The Skittle Core Lab---a Place to Begin: Early Elementary

The Skittle Core Lab, an inquiry-based, integrated math and science lesson, is geared toward 5^{th} – 8^{th} grade. Although the math is directed toward middle school, it can be modified for K-4. This activity engages students in collecting and sharing data and then generates discussion about the natural world and how life in the ocean is connected.

Introduction: *"Dr. Bowser's team dives beneath the ice in Antarctica, much like the penguins do, except, the scientists must put on dry suits and scuba gear to dive. Unlike the penguins, the scientists aren't looking for food. The scientists are looking for tiny little creatures called foraminifera, or "forams" that are living on the bottom of the seafloor. Some forams float around in the water, but Dr. Bowser is looking for the ones found living in the muds and sand at the bottom of the ocean at Explorers Cove and nearby places in Antarctica. Forams aren't plants or animals. It's amazing that our bodies are made up of trillions of cells to help us move, grow, eat, breathe, and live, yet forams only have one cell. While penguins have feathers to keep warm and protected, these little microscopic organisms build their homes from tiny grains of sand and mud gathered from where they live. The bottom of the ocean is cold and dark, and it's not always easy for them to find food, so the little forams must build their own shells for protection and for getting the food that they need to survive. The forams are so small, so it helps to see them with a microscope. Forams are like little detectives that can tell us how the ocean is doing, and if any changes are happening in the ocean."*

"Have you ever watched a fish in a fish bowl, or have you ever gone swimming in the ocean? (This lesson could begin by having students observe a fish in a bowl). *What are some of the things that you noticed? What would make a difference to you…or a little fish, or a foram in the ocean? Think about what you would need if you were living in the ocean. What would you need to live and survive? What could help or hurt something that was living in the ocean?"* (possible answers: warm or cold water; we can't breathe under water, predators, salty water, waves, other things living there, clear water, deeper water, pollution, erupting volcanoes, hurricanes).

Today, we are going to do a lab that will help us understand that different things live in different parts of the ocean. (i.e., patchiness of the ocean)*, and that whether it's you, a fish, a penguin, or a foram, we must all live where we can survive." Things or conditions in the ocean can change, and if they do, would living things be able to survive the changes* (adaptation)? *Scientists can watch changes in the ocean by looking at what's living in the ocean to see what and how things (environment) are changing over time. Since Dr. Bowser can't count each foram that lives at the bottom of the ocean near Explorers Cove, the scientists collect core samples from different parts of the ocean floor to see what is living in the area.* (We will begin at: **www.bowserlab.org** - "Education" -> "Skittle Core Exercise" -> "**Real World Sampling**" -> "Collecting at Explorers Cove: Watch Divers in Action!": **YouTube Video clip**- Diving under the Ice to find Forams)
This skittle core lab will give you an idea of what Dr. Bowser does in Antarctica, and why core samples are important for his research. The different colored skittles represent five different species of foraminifera that Dr. Bowser studies in Antarctica.

FYI: Background Information for teachers: (**www.bowserlab.org** - Skittle Core Exercise -> "Real World Sampling" -> "About Forams", (Although, this isn't a study of foraminifera, the teacher might find it interesting to know more about these little climate change detectors that are so sensitive to the environment.) **Other Supplemental Resources:** Tina King's journal entry: **http://tea.armadaproject.org/king/11.20.2001.html** and **www.deepearthacademy.org-** Go to "Highlights" and "Teach It!"**.** Scroll down to Grades 5-8: Mohawk guy", then "*Mohawk guy Additional Background*→ "***Why Study Forams?***" (More information about *Where do forams live? What do forams eat? How do they build their shells?)*

Explore: (This activity gives students the opportunity to collect and compare data.) Since the scientists can't count every foram in the ocean, and the students can't count every skittle in their cake, sampling the population gives an idea of what is there.

- **Step 1**: See the **"YouTube" video clip** of Dr. Bowser's dive team collecting the sediment cores beneath the Antarctic Ice at Explorers Cove.
- **Step 2**: "***Meet the forams***": (**www.bowserlab.org** -> Education -> Skittle Core Exercises -> **"For Students"** -> "Forams from the Exercise".

Materials for Each Team:

Prepared pan of Skittle-laden Brownies: Baked brownie mix in a 9 x 13" pan, 2-3 packages of skittles, 16 oz. tub of chocolate icing. (Leave uncut and in the pan.)
Coring tools: Orange juice can (12 fl. oz), *or* PVC pipe coupler (diameter ~ 7 cm)

Supplies: Small paper plates, paper towels, toothpicks to extract the forams/skittles, crayons, and yellow highlighter (The Students need to highlight the letter- A, B, C, D, E, or F on their lab sheet to indicate their own core. The students need to write their cake number (1, 2, 3, or 4) on the top of the page.

- **Note**: If students cannot have chocolate or food products, then modeling clay or moist potting soil and different colored beads or beans may be substituted for the skittles and brownies. Skittles work better than M & Ms for this activity because they hold their shape and color.
- **Preparation:** Parents or student volunteers will be needed to make one cake per group of six students, so that each team can have their own "sampling site". This works well because it enables the students to compare their own cores within their sampling site, as well as with other regions (other cakes in the classroom). Each team will need one coring tool, a large spoon or tool to push the core from the coring tool, and a paper plate, toothpick, paper towel, and a lab sheet.
- **Preparation for brownies:** The brownies must be left uncut in the pan, so students can get core samples. Bake the brownies according to the package in a 9 x 13-inch pan. Cool slightly and gently press skittles into the cake to randomly cover the surface of the cake. Do not overlap the skittles, but lay them next to each other before covering with icing. (Some of the benthic forams at the bottom of the ocean live in the top one-cm of sediment and are slightly covered by soil.)

Procedure: *Each student will collect their own core sample.*

Getting a core sample: (e.g. For **Cake1**: The students will record their core sample by highlighting the letter of their core sample: (i.e., 1**A**, or 1**B**, 1**C**, 1**D**, 1**E**, or 1**F**). The other core samples from the other cakes (Cakes 2-4) will do the same, so students can identify the data from their own core sample (A-F). Students will write their cake # on the top of the page. (Cake 1, 2, 3, or 4).

The students will gently push and twist the coring tool (orange juice can or pvc coupler, diameter~ 7 cm) into the cake. The students must allow for six cores to be taken from the cake. As the core is twisted and pulled from the cake, the student will use a spoon to push the cake sample from the coring tool unto the plate. Each student will use a toothpick to extract the skittles from their own core. It's important to remind the students NOT to eat the data (their skittles) until after they have recorded and verified their data with their teammates.

- The students will count and record each of their colored skittles on their Lab Sheet. The students will work as a team to record the data from each individual core sample in their sample area. The students will first list the total number of each species found in their core. (e.g. Cake **1**, ***Sample Core A***: List as **1A**: and record skittles found, such as 8 red; 4 yellow; 5 green; 1 orange; 6 purple for a total of 24 forams found in core sample **1A**). The students will then work as a team to record and calculate the total from each core sample in "Cake 1". This will give them a final total for their cake (region) to compare with other cakes.

Explain: The **math** helps promote and generate active discussion between the team members and the teacher as the students make comparisons between their data, especially if one student has more skittles in their core, or if one cake has more skittles than the other. The students benefit by comparing individual core samples within their sample area (Cake). One student might only have 9 skittles, and the next person might have 20.

This is the time to **lead students to the science** by getting them to see beyond the simulated skittles to the very organisms (forams) that they represent. What could this data tell scientists? The teacher may lead the discussion toward patchiness in the ocean, and how organisms are distributed by the factors that enable species to thrive in one area and not in another. This gives an opportunity to talk about limiting factors that might affect organisms to thrive in one area and be absent in another. Having three or four cakes in a classroom also helps students to compare the data from each cake. The absence of data may also be significant, as well as generate questions as to why organisms might not be present.

Why do you think it is important for scientists to take more than one core sample in an area? (FYI: Teacher Background Info): The scientists might find an abundance of different species in one area, but not in another area. This might encourage further investigation or help scientists see the distribution of species from one area to the next, as well as one year to the next. The scientists can also monitor seasonal changes to see if glacial melting, or input of freshwater into a marine ecosystem is changing the distribution (where and how many forams are located in the area) or the species

composition (which species are living in an area). Some species are more dominant in some areas, so the factors contribute to what lives in an area. Encourage students to look in their own backyard or school yard to see what lives in one tree, or what lives in one section of grass or soil in the school yard compared to the other, or what bird is in the park. *Why does Antarctica have penguins? Why do polar bears live in the Arctic? Would you find either in your own backyard? What if you had a fish tank or a pond nearby? If you noticed all the fish had died, then think about what could have happened to cause this. What would happen if trash or chemicals are thrown into a lake or river?*

It's important to get students to think and talk in order to help them realize that one thing can affect another. It's important for students to see our role as humans. What are the limiting factors (biotic or abiotic) that could affect the foraminifera in Explorers Cove, Antarctica? What could limit certain species from living in an area?

Kindergarten and first grade students do not need to use this terminology *(i.e., limiting factors, biotic, abiotic, patchiness),* ***but it would be important to hear what they do know.*** It's important to get students talking. Are they bringing the outside world into the classroom? What have they observed in nature?

FYI: Teacher Background Info: ***Listed are some of the factors that fifth grade students came up with during a brainstorming/ class discussion.***

<u>Abiotic Factors (non-living)</u> that could affect organisms in an area:

- Temperature (water/air), sediment, rocks, sand, ice (iceberg scouring), oxygen, water (fresh or salty water), light (sun), pollution, natural disasters (erupting volcanoes and hurricanes).

<u>Biotic Factors (living):</u>

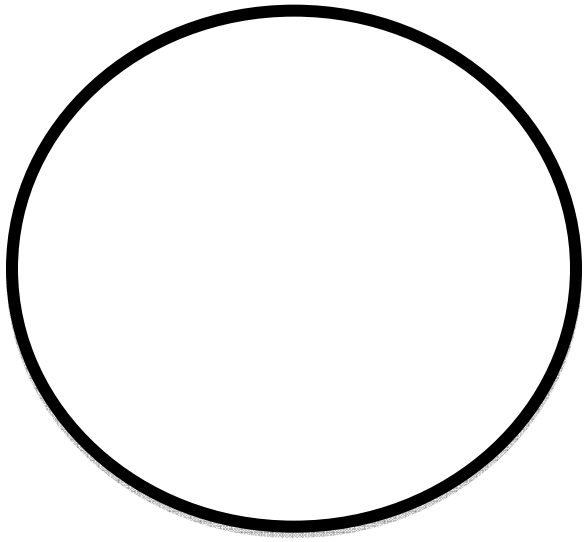
- Fish and other animals, algae and other plants (blocking light or providing for photosynthesis), humans, other organisms, and bacteria (forams eat it.)

Why do you think it is important for Dr. Bowser to take core samples from the same area from one year to the next? It is important for scientists to see changes in an area over different years to see if the area is healthy and if the population is changing, and if so, why these changes may be occurring.

Population vs. Population Density: No need to use the terms, but this concept also helps build understanding of how species survive, thrive, or become less dominant in a region. The students may best understood the difference between the concept of population and population density if the class counts the number of students in the classroom (i.e. population in our classroom is 20 students.). Then the teacher tells all 20 students to go into one corner of the room or gather together on the small carpeted area. Did the population stay the same (20 students)? Yes, but what changed? (population density) . The students might note that they are more crowded. In nature, many species like to cluster together for safety and food. Why do some things cluster together? (Many people like to live near grocery stores, water, and transportation.) Sometimes, if it becomes too crowded, it may also lead to some fighting, diseases, and competing for space and food. Some may leave the area or might die. This could be the same for penguins, fish, and forams. We only have one ocean, and even small changes in the ocean can affect what lives there. The forams, sensitive to change, are like little watchdogs on our environment.

Population Sampling from Skittle Cores: Draw and color the skittles found in your core sample in the circle provided. Each color represents a foram species that Dr. Bowser studies in Antarctica. Count the number of skittles of each color found in your core sample. Record the number of each on the table below. Add up the total number of skittles that were found in your core.

Species (Color-code) Cake # _____	Write the Number Found in Your Core Sample:
Red	
Yellow	
Green	
Orange	
Purple	
Total from your sample : A, B, C, D, E, F (Highlight)	



Record the **total number** from your chart under the letter of your core sample listed below. Then, share and record data from each member of your group by writing each total under the core sample listed below (A-F). Add totals of each sample taken from your area (pan of brownies). Write this total in the last column listed, "Total (A-F)".

Sample	**A**	**B**	**C**	**D**	**E**	**F**	**Total (A-F)**
Share data Total: each sample							

Compare your data: Did each sample core have the same number of skittles?