Name: _____
Period: _____
Date: _____

Estimating Population Size

As you already know, it is impossible for scientists to count all of the dolphins in a given population. Instead, scientists must estimate the number of individuals in a population. There are many different methods that can be used by scientists to do this. One way to estimate population size is a method commonly referred to as "sight, resight". In this method, some of the individuals in a population are identified by their unique dorsal fins, and their identification photographs are cataloged. These animals mix with the unmarked animals in a population. Scientists will then survey a second sample group of animals. Scientists will count the number of previously identified individuals in this second group, as well as the total number of animals in the survey second group, and then solve a proportion in order to estimate the total size of the population. Often, this process is followed by complex statistical analysis to allow for immigration, emigration, births, and mortality. In this activity, your group will conduct two population surveys in order to predict the size of a population at two different points in time.

Materials:

- Brown bag containing macaroni
- 2 different colored markers
- Calculator (optional)

Procedure:

Survey I

1. Scoop some of the macaroni pieces out of the bag and mark them with one color. (You should have *at least* 30 pieces, but no more than half of the bag.) These represent the sample group of dolphins that you have identified using photo identification techniques.
2. Count the total number of marked pieces (M1), and record this number in the table below.
3. Place these marked pieces back into the bag and shake it.
4. Scoop out some of the macaroni pieces again. This is your new sample group. Count the number of marked pieces that were in the sample (M2), and record this number in the table below. Then count the **total** number of pieces you scooped out of the bag (N), and record this number in the table below.

Trial	Total # of Marked Pieces (M1)	# of Marked Pieces in New Sample (M2)	Total # of Pieces in New Sample (N)	Predicted # in Population (y)
1				
2				
3				
4				
5				

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5. Use the data you collected in Trial 1 and solve the equation for 'y'. Show your work on a separate sheet of paper, and record your answer in the table above.

$$\frac{\text{(Total \# of Marked Pieces)}\ M1}{\text{(Predicted \# in Population)}\ y} = \frac{\text{(\# of Marked Pieces in New Sample)}\ M2}{\text{(Total \# of Pieces Pieces in New Sample)}\ N}$$

6. Repeat Steps 3-5 until you have completed a total of five trials. (NOTE: The total number of marked pieces (M1) will remain the same for all of the trials!)
7. a. Calculate an average population size estimate from the five trials you conducted. Record this number in the space below
   b. Count the **total** number of macaroni pieces that your group was given in the bag. Record this number in the space below.

Estimated Population Size	
Actual Population Size	

Survey II

1. Place **all** of the marked and unmarked macaroni pieces back into the bag. Reach in and grab a small handful of pieces, and place these pieces off to the side. *You no longer need these pieces.*
2. Scoop some of the macaroni pieces out of the bag, and mark them with a new color of marker. Remember that you should have at least 30 pieces, but not more than half of the bag. (If some of the pieces you pulled out had been marked in Survey I, it's okay—just ignore the old marking and place a new marking on the piece.)
3. Count the total number of pieces marked with the new color (M1), and record this number in the table below.
4. Place these marked pieces back into the bag and shake it.
5. Scoop out some of the macaroni pieces again. This is your new sample group. Count the number of marked pieces that were in the sample (M2), and record this number in the table below. *(Remember, if any of the pieces have the old color on them, just ignore it. You are only counting pieces marked with the new color.)* Then count the **total** number of pieces you scooped out of the bag (N), and record this number in the table below.

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Trial	Total # of Marked Pieces (M1)	# of Marked Pieces in New Sample (M2)	Total # of Pieces in New Sample (N)	Predicted # in Population (y)
1				
2				
3				
4				
5				

6. Use the data you collected in Trial 1 and solve the equation for 'y'. Show your work on a separate sheet of paper, and record your answer in the table above.

$$\frac{\text{(Total \# of Marked Pieces)}\ M1}{\text{(Predicted \# in Population)}\ y} = \frac{\text{(\# of Marked Pieces in New Sample)}\ M2}{\text{(Total \# of Pieces Pieces in New Sample)}\ N}$$

7. Repeat Steps 4-6 until you have completed a total of five trials. (NOTE: The total number of marked pieces (M1) will remain the same for all of the trials!)
8. a. Calculate an average population size estimate from the five trials you conducted. Record this number in the space below
   b. Count the **total** number of macaroni pieces that your group was given in the bag. Record this number in the space below.

Estimated Population Size	
Actual Population Size	

Estimating Population Size

Conclusion Questions

Answer the following questions based on your results from the activity, as well as what you know about population estimation.

1. How did your predictions compare with the actual number of individuals in the population? (Make sure to include your data in your response!)

2. Give one advantage of using the "sight, resight" method to estimate animal populations.

3. Give one disadvantage of using the "sight, resight" method to estimate animal populations.

4. You probably witnessed a rather drastic decline in population between Survey I and Survey II. Describe two natural causes that could result in such a decline in a marine mammal population.

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5. Describe two human-related causes that could result in such a decline in a marine mammal population.

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6. Once a population has been faced with a drastic reduction in size, oftentimes conservation measures are put into place. Why would it be useful to continue monitoring populations while these measures are in effect?

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