SCIENCE·3D

HELLBENDERS: SAVING THE SNOT OTTER

In this packet, sample student answers are provided in red and notes to teachers are in blue.

In this **Science Mission**, students will use what they learned from the **Mission Reader** and **Mission Video** to predict how changes in environments may help or harm animals. Then, they will use data to make graphs and determine which abiotic factors and human impacts affect hellbender populations. Finally, they will use their knowledge and scientific data to develop hypothesis about what has happened to rivers and suggest where hellbender populations might be restored.

Activity 1: Hellbender Habitats

Hellbenders need just the right conditions to thrive. Predict whether the changes described below would help or hurt hellbenders. Provide an argument for each of your answers.

1. A farmer clears the trees next to the riverbank. Erosion causes soil to flow into the river. The soil is deposited over the rocks in the river.

This should hurt hellbenders. The soil will make water quality worse. The soil covering the rocks will take away hellbender habitat.

2. A farmer creates a wetland next to her farm. This wetland keeps pollution out of the river. Oxygen levels in the river increase.

This will help hellbenders. They need a lot of oxygen in the water.

3. A rockslide causes many large, flat rocks to fall into a river where there used to be only small pebbles.

This will help hellbenders. They need rocks to hide and reproduce.

4. A disease causes the population of crayfish to disappear.

This will hurt hellbenders because their prey is gone.

5. A chemical plant 40 km (25 mi) upstream releases chemicals into the river accidentally.

This will hurt hellbenders. Chemicals will flow downstream and can easily get into hellbenders' bodies through their skin.

6. People remove all of the large, flat rocks from a section of a clean river to build a rock wall.

This will hurt hellbenders. It will take away habitat that they need.

Activity 2: Where Are the Hellbenders and Where Should They Be?

One way to find hellbenders is to go for a swim and count them! Table 1 shows the abiotic, or non-living, conditions in seven rivers. It also shows the number of hellbenders that were counted by the science team.

Table 1. Water quality and hellbender counts from 1990

River number	Oxygen	Water quality	Number of large rocks	Number of hellbenders
1	High	Good	Many	35
2	High	Good	Many	30
3	High	Good	Few	7
4	High	Poor	Many	5
5	Low	Poor	Many	0
6	Low	Poor	Few	0
7	High	Good	Some	2

1. Make a graph of the number of hellbenders in each river. Label the axes and write a title for your graph.

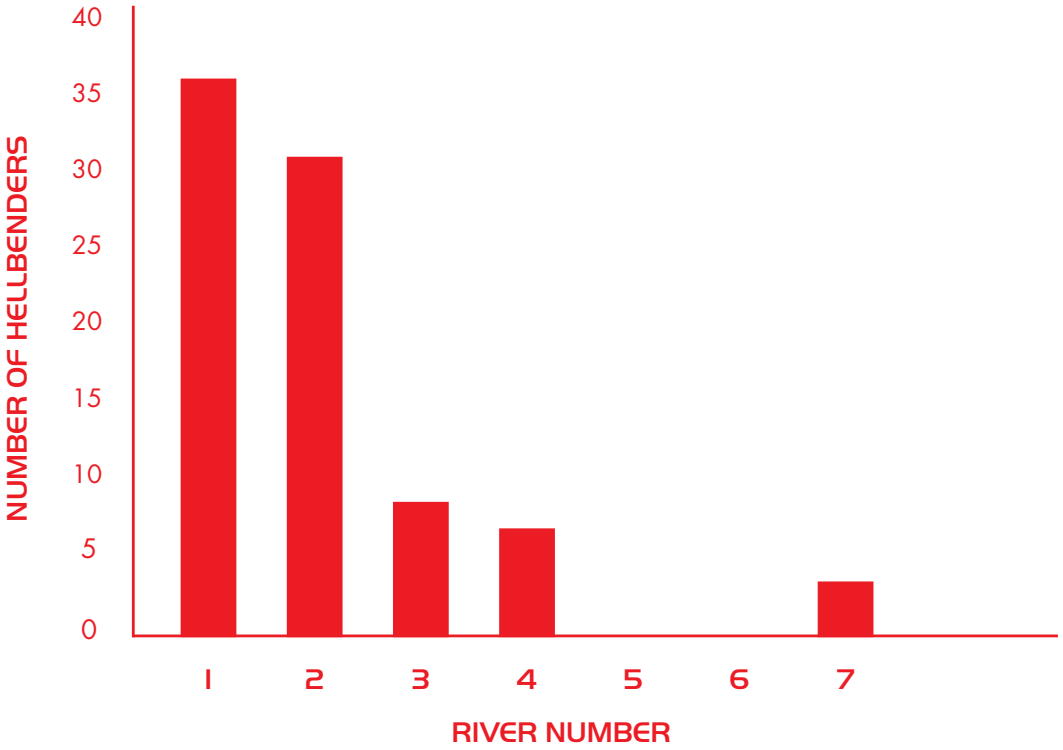

Figure 1. The number of hellbenders in each river in 1990.

2. Based on Table 1 and your graph, what conditions are important for hellbender survival?

Students should argue that hellbenders need clean water with a lot of oxygen and many large rocks.

3. What biotic factors might influence whether hellbenders can survive in a river? Why might there be few hellbenders in River 7?

The amount of food and the number of predators are biotic factors that influence hellbender survival. The low number of hellbenders in River 7 could be due to there being many predators, not enough food, or other bad conditions.

Activity 3: Return of the Hellbenders

This activity can be done individually or in small groups. For groups, consider assigning each group a river and asking them how they would protect or improve their assigned river for hellbenders. Although there is no question about the river, you might ask students if there is cause for concern for River 2, which had a decline in water quality and hellbender counts.

People have been working hard to improve the quality of rivers. This can result in better homes for hellbenders.

Table 2. Water quality and hellbender counts from 2018

River number	Oxygen	Water quality	Number of large rocks	Number of hellbenders
1	High	Good	Many	40
2	High	Medium	Many	20
3	High	Good	Few	5
4	High	Good	Many	0
5	High	Good	Many	0
6	Low	Good	Few	0
7	High	Good	Some	4

1. **Compare** the habitat quality and number of hellbenders in each river in 1990 to those in 2018. In each cell of Table 3, write a word to describe the change. Use the terms **none, better, worse** for the columns with oxygen, water quality, and the number of rocks. Use the terms **more, fewer, same** for the column with the number of hellbenders.

Table 3. Changes in conditions from 1990 to 2018

River Number	Oxygen	Water quality	Number of large rocks	Number of hellbenders
1	none	none	none	more
2	none	worse	none	fewer
3	none	none	none	fewer
4	none	better	none	fewer
5	better	better	none	same
6	none	better	none	same
7	none	none	none	fewer

2. What do you think happened to the hellbenders in River 4?

Conditions improved but hellbenders disappeared. They might hypothesize that something happened to the prey of the hellbenders. They might also suggest that the bad water quality in 1990 was too much for hellbenders to survive.

3. Describe a way that scientists might be able to help hellbender populations grow in River 3.

Adding large rocks or hellbender huts might give populations places to live and reproduce.

4. Choose a river in which you would want to release new hellbenders. Describe why you chose that river. List the things you would do to bring their populations back.

Accept all reasonable answers. Most students should pick Rivers 4 and 5 because the conditions are now good enough to support hellbenders. They could describe keeping water quality good, adding hellbender huts, and releasing young hellbenders that are big enough to survive.

5. Use what you have learned about hellbenders to argue how some changes in the environment harmed hellbenders and how others helped them.

Answers should include how humans can harm hellbenders through pollution or sedimentation and discuss how cleaning rivers helps hellbenders.