Paper Stickleback Sampling

Abstract

Does the lateral plate trait in a population of stickleback fish change over time? Is the trait variable among individuals in the population? Individually or in pairs, students collect a random sample of paper stickleback fish from Loberg Lake and plot them by lateral plate number on a bar graph. Students first compare their data with others', then with an aggregated graph representing a larger sample size. They repeat the process for three sampling periods.

Learning Objectives

- Individuals in a population typically vary in their traits.

  In this example, the number of lateral plates in stickleback populations varies.

- The frequencies of trait variations in a population can change over time.

  In this example, The frequencies of lateral plate phenotypes in the population of sticklebacks in Loberg Lake changed over time: low-plated fish became more frequent, and completely plated fish became less frequent.

Estimated time

- 30 minutes

Materials

- Stickleback cards. There are 100 cards for each sample year. Make enough copies for each student or group to select 10 cards per sample year. Cut the cards out and **shuffle them well**. Keep each sample year separate.

  Tips: To make it easier to tell the sample years apart, print the cards in color or onto different colors of paper. Paperclip shuffled cards together in groups of 10 for easier distribution.

- (Optional) Three envelopes, boxes, or bins for holding the stickleback cards (one for each year)
- Student handout: One per student
- Aggregate graphs (included in this document): Project, or print out one set per student or pair of students.
- (Optional) Document camera or computer hooked to a projector for showing aggregate graphs

Instructions

1. Distribute the student handouts.
2. Have students take 10 fish cards from each sample year (1990, 1996, and 2002). For the 1990 sample only, tell students to arrange their fish by lateral plate number and plot them on their graphs.
3. When students are finished, project or hand out the aggregate graph for 1990 and discuss:

a. Raise your hand if your graph looks different from your neighbor's. Why might the graphs look different?

b. Raise your hand if your graph looks different from the aggregate.

c. Sample size:

- The fish in one small sample may not be representative of the whole population. A larger sample size is more representative of the population.
- (Optional) To demonstrate, ask two students about their preference in pizza, then make a statement about the whole group's preference based on those answers. Discuss the accuracy of your statement).

d. Using the aggregate graph, review graph interpretation:

- What is the range in plate number?
- What is the most frequent number of plates on fish in this sample?

4. For the 1996 sample, tell students to arrange their fish by lateral plate number and plot them on their graphs.

5. When students are finished, project or hand out the aggregate graph for 1996. Remind students that 6 years have passed, and sticklebacks live for roughly 2 years. Discuss:

a. How are the 1990 and 1996 graphs different?

b. Describe lateral plate trait in the population for 1996.

c. Are these the same fish from the previous sample, or different fish? *(Answer: They are different fish.)*

d. Where did the fish with fewer lateral plates come from? *(Answer: They are the great-grandchildren of the 1990 population.)*

6. Repeat the process for the 2002 sample. Emphasize that each sample represents the descendants of the previous sample—not the same fish. Project the three aggregate graphs and discuss the differences between the samples:

a. What are the trends for the lateral plate number trait in Loberg Lake sticklebacks over the generations?

Answer: Over time, the number of lateral plates in the population decreased. Or, the number of low-plated individuals increased, while the number of high-plated individuals decreased, shifting the number of lateral plates in the population as a whole.

After students complete the activity, help them fill out their **Natural Selection Checklists**:

7. Fill in "Stickleback" for the ORGANISM and "Lateral Plate Number" for TRAIT.

8. Change over time

a. View the aggregate graphs. Ask students to decide if the data show a change in the trait (lateral plate number) in the population over time.

b. Check the appropriate box on the checklist: Has the frequency of the trait changed over

time? *(Answer: Yes)*

c. As a group, generate an evidence statement.

9. Variability

a. Check the appropriate box on the checklist: Does the trait vary? *(Answer: Yes)*

b. Individually or as a class, write an evidence statement that sums up the data that indicate the trait is variable.

References

Bell, M. A., Aguirre W. E. & Buck, N. J. (2004). Twelve years of contemporary armor evolution in a threespine stickleback population. Evolution 58(4), 814-824.

Bell, M. A. (n.d.). Contemporary evolution of threespine stickleback in Loberg Lake, Alaska. Retrieved February 17, 2010 from the Bell Lab website.

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