A Case Study on Boldness and Fish

Research Background*:*

Just as each person has their own personality, animals in the same species can behave very different from one another! For example, pets like dogs have different personalities. Some have lots of energy, some are cuddly, and some like to be alone. **Boldness** is a behavior that describes whether or not an individual takes risks. Bold individuals take risks, while shy do not. The risks animals take have a big impact on their survival and the habitats they choose to search for food.

Bluegill sunfish are a type of fish that live in freshwater lakes and ponds in the eastern United States. Open water and cover are two habitats where young bluegill are found. The **open water** habitat in the center of the pond is the best place for bluegill to eat lots of food. However, open water is risky and has very few plants or other places to hide. Predators can easily find and eat bluegill in the open water. The **cover habitat** at the edge of the pond has many plants and places to hide from predators, but also much less food. Both habitats have costs and benefits – called a **tradeoff**. The center of the pond is the open water habitat with no plants. At the edge of the pond is the cover habitat with plants. At the start of the experiment, 100 bold bluegill, 100 shy bluegill, and 2 largemouth bass predator were placed in the pond. Here, scientists are using a net to collect the surviving bluegill at the end of the experiment.

Melissa is a scientist who was interested in whether differences in young bluegill behavior changes the habitats they choose to use to find food. First, she looked at whether young bluegill have different personalities by bringing them into an aquarium lab and watching their behavior. She saw that just like in humans and dogs, bluegill fish each had their own personality. Some bluegill were bolder than others. Melissa wanted to know how bold and shy fish act differently back in the pond. She thought that bold fish would take the risk and use the open water habitat more. Bold fish would then have more food and grow faster. She thought that shy fish would not take risks and use the cover habitat. Shy fish would then have less food and grow slower, but they might also avoid predators and have higher survival.

Melissa designed a study to test the growth and survival of bold and shy fish. When she was watching the fish's behavior in the lab, she determined if a fish was bold or shy. If a fish took the risk of leaving the vegetation and ate food while there was a predator behind a mesh screen, they were called bold. If it did not eat, it was called shy. She marked each fish by clipping the right fin if it was bold or the left fin if it was shy. She placed 100 bold and 100 shy bluegill into an experimental pond with two largemouth bass (predators). After two months, she drained the pond and found every bluegill that survived. She recorded survival and growth (length and weight) for each fish and noted if it was bold or shy.

Scientific Question: Is there a tradeoff between being bold and shy? How does the personality of bluegill affect their growth and survival?

Hypothesis: Find the hypothesis in the research background and write it below.

Draw your predictions: Below is a diagram of a pond where you can draw your predictions. Think about how bold and shy fish might respond to a predator.
1) Start by looking at the legend. Do you predict bold or shy fish will grow larger? Label which fish is bold and which is shy and choose a color for each.
2) Now move to the pond diagram. Draw bold and shy fish in the habitats where you predict they will spend most of their time.
3) Draw your survival predictions. Do you predict there will be more bold or shy fish left at the end of the experiment? Add more fish to your diagram if necessary.

cover habitat

open water habitat

predator

🐟 = _____

🐟 = _____

Scientific Data:

Finish filling in the table below. Use the data to answer the scientific question:

Scientific Data: Finish filling in the table below.

Bluegill Behavior	Proportion Survived	Percent Survival	Average Length (mm)	Length SE**	Average Weight (g)	Weight SE
Bold	66/100		68.6	0.8	5.5	0.2
Shy	74/100		65.6	0.8	4.8	0.2

** *Standard error (SE) tells us how accurate our estimate of the mean is likely to be and depends on the number of replicates in an experiment and how much variation is in the data.*

Graphing: What data will you graph to answer the question?

Graph 1: Survival
Independent variable:
Dependent variable:

Graph 2: Length
Independent variable:
Dependent variable:

Graph 3: Weight
Independent variable:
Dependent variable:

<mark>**Draw your three graphs on a separate sheet of paper!**</mark>

Interpretations

1) What trends, changes, or differences do you see in the table or on the graphs?

2) What does the relationship between the dependent and independent variables mean?

3) Make a claim that answers the scientific question.

4) Support your claim using data as evidence. Reference specific parts of the table or graphs.

5) Explain your reasoning and how the data supports your claim. Connect the data back to what you learned about fish personality and habitat tradeoffs.

6) What other evidence would you like to collect to test the hypothesis that bold fish are using the open water habitat while shy fish are using the cover habitat?