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# The Lore of South Slough

LEVEL III

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# The Estuary Study Program

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Coordinator of Outdoor Education  
for  
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JOHN GARNER

Education Specialist  
for  
South Slough Estuarine Sanctuary

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\*\*\*

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\*\*\*

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## "THE LORE OF SOUTH SLOUGH"

### -A TEACHER'S GUIDE-

Your students are about to embark on an exciting adventure in learning at the South Slough Estuarine Sanctuary. 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 is the enthusiasm and excitement which accompanies it. At the South Slough, learning is fun and full of adventure, and you are invited to join in. This booklet will briefly explain the program and your suggested roles. Please read it over carefully as soon as possible for your preparation materials will be coming shortly.

### 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 visit the South Slough Estuarine Sanctuary. The preparation materials, on-site experiences, and follow-up activities are aimed at the following supporting goals:

1. A thorough understanding of what an estuary is
2. Knowledge of why an estuary is important
3. Knowing that estuaries change because of natural processes and man's use

## ASSUMPTIONS ABOUT AGE LEVEL

- + The need for an organized learning pattern.
- + The ability to comprehend more complex terms and concepts.
- + The ability to gain and communicate a higher level of conceptual understanding than Level II learners.
- + The ability to research, collect and interpret data to reinforce concepts.
- + The need for independence in completing projects (with guidance from teachers and group leaders)
- + The ability to illustrate abstract concepts and ideas in a concrete and visual representation.
- + The ability to read and comprehend written materials.
- + The likelihood of being captivated by participating in independent projects, exploration, and searching for the unknown.

## KEY UNDERSTANDINGS OF ON-SITE EXPERIENCE

"AN ESTUARY HAS BOTH HIDDEN AND OBVIOUS RICHES: YOU CAN'T TAKE ONLY ONE OF THE RICHES WITHOUT AFFECTING THE OTHERS."

## SPECIFIC LEARNING OUTCOMES OF ON-SITE EXPERIENCE

1. The South Slough Estuary is rich in natural and human history.
2. In seeking the riches of South Slough Estuary, people have brought about change.

3. The South Slough Estuary is valuable to us in its natural state.

## PREPARATION MATERIALS

These materials are designed to provide the necessary information to prepare your students for the on-site and follow-up experiences. The learning experiences in "The Lore of South Slough" have a dual thrust -- learning the natural and cultural heritage of the South Slough and interpreting it to peers, parents, and the public. The students will take on the role of investigative reporters and journalists to gather all the facts, and then as the followup, they will use their information to make displays, exhibits, special edition newspapers, or similiar projects. This guide will explain more details later.

## SETTING THE STAGE

The stage is set for the project when an offical looking letter is opened and read to the class. The letter is from the manager at the South Slough Estuarine Sanctuary and it invites the students to take part in their public awareness program. It goes on to tell a brief history of the Sanctuary, as well as introduce a little about the importance of estuaries. Finally, it tells why their help is needed -- to help people become more aware of estuaries and how they are important to our lives. They are told that a set of special materials will soon be sent to them. The preparation materials focus upon building a information base of the natural history of South Slough. In addition, they will generate excitement



about the cultural history. In the on-site experience, they will then carry that interest and dig deeper into the cultural history of the South Slough, although knowledge of the natural history will be reinforced as well. But, before the preparation materials arrive, you have an important role in organizing your class to receive them.

### ORGANIZING THE CLASS

After the letter has arrived and has been read, fill your students in on the details of their involvement. They will take on the roles of investigative reporters and journalists to gather information about the South Slough's natural and cultural history. They will then use this information in a class project that will enable them to share their knowledge with others. Here are some potential class projects:

- + produce a one page flier, brochure, or poster on a topic of interest
- + write and publish a "Special Edition Newspaper"
- + create a wall display or showcase exhibit that can be in public viewing at their school, the sanctuary's interpretive center, the public library, a mall, or other suitable location
- + write and put on a play
- + put together a slide show about the South Slough and show it to a parent-teacher organization, garden club, businessman's luncheon, or Rotary Club
- + present a "Living History" experience to younger grades

Choose the class project before the on-site experience and their information gathering at the South Slough will be more focused.

## THE STUDENT ROLES

Of course, all of the students have different skills, so the challenge is to divide the labor in such a way that each student contributes something. The final organization of your class depends on the project they choose and is essentially up to you, but here are some suggestions.

Dividing the Labor -- The class can break up into various data-collecting roles. These might include writers, artists, photographers (if cameras are available), and sound engineers (if tape recorders are available). They must be ready to take in the information presented in the preparation materials and also the information presented on site. Their main learning tools will be a notepad, so each student should prepare a special notepad.

Forming Teams -- Ultimately, it will probably be helpful for the students to work in teams to prepare the final projects, but the teams need not be formed until after the preparation and on site experiences have occurred.

The Trunk -- The preparation materials will arrive in an antique-looking steamer trunk. It can be opened and the contents can be inspected by all. It will hold various cultural and natural artifacts and is topped off by a Natural History Portfolio filled with folders. Each folder describes one aspect of the slough's natural history and is keyed to several artifacts that appear in the trunk. They help to "bring alive" the natural history information the students will study during their preparations. Each folder contains text about the subject, illustrations, and key vocabulary words.

Using the Portfolio -- Working in five to seven teams, notebooks in hand, the students can gradually work through all of the folders. This may take several time periods over the course of two or three days. When a group is finished with one folder, they can turn it in for another, or exchange it with another group. For a fun twist, you might ask each group to come up with and turn in three quiz questions. You could then arrange a fun quiz on the materials using their own questions. (It is suggested that the quiz idea be used only as a fun reinforcement of knowledge gained and not as a threatening measurement of knowledge gained) OR, each team reads one folder carefully and uses the artifacts to present the material to the rest of the class. Again, use of notebooks should be stressed and the fun quiz can also be given.

## THE NATURAL HISTORY PORTFOLIO CONTENTS

"South Slough - A Sanctuary within an Estuary"

-introduces estuary, slough, and sanctuary, and describes South Slough's relationship to its surroundings

"Water, Mud, Grass, and Forest"

-overviews the natural communities of South Slough

"Links to the Sun"

-describes the flow of the sun's energy through food chains

"The Tide "

-tells the role of the tide in distributing nutrients in an estuary

### "Shells, Burrows, and Salt-Safe Shells"

-reviews the harsh conditions that are faced by the life of an estuary and presents some examples of how the plants and animals survive

### "The Estuary's Crops"

-describes why an estuary is one of the most productive places on earth and reviews the "main crops" of the South Slough

### "Visitors to the South Slough"

-presents a few examples of the birds and fish that visit and depend on South Slough

## THE CULTURAL HISTORY ARTIFACTS

These items in the trunk can be displayed, examined, and conjectured about prior to the visit to the Slough, but the lore behind them will not be revealed until on site.

The next section offers some specific ideas and guidelines for the follow-up project.

## PLANNING AND ORGANIZING YOUR CREATIVE COMMUNICATION PROJECT

The value of this follow-up project is threefold:

+ it allows your students to apply their knowledge and new understandings that they learned during their preparatory and on-site experience

- + for the student it is more than an exercise - it allows students to learn and apply newly learned skills to a real life situation
- + the students will make a valuable public contribution to the South Slough Sanctuary and its public awareness program.

Following are some simple steps and hints that will help you organize your class's follow-up project:

- I. BEFORE THE ON-SITE EXPERIENCE
  - A. Decide upon a method of communication
    - a news publication, display, presentation?
  - B. Identify the different jobs needed to produce your project
- II. AFTER THE ON-SITE EXPERIENCE
  - A. Make an outline of topics that will communicate the class's understandings and impressions of the South Slough's cultural and natural history
  - B. Establish a production timetable
    - 1. Estimate the number of days needed to complete the project
    - 2. Establish times for planning meetings, and project production
    - 3. Share progress reports and update the timetable as the project proceeds
  - C. Make job or "staff" assignments and organize work groups

PRODUCTION HINTS

1. Ensure total group participation.
2. Make sure that the project's final product is simple to produce.
3. Come up with communication ideas that have impact:
  - fun facts or unusual artifacts that will arouse curiosity
  - novel headlines, unusual pictures, or provocative statements that will hook your audience's interest
4. Enlist the support of parents, community businesses, and school staff for resources, skill training, or free production materials.

## OVERVIEW OF THE ON-SITE EXPERIENCE

By now, you may already be familiar with the events of the onsite experience. Here is a quick overview.

### THE MODEL

Using a model of the South Slough and help from volunteers, a leader demonstrates the estuary's shallowness, shelteredness, and its connection to the ocean. The four natural communities they have learned about are pointed out. The students then view the estuary for themselves. (In case the model is not available a large scale map will be used.)

### THE GOURMET COOK

A gourmet cook will introduce the students to one of the key meals of estuary inhabitants -- Estuary Soup. In this fun, theatric presentation they will learn the importance of the micro-world of the estuary.

### THE TRAIL OF TIME

The students will then step back in history to meet the folks that settled in the South Slough area many years ago. In small groups they will rotate among six characters that have lots of stories to tell about the riches that South Slough provided them. With cameras, tape recorders, and notebooks in hand, the students gather the facts.

THE EXPLORATIONS

Following a lunch break, the students embark on a series of explorations to find evidence of the historic uses of South Slough. In the last portion of the experience, they share their findings with the group.

FOLLOW-UP

The featured follow-up experience will be completing the project they have chosen to undertake. Because of the magnitude of this project you may not have time to pursue other activities, but just in case here is a list of ideas.

SUPPORTING FOLLOW-UP IDEAS

- 1. Investigate, as a class, the early history of Coos Bay, North Bend, or whatever community your school serves.
- 2. Have each student trace their own personal family tree to find out what their ancestors were doing around the turn of the century.
- 3. Recreate the artifacts or food gathering implements of the early settlers or Indians.
- 4. Research the history of the local Indian tribes.



## III

## PREPARATION MATERIALS

CONTENTS

- LIST OF ARTIFACTS FOR  
NATURAL HISTORY PORTFOLIO
- LIST OF CULTURAL HISTORY  
OBJECTS INCLUDED IN THE  
TRUNK
- THE COPY FOR THE NATURAL  
HISTORY PORTFOLIOS



VICTOR ATIYEH  
GOVERNOR

## SOUTH SLOUGH NATIONAL ESTUARINE SANCTUARY

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### *Division of State Lands*

P.O. BOX 5417, CHARLESTON, OREGON 97420 PHONE 888-5558

Dear Friends,

I am pleased to invite your class to take part in the South Slough Estuarine Sanctuary's public awareness program. The sanctuary has a long history of devoted public effort leading to its establishment.

The South Slough is the first sanctuary of its kind in the nation and has served as the prototype for similiar estuarine sanctuaries scattered along the American coast. The idea of making part of South Slough a sanctuary originally came from a group of neighbors in the Charleston area. With the help of state and federal officials this idea resulted in the formation of the sanctuary in 1975. Today, some 4,300 acres of land and water make up the sanctuary.

An estuary is a very important ecological system. Estuaries are formed where a river meets the sea, and this shallow, sheltered environment is rich with life. Many of the fish harvested by the boats at Charleston depend upon the estuary in one way or another. Even though it is a part of the Coos Bay Estuary, South Slough is relatively undisturbed by the activities of people.

Why do we need your help? You are invited to help explain and interpret the lore of South Slough - from both an historical and ecological point of view. The result of your work will help people become more aware of estuaries and their value to our lives and the lives of people before us.

Within a week, you will receive background materials that we have compiled for you. We are now making arrangements for your visit to the South Slough, and we look forward to your involvement and dedication to this project.

Sincerely,

Sanctuary Manager

Following is a list of numbered artifacts, keyed to the Natural History Portfolio:

1. An aerial photo of Coos Bay
2. An acetate overlay showing South Slough Estuarine Sanctuary
3. A map showing all of Oregon's estuaries
4. The human community comparison poster from Level II
5. Natural communities of Oregon poster from Level II
6. Photograph of Harbor Seal
7. A photograph of the mudflat mud
8. Salt grass and pickleweed specimens in clear container
9. Photo of Great Blue Heron rookery
10. Algae Specimen
11. Photograph of Great Blue Heron
12. Clam Shell
13. Can of Campbell's Clam Chowder
14. A crab molt
15. A flask of rich forest soil
16. A photo of the moon
17. A tide chart
18. A sack of bean bags labeled "Estuary", "Cornfield", "Wheatfield", "Forest", and "Desert" with filled ratios of 10, 5, 5, 2, 1.5, and .5 respectively.
19. Large-scale photographs of phytoplankton
20. Photograph or small jar of eelgrass
21. Oyster shell or shells glued together
22. Barnacle
23. Crab imbedded in plastic
24. Lugworm imbedded in plastic
25. Photo of a Caspian tern
26. Skull of a salmon's head
27. Diagram of a Salmon's lifecycle

These items might also be in the trunk and they set off wonder and curiosity about the slough's history:

- + historical photographs and family album snapshots
- + old maps
- + small tools with hand-hewn wood handles
- + a piece of shredded cedar bark
- + rusty railroad spike
- + square headed nails
- + a chunk of coal
- + steering wheel to a Hudson automobile
- + piece of rusted barb wire
- + a cowbell
- + bucket of clamshells
- + excerpts from diaries, log books
- + old news clippings

SOUTH SLOUGH:  
A SANCTUARY WITHIN AN ESTUARY



## SOUTH SLOUGH - A SANCTUARY WITHIN AN ESTUARY

Natural Treasures of the Earth

If you were to sit down and spread a map of the world out in front of you, then pin-point what you thought were the three or four most amazing natural treasures on earth -- what would come to mind???

The Himalayas - the roof of the world with mountains towering to 29, 029 ft.!

The Amazon River - the world's longest river stretching 3000 miles long!

The Grand Canyon - a mile deep cut out of the earth's surface -- gouged by the force of river water over several thousands of years!

Mt. St. Helens - the volcanic mountain not far to the north that blew up with a force equal to 500 atom bombs!

Now, take a moment and consider a natural treasure on earth that you may never have heard of, but almost sits in your backyard -- the ESTUARY.

- + Its waters and surrounding shorelands provide resting spots for 1000's of birds who make their transworld migrations twice a year.
- + Its sheltered waters provide a protected cradle for young fish preparing for their life at sea.

+ 65% of the harvested seafood like salmon, shrimp, and oysters use the estuary sometime during their lifetime.

+ Its waters and land zones produce five times more plant (food) material than a cornfield of comparable size.

Estuaries, as you will discover, are one of the Earth's hidden treasures.

### What Is An Estuary?

Oceans, rivers, lakes, and ponds are bodies of water that are familiar to you. Estuaries are shallow basins of water that we more commonly call bays, sloughs, or inlets. An estuary is found where a river meets the ocean and where the tide mixes the fresh water from the land and salty water from the sea. Land encloses it from the sea except for the mouth which connects it to the ocean.

Artifact No. 1 is an aerial photo showing Coos Bay - a large estuary. Look at the colors of the water. Can you see the mixing of the fresh and salt water?

### An Estuary Within An Estuary - The South Slough

Coos Bay is a rather large estuary, as Oregon's estuaries go. Within it are found small arms that extend off the main bay. Another name we give for these smaller arms are SLOUGHS.

Place Artifact No. 2 (an acetate overlay showing the sloughs of Coos Bay) over No. 1. See if you can spot South Slough.

1975 marks the year the South Slough was established as a national estuarine sanctuary -- an area of refuge and protection. The sanctuary is a place where scientists can research the life of the estuary and determine its importance to oceanic life. As well, the sanctuary has been established as a place for students, like yourself, to learn about the estuary's treasures and the remarkable life the estuary supports. Check Artifact No. 2 again and see if you can find the boundaries of the Sanctuary.

### Are Estuaries Endangered ?

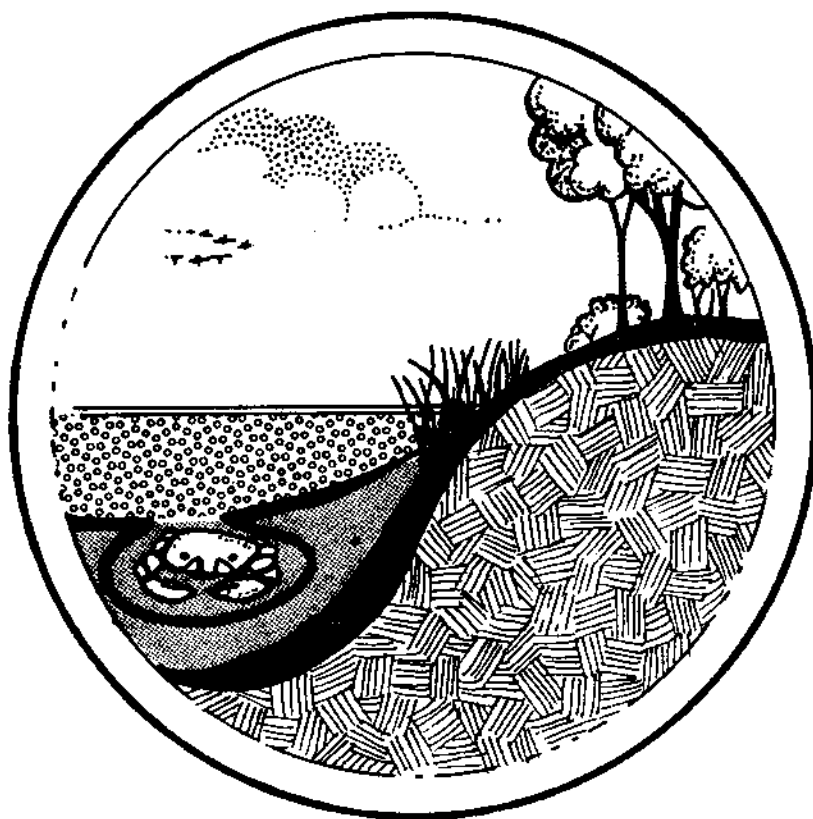
For the number of estuaries that dot the fringes of seashores around the world, the relative size of their land mass is quite small.

In Oregon, twenty-six estuaries dot the fringe of the Pacific coast and account for only one tenth of one percent of all Oregon's land. Look at Artifact No. 3 and see how the figures stack up. Check Coos Bay Estuary and see its size in relation to Oregon's other estuaries.

You will soon be learning of the estuary's other rich treasures. Keep in mind the size of land holding the treasure is not very big and special care will need to be taken to preserve the treasures.



WATER, MUD, GRASS, AND FOREST:  
A LOOK AT THE NATURAL COMMUNITIES OF SOUTH SLOUGH



WATER, MUD, GRASS, AND FOREST - A LOOK AT THE NATURAL COMMUNITIES  
OF SOUTH SLOUGH

What is a Natural Community?

You are all familiar with the idea that people live in communities. People usually live together in places where all their needs can be met--food, water, shelter, and space to carry out daily activities. Plants and animals also live in areas that provide for their needs. Look at Artifact No. 4. It shows a comparison between a people community and a natural community - in this case, a forest.

But, all is not forest. This is because from place to place there are varying conditions. The rainfall, temperatures, water types, soil types, and influences from weather and other natural forces is different from one area to another. In nature, there are hundreds of types of natural communities. These include many types of forests, deserts, grasslands, the treeless arctic, seashores, shallow ocean waters, deep ocean waters, marshes, swamps, bogs, and many, many more. Oregon has many different natural communities within its borders. Artifact No. 5 shows where large natural communities of Oregon are located.

Four general types of natural communities can be found at the South Slough. These natural communities make up the estuary.

### The Open Water

Part of the South Slough Estuary is always covered by open water. Even at the lowest tides, the deepest channels of the estuary are below sea level and remain full of water. In these channels animals and plants from the ocean live and pass through. Salmon migrate through on their way to their spawning grounds in the freshwater streams. Many other kinds of fish live in or frequent the estuary's waters. See Artifact No. 6 for a look at one of the ocean dwellers that can sometimes be seen in estuary waters. (Artifact No. 6 is a photograph of a harbor seal.)

Animals and plants of the Open Water community include plants such as eelgrass and animals like the salmon and jellyfish.

Migrating and resident birds can often be seen swimming or feeding in the Open Water.

### The Mudflats

When the tide goes out, much of the estuary bottomland is exposed. These flat areas where little appears to be growing or living are the Mudflats. Take a look at Artifact No. 7 for a close up of a section of Mudflat. (Artifact No. 7 is a photograph of Mudflat mud.)

But, this is only a first appearance. True, little land vegetation is able to gain a foothold due to the constant coming and going of the tide and the total submersion for periods of time twice daily, but many things live on and in the Mudflats. Green films of algae--tiny, one-celled green plants--can

be seen upon the surface of the mud. Crabs burrow in the top few inches and clams can be found a few feet below. There's lots more here than meets the eye--and also lots that don't meet the eye. The great bulk of the life in the Mudflats are microscopic. Tiny, one-celled animals and plants thrive in this shallow and nutrient-rich natural community. The Mudflats provide a rich food source for lots of the estuary's residents.

### The Salt Marsh

As the Mudflats are built up by layers of sediment from the tides and streams, sooner or later the level of the Mudflat becomes high enough to allow land plants to grow. Grasses and other plants then dominate. Although the area is a bit higher in elevation than the rest of the Mudflats, the upper reaches of the tide still invade the Salt Marshes occasionally. So, the plants that live here must be able to withstand the force of the tide and the saltiness of the ocean water the tide brings in. Few land plants can withstand these hardships, but Artifact No. 8 holds some that can. These plants have special ways of tolerating the harsh conditions present. They thrive where other plants would perish. (Artifact No. 8 is specimens of Salt Grass and Pickleweed in a clear container.)

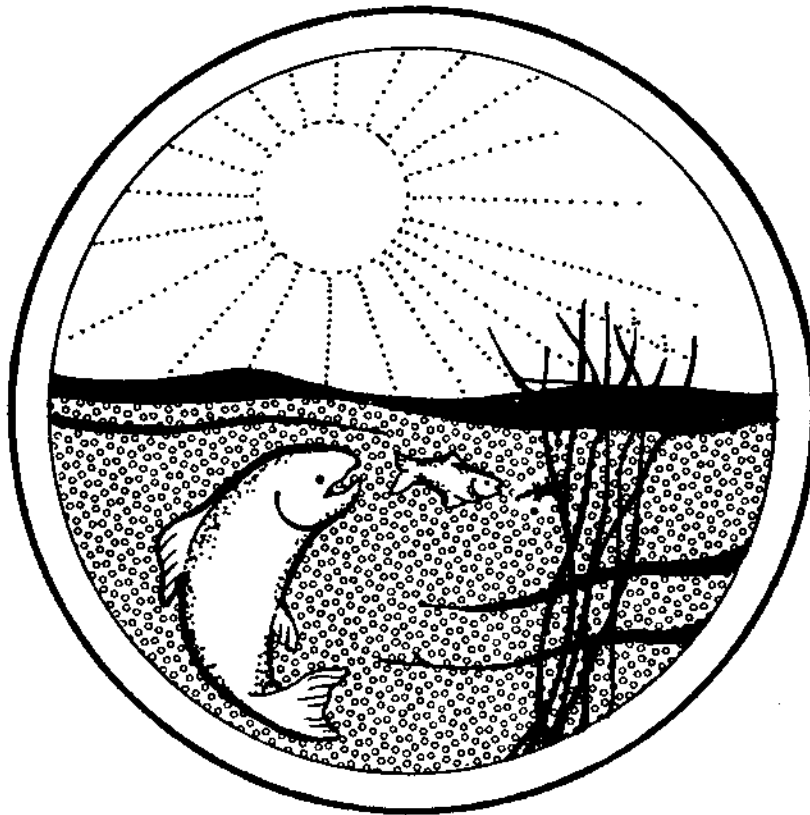
Many of the animals that live in and around the estuary depend directly or indirectly upon the plant material produced by the Salt Marsh.

### The Upland

As the elevation surrounding the estuary rises above the level of the tides, the Uplands community begins. Here, safe from the tidewaters, trees grow tall and thick. The Upland community is important to the estuary because it provides shelter and protection for many of the animals that feed in the other parts of the estuary. Take a look at Artifact No. 9.

This is a picture of a Great Blue Heron rookery. The herons build their nests in the trees to keep their young safe from predators. The herons can often be seen fishing on the estuary's shores.

LINKS TO THE SUN



## LINKS TO THE SUN

### Solar Energy - The Source of All Life

93,000,000 miles away, hurtling through the void of space, is the sun - the source of energy for all life on earth. Scientists say the sun is a medium-sized star, as star sizes go, and that it has been around for a long time - some scientists estimate at least 6 billion years. For millions and millions of those years, the sun has served life on earth by beaming its radiant energy down to earth on an unflinching daily schedule. The energy seems endless and it only takes eight minutes for the sun's radiant energy to make its 93,000,000 mile trip.

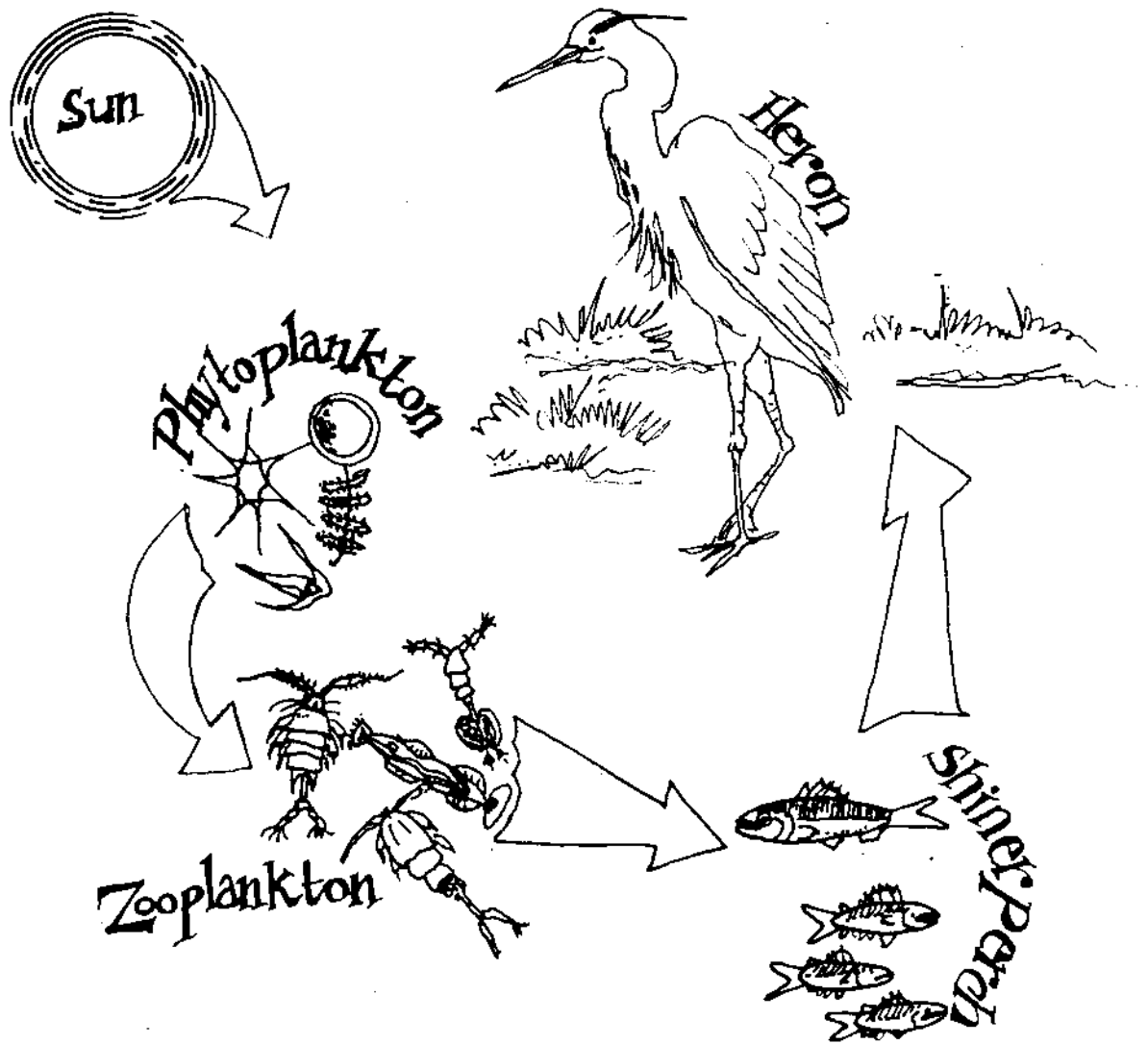
### Photosynthesis in the Earth's "Food Factories"

The sun can be likened to a gigantic power plant. But once the radiant energy leaves the power plant and completes its trip to earth, how is the energy converted to keep all species alive on our planet? The answer lies in the cells of the green plants - the earth's "Food Factories". Green plants have a process that first uses the sunlight's energy to produce food, or carbon compounds, that we and other animals can eat. The name we give to this life-sustaining process is "photosynthesis".

Once energy is captured by green plants, it follows numerous pathways to nourish the life of the earth. These pathways are called "food chains". A food chain illustrates how energy is transferred from one organism to the next. The following describes a couple of food chains that trace the sun's energy as it passes through the life of an estuary.

## Food Chains

- Link # 1 Examine Artifact No. 10. Phytoplankton is the first vital link of this food chain. It uses the sun's energy to produce food.
- Link #2 Next, phytoplankton is consumed by zooplankton, tiny animals found floating in the estuary's waters.
- Link #3 After feeding on the zooplankton, the shiner perch is next to receive the energy.
- Link #4 The heron eats the perch for its energy. Examine Artifact No. 11. (Photo of Great Blue Heron)





The second food chain begins with the sun providing energy to the estuary's salt marsh grasses. When the grasses die and are broken into smaller pieces, they become covered with bacteria and get mixed with plankton and other particles. The tides stir up this mixture, and this mixture forms a primary food source of the estuary. These decaying particles, covered with bacteria, are called detritus. Detritus is a favorite food of Artifact No. 12.

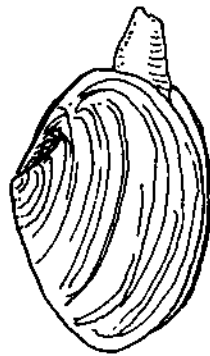
Link #1 Detritus with attached bacteria

Link #2 Clams which eat detritus

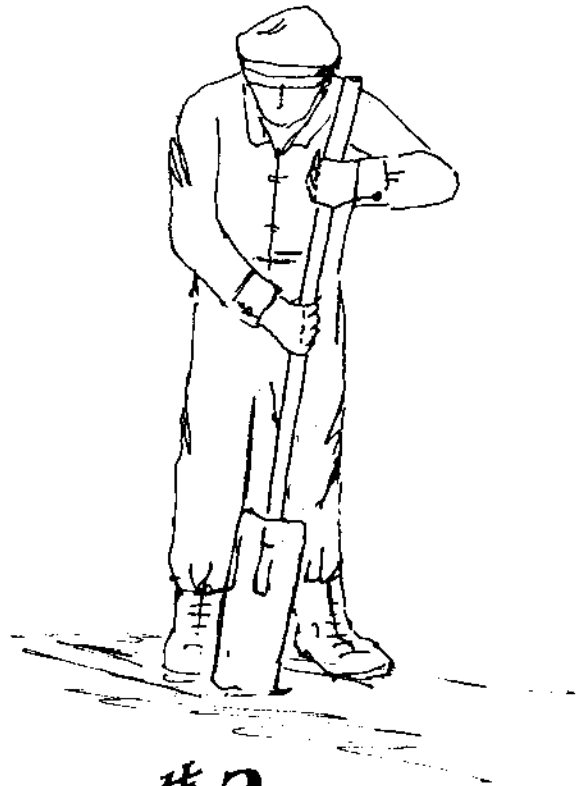
Link #3 The last link of the food chain represents man who consumes the clam in none other than Artifact 13. Check it out! (Campbell's Clam Chowder Soup)



#1



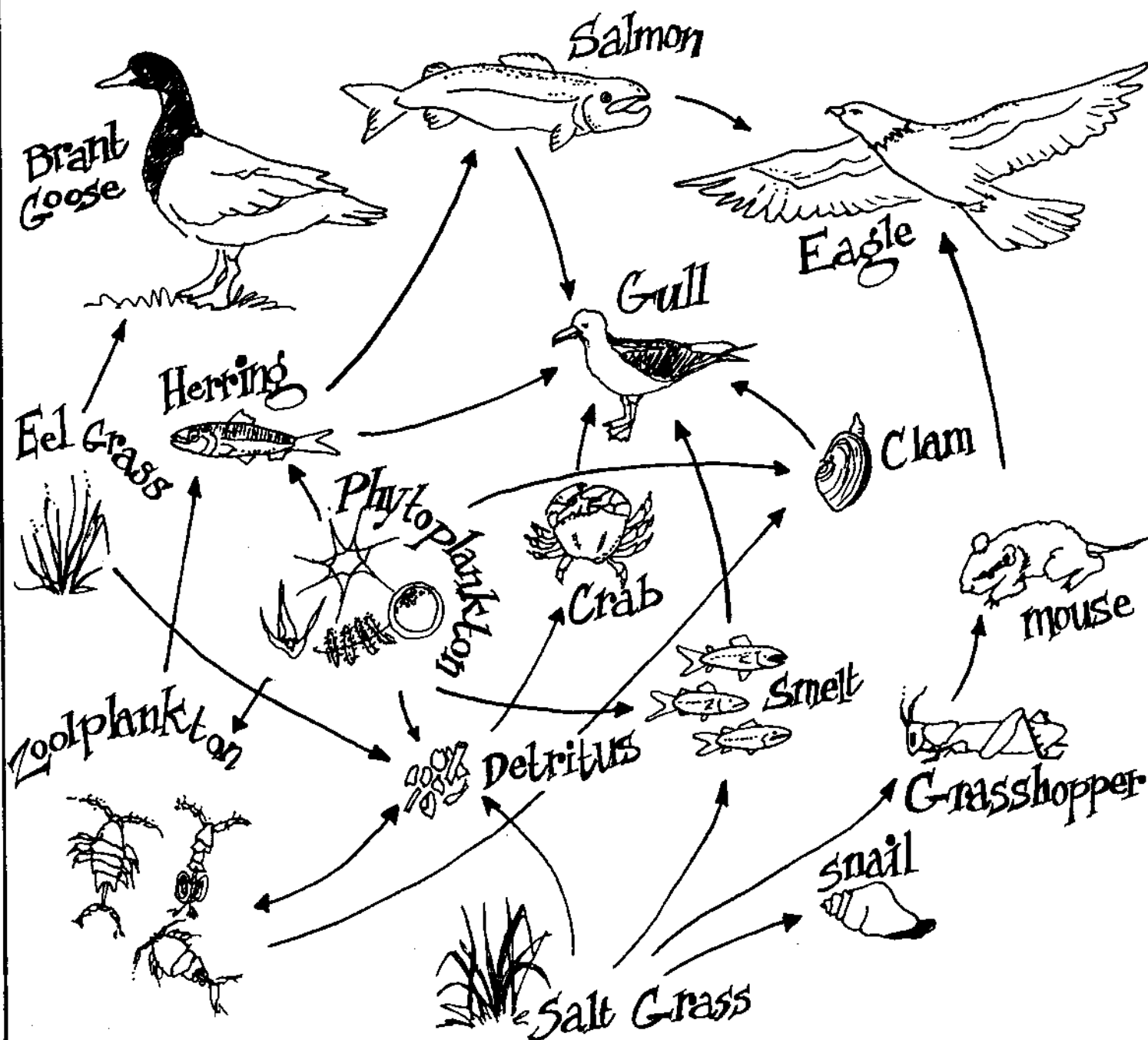
#2



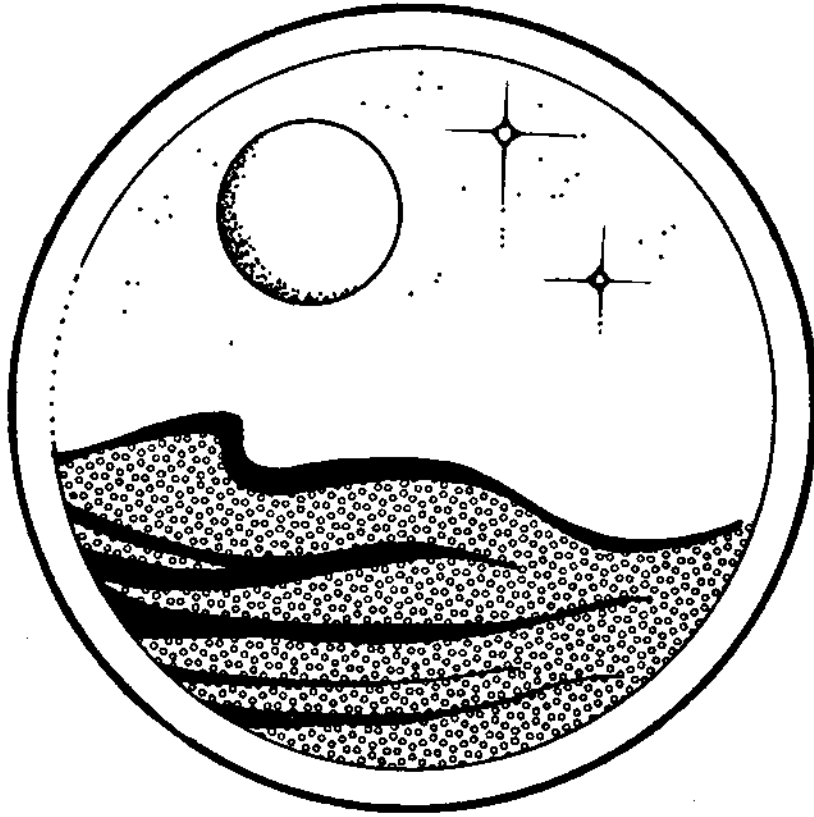
#3

## FOOD WEBS

Food chains help illustrate how the life of the estuary is ultimately linked to the sun, and how energy is transferred from one organism to the next. But rarely are animals' food eating patterns so simple. More commonly, the estuary's food chains are crosslinked into a complex system called a "food web". Examine the food web below. Can you think of some additional strands in the web?



THE TIDE



## THE TIDE

### What is a Nutrient?

A nutrient is a tiny particle that a living thing can use to live and grow. Nutrients can be from dead things - such as tiny pieces of dead leaves or animal tissue--or from non-living things--like bits of rock or mineral. When you eat food, your body cannot utilize the food to live and grow in its whole form. It must first break the food down into nutrients. Then the nutrients can be used by the cells of your body for energy and maintenance of your body's structure. The process is similar with plants. The actions of fungi and bacteria break down or decompose plant and animal tissue and the forces of wind and water wear down rocks and minerals to make nutrients available to plants.

### Nutrients from the Sea

The flow of high tide brings to the South Slough nutrients from the ocean. Many of the nutrients are already quite tiny, having already been broken down by bacteria and the wave action. Others are locked in the tissues of living things and await for the estuary's bacteria to break them down to a size usable to plants and animals. Artifact No. 14 shows a typical animal sign that might be found washed up on the estuary's shore. It is the shell of a crab. In addition, nutrients from dead fish, and possible an occasional seal are likely to be brought in by the tides and add nutrients to the estuary. Sea water also contains minerals that are useful to the life of the estuary.

### Nutrients from the Land

The earth's gravity causes the rain to fall. When the drops hit the land around the South Slough, they are absorbed by the plants and the soil. When the plants and soil can hold no more, the water flows downward again to creeks, streams, and small rivers. The flow of water often takes with it particles of the rich forest soils. So the waters of the creeks and streams that feed the South Slough are rich in nutrients from the land. Artifact No. 15 is a flask of rich forest soil. Look at it carefully and see if you can determine what kinds of things make up the soil. Millions of particles just like the ones in the flask are washed down to the estuary by the creeks and streams each day. These nutrients are added to the estuary's waters and are used by the plants and animals that live there.

The gravitational force of the moon (Artifact No. 16 is a photograph of the moon) tugging at the ocean brings the tide in and out of the South Slough. By taking a look at the tide chart, Artifact No. 17, you can check to see when the high and low tides occur each day. The tides and fresh waters deliver great quantities of nutrients to the estuary. Because the South Slough is shallow and protected it doesn't allow all of these nutrients to flow out with low tide. The end result is that many of the nutrients are trapped. Think of the estuary as soft sand, the ocean as hard ground, and you as the water. You can easily carry a load over the hard ground but it is very difficult to carry the same load over the soft sand. If the load is thought of as nutrients, you can see that to carry a load over the sand for very long you'll have to drop some of the load. This is what is happening in South Slough. The water slows down, the nutrients accumulate and build up the bottoms, forming the vast Mudflats. The rich collection of nutrients provide the base for the abundant life forms which thrive in the estuary.

THE ESTUARY'S CROPS



## THE ESTUARY'S CROPS

The estuary grows more plant material than any environment on earth, including our own farms. It is the combination of several happenings that makes the estuary's lands even more productive than the most fertile farm.

Artifact No. 18 will show you how the amount of plant material that the estuary produces compares to people's farms as well as nature's own. The plant material represented in each feed sack was grown on the same amount of land in each area. (Artifact No. 18 is a sack of bean bags shaped like feed sacks. They are labeled "Estuary", "Cornfield", "Wheatfield", "Forest", and "Desert". The estuary sack is twice that of the next closest, the cornfield. The ratio of relative weights is: Estuary-10, Cornfield-5, Wheatfield-2, Forest-1.5, Desert-.5.)

Here at the South Slough there are three important crops.

### Crop One--The Phytoplankton

Phytoplankton are tiny, one-celled plants which float in the estuary's waters. They include such things as one-celled algae and one celled plants that actually have the ability to swim around, the dinoflagellates. This crop thrives in the fertile estuary waters and provides food for countless animals. Artifact No. 19 is a set of photographs of these tiny plants.

### Crop Two - The Eelgrass

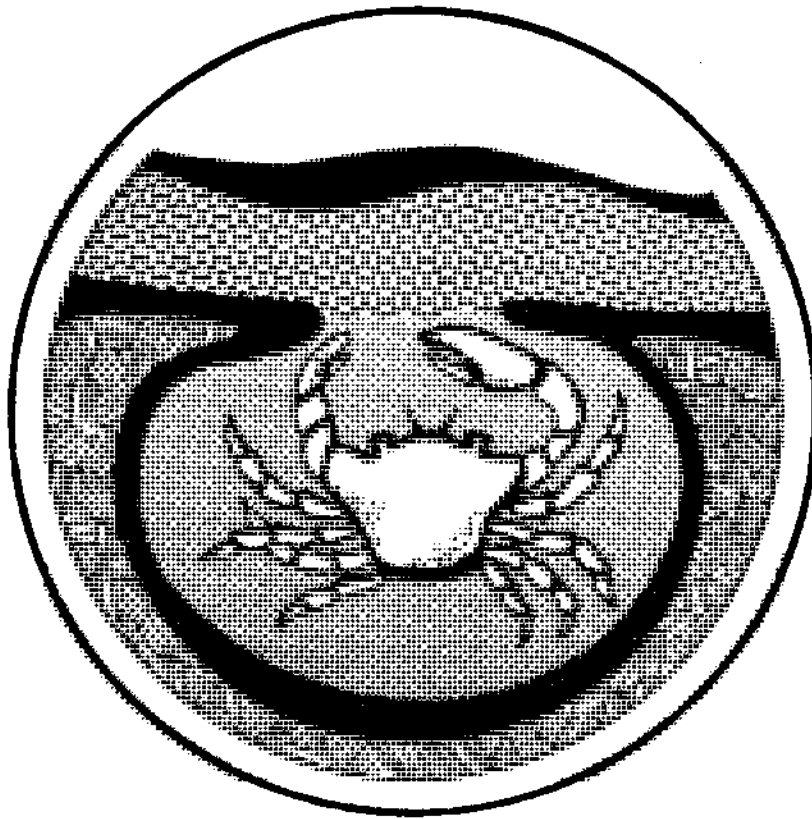
Eelgrass grows along the bottom and sides of the South Slough's deepest channels. Artifact No. 20 shows what it looks like. (Artifact No. 20 is a photograph or small jar of Eelgrass) The Eelgrass crop also provides shelter and hiding places for lots of small animals of the estuary. Eelgrass is an important food crop for migratory birds.

### Crop Three--The Salt Marsh Plants

The plants of the Salt Marsh grow fast in the perfect growing conditions of the Tide Farm. As the leaves of the plants grow and die, they are quickly washed out by the tide into the estuary's waters. Here they are broken down by the waves and decomposed by bacteria into tiny pieces. These tiny pieces, called detritus, are fed on by crabs, clams, and other animals of the estuary. Artifact No. . is a bundle of Salt Grass, a plant that thrives on the Salt Marsh.



SHELLS, BURROWS, AND SALT-SAFE CELLS:  
DEALING WITH THE HARSH CONDITIONS OF ESTUARY LIFE



Artifacts 22, 23, 24, 25, 26, and 27

## SHELLS, BURROWS, AND SALT-SAFE CELLS DEALING WITH THE HARSH CONDITIONS OF ESTUARY LIFE

The estuary can be a harsh environment because conditions can change drastically over the course of a very short time. Amazingly enough, life is abundant in the estuary because animals and plants have developed ways to cope with the harsh conditions present.

### The Problem of Saltiness

Animals and plants that live in salt water are especially suited to live in that environment. Life processes go on without problems. But when the saltiness of the water changes, most animals and plants are not able to withstand the sudden stress and they quickly die. The same is true in fresh water. When fresh water animals and plants are suddenly exposed to salt water, they are generally unable to make the quick adjustments necessary and they subsequently perish.

The plants and animals of the estuary, however, do not have these problems. They have developed special ways to cope with the changing salinity of estuary waters.

### The Level of the Tide

The level of the tide is always changing. Twice each day high tide covers much of the estuary with water and low tide leaves vast areas exposed. Plants and animals of the estuary must be able to survive the changing water levels.

### Temperature Extremes

Because of the varying level of the tide and the shallowness of the estuary, the temperature of the waters and bottoms can reach extremes. In the summer, with the constant beaming of the sun's warm rays, the waters and muds of the estuary get very hot - much warmer than nearby waters that are deeper. The opposite is true in winter. The coldness and shallowness makes the estuary's waters and muds much colder than deeper waters. The plants and animals of the estuary must have built-in strategies to deal with these temperature extremes.

#### HOW THEY SURVIVE: Altering the Saltiness of the Water Within Them

Most plants, and a few worm-like animals, survive in the estuary by actually having the ability to alter the saltiness of the water within them. When sudden changes in saltiness occur, they simply adjust the saltiness of the water within them to the appropriate level. In this way, they can survive the shock that quick-changing salinity would ordinarily apply to their system.

Artifact No. 26, pickleweed, does this by storing salts for later use in its fleshy succulent tissues. Artifact No. 27, salt grass, has special glands that remove excess salts from internal waters when necessary. Because of these amazing adaptations, these plants thrive where most would perish.

#### HOW THEY SURVIVE: Closing Themselves Off

Many of the animals of the estuary survive by special mechanisms which close them off from the hazardous conditions. If temperatures, variations in saltiness, or low tide leave them high and dry, they are able to seal themselves from the outside world. Artifacts No. 22 and 23 are two animals that survive in the estuary in such a way. They are not able to

move from one place to the other to escape these hazards, but their own solution works well. Artifact No. 22 is an oyster, No. 23 is a barnacle. When conditions return to acceptable levels, the shells open and the activity of collecting food resumes.

HOW THEY SURVIVE: Burrowing in the Mud

The animals of the estuary that can move, generally burrow down into the mud when harsh conditions prevail. They do this in the heat of the summer, the cold of the winter, and during low tide. Many of them are also able to escape a quick surface change in salinity in this way. This group of creatures includes Artifact No. 24, a crab (imbedded in plastic), and Artifact No. 25, a lugworm (imbedded in plastic.)

VISITORS TO SOUTH SLOUGH



## VISITORS TO SOUTH SLOUGH

### Where Do Those Birds Go, Anyway?

Every year, almost like clockwork, many birds, animals, and fish prepare for their journeys to distant lands. We call this event "migration". Many centuries ago it was observed that birds vanish in the fall, and then turn up again in the spring. Not realizing that birds travel to distant areas, people believed in explanations such as "swallows bury themselves in the mud of swamps and spend the winter sleeping" or "they turn into different kinds of birds during the winter and then return to their original form in the spring"!

Today there are still mysteries about migration, but we do know that birds, like the geese, and fish, like the salmon, return to their birthplace to raise their young or spawn. Another reason birds migrate is due to the lack of food sources in winter. Birds leave for a warmer climate where food is plentiful to keep from starving.

### South Slough's Migratory Visitors

The South Slough is an important and popular landmark for both migrating fish and birds. Fish and birds make migratory visits to the slough for a variety of reasons. Some depend on the slough as a resting spot, some just pass through, and for others the slough is their summer or winter home.

The Caspian Tern is one of the slough's transient visitors. It is a seagull-like bird that visits the South Slough in the spring and autumn on its journey between the north Pacific Coast and Central America. It will stop at the South Slough to rest up and catch a meal in the sheltered waterways. It can often be seen patrolling the waters for fish. Then, after spotting

its prey, it makes a plunge headlong into the water after it. Artifact No. 25 shows the tern in flight (photograph).

Another migrating visitor is the salmon who swims through the slough to find the freshwater stream where it was born. Examine Artifact #26, the skull of a salmon. Once it finds the spot, the salmon will complete its life cycle, spawn and eventually die. Study Artifact #27, a poster illustrating the salmon's lifecycle.

Some birds migrate to the slough for a long vacation, staying several months or even seasons. The Merganser, a fish-eating duck, makes its home at the slough during fall, winter, and spring. Then, in the summer, it wings its way up to Alaska where it nests and raises its young.

#### South Slough - A Popular Nursery

In addition to attracting migratory visitors, the slough's waters provide a perfect nursery environment. Every year, fish swim in from the ocean, spawn, and leave their young to grow up on their own. The conditions are perfect. The shallow, sheltered waters allow younger fish to more easily escape the jaws of larger fish and the food supply is bountiful. Once grown up, the slough's nursery fish (such as the herring) swim away and are ready to face the open sea.

Whether for a migratory rest, a feeding stop, or for a place to breed and raise young, the lives of both birds and fish depend on the slough's wild and protective environment. The slough's waterways will always welcome feathered and finned visitors.

## ON-SITE EXPERIENCE

### LEVEL III (7TH AND 8TH GRADES) KEY UNDERSTANDING

An estuary has both hidden and obvious riches: you can't take only one of the riches without affecting the others.

### LEARNING OUTCOMES

1. The South Slough is rich in natural and human history.
2. In seeking the riches of South Slough estuary, people have brought about change.
3. The South Slough estuary is valuable to us in its natural state.

### PART ONE

When the students arrive on site, they have already been briefed in the finer points of the slough's natural history. They are now eager to see the area and learn of its cultural history.



## THE MODEL

(In case the model is unavailable a large-scale map might be used.)

The students are dropped off partway down the hill, a little above the bus turnaround. Here they are met by the coordinator who introduces herself and welcomes them to the South Slough. She leads them about two hundred feet to a scenic overlook. Near the crest of the lookout spot is a large model of the South Slough.

It is well-crafted of cement or fiberglass (or other durable, weatherproof material), brightly colored, and immediately attracts their attention. The leader invites them to surround it and each of the group of forty kids easily finds a "ringside" spot.

"Here is a working model of the South Slough Estuary," she begins. "It, along with the help of some of you, is going to show us just how an estuary works. If you remember from the preparations you have done in your classroom, an estuary is an arm of the ocean. You can see here on the model how South Slough is connected to Coos Bay, which is connected to the ocean."

With a stick, she points out the features of the model as she explains.

"You might have noticed that there is no water in our model--yet. In fact, we're going to add water soon. In an estuary, both fresh water and salt water fill its shores. The fresh water flows from the streams and rivers which drain into the estuary, while the salt water, of course, enters from the ocean.

"We're going to add water right now. Here's how it will work. I'm going to assign some of you to work the model's pumps and buckets. These buckets will bring salt water in from the ocean

and these simple pumps will push fresh water down from the streams. Don't begin until I give the word."

The leader assigns each of the pumps to students who stand near where the pumps are situated on the model. The hand-operated pumps are simple devices which spurt water onto the surface of the model from hidden reservoirs below. Water is added to the model from seven small rivers and streams and from the ocean. Because of the larger volume of water originating in the ocean, the sea water is poured into the model from buckets labeled "sea water".

The leader then gives the word to the selected helpers to begin operating the pumps and buckets. Water begins to fill the model from the many sources. But, right off, something unusual is noticed. The water pouring from the rivers and streams is tinted blue while the sea water is clear! The mixing of the two kinds of water is visually represented before them.

"As you can see, an estuary is a place where fresh water and salt water mix. The fresh water brings in the nutrients from the land, and, when the tides rise, the salt water brings in the nutrients of the sea. Where the two mix, there is some of each--the best of both. The flow of the tides and the streams mixes the water."

When the model reaches the full line, known to the leader, the pump stops.

"The estuary is a special place for another reason. Although the water of the sea helps to fill it, the South Slough is protected from the large, damaging waves of the ocean. John, pull the "wave-maker" cord and make waves in the ocean. We'll watch and see what happens."

John pulls the cord attached to a board mounted in the ocean part of the model, forcing waves into the bay and slough. They watch the waves become progressively smaller as they move inland.

"You see, for the things that live here, the land which almost surrounds the estuary provides shelter from the ocean waves and even the ocean winds.

"The life of an estuary is concentrated in four natural communities and these places are illustrated on the model by different colors. The blue on the bottom is where there is always open water - even at low tide as you will soon see for yourselves.

"The brown is for the mudflats. Being very shallow and very flat, the mudflats will be exposed during low tide.

"The light green areas further inland represent the salt marshes. Flat like the mudflats, they are full of low-growing plants.

"And finally, the uplands. This dark green area is where the land slopes up and forests begin.

"This is what an estuary looks like at high tide, when the tides of the ocean fill the slough to its brim. You can see that the water extends almost to the uplands.

"Now let's see what happens at low tide."

Again the pumps operate (different students are the operators) but this time a drain near the ocean is pulled and the sea water buckets fill as water pours out. The water level lowers to cover just the dark blue bottom, then all the pumping stops.

"At low tide, only the open water areas remain full. The mudflats and salt marshes are all drained. The stream water now has a longer course before reaching the sea water. And this all happens twice a day, every day, day after day, year after year.

"Let's go over to the edge here and look down on the real estuary."

The group reassembles nearby and looks down upon the slough. The coordinator mentions the level of the tide they see and states whether it is rising or falling. After a few minutes of comparing the scene before them to the parts of the model, they move on.

The coordinator then reinforces the main thrust of each of the folders in the Natural History Portfolio. Following this, the coordinator sets them up for the morning.

"You have a very exiting day ahead of you. First, we have an adventuresome hike down this watershed to the edge of South Slough. All the way down, we will walk alongside the route fresh water takes to get to the slough. A few signs along the way will point out some interesting features. Down at the bottom, we've arranged for you to meet some very interesting people to help you get your stories for your project. The first person you will meet is a gourmet cook that will tell you about how to prepare the favorite meal of many of the animals that make the estuary their home. Then, you'll depart on the 'Trail of Time' to meet some of the people who first settled and lived in this area. These people have some great stories to tell--they'll be a great help. It's not every day that you have the opportunity to talk to someone that lived fifty, a hundred, or even a hundred and fifty years ago!"

Following the model demonstration, the class is divided into six groups and led down the hill by the group leaders to the overlook at the slough's shore. Upon reaching the observation deck, the leaders split off to prepare and dress for the Trail of Time.

The teacher assembles the large group in several rows in a semicircular arrangement. Then, the teacher introduces the estuary's own gourmet cook who will prepare a favorite meal of many estuary dwellers. (This activity will introduce the students to the importance of the micro world of the estuary and give the group leaders time to prepare.)

With this, the coordinator emerges, decked out as a gourmet cook.

"Welcome to my kitchen! Today we're going to make Estuary Soup. This is a very popular meal for many estuary critters. Here's the recipe card."

The cook then pulls out a large recipe card which clearly describes in large letters how to make the soup. Then the cook sets a hefty soup kettle in the middle of the table.

"O.k., let's read the recipe card. It says, 'Step One: add tiny plants to soup kettle.' Jack, would you reach into the cabinet and grab the container labelled 'Tiny Plants'?"

Jack produces a large seasoning-like container. On it in large letters it says, "TINY PLANTS". Underneath these words, in smaller letters, it says: "Seaweeds and Phytoplankton".

"O.k., Jack, pour some of that in the kettle, will you? You may be puzzled as to why it appears that nothing is coming out of the can. Unlike land plants such as daisies, blackberries, and trees which are common to us, there exist in the waters of the earth billions of tiny, microscopic plants. We call these microscopic plants algae and phytoplankton. It's not so important to remember the names as it is to know that there are billions of these microscopic plants in Estuary Soup."

The next step is read: "Step Two: add tiny animals." Another helper reaches into the cabinet to find the container labelled "TINY ANIMALS". In small letters also on the container, it says "Zooplankton".

"Just as there are billions of microscopic plants in the water, so it is also with microscopic animals. Actually, they feed on the plants! We call these 'zooplankton'."

After the tiny animals are added comes Step Three: 'add tiny bits of dead plants.'

"When plants die, they begin to decay and rot and are broken down into tiny particles by bacteria and insects. The movement of water also helps to break them down into smaller bits."

A volunteer adds this ingredient to the pot and after a quick review of what's in the kettle so far, they are ready for Step Four: 'pour in salt water and fresh water.' And again, another person finds two pitchers in the cabinet with the appropriate labels.

As the water is added, the chef says, "The fresh water comes to the estuary from the rivers and streams and rains while the salt water is delivered from the ocean by the tide.

"Now for the last step. It says here, 'Step Five: stir soup with mixing spoons.' This will combine all the ingredients to make the perfect mixture to feed the soup eaters."

Three spoons are found in the cabinet. They are huge wooden spoons and each has a different label on the wide end: 'TIDE', 'STREAM FLOW', and 'SOUP EATERS'.

Someone stirs with the 'TIDE' spoon while the chef asks them to imagine the constant rise and fall of the tide.

Next, the 'STREAM FLOW' spoon is employed as they consider the water pouring in from the hills.

Finally, the third spoon is used as the chef mentions how the soup eaters themselves stir the soup up as they go about their business of eating the soup.

"Well, now let's take a look at some soup that was brewed out in the estuary."

The chef empties the kettle and attaches it to a simple boom made from poles and, with the help of a few kids, swings the kettle out over the water. There it is lowered until it fills with Estuary Soup. Once it is hauled in, they place it on the center of the table. The chef sets the table and each participant receives a soup bowl (petri dish), mini-strainer or filter, and pocket microscope. The kids, using a ladle, each fill their own soup bowls and begin to look for the ingredients of the soup about which they just learned.

After viewing the soup up close and sharing discoveries, the chef says, "Now's the time to find out who eats this soup! Let's invite them to our table. Here are the placemats."

The chef reaches into the cabinet and distributes a set of placemats. On each placemat is the picture of an estuary soup eater and a fun fact about it.

Under the picture of the clam, for example, the fun fact reads: "I suck up estuary soup through the siphon that is my neck."

Then tiny hairs sort out the food parts from the water and pass the food on to my stomach.

Each placemat depicts a different soup eater: ducks, oysters, worms, shrimp, and mussels. The soup eater's filter-straining processes are emphasized in the fun facts, and the Gourmet Cook then asks the students to show and read their placemats.

After all the sharing is finished, somehow, the cook needs to "exit, stage left." The chef could be fretting about being late for the next cooking demonstration, in Paris ("Oh, my goodness, it's time to catch my commuter plane") or whatever. Meanwhile, the assistant (standing by) coaches the students into another rousing round of applause for the cook.

After a quick change, the person that was the cook re-enters as one of the coordinators, scratching his/her head, wondering what has been going on. (Perhaps the coordinator had just seen a crazy chef running in the woods... like he was late or something.)

Following the cook's presentation, they are told they are about to enter the "Trail of Time", which will help them learn about the earlier years at the South Slough. They "must be alert and ready to get the story--this is a once-in-a-lifetime opportunity." When all are prepared, the coordinator hands each group a map, shows them where to return following each presentation, and sends them off on the first experience. The coordinator "stands by" at the central location, or hub area, to control traffic as the groups return for a visit to another place. Each group follows a prescribed sequence and small signs help to point out general directions. The maps and trail markers keep the groups on course.

Each group will then encounter an "old timer", busy carrying on his/her everyday tasks. Each is decked out in the garb of the era and greets the group cheerfully. For the next ten minutes, the "old timer" will tell the group what life was like in the old days and point out why he/she came to the slough. Each was in search of one of the slough's riches.

The old timers are the group leaders. They have a simple script and have had the opportunity to study it carefully as well as to memorize all or most of it. Somewhere in the interaction, the old timer invites the kids to help with a typical chore or task of the day. After the ten minute encounter is over, the group heads back to the hub. Here the coordinator directs the traffic and each group goes to their next scheduled stop. In case of traffic jams, there is lots to observe at the deck using the scopes that are on hand. They will each visit a settler, a transporter, a logger, a miner, a trapper who will tell them about Indian life, and an early scientist.

Following are the scripts of the old timers.



## SETTLER'S SCRIPT

"Our family came to the South Slough like pioneers seeking the riches of the land - and we found them here, too! Living at the edge of the marsh provided us with all the duck dinners we could eat. I remember when my brother Joe brought down thirty ducks with one gun shot! Sometimes the birds around here were as thick as a hoard of mosquitos. We lived off the land, eating vegetables and potatoes we'd grow in the garden, raising chickens for eggs and a few cows for milk. The milk wouldn't keep without refrigerators, so one of the daily chores was to churn the milk into butter. Whenever we had extra eggs or butter we'd pack them up and take them with us when we went to Empire for supplies. We'd sell them and buy groceries with the extra money. One thing I remember well was Ma buying me sticks of candy on those trips!"

(Hazel shows a butter churn to the group, the type her family used back at the turn of the century, and demonstrates how to use it. She explains the buttermaking process and lets each student have a turn at churning.)

"Well, I told you I'd show you around the place. Let's amble down the way a bit toward the dike over there. We'll be able to see the lay of the land better." The group follows Hazel. From an old satchel she pulls out a family picture album.

"Here - these old snapshots and sketches of the property will help you see how we set up our farm."

Hazel sketches in where the house was located and shows the picture of it. She comments, "My Pa built this house out of the trees around here. Trees was one thing there sure were plenty of around here. Besides the house we built a

chicken coop, woodshed, cold frame, and we even had a windmill to pump water up to the house - one of the first windmill pumps in the slough!"

Hazel shows the boardwalk and dredging pictures. She explains, "Before we had any dikes running across the marsh we built these boardwalks from one side of the marsh to the other. (Hazel points to the point of land.) There on the other side of that point was a big dock where the boats would pull up. I remember we always had to walk up and over the point because we couldn't walk around it like you can do now. We eventually had the steam-powered dredge from Marshfield come up here to the slough and build a dike instead of having the boardwalk. Later on we built more dikes so we could get the land dry enough so that we could grow hay for the cows." Hazel sketches out the dike system on the map.

"Well, time is running out here for our visit, but I just want to share one last memory before you head on down the trail. As a child growing up here I remember lots of things - swimming in the slough, going to school, packing home apples in my arms only to discover them full of ants - even the scariest night of my life. That was the night my Pa wasn't home and my Ma had a mild heart attack. Not having any lights, it wasn't common to go outside at night - it was scary - especially to a young girl like me at the time. My ma told me to go get help from the neighbors, the Latins, who lived about three-quarters of a mile by trail away from our house. I set off scared as the dickens in the dead of night. And all along the way I had this spooky feeling that something was following me. Sometimes I would stop to see if I heard anything, then I'd continue down the trail. Anyway, I finally arrived at the Latin's house and was so breathless with fright

I couldn't even talk and tell them what had happened to my ma. I think they finally figured it out from my gestures and went to help. The best part of the story, though, is that the next day my brothers went out along the trail and found fresh cougar tracks! That's how beautiful and wild the land was around South Slough. I remember walking barefoot always trying to find some neat place that no one had ever been before. I like exploring and discovering the richness this land held. I hope all you kids can help to keep the land as rich as I remember it.

"Bye now - I've got to be on my way."

## TRAPPER/INDIAN SCRIPT

"Hey there! You are talking to the one and only Jud Buckman, trader, fur trapper, and long-time friend of the Hanas Indians. I trapped and lived in this area back in, well, let's see, I believe it was 1812 when I first came here. I heard stories of plentiful fur-bearing game, forests so deep and dark you couldn't see the sun, and so many fish they choked the rivers. And you know, they were all true, too. Yes, I used to trap beaver, fox, mink and otter from these shores, and trade with the Hanas Indians for skins, too.

"You know? When I first came here, I really didn't know much about this wild country. I was a young, spry kid of 19 years of age. Green as the first leaves that shoot out of the ground on a warm spring day. If it wasn't for making friends with the Hanas people, I never would have made it. They really knew how to live from the land - and respect it too. Well, heck, they were living here a couple thousand years, they must have taken care of it. It was their life-blood. They knew of no other place to go, not that they ever had any reason to go somewhere else even if they wanted to.

"When I first came here, there were small villages along the shores here, and a larger one where Charleston is now. They called it 'Baldiyasa'. In fact, they believed that all life began from a place near where Charleston stands today.

"The Hanas showed me how to make fish traps like this one here. (Shows group photo of fish trap, or replica in slough). They showed me how they made their houses from slabs of cedar they split with stone wedges (shows photo). And they showed me how they made their clothing from cedar bark (photo).

I'd like to show you all how this was done. I've brought some cedar bark." (He shows how to separate inner bark from cedar and pound till shredded. Participants give it a try.)

"The cedar was sacred to the Hanas people. It sheltered them and clothed them. They even made Oregon's first rain-coats - spruce pitch sandwiched between two layers of shredded cedar bark.

"They showed me how to make fish nets using the roots of wild iris. Fish was one of their main foods. They used to catch a lot of fish - salmon, sturgeon, and sea bass. The fish were very plentiful in those early days, nothing like I hear they are now. During the summer, the Hanas would hang their fish to dry and then store it for winter food. They would also hunt deer and bear with bows and arrows.

"They also showed me where their elk traps were. They would dig pits up on those ridges and the elk would fall into them. Yes, they knew all there was to know about living in this country. I was very fortunate to have the Hanas people as friends.

"Well, the settlers came in starting about 1850 or so. It just got too crowded for me and I moved north to wilder country. I heard that my friends the Hanas were sent away to reservations shortly after that. Can you imagine? A home for thousands of years then suddenly someone forces you away to a strange land. Well, I don't know much about what happened to the Hanas as people after that. Maybe that's something you could look into.

"Well, nice talking to you. I don't want to take up any more of your time - I know you have lots to do today. Bye, now."

## TRANSPORTER'S SCRIPT

"Pleased to meet you. I'm Cappy Dodds. I have been so busy piloting boats and driving trains all my life, it feels good to stop in one place for awhile. I may be getting old, but my memory is still sharp as a whistle. I can remember how rugged life was in these parts and how transportation played a vital role in people's life at the South Slough.

"In the early days, there weren't any roads to speak of. In fact, the first automobile didn't show up on the Slough until 1923. Before then, transportation was by foot, horse, or boat. Short train systems were built to transport the logs from the forest. Take a look at this map drawn up at the turn of the century. It's no wonder that boats and trains were so important. (Cappy shows the waterways of Coos Bay and the Slough's proximity to the nearest towns - Empire and Marshfield, which is now Coos Bay.) The slough was a rich waterway.

"People living along the slough had a long way to go to the store to shop for supplies like flour, kerosene, or cloth for making clothes, or for getting help from a doctor. I remember when one of the Rhodes boys got a nasty infected blister. The nearest doctor was days away and the boy died the next day from blood poisoning.

"When families like the Rhodes and Lattins were living here at the Slough they would depend on Joe Yunker for transportation to town. At the time, supplies were procured mainly in Marshfield. Although only ten miles away as the crow flies, it took two days for Joe to pilot his boat, the "NORTHSTAR", that short distance to Marshfield. Because of the tides, Joe and his passengers would have to spend the night in Empire. (Cappy shows a picture of Joe Yunker's boat and the route to Marshfield on the map.) We all remember what a sad day it was when

the arrival of the "Northstar" was overdue, and then we learned that Captain Joe and all his passengers had perished at sea. That's what happens now and then on the frontier.

"After that tragedy, families were without transport and had to buy their own boats. I remember Chester Rhodes naming his boat the "THREE SISTERS" after the three of his six daughters who were still living at home. (Cappy shows the dock pilings where the main boat dock was located.)

"Some of the real wild days of the South Slough were when the Stout Lumber Company brought in the railroad operation to haul the timber out of the forest. Everyday a fleet of barges, boats, and log rafts would come in and out of the slough at high tide. They brought up tons of supplies and hundreds of men to put the railway in and transport the logs out. (Cappy guides his group over to the pilings, and has the group imagine the tracks leading out to the end of the pilings, how the logs were dumped from the railroad cars, and the flotilla of boats waiting to haul them away. Cappy shows pictures of the trains and trestle to help everyone imagine the scene better).

"Building the railroad was a giant job. Lots of Chinese people helped to complete the job. In fact, that's how Charleston got its name. Back then a slang name for Chinese workers was "Charlie" and many of them were living at the present-day town site. Eventually the town's name evolved from "Charlietown" to "Charlestown". Well, everyone sweated while building that railroad, but it finally was ready to go. It was hard work laying many, many miles of rail. Cutting the timbers and hammering the rails to them was the really hard part."

(Cappy shows the group a couple of the old spikes, then lets each of his visitors take a swing with the sledgehammer to see for themselves the work involved in hammering down a piece of railroad rail. He points out the general direction he believes the railway headed, then thanks his group for the visit.)



## MINER'S SCRIPT

"How do! Well, I know you didn't come here to dig the gold or cut the trees, but maybe to learn something, eh? My name is Angie Krantz. I was one of the school teachers back long ago. Here's a picture of my school house and students. (She shows the photographs). Having taught a little history in my life, I figure that I'm not too old to teach you a little.

"1852 marks the year the flood of settlers rushed to seek the riches of gold discovered on a beach near Coos Bay. They called the place "Whiskey Run." Almost overnight a town sprang up and pretty soon there were over 2000 people living there.

"Move in here and you can see up close what that boom town looked like. (Angie shows some boom town pictures.) Well, it wasn't long before people realized there wasn't all that much gold around and left disappointed, without their promised fortune. There was hardly a trace of that town two years later.

"Some folks high-tailed it out of here altogether, but a few determined miners stuck around. Some found their way to the South Slough. Will Wasson was one of them. He set up a black sand mine near John B. Anderson Creek right here near my old school house (Angie shows the mine's location on the map and its relation to the slough, creek, and school.)

"They called the mine the "Chickaman Mine". Sometime, I believe around 1920 or so, that mine, along with its sluice box, was sold. (She shows a sketch that demonstrates the

sluicing process.) Oddly enough it was sold for quite a fair price, but the buyers didn't think much of the fact that their new mine hardly produced more than a handful of gold. After they discovered the shady deal and learned that the mine had been seeded with quality ore, the disheartened owner lost interest in seeking the Slough's gold riches.

"That didn't mean there weren't other riches in the ground around the South Slough. Take a look at this. (Angie shows the group a jet black piece of rock and passes it around.) Coal! Black gold! (Using a map Angie points out where the coal mines are located.) Miners in the region started digging out the coal deposits as early as the 1850's - some of it even found its way to San Francisco. When digging for the coal the miner would follow the vein of coal into the ground, chink it out with a pick, and trolley it out the shaft in miniature railroad cars. Without electricity back then their source of illumination in the dark mine shafts was carbide. Take a good look at this old miner's lamp. (She explains how a carbide lamp works, and lets the kids light one).

"The last mine in operation around here was Mr. Gibb's - its mine shaft was shallow-pitched so it was easy to get at. He'd deliver the coal to customers in Coos Bay and Coquille using his pickup truck to haul it around. After twenty years the market for Mr. Gibb's coal failed and he had to shut the mine down. This is what you would see if you went down to the Gibbs' mine today. (Angie shows the pictures.) But, like gold and timber, these obvious riches that were found in the South Slough region finally ran out."

## SCIENTIST'S SCRIPT

"Welcome to one of the richest places on earth. That's what I call an estuary. I first began studying estuaries a long time ago. Back then, estuaries were misunderstood to be barren wastelands, sticky mudholes, and mosquito flats. Through the work of myself and my colleagues, I hope to show people how important estuaries are to the life of the earth. Why even this muck is rich in life. Would you like to take a look at what lives in the mudflats?"

The group uses a dredge and boom to get a muck sample. As with the activity in Level II, they examine the creatures that live in the tideflats, using screens, scopes, and sifters.

## LOGGER'S SCRIPT

"My name is James Black - you can call me "Blackie" for short. I hear you all are beatin' the bushes around here tracking down the story of what the good ol' days were like. Well, I've been around about as long as that ol' tree stump over there and I reckon I can tell you a thing or two.

"Many folks came to South Slough looking for gold, or wanting to farm; others came in search of the great trees which flanked its shores and covered its surrounding slopes. I think it was George Wassen who was one of the first settlers in these parts to seriously take up the logging track. He was the first to set up a sawmill operation that was run by water power. Here is a picture of the Wassen family and there's his son George (pointing him out) who gained a bit of notoriety. George crossed the continent and went to school back East and found himself learning to play the clarinet and marching in John Phillip Sousa's band!

"Now, you might be wondering how the loggers managed to get 250 foot tall trees that measured 40 feet around at the base to the sawmill. That means eight of you holding hands could barely circle around a tree that size! First, they had to be cut by hand - a slow process taking a sharp saw at least eight feet in length, a couple of days of hard work, and super strong muscles. The sawyers would stand up on "springboards" to cut from. Come on over here and see for yourselves."

(The group gets to try out standing on a springboard and examines old pictures showing the elevated cutting technique.)

"I remember when that tree finally fell down - you could hear the crash for miles! Now how do you suppose they got those

big cedar, hemlock, and spruce logs out once they were down? Good ol' pioneer ingenuity solved that problem. If you went to the end of the slough about 100 years ago you'd find a big oxen barn. Those oxen were the loggers' workhorses. (Blackie shows photos of the oxen teams at work.)

"Later came the steam donkey - a giant upright boiler fed by a wood fire. They ran a geared winch that dragged logs through the woods with a steel cable. (Blackie shows a cable remnant he says he found along the "Tunnel Trail".) Once to the water's edge they'd roll the logs in the water and wait till the high tide came to float 'em away to the mill.

"Well, by the 1900's the logging in the slough was seeing its heyday. I remember that there was plenty of work and money for any young man then (picture of the camps and train here.) It was a time of bustling lumber camps and the mighty steam locomotive - known as the 'Iron Horse". Track was laid many miles to the virgin forest and the timber riches were taken away. The Iron Horse would haul the trees to the log dump located at the end of the trestle and dump 'em in the slough.

"Little evidence remains now of those mighty days, but with a little exploring you can come across some of the old tree stumps with their springboard notches in them, or find some of the old cable the loggers used with the steam donkeys.

"Well, good luck on your story - I gotta be on my way."

## LUNCH BREAK

After the students finish meeting the historical figures, they are directed toward the smoke billowing nearby. While approaching the area, the kids hear a voice through the trees welcoming them to a warm fire and an unexpected cookout. One of the leaders is dressed as the homesteaders wife and has spent the morning preparing a historical lunch with most of the ingredients related in some way to the estuary. Some old fashioned recipes are used in food preparation. All sit down around the warming fire, eating their chowder and sharing the morning's experiences.

## PART TWO

Following lunch, the students embark on mini-explorations to make first hand investigations of the site. The coordinator introduces the six exploration topics, and following this, the students sign up for the one that interests them. Each group receives a "Briefing Sheet" which outlines their goals and it is up to the students in each group to decide from moment to moment how to accomplish their tasks for the 45 minute period. A group leader is on hand to advise.

The Briefing Sheets for the six exploration topics follow. Old photos and maps will be attached when appropriate.

THE SETTLERS  
-BRIEFING SHEET-

The Rhodes family had a big spread in this area. They built a large house, chicken coop, woodshed, cold frame, and a windmill.

Your goals:

- To find evidence of the Rhodes family's house and other buildings
- To map the location of the various buildings
- To locate farm implements and other tools and things that might have been left behind
- To explore the area in search of unknown information
- To document the impact that the settlers had on this area.

THE LOGGERS  
-BRIEFING SHEET-

Three logging companies worked this area, cutting the virgin timber: The Coos Coal and Lumber Company, The Stimpson Lumber Company, and The Stout Lumber Company.

Your goals:

- To find evidence of the virgin timber
- To document the largest stump and oldest tree (count rings if possible)
- To map probable locations of logging roads, the "donkeys", and the largest timber
- To find the "old donkey" that was left in the woods (do not investigate the railroad)
- To document the impact that the loggers had on the area.



THE RAILROAD  
-BRIEFING SHEET-

The logging and mining companies transported their lumber and minerals to the channels of the slough by rail. Here they were transported by water to Marshfield (now Coos Bay).

Your goals:

- To find evidence of the railroad - pilings, spikes, ties, etc.
- To map the route of the railroad
- To find the lost locomotive - an "old timer" reports that somewhere in the woods of South Slough lies an old locomotive
- To document the impact that the railroad had on the area.

## THE WORK OF TIME

### -BRIEFING SHEET-

Since the time when the early settlers, miners, loggers, and transporters were in the area, much time has elapsed. Nature has reclaimed much of what was once disturbed. Even the natural areas have changed over time.

Your goals:

- To document how time has affected the changes that loggers, miners, the railroad and the settlers have made at the South Slough
- To document evidence that the natural areas of South Slough have also changed
- To estimate how many years might pass for all evidence of the early users of South Slough to disappear
- To describe what this area must have been like before the loggers, miners, railroaders, and settlers came.

THE ARTISTS AND POETS  
-BRIEFING SHEET-

Your goals:

- To capture the feelings and essences of the South Slough in art and words.

PHOTOGRAPHERS AND MAPPERS  
-BRIEFING SHEET-

Your goals:

- To document in pictures the South Slough's natural and cultural history
- To map the details of this part of South Slough

## ENVIRONMENTAL IMPACT OPTION

Teachers who desire to follow the morning's programs with a natural history emphasis instead of a cultural history emphasis may choose the "Community Census" option.

The coordinator introduces the afternoon challenge:

"This morning we have seen how the 'homesteader of yesterday' lived and affected the estuary. Up until recently we have been unaware of the intricacies of an estuary's life system or ecosystem. Now scientists have given us a clearer understanding of how the ecosystem of an estuary works - you read about some of these understandings in your preparatory reading."

The coordinator unveils a chart and points out the activities of "today's homesteaders" (loggers, fishermen, farmers, and developers) which affect estuaries. The coordinator reviews the information with everyone.

### THREATS TO AN ESTUARY

Problem: Filling and covering over marsh and mudflat areas.

Impact and Effect:

- Habitats are permanently destroyed
- Estuarine life is killed off and other sea and land animals are affected because of diminished food sources, nursery and resting places.

Problem: Diking and draining water from marshes.

Impact and Effect:

- The habitat is destroyed as described above.
- Tide flow is blocked causing changes of currents and stream flows.

Problem: Overgrazing

Impact and Effect:

- Siltation is caused which changes natural stream flow.
- Siltation causes changes in the oxygen level of the water and has the potential to smother and suffocate oysters and other bottom-dwelling animals.

Problem: Fertilizers and Pesticides

Impact and Effect:

- Rain causes run-off from fields. The run-off washes chemicals into the water and pollutes it. Chemicals are ingested by wildlife and fish - many of which we eat.

Problem: Encroachment on Wildlife

Impact and Effect:

- Wild animals are scared away from their homes when human activity gets too close. Buffer zones between human activity and wildlife activity become diminished.

To prevent these problems from happening, our government makes "environmental impact statements". These documents are designed to ensure that the land and water decisions are made with the natural environment in mind.

This afternoon, your challenge is to carry out the first step in making an Environmental Impact Statement.

Your job is to bring back proof that the estuary supports a variety of plants and animals. You will need to take a census that will show us what lives in an estuary, what natural community they live in, and what they do that makes them important to the ecosystem.

Each student is given, along with an official "Census Taker Badge", a clipboard which holds the Estuary Survey sheets.

Plant/Animal Description	Job or Role	Address		
		Mudflats	Salt Marsh	Uplands

On the back of the survey sheets is a list of community job descriptions which the students are likely to find in their search:

- garbage men
- food producers
- soil builders
- transporters
- air conditioners
- population controllers
- fertilizers

After these categories are reviewed and the students are divided into groups, they are instructed to take a census of the inhabitants of each community in the estuary. Tools that will help the census-taking activity (hand lenses, trowels, binoculars) are distributed to ensure a thorough job.

The explorations or census take about forty-five minutes, longer if time allows. Following the explorations or census, the groups meet at the lookout to share their discoveries. Each group is given five minutes to capsulize the information they have documented.

Following this, the coordinator sums up the day:

"Back at the classroom and here this morning, you learned of the slough's biological riches and marvels. Today you've also met some of the historical people who worked and lived here in the past. You now have lots of information to work with--information that will help you understand and then communicate the Lore of South Slough. The biggest challenge lies ahead--to sort out what you have learned, dig deeper to find more information, and to present your findings about the Lore of South Slough--both natural and historical--to people in your home communities. As you have seen, South Slough has an amazing story to tell. You now have the opportunity to tell others in a very special way about the riches of South Slough. Good luck. From here on, it's up to you."

