Capture-Recapture Activity Names: _____

Group Number: _____

Wildlife Sampling:

Often, ecologists want to estimate the total number (population size) of a certain kind of animal in a given area. If the population size remains constant throughout the sampling period, the capture-recapture method is often used. In this method, one samples a animals and releases them after "tagging." After sufficient time has passed for the tagged animals to thoroughly mix with the untagged population, n animals are captured, the number of tagged animals in the n units is counted and, based on this information, the unknown population size, N, is estimated.

Let's Go Fishing!

Objective: In this activity, each group is going to use its statistical knowledge to estimate the total number of fish in its small pond, N. (A Ziploc bag is close to a small pond, right?!)

Materials: One Dixie cup, napkins, one bag of cheddar fish, and one bag of pretzel fish

In this example,

- What is the research question of interest?
- What is the unknown population parameter?

Directions: To use the capture-recapture method, you need to do the following:

1) Capture a sample of fish with your "net" (i.e., your Dixie cup),
2) Count the number of fish in your sample, and
3) "Tag" the fish by replacing the number of cheddar fish in your sample with the same number of pretzel fish.

- Number of Tagged (pretzel) Fish in Population = a = _____
- Number of Un-tagged (cheddar) Fish in Population = _____
  (In symbols; don't actually count them.)

4) Next, mix the untagged fish with the tagged fish in your "pond."

- In the population (after tagging), there are a = _____ tagged (pretzel) fish and $N-a$ untagged (cheddar) fish. Let the random variable X represent the number of tagged fish in a sample of size n. What distribution does X follow?

5) Once the fish are thoroughly mixed, recapture a sample of fish with your "net."
6) Count and record the total number of tagged (pretzel) fish and the total number of untagged (cheddar) fish in your second sample.

- Total Number of Fish in 2nd Sample = n = _____
- Number of Tagged (pretzel) Fish in 2nd Sample = x = _____
- Number of Un-tagged (cheddar) Fish in 2nd Sample = $n-x$ = _____

Estimate: In the end, each group wants an estimate of the number of fish in its pond. In this particular case, we could actually count the number of fish in our respective populations, but that's not nearly as fun as thinking about this statistically! That is, we want to think about what estimator we could use to estimate this unknown parameter.

So far, we know the following:

N = unknown population size
a = total number of fish tagged
n = sample size
x = number of tagged fish in sample

Intuitively, what seems like a good estimator for N? Why does this seem like a good estimator?

Now, let's think about all of this another way...

Earlier, we determined if X = the number of tagged fish in a sample of size n, then X has a _____ distribution. Consequently,

$$P(X = x) =$$

For simplicity, let's assume momentarily that in a sample of three fish, we catch one of four total tagged fish. That is, n = 3, x = 1, and a = 4. We want to estimate the total number of fish in this particular population, N. Given that we observed one tagged fish in a sample of size n = 3, what population size, N, would make this observation most likely? How could we find out?