Science in a Square

A Quadrat Survey Activity

For use with the **Field** section of *Eyes on Eiders*

Overview: Students will discover that using simple tools can yield important scientific knowledge. During the first of two activities students will learn how to sample using a paper quadrat to make predictions of the overall test area. Then by constructing and implementing their own quadrats and data sheets students will be able to make predictions about the habitat in their own school yard. Increasing their appreciation and understanding for how scientific data is collected in the real world.

Learning Objectives:

The student will:

- *Understand and be able to explain how* ***samples collected using a quadrat can help predict*** *the overall occurrence of various types of species throughout a particular habitat.*
- ***Build a quadrat and sample sections of their own school yard*** *to gain an understanding for how this technique is done and how simple these measurements can be applied in a variety of situations.*

Standards Addressed:

Alaska Science GLES :
https://education.alaska.gov/akstandards/standards/standards.pdf
5th: SA1.1, SA1.2, SA3.1
6th: SA1.1, SA1.2, SA3.1
7th: SA1.1, SA1.2, SA3.1
8th: SA1.1, SA1.2, SA3.1

Next Generation Science Standards:
https://education.alaska.gov/akstandards/standards/standards.pdf
There are no direct standards for hands on use of an apparatus. However due to the way in which the NGSS is constructed this activity is supported by the theme of several standards.

Materials/Location Needed:

- *This lesson encompasses two activities; the first can be done in the classroom provided there is a large table or desk that can accommodate the sample (see directions below). The second activity will need to be performed outside on the school grounds somewhere. Either in the playground, the lawn, or any large open space.*
- *Large bag of similarly sized and shaped candies in various colors (ie: m&ms, skittles, runts, etc.)*
- *Wooden popcicle sticks, coffee stirrers, straws – any easily cut straight and firm material to make several 8cm x8cm quadrats. Ink marker to indicate cm marks on quadrat (see directions below). Glue or tape to hold the materials together if needed. Metric rulers.*
- *Meter sticks,1m dowel rods or 1m pvc pipe & corners and string to construct large 1m quadrat (see directions below). Roll of string or twine. Build as many of these as your judgment, or your budget will allow.*
- *Student worksheet found on page 5 of this lesson. Clipboards and pencils.*

CURRICULUM SUPPLEMENT

Teaching Time: 60 minutes.

Preparation Time: 30 minutes.

Background:

The tools scientists use to collect data can be very sophisticated and high-tech, think of the Hubble Space Telescope or the Large Hadron Collider. But sometimes important data can be gathered and so much can be learned from the simplest of tools. In the **Field** section of Eyes on Eiders we meet Sadie Ulman, a field researcher who studies not just the Steller's Eider but also the environment they live and breed in. Sadie needs to know what kind of environment these brids favor and what kinds of habitat they do not. But the area she studies is vast and very hard to move around in. How can she gather data that will allow her to make a hypothesis for the type of habitat Steller's Eiders require for success? What kind of tool will help her with her observations? The Quadrat! This simple piece of hardware can be made for just a few dollars, but when used with the proper technique & skill and combined with sound data recording & analysis the results can be priceless!

Directions:

1. After completing the **Field**section of *Eyes on Eiders*, explain to your class that they are going to collect some data in the same manner that Field Researcher Sadie Ulman does it. Show one of the full size meter square quadrats you have already put together and explain that they will be building their own scientific instruments with which they will be collecting data.
2. **Activity 1**: Group your students into lab groups that support your situation (either already established groups, or numbers that equally match the amount of materials at hand. Pass out the materials for the small 3cm quadrats and instruct your students how you would like them assembled.
    a. If using bendy straws this is as simple as cutting the straws to length bending the 4 pieces in 90° angles and inserting the ends. Then taking the ruler and making a mark each 1cm per side.
    b. If using wooden sticks or similar have students cut the material to length, attach the corners with adhesive of choice, then taking the ruler and making a mark each 1cm per side.
    c. Another option is to use pipe cleaners – the instructions for this should be obvious.

3. Clean desktops with a bleach based cleaner and have all group members wash their hands (this will not guarantee that the candies are safe to eat at the end of this activity but it's possible!)
4. Open the bag of candy and spread them evenly across the desk ***as they come out of the bag***, in an area approximately 2 feet by 2 feet. Spacing between candies does not have to be exactly equal – no "arranging" is allowed!
5. Have your students take their small quadrats and place them three locations at a time on the "candy spread". Count the number of each color they see inside their square. This is called a ***quadrat sampling method.*** Have them then fill out the table on their worksheet as they

collect the data. Cycle thru the groups three at a time until all have had a chance to sample different areas.

6. Draw a table on the board in your classroom for each team's data to be recorded in.
7. Next have the students sort the candy by color and record the total number of each color represented in the spread. This data also should be recorded on their worksheets.
8. Completion of the worksheet will provide your students with insight into the advantages and drawbacks of this sampling technique.
9. **Activity 2**: Group your students into lab groups that support your situation (either already established groups, or numbers that equally match the amount of materials at hand. Pass out the materials for the small 3cm quadrats and instruct your students how you would like them assembled. These groups may be larger than the groups for the candy sample as you may not have enough materials for an equal number of large quadrats. Pass out the materials for the 1m quadrat and instruct your students how you would like them assembled.
    a. If using pvc pipe have it already cut to 1m length (the hardware store can do this for you), pass out these sides and 4, 90° corners. In addition pass out 18, 1.2m lengths of string or twine. Ask your students to assemble the pvc pipe by fitting the corners to the lengths of pipe. Once assembled ask them to measure and mark with a pencil every 10cm along the perimeter of the pipe. Next have them take the lengths of string and tie on each end of the quadrat at each mark. See the photo of Sadie's field quadrat in the **Field** section.
    b. While the above method is the preferred and trusted field tested method for building a quadrat, it can be a bit expensive. The following directions work for either using a 1m dowel rod or 1m stick. Pass out two dowels or sticks to each group and 18 , 1.2m lengths of string or. Twine. Have your students measure every 10cm on the length of the dowel or stick (disregard the measuring and marking if you are using a meter stick, obviously). Placing the dowels or sticks 1m parallel from each other have the students attach the string or twine every 10cm on each stick. Finally have them measure 10cm down the length of each of the outer most strings and tie another length of string or twine to create a grid pattern. When using this quadrat on the group it is important to remind your students that they have to pull the dowels or sticks tight apart to create the most accurate measurements possible.
10. It is now time to select your area of study. While it is possible to survey animals with a quadrat this is usually only done with those animals whose mobility is limited, think barnacles or oysters! Instead, plants are what Sadie and her colleagues are most interested in surveying out on the tundra of the YK delta. What is the distribution of favorable forage foods or nesting materials across the landscape? Likewise you can have your students survey for specific species of plants in your school yard that are favorable, like clover or unfavorable, like chickweed. Or have them sample every plant that grows within their quadrat, thus providing them with the ability to make an educated guess based on data of what is growing in the entire yard by percentage.

11. Once the students have selected their area of study have them lay down their quadrat and observe what they find inside its borders. Then, just as they did in the candy survey students should use the data sheet to record their findings for analysis later in the classroom.
12. Back in the classroom have all the students report their data, totaling all species, percent cover and population. Have them draw conclusions and record their findings on the worksheet.

Optional:

This activity can be repeated for the length of the term or school year. Different seasons can bring about great change to the study area. As long as steps are taken to ensure that the sample area is in the same place each time this additional data can yield some interesting results!

For more advanced measurements introduce the concept of using a 'transect' to limit the amount of ground sampled. Ask why the transect was placed where it was, how this may or may not have influenced the data collection and whether this shows bias in the sampling. Is bias something that happens in data collection for scientists? These and other questions will get your students thinking about the challenges faced when collecting viable and credible data in the field. A transect line is simply a straight line from one end of your study area to the other and data is collected only along this line, either by measuring out 1m from the line on either side or by laying the quadrat down along the line. The candy activity can benefit from a transect measurement if you have a clear acrylic ruler. Simply lay the ruler across the field of candy and count only what is under the ruler.

Assessment:

Students can be assessed on participation in many aspects of the activity and/or their success at completion of the worksheet.

STUDENT WORKSHEET

Name ____ Date______________Class_________________

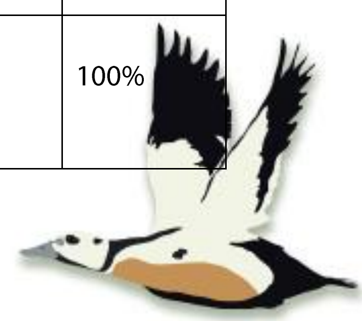
Activity #1: Countin' Candy!

1. Enter your data from your quadrat sample in the chart below:

Color							**Total of all colors**
Your Trial							
% of total using averages							100%

Next, enter the data from the other team's samples below:

Color							**Total of all colors**
Group Trial 1							
Group Trial 2							
Group Trial 3							
Group Trial 4							
Group Trial 5							
Group Trial 6							
Group Trial 7							
Average of all 3 Trials							
% of total using averages							100%



STUDENT WORKSHEET

Finally, as class sort and count all the candy in the entire spread and enter the data below:

Color	**Total of all colors**
Count the entire "candy spread"	
% of total	100%

2. Use data to support your answer to the following question. Do you think this sampling method provides a good overall picture of the total?
   ____
   ____

3. What are some things you can do to make sampling more accurate? __________________________
   ____
   ____

Activity #2: School Yard Surveys

4. What other types of habitat or places could you use a quadrat to measure? Think outside the box, scientists use quadrats in all sorts of ways and places!______________________ _________________
   ____
   ____
   ____

5. Use the blank space on the next page to build your own chart for the data you collect on your school yard survey: