# Activity 7 - Humans and the Estuary: Clams Enough for Everybody

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| **PURPOSE:** | To demonstrate how scientific investigation is used to protect and manage a resource for the benefit of the ecosystem and the people who use the resource. |
| **TIME REQUIRED:** | Two class periods (~45 minutes each) |
| **SUBJECTS:** | Science, English, Math |
| **MATERIALS NEEDED:** | Several types of durable fruit or candies to represent clams (quantity depends on student #'s), a chalk or white board and markers, ~ 30-foot length of rope, a clipboard, a data sheet (see copy in activity.) |
| **VOCABULARY:** | Abundance, depletion, exploitation, habitat, harvest limit, impact, management, population, quantify, regulator, reproductive strategy, resource, tide. |

**Outcomes:** 1) Students will be able to describe how tides affect distribution and abundance of organisms in the estuary. 2) Students will be able describe a method to quantify and assess an impact to a resource. 3) Students will be able to name and describe two possible management methods to protect a population.

**Life Science**
- Organism structure & functions
- Traits of an organism passed on
- Population change in the environment

**History and Nature of Science**
- How scientists investigate

**Scientific Inquiry**
- Ask questions to support scientific inquiry
- Design scientific investigation
- Collect data
- Analyze data

**Science in Personal and Social Perspectives**
- Acting on personal and social issues.

**Background:** Natural resource management is where many people interact with science on a personal basis. When individuals seek to harvest a particular species of plant or animal for personal or commercial purposes, they are typically going to have to respond to regulations. Regulations determine how much of any particular plant or animal can be harvested and still allow the species to successfully reproduce and exist within that specie's habitat.

Appropriate regulations are typically based on science that has looked at the life history of the species, habitat requirements, years to adulthood, size, and other factors that may influence the species ability to successfully reproduce. When the science is inaccurate or lacking, managers are often faced with a

difficult choice. Should they allow the harvest level to be set by the harvesters or should they choose a conservative level that will protect the resource but may upset those who want to harvest?

**Preparation:** (Day 1) Invite a shellfish or other relevant marine biologist, or someone involved in wildlife management to class and ask them to discuss collecting data to make a management decision about harvest levels and protection of the resource. Ask them to focus on the importance of maintaining a viable population to continue successful reproduction of a species and to discuss the challenges of deciding acceptable harvest limits and enforcing those limits. Talk about the role of education versus regulation with your class.

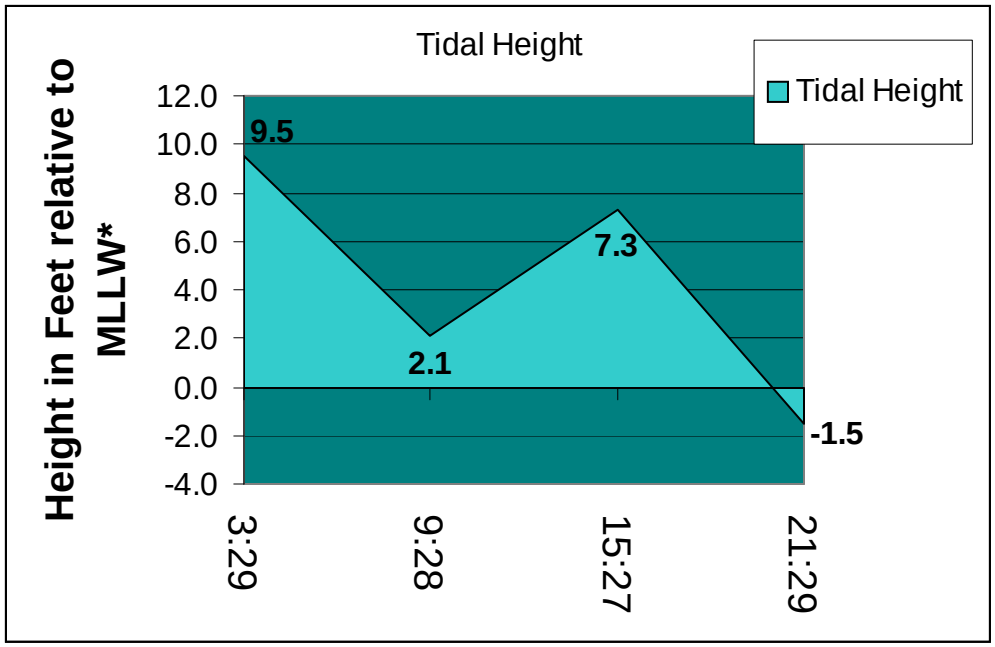
If possible, ask the biologist to discuss the life history of clams, the variability of habitat requirements (depth, sediments, & locations), and the length of time required to reach harvest size. If they do not have a background in clam biology, review the relevant information with your class. This information can be found at the South Slough web-site, or in the Estuaries Feature Series, Articles # 4 & 5, and in the Teacher Background Document included in this activity.

(Day 2) Collect the items identified in the **Materials Needed** list at the beginning of this activity. Be sure to prepare enough representative clams to support reasonable analysis of the data at the end of the exercise. This should become clear after reading the activity description.

**Activity Description:** (Day 1) The natural resource specialist that you have invited as a guest should cover the concept of resource management so that students can transfer these ideas to the hands-on activity which will occur the following day. Depending on the specialty of the speaker, you may need to supplement their presentation with information about clam biology and tides. *An optional approach would be to forego the invited guest speaker and use Day 1 for an exploration of clam biology and relationship to tides. Activity 4 "Tides of Change" gives a more thorough treatment of this topic and should be reviewed prior to conducting the tides portion of this activity.

Using two volunteer students and the length of rope, ask each of the students to grab one end of the rope and stretch it across the length of the room. As they pull the rope taught, explain that the line formed will symbolize the elevation of the surface of the water in the estuary at a given point in time, viewed in cross section. Now, ask the students to slowly bring the rope down to a point near the floor, explaining that this represents the falling or ebb tide where the waters of the estuary are moving towards the ocean. The students will then reverse the motion, raising the rope above their heads to symbolize a high tide. At this point, you should discuss the time interval between low and high tides, a period of approximately 6 hours for tides on the west coast of North America. You may follow this by guiding the rope through two more "High/Low" cycles to illustrate that 2 high tides and 2 low tides typically occur during a 24 hour period.

You can now discuss the elevation of tides as they are measured relative to "sea level" which is usually referred to as Mean Lower Low Water, or the average of the lower of low tides for a given area. So a +7.3 ft. high tide is literally 7.3 feet above the average of the lower of the low tides which then becomes 0.0 ft. or "sea level". A low tide of –1.5 ft. is then, 1.5 ft. below the average of the lower of the low tides. See the chart which follows for a graphic presentation of this concept.




***MLLW or mean lower low water is represented by 0.0 on the Y axis of the chart.**

(Day 2 ) Begin by reviewing the previous day's discussions with the natural resource specialist concerning management of a resource for protection and use. Transition to the activity by explaining that the students are going to participate in the management of a small clam fishery to determine the best way to ensure that a population exists for future harvest opportunities and in support of a healthy ecosystem. You may choose, at this point, to share the graph (transparency) included in this chapter which shows an example population of clams before and after harvest. Use this example to discuss the implications of over harvest relative to reproductive success of the clams and future availability of the resource. You may wish to wait and show the results of the mock clam harvest until after the first round of the activity.

**Clam Harvest: Clams Enough for Everybody?**

Divide the students up into groups identified as follows:

**Harvesters** – These students will have the opportunity to "harvest" the clams. They may choose to obey posted limits, listen to regulators and educators, or ignore at their peril!

**Educators** – These students will try to come up with techniques to keep the harvesters in line with legal limits. They may wish to use signs, interpretive exhibits, or simply conversation to try to educate the harvesters. They may have other ideas to contribute as well.

**Regulators** – These students will attempt to regulate the clam harvest to protect the resource. These students may wish to use signs, their physical presence, or conversation to engage the harvesters. They may have other ideas to contribute as well. These students will also have the responsibility of setting the legal limits for each type of clam.

In addition, you will need two volunteers to control the rope which represents the tide level. As the tide level rises, the "clams" behind the line become off-limits to harvest. Harvesters must respect the tide line and not harvest clams on the far side of it.

To conduct the activity, ask the harvesters to wait in the hallway or somewhere out of site of the harvest area. Set up the classroom to represent a tide flat with the desks as the surface, seats as the clams at depth, and the floor for the deepest clams. Have student volunteers place the "clams" throughout the room in various locations on the tide flats. Make sure that some of the biggest and best "clams" – the Gapers, are located at one end of the room on the seats or floor. Ask the volunteers with the rope to cordon off this section as this will be the lowest tide point and these clams will not be available for harvest.

While the clams are being placed, consult with the educators and regulators. You may wish to give them simple written instructions by printing out a copy of the role descriptions listed above. Give them some time to write up their signs.

Now invite the harvesters into the room. As you do this, clap your hands to represent the rising of the tide. When you clap your hands, the students holding the rope should move it one step across the room, reducing the amount of available "tide flat" for harvest. Periodically, clap your hands to raise the tide level further. When the tide has risen to an acceptable level, call out "Freeze".

At this point, ask another student volunteer to collect the data for the number and type of clams harvested. This can be written on the board so that all students can see it. It should look something like the sample table included in this activity.

**Post activity analysis:** A sample spreadsheet is included in the Resources folder for this activity. Once the students have completed a cycle of harvest, ask them to divide the harvest with their classmates so that each student gets some "clams".

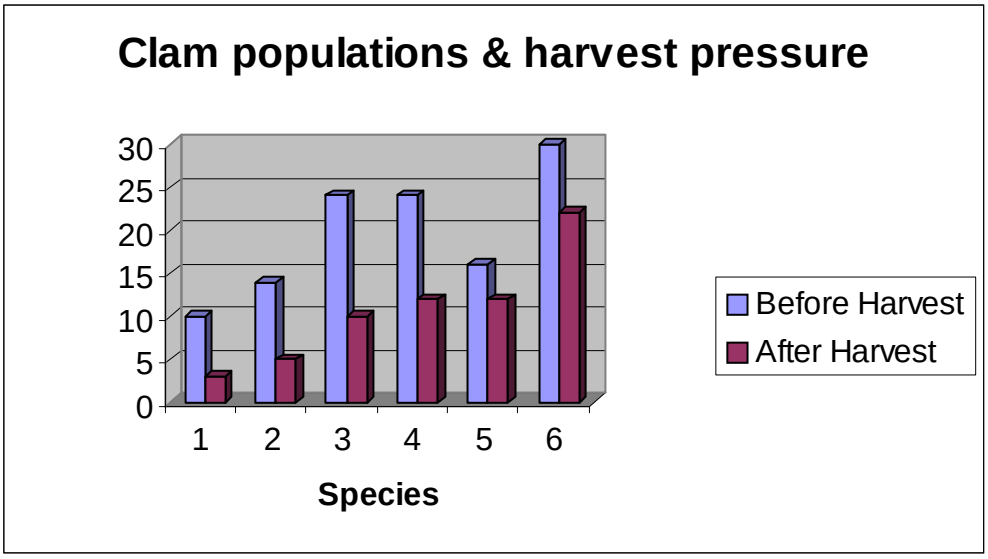
As evaluation for this activity, you may choose to discuss the following questions as a group or assign the students to individually answer these questions.

1. Will all the species of clams survive to reproduce another generation?
2. Which clams were harvested most heavily? Why?
3. Which clams suffered the least amount of harvest pressure? Why?
4. Were the harvesters aware of the regulations? Did they obey them?
5. What educational techniques, if any, were effective?
6. Should the regulations be adjusted? How would you set the limits differently?
7. What might work best to protect the populations of each clam so that there are clams for future generations?

**Follow up ideas:** Ask students to go to the State of Oregon website and find the regulations for recreational shellfish harvest. Ask them to describe what they think works well about the current regulations and what does not. Take the class on a trip to the tide flats to harvest clams and then have a class feast by cooking and eating the clams as steamers or in clam chowder.

**Example of classroom mock harvest pressure & effects on population**

| Types of Clams | Represented by | Before Harvest | After Harvest |
|---|---|---|---|
| Gaper | Snickers bar | 10 | 3 |
| Butter | Mini Milky way | 14 | 5 |
| Littleneck | Peanuts in shells | 24 | 10 |
| Softshell | Hershey's Kiss | 24 | 12 |
| Cockle | Atomic Fireball | 16 | 12 |
| Bentnose | Gumballs | 30 | 22 |




If the critical threshold for successful reproduction is 5 individuals, then populations 1 & 2 do not have sufficient #'s of adult clams to succeed and they will disappear from the local area.