

Name _____ Period _____ Date _____

Environmental Preferences: Designing an Experiment to Determine the Environmental Preferences of GloFish®

Objective

The learner will conduct an experiment to determine whether GloFish® fluorescent fish prefer a light or dark environment.

The learner will design a controlled experiment to determine whether GloFish have a preference for a specific environmental condition.

Introduction

GloFish are genetically modified Zebra Danios which are found in temperate to tropical environments in nature. In this activity, you will investigate specific environmental preferences found in GloFish. In order to establish “normal” behaviors under these experimental conditions, the fish will be observed for 7 minutes with no environmental variable being applied. In Part B you will darken one side of the chamber and leave one side light. This will allow you to determine whether or not the environment variable of light impacts the behaviors and location of the fish. Part C of this activity will require you to design your own experiment to determine GloFish response to a specific environmental variable.

National Standards Addressed

Science as Inquiry A—Abilities necessary to do scientific inquiry

Life Science C—Interdependence of organisms

Materials Per Group

1 two gallon size zippered plastic bag

Tape

24 cm x 12 cm piece of black construction paper

4-6 GloFish®

700 mL aquarium water

Part C materials list will vary per lab group

Safety Precautions

Students should be instructed as to the proper procedure for handling live fish. Students should wash their hands at the conclusion of this and any activity involving living organisms.

Procedures

Part A: Observing GloFish® in the Control Chamber

1. Prepare your control chamber using a one gallon sized zippered freezer bag. Draw a vertical line down the center of the bag. Label the left and right sides of the bag as Side A and Side B.
2. Pour 700 mL of aquarium water into the bag.
3. Place 4-6 GloFish inside the bag and seal the bag tightly leaving air space in the top.
4. Rest the base of the bag on the lab table and tape the top of the bag between two ring stands. This set up will serve as your control chamber in which your fish will swim as you make initial observation. See Fig. 1 below.

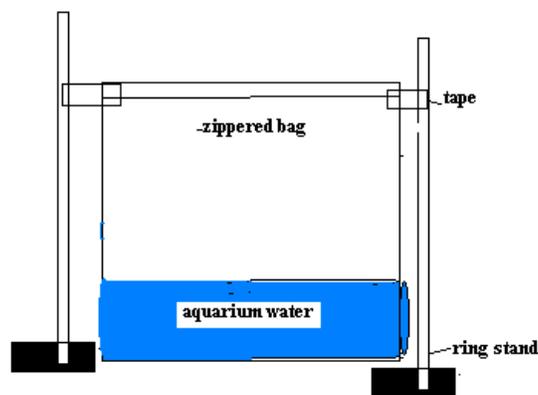
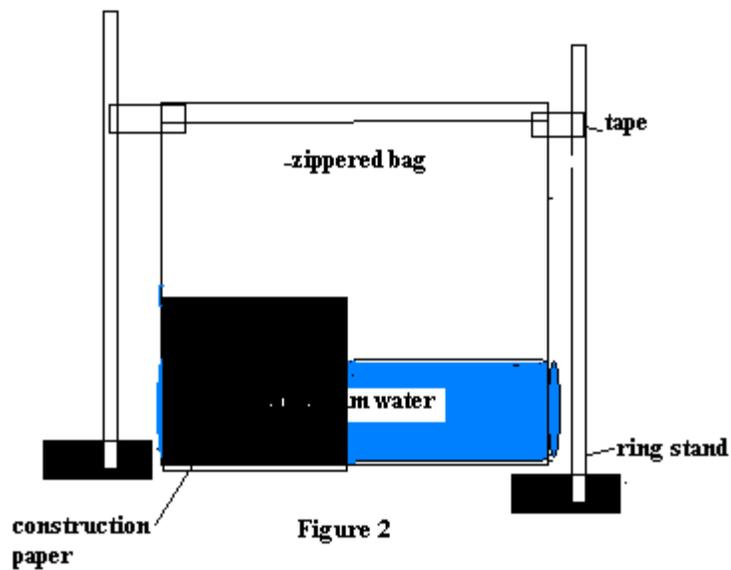


Figure 1

5. Wait 30 seconds and record the number of GloFish found on Side A and Side B. Record your data in Table 15.1.
6. Observe the fish every 30 seconds for 7 minutes and record the number of fish found on each side of the bag.
7. Answer discussion questions 1-3.

Part B: Investigating GloFish® Preference of Light and Dark Environments

1. Using the chamber from Part A, cover the left half of the zippered bag with construction paper. Fold the construction paper so that it covers both the front and the back of the bag. See Figure 2 below.
2. Wait 30 seconds and record the number of GloFish found on Side A and Side B. Record your data in Table 15.2.
3. Observe the fish every 30 seconds for 7 minutes and record the number of fish found on each side of the bag.
4. Answer discussion questions 4-6.



Part C: Design an Experiment to Test the Environmental Preference of GloFish®

1. Select one of the following environmental conditions to investigate. Upon teacher approval, you may decide to investigate a condition other than one from this list.
 - a. Do GloFish prefer a 20 °C or 28 ° C environmental temperatures?
 - b. Do GloFish exhibit a color preference?
 - c. Do GloFish prefer an environment containing aquatic plants?
2. Design your experiment by identifying your hypothesis, materials, procedures and data table design in the space provided on the student answer page.
3. Once your teacher has approved your design, conduct your investigation. Collect and record your data.
4. Prepare a graph depicting your results.
5. Write a conclusion for your investigation. In your conclusion should address the following:
 - a. Is your hypothesis is supported by the data you have collected?
 - b. What are some possible sources of error in your experiment?
 - c. Are there any improvements you would make to your experiment if you were going to repeat it?
 - d. What further investigations would you suggest?

Data

Table 15.1 Location in Control Chamber

Time	Side A	Side B
0:30		
1:00		
1:30		
2:00		
2:30		
3:00		
3:30		
4:00		
4:30		
5:00		
5:30		
6:00		
6:30		
7:00		
Average number of fish		

Table 15.2 Location in Light/Dark Chamber

Time	Side A	Side B
0:30		
1:00		
1:30		
2:00		
2:30		
3:00		
3:30		
4:00		
4:30		
5:00		
5:30		
6:00		
6:30		
7:00		
Average number of fish		

Part C: Experimental Design

Hypothesis:

Materials Needed:

Procedures:

Data:

Conclusion:

Discussion Questions:

1. Based on the data obtained in Part A, did the GloFish® spend more time on Side A or Side B of the chamber? Support your answer using data.
2. Is your data for Part A similar to that obtained by other groups? Support your answer using data from at least three other groups.
3. Write a conclusion statement regarding whether or not the fish exhibit a preference for Side A or Side B.
4. Based on the data obtained in Part B, did the GloFish spend more time on the light or dark side of the chamber? Support your answer using data.
5. Is your data for Part A similar to that obtained by other groups? Support you answer using data from at least three other groups.
6. Write a conclusion statement explaining whether GloFish prefer a light or dark environment.

Elaborations and Extensions

Students could prepare posters of their experimental design and present their findings to the entire class. Posters could then be put on display.

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Intended Grade Level

9th, 10th, and 11th

Teacher Information

Two gallon size zippered bags will allow the chamber to be long enough to have an actual variation in environment. Smaller bags will likely not be long enough to allow a pronounced difference especially for students working with difference in temperature. The temperature difference can be established by resting the test chamber on smaller baggies containing water that is warmer or colder than the test chamber water. Part C materials will vary per lab group but may include items such as quart sized zippered bags for warm and cool water, colored cellophane, and aquatic plants.

Discussion Questions and Possible Answers

1. Based on the data obtained in Part A, did the GloFish® spend more time on Side A or Side B of the chamber? Support your answer using data.

Students should find no clear preference for either Side A or Side B. However, a single lab group may find an average that indicates a preference, although slight, for one side or the other.

2. Is your data for Part A similar to that obtained by other groups? Support your answer using data from at least three other groups.

Individual group data will likely vary from the class average. Some groups will find a slightly larger average for Side A while others will find a slightly larger average for Side B. As a class, the data should indicate no preference for Side A or Side B. The data should indicate the fish spending approximately equal time in both sides of the chamber.

3. Write a conclusion statement regarding whether or not the fish exhibit a preference for Side A or Side B.

GloFish spend an equal amount of time in Side A and Side B of the control chamber.

4. Based on the data obtained in Part B, did the GloFish spend more time on the light or dark side of the chamber? Support your answer using data.

The GloFish will most likely spend more time on the dark side of the bag.

5. Is your data for Part A similar to that obtained by other groups? Support your answer using data from at least three other groups.

Groups will likely have similar data that indicate the GloFish will spend more time on the dark side.

6. Write a conclusion statement explaining whether GloFish® prefer a light or dark environment.