Count the Kill - Pizza Box Estimates

Grades 4-6
Estimated Time: 45 minutes
Math/Science

Objectives - Students will:

1. determine how to quickly estimate the number of "dead fish" that resulted from a fictitious fish kill
2. explain the difference between an estimate and an exact count
3. explain why it might be necessary to make an estimate instead of an exact count
4. explain why it might be necessary to randomly select a section to count when trying to estimate numbers.
5. explain why it might be necessary to average several randomly selected counts to get a more accurate count

Materials:

- 1 pizza box for every group of 3 to 5 students. The box should be clean and the inside bottom of the box should be covered with a fabric that provides some friction. The fabric should be glued down so that it won't slip. Then, the bottom should be divided into 6 equal sections by drawing a grid on the fabric.
- 1 die for each group of students
- 200 beans per pizza box which will simulate dead fish (or you could use small colored marshmallows). Use 2 or more different colors to represent different kinds of fish.
- Timer
- Student Activity Sheet – "Count the Kill"

Background:
Natural disasters such as floods, hurricanes and even disease can sometimes kill large numbers of wild animals. Sometimes wild animals can be killed as a result of human-caused pollution such as an oil spill or by development that impacts habitat. Field biologists and chemists who investigate wildlife kills must do so in a very scientific manner to determine exactly what caused the die-off and, if possible, what can be done to reduce mortality in the future. In some cases, polluters can be fined a good deal of money to compensate for killing wildlife and destroying habitat.

One of the first things a field biologist who is investigating a wildlife die-off must do is to determine how many animals were killed. Generally, this job must be done rather quickly before scavengers and decomposers or even currents or other weather factors impact an accurate picture of the die-off.

In this activity, we will pretend there has been a fish die-off and students will simulate how biologists can estimate the number of fish killed.

To create the scenario of the fish kill, pretend that the kill might be caused by either golden algae or by a polluter. To find out more about golden alga, an organism which has caused many fish kills recently, see: http://www.tpwd.state.tx.us/landwater/water/environconcerns/hab/ga/faq.phtml For photos of golden algae fish kills, see: http://www.tpwd.state.tx.us/landwater/water/environconcerns/hab/ga/images.phtml

To find out more about the BP oil spill, see:
http://www.tpwmagazine.com/archive/2010/dec/ed_1/index.phtml
http://www.tpwmagazine.com/archive/2010/dec/ed_2/index.phtml

Procedure:

1. Review the background information about golden algae provided on the Texas Parks and Wildlife web site and/or find out about the BP oil spill and how it has affected Texas wildlife.
2. Divide the class into groups of 3 to 5 students and explain that there has been a fish kill in a small lake. Students are to pretend they are biologists with the job of trying to determine how many fish were killed and why. Explain that one of the main suspects in the kill is a microorganism called "golden alga." Share the golden alga web site above with the students and show images of a golden alga fish kill.
3. Another possibility is that the kill could be caused by pollution. You may want to share with students information about the BP oil spill in the Gulf of Mexico. An oil spill is an example of a human-caused fish kill. Chemists are often called in to help biologists determine what the pollutant is and who might have caused it.
4. Pass out the closed pizza boxes, telling the students NOT to open the box until you give the word. The box will represent a small lake with a fish kill. The beans will represent dead fish.
5. Using a timer, tell the students to open the box when you say, "go" and count the number of beans in the box. Remember, biologists don't have a lot of time to "count the kill." Give them 15 seconds to count the kill and ask for results. Students should respond that they didn't have enough time to count all of the beans.
6. Ask students to guess how a biologist in the field might solve the problem when there are too many fish to count and not much time to do it. As students come up with possible answers and as they notice the grid on the bottom of the box, ask them what the word, "estimate" means. Can the number of "fish" in their pizza box ponds be estimated? How? (by counting the number of fish in 1 square and then multiplying that number by 6 squares).
7. Ask students to imagine they are biologists and that they have time only to count one of the squares. Which one would they count to get their estimate? Would they want to count the square with obviously the most fish or would they want to count the square with obviously the least number of fish? Either method would introduce "bias" into the count and not give a good estimate. In order not to bias

the count, biologists will count more than 1 square in the grid and they will choose which squares to count by using a method that randomly chooses the square. This is called random sampling. We will use the roll of the die to choose the square to count.

8. Ask students to close the lids of their boxes and shake gently up and down. Before they open their boxes, they will roll the die to determine which square to count. Then, when you say "go", they will open their boxes and have 15 seconds to count the beans in that square. They will do the math and come up with an estimate of the "fish kill" in their boxes.
9. Ask each team to report their "fish kill" numbers and write them on the board. As the numbers are written, see if there is a great discrepancy in the numbers reported. What should you do if the selected sampling area either had none of the fish or almost all of the fish? Students can easily see that you might either have to roll again or take a high and low square and average them before multiplying. Or, for the class, you can average all of the estimates and see if that is a more accurate number. Often, biologists have to take multiple counts to make sure their estimates accurately reflect the actual number.
10. To simulate what a biologist would have to do when trying to count different fish species, repeat the activity but have the students count the different colors of beans.
11. Finally, let the students determine how much a polluter would have to pay if he or she was found guilty of causing the fish kill. Ask students if

Extension:

12. Assign a monetary value to each color of bean or marshmallow. Ask students to estimate the amount of money a polluter might have to pay the state if each of the fish were valued at those amounts.

Key Vocabulary:

- estimate
- random sample
- bias
- golden algae

Counting the Kill – Student Activity Sheet

1. What does your box represent?

2. What do the beans represent?

3. How does the grid on the box help count the beans?

4. How does the die help you count the beans?

5. What number did you roll for the count? _____

6. How many squares do you have in your "pond?"

7. Use the space below to show how you arrived at an estimate of the total fish in your box.

8. How does your estimate compare with the estimates of other groups? Why?

9. If you were going to be held responsible for paying for the dead fish, which total would you want? Which one would you not want? How would biologists make sure that the amount you paid was fair?

10. Repeat the estimating activity by closing the box, gently shaking the beans and rolling the die to determine which square to count. This time, count the numbers of each type of bean or marshmallow in the square chosen by the die.
    Fish # 1 _____
    Fish # 2 _____
    Fish # 3 _____

11. Now, estimate the amount that a polluter might have to pay if each of the different types of fish were valued at the values below and he was found guilty of causing the fish kill.
    Fish # 1 _____ X $2.00 per fish = _____
    Fish # 2 _____ X $50.00 per fish = _____
    Fish # 3 _____ X $1000.00 per fish = _____

    Total to be paid = _____