Activity 6 - Life in the Waters of Productivity and Change – Estuary Survival

PURPOSE:	To help students understand the relationships between habitat complexity, survival, adaptation, and species diversity using a game strategy involving coho salmon, Dungeness crab, and eelgrass beds to illustrate these concepts.
TIME REQUIRED:	One class period (~45 minutes)
SUBJECTS:	Science, English, Math
MATERIALS NEEDED:	Pre-printed and prepared game pieces, grid coordinate markers (pennies work well), Predator-Prey cards, Estuary Condition cards, game board, and worksheets.
VOCABULARY:	predator, prey, ecology, cover, non-native, juvenile, adult, larval, reproduction, survivorship, diversity, adaptation, habitat complexity, characteristic

Outcomes: 1) Students will be able to describe a predator-prey interaction and the factors that influence survivorship. 2) Students will be able to identify at least two characteristics that a crab or salmon possesses that contribute to the animals survival. 3) Students will be able to identify an interaction of at least three conditions that describe the ecology of the estuary.

Unifying Concepts and Processes:
- System inputs & outputs
- Evidence of changes over time
- Relationship of structure & function

Physical Science:
- Energy transfer & transformations

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

History and Nature of Science:
- Change in science over time
- Scientific investigation examples

Scientific Inquiry
- Ask questions to support scientific inquiry

Background: The competition for survival in the wild is a complex and dynamic process that is difficult to understand at times and dramatically clear at other times. Witnessing the interaction of

predator and prey firsthand is perhaps one of the most powerful experiences an individual may have when viewing nature. Sometimes the means of survival for the predator appears ruthless and yet, without sufficient calories gained by a successful hunt, the hunter may fail to successfully reproduce or even survive itself.

In a world where nearly all of our population depends on grocery stores to provide us with the majority of our food, we are far removed from terms like survival and predator and prey relationships. Yet, without an understanding of the process, we cannot truly appreciate what an estuary is and how many such interactions are constantly occurring beneath the surface and along the shore.

In this simple game of Estuary Survival, students will have an opportunity to take on the role as a crab or fish and consider some of the factors that lead to success or failure as these creatures strive to reach adulthood. While the terms of the game are necessarily simplified from the reality of life in an estuary, the conditions and predator/prey interactions are derived from true situations.

Preparation: You will find files inside the Resources folder for this activity which have master files for each of the crabs or salmon game pieces, cards, and game board. If possible, laminating these sheets before cutting them apart will help them to last longer.

- Print out and cut apart (preferably in color and on card stock) game piece sheets for:

  Dungeness crab megalopae cards – three different sizes 21 game pieces (each card may represent 1 or 10 individuals)

  5mm across carapace – megalops
  12mm across carapace – 1st instar
  20mm across carapace – juvenile

  Coho salmon juvenile cards – three different sizes 21 game pieces (each card may represent 1 or 10 individuals)

  35mm fork length - parr
  50mm fork length - smolt
  65mm fork length - juvenile

- Print one Estuary Survival worksheet for each student player.
- Print out the file "Game with Grid" in the Images folder inside the Resources folder for this activity. This file must be printed in color.
- Print out two complete sets each of the Estuary Condition cards and the Predator Prey cards.
- Collect enough pennies or other game tokens for the entire class. The students may place the tokens on the game board at the correct location and track progress or this may be done at the front of the class with one student announcing the position of each token to the player.
- Review the Powerpoint presentation Estuary Survival rules and print a copy of the notes. These notes will be read during the presentation at the beginning of the class.

Activity Description: Introduce the activity by passing out the Estuary Survival worksheets, one to each student. Ask the students to read through the top part of the worksheet and then present the PowerPoint presentation "Estuary Survival rules" using the notes contained with the presentation to explain how the game works.

1. Students receive or may choose either a crab or a salmon card and an Estuary Survival worksheet to complete before beginning the game.
2. Give students 5 minutes to complete the worksheet for their crab or salmon after viewing the presentation.
3. Discuss student Estuary Survival worksheet answers as a group.
4. Students randomly select a location card with a letter and number coordinate. As an alternative method, you may ask students to choose a letter from A-K and a number between 1-18. They should write these coordinates down and then place their token on the corresponding grid location on the game board. In cases where two students end up with the same location, the larger salmon or crab prevails. In the case of a tie, toss a coin. For the first round only, they may elect to move one or two grid squares away from the selected location.
5. The teacher or activity leader randomly selects an estuary condition card and reads it aloud.
6. Any tokens that do not survive the reported estuary condition are removed from the board and students write a short description of the fate of their individual on their Estuary Survival worksheet. If the class is keeping track, tally these individuals for later charting. An Excel spreadsheet is included in this activity to track this part of the activity.
7. Remaining players randomly select a predator/prey card and read it aloud one at a time.
8. Any tokens that are affected by the predator/prey are either removed from the board or exchanged for a new token. Students write a short description of the fate of their individual on their Estuary Survival worksheet.
9. The teacher or activity leader again randomly selects an estuary condition card and reads it aloud.
10. Any tokens that are affected by the reported estuary condition are removed from the board and students write a short description of the fate of their individual on their Estuary Survival worksheet.
11. A new round may begin following two changes of estuary conditions. In a new round, all individuals are surrendered and the game begins again. As an alternative, individuals surviving at the end of a round may choose to keep their piece in play for the next round. No purposeful grid movements are allowed in second and subsequent rounds.

Play continues for at least four rounds. If the conditions prove too harsh and survivorship is too low, count each individual token as a sub-population of ten individuals and ask the students to keep track with a tally of the final number that survive through all four rounds.

Post activity analysis: Creating a chart that demonstrates survivorship for the overall class populations of the different size classes of crabs and salmon is useful when analyzing the game results. Discuss with the students which factors seemed to play the most prominent role in determining success or failure of a population. They should refer to their notes during this stage of the game. You may wish to ask them how realistic they feel that the game was. Perhaps they will have suggestions for how to make the game more realistic. Please forward any ideas to South Slough so that we may incorporate them into updates of Estuary Survival.

Collecting the student worksheets and evaluating them for care in collection of the data and accuracy in providing answers to the questions is the best method of individual assessment for this activity. A sample student worksheet with possible answers is included in the Resources folder for this activity.

Follow up ideas: Ask the students to conduct a literature search to find studies that have investigated the factors that lead to survivorship within a population. They will find several articles in the Resource Library section of the South Slough NERR website – www.southsloughestuary.org

From these studies and others they have found, ask students to report what they have discovered to the class. Perhaps they will discover ways to improve the Estuary Survival game or create a new, more realistic game.