DATA *Nugget*

Round goby, skinny goby
Featured scientists: Jared Homola (he/him) and Bailey Lorencen (she/her) from
Michigan State University

Research Background:

Animals often have adaptations, or traits that help them live in certain environments. For fish, that can mean having a body shape that allows them to feed on available prey, better hide from predators, or swim more effortlessly. When these

An invasive round goby from the Kalamazoo River, Michigan.

traits vary within the same species from one location to another, they are called **local adaptations**. Such adaptations were once thought to only evolve slowly over hundreds or thousands of generations. However, new evidence shows that evolution can result in meaningful adaptations much more quickly than originally thought, sometimes in just a few generations!

Invasive species are those that have been moved by humans to areas where they do not usually exist and cause disruptions to native ecosystems. Because they have been moved to new places where they did not evolve, invasive species often have traits that aren't matched to their new habitats. When mismatches occur, species may be able to adapt in just a few generations in their new locations.

Several invasive species have been problematic in the Great Lakes of North America. The round goby is a small invasive fish species that arrived in the Great Lakes around 1990. It is a bottom-dwelling species that is able to quickly reproduce and crowd out native fish species. Both avid anglers, Jared and Bailey observed the increasing numbers of round gobies during their time spent outdoors. They noticed that sometimes round gobies would even outnumber all other native fish in an area.

Originally appearing just in the Great Lakes themselves, the species is increasingly being found in rivers throughout the region. Jared and Bailey were surprised this species did so well in both river and large lake habitats since they are very different environments for fish to live. For example, water is constantly flowing downstream in rivers, whereas lakes can be still or have waves near the shore. Also, these two habitats

have different predator and prey species living in them and differ in water chemistry characteristics.

With the spread of more and more round gobies into rivers, Jared and Bailey set out to learn how this species is successful in both habitats. They thought that round gobies found in rivers would have adaptations to help navigate fast flowing waters. Fish with narrower body shapes can move more easily in flowing waters, giving narrow-bodied individuals an advantage over those with bulkier bodies. Over time, those individuals with such an advantage would be more likely to survive and reproduce in the rivers, eventually shifting the entire river-dwelling population to a narrow body shape. They predicted that round gobies from rivers would have shorter body depths and narrower caudal peduncles, which is the area between the fish's body and tail. To test their idea, Jared and Bailey captured and measured hundreds of round gobies from both Great Lakes and inland river habitats.
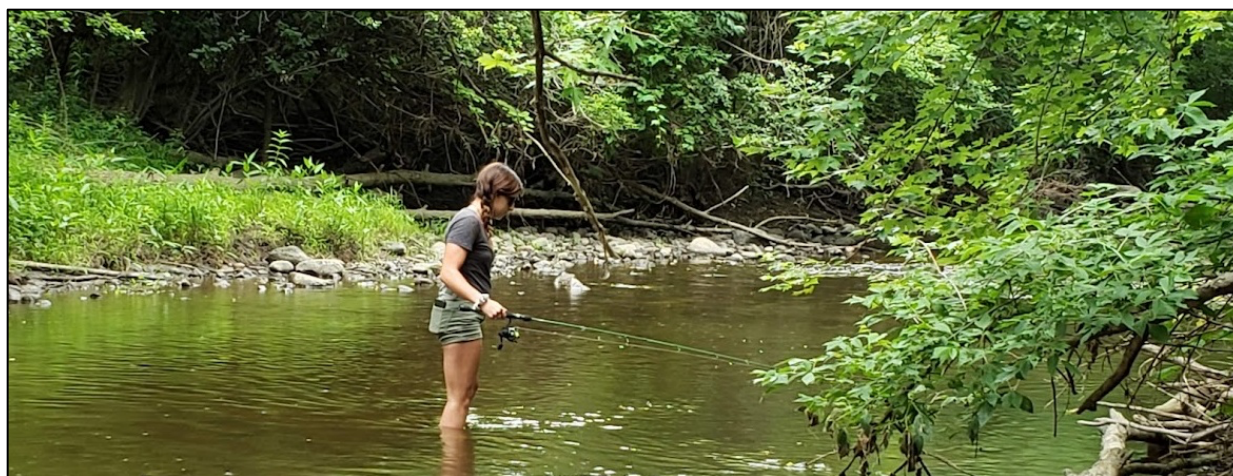

Michigan State University researcher Bailey Lorencen fishing for gobies in a Michigan river.

Scientific Question: How do body shapes of round gobies that live in rivers compare to those that live in the Great Lakes?

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.

Scientific Data:

Use the data below to answer the scientific question:
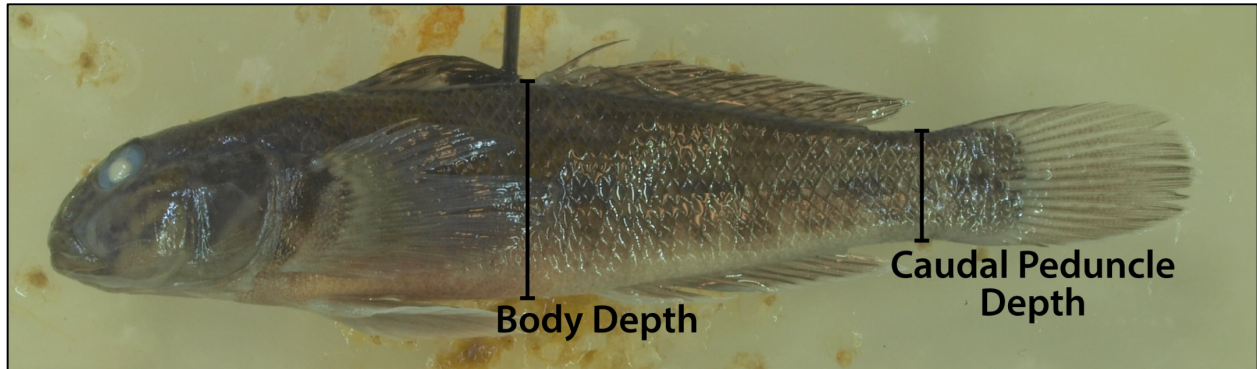
Analyzed round goby body measurements

	Body depth (cm)	Body depth standard error	Caudal peduncle depth (cm)	Caudal peduncle depth standard error
Lake	2.03	0.29	0.85	0.01
River	1.36	0.02	0.66	0.01

* 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 and there is a large amount of variability among individual measurements, while a small SE means we are more confident and there is less variability.

What data will you graph to answer the question?

        Independent variable(s): _____

        _____

        Dependent variable(s): _____

        _____

Draw your graph(s) below: Identify any changes, trends, or differences you see in your graph(s). 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 the scientific question.

What evidence was used to write your claim? Reference specific parts of the table or graph(s).

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how local adaptations in invasive species.

Did the data support Jared and Bailey's hypothesis? Use evidence to explain why or why not. If you feel the data are inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Jared and Bailey's research? How do your questions build on the research that has already been done?