

DATA *Nugget*

Which guy should she choose?

Featured scientist: Alycia R. Lackey from Michigan State University

Research Background:

In many animals, males use complex behaviors to attract females. They use **displays** to show off colorful parts of their bodies, like feathers or scales. For example, male peacocks fan out and shake their colorful tails to attract female attention. These displays take up a lot of energy, and yet some males are unable to attract any females while other males attract many females.

In stickleback fish, males are very colorful to attract females. Their throats turn bright red during the spring when they mate. Stickleback males also court females with zig-zag swimming! The males swim in a z-shaped pattern in front of the female, probably to show off their mating colors. Before male fish can get the attention of female fish, they must gain a territory and build a nest. In sticklebacks, females inspect nests that the males build and then decide if they want to deposit their eggs. Males care for the offspring before and after the eggs hatch. A female fish would benefit from identifying “high quality” males and choosing those males for mates. High quality males would have more energy to protect their offspring and would make better fathers. They could also pass on genes that make offspring more attractive to females in the next generation.

Alycia is a scientist who is interested in the stickleback’s mating behaviors. She wanted to figure out why there are differences between males and why certain males can attract a mate while others cannot. What is it about the way a male looks, moves, or smells that attracts females? What male traits are females looking at when deciding on a mate? Alycia thought female sticklebacks may choose males with redder throats and/or more complex behaviors because those traits show the female that those males are high quality. Previous work with these fish showed that male behavior, color, or territory size, or the presence of a nest could all be important. But it was still not clear which characteristic might be most important.



Figure 1: A male stickleback tending his nest. Notice the male’s bright red throat, blue eye, and blue-green body.

Alycia set up an experiment to figure out if male throat color or zig-zag swimming behaviors were attractive to females. She used a total of 24 male fish and six 75-gallon tanks. She divided the males up evenly between the large tanks, placing four males in each one. For 10 days she observed the male fish and recorded competition behaviors, territory defense, and nest building. On the tenth day, she introduced one female to each tank of four males. She recorded how the males behaved in courtship and which males the females chose. She also recorded the redness of each male.



Figure 2: Scientist Alycia collecting fish from a freshwater lake in British Columbia, Canada.

For each of the 24 male fish studied, Alycia collected the following data:

1. Female preference score: The higher the number, the more the female was attracted to that male. The scores were given as follows: (0) the female did not respond to the male, (1) the female approached the male, (2) the female followed the male to his territory, and (3) female examined the male's territory, poking her head into the sand to look for a nest.
2. Male courtship behaviors: number of display zig-zag dances the male did per minute.
3. Redness of male throat: The higher the number, the more red the male's throat was. This score includes both the area covered by and the intensity of red coloration on each male fish's throat.
4. Territory size: Each male's territory size was categorized as small if it was smaller than half the tank and large if it was larger than half the tank.
5. Presence of nest: whether or not the male fish made a nest.

Scientific Questions: Does male throat redness and courtship behavior influence which males females choose, and if so, how?

What is the hypothesis? Find the hypotheses in the Research Background and underline them. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies. Having two alternative hypotheses means that more than one mechanism may explain a given observation. Experimentation can determine if one, both, or neither hypotheses are supported.

Scientific Data:

Use the data below to answer the scientific questions:

Female Preference Score	Male Courtship Behavior	Redness of Male Throat	Territory Size	Presence of Nest
<i>(0-3)</i>	<i>(# per minute)</i>	<i>(0-10)</i>	<i>(none, small, large)</i>	<i>(yes or no)</i>
0	1.75	5.0	Large	No
0	0.28	5.0	None	No
0	0.00	7.0	None	No
0	0.74	5.0	None	No
0	0.11	3.0	None	No
0	1.20	4.0	Small	No
0	0.28	6.5	Small	No
0	0.49	5.5	Large	Yes
0	1.55	6.5	Small	Yes
1	2.57	7.5	Large	No
1	6.48	7.0	Large	No
1	1.89	7.5	Large	No
1	0.48	5.0	None	No
1	0.14	8.0	Small	No
1	8.04	7.5	Large	Yes
1	0.38	7.5	Small	Yes
1	3.81	8.0	Small	Yes
2	8.23	8.0	Large	No
2	10.00	6.5	Small	No
2	11.07	6.0	Small	No
2	1.87	6.5	Small	Yes
3	3.30	6.0	Large	Yes
3	12.93	7.0	Large	Yes
3	12.72	7.5	Large	Yes

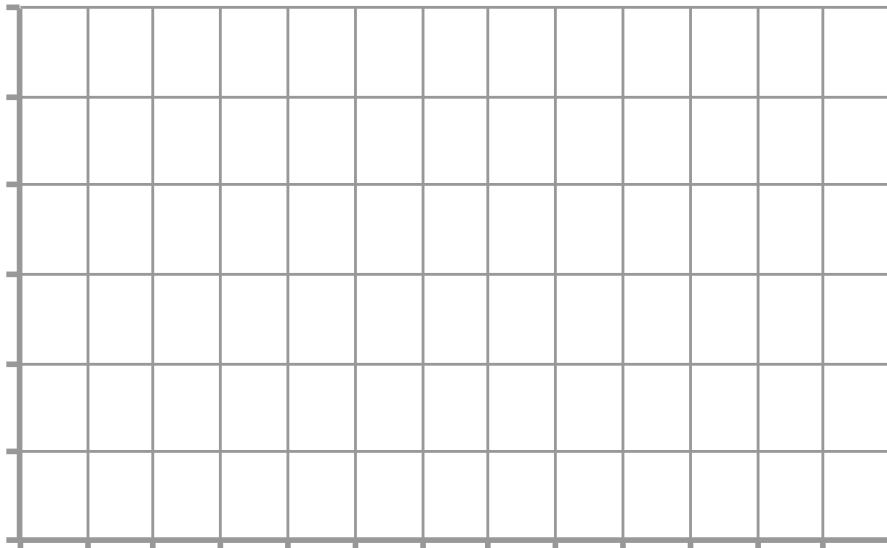
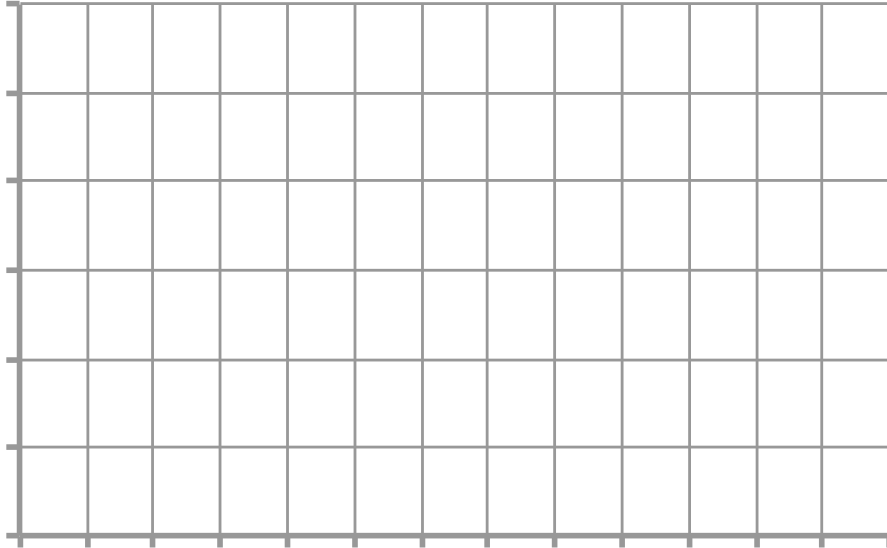
What data will you graph to answer the questions?

Independent variables: _____

Dependent variable: _____

Name _____

Draw your graphs below: Identify any changes, trends, or differences you see in your graphs. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Name _____

Interpret the data:

Make a claim that answers each of the scientific questions.

What evidence was used to write your claim? Reference specific parts of the table or graphs.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how female stickleback fish choose their mates.

Name _____

Did the data support one, both, or either of Alycia's two alternative hypotheses? Use evidence to explain why or why not. If you feel the data were inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question do you think should be investigated? What future data should be collected to answer your question?