Name_____

DATA Nugget

Dangerously bold

Featured scientist: Melissa Kjelvik from Michigan State University

Research Background:

Just as each person has her or his own personality, animals of the same species can behave very differently from one another! For example, pets, like dogs, have different personalities. Some have a lot 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 individuals 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 lives in freshwater lakes and ponds across the world. Open water and cover are two habitat types where young bluegill are found. The **open water** habitat in the center of the pond is the best place for bluegill to eat a lot of food. However, the open water is risky and has very few plants or other places to hide. Predators, like large birds, 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 it has less food that is best for bluegill to grow fast. Both habitats have costs and benefits—called a **tradeoff**.

A view of the experimental pond. 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 predators were placed in the pond. Here, scientists are using a net to collect the surviving bluegill at the end of the experiment.

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Melissa is a scientist who is interested in whether differences in young bluegill behavior changes the habitats in which they choose to search for food. First, she looked at whether young bluegill have different personalities by bringing them into an aquarium lab and watching their behavior. Melissa observed that, just like in humans and dogs, bluegill sunfish have different personalities. She noticed that some bluegill took more risks and were bolder than others. Melissa wanted to know if these differences in behavior could also be observed in her experimental pond. She reasoned that being in open water is risky, but results in more access to food. Therefore, bold fish should take more risks and use the open water habitat more than shy fish, giving them more food, allowing them to grow faster and larger, but exposing them to more predation. Just the opposite should be true about shy fish: more time for them in the cover habitat of the pond exposing them to less predation, but also giving them less access to food and an overall smaller body size than bold fish. A tradeoff for both types of fish based on personality.

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 safety of the vegetation in a tank so that it could eat food while there was a predator behind a mesh screen, it was 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). The shy and bold fish started the experiment at similar lengths and weights. After two months, she drained the pond and found every bluegill that survived. She recorded whether each fish that survived was bold or shy and measured their growth (length and weight).

Scientific Questions: How does the boldness of bluegill affect their survival and growth? Is there a tradeoff in bold and shy behaviors?

To determine their personality, Melissa observed young bluegill sunfish in the aquarium lab.

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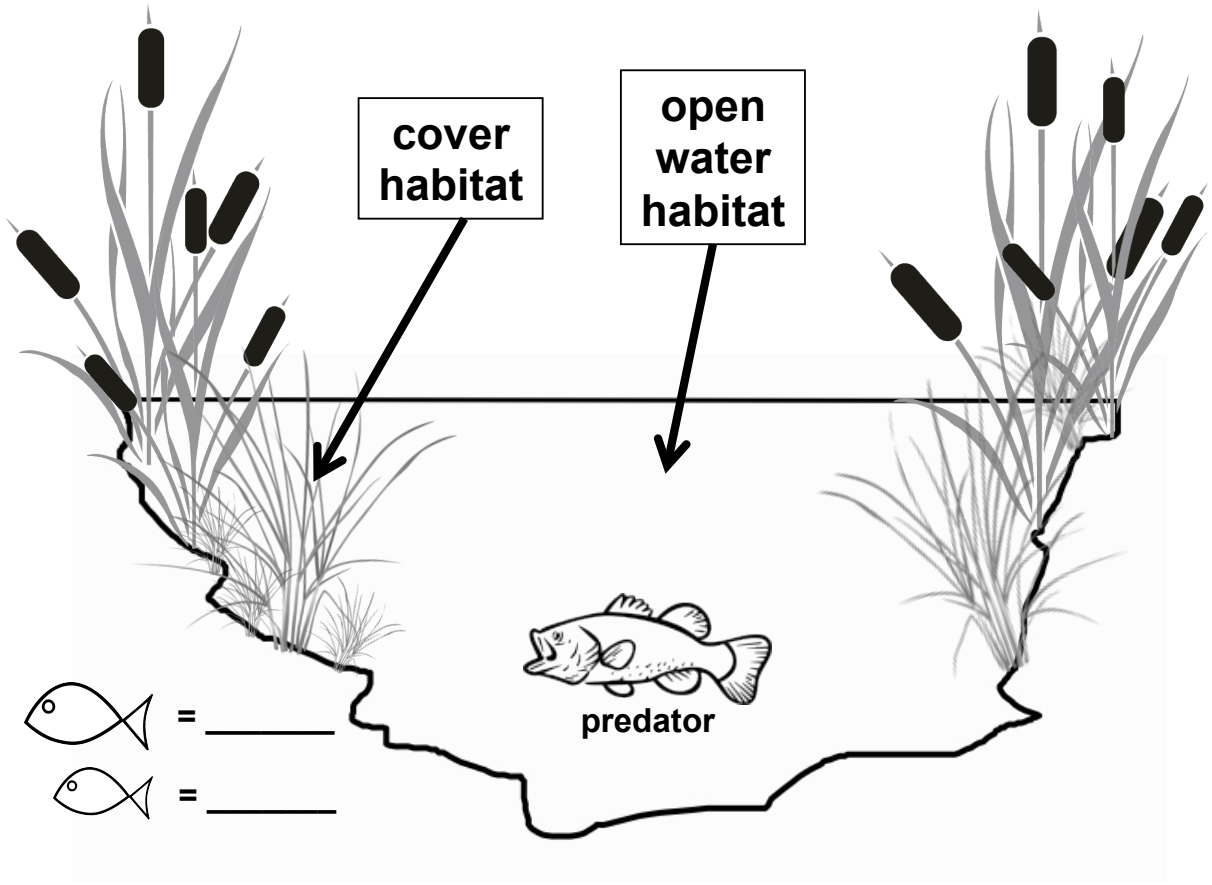
What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

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.



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Scientific Data:

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

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 confident we are in our estimate of the mean, and depends on the number of replicates in an experiment and the amount of variation in the data. A large SE means we are not very confident, while a small SE means we are more confident.*

What data will you graph to answer the questions?

Graph 1: Survival

Independent variable: _____

Dependent variable: _____

Graph 2: Length

Independent variable: _____

Dependent variable: _____

Graph 3: Weight

Independent variable: _____

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.

Interpret the data:

Make a claim that answers each of the scientific questions.

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

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Explain your reasoning and why the evidence supports your claims. Connect the data back to what you learned about the tradeoff for using the cover and open water habitats.

Did the data support Melissa's hypothesis? 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(s) should be investigated to build on Melissa's research? What future data should be collected to answer your question(s)?