How can you determine the size of an animal population?

Objectives: 1. Use a simulation to MODEL an actual field sampling technique.  
2. Collect DATA.  
3. CALCULATE the size of a modeled animal population.

Materials: Paper bag containing beans  
Markers

Procedures:

1. Reach into the bag and remove 20 beans.
2. Use the marker to color these beans. They represent caught and marked animals.
3. When the ink has dried, return the beans to the bag.
4. Shake the bag. Without looking into the bag, reach in and remove 30 beans.
5. Record the # of marked beans (recaptured and marked) and the # of unmarked beans (caught and unmarked) in your data table as trial 1.
6. Return all the beans to the bag.
7. Repeat steps 4-6 four more times for trials 2 to 5.
8. Calculate averages for each of the columns.
9. Using average values, calculate the original size of the bean population in the bag by using the following formula:
   
   $M = \# \text{ initially marked}$
   $CwM = \text{average} \# \text{ caught with marks}$
   $Cw/oM = \text{average} \# \text{ caught without marks}$

   Calculated Population Size = $M \times \frac{(CwM + Cw/oM)}{CwM}$

10. Record the calculated population size in the data table
11. To verify the actual population size, count all the beans in the bag and record this value in the data table.

Data Table:

<table>
<thead>
<tr>
<th>Trial</th>
<th>Total Caught</th>
<th># Caught w/ Marks</th>
<th># Caught without Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Averages</td>
<td>30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculations:

Calculated Population Size =

Actual Population Size =
Analysis / Conclusions:

1. Explain why this type of activity is best done as a *simulation*.

2. A) Compare the calculated to the actual population size. Explain why they may not agree exactly. B) What changes to the procedure would improve the accuracy of the activity?

3. Explain why this technique is used more often with animals than with plants when calculating population size.

4. In which situations might this be dangerous? (hint: what if you weren’t dealing with beans?)