Estuary Web-Quest	
Notes	• This lesson plan goes along with the estuary Web-Quest site (http://estuary-Web-Quest.tripod.com). To complete these activities, internet access is required. • The Web-Quest can be completed as a whole group with one computer connected to a digital projector, with small groups (4 students per computer), or in a lab where each student has access to his/her own computer. • If students do not have experience using science notebooks, the first few sections should be done together with teacher modeling and you may wish to use the follow website for support: http://sciencenotebooks.org • Following this lesson plan is a unit outline with suggested questions, vocabulary, etc. listed out for each section of the Web-Quest. • This unit is geared to 4th-6th grade students • Can be used to supplement any of the Life Science Kits, such as: Environments or Structures of Life or as a supplement for the Earth Science Kit: Water • Activity will take approximately 10 class sessions to complete
Big Ideas	• An estuary is a partially enclosed area where fresh and salt water mix. • Estuaries are systems with multiple parts. • Estuaries perform many functions in the environment. • Human activities affect estuaries. (See the unit outline for the big ideas for each section of the estuary Web-Quest.)
Essential Questions	• What structures make up the estuary system? • What is the function of the estuary system? • How do human activities impact the estuary system? (See the unit outline for the essential questions for each section of the estuary Web-Quest.)
GLE Ties	The following GLEs are covered in the unit. See the unit outline for which Web-Quest sections are aligned with which GLEs. These are from the 3rd-5th grade GLEs. **1.2.1**: Analyze how the parts of a system go together and how these parts depend on each other. **1.3.4**: Know processes that change the surface of the Earth. **1.3.8**: Understand living things need constant energy and matter. **1.3.10**: Understand that an organism's ability to survive is influenced by the organism's behavior and the ecosystem in which it lives. **3.1.1**: Understand problems found in ordinary situations in which scientific design can be or has been used to design solutions. **3.1.2**: Understand how the scientific design process is used to develop and implement solutions to human problems. **3.2.4**: Understand how humans depend on the natural environment

<table>
<tr><td></td><td>and can cause change in the environment that affect humans' ability to survive.</td></tr>
<tr><td>Vocabulary</td><td>
<table>
<tr><td>Actions</td><td>Algae</td><td>Bacteria</td><td>Carbon dioxide</td><td>Carnivore</td></tr>
<tr><td>Choices</td><td>Consume</td><td>Consumer W</td><td>Decompose W</td><td>Density</td></tr>
<tr><td>Detritivore</td><td>Detritus</td><td>Earth</td><td>Eelgrass</td><td>Estuary</td></tr>
<tr><td>Filter</td><td>Fresh water</td><td>Function</td><td>Glucose</td><td>Gravity W</td></tr>
<tr><td>Habitat W</td><td>Herbivore</td><td>Impact</td><td>Industry</td><td>Input</td></tr>
<tr><td>Invasive species</td><td>Microscopic</td><td>Moon</td><td>Nitrates</td><td>Ocean</td></tr>
<tr><td>Organism W</td><td>Output</td><td>Oxygen W</td><td>Photosynthesis</td><td>Phytoplankton</td></tr>
<tr><td>Plankton</td><td>Pollution</td><td>Preserve</td><td>Producer W</td><td>Protect</td></tr>
<tr><td>Recreation</td><td>River</td><td>Salinity</td><td>Salmon</td><td>Saltwater</td></tr>
<tr><td>Sediment</td><td>Structure W</td><td>System W</td><td>Temperature W</td><td>Tides</td></tr>
<tr><td>Watershed</td><td>Waves</td><td>Zones</td><td>Zooplankton</td><td></td></tr>
</table>

(See the unit outline for which words are connected with each activity in the Web-Quest.)
W- refers to WASL terms
Link to glossary: http://www.padillabay.gov/lessons/glossary.htm

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<tr><td>Possible Misconceptions</td><td>

Not knowing what an estuary is, or thinking that an estuary is only wetlands/muddy areas.
Not understanding how human choices and activities impact the environment.
Thinking that because Puget Sound looks nice and natural that it's a healthy estuary.
Not understanding that an estuary is a system, and that something that happens in one part of the system affects the system as a whole.

</td></tr>
<tr><td>Instructional Strategies</td><td>

Students will be using science notebooks as they work on the Web-Quest (modeling will be required for classes who haven't used notebooking). This unit could also be a good introduction to notebooking by going through the activities together and using ample teacher modeling for help see the science Notebooking website: : http://sciencenotebooks.org
There are related hands-on activities mentioned in the unit outline (below), and on the teacher section of the Web-Quest.
Accommodations for diverse learners can include grouping students so that there are other children available to help, modeling by the teacher, reading the information to students with reading difficulties, creating an electronic notebook so students can type their entries on the computer, etc.

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<tr><td>Assessments</td><td>There are several assessments that can be used with this unit:

science notebook (rubric available on Web-Quest)

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	• "experts only" section asks students to solve an estuary problem (rubric available on Web-Quest) • pre- and post- estuary tests can be found below or at: http://www.padillabay.gov/lessons/Web-QuestTest.pdf
Lesson Description	The Web-Quest is broken into sections; each section is designed to be a day's science lesson (approximately 30-45 minutes). The sections are: Start Here (what is an estuary), watersheds, waves & tides, plankton, detritus & bacteria, plants of the estuary, animals of the estuary, humans and the estuary, inputs & outputs, and experts only (Puget Sound). The following shows a suggested sequencing of the daily lesson: 1. Students should have their science notebooks and writing utensils ready to go. 2. Review previous learning about estuaries (after first day). 3. Log on to the estuary Web-Quest http://estuary-Web-Quest.tripod.com Follow the directions for the section you are on – pre-teaching and background question are built into the daily activities, so pre-discussion is not necessary. Tricky vocabulary could be reviewed prior to beginning, if you feel your students need this. 4. Students complete the activities and their science notebooks. 5. Post discussion – questions tie in the systems approach and what they learned for the day. (See the unit outline for questions that go along with each section).

<table>
<tr><th colspan="2">Lessons</th></tr>
<tr><td>Part 1</td><td>Introduction</td></tr>
<tr><td>GLE</td><td>1.2.1
1.3.4</td></tr>
<tr><td>Vocabulary</td><td>
<table>
<tr><td>Estuary</td><td>System</td><td>Function</td><td>Input</td><td>Output</td></tr>
<tr><td>Habitat</td><td>Filter</td><td>Oxygen</td><td>Detritus</td><td>Industry</td></tr>
</table>
</td></tr>
<tr><td>Big Idea and Activities in WebQuest</td><td>• An estuary is a partially enclosed area where freshwater and saltwater mix.
• Estuaries have several functions.
• Estuaries change daily and over time.</td></tr>
<tr><td>Essential Questions</td><td>• What is an estuary?
• What functions are performed by the estuary?
• How do estuaries change?</td></tr>
<tr><td>Functions</td><td>• Natural filter
• Create oxygen
• Provide habitat
• Break down detritus
• Flood and storm buffer
• Commercial (fishing, tourism)
• Change: daily with tides, seasonally, with sediment build-up over time, due to human development</td></tr>
<tr><td>Post-WebQest Discussion</td><td>• What did you learn today?
• What is an estuary?
• What do estuaries do for the environment (functions)?
• How do estuaries change?
• What questions do you have about estuaries?</td></tr>
<tr><td>Part 2</td><td>Watersheds</td></tr>
<tr><td>GLE</td><td>1.2.1
3.1.1
3.1.2
3.1.3</td></tr>
<tr><td>Vocabulary</td><td>
<table>
<tr><td>Watershed</td><td>Freshwater</td><td>Saltwater</td><td>Salinity</td><td>Plankton</td></tr>
<tr><td>Sediment</td><td>Detritus</td><td>River</td><td>Ocean</td><td>Impact</td></tr>
<tr><td>Temperature</td><td>Density</td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
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<table>
<tr><td>Big Ideas and Activities in WebQuest</td><td>• A watershed is the land area that frainis into a specific river, lake, or estuary.
• Things that happen in the watershed affect the estuary.</td></tr>
<tr><td>Essential Questions</td><td>• What is a watershed?
• What does the watershed bring to the estuary (inputs)?
• If something happens to the watershed, how does that impact the estuary?
• Does the watershed bring to the estuary (inputs)?
• If something happens to the watershed, how does that impact the estuary?</td></tr>
<tr><td>Functions</td><td>• Bring in oxygen
• Bring in freshwater
• Bring in sediment and detritus
• Bring in nutrients for plankton
• Fish travel between river and estuary and ocean
• Seasonal influence on water temperature
• Lower density (freshwater is less dense than saltwater)</td></tr>
<tr><td>Post-WebQuest Discussion Questions</td><td>• What did you learn today?
• What is the function of the watershed?
• Discuss their experiences with the Watershed Game – choices they made, how they impacted the estuary and watershed.
• Discuss their answers for what happens when something is dumped into a river within an estuary’s watershed (oil/gas runoff from car).
• What questions do you still have about watersheds?</td></tr>
<tr><td>Extention Activities</td><td>• Investigate density – which will float (hot or cold water, salt or fresh water) using food coloring to observe the differences.</td></tr>
<tr><td>Part 3</td><td>Tides and Waves</td></tr>
<tr><td>GLE</td><td>1.2.1
1.3.10</td></tr>
<tr><td>Vocabulary</td><td><table>
<tr><td>Waves</td><td>Tide</td><td>Habitat</td><td>Plankton</td><td>Zones</td></tr>
<tr><td>Density</td><td>Freshwater</td><td>Saltwater</td><td>Earth</td><td>Moon</td></tr>
<tr><td>Gravity</td><td></td><td></td><td></td><td></td></tr>
</table>•</td></tr>
<tr><td>Big Ideas and Activities in WebQuest</td><td>• Waves are caused by wind.
• Tides are caused by the moon’s gravitational pull on the Earth.
• Waves and tides affect the type of plant and animal life that can survive in the estuary.</td></tr>
<tr><td>Essential Questions</td><td>• What causes waves?
• What causes tides?
• What do waves and tides bring to the estuary?</td></tr>
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<tr><td></td><td>

- How do waves and tides affect the animals living in the estuary (adaptations)?

</td></tr>
<tr><td>Functions</td><td>

- Bring in oxygen
- Bring in saltwater
- Bring in detritus
- Stir up nutrients from the sea floor
- Provide habitat for animals needing water all/part of the day
- Change the shoreline (erosion)
- Moving larvae from place to place
- Increase water density (saltwater is more dense than freshwater)
- Carry in debris from the ocean (kelp, driftwood, etc.)
- As some fish (i.e., salmon) grow, they leave with tides to go to the ocean
- Create habitat, such as tidepools

</td></tr>
<tr><td>Extension Activities</td><td>

- What did you learn today?
- What causes waves?
- What causes tides?
- What are the functions of waves and tides?
- How do waves and tides affect the plants and animals of the estuary?
- What questions do you still have about waves and tides?

</td></tr>
<tr><td>Part 4</td><td>Plankton</td></tr>
<tr><td>GLE</td><td>1.2.1
1.3.8
1.3.10
3.1.1
3.1.2
3.1.3</td></tr>
<tr><td>Vocabulary</td><td>
<table>
<tr><td>Plankton</td><td>Phytoplankton</td><td>Zooplankton</td><td>Microscopic</td><td>Photosynthesis</td></tr>
<tr><td>Oxygen</td><td>Glucose</td><td>Carbon dioxide</td><td>nitrates</td><td>Organisms</td></tr>
<tr><td>Algae</td><td></td><td></td><td></td><td></td></tr>
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</td></tr>
<tr><td>Big Ideas and Activities in Webquest</td><td>

- Phytoplankton are free floating, microscopic, single-celled plants that live in water.
- Zooplankton are animals, often microscopic, that can move but cannot swim against a current.
- Pollutants affect plankton.
- Plankton is essential to the food web.

</td></tr>
<tr><td>Essential Questions</td><td>

- What is plankton (phytoplankton and zooplankton)?
- What do plankton bring to the estuary system?
- How are plankton affected by changes in the system?
- How would changes in plankton affect the rest of the estuary system?

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<table>
<tr><td>Functions</td><td>

Phytoplankton:

Use carbon dioxide and sunlight to create oxygen and glucose (photosynthesis)
Provide food for zooplankton and other organisms

Zooplankton:

Provide food for other organisms
Often are young forms of animals (jellyfish, crabs, barnacles, etc.)

</td></tr>
<tr><td>Post-WebQuest Discussion Questions</td><td>

What did you learn today?
What is phytoplankton?
What is zooplankton?

Discuss their ideas on the nitrate problem:

What does plankton bring to the estuary system (inputs)?
What does plankton take out of the estuary system (outputs)?
What questions do you still have about plankton?

</td></tr>
<tr><td>Extension Activities</td><td>

Plankton Activities and Microorganisms links on teacher section of webquest.
Create plankton nets, gathering and viewing plankton (microscope needed).
Food Webs of the Estuary lesson on Padilla Bay website.

</td></tr>
<tr><td>Part 5</td><td>Detritus and Bacteria</td></tr>
<tr><td>GLE</td><td>1.2.1
1.3.8
1.3.10</td></tr>
<tr><td>Vocabulary</td><td>
<table>
<tr><td>Detritus</td><td>Bacteria</td><td>Decomposition</td><td>Detritivore</td><td></td></tr>
</table>
</td></tr>
<tr><td>Big Ideas and Activities in WebQuest</td><td>

Plants and animals die and become detritus.
Bacteria and other organisms eat detritus (detritivores).
Detritus is a vital part of the estuary food web.

</td></tr>
<tr><td>Essential Questions</td><td>

What did you learn about detritus and bacteria?
What does detritus bring to the estuary?
What does detritus take from the estuary?
What questions do you still have about detritus?

</td></tr>
<tr><td>Extension Activities</td><td>

Food Webs of the Estuary lesson on Padilla Bay website.

</td></tr>
<tr><td>Part 6</td><td>Plants of the Estuary</td></tr>
<tr><td>GLE</td><td>1.2.1
1.3.8
1.3.10</td></tr>
<tr><td>Vocabulary</td><td>
<table>
<tr><td>Eelgrass</td><td>Phytoplankton</td><td>Carbon dioxide</td><td>Producer</td><td>Photosynthesis</td></tr>
</table>
</td></tr>
</table>

Big Ideas and Activities in WebQuest	• Plants provide habitat, food, and oxygen in an estuary. • Plants are producers.
Essential Questions	• What is the role of plants in the estuary?
Functions	• Provide habitat • Provide oxygen and glucose through photosynthesis • Provide food Remove carbon dioxide • Plants die and become detritus
Post-WebQuest Discussion Questions	• What did you learn about plants in the estuary? • What do plants bring to the estuary? • What do plants take from the estuary? • What questions do you still have about plants?
Extention Activites	• Food Webs of the Estuary lesson on Padilla Bay website.
Part 7	**Animals of the Estuary**
GLE	1.2.1 1.3.8 1.3.10 3.1.1 3.1.2 3.1.3
Vocabulary	Consumer | Consume | Herbivore | Carnivore | Invasive Species
Big Ideas and Activities in WebQuest	• There is an abundant amount of animal life in the estuary. • Animals have many functions in the estuary. • Some animals live in the estuary all their lives, while others live there only when they are young. • Some animals are brought to the estuary from other places (invasive species), they have an impact on the estuary.
Essential Questions	• What kinds of animals live in estuaries? • What is the role of animals in the estuary? • What are invasive species?
Functions	• Animals are consumers in the estuary. • Animals are food in the estuary. • Animals die and become detritus. • Invasive species are brought to the estuary, they can have an impact on the system.
Post-WebQuest Discussion Questions	• What did you learn about animals in the estuary? • What do animals bring to the estuary? • What do animals take from the estuary? • What are invasive species? • Why are they important? • Discuss what they think should be done about invasive species.

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- What questions do you still have about animals in the estuary?

</td></tr>
<tr><td>Extention Activities</td><td>

- Food Webs of the Estuary lesson on Padilla Bay website.
- Creating an estuary aquarium (teacher section on webquest).
- Interdependence and adaptation link (teacher section of webquest).

</td></tr>
<tr><td>Part 8</td><td>Humans and the Estuary</td></tr>
<tr><td>GLE</td><td>1.2.1
1.3.10
3.1.1
3.1.2
3.1.3
3.2.4</td></tr>
<tr><td>Vocabulary</td><td>
<table>
<tr><td>Protect</td><td>Preserve</td><td>Recreation</td><td>Actions</td><td>Choices</td></tr>
<tr><td>Pollution</td><td>Industry</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Big Ideas and Activities in WebQuest</td><td>

- Human actions effect estuaries in many ways (i.e., diking, pollution, recreation activities, etc.)
- Everyone can do something to protect estuaries and the environment.

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<tr><td>Essential Questions</td><td>

- How do human choices and actions affect the estuary system?
- What choices can we make to protect estuaries?

</td></tr>
<tr><td>Functions</td><td>

- Human uses: diking for farmland, transportation and shipping, recreation, fishing, etc.
- Environmental protection & preservation focus on things everyone can do, rather than large-scale protections (i.e. industrial pollution)

</td></tr>
<tr><td>Exention Activities</td><td>

- National Geographic Finding the Balance activity (teacher section of webquest).

</td></tr>
<tr><td>Part 9</td><td>Inputs and Outputs</td></tr>
<tr><td>GLE</td><td>1.2.1
1.3.10</td></tr>
<tr><td>Vocabulary</td><td>
<table>
<tr><td>Structure</td><td>Function</td><td>Input</td><td>Output</td><td></td></tr>
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</td></tr>
<tr><td>Big Ideas and Activities in WebQuest</td><td>

- Structures of systems bring things in (inputs) and take things out (outputs) of the system.

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<tr><td>Essential Questions</td><td>

- See previous lessons

</td></tr>
<tr><td>Post-WebQuest</td><td>

- Discuss what they put inside their circle (inputs) and outside their circle (outputs) and why.

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</table>

Discussion Questions	
Part 10	**Experts Only**
GLE	1.2.1 3.1.1 3.1.2 3.1.3 3.2.4
Vocabulary	Salmon | Life Cycle | Disruption | Smoltification |
Big Ideas and Activities in WebQuest	• Salmon lifecycle and use of estuaries. • Puget Sound Problem – analyze the effect on the estuary of an issue in the watershed. (Evaluation)
Essential Questions	• Why are estuaries important to the salmon lifecycle? • How might humans disrupt this part of the Salmon life cycle?
Functions	• Estuaries are a link between the fresh water and the salt water. • Estuaries provide habitat for salmon smoltification.
Post-WebQuest Discussion Questions	• Discuss their solutions to the Puget Sound Problem. • Self-asses using the rubrics on the evaluation page.
Extension Activities	• Have students make a model of the salmon life cycle and include all of the components needed to sustain a population.

Pre and Post Test – Estuaries Name: _____ Date: _____

This test is designed to show what you know before starting the estuary unit, and what you've learned after we finish.

1. What is an estuary?
   _____
   _____
   _____
   _____
   _____
2. Where could you find an estuary near you?
   _____
   _____
   _____
   _____
   _____
3. Why are estuaries important?
   _____
   _____
   _____
   _____
   _____
4. What are the possible problems for estuaries?
   _____
   _____
   _____
   _____
   _____
5. How do humans impact estuaries?
   _____
   _____
   _____
   _____
   _____