trout has a goat-like appetite which feeds on fishes, birds, leaves and trash - but not on insects or animal plankton.

The dolly varden may run from 2 pounds in creeks to over 20 pounds in lakes and rivers. It preys on the eggs and young of other fishes but does not eat animal plankton or insects. The mackinaw trout will eat the dolly varden.

The blueback salmon, also called sockeye or red salmon, is seldom over 6 pounds and is a maximum of 12. It is found in the upper 30 to 40 feet of the open lake. It eats animal plankton and insects, and will chase whitefish and chubs away from their food supply or territory. Blueback salmon must avoid the dolly varden and mackinaw trout.

The rainbow trout, or steelhead, averages 2 to 8 pounds and has been reported to reach 40 lbs. The rainbow lives near the shoreline in shallow water. It likes insects and animal plankton and will chase chubs and whitefish away from their food supply or territory.

Whitefish commonly weigh 2 to 6 pounds. Some large varieties reach 26 pounds. They like shallow water and with small pointed mouths feed on the lake bottom, animal plankton, and insects. They will chase rainbow trout and chubs away from their food supply or territory.

The chub in this simulation is a freshwater fish. Freshwater chub prefer swift streams and clear lakes and live and feed near the edge of the water on animal plankton and insects.

While role-playing one of the fish, students will encounter large birds, mammals, other fish, plankton, and insects and must decide whether to:

1. Escape deeper
2. Escape shallow
3. Ignore it
4. Eat it
5. Chase it

BACKGROUND INFORMATION (Continued)...

The Model

Each fish has the same series of encounters reflecting their position in the food chain. Chub, for example:

a) eat plankton, water, and insects.
b) can ignore whitefish, blueback salmon, and rainbow trout.
c) are eaten by the mackinaw trout and dolly varden.

When fish pass up two chances to eat, they may starve to death. Even with the right choices, the odds for:

a small fish getting away from mackinaw trout in deep water are 4 out of 5.

a fish being caught by a fisherman's hook when eating water insects are 3 out of 20.

the Odell Lake model was derived from actual data gathered on a lake in Montana. Handout #2 - Odell Lake Student Reading describes these studies.

The model operates under the following assumptions:

1. that the program uses encounters between fish of different species rather than between fish of the same species.

2. that the program does not consider the effects of old age, parasites, and disease.

3. that the program does not take into account the many seasonal fluctuations of the lake and the life it contains.

4. that the program does not make use of ecological relationships of plants and animals not mentioned in the program and their possible effects on the lake inhabitants.

5. that the program encounters are dramatized. Fish do not necessarily move around as much as the encounters suggest.

6. that enough research has been done to indicate the relationships mentioned in this program are indeed true.

USE IN AN INSTRUCTIONAL SETTING...

Preparation

Students would benefit from understanding the ecological concepts of:

Food chains
Food webs
Niches
Predator/Prey
Competition

These concepts could be developed using any of several classroom and outdoor activities. Suggestions include:

(1) Have up to 12 students from the class form a yarn-connected food web. Assign one student to be the sun (primary source of energy). Have four students be plants - e.g. grass, cattail, aspen etc. Assign four students the roles of plant eating animals - e.g. field mouse, deer, fruit feeding bird, etc. Have three students be meat eating animals - e.g. shrew, fox, owl, snake. Actual role name-tags would help students identify the relationships between organisms. Have students connect themselves using yarn to all the other organisms they eat. In the case of plants, their source of energy is the sun.

(2) The class could choose an animal and discuss its relationship to three other animals. The first relationships students will think of are food/predator relationships. Encourage them to also think of competitive relationships both within and between species.

(3) Students could do library research and draw small food webs and chains for a variety of animals of their choosing.

(4) Food chain and food web mobiles can be fun to make and interesting to display from the classroom ceiling. Magazines can be used to provide pictures. Cardboard, glue, string, and coat hangers are other handy materials. The connections between organisms are illustrated by the strings on the mobile. Point out student mobiles which begin with a representation of the sun as the source of all energy.

USE IN AN INSTRUCTIONAL SETTING (continued)...

> You may want to cover a few vocabulary terms before beginning: niche, simulation, animal plankton, territory, food chain, organism, etc.

For junior high students, handout #2 - Odell Lake Student Reading can be used prior to running the simulation or as follow-up to the program. You may prefer to use it as follow-up. The reading gives some information about the food chain and may detract from the intrigue of discovering those food chain relationships while running the program

There should be some discussion of the instinctual nature of many animals' actions. For example, in the simulation the phrase, "you decide to" suggests a type of reasoning that hasn't been proven to exist in many animals. Assigning human characteristics to lower animals is called anthropomorphism and is a term you may want to introduce at this time.

Using the Program

Students can use this program individually or in small groups. It has also been used with an entire classroom discussing and selecting the actions to be taken. In any of these situations, the following procedure should be followed:

> Allow the students to run the simulation through once or twice without recording anything. Ask them what fish they chose and what its relationship was to other organisms in its surroundings. Usually the excitement of the game is such that students will not be able to remember many relationships. Have them run the simulation again filling out handout #3 - Relationships. Several copies of handout #3 should be given the students so they can run the simulation more than once.

Follow-up

After all the class has had an opportunity to run the simulation a number of times, have them draw what they believe to be the food web in Odell Lake. Handout #4 - Food Web has figures of the various fish from Odell Lake. Students could cut these out and arrange them in what they believe to be the Odell Lake food web. As an entire class, decide upon one most likely food web. This final web should look much like the one in the handout #4 - Answer Key.

Emphasize that the Odell Lake food chain is specific to Odell Lake. Other fish species in different climates or locales have similar food chains.

USE IN AN INSTRUCTIONAL SETTING (continued)...

If handout #2 - Odell Lake Student Reading was not used prior to running the program, it can be included as follow-up.

The topic of natural selection and the part it plays in evolution is an appropriate topic to follow Odell Lake. Discuss with the students what happens to animals which make the wrong choice of actions in response to an encounter.

Complete the questions on handout #5 - Follow-up Questions. Discuss the answers as a class. Re-run the Odell Lake simulation as a class demonstration to illustrate answers to the questions.

Use ODELL LAKE as a stimulus to creative thinking. Pose open-ended questions such as, "what might happen if ... a developer built cottages all around the lake, ...acid rain fell on the lake, ... the plankton mysteriously died", etc.

Use analogies to promote imaginative thinking. For example, how is Lake Odell like a city? Like a high school?

2

ODELL LAKE

STUDENT READING

Lake Origin:

Thousands of years ago the bed of a lake was gouged out of the earth by a retreating glacier. This deep trench in the heart of the Cascade Mountains in Central Oregon, six miles long, one and a half miles wide, and three hundred feet deep, was gradually filled with water from the surrounding snows and melting glacier. Thus, a lake was formed that today is called Odell.

During the thousands of years since the birth of Odell Lake many things happened. The first forms of life were washed in from the surrounding land and more microscopic life was carried into the lake on dust particles from the wind. Ducks, geese, and other migratory birds brought bacteria, protozoans, algae and pieces of aquatic vegetation from the mud on their feet and wings. The lake overflowed as melting snow and ice added volume and a fifteen mile path was cut to the Deschutes River. The Deschutes flowed off the east slope of the Cascades northward into the Columbia, which in turn flowed into the sea. This fifteen mile path from Odell Lake is known as Odell Creek.

Some larger forms of life came up the waterways in the course of spawning. Fish came out of the sea up the Columbia River, up the Deschutes River, through Odell Creek, and into Lake Odell. Forest species such as Douglas fir, spruce, hemlock, ponderosa pine, alder trees and various shrubs invaded the shoreline. Parts of trees torn off by wind or disease fell into the lake. Various insects died and also fell into the lake, while other insects laid their eggs directly in the lake.

Fur bearing animals traveled up the waterways to Odell Lake flowing the same route as the fish, and soon otter and mink become very abundant. Beaver and birds became residents and the bald eagle and fish hawks flourished.

Among the fish that survived the trip from the sea to Odell Lake were rainbow trout, dolly varden, and whitefish (all members of the salmon family). Makinaw trout (lake trout) and blueback salmon were stocked to improve fishing. Small fish known as chub (related to the carp) were added accidentally by fisherman who used them as live bait.

ODELL LAKE

STUDENT READING (Page 2)

The Study

Fishing was not as good in Odell Lake as it was in some nearby mountain lakes and consequently a biological study was conducted to determine the reason. In the study, relative numbers of fish were considered as well as interspecies-interaction.

Information about numbers came quickly, but reasons for relative populations were very puzzling. Rainbow trout were scarce and did not appear to grow to normal size. This was unusual because they were a native fish and generally were quite numerous in nearby lakes. In fact, the rainbow trout had the greatest population in most nearby lakes and was considered the dominant species. Some type of succession must have occurred to make another fish the dominant species in Odell Lake.

But what species was it? The search for the new dominant species began. Scientists first studied the mackinaw trout and found the mackinaw to be very large but not very abundant. The mackinaw lived in the deepest part of the lake, whereas, rainbows lived only near the shore in shallow water. Stomach analysis of the mackinaw trout indicated little evidence of preying upon the rainbow and no evidence of food competition. Biologists decided the mackinaw could not be the dominant species.

The blueback salmon was considered next. Biologists found this fish to live in the upper 30 to 40 feet of the center of the lake and to feed mainly on algae and animal plankton. Stomach analysis showed no evidence of feeding on insects (the rainbow's main food), thus, bluebacks were not in competition with rainbows.

Then the chub was considered. Studies in other area lakes showed that wherever the chub was introduced it quickly became the dominant fish because of a high reproductive rate and its eating of other small fish in the lake. However, population counts on the chub failed to find large numbers in the lake, therefore, the chub was ruled out as the dominant species.

Only two species remained to be investigated: the dolly varden and the whitefish. The dolly varden was found to be a large fish but very scarce. So scarce, it was difficult to get specimen fish to study. Whitefish, therefore, must be the dominant species. As whitefish was not the dominant species in other nearby lakes, why did this unusual event come to be?

ODELL LAKE

STUDENT READING (Page 3)

In talking to fishermen and construction workers, biologists found that the dolly varden had been dynamited, speared and shot as they went up the inlet to spawn. Fishermen did this because they knew dolly vardens preyed on fish they wanted to catch. Man had taken a competitive role in the lake's energy web. Dolly vardens would have kept the whitefish population down. However, why the whitefish emerged as the dominant species was still not completely understood.

Whitefish have pointed mouths adapted for feeding on small bottom dwelling organisms, but they usually do not prey on other fish. They could compete with the rainbow for food, but did they? In other lakes this did not happen, so what niche did the whitefish actually occupy in Odell Lake? Never before had whitefish become so numerous as to threaten the rainbows dominance.

Biologists began a total study on the whitefish. They found whitefish everywhere, including in the stomachs of the mackinaw. Whitefish had ventured into the deepest parts of the lake, something they seldom do. Maybe whitefish had undergone a population explosion due to the killing of the dolly varden. Could whitefish eat faster than the chub could reproduce to account for the low chub population? This did not seem possible. The chub lays many more eggs than the whitefish and with its large mouth, is an especially efficient feeder.

One day by accident, the last piece of the puzzle fell into place. On a bright, quiet summer morning a biologist waded out onto the gravel at the east end of the lake. He stood quietly and looked into the shallow water. a school of spawning chub approached, females and males, side by side. The females layed eggs and the males spread sperm over them. The fertilized eggs sank into the rocky crevices and the school of chub moved on. Very soon another school of fish approached. More spawning chub? No, these were whitefish and they were feeding, not spawning. With their tiny pointed mouths, the whitefish were feeding on the newly deposited chub eggs. They would stand on their heads, tails up, and drive their mouth down into the crevices where the chub eggs had fallen. Now the niche of the whitefish was clear. By eating the chub eggs, the whitefish kept down the chub population. The whitefish were biological controlling agents.

ODELL LAKE

STUDENT READING (Page 4)

Biologists now knew the niche of each species of fish in Odell Lake. They knew that rainbows were rather confined to shallow areas and fed mainly on insects. The chub also seemed to live and feed near the edge of the lake. The mackinaw lived at depths of 100 to 300 feet and fed mainly on whitefish that ventured in. Blueback salmon were not greatly affected by other fish because they lived mostly apart from the others in the top 30 to 40 feet of the open lake and fed mostly on plankton; they were least affected by predation and competition. Whitefish were found everywhere in the lake due to their great numbers. They also ate fish eggs and water insects, thus, keeping the rainbow and chub population very small.

Now, another question was asked. "How are we going to improve fishing in this lake?" People always believe there has to be some personal gain. Ecology can be defined as saving nature for nature's sake and conservation can be defined as saving nature for mankind. To improve fishing, one has to determine which fish it is that fishermen desire most. Mackinaw are popular with some fishermen - previously, 38 pounders had been caught in the Odell Lake area. Rainbows, also popular with some fishermen, grow best in shallow areas of the lake which are warm and produce many insects, but Lake Odell has very little shallow water. The mackinaw grow best in cold deep water which Odell has in abundance. Should the lake be heavily stocked with mackinaw or rainbow?

In November, whitefish start spawning at Trapper Creek (an inlet at the west end of the lake). The number of whitefish during the year of the study was beyond belief. They packed the stream from bank to bank and passed in what seemed an endless, wriggling mass. Fish-eating ducks, even mallards, (normally plant eaters) fed on the whitefish. Since whitefish competed with the rainbow for food, some fishermen demanded action be taken against the whitefish. In response to their demand 55,000 whitefish (six tons) were removed in five days and used as food in the nearby trout hatchery. The removal of the whitefish would mean less food for the mackinaw and reduce control of the chub. This would also increase the supply of plankton, insects, and crustaceans, that the whitefish eat. Certainly the rainbow would thrive better than before although there is not much shallow water in Odell Lake. The mackinaw population with some of its food taken away would decrease. Eventually, the lake would exist under more of nature's own controls.

RELATIONSHIPS

Name _____ Class _____ Date _____

The fish you have selected to role play is: _____.
Number and record information on each encounter in the spaces below. Use additional sheets if necessary.

Encounter # _____

You Meet: _____

You decide to: _____

Results: _____

Encounter # _____

You Meet: _____

You decide to: _____

Results: _____

Encounter # _____

You Meet: _____

You decide to: _____

Results: _____

Encounter # _____

You Meet: _____

You decide to: _____

Results: _____

Encounter # _____

You Meet: _____

You decide to: _____

Results: _____

RELATIONSHIPS (Page 2)

Encounter # _____

You Meet: _____

You decide to: _____

Results: _____

Encounter # _____

You Meet: _____

You decide to: _____

Results: _____

Encounter # _____

You Meet: _____

You decide to: _____

Results: _____

Encounter # _____

You Meet: _____

You decide to: _____

Results: _____

What can you say about this fish's relationships to other organisms in its environment?

Eats? _____

Eaten By? _____

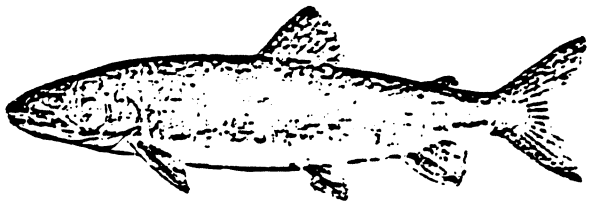
Other? _____

4

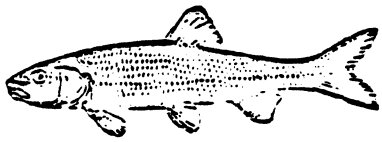
FOOD WEB

Cut out the figures of the Odell Lake fish. Arrange them in a food web on another sheet of paper. Interconnect the organisms with lines showing their food source.

WATER INSECTS

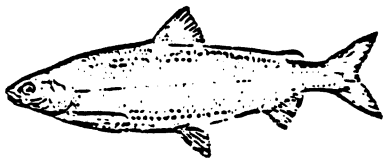


MACKINAW TROUT

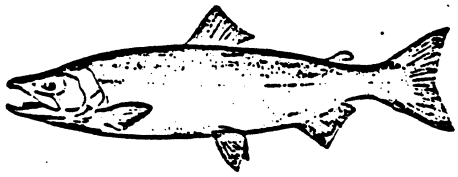


CHUB

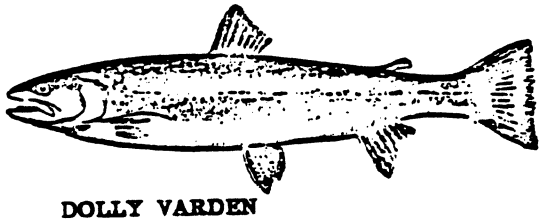
ANIMAL PLANKTON



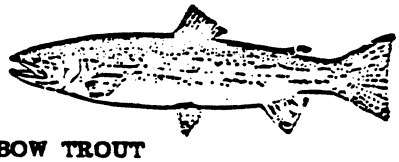
WHITEFISH



BLUEBACK SALMON



DOLLY VARDEN

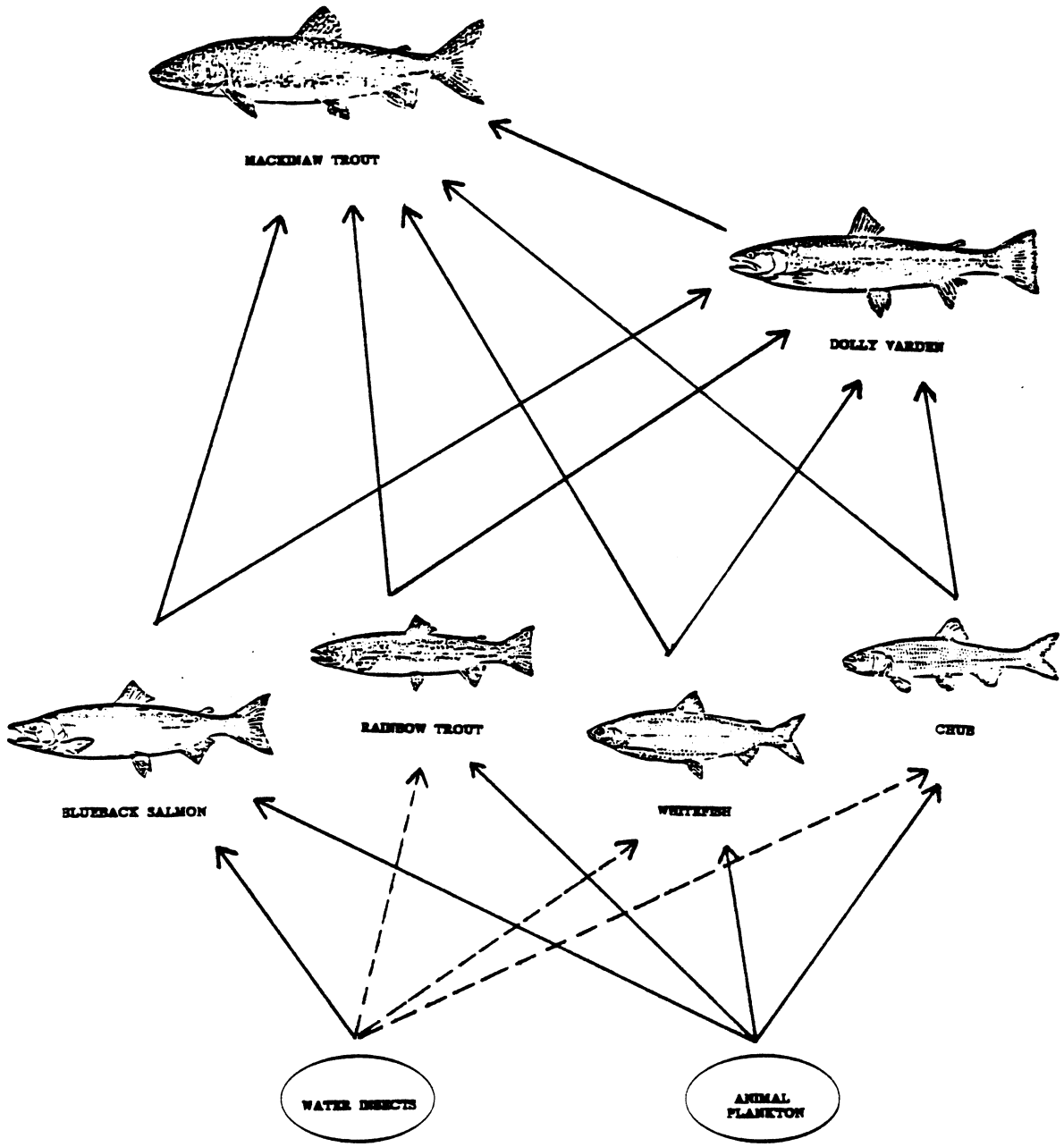


RAINBOW TROUT

4

FOOD WEB

ANSWER KEY



5

FOLLOW-UP QUESTIONS

Name _____ Class _____ Date _____

Think about the fish you role played when you ran ODELL LAKE as you answer these questions.

1. Under what circumstances would you ignore another animal?

2. Under what circumstances would you chase another animal?

3. For what reasons would you attempt to escape to deeper or more shallow water?

4. Would you be wise to attack any animal that invaded your territory? Why or why not?

5. If you were to meet an unknown animal, what would be some factors that might affect what action you decide to take?

6. List the fish in order of predator-prey relationship, the highest order predator at the top of the list.

7. Which fish feed on insects?

8. Which fish do not eat insects?

9. Which fish feed on animal plankton?

SAMPLE RUNS

```
You will become a fish in the Odell
Lake food chain.  After having been
each fish, you should understand
the relationships between them.

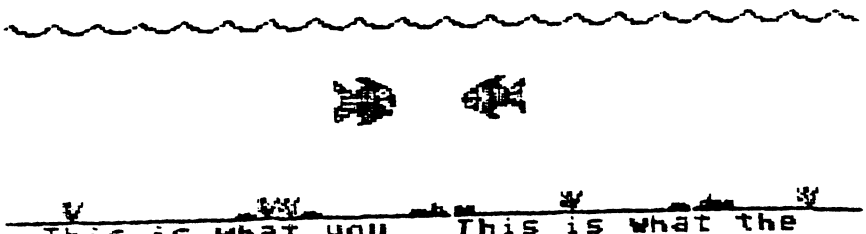
The fish you may become are:

     1. whitefish
     2. chub
     3. blueback salmon
     4. rainbow trout
     5. mackinaw trout
     6. dolly varden

Which fish would you like to be?
```

Students choose the fish they would like to role play.

EXAMPLES OF SCREEN OUTPUT

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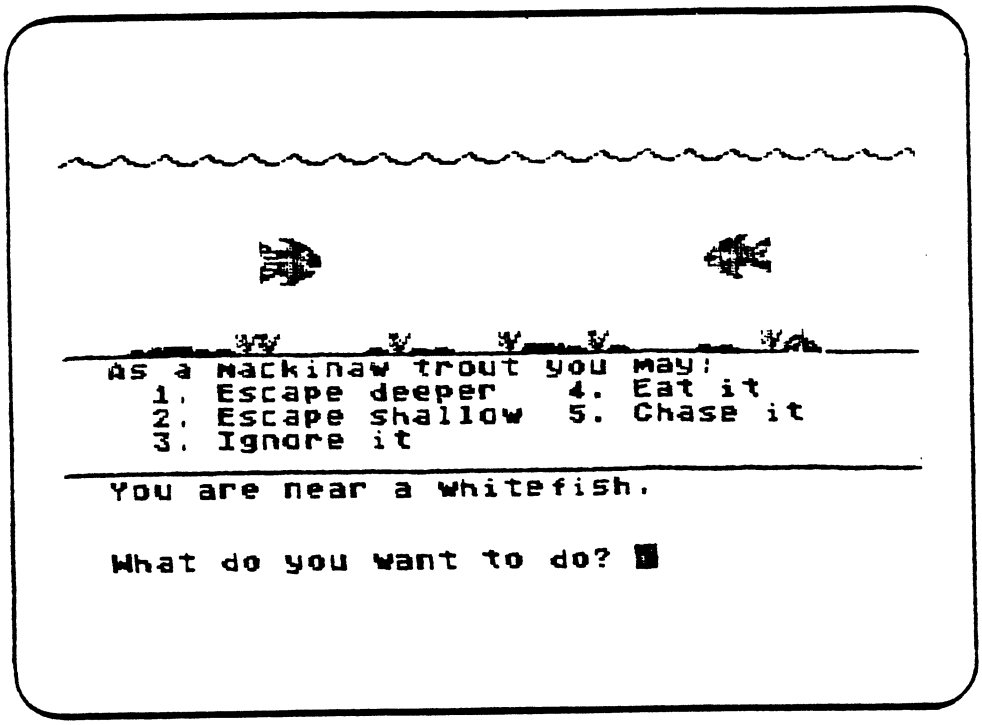
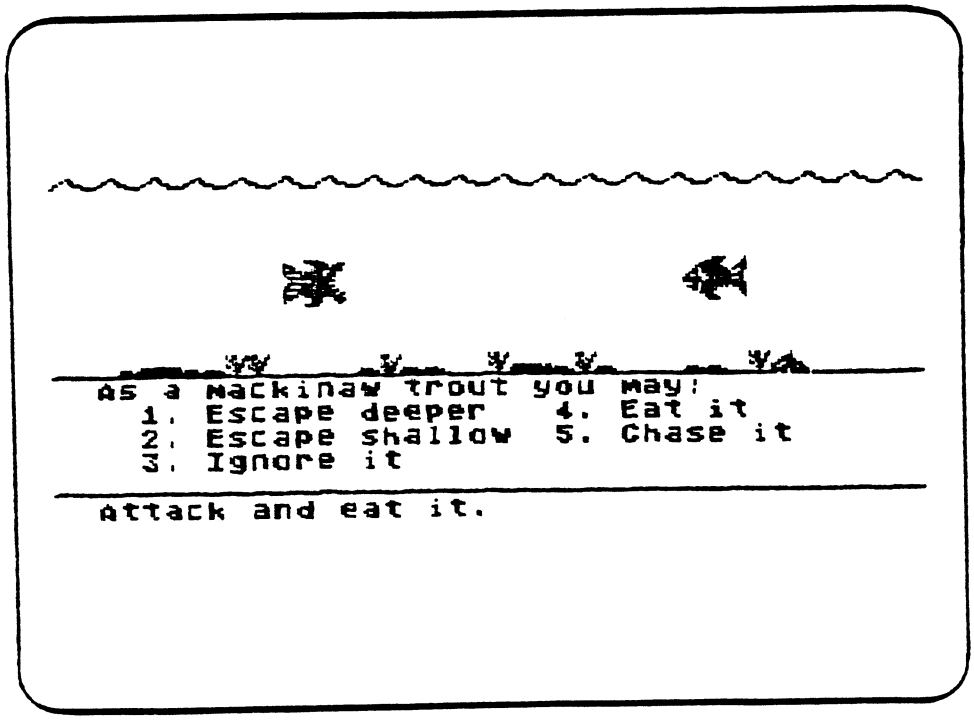
Press RETURN to continue.
```

The computer uses two different drawings to represent fish. The fish a student chooses to role play will look like the fish on the left side of the picture. The fish the student encounters will look like the fish on the right.



The computer randomly presents a situation such as the one depicted in this screen. Students must choose one of the five actions they can take by typing a number.

EXAMPLES OF SCREEN OUTPUT



After the students choose a response, the computer tells them the result of their action. If they survive, the computer will go on to the next situation. If not, the results of their action is restated for the student and they are allowed to try again.

UNDERSTANDING ECOLOGICAL RELATIONSHIPS

Specific Topic: Ecology, Food Chain

Type: Simulation

Reading Level: 2.2 (Spache Test)

Grade Level: 2 - 8

DESCRIPTION...

Students role play one of four animals found in the northern United States and learn what decisions are necessary for survival. As they encounter other organisms and make decisions about actions they should take, they discover the food chains of the woods.

OBJECTIVES...

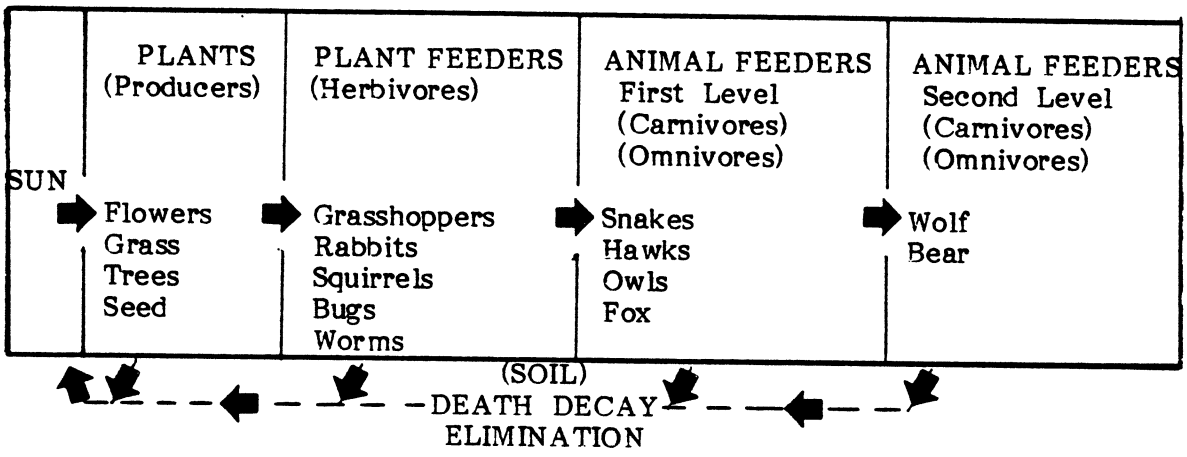
1. to describe characteristics of behavior of four animals: red fox, mouse, wolf, and rabbit.
2. to learn the relationship of these four animals to other organisms in the woods such as the plants, the owl, hawk, snake, and deer.
3. to be aware of the balance between plant and animal life and how that balance is maintained in a food chain.
4. to classify each animal as herbivore or carnivore.
5. to understand the role of the animals in the simulation and the controlling factors which limit each of their populations.
6. to demonstrate knowledge of basic predator-prey relationships (Science SELO I-A-3-13-e).
7. to understand ecological systems (Environmental Education SELO I-A-2-4).
8. to recognize the schemes involved in ecology (Science SELO 2-C-2-13).

BACKGROUND INFORMATION...

The Food Chain

All plants require sunlight, soil, water, and minerals to grow. Animals require different kinds of food. Some live primarily on plants and others eat meat. But whatever an animal eats, all the food they consume is ultimately derived from plants.

Any food cycle is a system of transferring energy. There are five basic groups in the food chain each transferring energy to the next. At the top of the food chain is the sun. Energy is passed from the sun to the second level - plants and so on down the chain.



Small animals feed on and derive their energy from the plants. These animals are called herbivores since they feed on herbs and green plants. Carnivores are animals that eat meat instead of just plants, and omnivores are animals that feed on both animals and plants. An animal like a bear is omnivorous. All animals replenish the soil and minerals through death, decay, and elimination.

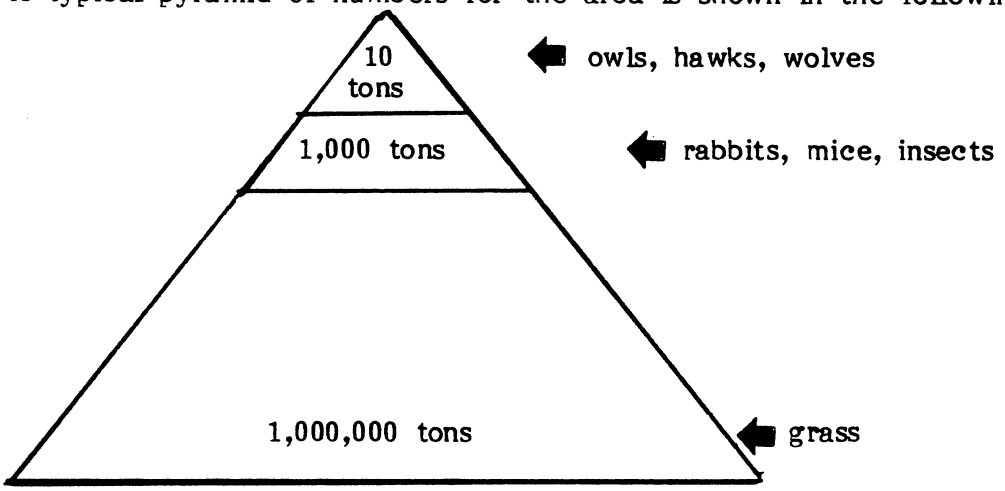
At the bottom of the food chain, but not an integral part of it, is man. Man often interferes in the complex cycle provided by nature. As wolves, fox, and animals at the bottom of the cycle are killed, other parts of the chain may grow out of proportion. For example, if man were to kill the hawks in a certain area, the woods may become over run with rabbits or mice. This might cause the grass to be completely eaten away resulting in erosion, or might leave little food for other herbivores.

BACKGROUND INFORMATION (Continued)...

The Food Pyramid

The food cycle has been described as a pyramid of numbers. Animals at the bottom of the pyramid are typically small in size and larger in number. As one moves toward the top of the pyramid, the size of the animals usually increase while their numbers decrease.

A typical pyramid of numbers for the area is shown in the following diagram:



Notice that grass which is at the bottom of the pyramid is most abundant — 1,000,000 tons. About 1,000 tons of plant feeding animals like rabbits, mice and insects exist on the plants, while only about 10 tons of animals like owls, hawks, and wolves are present. The large animals which occupy the dominant position in the food chain are least in number.

The Animals

The animals chosen for the simulation are common to the northern United States. Below are short abstracts about each of the four animals. Included with the student worksheets are transparency masters which the teacher may use when discussing the animals with the students. Each transparency master (handouts #9-12) shows a picture of the animal and its footprints.

TIMBER WOLF — The timber wolf is found in the wilder portions of the north woods. Now fairly abundant in northeastern Minnesota, the wolf prefers to stay in the woods except when the desire for food brings it into the open areas. The wolves feed on a variety of animals from mice to deer including rodents, rabbits, and large birds. Wolves usually travel in packs and their keen sense of smell, vision, and hearing, plus the cooperative efforts of the pack, make them excellent hunters.

BACKGROUND INFORMATION (Continued)...

The adult wolf is about 1.5 meters (5 feet) in length, 1.2 meters tall (4 feet), and weighs from 26 - 36 kilograms (58-79 pounds). The adult male wolf will occasionally reach weights of 72 kilograms (150 pounds). Wolves have very muscular bodies, long legs, curved teeth and slanted eyes. Their fur is gray in color except for the grayish-white underside.

The wolf's cry is a long, monotone sound lacking the yapping of the coyote. Living to be about 16 years old, wolves usually live in dens in rocky areas. They have litters of 4 - 12 pups which are blind when they are born and are weaned after about two months.

RED FOX

The red fox can be recognized by its reddish gray color and bushy tail. The feet and legs are black in color with the tip of the tail being white. The fox's body is approximately 1 meter (3 feet) long and has a .6 meter (2 foot) tail and weighs about 7 kilograms (5 pounds). Although the fox usually sleeps in the open, a den, often borrowed from a woodchuck, serves as a nursery when the litter is young. Four to ten pups are born to each litter. When upset, the fox will cry out with a harsh, penetrating bark.

The fox is omnivorous, eating meat such as rabbits and mice, as well as berries, fruits, and nuts. On occasion, foxes will prey upon domestic animals such as poultry. Noted for being an intelligent, alert, cunning animal, the fox hunts mainly at night.

SNOWSHOE RABBIT

The snowshoe rabbit's coat changes color seasonally; the summer coat is dark brown fur and the winter fur changes to snow white. Weighing from 1-2 kilograms (2-5 pounds), rabbits are less than one half meter (1-1/2 feet) long with 13 centimeter (5 inch) hind feet and 7 centimeter (3 inch) ears. Their large feet help them move on the snow. The rabbit has keen eyes to protect it from predators and spend their entire life on a few acres of land.

Rabbits have litters of two to seven furry, open-eyed bunnies, and within two weeks the little rabbits are eating grasses and other vegetation.

The snowshoe rabbit grooms itself like a cat and takes dust baths to keep clean. In wooded areas, where the rabbits become numerous, they form well established trails in the snow.

BACKGROUND INFORMATION (Continued)...

In winter rabbits eat twigs, buds, and bark, while in summer green vegetation is the main meal. The rabbit's most common enemies are fox, badger, man and predatory birds such as hawk, eagle, owl, and raven. When being chased, the rabbit usually circles the area and thumps warnings of danger.

FIELD MOUSE — An energetic little creature, the field mouse eats the equivelent of its own weight every 24 hours. Chewing out a network of paths, clipping grass, eating seed, and tramping the surface with its busy feet, the mouse is a builder of one inch highways. On the move day and night, the mouse will die of exhaustion before it is one year old if it has not been caught and eaten by a predator before that time.

Snakes attack the mouse in its burrow, while hawks, owls, crows, heron, and gulls attach from the air. Bullfrogs, trout, and turtles snap it up when it takes a swim, while skunks, fox, and bobcats feed on the mouse in the open. One weasel can wipe out an entire field of mice and even the great brown bear will dig a mouse out of its burrow.

Although mice are prey for many animals, they are plentiful as the pyramid of numbers shows. A litter will consist of 5-9 young with up to 17 litters being born in one year. The young mice are born in a grass nest inside a burrow or in a tuft of weeds. In three weeks they are out on their own and are full grown by three months.

An adult mouse is 13-17 centimeters (5½-7 inches) long and weighs 28-70 grams (1-2½ ounces). The male mouse digs a burrow with side tunnels leading to toilets and escape routes. Some tunnels have been measured at 150 meters (350 feet) long. The females seldom venture further than 10 meters (20-30 feet) from their birthplace. The mouse, like a squirrel, stores berries, bulbs, roots, and seed along its tunnels for the winter.

Program Model

The ODELL WOODS program allows the user to role play one of the following animals:

MOUSE
RABBIT
FOX
WOLF

BACKGROUND INFORMATION (Continued)...

Each animal will randomly encounter ten situations. The students can make one of four decisions for their animal when they encounter a situation:

1. Run
2. Ignore it
3. Eat it
4. Chase it

The program also keeps track of the animals injuries and the energy it spends and acquires through food. If the animal's energy level gets too low, it will die of starvation. If its injury level is high and it encounters an enemy, its chances of being caught are higher, even though students have selected a correct move. In order to make the simulation more realistic, the model is designed so that even if the animal makes the right decision, the outcome is not always what the animal would like. For example, if the wolf attacked the fox, there is a 20% chance that the fox may escape the wolf's attack. Following are charts of the situations each animal will encounter and the consequence of the different actions.

BACKGROUND INFORMATION (Continued)...

MODEL FOR RED FOX

SITUATION ENCOUNTERED	ACTION	RESULT
Rabbit	Run	Energy will be lost.
	Ignore	Energy will be lost.
	Attack	Energy will be gained; fox will kill the rabbit; thus energy will be gained and injuries will heal.
	Chase	Energy will be lost.
Wolf	Run	85% of the time the fox will not be caught. 10% of the time, it will be injured. 5% of the time the fox will be killed. This will increase with injury.
	Ignore	100% of the time, the fox will be killed.
	Attack	100% of the time, the fox will be killed.
	Chase	100% of the time, the fox will be killed.
Mouse Gopher	Run	Energy will be lost
	Ignore	Energy will be lost
	Attack	95% of the time, the fox will catch the mouse and energy will be gained; injuries will be healed. 5% of the time, it will miss it. 80% of the time the fox will catch the gopher and 20% it will miss.
	Chase	Energy will be lost.
Tree Deer Owl	Run	Energy will be lost.
	Ignore	Good response.
	Attack	Fox is injured attacking the tree or owl — energy is lost attacking the deer.
	Chase	Energy is lost.
Man	Run	70% of the time, man will miss the fox. 15% of the time, the fox will be injured and 15% of the time the man will shoot the fox. This percentage will increase with injury.
	Ignore	100% of the time, the fox will be caught.
	Attack	100% of the time, the fox will be caught.
	Chase	100% of the time, the fox will be caught.
Bear	Run	90% of the time, the fox will escape. The fox will be injured and caught 5% of the time. Injury increases the chance of being caught.
	Ignore	97% of the time, the fox will be killed. This will increase with injury.
	Attack	The fox will be killed.
	Chase	The fox will be killed.
Berries	Run	Energy will be lost.
	Ignore	Small amount of energy lost.
	Attack	Energy will be gained, injuries will be healed.
	Chase	Energy will be lost.

BACKGROUND INFORMATION (Continued)...

MODEL FOR RABBIT

SITUATION ENCOUNTERED	ACTION	RESULT
Fox Wolf	Run	The rabbit has a 80% chance of being successful when it runs. 10% of the time it will be hurt and 10% of the time, even if the rabbit made the right decision it will be caught. If the rabbit is injured the percentage of time that it will be hurt or caught increases with the severity of the injury.
	Ignore	90% of the time the rabbit will be caught and 10% of the time the wolf or fox will not see it.
	Attack Chase	100% of the time the rabbit will be killed. 100% of the time the rabbit will be killed.
Clover Tree Grass	Run	Energy will be lost running from these objects.
	Ignore	A small amount of energy lost because it passed a chance to eat.
	Attack	Energy will be gained from eating and injuries will be healed through the gain of strength and energy.
	Chase	Energy will be lost.
Owl	Run	The rabbit has a 80% chance to successfully run from the owl. 10% of the time it will be hurt and 10% of the time it will be caught. If the rabbit is injured, the percentage of time it will caught or hurt increases.
	Ignore	60% of the time it will be caught if it ignores the owl and 40% of the time the owl will not see it or will not attack.
	Attack Chase	100% of the time it will be killed. 100% of the time it will be killed.
Dog	Run	75% of the time it will be safe, 15% of the time it will be hurt and 10% of the time caught. The percentage of time it is hurt or caught increases with injuries.
	Ignore	50% of the time it will be caught and 50% of the time safe.
	Attack Chase	100% of the time the rabbit will be killed. 100% of the time the rabbit will be killed.
Deer Mouse	Run	Energy will be lost.
	Ignore	Good response - no energy will be lost.
	Attack Chase	Energy will be lost. Energy will be lost.
Raccoon	Run	The rabbit will escape 100% of the time but lose energy in the run.
	Ignore	80% of the time the rabbit will be killed and 20% of the time it will get away.
	Attack Chase	100% of the time the rabbit will get killed. 100% of the time the rabbit will get killed.

BACKGROUND INFORMATION (Continued)...

MODEL FOR MOUSE

SITUATION ENCOUNTERED	ACTION	RESULT
Fox Wolf	Run	80% of the time the mouse will be successful. 10% of the time it will be caught and 10% injured. These percentages will increase with injury.
	Ignore	90% of the time the mouse will be caught and 10% of the time the wolf or fox will not see it.
	Attack	100% of the time the mouse will be killed.
	Chase	100% of the time the mouse will be killed.
Rabbit Deer Dog	Run	Energy will be lost.
	Ignore	Good response.
	Attack	Energy will be lost.
	Chase	Energy will be lost.
Owl	Run	80% of the time the mouse can successfully run from the owl. 10% of the time it will be hurt and 10% of the time it will be caught. If the mouse is injured, the percentage of time it will be caught or hurt increases.
	Ignore	60% of the time it will be caught if it ignores the owl and 40% of the time the owl will not see it or not attack.
	Attack	100% of the time it will be killed.
	Chase	100% of the time it will be killed.
Snake	Run	80% of the time the mouse will be successful. 20% of the time it will be caught; this increases with injury.
	Ignore	100% of the time it will be caught.
	Attack	100% of the time it will be caught.
	Chase	100% of the time it will be caught.
Roots Grass	Run	Energy will be lost.
	Ignore	Energy will be lost.
	Attack	Good response — energy will be gained and injuries will heal through acquired strength.
	Chase	Energy will be lost.
Hawk	Run	70% of the time, the mouse will be successful. 25% of the time, the mouse will be injured. 5% of the time, the mouse will be caught; this percentage increases when the mouse is injured.
	Ignore	75% of the time the mouse will be caught. 25% of the time the hawk does not see him.
	Attack	100% of the time the mouse is caught.
	Chase	100% of the time the mouse is caught.

BACKGROUND INFORMATION (Continued)...

MODEL FOR WOLF

SITUATION ENCOUNTERED	ACTION	RESULT
Rabbit Gopher Mouse Owl Deer	Run	Energy will be lost.
	Ignore	Energy will be lost.
	Attack	The wolf will catch the rabbit and gain energy. The gopher will be caught 80% of the time, the mouse 95% of the time; the owl and deer will be caught 50% of the time; the fox will be caught 70% of the time.
	Chase	Energy will be lost.
Tree	Run	Energy will be lost.
	Ignore	Good response.
	Attack	The wolf will be injured.
	Chase	Energy will be lost.
Man	Run	75% of the time, man will miss. 15% of the time, the wolf will be injured and 15% of the time it will be killed. This percentage increases when injured.
	Ignore	100% of the time, the wolf will be killed.
	Attack	100% of the time, the wolf will be killed.
	Chase	100% of the time, the wolf will be killed.
Grass	Run	Energy will be lost.
	Ignore	Good response.
	Attack	Slight energy gained.
	Chase	Energy will be lost.

USE IN AN INSTRUCTIONAL SETTING...

Preparation

Students would benefit from understanding the ecological concepts of:

Food chains
Food webs
Niches
Predator/Prey
Competition
Food Pyramid

These concepts could be developed using any of several classroom and outside activities. Suggestions include:

(1) Have up to 12 students from the class form a yarn-connected food web. Assign one student to be the sun (primary source of energy). Have four students be plants - e.g. grass, cattail, aspen etc. Assign four students the roles of plant eating animals - e.g. field mouse, deer, fruit feeding bird, etc. Have three students be meat eating animals - e.g. shrew, fox, owl, snake. Actual nametags would help students identifv the relationships between organisms. Have students connect themselves using yarn to all the other organisms they eat. In the case of plants, their source of energy is the sun.

(2) The class could choose an animal and discuss its relationship to three other animals. The first relationships students will think of are food/predator relationships. Encourage them to also think of competitive relationships both within and between species.

(3) Students could do library research and draw small food webs and chains for a variety of animals of their choosing.

(4) Some students may have observed animals in a natural environment and can write or tell about their observations.

USE IN AN INSTRUCTIONAL SETTING (Continued)...

(5) Food chain and food web mobiles can be fun to make and interesting to display from the classroom ceiling. Magazines can be used to provide pictures. Cardboard, glue, string, and coat hangers are other handy materials. The connections between orgainisms are illustrated by the strings on the mobile. How many mobiles begin with a representation of the sun?

(6) Discuss the problem of anthropomorphism (assigning human traits to animals). How does anthropomorphism affect our attitude about other organisms in our food chain, especially predators?

You may want to cover a few vocabulary terms before beginning: simulation, territory, food chain, organism, etc.

Discuss the food pyramid and how nature regulates the number of each different species. Put three headings on the board; herbivores, carnivores, and omnivores. Have students name animals that will fit under each category. If unsure where an animal fits, students can research and report on those animals.

Using the Program

Divide class into groups with each group running the simulation two or three times. While running the program, the students should fill in handout #6 - Predator/Prey.

One person from each group can show the food chain to the class and explain what happened within the small group as the program was run.

Use handouts #9 - 12 and discuss each of the key animals in the simulation. Transparencies of these handouts might be made for the discussion. Use the information in Background to explain more about each one. The transparencies ask who eats who. In the case of the predators, man kills but does not eat. Point this out and emphasis that man affects the ecology but isn't a part of the food chain.

Have students fill out handout #7 - Food Chain when you feel they have a good understanding of the Odell Woods food chain.

USE IN AN INSTRUCTIONAL SETTING (Continued)...

Follow-up

The topic of natural selection and the part it plays in evolution is an appropriate topic to follow Odell Woods. Discuss with the students what happens to animals which make the wrong choice of actions in response to an encounter. How do the offspring of "wrong choice" animals compare with "right choice" animals in terms of numbers? How might they compare in the way they react to encounters in their environment?

Complete the questions on handout #8 - Follow-up Questions. Discuss the answers as a class. Set up ODELL WOODS as a class demonstration in case you want to rerun the simulation to illustrate answers to some questions.

If you live in northern areas, take a walk after a fresh snow fall looking for the prints of the animals in the simulation and any others you might find - e.g. dog, cat, squirrel. How do these animals fit into the food web of the area?

Other classroom projects could include:

Have students write a report on their discoveries.

Make a bulletin board to feature pictures and characteristics of each animal.

Make a bulletin board with the paw prints of each animal for students to identify.

Have students research some of the other animals introduced in the simulation such as the hawk, owl, deer, bear, etc.

Discuss the effect of man, the hunter, on nature and its creatures.

Discuss the timber wolf situation in northern United States. Where was their historical territory? ... present day territory? what are common attitudes held by people toward the timber wolf? What is an accurate analysis of the controversy surrounding this animal?

Visit a natural science museum. Study the animals and foodwebs found in your area.

Use analogies to promote creative thinking. For example, how is Odell Woods like a school? Like a medieval kingdom (king-knights-peasants etc)?

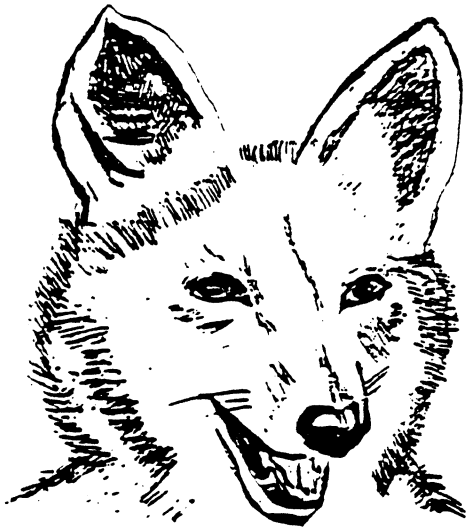
Ask open-ended questions to stimulate original, imaginative thinking. For example, what might happen if a forest fire destroyed the woods? ... a public campground was set up in the woods? etc.

6

PREDATOR/PREY

Name _____ Class _____ Date _____

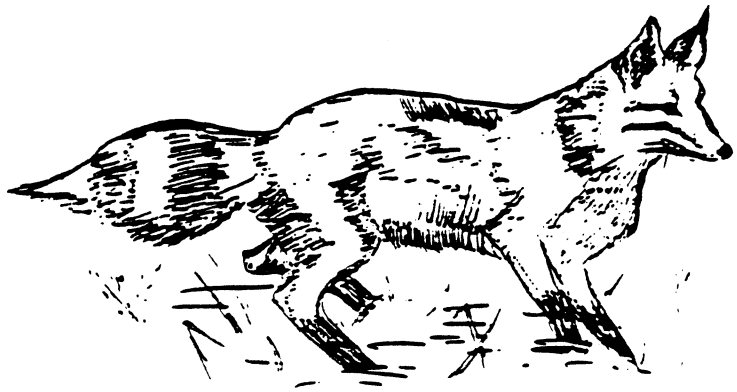
TIMBER WOLF



EATS:

EATEN BY:

RED FOX



EATS:

EATEN BY:

6

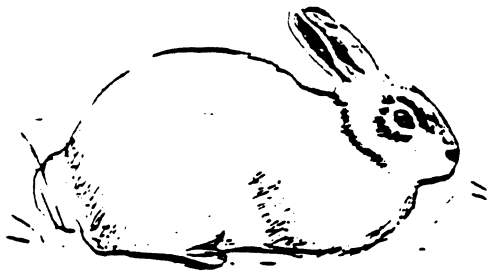
PREDATOR/PREY (Page 2)

Name _____ Class _____ Date _____

EATS:

EATEN BY:

SNOWSHOE RABBIT



FIELD MOUSE

EATS:

EATEN BY:

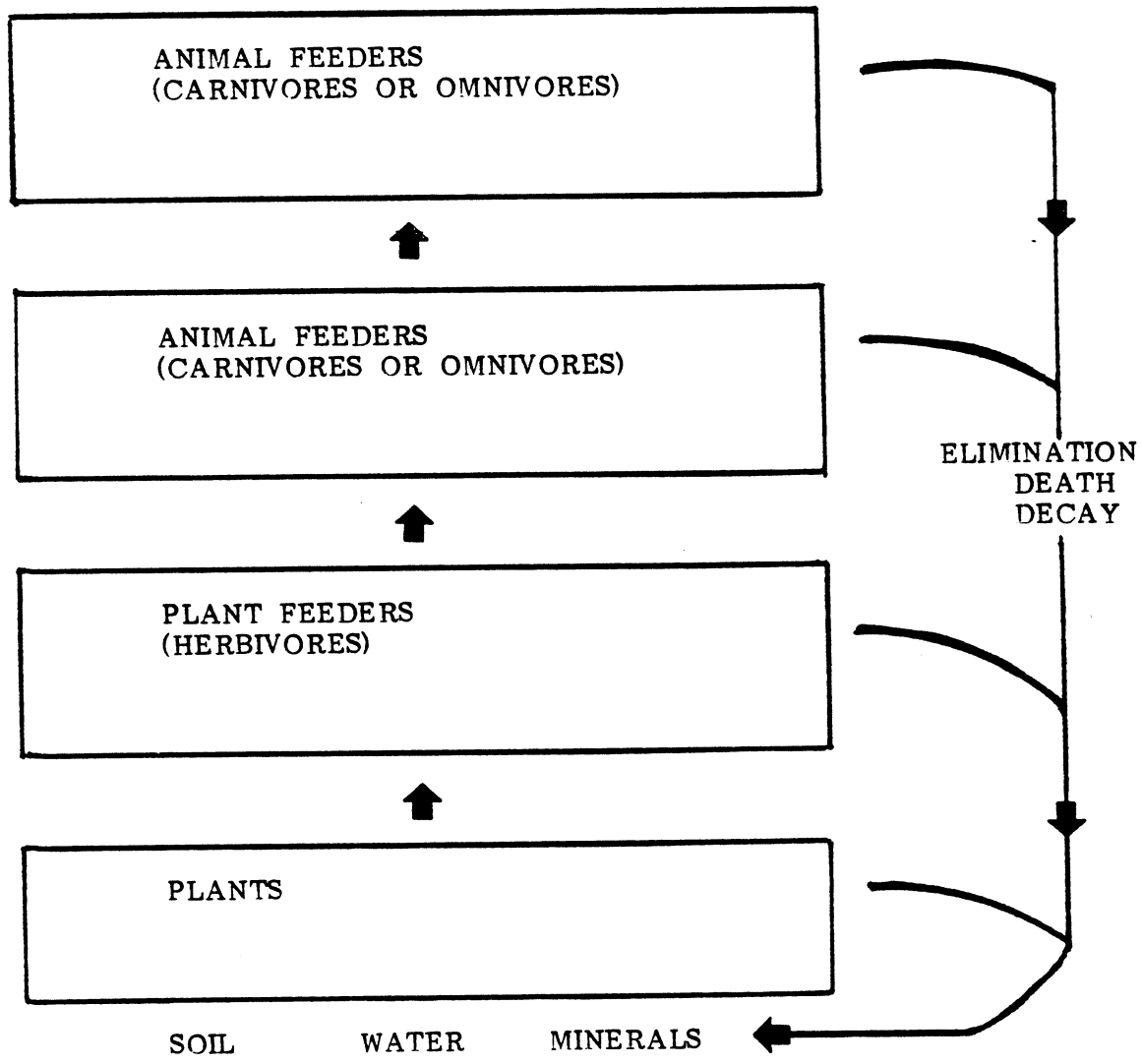
7

FOOD CHAIN

Name _____ Class _____ Date _____

Place the animals below in the correct boxes:

FOX RABBIT MOUSE WOLF



Also try to place these names in the correct boxes.

GRASS BULB TREE BARK CLOVER OWL

DEER RACCOON

7

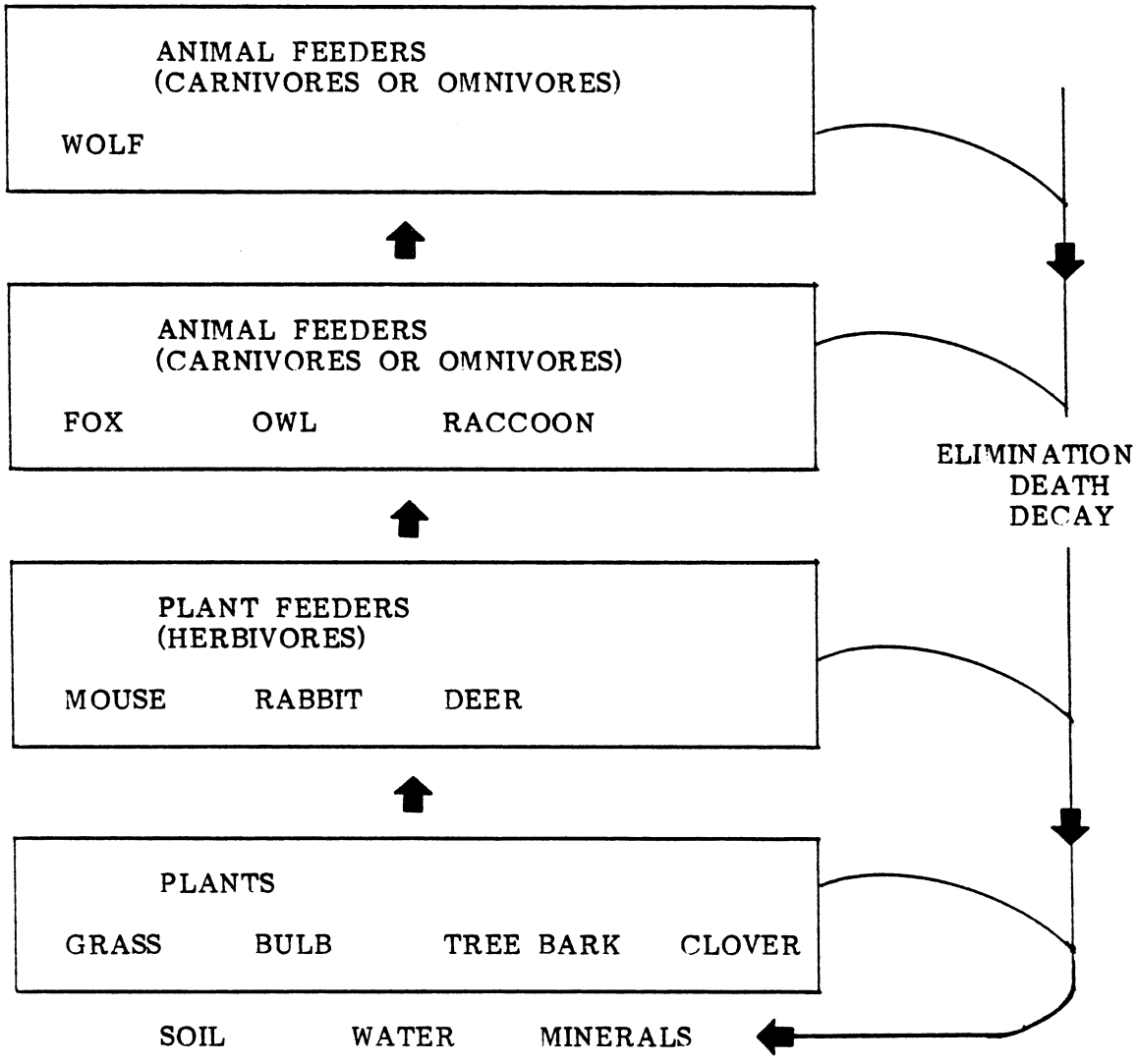
FOOD CHAIN

ANSWER KEY

Name _____ Class _____ Date _____

Place the animals below in the correct boxes:

FOX RABBIT MOUSE WOLF



Also try to place these names in the correct boxes.

GRASS BULB TREE BARK CLOVER OWL

DEER RACCOON

MECC

8

FOLLOW-UP QUESTIONS

Name _____ Class _____ Date _____

Think about the animal you role played in ODELL WOODS as vou answer these questions.

1. When would you ignore another animal?_____

_____

2. Name two items each of the following animals would eat.

Red Fox: _____ _____ Timber Wolf: _____ _____

Mouse: _____ _____ Rabbit: _____ _____

3. Name two herbivores. _____

_____

4. Name two carnivores or omnivores. _____

_____

5. Put the following in order from the greatest number in nature to the least number: wolf, mouse, fox, clover

Greatest Least

1. _____ 2. _____ 3. _____ 4. _____

6. If you were an animal and you met a strange animal, what do you think you would do and why?_____

_____

FOLLOW-UP QUESTIONS (Page 2)

7. In what ways would the paw print of the field mouse look different from that of the red fox?_____

_____

8. Animals must defend their food supply and themselves. Name some ways they do this._____

_____

9. What pets are carnivores?_____

_____

10. What happens to an animal that has too few enemies?_____

_____

WOLF

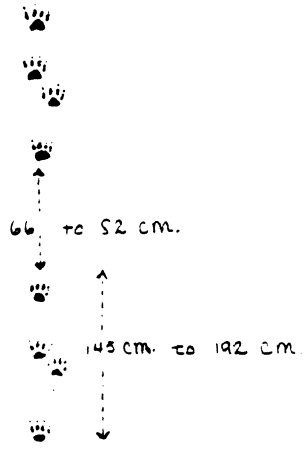
Timber Wolf

Front Foot

9.15 cm.

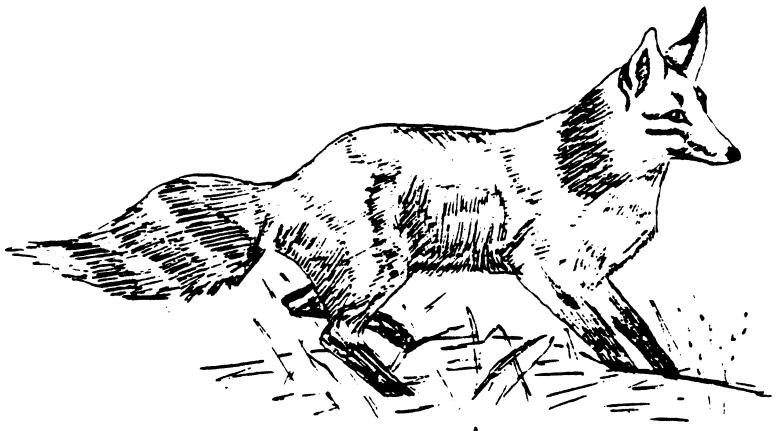
Hind foot

9.60 cm.



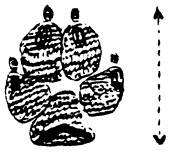
10

FOX

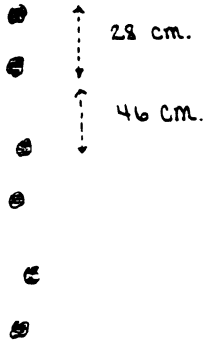


Red Fox

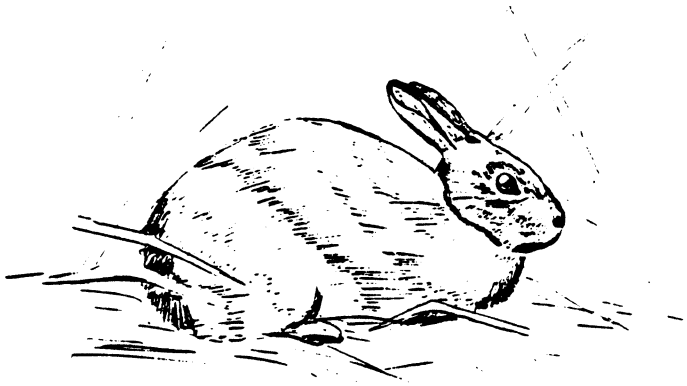
Front Foot



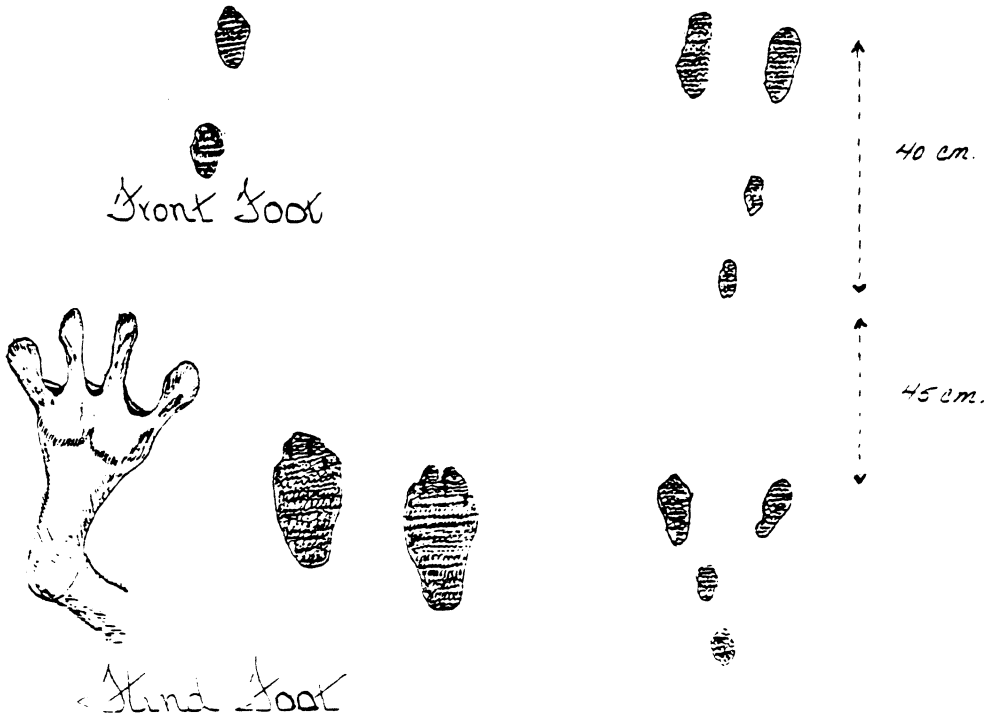
Hind Foot



RABBIT



Snowshoe Rabbit



MOUSE

Field Mouse

Front Foot

Hind Foot

SAMPLE RUNS

```
The animals you can become are:
        1. RABBIT
        2. MOUSE
        3. FOX or
        4. WOLF


Which animal would you like
  to be? 2
```

Students choose which animal they would like to role play.

EXAMPLES OF SCREEN OUTPUT

```
As a mouse your options are:
  1. Run          3. Eat it
  2. Ignore it    4. Chase it
-----------------------------------
There is a grassy field ahead of you.


What would you like to do?
```

Role playing their chosen animal, students encounter other organisms in their surroundings.

They must choose to:

1) Run
2) Ignore it
3) Eat it
4) Chase it

SAMPLE RUNS

```
As a wolf your options are:
  1. Run          3. Eat it
  2. Ignore it    4. Chase it
-------------------------------------
He got you.

Press RETURN to continue.
```

If the students makes incorrect decisions the animal they are role playing may die. In this example the sound of gunshots can be heard.

EXAMPLES OF SCREEN OUTPUT

```
                CONGRATULATIONS!

You made it through Odell Woods alive.

I hope you had fun.

                Come back again!

Press RETURN to continue.
```

If ten situations are survived, the animal will make it through the woods.

APPENDICES

GETTING TO KNOW YOUR ATARI COMPUTER

Equipment

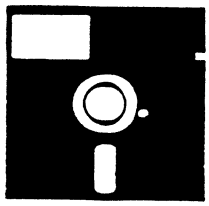
ATARI COMPUTER CONSOLE: The computer and keyboard.

BASIC LANGUAGE CARTRIDGE: A cartridge (containing the BASIC computer language) that is inserted into the console above the keyboard.

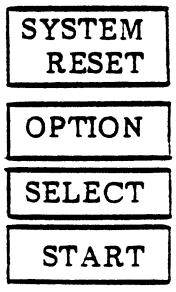
TELEVISION: A television set used to display information.

DISK DRIVE: A unit that holds and reads the diskette.

DISKETTE: A 5¼ inch "record" that contains a series of computer programs.



ATARI Computer Keyboard

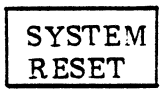


The ATARI Computer keyboard looks much like the keyboard of a typewriter. Some special keys are noted below:

RETURN Key—When you are finished typing either a response to a question or a line in a program, you send the information to the computer by pressing the **RETURN** key.

BACK S (Backspace) Key—Each time you press the **BACK S** key, the cursor backs up one space and erases each letter it passes over. This feature allows you to correct typographical errors easily.

BREAK Key—Press this key to stop the execution of a program. The program will remain in the computer memory and may be run again. If **BREAK** doesn't work to stop the program, try the **RESET** key.



RESET Key—Like the **BREAK** key, the **RESET** key stops program execution. It also clears the screen. To restart, type RUN"D:HELLO".

ESC (Escape) Key—While you are using MECC diskettes, press the **ESCAPE** key in response to a question to stop program execution. The computer will ask whether you wish to run the program again. If you do not, the computer will display the diskette menu, and you may choose another program.

SHIFT Key—Use the computer SHIFT key like that of a typewriter. If a key displays two characters, you may hold down the **SHIFT** key while typing to print the upper character. For example, holding down the **SHIFT** key and typing  will print !.

CAPS/LOWR (Capitals/Lower case) Key—When you press this key, the computer begins typing in lower-case letters. To capitalize individual letters, you must hold down the **SHIFT** key as with a typewriter. To switch back to all capitals, hold down the **SHIFT** key, and press the **CAPS/LOWR** key again.

CTRL (Control) Key—Hold down the **CONTROL** key while pressing another key if indicated by the computer instructions.

Keys That Can Cause Confusion

0 (Zero)—The zero is on the top row of keys. Do not use the letter O interchangeably with this number key.

1 (One)—The number one is on the top row of keys. Do not use it interchangeably with a lower-case L (l).

USING A MECC DISKETTE

Using the Computer

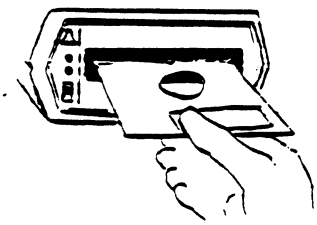
1. Make certain that the ATARI Computer, BASIC language cartridge, disk drive and television are plugged in and connected to each other properly. (See the ATARI Computer New User's Guide by MECC for detailed instructions.)

2. Turn on the television.

3. Turn on the disk drive. The PWR ON and BUSY lights will come on. After about 10 seconds the BUSY light will go off, and the whirling sound will stop.

   Turn on the disk drive before you turn on the computer.

4. Press the rectangular release button below the disk drive to open the door. Insert a diskette into the disk drive, exposed oval part first, with the diskette label up. Diskettes are sensitive to dust, heat, cold and magnetic fields, so handle them with care. (See the User's Guide for information on diskette care.)



5. Close the door on the disk drive.

6. Turn on the ATARI Computer. The power switch is located on the right side near the power cord. The disk BUSY light will turn on, and you will hear a whirling sound from the disk drive.

   If the disk BUSY light does not go off in about 10 seconds, turn the computer off, and make sure that the diskette is placed correctly in the disk drive. Then turn the computer on.

   If no display appears on your television screen at this point, and the television is set at channel 2 or 3, the computer may be set for the wrong channel. The channel select switch is on the back of the ATARI 400 Computer. Switch it to the opposite position.

7. A MECC logo will appear on the screen with the diskette name. Then a "menu" will appear. The menu gives a list of programs on the diskette. To run a program, type the number shown in front of the program name, then press the **RETURN** key. To access any available teacher options on the diskette, hold down the CTRL key and type A.

8. Follow the directions given in the program. Remember to press the **RETURN** key after each answer.

9. To return to the menu while running a program, press the **ESC** (Escape) key in response to any question.

   The screen will then ask whether the current program is to be run again or not. If not, the menu is automatically displayed.

10. To use a different diskette, select the END option from the menu, and follow the directions on the screen.

Turning Off The Computer

1. Take the diskette out of the disk drive, and store it in its protective envelope.

2. Turn off the ATARI Computer, the disk drive and the television.

DEFINITIONS OF TERMS

BACKGROUND INFORMATION—The information that explains or enriches program content or provides technical information on the program.

COURSEWARE—A collection of computer programs together with accompanying support materials.

DOCUMENTATION—The written material for the teacher to use with the computer program (also called a support booklet or support materials).

DRILL AND PRACTICE—A computer program that provides repetitive practice on a skill or a set of facts.

EDUCATIONAL GAME—A computer program that presents an instructional purpose in a game format.

GRADE LEVEL—The range of grades for which the program was designed.

HANDOUTS—The pages of the support booklet that may be duplicated for student or teacher use.

MODULE—The package containing the computer program(s) and the support booklet.

OBJECTIVES—The results to be achieved by using the program and support materials.

PROBLEM SOLVING—A computer program that processes data for a problem defined by the student.

PROGRAM—The routines and operations that instruct the computer.

READING LEVEL—The readability of the text that appears on the computer screen.

SAMPLE RUNS—The pages of the support booklet that show examples of computer screen output and accompanying explanations to outline the program flow.

SELO—Some Essential Learner Outcomes prepared by the Minnesota State Department of Education. When applicable these are included with the objectives in MECC support booklets.

SIMULATION—A computer program that approximates a real-world environment for examination.

SUPPORT BOOKLET—The written material (also called documentation) that provides the information a teacher may need to use the program in a classroom.

TEACHER AID—A computer program designed to assist a teacher with classroom management tasks.

TUTORIAL—A computer program that provides new information to teach a concept and may include drill and practice.

CREDITS

ELEMENTARY BIOLOGY PROGRAMS

The ATARI Computer programs contained in the Elementary Biology module had their origin in MECC programs for the Apple II microcomputer and the MECC Timeshare System. Some authors and programmers involved in the historical development of these programs are noted below.

ODELL LAKE

ODELL LAKE was created for Timeshare by Ken Witte of Tracy Minnesota Schools. The program was redesigned for the Apple II by Mike Fish, and Curt Smith. Mike Fish converted ODELL LAKE to the ATARI Computer.

ODELL WOODS

Marge Kosel and Mike Fish of MECC developed the ODELL WOODS simulation for the MECC Timeshare System and the Apple II microcomputer. Darrell Ricke converted Odell Woods to the ATARI Computer.

CIRCULATION

This program was written under the name FISH for the Apple II microcomputer by Ken Brumbaugh and Rick Crist of MECC. Conversion to the ATARI Computer was completed by Greg Ricke.

ELEMENTARY BIOLOGY SUPPORT MATERIAL

The content of this support booklet is in large part a revision of materials written and designed for the Apple versions of these programs by Shirley Keran, MECC. The Apple support booklet, in turn, included much material from the book, Elementary...My Dear Computer developed by Marge Kosel and Geraldine Carlstrom for timeshare computing. Teachers from throughout the state of Minnesota contributed ideas to that effort.

The ATARI Elementary Biology module was prepared by Karen Jostad and is a conversion and revision of the materials described above. Conversion of the programs was completed by Mike Fish, Bret Indrelee, Darrell Ricke, and Greg Ricke, MECC.

ELEMENTARY BIOLOGY

TECHNICAL INFORMATION

Circulation

Main Program:	FISH		
Chains to:	FISH1		
	FISH2		

Odell Lake

Main Program:	ODELL		
Chains to:	ODELLP1		
	ODELLP2		
Overlays:	ODELLP1.TXT		
	ODELLP2.TXT		
Binary Files:	FFS.BIN	Address:	15229
		Length:	102
	ODELL.FNT	Address:	15360
		Length:	1024

Odell Woods

Main Program:	ODELL2
Chains to:	ODELLF
	ODELLM
	ODELLR
	ODELLW

MECC INSTRUCTIONAL SERVICES ACTIVITIES

PURPOSE: The primary purpose of the Minnesota Educational Computing Consortium (MECC) is to assist users and educational member systems in coordinating and using computing resources through cooperative planning and decision making. MECC also provides current computing methods and materials.

SERVICES: All MECC activities in instructional computing are the responsibility of the Director of Instructional Services (Telephone: **612/376-1105**). Direct any questions related to MECC policy, procedures, or regulations to this office. The MECC Instructional Services Division is organized as follows:

Instructional Systems Development—This group is responsible for the production, coordination, and refinement of MECC instructional computing courseware products, computer programs, and their related user support material. Direct any questions on operations within this area to the Manager, Instructional Systems Development (Telephone: **612/376-1103**).

Technical Services—This group is responsible for operation and operating systems maintenance of the MECC Timeshare System (MTS), a 400+ port, all-purpose, multiple language computer, which serves all Minnesota public higher education institutions and 300 school districts. Technical Services also establishes and maintains the MTS telecommunications network. Direct any questions on operations within this area to the Manager, Technical Services (Telephone: **612/376-1141**).

User Services—This group is responsible for timeshare and microcomputer user communications and training and the distribution of computing equipment and MECC courseware products. A staff of instructional computing coordinators is located throughout Minnesota to promote and facilitate computer usage. Direct all questions on operations in this area to the Manager, User Services (Telephone: **612/376-1101**).

GENERAL INFORMATION: MECC provides the above information to assist individuals who wish to contact the MECC office with specific questions. Direct all written requests for information to the appropriate office at MECC, 2520 Broadway Drive, St. Paul, MN 55113. The following two items address many routine questions:

MECC Publications and Programs Price List
MECC distributes this free list upon request and suggests that you obtain it quarterly. Contact the MECC Publications Office (Telephone: **612/376-1118**).

MECC USERS Newsletter
MECC distributes this free newsletter regularly during the school year to individuals on the mailing list. Contact the User Services Office (Telephone: **612/376-1117**).

All requests for visits to MECC must be scheduled in advance by calling **612/376-1130.**

Limited Warranty on Media and Hardware Accessories. Atari, Inc. ("Atari") warrants to the original consumer purchaser that the media on which APX Computer Programs are recorded and any hardware accessories sold by APX shall be free from defects in material or workmanship for a period of thirty (30) days from the date of purchase. If you discover such a defect within the 30-day period, call APX for a return authorization number, and then return the product to APX along with proof of purchase date. We will repair or replace the product at our option. If you ship an APX product for in-warranty service, we suggest you package it securely with the problem indicated in writing and insure it for value, as Atari assumes no liability for loss or damage incurred during shipment.

This warranty shall not apply if the APX product has been damaged by accident, unreasonable use, use with any non-ATARI products, unauthorized service, or by other causes unrelated to defective materials or workmanship.

Any applicable implied warranties, including warranties of merchantability and fitness for a particular purpose, are also limited to thirty (30) days from the date of purchase. Consequential or incidental damages resulting from a breach of any applicable express or implied warranties are hereby excluded.

The provisions of the foregoing warranty are valid in the U.S. only. This warranty gives you specific legal rights and you may also have other rights which vary from state to state. Some states do not allow limitations on how long an implied warranty lasts, and/or do not allow the exclusion of incidental or consequential damages, so the above limitations and exclusions may not apply to you.

Disclaimer of Warranty on APX Computer Programs. Most APX Computer Programs have been written by people not employed by Atari. The programs we select for APX offer something of value that we want to make available to ATARI Home Computer owners. In order to economically offer these programs to the widest number of people, APX Computer Programs are not rigorously tested by Atari and are sold on an "as is" basis without warranty of any kind. Any statements concerning the capabilities or utility of APX Computer Programs are not to be construed as express or implied warranties.

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For the complete list of current APX programs, ask your ATARI retailer for the APX Product Catalog

EVALUATION SHEET

MECC encourages your comments on this manual and the accompanying diskette. User suggestions will be considered carefully and incorporated in future documentaton whenever practical.

COMMENTS ON COMPUTER PROGRAM

Diskette Name _____
Volume No. _____ Version _____
Program Name _____

COMMENTS ON MANUAL

Title of Manual _____
Program Name _____
Page No. _____

From: Name _____
Institution _____
Address _____
_____
ZIP _____

Please detach and mail to MECC.

STAPLE STAPLE

FOLD FOLD

First Class
Postage
Necessary

Minnesota Educational Computing Consortium
Manager, Instructional Systems Development
2520 Broadway Drive
St. Paul, MN 55113

FOLD FOLD

APX ATARI® PROGRAM EXCHANGE
P.O. Box 3705
Santa Clara, CA 95055

Review Form

We're interested in your experiences with APX programs and documentation, both favorable and unfavorable. Many of our authors are eager to improve their programs if they know what you want. And, of course, we want to know about any bugs that slipped by us, so that the author can fix them. We also want to know whether our instructions are meeting your needs. You are our best source for suggesting improvements! Please help us by taking a moment to fill in this review sheet. Fold the sheet in thirds and seal it so that the address on the bottom of the back becomes the envelope front. Thank you for helping us!

1. Name and APX number of program.

2. If you have problems using the program, please describe them here.

3. What do you especially like about this program?

4. What do you think the program's weaknesses are?

5. How can the catalog description be more accurate or comprehensive?

6. On a scale of 1 to 10, 1 being "poor" and 10 being "excellent", please rate the following aspects of this program:

_____ Easy to use
_____ User-oriented (e.g., menus, prompts, clear language)
_____ Enjoyable
_____ Self-instructive
_____ Useful (non-game programs)
_____ Imaginative graphics and sound

7. Describe any technical errors you found in the user instructions (please give page numbers).

8. What did you especially like about the user instructions?

9. What revisions or additions would improve these instructions?

10. On a scale of 1 to 10, 1 representing "poor" and 10 representing "excellent", how would you rate the user instructions and why?

11. Other comments about the program or user instructions:

From

STAMP

ATARI Program Exchange
P.O. Box 3705
Santa Clara, CA 95055

[seal here]