

## Stickleback Behavior

The stickleback is a fish that is easy to keep in an aquarium.



During the breeding season the male stickleback's belly turns from silver-colored to red (Figure 1). The male stickleback will attack any competing male that comes into his territory and try to chase it away. If a silver-colored female approaches, he will try to guide her to his nest, so she will lay her eggs there.

To investigate this aggressive behavior, a student performs an experiment.

Figure 1 Male (right) and female (left) stickleback fish

A male stickleback is alone in the student's aquarium. The student has made three wax models attached to pieces of wire. He hangs them separately in the aquarium for the same amount of time. Then the student counts the number of times the male stickleback reacts aggressively by pushing against the wax figure. The results of this experiment are shown in Figure 2.

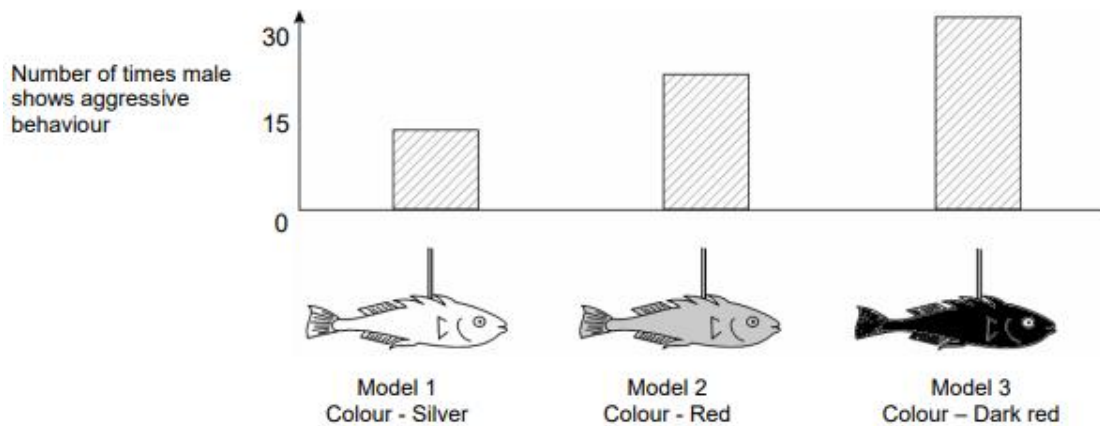


Figure 2 Aggressive behavior of male stickleback fish to different models

1. [SP 2, SP 3] Identify a question the student is trying to answer in this experiment.
2. [SP 3] a) Identify the reason the student put the male in the aquarium alone.  
b) Justify the placement of the models in the aquarium for the same amount of time as the male.

During breeding time, if the male stickleback sees a female, he will try to attract the female with courtship behavior that looks like a little dance. In a second experiment, this courtship behavior is investigated. Again, three wax models on a piece of wire are used. One is red-colored; two are silver-colored with one having a flat belly and the other a round belly. The student counts the number of times (in a given amount of time) that the male stickleback reacts to each model by showing courtship behavior. The results of this experiment are shown in Figure 3.

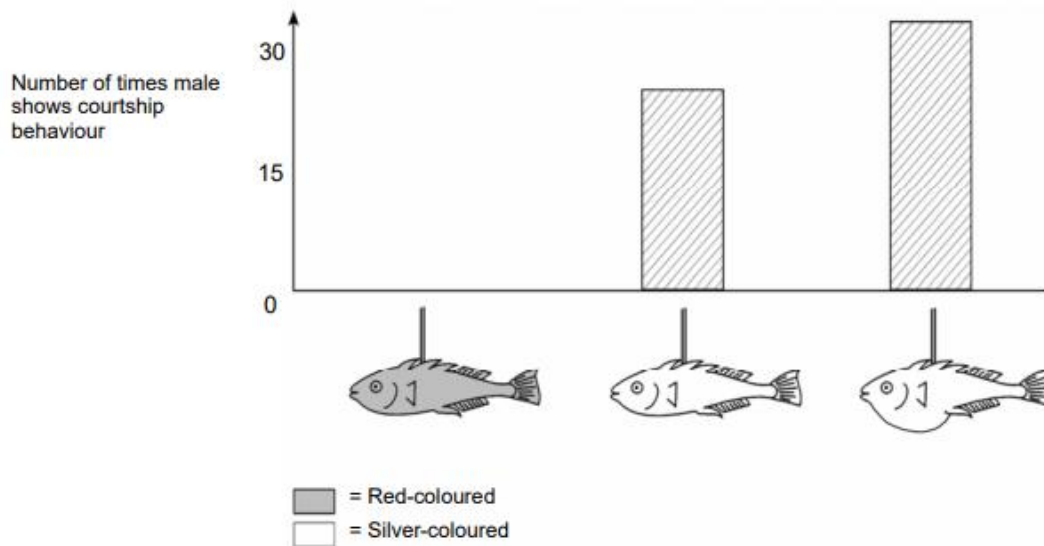


Figure 3 Courtship behavior of male stickleback fish toward different models

3. [SP 1, SP 2, SP 4, SP 6] The student proposes three conclusions based on the results of this second experiment. Use the information in Figure 3 to support or refute each claim. Justify your responses.

Conclusion 1 The red color causes courtship behavior by the male stickleback.

Conclusion 2 A flat-bellied female stickleback causes most courtship behavior from a stickleback male.

Conclusion 3 The male stickleback shows courtship behavior more often to a round-bellied female than to a flat-bellied female.

Experiments have shown that male sticklebacks react with aggressive behavior to models with a red belly, and with courtship behavior to models with a silver belly.

4. [SP 1, SP 6] Explain why this pattern of behavior occurs.

In a third experiment, the four models shown in Figure 4 were used in turn:

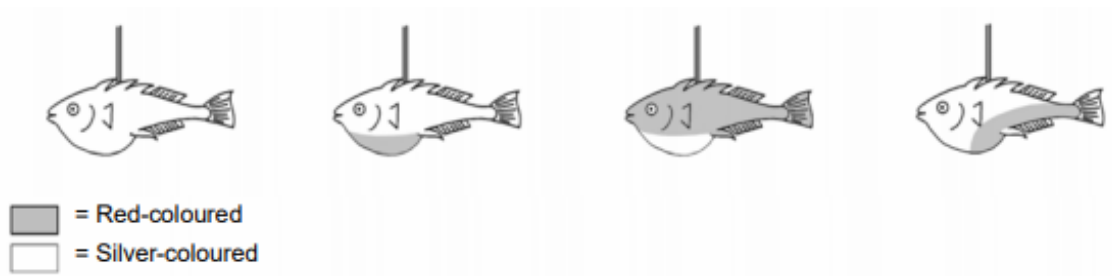


Figure 4 Representation of different models of female stickleback fish

Figure 5 shows possible reactions of a male stickleback to each of the above models.

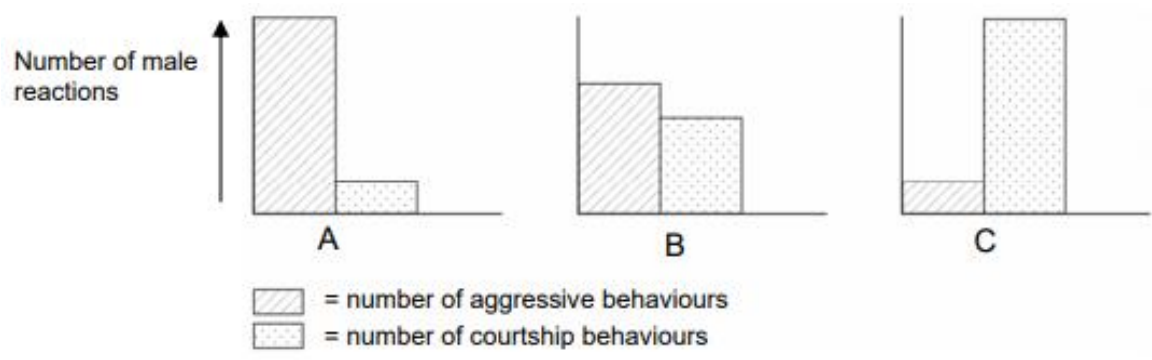


Figure 5 Male reactions to models of female stickleback fish

5. [SP 1, SP 2, SP 4, SP 6] Predict the reaction (A, B, or C) you would expect for each of the four models. Justify your predictions. Record your responses in table 1.

Table 1 Predicted reaction to each model

	Reaction	Reasoning
Model 1		
Model 2		
Model 3		
Model 4		