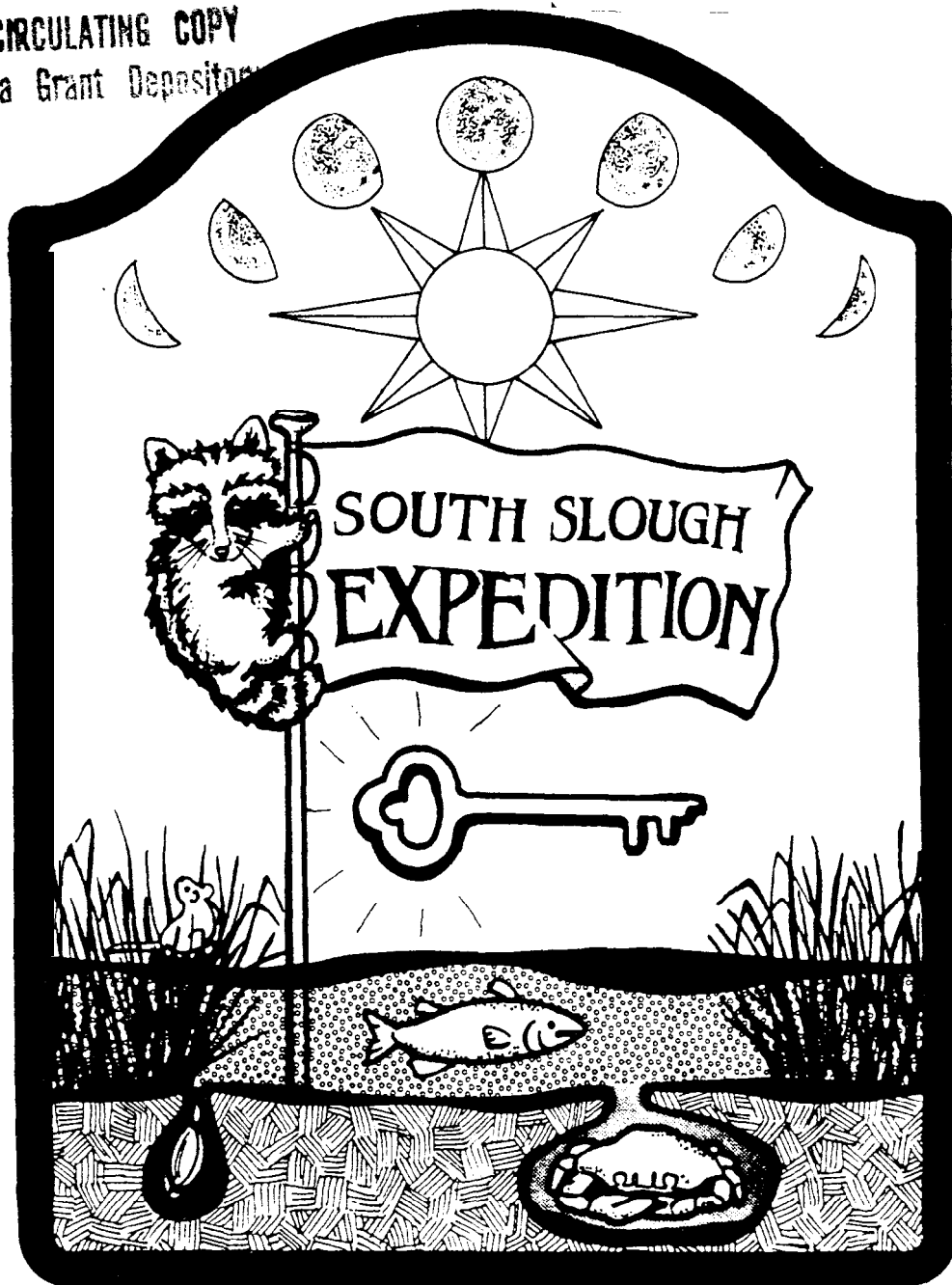


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The Secret of the Medallion

LEVEL II-GRADE 6

TEACHER'S MANUAL

THE SECRET OF THE MEDALLION

The Estuary Study Program

Level II--Grade 6

Third Edition, 1982

Revised by Karen Gartland

Address correspondence to

Estuary Study Program
South Slough Estuarine Sanctuary
P. O. Box 5417
Charleston, OR 97420

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KAREN GARTLAND

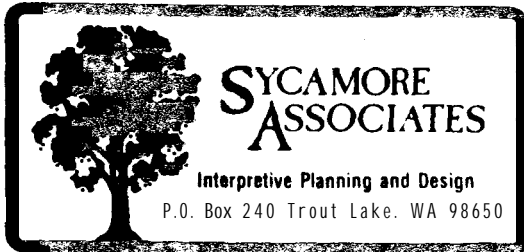
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OVERVIEW
OF THE ESTUARY STUDY PROGRAM
(ESP)

AN OVERVIEW OF THE ESTUARY STUDY PROGRAM, GRADES 4 THROUGH 8

This manual is about one of three programs designed for the intermediate or junior high school classroom: Level I is designed for the 4th or 5th grade classroom; Level II is designed for the 6th grade; and Level III is for the 7th and 8th grade science or social studies classroom.

Program Goals

"An estuary is one of the richest places on earth."

This line sums up the "Big Picture" of what we're trying to convey to the learners who are involved in any of the three programs. Students who participate in any one of the programs should leave with:

- 1) an understanding of what an estuary is,
- 2) knowledge of why an estuary is important, and
- 3) knowledge that estuaries change because of natural processes and human use.

A Short Synopsis of Each Level's Estuary Visit

Level I. In Search of the Treasures of the South Slough (4th and 5th grade).



In Search of the Treasures
of South Slough
LEVEL I

Students are sent on a treasure hunt to discover the "treasures of the South Slough." They encounter four different activities, each involving a different "zone" or part of the estuary: the uplands, salt marshes, mudflats, and open water. Each zone's activity helps them get a little closer to figuring out the treasure: that this part of the estuary has been set aside as a SANCTUARY, a protected place for the animals and plants, with very little disturbance by people.

Level II. Secret of the Medallion (6th grade).



The Secret of the Medallion
LEVEL II

Students are sent on an expedition to figure out the meaning of a special medallion that was uncovered in the South Slough area. To do that, students must "unlock" the "truths" about estuaries through scientific investigations. At seven different "outpost stations" they help figure out the Big Secret of an estuary: "That the sun and the moon combine forces to support one of the richest places on earth."

Level III.-Lore of the South Slough (7th and 8th grade).



The Lore of South Slough
LEVEL III

In the morning, students join five different old-timers of the South Slough to investigate the Slough's rich cultural and natural history. These old-timers share stories of the obvious riches they were so dependent on in the South Slough area: the timber, farmland, minerals, water transport, and native plants and animals.

In addition, surprise visits are made by two characters that stress hidden riches of the natural workings of the estuary: "Dr. Mudflat" and the-"Estuary Soup Chef."

After an old-time lunch over an open fire, the science students may conduct scientific investigations in the different zones of the estuary. On the other hand, the social studies students may make mini-investigations of the evidence still remaining of the early activities in the South Slough.

AN IMPORTANT PROGRAM NOTE: This program is highly dependent on enthusiastic energetic teachers, able to recruit available volunteers. It is imperative that teachers and volunteers attend a five-hour training session held free at the South Slough Sanctuary. Please contact the sanctuary for more details. Address all correspondence to:

Estuary Study Program
South Slough Estuarine Sanctuary
P. O. Box 5417
Charleston, OR 97420
(503) 888-9015

INTRODUCTION
TO LEVEL II

INTRODUCTION

Your students are about to embark on an exciting adventure in learning about estuaries. Their entire experience, from the preparation materials and on-site experience, to the follow-up parts of the program, has been carefully planned and prepared to assure a quality experience with plenty of solid, good learning. As important as the knowledge your students will gain are the enthusiasm and excitement which accompany it. This booklet will briefly explain the program and your suggested roles. Please read it carefully as soon as possible. Your preparation materials should be arriving approximately two weeks before your class's visit to the slough.

ASSUMPTIONS ABOUT AGE LEVEL

Our program is based upon the following assumptions about sixth graders:

- their need for an organized learning pattern
- their need for simple terms and concepts
- their ability to achieve a higher level of conceptual understanding, and thus to assimilate more information than Level I learners
- their ability to collect and interpret data to reinforce concepts
- their need for strong leaders and guidance, with some opportunity for independent learning
- their need for concrete and visual representation of abstract ideas
- their likelihood of being captivated by adventure and exploration
- their need for safety-conscious activities and areas

KEY UNDERSTANDING OF LEVEL II ON-SITE EXPERIENCE

"An estuary is where the sun and moon combine forces to support one of the richest places on earth."

SPECIFIC LEARNING OUTCOMES OF LEVEL II ON-SITE EXPERIENCE

1. The tide and streams transport and distribute nutrients to the estuary.
2. An estuary produces some of the richest plant growth on earth.
3. The sun is the primary source of energy for the life of the estuary.
4. The natural communities in an estuary have many interrelationships.
5. The plants and animals in an estuary have to survive changes in temperature and salinity.
6. Each natural community in an estuary supports a tremendous diversity of life forms.
7. The forces of man and nature combine to bring change to the estuary.

PREPARATION MATERIALS

These materials are designed to provide the necessary information to prepare your students for the on-site experience.

The preparation materials for Level II are delivered in a shipping crate constructed of rough-cut wood. On the crate in large, stenciled letters appear these words: "SOUTH SLOUGH ESTUARY EXPEDITION." The crate contains:

- a master packet to be pulled out by the teacher when students are not around. Copies must be made of the Expedition Guidebook for students and then placed back into the crate before the students' inspection. (With your school helping with printing costs, this program is allowed to continue. Thank you!)
- a large map showing the ocean, Charleston, and the South Slough. The map is titled "ONE OF THE RICHEST PLACES ON EARTH."
- a stack of small maps, one for each student. Side one is identical to the large one only reduced in size. Side two is an enlarged section showing the area your class will visit.
- a medallion on a chain. On one side of the medallion is a relief of the sun; on the other appears a relief of the moon.
- a story to be read aloud: "The Secret of the Medallion" This introduces the South Slough and the estuary and then tells a story of a strange medallion that is found in the mudflats of South Slough. Part of the medallion's story is known, but the ending which reveals its secret is missing. The students are challenged to embark on an expedition to the South Slough to find out the Secret of the Medallion.
- a sample Expedition Guidebook.
- the "Task Cask."
- a set of natural objects found around the slough: oyster shells, crab pinchers or molts, dried seaweed, driftwood, etc. Your students can use these objects to set up a classroom display.
- nametags made out of wood or tagboard.

THE ARRIVAL OF THE EXPEDITION CRATE

When the crate arrives (about 2 weeks prior to your visit) perhaps you could arrange for someone special to deliver it to the classroom, maybe the custodian or principal. In this way, the excitement is stirred from the start. Set the crate in front of the room, closed and intact, for all to inspect from their seats until you are ready to begin the first phase of the preparation. PLEASE DO NOT open it in the presence of the students unless you are ready to set aside some time to probe its contents.

Remember, you need to prepare masters before the students inspect the inside of the crate!

On the following pages, this manual will explain how each of the items in the crate works as well as provide a ten-day, hour-or-so-a-day plan for using all the material by the day of your visit. The materials can also be completed over longer time blocks, in fewer days, although we recommend the particular sequence of activities described here.

THE TEN-DAY PREPARATION OUTLINE

Things to Round Up Before the Expedition Crate Arrives

- 1) Some very willing adult volunteers or very capable and available high school student volunteers. The ratio of sixth grade students to volunteers should be at most seven to one. All volunteers should be able to attend the five-hour Leader Training Session that will be held at the South Slough.
- 2) Hard backing for use as the back cover of the students Expedition Guidebook. Students will be writing in their guidebooks during their visit to the slough.

The Day the Crate Arrives

Find a time when students are not around to pull out the Master Packet which includes masters for:

- 1) student Expedition Guidebook,
- 2) key word list,
- 3) key word find, and
- 4) crossword puzzle.

Make copies of each and pack them back into the crate. Allow the expedition crate to sit in front of the room as curiosity builds.

To Begin

When you are ready to devote an hour or so to preparation, have the students look over the contents. They can carefully lift things out to see all that's there, but do not allow them to open any of the packages yet.

The Secret of the Medallion

As the first part of the preparation, read this story (pp. 15-16 of this manual) to the class.

The Maps

Post the large map and refer to the South Slough as mentioned in the Secret of the Medallion story. Distribute the small maps, making sure students realize side one is exactly like the large posted map. Make mention of side two as an enlargement of the area they will be exploring on their visit to the slough.

Key Word Activities

Introduce the key words and their definitions to your students as information they will need to help them figure out the "Secret of the Medallion." Refer to page 16 for further instructions.

The Expedition Guidebook

Introduce the guidebook through its opening letter, found on page 25. Break into compatible groups with each student responsible for filling out their own copy. Through individual, group, and class work on the sets of conclusions, the best questions should be neatly written by each student into his own guidebook. Refer to page 23 for further instructions.

The "Task Cask"

Use this when students have extra time. It contains slips of paper describing small research tasks that can be taken on by volunteers. See page 51 for further instructions.

Hang and Read the "Community" Posters

The posters will help introduce the concept of natural communities. They are located within the expedition crate.

Tide Lesson

Present the lesson which overviews tides. It is located within your expedition crate.

Photosynthesis

Make sure your class has reviewed this topic recently. You should be able to find information concerning it in your adopted science text. Present a simple explanation to help your students with their work at the slough.

Nametags

Pass out nametags and have students write their names on both sides of the tag with a permanent felt marker. Collect, then redistribute them on the bus enroute to the slough.

First Week Preparation Overview

- Inspect the crate.
- Read the Secret of the Medallion story, pages 15 and 16.
- Post the large map.
- Inspect both sides of the small map.
- Introduce key words and definitions through key word activities pp. 17-22.
- Read opening letter of the Expedition Guidebook, page 25.
- Begin construction of questions, based on the conclusions in the Expedition Guidebook.
- Introduce the "Task Cask." page 51.
- Review the very_important South Slough Visit Checklist, page 52.

Second Week Preparation Overview

- Finish the construction of questions based on the conclusions in the Expedition Guidebook.
- Continue key word activities via
 - 1) word games, page 17,
 - 2) crossword puzzle, page 19 and 20, and
 - 3) key word find, page 21 and 22.
- Continue "Task Cask" usage.
- Hang and read the Community Posters.
- Involve students in tide and photosynthesis lessons.
- Make nametags.
- Review the very important South Slough Visit Checklist, page 52.
- Review Details the day of your visit
 - 1) in class, page 53,
 - 2) when you depart, page 53, and
 - 3) when you get off the bus, page 53.

PREPARATI ON MATERI ALS

THE SECRET OF THE MEDALLION

A Story to be Read Aloud

The medallion was found on a blustery fall day in the South Slough. South Slough is part of what we now call an estuary. An estuary is a place where a river meets the sea and fresh water and salt water mix. Land encloses it from the sea, except for the mouth which connects it to the ocean. South Slough is actually a part of a much larger estuary called Coos Bay. It is called a slough because it is a small part of the main bay. (A river has tributaries and a bay has sloughs.)

The medallion was found not too long ago. A dredge was scooping out a channel of the slough to enable boats to pass back and forth without getting caught on the bottom. The dredge bit into a heavy metal object and the object was hauled on board. It was rusty and worn; barnacles covered its surface. It appeared to have been partially submerged in the muck for quite sometime. It was a very old safe. The mechanisms of the safe were rusted and corroded--there was no way to open it. One of the workers offered to cut through it with a welding torch to see what was inside and took it home that evening.

The safe was very thick, much thicker than safes are made now-a-days. The worker thought there must be great riches in a safe that was buried in the slough for so long...gold, silver, jewels? But when he finally cut through, all he found was a strange medallion and a book. The safe contained nothing of value, or so he thought.

The medallion was very unusual. It was made of wood, and on one side it showed a relief of the sun, on the other a relief of the moon. It hung on a bright chain. There was not a clue as to what it meant...until he looked into the book.

The safe was almost purely watertight, but unfortunately there had been some seepage. Most of the book was unreadable as a result of the blurring of ink due to moisture. But when the book--which actually turned out to be a personal journal of a very interesting man--was carefully inspected, an intriguing story unfolded. Here is the tale, pieced together as well as fate would allow.

Right now, South Slough is a sanctuary--that is, it is a special place that has been set aside where all animals and plants can live with very little disturbance by people. It wasn't always so. Years ago people came to the South Slough to take out its riches. Miners worked up its streams in search of coal. Loggers worked its steep slopes to bring lumber to market. Homesteaders diked off areas and drained them to make farms. Railroads and boating channels were constructed to haul away the timber and coal and surplus crops of the farmers. Somewhere during the time all this activity was occurring at South Slough, an old man lived back in one of its isolated arms. The journal was the account of this old man, written in his final years.

The journal revealed a very unusual man--a man clearly years ahead of his time regarding the workings of nature. He lived his humble life in a small shack and came out to work in a town nearby for a few months out of the year. (It is suspected that this man was a blacksmith during these years because his journal tells how he made the safe.) But most of his life was spent alone. Alone from people, that is, for he was far from alone.. This is evident from his intimate stories of close interaction with wild animals. He tells of canoeing

with the otter and the seal, hunting fish with the heron, and walking side by side with the bear or the elk. He tells how one day he realized that the slough was a very unusual place. There was something about it that made it quite unlike any other place on earth. (From certain references from time to time, one might deduce that he could have been a sea captain or first mate on a ship. He wrote of similar places in Africa, Australia, and South America. Perhaps he had come to South Slough to live out the later years of his life.) He vowed to devote time each day to finding out what was so special about his home.

This is when he began to see things about estuaries that men of science have now just begun to reveal to us. Of course, he didn't call the place an estuary. He simply called it Tide Land. He made a primitive microscope so he could view the tiny things that he was sure were in the waters. What else would the crab or the clam be eating, he thought? He saw the close relationship between all the things that lived there.

Towards the end of the journal, he composed all of the knowledge he had gained into what he called The Seven Truths of Tide Land. From these truths, one powerful statement emerged. A statement that in one line could solve the mysteries of Tide Land and show its uniqueness to all who wished to know. He carved the medallion to honor and symbolize the secret of Tide Land.

The last readable page says:

"I thought back to those days when I first wondered why this place was so different. It was not the sea entirely, but then again it was not only land. For years I have thoroughly been entranced by probing the mysteries and unknown stories of Tide Land. Finally, the meaning has found a home within me. It is a meaning I wish to someday share with the people who now cut the forests and dig into the earth. It is a secret that should be known to the ones who fish and the ones who hunt the fowl. The farmers that fill the Tide Land must one day know the secret of its existence that I found.

I have crafted this medallion to the best of my skill and knowledge to symbolize and honor the secret for which it stands. My hope is only that when the time is right, the secret will be as clear to all as is our need for air. This is the secret of the medallion I wish to share."

Just before the secret was stated, the journal became unreadable. The seepage had taken its toll and no more knowledge of the man or his work could be gained. Nor will it ever be known how he wanted to share his secret. All that is known is that someone, perhaps the old man himself, placed the medallion and the journal in the watertight safe. Perhaps the boat it was being transported in capsized and it sank to the bottom mud. This part of the medallion story will never be known.

What of the secret? The secret is known. So are the truths. But they are too important to simply be told. They must be experienced. You will soon be made aware of a long list of conclusions. Some of these are right and some are wrong. To find which are right and which are wrong, you will, in the near future, embark on an expedition to the South Slough Estuary. Knowing and proving the right conclusions will help you see the seven truths. Only when you have gained the knowledge of all seven of these truths will you discover and understand the secret of the medallion.

KEY WORD ACTIVITIES

Key Words should not be presented in such a way that the students feel that they will be tested on them or that they must memorize them. They are simply words with which they should become familiar. The reward will come when they are able to use these words during the on-site activities. Write the words and definitions on the blackboard. Use the key words in sentences that you recite or write on the board. Tell them that knowing the meanings of these words will help them figure out the secret.

These are fun ways of practicing and reinforcing the key words.

Crossword Puzzle

- Uses definitions to describe the words that fit across and down (pp. 19 and 20).

Word Find

- The words appear in a jumble of letters: vertically, horizontally, and diagonally (pp. 21 and 22).

Password

- This is a game for the class to play as a whole. Two students stand in front of the room, facing the class. A "key word" (or other related vocabulary word) is written on the board behind them; they cannot see it but the rest of the students can. One word clues are given to each of the two students in turn, with one guess allowed for each clue. When one of the students guesses the word, two others come to take their place.

20 Questions

- A student has one vocabulary word in mind: the others ask "yes or no" questions, trying to establish its identity in twenty questions or less.

What's the Key Word?

- In small groups, assign key words to be used in a sentence created by the group. Groups write the sentence on the board, leaving the key word blank. Other groups decide on the correct key word to fit the sentence.

We'd love to hear of other word games that worked for you and your class.

KEY WORDS

DECAY - The process by which dead plants or animals are broken down to small pieces by bacteria or fungi.

DETRITUS - (dee tri' tus) Decaying bits of plants or animals, Detritus floats in the estuary water and is sometimes microscopic.

ESTUARY - A place where fresh and salt water mix, usually where a river meets the sea. It is enclosed from the sea by land except where it empties into the ocean.

FILTER-FEEDING - A way that some animals sort out and eat very small plants and animals from the water.

MICROSCOPIC - Something so small it cannot be seen with the naked eye.

MIGRATION - To fly to another place in search of a warmer climate, as the birds do in the late fall.

MUDFLATS - One of the four natural communities of the estuary. It's a muddy place covered and uncovered by the tide water every day. There are very few standing or visible plants. The many holes indicate lots of life below

NUTRIENT - A tiny bit of dead plant or animal, or a bit of rock or mineral that provides nourishment or food to living things.

OPEN WATER - One of the four natural communities of an estuary. It is the water that fills the low places in the mudflats even at low tide and covers the mudflats at high tide.

PLANKTON - Small plants or animals that are found drifting or floating in the estuary water. Most plankton is hard to see with the naked eye. (Phytoplankton is plant plankton. Zooplankton is animal plankton.)

SALT MARSH - One of the four natural communities of an estuary. It is a grassy place along the edge of the mudflats and next to the trees and bushes of the uplands.

SANCTUARY - A place that has been set aside to allow the animals and plants to live a life with very little disturbance from people.

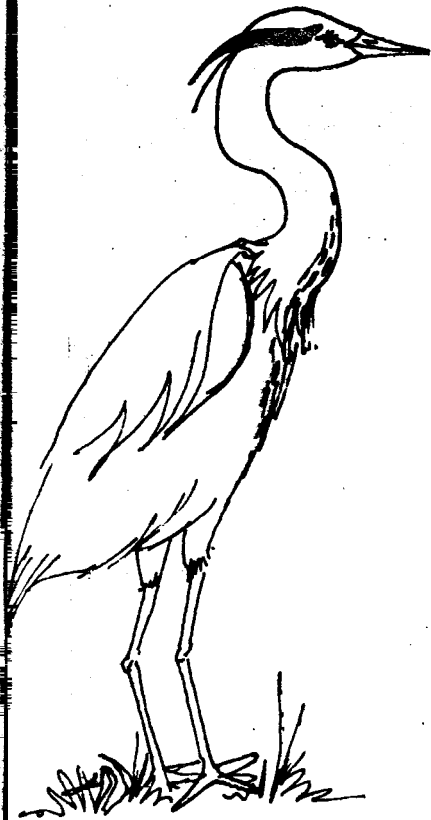
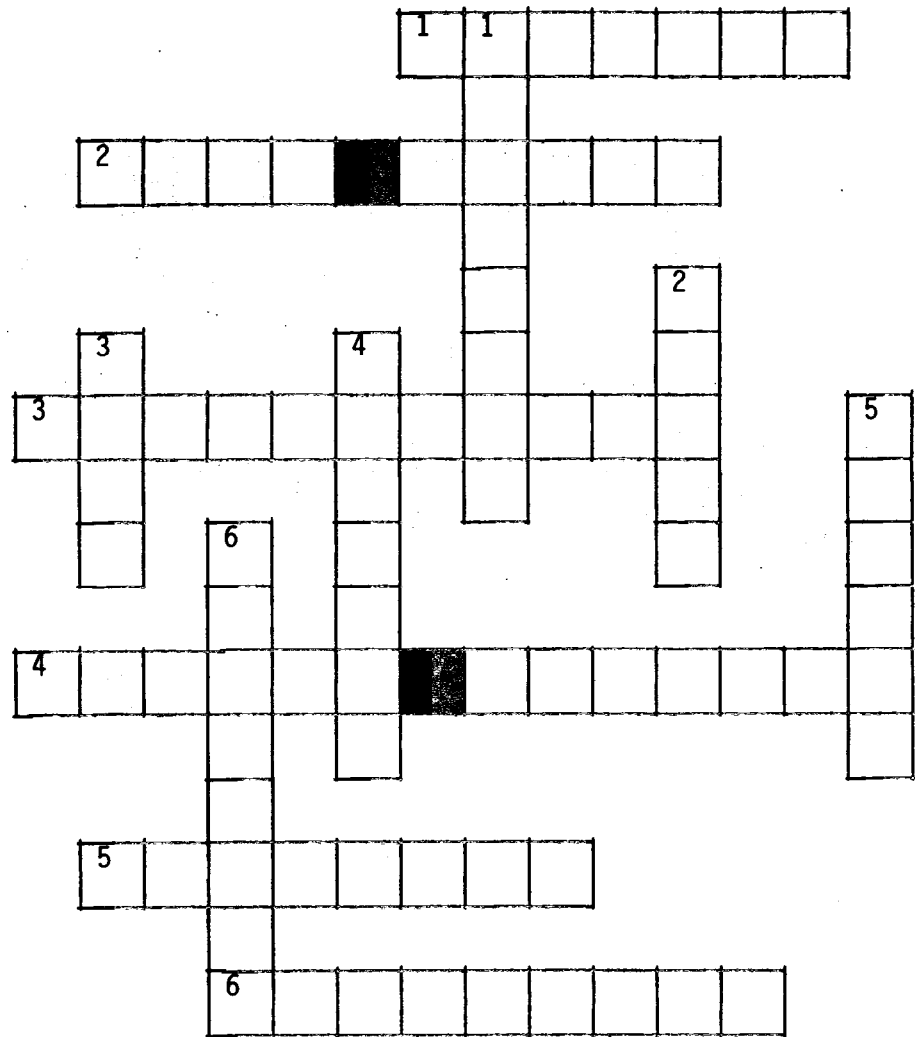
SLOUGH - A small part of a main bay or estuary; a backwater.

TIDE - The periodic rise and fall of the ocean water level due to the attraction of the sun and the moon. There are usually two high and two low tides every day.

UPLANDS - One of the four natural communities of the estuary. It is a higher and drier place than the other parts of the estuary and usually has bushes and trees.

ZONES or NATURAL COMMUNITIES of the estuary - Uplands, salt marsh, mudflat, and open water.

KEY WORD CROSSWORD PUZZLE



ACROSS

1. the highest and driest natural community of the estuary
2. a grassy place between the mudflats and the uplands (two words)
3. something too small to be seen with the naked eye
4. one way to eat microscopic plants and animals (two words)
5. something which provides nourishment to living things
6. a place where plants and animals can live with little disturbance from people

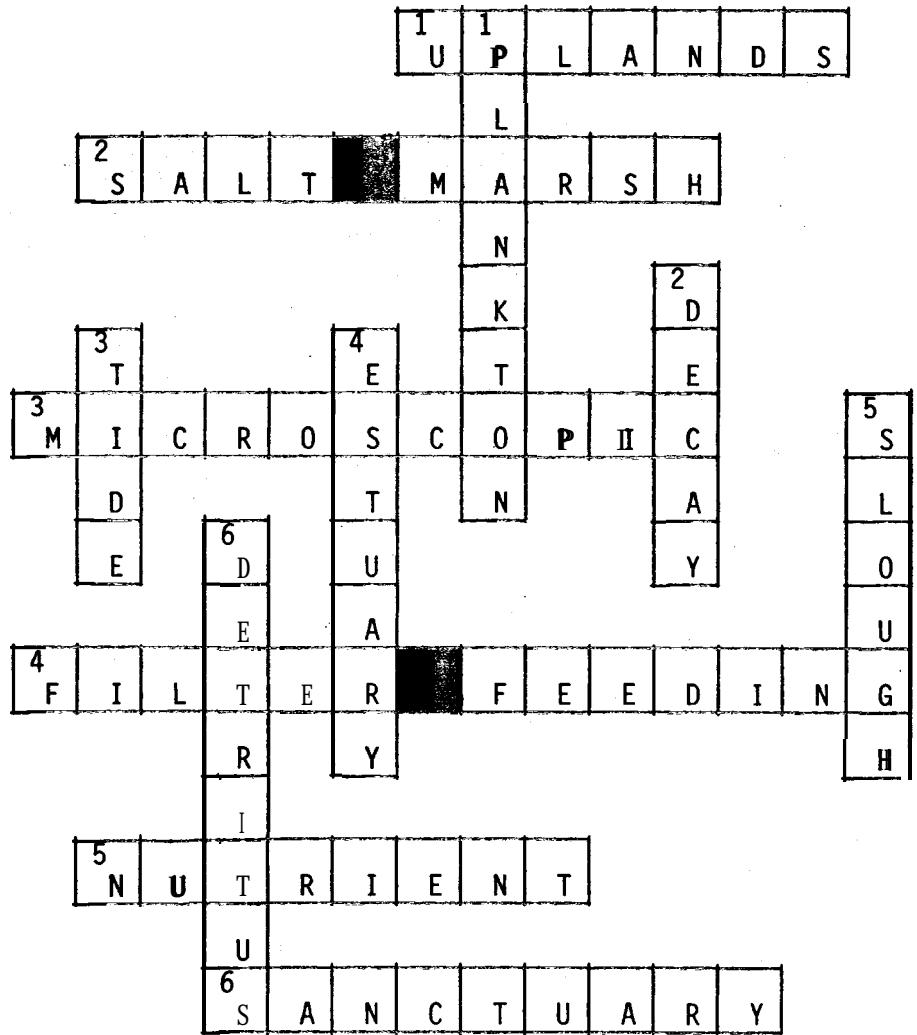
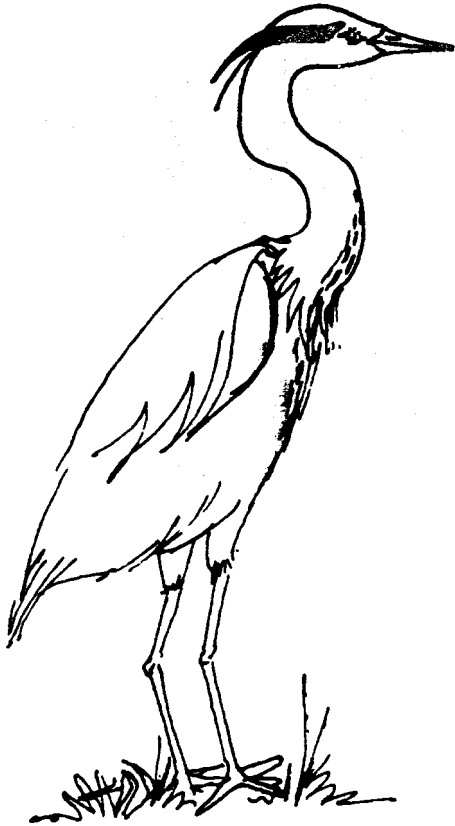
DOWN

1. small plants or animals which drift in the water (usually microscopic)
2. the breaking down of dead plants and animals
3. the rise and fall of ocean
4. a place where fresh and salt water mix
5. a small part of a main bay
6. the decaying bits of plants in an estuary

USE THESE WORDS

decay, detritus, estuary, filter feeding, microscopic, nutrient, plankton, salt marsh, sanctuary, slough, tide, uplands

KEY WORD CROSSWORD PUZZLE (ANSWER KEY)



ACROSS

1. the highest and driest natural community of the estuary
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6. the decaying bits of plants in an estuary

USE THESE WORDS

decay, detritus, estuary, filter feeding, microscopic, nutrient, plankton, salt marsh, sanctuary, slough, tide, uplands

KEY WORD WORD FIND

Find these Key Words: decay, detritus, estuary, filter feeding, microscopic, nutrient, plankton, sanctuary, slough, tide, uplands.

Bonus the names of four other animals you might see on your visit to South Slough are also included.

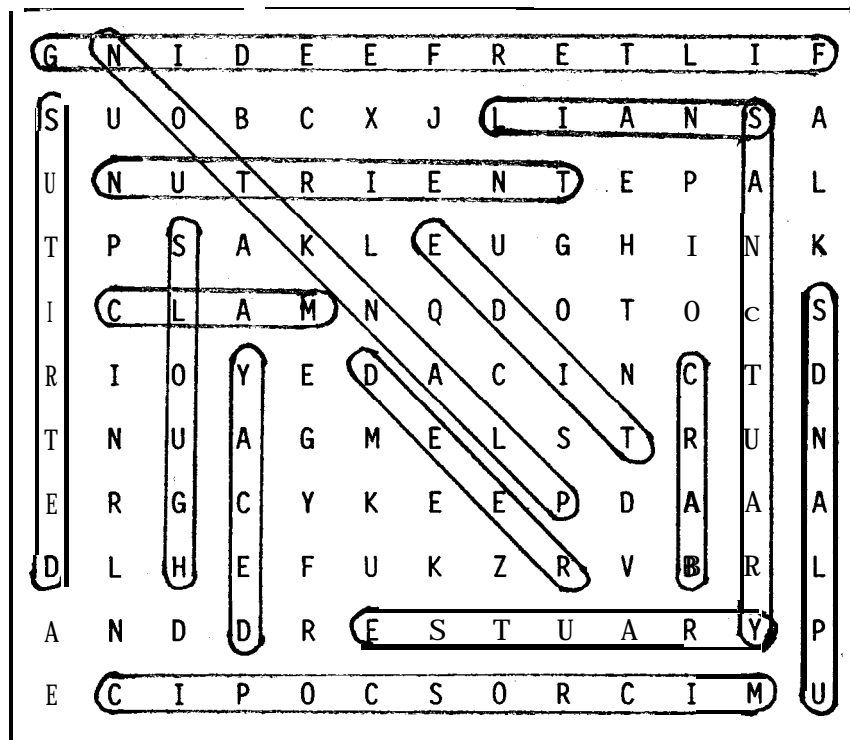
G	N	I	D	E	E	F	R	E	T	L	I	F
S	U	O	B	C	X	J	L	I	A	N	S	A
U	N	U	T	R	I	E	N	T	E	P	A	L
T	P	S	A	K	L	E	U	G	H	I	N	K
I	C	L	A	M	N	Q	D	O	T	O	C	S
R	I	O	Y	E	D	A	C	I	N	C	T	D
T	N	U	A	G	M	E	L	S	T	R	U	N
E	R	G	C	Y	K	E	E	P	D	A	A	A
D	L	H	E	F	U	K	Z	R	V	B	R	L
A	N	D	D	R	E	S	T	U	A	R	Y	P
E	C	I	P	O	C	S	O	R	C	I	M	U

KEY WORD WORD FIND (ANSWER KEY)

Find, these Key Words: decay, detritus, estuary, filter feeding, microscopic, nutrient, plankton, sanctuary, slough, tide, uplands.

Bonus: the names of four other animals you might see on your visit to South Slough are also included.

Answers - snail, clam, deer, crab



THE EXPEDITION GUIDEBOOK

As a class, read the opening letter to the Expedition Guidebook, page 24. This will set the scene for your preparatory work with the key words and their definitions. It will also introduce the question-construction tasks which need to be completed before your on-site visit.

After reading the opening letter together and introducing the key words, divide the class into groups of 6-8 students each. The groups should be arranged in such a way that the members are compatible, and strengths and weaknesses are evenly distributed.

As a group, ask students to look over the directions for numbers one and two on Outpost One. Instruct each student to answer number two on some scratch paper as a practice. Each student should decide what the best question might be before comparing questions with group members. After a few minutes, work over the first set of conclusions and a possible question out loud. Use the blackboard or overhead projector. Be sure to use each conclusion as a possible answer to test whether or not the question will work. A sample question is given in italics for each set of conclusions in your copy of the Expedition Guidebook found in this manual (pp. 24-50) These need only be used as guideline questions; students need not come up with the exact wording.

Once the best question has been formulated, each student should neatly write it into their Expedition Guidebook. Be sure to remind the students that they are only expected to figure out the best question. They should not concern themselves with any of the other information at any of the outposts or try to guess the best conclusion. The rest of the information will be needed at their on-site visit.

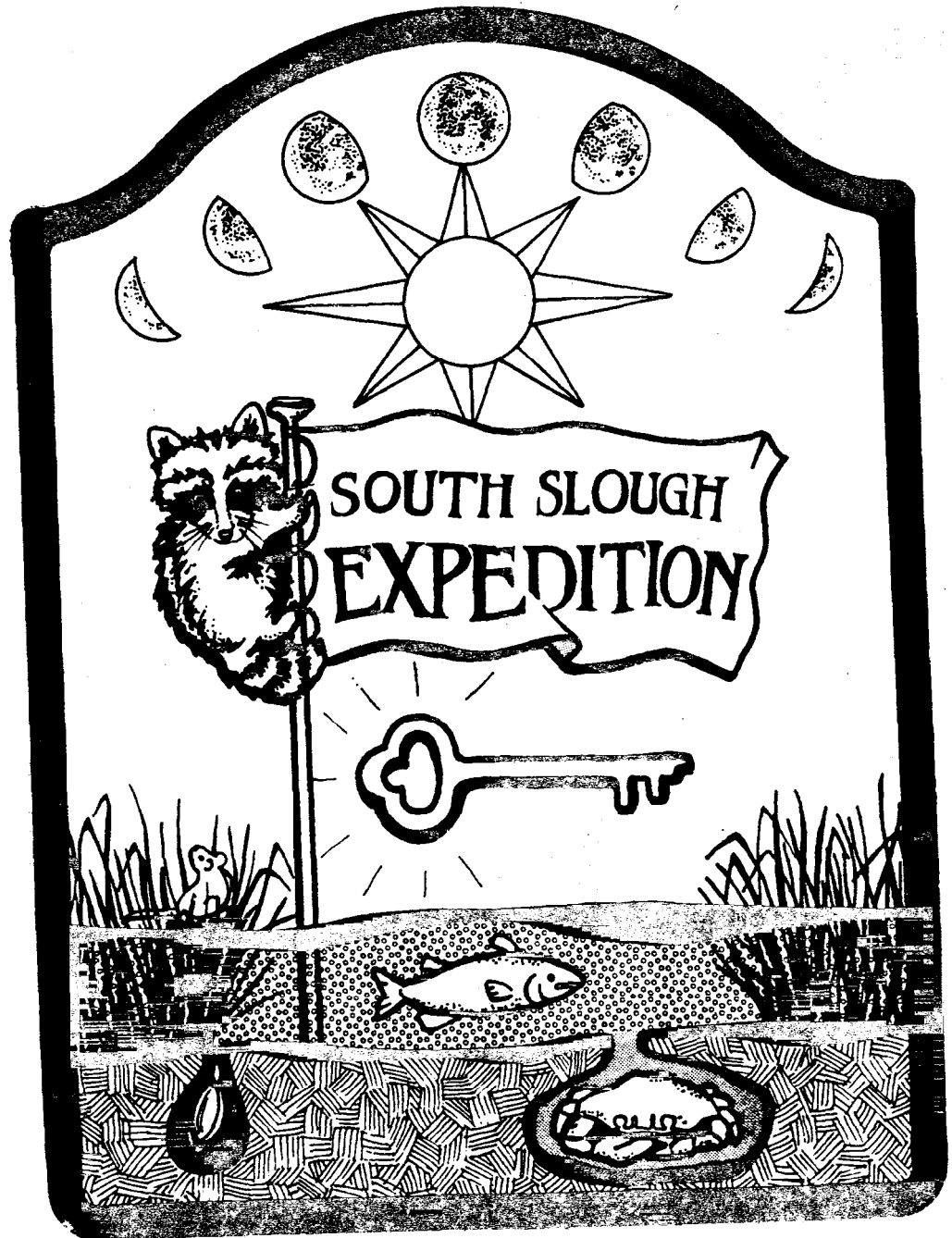
Continue the question-construction task for each set of conclusions within each of the seven outposts. Check with each group on their progress, making sure each student is thinking for himself instead of just copying down someone else's question.

Expedition Guidebook

YOUR NAME
(THE EXPLORER) _____

SCHOOL _____

TEACHER _____





VICTOR ATIYEH
GOVERNOR

SOUTH SLOUGH ESTUARINE SANCTUARY

Division of State Lands

P. O. Box 5417, CHARLESTON, OREGON 97420 PHONE 888-9015

Greetings fellow explorer!!!

It will soon be your chance to visit the South Slough Estuary and discover "The Secret of the Medallion." Before your visit, there is still some important preparation to do!

On the following pages are sets of conclusions (possible answers) which will help you to solve "the secret." Your job now is to closely look at these conclusions and discover the question that could be asked. You will do this by going directly to the marked conclusions on each page that follows. Based on each set of conclusions, what could the question be? Think carefully and then write the question on a piece of scratch paper. Double-check that your question could be answered by any one of the conclusions.

Then compare your questions with your group and teacher. Decide on the best question. On each page, neatly write each question in the blank provided under step two. Return your Expedition Guidebook to your teacher when you have finished. You will receive it just before you begin your expedition at the South Slough Estuary. It will be at the South Slough that the rest of your Expedition Guidebook will be needed.

Good luck and see you soon!

Your Expedition Guide
South Slough Estuarine Sanctuary

P.S. Please remember to put your name, school and teacher's name on the front of your Guidebook. Thank you!

OUTPOST ONE

We are standing near a point where the freshwater, draining the hills, meets the saltwater from the ocean. Before us stands the mudflats--the place where little plant growth can be seen. The mudflats are one of the estuary's natural communities.

To find the true conclusions we will need to work together. First we will use the RICHNESS TEST, then take on the DEPOSIT QUEST.

The Richness Test

Dead plants, animals and tiny bits of rock provide nourishment for living things. These are the raw materials that feed plants and animals. Other particles like sand and clay are also found in the water.

Here are the steps to follow for the RICHNESS TEST:

CONCLUSIONS

1. Read together the "A" conclusions and make up the question that could be asked.
 - 1) The estuary's waters are the richest.
 - 2) The stream's waters are the richest.
 - 3) The ocean's waters are the richest.
2. The question that could be asked is:

Which waters are the richest?

3. Shake up your freshwater sample. With the funnel, pour it into the nutrient meter bottle marked "Freshwater."
4. With the ladle, stir the estuary water in the bucket that you find in the mudflats. Pour a sample of this water into the bottle marked "estuary" and place it in the nutrient meter.
5. Shake the nutrient meter.
6. Hold the meter up to the light to see which bottle has the most nutrients.
7. Write down what you observed in the box provided.

When I looked at the Nutrient Meter, I observed:

- a. Decide which "A" conclusion is true and circle it completely.
9. Remove and save the fresh water sample from the nutrient meter.

The Deposit Quest

We will have to use our observation skills to help find the true conclusion in 1B. Here is an experiment that will help. The materials to be used are in the crate.

CONCLUSIONS

1. Read together the "B" conclusions and make up the question that could be asked.
 - 4) The mudflats are built up by the leaves of trees.
 - 5) The mudflats are built up by materials brought in by the tides and streams.
 - 6) The mudflats are built up by materials brought in by bulldozers and dumptrucks.

2. The question that could be asked is:

What are the mudflats built up by?

3. Place a piece of filter paper in the filter box.
4. Pour the saltwater through the filter. This shows a sample of the materials brought by the tides.
5. Pour the freshwater that you saved through the filter. This shows a sample of the materials in the same amount of water brought in by freshwater streams.
6. Look for the build-up of materials.
7. Make a quick search of the mudflats. Look for signs of tree leaves or bulldozer tracks.
8. Record your observations in the following box.

What did I see when I searched the mudflats?

9. Choose the true "B" conclusion and circle it.
10. Put used filter papers in the "Used Filter Paper Can."



1 THE FORCE OF THE SUN AND
MOON TUGGING AT THE OCEAN
BRINGS NUTRIENTS AND SEDI-
MENT FROM THE SEA TO THE
ESTUARY, THE FLOWING
STREAMS BRING NUTRIENTS
AND SEDIMENT FROM THE LAND,

Tides, powered by the pull of the sun and moon, carry water from the ocean into the estuary. Streams flowing from the land carry freshwater into the estuary. Sediment and nutrients are carried by both fresh and the salt water. The sediments spread out and build up the mudflats. Nutrients provide the richness which supports life in the estuary.

The Bonus Exhibit

Just like a farm the estuary is rich with many crops. In addition to the salt marsh plants that you saw in THE HOOP THROW, the estuary is also rich with eelgrass, seaweed, and tiny plant plankton.

Tiny plant plankton, or phytoplankton, may mature in the estuary in as little as two weeks. A Douglas fir tree may take 60 years to mature. Examine Pouch A for photographs of this fast-growing estuary plant.

Eelgrass is another "crop" of the estuary that grows in the mudflats near the deeper channels of the open water zone. It provides food and homes for many animals. Take a look at Pouch B for examples of eelgrass.

Seaweed is another major "crop" of the estuary. Examine Pouch C for photographs.

Mystery of the Dead Plants

The "crops" of an estuary, like salt marsh plants, die and decay. With the help of the tide, the decayed plants are mixed with other tiny plants and animals in the estuary's waters. This rich food source is called "detritus."

Here are the steps to follow for the MYSTERY OF THE DEAD PLANTS:

CONCLUSIONS

1. Read together the "B" conclusions and make up the question that could be asked.

- B
- 4) Salt marsh plants are unusual because they never die.
 - 5) Dead salt marsh plants can be found around the base of the plants, where they are later washed into the estuary as detritus.
 - 6) Dead salt marsh plants can be found washed into the upland forest.

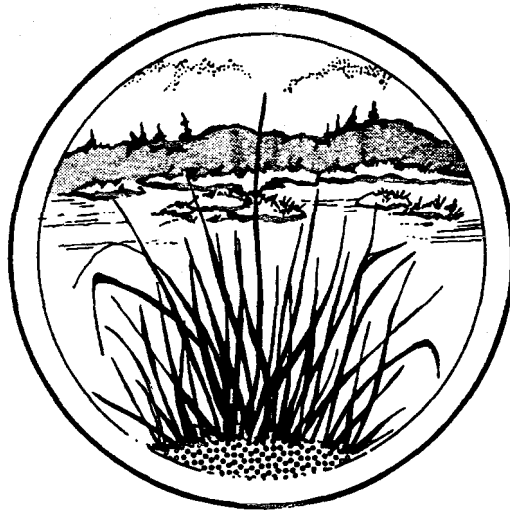
2. The question that could be asked is:

Can evidence of dead salt marsh plants be found, if so, where?

3. Look closely and touch around and under the salt marsh plants to see if any dead plants are visible. Sketch or describe what you noticed in the following box:

When I closely investigated around the salt marsh plants I saw, heard, and touched:

4. Decide which "B" conclusion is true and completely circle it.



2 AN ESTUARY PRODUCES SOME
OF **THE RICHEST** PLANT
GROWTH **ON EARTH.**

The estuary is a rich place because it produces a lot of food very quickly for the estuary's residents. Just as a farm has crops, so does an estuary. Some important estuary "crops" are plankton, algae, eelgrass, and salt marsh plants. Many of these "crops" become most valuable when they die. Their leaves decay and are washed by the tides to the mudflats and open waters to feed clams, crabs, and many other small animals.

OUTPOST THREE

Here at Outpost Three, two activities will help you to discover the next true conclusion. Let's find out about ENERGY CHAINS or WHAT'S FOR DINNER.

Energy Chains or What's For Dinner

We will need to use Problem Pouch A to solve the question of where plants and animals are getting their energy to survive.

Here are the steps to follow:

- CONCLUSIONS
1. Read together the "A" conclusions and make up the question that could be asked:
 - 1) The sun gives energy to the phytoplankton (tiny plants) which gives its energy to the zooplankton (tiny animals) which in turn is eaten by the shiner perch who gives its energy to the great blue heron.
 - 2) The salt water gives its energy to the shiner perch which gives its energy to the great blue heron.
 - 3) The air gives its energy to the phytoplankton (tiny plants) which give their energy to the zooplankton (tiny animals) which give their energy to the shiner perch which is eaten by the great blue heron.

2. The question that could be asked is:

Where do the plants and animals of the estuary get their energy to survive?

3. Read aloud the Problem Pouch cards.
4. Line the cards up in their proper feeding order. This will show us the energy chain.
5. Write or draw the energy chain in the box.

The correct energy chain is:

6. Decide which "A" conclusion is true and completely circle it.

Energy Chains or What's For Dinner - Part 2

Here's another energy chain riddle for you to solve.

CONCLUSIONS

1. Read together the "B" conclusions and make up the question that could be asked.

- B
- 4) The sun gives energy to the phytoplankton, the phytoplankton is eaten by a clam, and the clam is dug, cooked, and eaten by people.
 - 5) The sun gives food energy directly to people.
 - 6) The sun gives energy to the phytoplankton, the phytoplankton gives its energy to the zooplankton, the zooplankton is eaten by the crab, the live crab is eaten by and gives energy to the clam, and people eat the clam and get energy.

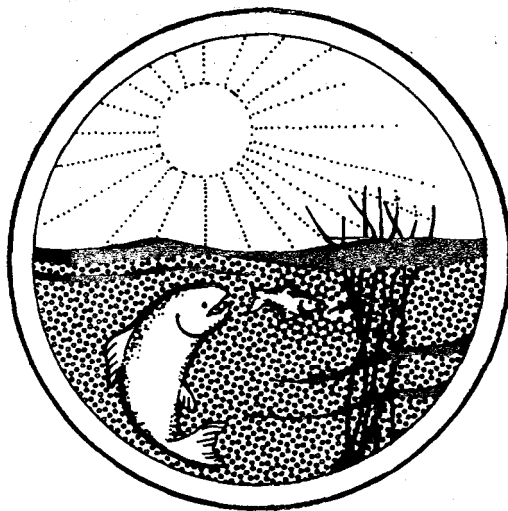
2. The question that could be asked is:

Where do the plants, animals, and visitors to the estuary get their energy to survive?

3. Read aloud the Problem Pouch B cards.
4. Line the cards up in their proper feeding order and record the correct energy chain in the following box.

The correct energy chain is:

5. Decide which "B" conclusion is true and completely circle it.



3 **THE SUN** IS THE PRIMARY
SOURCE OF ENERGY FOR THE
LIFE OF THE ESTUARY,

Only the green plants can capture the sunlight energy and convert it to a form of energy that is useful to all other life. The green plants package the sun's energy with nutrients and other materials from the air, water, and soil. This energy is passed on as animals eat the plants, and other animals eat the plant-eaters. In the estuary, two valuable packagers of sunlight energy are the tiny plant plankton and the salt marsh plants.

OUTPOST FOUR

Border Patrol

There are four natural communities that make up an estuary: open water, mudflats, salt marsh, and upland forests. Our job here is to find the borders between at least two of these natural communities.

Here are the step-by-step instructions:

1. Read together the "A" conclusions and make up the question that could be asked:

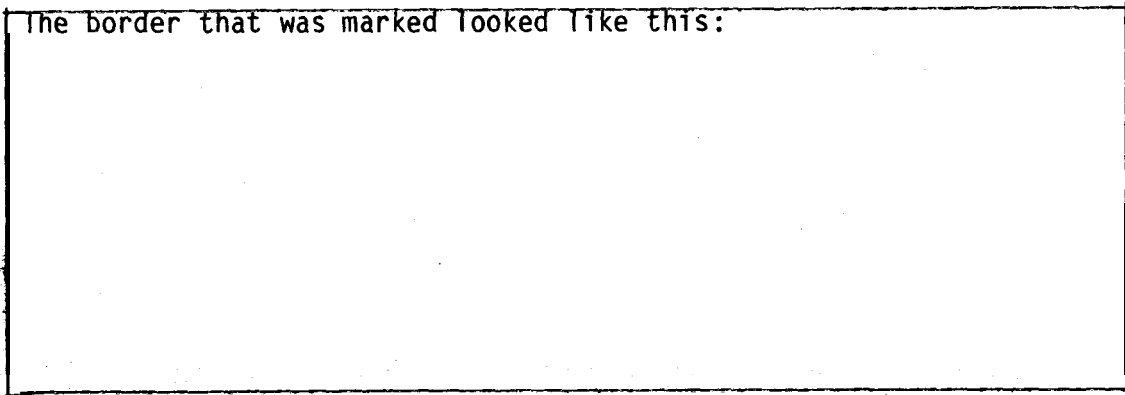
- CONCLUSIONS
- 1) The border between the natural communities of the estuary is always a straight line.
 - A 2) The border between the natural communities of the estuary is not always a straight line.
 - 3) A border does not exist between the natural communities of the estuary.

2. The question that could be asked is:

How would you describe the border between the natural communities of the estuary?

3. Take the rope from the bucket and use it to mark the boundary between at least two natural communities.
4. Fill in the following box and be sure to label each different natural community.

The border that was marked looked like this:



5. Decide which "A" conclusion is true and completely circle it.

Tide Detectives

How do we know that the tide level is not always at the present level?
Here are the steps to follow to solve the mystery of the tides:

CONC
CLUSIONS

1. Read together the "B" conclusions and make up the question that could be asked.
 - 4) The open water community moves into the mudflats and salt marshes with the tides.
 - B 5) The open water community stays in the same place.
 - 6) The open water community flows over the uplands community twice each day.
2. Make up the question that could be asked.

What does the openwater community do?

3. Look for evidence that the tide level changes from its current level and record it in the following box.

5. Decide which "B" conclusion is true and circle it completely.

CONCLUSIONS

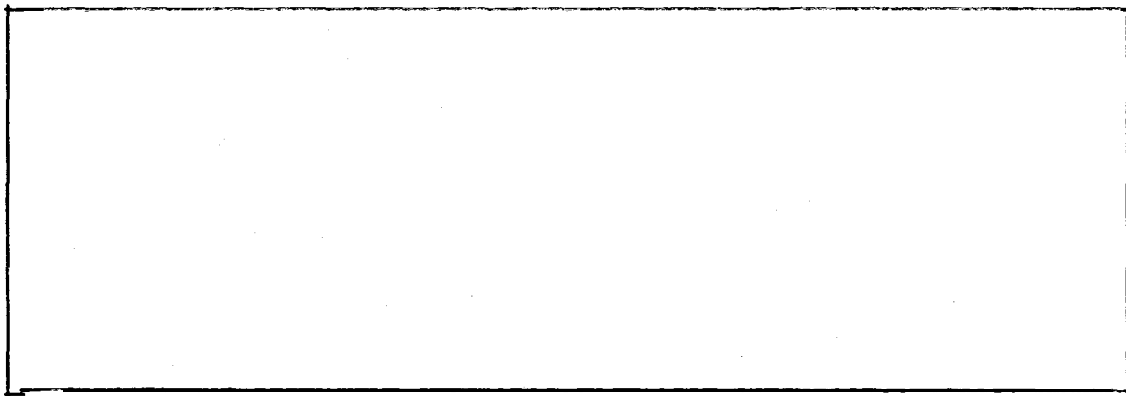
Natural Communities - Who Uses What?

CONCL US DMS

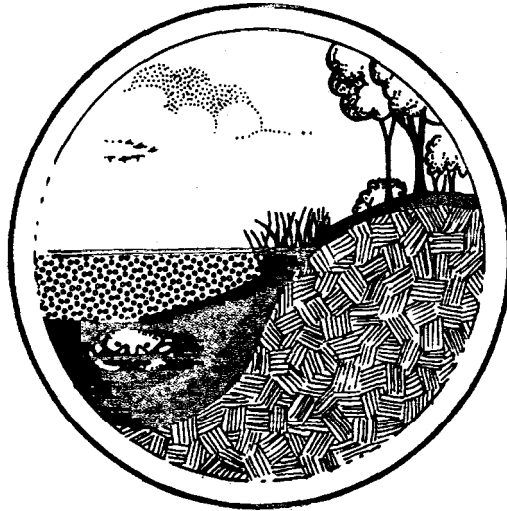
1. Read together the "C" conclusions and make up the question that could be asked.
 - 7) The animals that live in the uplands often come to the mudflats and salt marshes for food.
 - 8) The animals that live in the uplands rarely come to the salt marsh for food.
 - 9) The animals that live in the uplands often come to the salt marsh and open water, but rarely to the mudflats.
2. Make up the question that could be asked.

How do the animals that live in the uplands use the other estuary zones?

3. Pass out the Problem Pouch cards to your group and read them aloud. Show the pictures to your group.
4. Write or draw a picture in the following box about your favorite estuary animal and how it uses more than one natural community.



5. Decide which "C" conclusion is true and completely circle it.



4 AN ESTUARY IS A **PLACE** WHERE
MANY INTERRELATIONSHIPS EXIST
BETWEEN ITS NATURAL COMMUNITIES,

Separate natural communities make up the estuary. The four natural communities of the estuary are the upland forest, the salt marsh, mudflats, and open water. Each plays an important role in the estuary. The estuary could not exist without these natural communities.

Many creatures of the estuary depend upon more than one community. For example, the great blue heron feeds in the open water and on the mudflats but nests and roosts in the upland forest.

OUTPOST FIVE

Temperatures

To do the temperature experiment, you will need to take some sample temperatures and compare them with some information that has already been recorded on the "Temperature Data Board."

Here are the steps to follow:

CONCLUSIONS

1. Read the "A conclusions and make up the question that could be asked.
 - 1) The temperature of the air, water and mud is always the same.
 - 2) The temperature of the mudflats never changes throughout the course of the day.
 - 3) The temperature of the air, water and mud is different and changes throughout the day.

2. The question that could be asked is:

How would you describe the temperature of the air, water, and mud of the estuary?

3. To get started, you will first need to divide into three groups. One group will be measuring the temperature of the air, one group the temperature of the water, and one group the temperature of the mud. The mud measurement should be taken one inch below the surface. There is a special thermometer in the crate to use for each of the different areas where we will be taking the temperatures.
4. Record the temperature (F°) from your area on the Temperature Data Board and in the following boxes.

AIR	WATER	MUD

5. Fill in the rest of the data needed to complete your boxes and report your data to the rest of the group.
6. Decide which "A" conclusion is correct and completely circle it. (Consult Problem Pouch A if you need help.)

The Saltiness Experiment

Here are the steps to follow for the saltiness experiment:

CONCLUSIONS

1. Read together the "B" conclusions and make up the question that could be asked.
 - 4) The animals and plants that live in the estuary's open water, mudflats, and salt marshes must be able to live in water that is mostly fresh.
 - B 5) The animals and plants that live in the estuary's open water, mudflats, and salt marshes must be able to live in water that changes in saltiness.
 - 6) The animals and plants that live in the estuary's open water, mudflats, and salt marshes must be able to live in mostly salt water.

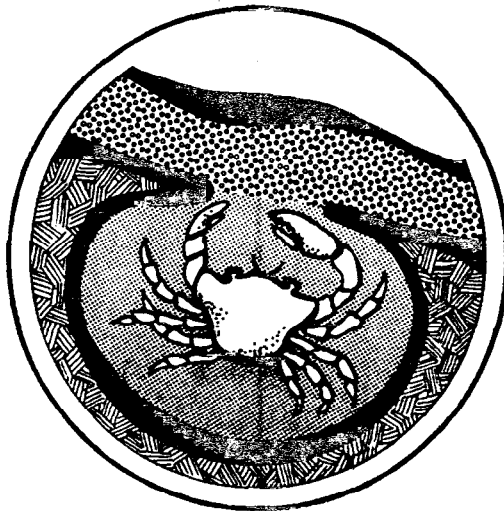
2. Make up the question that could be asked:

What kind of water must the animals and plants of the estuary be able to live in?

3. Collect a sample of estuary water using the bottle found in the crate .
4. Take a salinity reading of your sample.
5. Take a salinity reading of the sample marked "A Rainy Day in Winter."
6. Take a salinity reading of the sample marked "A Sunny Day in Summer."
7. Compare the results.
8. Record your salinity readings in the box provided.

Ocean Water	Fresh Water	Rainy Day in Winter	Sunny day in Summer	Your Sample
$\frac{35 \text{ parts salt}}{1000 \text{ parts H}_2\text{O}}$	$\frac{0 \text{ parts salt}}{1000 \text{ parts H}_2\text{O}}$	$\frac{\quad \text{ parts salt}}{1000 \text{ parts H}_2\text{O}}$	$\frac{\quad \text{ parts salt}}{1000 \text{ parts H}_2\text{O}}$	$\frac{\quad \text{ parts salt}}{1000 \text{ parts H}_2\text{O}}$

9. Decide which "B" conclusion is true and completely circle it.



5 THE PLANTS **AND** ANIMALS IN
AN ESTUARY HAVE TO SURVIVE
LARGE CHANGES IN TEMPERATURE
AND SALINITY,

An estuary is a harsh place to live.
Because both fresh and saltwater are present,
the things that live in an estuary must also
have ways of living with and without standing
water. Due to the estuary's shallow water and
its low tides, living conditions change in a
short time.

OUTPOST SIX

The Mud

CONCLUSIONS

1. Read together the "A" conclusions and make up the question that could be asked.
 - 1) There is no life in the mud.
 - A 2) There is abundant life in the mud
 - 3) There are only dead animals found in the mud.

2. Make up the question that could be asked:

How would you describe the life in the mud?

3. Place part of the mud sample in your milk carton container and using a toothpick, carefully look at the mud.
4. Use your hand lens and slowly search your mud sample. Make sure you are in a lighted area.
5. Dissolve some mud with water in the milk carton sifter, look again for life.
6. In the box below, describe or sketch the evidence that proves your conclusion is true.

In the mud of the estuary I observed:

7. Decide which is the true "A" conclusion and completely circle it.

Differences

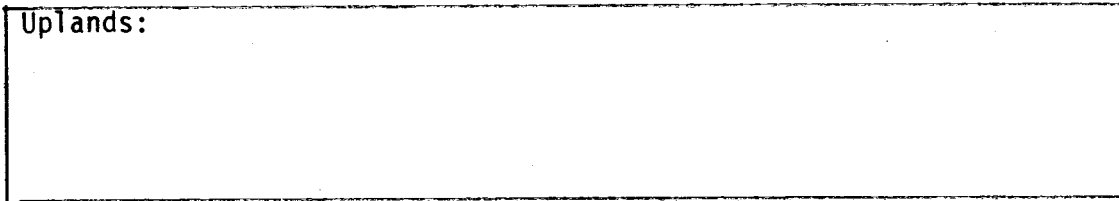
CONCLUSIONS

1. Read together the "B" conclusions and make up the question that could be asked.
 - 4) The vegetation of the natural communities in an estuary are all the same.
 - B 5) The natural communities in an estuary have the same types of vegetation, but they grow to different heights.
 - 6) The natural communities in the estuary have different kinds of vegetation.
2. Make up the question that could be asked:

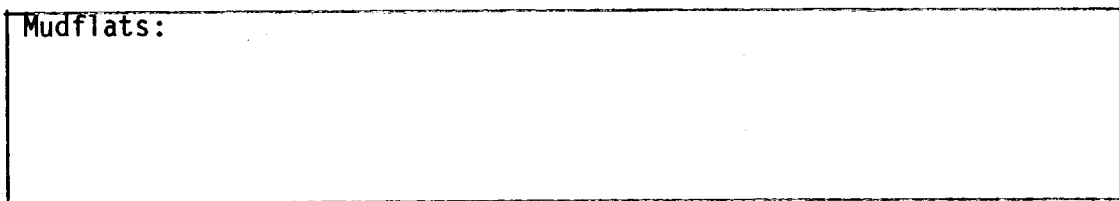
How would you describe the vegetation in the natural communities of an estuary?

3. Describe or sketch the natural communities that you see in the boxes below.

Uplands:



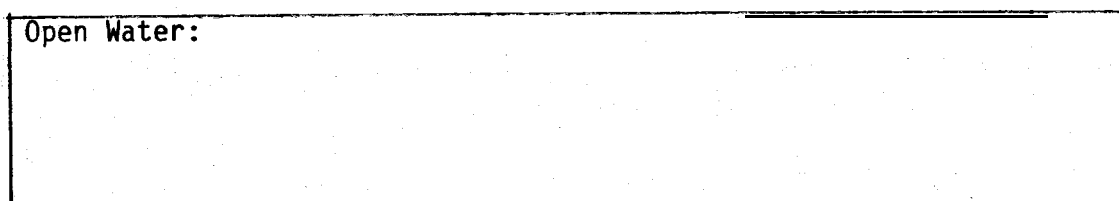
Mudflats:



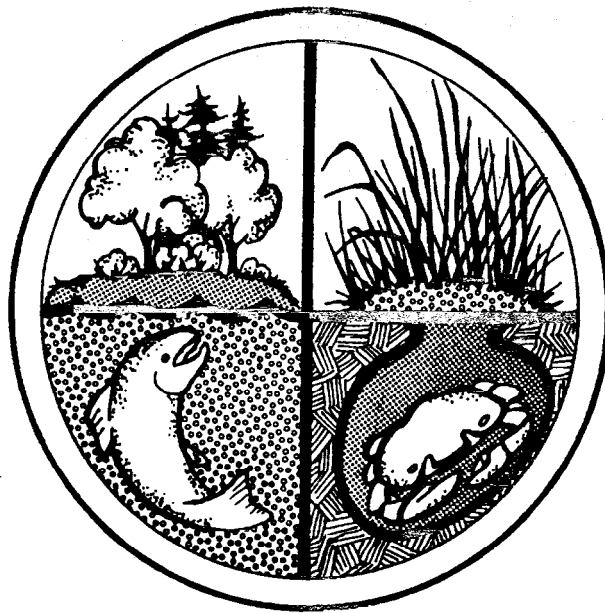
Salt Marsh:



Open Water:



4. Use your skills of observation to prove or disprove the "B" conclusions. Decide which conclusion is true and circle it completely.



6 THE NATURAL COMMUNITIES
OF THE ESTUARY HELP TO
SUPPORT THE LIFE OF MANY
PLANTS AND ANIMALS, THE
"MUDFLATS," ONE OF THE
COMMUNITIES WHICH AT FIRST
MAY SEEM TO BE LIFELESS,
ARE ACTUALLY TEEMING WITH
MANY LIVING THINGS.

Varying conditions of life, like changing water levels and temperatures, cause differences in the estuary's four natural communities -- the Open Water, Salt Marsh, Mud Flats, and Uplands. As a result, different kinds of plant and animal residents can be found in each of the four communities.

OUTPOST SEVEN

Changes - Part 1

CONCLUSIONS

1. Read together the "A" conclusions and make up the question that could be asked.

- A
- 1) People have never changed the South Slough area.
 - 2) People have permanently destroyed the South Slough area.
 - 3) People have made some changes at the South Slough area.

2. Make up the question that could be asked.

How have people changed the South Slough area?

3. Look for evidence of people changing the South Slough area and record your evidence in the box below.

4. Check Problem Pouch A for extra help.
5. Decide which "A" conclusion is true and circle it completely.

Changes - Part 2

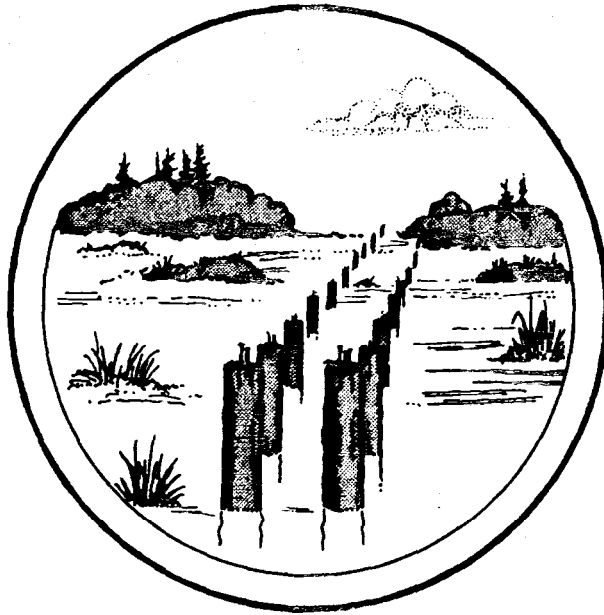
CONCLUSIONS

1. Read together the "B" conclusions and make up the question that could be asked.
 - 4) The natural communities of an estuary change with time because of man and nature.
 - 5) The natural communities never change.
 - 6) The natural communities only change because of people.
2. Make up the question that could be asked.

How do the natural communities of an estuary change?

3. Look for evidence that nature changes the communities of the estuary. Record your data with sketches and/or descriptions in the box below.

5. Check Problem Pouch B for extra help.
6. Decide which "B" conclusion is true and completely circle it.



7 THE **FORCES** OF MAN AND
NATURE **COMBINE** TO BRING
CHANGE TO THE ESTUARY,

Forces are always working to bring change to the estuary. These forces may take the form of waves, tides, storms or the slow building up of the soil by plants. Changes can also happen through the blades of bulldozers, the whizzing bite of saws, or the scrape of a dredge. Change will always occur, through the actions of both man and nature.

The Secret of the Medallion is: _____

In my own words, this is what the Secret of the Medallion means: _____

These are some other things I would like to know about estuaries: _____

TASK CASK

This opaque cask contains slips of paper describing several small tasks that can be taken on by volunteers. These tasks require simple research, looking in an encyclopedia, or asking parents or others back at home. Some of the tasks help "troubleshoot" your on-site visit.

- Find a tide chart and look up the high and low tides for the day of your visit to the estuary. Announce to your class what the tide height will be when you are at the South Slough. When using the Humboldt Current tide chart, add 30 minutes to the low and high tide readings to get the South Slough tides.
- Find out who uses the waters of the Coos Bay Estuary and report this to your class. Think about recreational and commercial use.
- Call the recorded phone message for Coast Guard weather information.
- Use a Radio Shack Weather Cube to keep track of the weather forecast five days before your field trip.
- Pick up or send away for the South Slough-related pamphlets at the Coos Bay Chamber of Commerce or Oregon Department of Fish and Wildlife.
- Check newspapers for articles on the South Slough or other estuaries.
- Make sure that everyone has a nametag and writes his or her name neatly with a permanent marking pen. If it is a "wooden cookie" name tag, make sure first names are on both sides, nice and BIG and in very readable writing.
- Make sure everyone brings his or her map, Expedition Guidebook, and a pencil. Double check to see that all your classmates have completed possible questions which could be asked.
- Have the class locate the water ways on their individual maps. With a blue marker or crayon, color in the ocean, Coos Bay estuary, South Slough estuary, and the fresh water creeks. LABEL the South Slough.
- Think up some ideas of your own. The Estuary Study Program coordinator would love to hear your ideas.

THE VERY IMPORTANT SOUTH SLOUGH VISIT CHECKLIST

- Letter home to parents informing them about the on-site visit and need for a sack lunch - Have you sent it out yet?
- Lunches and Drinks - Try to get donated apple cider (in the plastic jugs) to heat up at lunch and/or the end of the expedition. Round up day-packs so all the gear (especially lunches) can be carried on student and volunteers' backs. Hand bags or sportsbags are not suitable.
- Clothing - Have you made the proper threats, i.e., shown them what they will wear from Lost and Found if they don't borrow warm, layered clothing? Consider having a dress rehearsal one day before. Insist on warm clothing and then another sweater. The wind can really blow down at the slough.
- Boots - Have you stressed the importance of their trying to borrow some rubber boots or bringing an extra pair of shoes to change into after the visit to the slough?
- Hat - Have you insisted on hats and explained how over 50% of one's body heat escapes out of the top of one's head? Have you said that hats will be their "ticket" on the bus?
- Rain gear - Have you emphasized that if they bring rain gear it will probably be good weather, but if they don't it might RAIN? Be ready to cut up plastic garbage bags for rain gear.
- Safety - Have you gone over some field trip and trail safety tips (especially after your on-site training)?
- Groups - Are students in compatible, cooperative groups, and have they picked an estuary word for their group name?. (Please avoid activity titles or estuary zones for group names. Thank you.)
- Nametags - Are your nametags ready, with first names filling up the entire nametag? Are first names on both sides? Did you use a permanent marking pen? Are the names very legible?

THE DAY OF THE VISIT

Page through the Expedition Guidebooks, reminding students what data they will be collecting and where the spaces are that need to be filled in during the on-site visit.

Neatly place all posters maps and other items back into the Expedition Crate. Load the crate on the bus.

When you depart for the slough, make sure you have:

- 1) Expedition Crate
- 2) Expedition Guidebooks with constructed questions neatly written after each set of conclusions. Student name, teacher, and school should be on the outside of the guidebook.
- 3) Student maps
- 4) Pencils and extra sharpened pencils
- 5) Hats and raincoats (and plastic garbage bags and scissors to make emergency raincoats)
- 6) Rubber boots
- 7) Lunches, including apple cider by the gallon in plastic jugs
- 8) Nametags with students' names printed neatly on both sides (use permanent marking pen)
- 9) Daypacks
- 10) Students

When you get off the bus at the slough:

- 1) All hats and raingear, boots, and lunches go with students in daypacks.
- 2) All Expedition Guidebooks, pencils, and student maps should be in each student's hand. Be ready to do some mapping adventure activities on the way down the trail.
- 3) Students should know their group name as well as their group members.
- 4) All nametags should be worn on the outside and visible the entire day.

ON-SITE
EXPERIENCE

ARRIVAL ON-SITE

When the Level II students arrive on-site, the expectations have been set. They know they will be trying to find and prove the right conclusions which will help them unlock the secret. The "expedition" theme has caught their attention and built up some excitement. The expedition crate and all its contents have done the job of preparing them.

The bus stops partway down the hill, above the bus turnaround. Here the coordinator boards the bus, introduces himself, and welcomes the class to the South Slough. Some last minute reminders are given, some introductory remarks are made and with pencils, Expedition Guidebooks, and maps in hand and lunches on their back, the class heads out to the Viewpoint. There each group acquires a different-colored flag that serves as their banner for the hike to the Lookout.

OVERVIEW OF THE CONCEPTS REVIEWED AT VIEWPOINT

1. An estuary is connected to the ocean.
2. An estuary is where salt and fresh water mix.
3. Estuaries are protected from the large waves of the ocean, and they are rather shallow.
4. Life in the estuary is concentrated in four tones: uplands, salt marshes, mudflats, and open water.

HIKE TO THE LOOKOUT

After map exercises and a review of the main concepts at the Viewpoint, the coordinator leads the class to where the narrow trail down the slope begins. He tells the students that the expedition will start at the bottom of the hill and that first they must venture through the uplands area. "Some of these areas are cleared of trees from recent logging," he says, "but as we get closer to the shore we will again see the forest."

"Well," he concludes, "we have an expedition to go on. We need to figure out the Secret of the Medallion. We'd better be on our way."

Staying in their groups, they hit the trail. The pace is brisk so as to keep the travel time to a minimum, but the trail is winding, with bridges and catwalks. All this makes for a fun walk. Small signs along the way call attention to interesting things. The last stretch, "The Tunnel Trail," is several hundred feet of twisting, tight pathways, sometimes completely grown over above their heads. Suddenly the Tunnel Trail opens out to a large overview in a group of trees just above the estuary's shore. It's their first close-up view of the slough and the unexpected scene is striking.

EXPEDITION ROUTES TO THE OUTPOSTS

Upon arriving at the Lookout, the central staging area for the expedition, students are instructed to find a flaghole for their flag and rally all their group's gear around it. Then they are invited to view the slough through a spotting scope, check their maps, and stop at the bathroom if necessary. After a few minutes of looking over the slough, each leader seats his group together around their flag. When their attention is focused, the leader explains how the expedition will work.

"Each of your groups will embark on an expedition to find out which of the conclusions in your Expedition Guidebook are true. Let me tell you a little about this expedition, since you are all probably wondering.

"The expedition will ultimately show you the Secret of the Medallion, but it won't give it to you. No doubt about it, you must be sharp and alert and really get into it.

"To help you on the expedition, each of you will use your copy of the Expedition Guidebook. These books will help you find the right conclusions. In a sense; the guidebook is your leader and you must pay careful attention to it, always doing just what it says.

"When you have proved a conclusion true, always circle the complete conclusion and fill in the evidence you have found which proves it or disproves the others. Of course you must have some kind of evidence to prove a conclusion right--a guess will not do.

"Your group will be given an itinerary and you will start out along the expedition route until you arrive at a crate with the correct number on it. That will be your first outpost. Open your Expedition Guidebook to the same chapter as the number on the crate. It will tell you what to do next.

"When you have done everything that your Guidebook tells you and you have recorded your evidence, your group will then come together and decide, based on the evidence, which conclusions are right. If the conclusions you pick are indeed right, you will soon know one of the TRUTHS behind the Secret of the Medallion. Your leader will help you with this part. All I will say is that the right conclusions are the KEY to unlocking one of the TRUTHS and you must know all of the TRUTHS before you can figure out the Secret of the Medallion."

What is happening here is this: the kids are motivated by searching for the right conclusions and trying to find the Secret of the Medallion. In so doing, they will unlock seven main ecological principles--the TRUTHS--of how estuaries work. The conclusions are very specific in nature. A conclusion can be proved or disproved by observation, experimentation, data collecting, or simulated problem-solving. In a few cases, the information conveyed in the conclusion is abstract, beyond the general knowledge of the students, or difficult to prove through observation, experimentation, or limited data collecting (an example concerns the energy chain). Here we turn to problem-solving techniques via the Problem Pouch. There are no instructions in the Problem Pouch, only a problem that must be solved. (In the case of the energy chain, cards with information about where different organisms obtain their energy are shared. See outpost 3, p. 33.) Solving the problem is fun, and when solved, the appropriate right conclusion will be revealed.

THE LEADERS

The leaders are usually parent, adult, or high school volunteers who have been recruited by the teacher(s) involved. They have all attended a four- to five-hour leader training session at the South Slough to prepare for their facilitating role in the program.

The leaders serve as the facilitators of all the activities. They select the students to perform the various experiments and observations, assist when needed, and maintain the timing and flow of each activity. Incidentally, each activity is designed so that all students participate. Facilitating total participation is a prime role of the leaders. The leaders also make sure the students support their conclusion choices with evidence and "circle up" the group after they have completed the instructions in the Expedition Guidebook. In this circle the group shares the evidence they have gathered and chooses the right conclusions.

THE TRUTHS

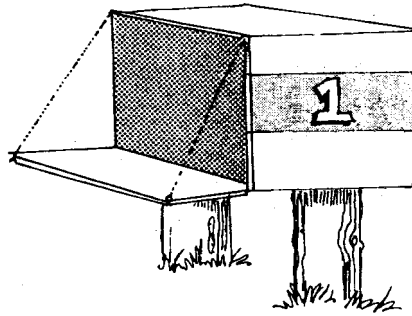
Here's how the truths are revealed. When the group has decided which conclusions are right, they look inside the crate for the Key Containers. In this crate are three opaque containers. Each container is labeled with a possible combination of right conclusions, but only one label is correct. The students pick the right one. If they are correct, there will be a key inside. They then take the key and open the lock on the small metal box inside the crate. In the box appears one of the TRUTHS. The TRUTH is printed on a pad of paper; the students tear off the top copy and read it. (Each TRUTH is illustrated with a particular symbol.) It is then placed in their Expedition Guidebook on the appropriately numbered "Truth Spot." If they are wrong (and each activity is designed to minimize this possibility), there will be nothing inside the container. The leader then helps them as they go back over their evidence.

Each TRUTH consists of a general statement and a following paragraph. The paragraph links together the segmented conclusions, experiments, and ideas into one whole, complete understanding.

The leaders, at the first activity, are the only ones that know how the keys and locks work. After that, the students catch on quickly and look forward to it.

THE CRATES

The crates serve as storage boxes for the data-gathering tools, Key Containers, and TRUTH BOX. They mark the location of each "Outpost" or station.



THE EXPEDITION

With their Expedition Guidebook, pencil, and itinerary in hand, students are dismissed by their groups to set out on their journey. The coordinator has discreetly released the group that must travel the farthest to their outpost first. Each group will stop at seven outposts or stations in all. It does not matter at which outpost they begin since they are arranged on a loop trail. The students will complete four outposts before lunch and three after lunch. A minimum of 4 hours is needed on-site to complete all 7 outposts; this includes travel time from the Viewpoint.

If there is time or a group is not finished with the equipment needed at the next outpost, groups can look for residents of the estuary. Occasionally one outpost takes a group a little more time so it is important to have "Ambulators" (short interesting activities) to do in between stations. A pair of binoculars and a scavenger hunt will be available for each group. It will be important that groups keep their pace moving fast, but that groups don't "tailgate."

Groups walk along the expedition route, soon reaching the elevated crate along the trail marked with the appropriate number from their itinerary. (Sign posts are used to distinguish the routes to the various outposts.) They then open their Expedition Guidebooks to the correct outpost for further instructions. Refer to pages 24 through 50.

THE END OF THE EXPEDITION

Upon completing all of the activities, the students assemble back at the Lookout.

"Congratulations--you have all sought out and unlocked the TRUTHS of the estuary by finding the right conclusions. These TRUTHS will now allow you to figure out the Secret of the Medallion."

The coordinator then passes out a stack of cards to each group.

"Each TRUTH has a word or words with a box around it. Write the word or words on each card. These key words, when arranged in a certain way, spell out the Secret of the Medallion.

The word combinations before rearranging:

MOON	THE RICHEST	ON EARTH	THE SUN	PLACES	AND	TO SUPPORT
		ONE OF	FORCES	COMBINE		

The secret: All the groups repeat together the secret!

"The sun and the moon combine forces to support one of the richest places on earth."

Following this, the coordinator offers a review of what they have done and what the secret means.

The Wrap-Up

This portion of the day serves as a review of what they have done. The coordinator uses the TRUTHS as a focus for the review: a symbol is placed on the map as each is recapped, the same symbol that appears on the TRUTH.

"You learned that the tide, sweeping in and out twice a day, distributes the nutrients from the streams and the ocean."
(Symbol: moon over water)

"You found that the salt marsh of the estuary produces more plant growth than any other place on earth--even our own farms."
(Symbol: salt grass clump)

"You found that the sun's energy is packaged by only green plants and then passed along from plant-eater to animal eater."
(Symbol: the sun)

"You saw that the zones or natural communities of the estuary--the open water, mudflats, salt marshes, and uplands--are all tied together by the tides and the things that live in each."
(Symbol: side view of each zone)

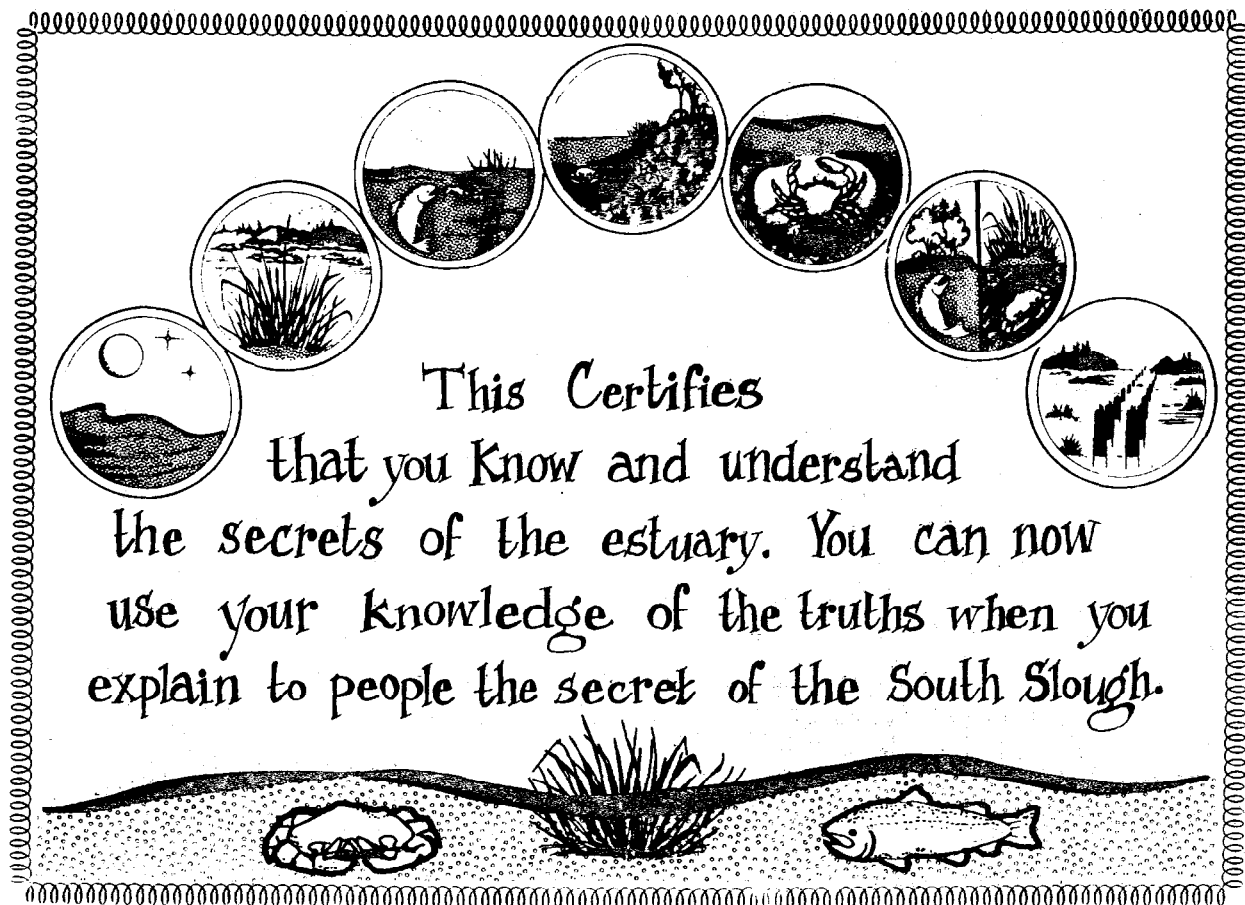
"You discovered that plants and animals are faced with harsh conditions--the temperatures, the salinity variations, the different tide levels--and that each must have ways of dealing with them."
(Symbol: crab in burrow below mud)

"You saw a variety of zones, and a large diversity in the life of one zone."
(Symbol: representatives of the different zones)

"And you saw that the work of man and nature bring change to the estuary."
(Symbol: man and water)

"Today you found the secret about estuaries that few people know. (The medallion is placed between the symbols.) An estuary is where the sun and the moon team up to create rich conditions where so many plants and animals can live and grow."

At this point the students each receive a certificate recognizing their hard work in figuring out The Secret of the Medallion.



FOLLOW-UP

THE FOLLOW-UP

These activities follow in a logical sequence from the events of the Preparation and On-site components. You are, of course, invited to create your own activities; these are merely a starter.

Classroom Sharing

When you return to the classroom, this sharing circle may be the most appropriate end to the day. The students assemble in a circle and each recites and completes this line: "South Slough Estuary was interesting to me because..." In this low-keyed way, the students can share and reinforce what they have experienced.

Also on the day of the visit you may want to provide an opportunity for the students to share, in their own words, some of the things they've learned.

The Secret of the Medallion

Review, outpost by outpost, the activities that took place at the slough. Ask students to paraphrase the correct conclusions and the truths. Discuss their evidence and why it proves or disproves the conclusions.

Consider group reports with each group sharing information and understandings from one of the outposts. A sharing session after each report would be helpful.

After the review session, each student should write the full Secret of the Medallion in his/her own words. The students use the evidence they have collected and their Expedition Guidebooks to help them.

The Expedition Report

A Parent's Night is organized where the students report on their expedition to the South Slough. The teachers or one of the students can narrate a slide show.

Model Estuary or Large Map

The students build their own model (using paper mache, plaster, or other materials), or draw a large map. On it, they color-code the natural communities and label the model or map with the medallion's secret.

State-Wide Involvement

Having the students write a report to the Director of the Division of State Lands, the governing state agency of the South Slough Estuarine Sanctuary. In it they can describe the importance of the slough, the sanctuary., and their field trip. The address is Division of State Lands, 1445 State Street, Salem, Oregon 97310,

Other Kinds of Estuaries

You may want to present a lesson on other types of estuaries, like "blind estuaries," "bar built estuaries," and "drowned river estuaries." The following reference would give you some of that information.

Habitat Classification and Inventory Methods for the Management of Oregon Estuaries, Vol. 1, by the Oregon Department of Fish and Wildlife.

Check your school and city libraries for this reference and others about estuaries.

Taking the Conclusions Home

Have your students take their completed Expedition Guidebooks home and test their families on their knowledge of estuaries.

Mini Research Topics

Students choose (or draw out of a hat) a topic. They then write a simple research report and present their information to the class. Topics include:

diatoms
raccoon
striped bass
clam digging
aquaculture

dinoflagellates
harbor seal
barnacle
oyster farming
commercial fishing

algal bloom
coho salmon
ghost shrimp
locations of other
Oregon estuaries

Field Trips

- visit the oyster farm in Joe Ney Slough.
- bring parents and friends to the South Slough.
- visit a nearby pond, lake, freshwater marsh or seashore and compare it to the estuary. Design a set of conclusions and try them out on a younger grade.

Films

You may wish to look for these and other estuary films at your County Education Service District or local School District Film Library. Be sure to check for appropriate audience designation and to preview your films. If a film is too technical, you may want to show only part of it.

Bay of Fundy

Estuary: Columbia's Link with the Sea

Ecology of a Tidal Slough

Other Places to Look for Appropriate Films:

Film Title:

Mailing Address:

Estuary

Modern Talking Pictures
5000 Park Street North
St. Petersburg, FL 33709
(813) 541-5763

Estuary: Columbia's Link
with the Sea

Your coastal county marine extension
agent's office (if in Oregon), or the
Portland State Film Library
P. O. Box 1383
Portland, OR 97207
(503) 229-4890
rental fee--\$5

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Additional Resources

At the present time, there are very few west coast-oriented estuary audiovisuals, especially at an elementary level. Three persons who could keep you posted on the latest material would be:

Title

Address

Education Specialist

Oregon State University
Marine Science Center
Newport, OR 97365

Information and Education
Specialist

National Oceanic and Atmospheric
Administration
11400 Rockville Pike
Rockville, MD 20852

Education Specialist

South Slough Estuarine Sanctuary
P.O. Box 5417
Charleston, OR 97420
(503) 888-9015

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We welcome your follow-up IDEAS! Please share any ideas with us in writing. Thank you for your interest and participation.