

DATA *Nugget*

Fish Fights

Featured scientist: Alycia R. Lackey from Michigan State University

*This is a modified version of the original Data Nugget that has been designed to be used on the DataClassroom web-app. The original pencil and paper activity can be found [here on the Data Nuggets website](#).

Research Background:

In many animals, males fight for territories. Getting a good territory and making sure other males don't steal it is very important! Males use these territories to attract females for mating. The males that get the best territories are more likely to mate with females and have more babies. Only the males that have babies will pass on their genes to the next generation.

Stickleback fish use the shallow bottom areas of lakes to mate. Male stickleback fish fight each other to gain the best territories in this habitat. In their territories, males build a nest out of sand, aquatic plants, and glue they produce from their kidneys. The better the nest, the more females a male can attract. Males then use courtship dances to attract females to their nests. If a female likes a male, she will deposit her eggs in his nest. Then the male will care for those eggs and protect the offspring that hatch.



Image right: A male stickleback in his territory (front) and an intruding male (back)

Alycia is a scientist who is interested in understanding what makes a male stickleback a good fighter and defender of his territory. Perhaps more aggressive males are better at defending their territory and nests because they are better at fighting off other males. She used sticklebacks she collected from British Columbia to test her hypothesis.

Scientific Question: How does aggressiveness in male sticklebacks affect their ability to defend their territories?

Scientific Data:

In Alycia's experiment, 24 males were kept in 6 large tanks, with 4 males in each tank. Alycia watched each of the 24 males every day for 10 days. She recorded the behaviors of each fish when they were competing for territories, defending their territory, and building their nests. She also recorded the size of the males' territories and whether they had a nest each day. As Alycia observed the fish, she measured three things:

1. **Average Male Net Aggression:** A number that indicates how many times the fish performed an aggressive behavior, like charging or nipping, minus the number of aggressive behaviors performed by another fish directed at that fish.
2. **Average Territory Size:** Each fish either had no territory (given the number 0), a small territory (1), or a large territory (2). Their territories changed during the experiment from one day to the next, so scientists averaged the values over the 10 days.
3. **Days With Nest:** The number of days over the course of the experiment that a fish had a nest.

1) What is the hypothesis? Find the hypothesis in the Research Background and copy/paste it below: *(A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.)*

2) Click on the graph tab, and explore the available variables. What data will you graph to answer the scientific question #1?

Independent variable:

Dependent variable:

3) Create the graph of your data and paste it below:

4) Identify any changes, trends, or differences you see in your graph. Write one sentence describing what you see

Interpret the data:

- 5) Make a claim that answers the scientific question.
- 6) What evidence was used to write your claim? Reference specific parts of the table or graph.
- 7) Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about the importance of territories for male sticklebacks.
- 8) Did the data support Alycia's hypothesis? Use evidence to explain why or why not. If you feel the data was inconclusive, explain why.

Your next steps as a scientist:

- 9) Science is an ongoing process. What new questions do you think should be investigated? What future data should be collected to answer them?

Digital Extension



These questions are a digital extension of the original Data Nuggets activity. The data manipulation and graphing tasks within are best completed here on DataClassroom.

10) Scientific Question 1: We want to find out if the numbers from the graph you created for #4 are actually different enough to be meaningful! Reset your graph to those variables, and run a **graph-driven hypothesis test** and list the t-score and p-value below:

T-score:

P-value:

11) Which value (the t-score or p-value) tells us if upstream and downstream are statistically significant differences? What is the big takeaway from that statistical test?