

TIDES



Teaching Investigation & Discovery through Estuary Study

“Most people are on the world, not in it – have no conscious sympathy or relationship to anything about them – undiffused, separate, and rigidly alone like marbles of polished stone, touching, but separate.” - John Muir

Teaching Investigation and Discovery through Estuary Study

Foreword - Why study an estuary?

Investigation and discovery are the most exciting ways to learn about life and to develop skills that will continue to serve us as we begin to think critically about the world around us and how we fit into that world. Whether our outlook leads us towards a path related to science, the arts, communications or the integration of these fields, the ability to investigate and discover for ourselves provides a powerful means of gathering knowledge in a meaningful way. Lessons and information gained through personal experience have a great and lasting impact which we apply throughout our lives.

The **estuary** is a rich and dynamic **ecosystem** which connects the rivers and waterways draining continents to the tidal surge and ebb of the ocean. This biologically productive and ecologically complex system is an essential link in the life cycle of 70-80% of commercially harvested seafood; a place where humans have settled for many thousands of years; and a mystery which is still poorly understood in many ways. Often, the information which we base management decisions on concerning our estuaries is dated and insufficient, while the voting public has little awareness and knowledge of the basic relationships, habitat and functions which define estuaries. We risk a great deal by allowing these conditions to continue to exist.

The opportunities to provide meaningful educational experiences through estuary study are many and the applications of the acquired knowledge to the fundamental needs of students are broad and diverse. In the study of an estuary, the teacher and students can explore the life cycle and anatomy of an individual such as the Coho salmon which traverses the boundary between land and sea twice in a journey of epoch proportions, spending several months of its early life in the quiet, dark waters of **eelgrass beds** and narrow **tidal marsh** channels. Connecting this story to the larger ecosystem, the explorers begin to discover the relationships and interconnectedness which define a food web, the dynamic physical factors which create the environmental conditions which life must conform to and the impacts which change in this system can cause. Taken from another perspective, the salmon can lead us to observe the estuary from a landscape and seascape level, exploring the uses, functions and elements of the **watershed**, the broad extent of estuarine influence and the vast realm of the ocean. All of this investigation and discovery can happen through the eyes of only one of the many inhabitants of the estuary.

In the use of this curriculum, we hope that you will find a tool for exploring a fascinating and constantly changing place which has captivated humans for thousands, perhaps millions of years. A good deal of scientific evidence suggests that estuaries were the “cradle of life”, an environment where physical and chemical conditions nurtured the first biological community on earth. The activities and information which follows has been developed to assist and support you and your students in your quest to learn not only what the estuary is, but what role we each play in the **stewardship** of these important ecosystems. We hope that you find these materials compelling and useful, and we look forward to your comments, feedback and suggestions for improvement.

Tom Gaskill

Education Program Coordinator

South Slough National Estuarine Research Reserve

What is TIDES?

TIDES is a curriculum developed by the South Slough National Estuarine Research Reserve to assist middle school (grades 6-8) students and teachers in the investigation and discovery of estuaries and their connection to watersheds and the ocean. TIDES consists of this *Activity Guide*, the *“Tide of the Heron” video and study guide*, a set of *Estuary Study images and videos*, the *“Estuaries Study Feature Series” articles and study guide*, and other *Internet resources*. Through the use of these resources, we encourage classes to explore the rich and diverse estuaries of Oregon and Northern California (the lower Columbian bio-geographic region) and to understand the importance of these extremely productive and highly impacted ecosystems.

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Classroom-based Activities

- Activity 1 - Welcome to the Richest Place on Earth**
(introduction to South Slough NERR & estuaries)
- Activity 2 - An introduction to the “Tide of the Heron”**
- Activity 3 - Estuary Connections - Watersheds to the Ocean**
- Activity 4 - Tides of Change**
- Activity 5 - Life in the Waters of Productivity and Change - Physical Environments**
- Activity 6 - Life in the Waters of Productivity and Change – Estuary Survival**
- Activity 7 - Humans and the Estuary**

Field & Lab Study Activities

- Activity 8 - Preparations for a Field Experience** (equipment, planning, etiquette, tides, etc.)
- Activity 9 - Mapping Watersheds, Habitat & Uses of the Coast** (aerial photos)
- Activity 10 - Tidal Marshes - Richness & Diversity**
- Activity 11 – Tidal flats - A World Beneath the Bottom**
- Activity 12 - Waters of Life - A Journey into the Microworld**
- Activity 13 - Waters of Life - Eelgrass and a Community of Creatures**
- Activity 14 - Protect, Conserve & Restore - A Connection to your Community**

Introduction to this curriculum

Goals & Objectives

Goal: To provide an investigative (investigation based) curriculum (organized group of activities and information) which can be used by teachers & students in grades 6-8 to learn about the importance estuaries of the lower Columbian bio-geographic region.

Objectives:

1. Teachers will utilize curriculum activities to provide students with first hand, preparatory & follow-up experiences with an estuary in the Lower Columbian Bio-geographic Region.
2. Teachers will utilize the presented resources as appropriate to improve the knowledge and awareness by their students of estuaries.
3. Teachers will increase their knowledge and awareness of:
 - a) types and characteristics of estuaries present (in the lower Columbian Bio-geographic region);
 - b) functional habitats of estuaries;
 - c) physical and chemical processes of estuaries;
 - d) ecological relationships within and related to estuaries;
 - e) impacts to estuaries;
 - f) historical activities in estuaries;
 - g) restoration activities related to estuaries.
3. Students will increase their knowledge and awareness of:
 - a) types and characteristics of estuaries present (in the lower Columbian Bio-geographic region);
 - b) functional habitats of estuaries;
 - c) physical and chemical processes of estuaries;
 - d) ecological relationships within and related to estuaries;
 - e) impacts to estuaries;
 - f) historical activities in estuaries;
 - g) restoration activities related to estuaries.

Audiences: (Primary) 6th-8th grade science teachers in Northern California, Oregon & Southern Washington

(Primary) 6th-8th grade students (same region as above)

(Secondary) Parent & volunteer assistants (same region as above)

Comments on learning styles, scope & sequence of activities

These activities and resources have been developed through many years of effort at the South Slough National Estuarine Research Reserve and working in partnership with other agencies and institutions. The assemblage presented here for your use has been designed primarily to be most useful as a sequential series which builds on fundamental concepts established in the primary chapters. While the primary scope has been developed to be useful in classrooms teaching the Natural and Physical Sciences, many occasions for use by interdisciplinary teams of teachers have also been incorporated to include skills in English, Mathematics, Social Studies and the Arts.

The classroom activities are designed to “stand-alone” without the support of a field experience, however there is no replacement for first-hand contact when exploring habitats such as tidal flats and marshes. Therefore, a field experience is strongly encouraged.

Field experiences are perhaps the most difficult element of the curriculum to integrate and offer to your students because just as in the world of scientific research, field time is expensive! Logistics can be very challenging, funding difficult to come by and administrative approval and support is at times, hard to negotiate. That said, the field experience is a very powerful one with proper preparation and can be one of the most potent learning opportunities in a student’s career.

Because learning styles vary from student to student, we recognize that the classroom instructor faces a challenging job in providing meaningful educational experiences for all the students of a given class. Attempts have been made to incorporate a variety of styles into each activity as appropriate.

Support for use (e-mail & homepage address)

Many individuals and institutions contributed to the development of this curriculum, however the primary responsibility for support and receipt of comments lies with the education program at South Slough National Estuarine Research Reserve. In the current age of technology, we can be reached in a variety of ways including in person visits to our site.

Please contact us at:

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About South Slough National Estuarine Research Reserve

Dedicated to Research, Education and Stewardship this 4,771 acre natural area encompasses 600 acres of tidal marshes, mudflats and open water channels. Connecting to the ocean through the Coos estuary mouth, near Charleston, Oregon, South Slough provides an outstanding natural laboratory. Established in 1974, South Slough NERR represents a partnership between the National Oceanic and Atmospheric Administration/NOAA - Sanctuaries and Reserves Division/SRD and the Oregon Division of State Lands.

Field trips to the Reserve may be arranged by contacting the Education Program at the above address and phone number. Custom programs can be designed with sufficient advance notice (preferably 1-3 months) and support from the participating school (teacher and parent volunteers and transportation to and from site), however the activities developed in this curriculum are designed for use at the Reserve as well as at other estuarine locations throughout the bio-region.

Assessments of student learning and comprehension

Evaluation and assessment of learning are fundamental to the measurement of the success of any educational venture, however these elements are often overlooked in the busy reality of conducting activities. We have attempted to incorporate evaluation and assessment into each activity as well as developing a more comprehensive evaluation plan for the overall performance of this curriculum which should assist us with improving subsequent versions of the material.

Each activity identifies the learning objectives and expected outcomes on the first page. The conclusion of the activity includes a framework for assessing the comprehension of the participants for the information being presented. In some cases, the instrument is a simple quiz and for some activities, the product provides the teacher with a means to assess the impact and success of the activity. Where a product is the measure of learning, we have attempted to provide a list of assessment criteria which can be used as a “yardstick”.

The learning outcomes have been developed to conform to the most recent information available concerning Oregon’s educational reform language and the Common Curriculum Goals. As individual classroom practitioners, we are very interested in your perspectives on the implementation of these learning outcomes and their usefulness to meeting the requirements of your students and the Department of Education.