

It would be helpful to introduce *adaptation* and *habitat* to the students before using the worksheet and activity. Many lessons introducing adaptations at the 4<sup>th</sup> grade level draw on physically visible adaptations, so teachers might consider introducing the concept of adaptations in a prior lesson with such examples. Although habitat is a part of this lesson, this lesson is not intended to be its initial introduction. This lesson will reinforce these ideas and introduce additional nuance (e.g., habitat alteration and fitness trade-offs).

**Learning objectives:**

1. Students will be able to identify fish adaptations for living in rivers.
2. Students will be able to explain how people may change a habitat and how animals may develop new adaptations to this new habitat.
3. Students will be able to explain a fitness cost or trade-off between two traits that are both adaptive.

**Introduction:**

Introduce the fish that live in the river – the answers use mummichogs as an example. Then, have the students brainstorm what kind of environment the fish were originally adapted to.

What do the students imagine that the river should be like? What **habitat** should the fish live in?

How do the fish respond to this environment?

- \*what do they eat? (bugs, like mosquitoes!)
- \*how do they get oxygen? (gills)
- \*how do they protect against predators? (shy?)
- \*how do they stay warm/cool?
- \*where do they shelter? (in grasses along riverbanks)

Before there were a lot of people here, do you think the water was polluted at all? (Pollution should have been introduced at least in 3rd grade.)

[answer: No.]

So, the fish species were adapted to living in a river that wasn't polluted!

*It may or may not be helpful to continue this conversation to discuss pollution before reading the story in the worksheet, **Resource C**.*

Well, some industries produce harmful chemicals and have released them into this river. So, the fish that were adapted to living in a clean river were now living in a polluted river. This is called **habitat alteration**.

What do you think might have happened to the fish?

Likely answers:

\*They got sick

\*They died

Many fish did get sick: some of them had cancer, and some of them had heart problems. But, there are some fish that are now able to live in the river without getting cancer or having heart problems. These fish have **adapted** to the polluted river.