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odell lake

instructional computing courseware
for the **apple**® II computer

How to use your MECC folder cover inserts
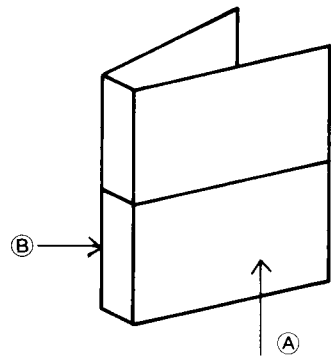
Tear cover on perforated lines. Place half-page title section in the clear vinyl pocket Ⓐ on the front of the binder. Insert finger-sized title in the clear plastic pocket on the spine Ⓑ.

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instructional computing courseware
for the **apple**® II computer

This manual is designed to be used

with

the *Odell Lake* diskette

Version 1.0

Table of Contents

The Product at a Glance

Title:	*Odell Lake*
Grade:	4-6
Subject area:	Life science
Topic:	Food chains; predator/prey relationships
Program type:	Simulation game
Hardware:	Apple II series computer with 64K RAM; color monitor recommended
Classroom use:	Individual students or small groups

Learning objectives:

- to determine the predator/prey relationships among a group of twelve organisms in a specific biological community (Odell Lake, Oregon)

- to create a diagram of the food web of the community based on the list of the predator/prey relationships

- to fit these specific relationships into a general conceptual framework of the relationships among living things and to apply the standard terms to these concepts

- to apply these general concepts to a variety of specific biological communities with which the students are familiar

A Quick Look at *Odell Lake*

Get information

```
┌─────────────────────────────┐
│         Odell Lake          │
│        Information          │
└─────────────────────────────┘
```

Choosing **Get information** from the main menu takes you to the Information Menu, shown here. This menu allows you to choose the information you will see.

```
Choose the information you want:

   1. How to Play Odell Lake

   2. High Score List

   3. The Fish of Odell Lake

   4. Teacher Information
```

```
┌─────────────────────────────┐
│ Use arrows, then press Return│
│ Escape: Main Menu           │
└─────────────────────────────┘
```

```
┌─────────────────────────────┐
│    How to Play "Odell Lake" │
│         Special Keys        │
└─────────────────────────────┘
```

For example, choosing **How to play *Odell Lake*** takes you to a series of screens describing the game. One of these screens, shown here, explains the use of special keys.

```
Two special keys may be useful during
the game:

   Escape Key  - to quit in the middle
                 of a game

   Control S   - to turn sound on or off


("Control S" means to press the S key
while holding down the Control Key.)
```

```
┌─────────────────────────────┐
│ Press Space Bar to continue │
│ Escape: Information Menu     │
└─────────────────────────────┘
```

Go exploring

```
╔══════════════════════════════════╗
║          Odell Lake              ║
║          Go Exploring            ║
╚══════════════════════════════════╝
```

Choose the fish you will play:

1. **Blueback Salmon**
2. **Chub**
3. **Dolly Varden**
4. **Mackinaw Trout**
5. **Rainbow Trout**
6. **Whitefish**

Choosing **Go exploring** from the main menu eventually takes you to this menu, where you choose the fish you want to role-play. If you wish, you can get some help by pressing the ? Key.

```
╔══════════════════════════════════╗
║ Use arrows, then press Return    ║
║ Escape: Main Menu       ? for help║
╚══════════════════════════════════╝
```

```
╔══════════════════════════════════╗
║         Rainbow Trout            ║
║       (Salmo gairdnerii)         ║
╚══════════════════════════════════╝
```

Weight: **Up to 40 pounds**

Length: **Up to 35 inches**

Habitat: **Shallow water near shore**

Comments: **Also known as Steelhead Trout. Native to Odell Lake, where it is prized as a game fish.**

```
╔══════════════════════════════════╗
║ Press Space Bar to continue      ║
║ Escape: Choose a Fish            ║
╚══════════════════════════════════╝
```

Upon pressing the ? Key, you see a screen describing one species of fish. The fish described depends upon the fish name that was highlighted when you pressed the ? Key.

You are a Rainbow Trout   ? for help

You see a
Mackinaw
Trout ahead.

Eat   **Chase away**   **Ignore**
Shallow escape   **Deep escape**
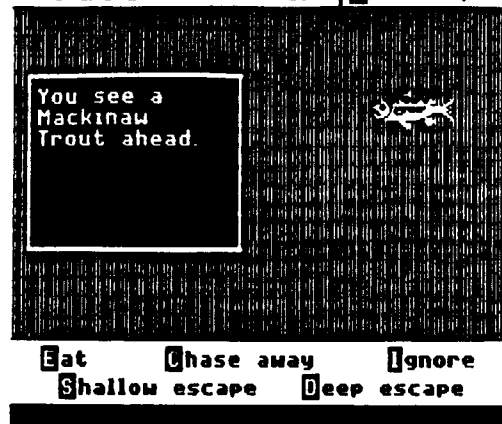
Once the game begins, you experience a series of up to eleven encounters as the fish you have chosen. With each encounter, you select one of five possible responses (listed at the bottom of the screen) by pressing the first letter of that response. You may also choose to get help by pressing the ? Key.

```
You are a Rainbow Trout |
You met a Mackinaw Trout
```

```
You now reside in the
stomach of a large
predator.
```

```
E at      Chase away      Ignore
    Shallow escape    Deep escape
        Press SPACE BAR to continue
```

After you choose the response to take, the result is acted out on-screen. Then a box containing textual feedback is displayed along with a reminder about the organism you encountered.

```
You are a Rainbow Trout |

              Algae
          (Various species)

Length:    From microscopic to filaments
           12 inches long or more

Examples:  Spirogyra; Cladophora

Comments:  Algae are a group of green
           plants that live in the water.
           The filamentous types can form
           thick masses.
```

```
E at         Chase away        Ignore
    Shallow escape    Deep escape
        Press SPACE BAR to continue
```

If you request help (by pressing the ? Key), a pair of screens is displayed that describe the two organisms in the encounter. Pressing the Space Bar resumes the game.

```
              Odell Lake
              Go Exploring
```
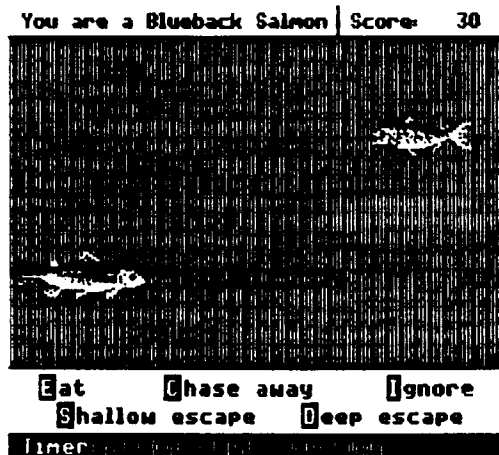
```
Would you like to go exploring in Odell
Lake again?

              Yes    No
```

```
Use arrows, then press Return
Escape: Main Menu
```

The game ends if you are eaten by another animal or if you successfully survive all eleven encounters.

Play for points

```
You are a Blueback Salmon | Score:    30
```



```
  Eat        Chase away       Ignore
    Shallow escape    Deep escape
Timer
```

If you choose **Play for points** from the main menu, you enter a game in which the opposing organism is shown but not identified. You have a limited amount of time to react to each one. If you fail to react before the timing bar runs out, then "Ignore" is automatically selected. (Note: The presence of an osprey is indicated by the lack of a visible opponent.)

```
You are a Blueback Salmon | Score:    50
You met Animal Plankton          +20
```



```
        Yum!  That was delicious.
```

```
  Eat        Chase away       Ignore
    Shallow escape    Deep escape
       Press SPACE BAR to continue
```
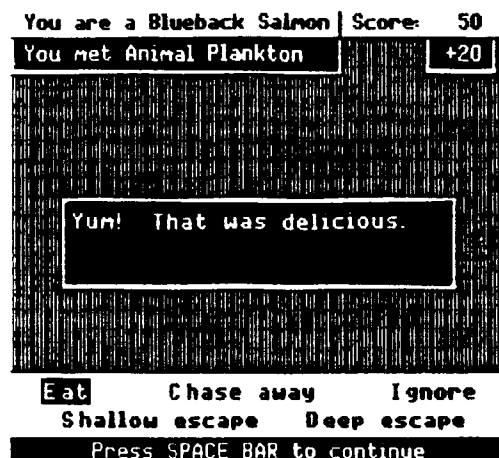
After making your decision, the results are acted out and you are given feedback, just as in **Go exploring.** In addition, you are shown the point value of your response.

```
              Odell Lake
           High Score List

    Name                  Score
 1. Oke Araghba            498
 2. Chau Nguyen            129
 3. Wendy Ho               117
 4. ≨                      114
 5. Karim El Kishky         99
 6. Bjorn Johnson           87
 7. Rosalinda Cortez        47
 8. David Stern             33
 9. Patty McGuire           17
10.

  Type your name and press Return
  Escape: Play for Points
```

The game continues until you are eaten by another animal. If your score qualifies, then you are invited to type your name into the High Score List.

Management options

```
        Odell Lake
     Management Options
```

You may want to remove some or all of
the entries that are currently in the
High Score List.

1. **See the High Score List**

2. Remove individual entries

3. Erase the entire High Score List

```
Use arrows, then press Return
Escape: Main Menu
```

Management options can be
accessed from the main menu by
typing Control-A. (Press A while
holding down the Control Key.)
These options allow teachers to
view and delete all or part of the
High Score List.

```
              Odell Lake
     Remove Entries from High Score List

      Name                      Score
   1. Oke Araghba                498
 > 2. Chau Nguyen                129
   3. Wendy Ho                   117
   4. Karin El Kishky             99
   5. Bjorn Johnson               87
 > 6. Rosalinda Cortez            47
   7. David Stern                 33
 > 8. Patty McGuire               17
```

```
Arrows     : to move cursor
Space Bar  : to mark unwanted entries
Return     : to delete marked entries
Escape     : Management Options
```

To delete individual entries from the
High Score List, you first mark the
unwanted entries with the > sign.
This is done with the Arrow Keys
and the Space Bar.

```
              Odell Lake
     Remove Entries from High Score List

      Name                      Score
   1. Oke Araghba                498
 > 2. Chau Nguyen                129
   3. Wendy Ho                   117
   4. Karin El Kishky             99
   5. Bjorn Johnson               87
 > 6. Rosalinda Cortez            47
   7. David Stern                 33
 > 8. Patty McGuire               17
```

```
You are about to PERMANENTLY delete
the entries marked with ">". Are you
sure you want to do this?
            Yes    No
```

To indicate that you are ready to
delete all of the entries marked by
the > signs, press Return. You are
then asked to verify that you really
want to proceed with the deletion.

Quick Answers to Questions

Q. How can I get out of the section I am in?

A. Press the Escape Key once. (Look for the key labeled "Esc" in the upper left-hand corner of the keyboard.)

Q. How do I turn the sound off?

A. You may press Control-S (press the S Key while holding down the Control Key) at any time to turn the sound off or on. *Odell Lake* will respond by making a special sound that indicates that the sound has been turned on or off.

Q. How do I access the **Management options**?

A. On any MECC product you can access the **Management options** by pressing Control-A when you see the main menu on the screen. (Press the A Key while holding down the Control Key.) In *Odell Lake*, the only **Management options** are to view and erase all or part of the High Score List. (See page 8 for more information.)

Q. Does *Odell Lake* run faster if my Apple has 128K?

A. On a 128K Apple, *Odell Lake* does not need to go to the diskette for additional information as often as on a 64K Apple. Therefore, operation is somewhat smoother and faster if you have the additional RAM.

Q. How do I erase the High Score List?

A. You can erase all or part of the High Score List by accessing the Management Options. (See page 8 for more information.)

Q. Sometimes when I am playing for points, no other organism appears on the screen. Why is this?

A. The lack of a visible opponent means that an osprey is overhead. If the sound is turned on, a distinctive noise at this point provides an additional cue.

Q. If I press the Escape Key to leave **Play for points**, will my score be saved on the High Score List?

A. Yes, unless ten higher scores are already on the list.

Q. What are the differences between **Go exploring** and **Play for points**?

A. The differences are summarized in the table below:

Go exploring	Play for points
You choose the fish to role-play.	The computer chooses the fish you role-play.
You role-play the same fish until the end of the game.	The fish you role-play changes after every five encounters.
The game ends if you survive eleven encounters.	The game does not end until your fish is caught.
You are told the name of the opposing organism, but not shown a picture until later.	You are shown a picture of the opposing organism, but not told the name until later.
You have unlimited time to make your decisions.	You have only until the timing bar expires to make decisions. (Note: This time decreases as the game progresses.)
You can get help by pressing the ? Key.	No help is available.

Use in an Instructional Setting

This section of the *Odell Lake* support manual begins with a discussion of the instructional value of the product. This is followed by a presentation of two alternative teaching strategies (an exploratory approach and a structured approach). Next comes a list of discussion topics, tied to the learning objectives listed on page 11. Finally, the section ends with a list of suggested follow-up activities.

The Instructional Intent of This Product

Odell Lake is normally used in conjunction with a textbook chapter on food chains and predator/prey relationships. It can be used either at the beginning of the unit to introduce the topics or at the end of the unit to apply and reinforce the key concepts.

Much of the value of this product derives from the discussion it inspires. Therefore, *Odell Lake* should be viewed as a learning tool rather than as a vehicle for "delivering instruction." Instructional strategies that encourage discussion will maximize the value of the package. Students will begin the discussion on their own as they interact with one another in an effort to solve the puzzle that *Odell Lake* poses. This interaction can be encouraged by having the students work in pairs. Giving students copies of Worksheets 1 and 2 before they begin also encourages this discussion and promotes an organized approach to solving the puzzle.

The most important learning opportunity actually comes after the students have finished with *Odell Lake*. At this point, there should be a class discussion of their findings and of what the findings mean. (See the section "Discussion Topics" on page 11.) This teacher-moderated discussion is essential to meeting all of the functional objectives of the product.

Please note that the learning goals of this product deal with the general principles of predator/prey relationships and food chains rather than with the specifics of a single system (Odell Lake, Oregon). Thus the role of the class discussion that follows the computer activity should be to help guide the students from the specific details to a generalized view of the concepts. From this point, then, the students should be encouraged to apply the concepts to other ecosystems. The discussion topics in this section have been designed with this progression in mind.

Also notice that such bits of trivia as "What species of fish are found in Odell Lake?" are not among the principal learning objectives of this package, but are merely the specific, concrete details that allow the learners to move from the specific to the general, from the concrete to the abstract.

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An Exploratory Approach

Odell Lake has been designed so that it can be easily used as an exploratory activity, providing the students with a great deal of control over the learning process and accommodating a variety of learning styles. Depending upon your own particular teaching style, the types of students you have, and the circumstances of your classroom, this approach may or may not be appropriate for you. An alternative approach is outlined in the next section, "A Structured Approach."

In our classroom tests, we did not find it necessary to explain or demonstrate the product to students before they used it. *Odell Lake* is designed to be self-explanatory, with a variety of options to try out. Students can apply their own particular problem-solving strategies to the inherent goal of identifying the relationships among the organisms of Odell Lake. Several student worksheets included in this manual can be very helpful to the students in organizing their data. Having the students work in pairs encourages discussion and gives them confidence to proceed without requiring assistance from the teacher.

1. Supply each pair of students with an *Odell Lake* diskette and a copy of Worksheets 1 and 2. Direct their attention to the differences between the two handouts and indicate that it is their choice which handout to fill out first. Provide the pair with access to an Apple computer. (Note: A color monitor is recommended but not required.)

2. Allow the students to choose their own path through the programs on the diskette. Most students will choose to spend some time in the program "Go exploring" and then eventually move to **Play for points.** Generally, about 45 minutes is sufficient for the students to have satisfied their curiosities and to have identified most of the relationships among the organisms.

3. Engage the students in a follow-up discussion. (See the section "Discussion Topics" on page 11.) You may want to have them fill out Worksheet 3 and/or Worksheet 4 as well.

A Structured Approach

1. Divide the students into pairs or have them work alone. Provide each group with an *Odell Lake* disk and each student with a copy of Worksheets 1 and 2. Inform the students that their assignment is (a) to fill out both handouts completely and (b) to study the program **Go exploring.** Tell them that they should take a look at the program **Get information** before they start **Go exploring.** Also indicate that, as soon as both handouts have been completed, they may enter the program **Play for points.**

2. After all of the students have completed the two handouts, discuss their findings with them. (See Discussion Topics 1 and 2, below.) Then pass out Worksheets 3 and 4 and have the students complete them. After they have completed these worksheets, then go over them with the students and cover Discussion Topic 3, below.

3. Have the students draw a reasonable food chain for some North American woodland community (as in Discussion Topic 4a) or for an African plains community (as in Discussion Topic 4b). Discuss their results.

Discussion Topics

The Discussion Topics below are tied to the learning objectives listed in the section "The Product at a Glance."

Objective #1: to determine the predator/prey relationships among a group of twelve organisms in a specific biological community (Odell Lake, Oregon)

Review Worksheet 1. What are the relationships among the twelve organisms and how did you determine them? Which fish prefer to eat other fish? Which fish prefer to eat smaller, non-fish prey? Which fish is the largest? Which fish is the smallest? Does there seem to be a relationship between the size of the fish and what it eats? What strategies did you employ in **Go exploring**? What strategies did you employ in **Play for points**?

Objective #2: to create a diagram of the food web of the community based on the list of the predator/prey relationships

Review Worksheet 2. From this diagram, how can you identify which fish are the predators and which are the prey? Which fish compete with one another for the same food? How can you use Worksheet 1 to answer the same questions? When is it best to ignore another fish?

Objective #3: to fit these specific relationships into a general conceptual framework of the relationships among living things and to apply the standard terms to these concepts

What terms did you encounter in the program and what do they mean? Are there predators and prey in other places besides Odell Lake? What is an example of a predator that lives on dry land? What is its prey? Are there any animals that are not predators? Are there any animals that do not have to eat at all? Can you think of any dry-land animals that compete for the same food? For example, can you think of two animals that both eat grass? Or that both eat tree leaves?

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Objective #4:   to apply these general concepts to a variety of specific biological communities with which the students are familiar

    a. What animals are predators and which are prey in a North American woodland community? (Select a community in which one or more large carnivores can still be found, such as the cougar in the Cascades or the timber wolf in northern Minnesota.) Can you construct a possible food chain diagram for this community? (The food chain diagram should have a carnivore at one end and a green plant at the other.)

    b. Of the various well-known African plains animals, which are carnivores and which are herbivores? What plants do the herbivores eat? Which animals compete with one another for the same resources? Can you construct a reasonable food web diagram that includes at least six African plains animals?

    c. Apply these concepts to microscopic worlds. Are there living things in a random glassful of lake water? Are there predators and prey among these creatures? Are there microscopic predators and prey in a scoopful of soil? (See Follow-up Activity 1, below.)

    d. How reliable is size as a predictor of diet? Do big animals always eat meat and small animals always eat plants? (See Follow-up Activities 2 and 3, below.)

    e. It is possible to have a balanced, self-sustaining biological community contained entirely within a terrarium. How can this be done? What are the essential ingredients to such a system? What are some possible organisms that might be included in such a terrarium? (See Follow-up Activity 7, below.)

Follow-up Activities

An immense variety of follow-up activities is possible. This section is intended to suggest just a few of the possibilities.

1. Collect samples of lake or stream water and examine them under a microscope. Are there living creatures in the water? What are they? What do they eat? Are some of these organisms plants? What might be a possible food chain among these organisms?

2. Make a list of as many species of whales as possible. For each whale, identify what it eats. Are all whales carnivorous? How are the different whales specially adapted for their own particular diets? (You may also want to do this activity using dinosaurs instead of whales.)

3. Talk to several anglers and find out which types of bait or lures work best with different species of fish. How does this relate to the fish's role in the food web? Also find out what sort of habitat the fish is normally found in. For example, does it prefer deep water or shallow water? If deep water, does it normally stay near the surface or near the bottom? How does this affect the angler's strategy for catching it?

4. Pose a variety of "What if" questions about Odell Lake to promote a creative discussion. For example:

   a) What would happen if all of the plants in Odell Lake were suddenly to die?

   b) What would happen if a new species of fish were introduced to Odell Lake?

   c) What would happen if all of the ospreys and otters were to be removed from the vicinity of Odell Lake?

5. Visit a fish hatchery. How are fish fry kept alive? What are they fed? Why does the government operate fish hatcheries?

6. Create a terrarium. Using a large aquarium tank, attempt to assemble a balanced, self-sustaining community of plants and animals.

7. Discuss the advantages and limitations of using simulation models to study a natural system. Try to identify as many limitations of the *Odell Lake* model as you can. (See "Limitations of the Model," page 26.)

Student Worksheets

On the following pages are the four worksheets mentioned in the previous section, "Use in an Instructional Setting." There are two versions of each worksheet:

1. The first version of each worksheet is the duplication master. Permission is granted to purchasers of this product to make copies of these worksheets for school use.

2. The second copy of each worksheet has been filled in with the answers. These pages may also be duplicated as handouts for your students.

Note: As indicated in the previous chapter, the purpose of the worksheets is to cause the students to think about the concepts of food chains and predator/prey relationships. The process by which the students arrive at their answers is far more important than the specific answers. The answer keys have been provided in this manual solely as a convenience to you and your students, *not* to emphasize the importance of obtaining "correct" answers.

Worksheet 1 : Predator/Prey Relationships

Fill in the blanks with the appropriate words.

Blueback salmon

likes to eat: _____

is eaten by: _____, _____, _____, _____

Chub

likes to eat: _____, _____

is eaten by: _____, _____, _____, _____

Dolly Varden

likes to eat: _____, _____, _____, _____, _____

is eaten by: _____, _____, _____

Mackinaw trout

likes to eat: _____, _____, _____, _____, _____

is eaten by: _____, _____

Rainbow trout

likes to eat: _____, _____

is eaten by: _____, _____, _____, _____

Whitefish

likes to eat: _____, _____

is eaten by: _____, _____, _____, _____

Worksheet 1 : Predator/Prey Relationships

Answer Key

Fill in the blanks with the appropriate words.

Blueback salmon

likes to eat: *animal plankton*

is eaten by: ___*osprey*___, ___*otter*___, ___*Dolly Varden*___, ___*Mackinaw trout*___

Chub

likes to eat: ___*insects and larvae*___, ___*algae*___

is eaten by: ___*osprey*___, ___*otter*___, ___*Dolly Varden*___, ___*Mackinaw trout*___

Dolly Varden

likes to eat: ___*blueback salmon*___, ___*rainbow trout*___, ___*whitefish*___, ___*chub*___, ___*bottom organisms*___

is eaten by: ___*osprey*___, ___*otter*___, ___*Mackinaw trout*___

Mackinaw trout

likes to eat: ___*Dolly Varden*___, ___*blueback salmon*___, ___*rainbow trout*___, ___*whitefish*___, ___*chub*___

is eaten by: ___*osprey*___, ___*otter*___

Rainbow trout

likes to eat: ___*insects and larvae*___, ___*bottom organisms*___

is eaten by: ___*osprey*___, ___*otter*___, ___*Dolly Varden*___, ___*Mackinaw trout*___

Whitefish

likes to eat: ___*insects and larvae*___, ___*bottom organisms*___

is eaten by: ___*osprey*___, ___*otter*___, ___*Dolly Varden*___, ___*Mackinaw trout*___

Worksheet 2 :   Odell Lake Food Web

Draw an arrow from each fish to its favorite foods:

Mackinaw
trout

Dolly
Varden

blueback
salmon

rainbow
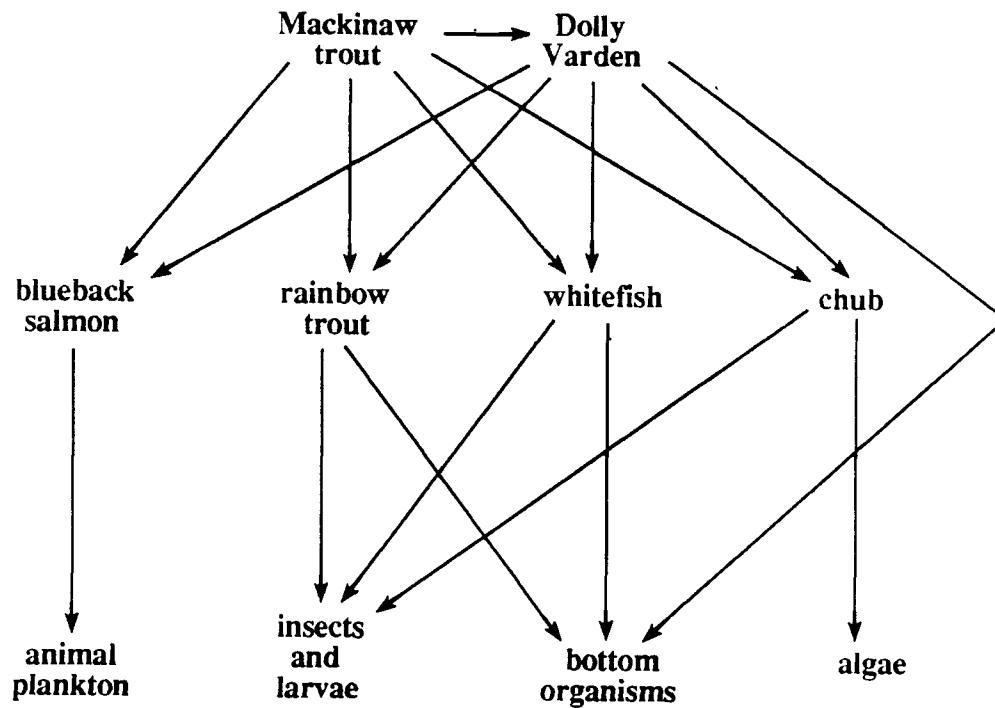trout

whitefish

chub

animal
plankton

insects
and
larvae

bottom
organisms

algae

Worksheet 2 : Odell Lake Food Web

Draw an arrow from each fish to its favorite foods:

Worksheet 3 : Predators, Competitors, and Prey

For each species of fish, identify its predators, its competitors, and its prey:

	Predators	Competitors	Prey
blueback salmon	4	c	1
chub	4	2	2
Dolly Varden	3	1	5
rainbow trout	4	3	2
Mackinaw trout	2	1	2
whitefish	4	3	2

Worksheet 3 : Predators, Competitors, and Prey

For each species of fish, identify its predators, its competitors, and its prey:

	Predators	Competitors	Prey
blueback salmon	osprey otter Dolly Varden Mackinaw trout	none	animal plankton
chub	osprey otter Dolly Varden Mackinaw trout	rainbow trout whitefish	insects and larvae algae
Dolly Varden	osprey otter Mackinaw trout	Mackinaw trout rainbow trout whitefish	blueback salmon whitefish chub rainbow trout bottom organisms
rainbow trout	osprey otter Dolly Varden Mackinaw trout	Dolly Varden whitefish chub	insects and larvae bottom organisms
Mackinaw trout	osprey otter	Dolly Varden	blueback salmon rainbow trout whitefish chub Dolly Varden
whitefish	osprey otter Dolly Varden Mackinaw trout	Dolly Varden rainbow trout chub	insects and larvae bottom organisms

Worksheet 4 : Terms and Definitions

For each term below, write the letter of the matching definition:

LETTER   DEFINITIONS

_____ **carnivore**   A. Tiny plants and animals that drift with the currents
                              in lakes and oceans

_____ **competitor**   B. An activity that models or duplicates certain key
                              aspects of a task or a situation

_____ **food chain**   C. An individual living creature

_____ **food web**   D. An animal that eats meat

_____ **organism**   E. In a situation in which one organism eats another,
                              the organism being eaten

_____ **plankton**   F. In a situation in which one organism eats another,
                              the organism doing the eating

_____ **predator**   G. An organism that utilizes the same resource, such
                              as a food source, as another organism

_____ **prey**   H. A linear sequence of organisms in which each eats
                              the organism below it and is eaten by the organism
                              above it

_____ **simulation**   I. A network of organisms tied together by
                              predator/prey relationships, in which any given
                              species may have predator or prey relationships
                              with many other species

Worksheet 4 : Terms and Definitions

Answer Key

For each term below, write the letter of the matching definition:

LETTER

DEFINITIONS

___D___ carnivore

A. Tiny plants and animals that drift with the currents in lakes and oceans

___G___ competitor

B. An activity that models or duplicates certain key aspects of a task or a situation

___H___ food chain

C. An individual living creature

___I___ food web

D. An animal that eats meat

___C___ organism

E. In a situation in which one organism eats another, the organism being eaten

___A___ plankton

F. In a situation in which one organism eats another, the organism doing the eating

___F___ predator

G. An organism that utilizes the same resource, such as a food source, as another organism

___E___ prey

H. A linear sequence of organisms in which each eats the organism below it and is eaten by the organism above it

___B___ simulation

I. A network of organisms tied together by predator/prey relationships, in which any given species may have predator or prey relationships with many other species

Background Information

The Real Odell Lake

Odell Lake is a small, natural lake high in the Cascade Mountains of southern Oregon. The lake is six miles long and only a half-mile wide. Yet this glacier-carved lake is about 300 feet deep, which provides plenty of cold-water habitat for such fish as the Mackinaw trout. The lake is surrounded by a coniferous forest.

Odell Lake is located in the northwest corner of Klamath County, very near to both Lane County and Deschutes County. The town of Cascade Summit is located beside the lake, and both the lake and the town are located near a 5000-foot pass through the Cascades. This pass is situated on the divide between the watershed of the Willamette River system and that of the Deschutes River, both of which flow north into the Columbia River. Water that drains from Odell Lake flows through Odell Creek into the Deschutes River.

Fish that are native to Odell Lake include the **Dolly Varden** (a type of trout). the **rainbow trout,** and the **whitefish.** Presumably these fish originally entered the lake by migrating upstream. The **blueback salmon** and the **Mackinaw trout** were both introduced to Odell Lake for the purpose of sport fishing. The **chub** was accidentally introduced by anglers who were using it as live bait.

The Creatures of the Lake

The help screens in **Go exploring** provide several pieces of information about each creature. In the case of the six species of fish, this includes the maximum length and weight of each. It might be wise to caution your students that these are *not* typical sizes. The typical weight of any of these fish is no more than ten pounds, yet individual fish that have managed to live a long time may be considerably larger. For example, the Mackinaw trout, under the right conditions, may reach a weight of 100 pounds.

The **osprey** and the **otter** are two native predators that rely on fish for much of their diets. The osprey is a fish-eating hawk (sometimes called the "fish hawk") that dives feet-first into the water to capture its prey. It has a wingspan of up to six feet and weighs about three or four pounds. (The females tend to be larger than the males.) The otter is an aquatic mammal, the only member of the weasel family that lives in water. Otters are quite playful, often spending much of their time frolicking about. Besides fish, their diet includes such fare as crayfish and frogs.

Animal plankton (or zooplankton) are very small animals that float around in the water at all depths (but not on the surface). The term "plankton" itself simply means "floating." These tiny creatures depend upon the currents to get from one place to another. Aquatic creatures from many different animal groups can be planktonic, including protozoans (one-celled animals), rotifers (wheel animalcules), ostracods (seed shrimp), cladocerans (water fleas), copepods, and many others. (Ostracods, water fleas, and copepods are all crustaceans.) Even though these creatures are extremely tiny, often microscopic, their great abundance makes them a very important part of the food web.

A wide variety of **insects** live in the water, either as larvae or as adults. In fact, about 5000 species of insects in North America spend at least part of their life in the water. Aquatic insects come from many different insect groups, including mayflies, dragonflies and damselflies, springtails, true bugs (such as the water boatman), beetles, caddis flies, and true flies (such as mosquitoes, gnats, crane flies, midges, black flies, and horse flies).

Bottom organisms (also called "benthic animals") also come from a variety of groups. These are animals that spend their time either sitting on the lake bottom or burrowing into it. They tend to be much larger than the planktonic animals, even though some are from the same groups. Examples are crustaceans (such as crayfish and isopods), mollusks (such as snails and clams), worms, amphibians (such as salamanders), turtles, and many kinds of insects. In addition, many other creatures spend their time clinging to stones, plants, or other objects that rest on the bottom.

Algae are chlorophyll-containing aquatic plants without vascular systems. (In other words, they do not have the water-transport tubes that most land plants contain.) Algae are divided into several groups, including blue-green algae (which are really chlorophyllous bacteria), green algae, and yellow-green algae (such as diatoms). Most of the freshwater algae that can be seen with the naked eye are green algae. Some green algae are unicellular (*Chlorella*, desmids), some form colonies (*Pediastrum*, *Volvox*), and others are filamentous (*Spirogyra*, *Cladophora*).

The *Odell Lake* Model

The *Odell Lake* model incorporates a total of twelve organisms: six species of fish and six other classes of organisms. The fish are as follows:

Mackinaw trout	The top carnivore among the fish, it eats all of the other fish.
Dolly Varden	Another large predator, it eats all of the fish except for Mackinaw trout. It also eats bottom organisms.
blueback salmon	This large fish prefers to feed on tiny plankton.
rainbow trout	Its favorite foods are insects and bottom organisms. It competes with the whitefish and the chub.

whitefish   Its favorite foods are insects and bottom organisms. It competes with the rainbow trout and the chub.

chub   This small fish prefers to eat insects and algae. While it competes with the rainbow trout and the whitefish for the insects, it is too small to chase them away.

The other classes of organisms are:

osprey   This large bird will eat any of the fish.

otter   This aquatic mammal will eat any of the fish.

animal plankton   This is the favorite food of the blueback salmon.

insects and larvae   This is a favorite food of the chub, the whitefish, and the rainbow trout.

bottom organisms   This is a favorite food of the Dolly Varden, the whitefish, and the rainbow trout.

algae   This is a favorite food of the chub.

The model is based on a table of 330 entries, with each entry containing several pieces of information. These entries represent the 330 possible combinations of the six fish you may be, the eleven opponents you may encounter (five other fish plus six other organisms), and the five possible responses you may make. Each of these 330 entries includes:

a) the usual response of your opponent (which determines, among other things, whether you survive the encounter);

b) two alternate feedback messages (with the program randomly choosing between the two messages);

c) the point value of your move (if you are playing for points).

If you choose to ignore your opponent or, when you are playing for points, fail to take action before the timer expires, then your depth can also play a part in determining whether you survive. The six fish appear on the game screen at the following depths:

blueback salmon	shallow
chub	shallow
Dolly Varden	shallow or medium
Mackinaw trout	deep
rainbow trout	shallow
whitefish	shallow, medium, or deep

Certain of the 330 combinations have a 10% chance of an alternate outcome, including a different response by your opponent, different feedback messages, and different point values. These "random events" are as follows:

1. If a Mackinaw trout or a Dolly Varden eats a chub, there is a chance of being caught by an angler. (The chub was being used as live bait.)

2. If any fish eats the insects and insect larvae, there is a chance of being caught by an angler.

3. If a Dolly Varden attempts to eat a blueback salmon or a rainbow trout, there is a chance that the prey may escape.

4. If a Mackinaw trout attempts to eat a Dolly Varden, there is a chance that the prey may escape.

5. If a chub attempts to eat a blueback salmon, a rainbow trout, or a whitefish, there is a chance that the bigger fish, rather than just ignoring the chub, may in fact eat it.

6. If a chub or a whitefish attempts to escape shallow from the Mackinaw trout, which is in fact the right thing to do, there is a chance that the Mackinaw trout will catch it anyway.

7. If a blueback salmon or a rainbow trout ignores the Dolly Varden, which is a very risky thing to do, there is a chance that the Dolly Varden will ignore it rather than eat it.

Limitations of the Model

As with all models, the *Odell Lake* model is greatly simplified compared to the immense complexities of the real system being modeled. An interesting follow-up activity for your class might be to identify as many of these limitations as possible and to discuss their impact on the reality of the model. A partial list follows:

1. Each of the species of fish included in the model is in reality highly variable in size, depending on such factors as its age and habitat. In fact, most of the six fish will occasionally eat *any* of the other fish, provided that the opponent is small enough. A fish may even eat other members of its own species.

2. The feeding habits of the real fish may vary not only with size and age, but also with the time of year, the availability of food, and several other factors. For example, a certain species of fish may eat nothing during the spawning season. Or a fish may prefer one type of food, but will switch to another if its favorite is not available.

3. Virtually all food chains are traceable to green, photosynthetic plants. Only one such plant, the algae, is included within this model, and only one of the fish (the chub) cares to eat it. In fact, the other food sources in the program (insects, animal plankton, and bottom organisms) are not at the base of the food web, but rely in turn either on plants or on organisms that eat plants.

4. By "taking the role" of the six fish in the model, we anthropomorphize the behaviors of these animals. In reality, their behavior is based more on instinct than on conscious deliberation as to the best action to take in a given situation.

5. There are other species of fish and other types of organisms in the lake besides the ones listed by the program. These other creatures may also interact with the fish in significant ways.

6. The vertical scale shown in the cross-section view of the lake has been greatly compressed. For example, the Mackinaw trout spends much of its time at depths of 100-300 feet. A fish swimming in shallow water is not likely to spot or be concerned about a predator that is so deep.

7. A large predatory fish such as the Mackinaw trout or the Dolly Varden does not try to eat every smaller fish it meets, but only eats when it is hungry. Furthermore, its success rate in catching the fish it tries to eat is most likely considerably lower than depicted in the program.

Bibliography of Related Materials

Books used in the preparation of *Odell Lake* include:

1. Eddy, Samuel. 1969. *The Freshwater Fishes*, 2nd ed. Wm. C. Brown Company Publishers. 286 pp.

2. Klots, Elsie B. 1966. *The New Field Book of Freshwater Life*. G. P. Putnam's Sons. 398 pp.

3. La Monte, Francesca. 1958. *North American Game Fishes*. Doubleday & Company. 206 pp.

4. Random, Jay Ellis, ed. 1981. *Harper & Row's Complete Field Guide to North American Wildlife*, Western Edition. Harper & Row. 809 pp.

5. Reid, George K. 1967. *Pond Life: A Guide to Common Plants and Animals of North American Ponds and Lakes*. Golden Press. 160 pp.

6. Welch, Claude A., *et al.* 1973. *Biological Science: Molecules to Man*. 3rd ed. Houghton Mifflin Company. 764 pp.

Related MECC products include:

1. *Oh, Deer!* - A simulation of the difficult choices facing a suburban residential community in which the local deer population has grown too large. Should some deer be removed? How should it be done? Based on a real-life situation, this package deals with both the ecological and the sociological aspects of the issues.

2. *Discovery Lab* - An imaginary simulation in which you play the scientist responsible for determining the needs of a variety of small organisms brought back from space for study. You have access to a laboratory in which you can test the organisms for their response to light, heat, moisture, sound, and various foods.

3. *Pets, Ltd.* - A simulation of responsible pet care. After deciding whether to keep a dog, a cat, or a hamster, you face a variety of realistic decisions about how to care for the pet.

Credits and History

Odell Lake is a product with a long history. Its continuing development reflects the advances made in instructional design. For those who have followed the various versions of this product, here is a brief history.

The original "Odell Lake" program was written for the MECC Timeshare System in the 1970s by Ken Witt of the Tracy (Minnesota) School District. It was inspired by a chapter in the Houghton Mifflin textbook *Biological Science: Molecules to Man,* 3rd edition (1974). This chapter, "Communities and Ecosystems," revolves around a discussion of the food web of Odell Lake, Oregon. In 1979, MECC released a short manual, also written by Ken Witt, designed to accompany the timeshare program.

In 1980, MECC released a version of "Odell Lake" for the Apple II computer. This program was included as part of two different products, *Elementary Volume 4* and *Science Volume 3*. Unlike the timeshare version, this microcomputer version included simple animated graphics.

A full color graphic version of "Odell Lake" was released for the Atari computer in 1982 in the package *Elementary Biology*. Still other versions of "Odell Lake" were included in *Simulations* for the IBM PC (1984), *Outdoor Biology* for the Radio Shack Color Computer (1984), and *Outdoor Biology* for the Commodore 64 (1985). These later versions featured minor revisions to the basic biological model, along with several different approaches to animating the fishes.

While retaining much of the spirit and many of the details of the original, a great deal has also been added to the 1986 version of *Odell Lake*. The product was designed by Philip Bouchard, who also wrote the support manual. The graphics were created by Charolyn Kapplinger. Paul Wenker and James L. Thompson were the programmers who put it all together and made it work. Many other people also contributed to the project in smaller but very important ways. A partial list of these people includes Gene Breault, Craig Copley, Greg Holey, Nan Leekley, Cheryl Marty-White, and Jane Richter's fifth grade class at Pinewood Elementary School in Mounds View, Minnesota.

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    2) note the *brand* and *model* of the equipment involved, as well as the type of *printer card* used if the problem concerns a printer;
    3) write or call the Help Line to describe the problem (**612/481-3660**).

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