raft®
RESOURCE AREA FOR TEACHING

STEAM
SCIENCE TECHNOLOGY ENGINEERING ARTS MATHEMATICS

LEARNING ACTIVITY

Material Needed

- 60 small, similar items of one color such as beads, pennies, paper cut-outs, or equivalent
- 15 small, similar items of another color
- Container
- Pen/pencil
- Optional: Calculator or phone

Grade Range

6-8

Topics/Skills

Math: Data Samples; Sampling Methods; Proportional Relationships
Science: Ecosystem Dynamics

Learning Standards

CCSS Math: Ratios & Proportions
NGSS: Ecosystems

Duration

20-30 minutes

Prep Time

5 minutes

Salmon You Can Count On

Use ratios and proportions to estimate population size!

Students simulate a tag-recapture technique and use proportions to predict the total population of "salmon" from the distribution of tagged fish found in "captured" samples.

Activity Challenge

Estimate the total population of "salmon" by taking samples of a population and setting up and solving problems involving ratios and proportions.

Preparation

1. Review the Materials Needed list and gather required items.
2. Put the 15 items of one color into a container (the habitat). These represent the "tagged" salmon in the habitat.
3. Record the 15 tagged salmon as the value for the upper-case **T** in the line above the data table on the next page.
4. Put all 60 of the items of a different color in the container with the tagged salmon. Stir to thoroughly mix the 75 salmon together. The mixture represents the total population ($\mathbf{N}_{\mathbf{actual}}$) of salmon in the habitat.

To Do

1. Scoop a small handful sample of the mixed salmon from the habitat container. If there are no tagged salmon in the sample, return the sample back to the habitat, mix thoroughly, and sample again.
2. Count the *total number* of salmon in the sample and record as **n** in the data table.
3. Sort out and count the *tagged* salmon in the sample and record as lower-case **t** in the data table.
4. Return all the salmon from the sample back into the habitat container and mix thoroughly.
5. Repeat steps 1-4 for nine more trials.
6. Divide **n** by **t** for each trial. Record this ratio as **R** (see data table).
7. Multiply **R** times **T**. Record the product as **N** (to nearest whole number).
8. Add the **N** values from all trials and divide by the number of trials to calculate the average, $\mathbf{N}_{\mathbf{average}}$, to the nearest whole number.

Observations

- What do you notice about each value of *N* as more samples are taken?
- How does $\mathbf{N_{average}}$ compare to $\mathbf{N_{actual}}$? Why?

Extensions

- Add more tagged and untagged salmon to the habitat and repeat the procedure, then compare the results.
- Change the ratio of tagged and untagged salmon (this ratio in the activity is 1:4, or 15 tagged / 60 untagged).

The Content behind the Activity

The tag-recapture method involves capturing subjects from a population of interest, tagging them, and releasing them. Shortly afterward, another sample is captured and counted. The size of the entire population can be estimated from the proportion of tagged and untagged subjects found in the second sample. Taking additional samples will increase the accuracy of the estimate. Sampling fast-moving and shy animal populations is more difficult to do than sampling plants or slow-moving organisms. The tag-recapture method is an important part of studying population dynamics in ecological and evolutionary biology because it enables scientists to estimate population size with minimal to no harm to the populations of interest. The data obtained using this method may help explain why some populations decrease (possibly heading for extinction) and may reveal outside factors that affect life cycles (such as over-fishing or pollution).

Population Data Sheet: Number of tagged salmon in the habitat: **T** = _____ (*example: 15*)

Trial	Total number of salmon in sample **n**	Number of tagged salmon in sample **t**	Ratio of all salmon to tagged salmon in sample **R = n / t**	Estimated number of salmon in habitat **N = R x T**
Example	*27*	*6*	*R = 27 / 6 = 4.5*	*N = 4.5 x 15 ≈ 67*
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				