

### Box 12. Most creative responses across countries for the Save the River item

- **Il y a un barrage qui a été fait au milieu de la rivière par des enfants qui voulaient juste s'amuser. Celui ci retient donc toutes les grenouilles [...]** // *There is a dam in the middle of the river that was built by children who were just having fun. It is trapping all the frogs [...]* (Belgium)
- **Tal vez se deba a una sequía actual o próxima, dónde el nivel del río baja y muchas ranas tienden a migrar a lugares con más agua, o a morir a causa de la sequía.** // *Perhaps it is due to a current or upcoming drought, where the river level drops and many frogs tend to migrate to places with more water, or to die because of the drought.* (Colombia)
- **Uma das causas do problema podem ser protozoários que atacam anfíbios. Em girinos esses protozoários o impedem de comer, e em sapos adultos o impedem de respirar [...]** // *One of the causes of the problem could be protozoa that attack amphibians. In tadpoles these protozoa prevent them from eating, and in adult frogs they prevent them from breathing [...]* (Brazil)
- **A mudança da cor do rio, devida à poluição, provocou uma sensação de estagnação nas rãs, fazendo com que estas, não reconhecendo o seu habitat habitual, se deslocassem para um local onde a água se encontrasse da cor normal.** // *The change in the colour of the river due to pollution has caused the frogs to feel stagnant and, not recognising their usual habitat, to move to a place where the water is a normal colour.* (Portugal)
- **There is a disease spreading throughout the frogs in the river, and the frog population has decreased [...].** (Canada)
- **Que puede haber una nueva especie en el rio en especifico en esa parte y que es un depredador que su principal alimento sea las ranas [...].** // *That there may be a new species in the river specifically in that part and that it is a predator whose main food is frogs [...]* (Chile)
- **موجود لى ال ي دوت ايرى ت ك ب دوج و وا تاسر ت فم ةئيب دوج و** // *The presence of a predator environment or the presence of bacteria that leads to a decrease in their number.* (Saudi Arabia)
- **[...] si la raison de ce manques de grenouilles n'était pas en rapport avec la pollution : ces petits batraciens sont parfois chassés et tués, pour en faire des cuisses de grenouilles... Pour vérifier cela, nous pouvons demander aux restaurants locaux quels sont leurs fournisseurs et demander à ces derniers d'où viennent leurs grenouilles.** // *[...] what if the reason for this lack of frogs has nothing to do with pollution: these little amphibians are sometimes hunted and killed to make frog legs... To verify this, we can ask local restaurants who their suppliers are and ask the suppliers where their frogs come from.* (France)
- **有一种新型细菌控制青蛙的生育功能并使其致命,这细菌只感染两栖类和爬虫类** // *A new type of bacterium controls the reproductive function of frogs and makes them deadly. This bacterium only infects amphibians and reptiles.* (Hong Kong)
- **Es gibt mehr Vögel in der Stadt, da die Stadt im Süden liegt, und die Zugvögel eingetroffen sind und die Frösche verjagen** // *There are more birds in the city because the city is in the south and the migratory birds have arrived and are chasing away the frogs.* (Germany)
- **possibile malattia genetica delle rane, [...] è possibile che con il passare degli anni rane di un determinato posto abbiano sviluppato un cambiamento genetico che le ha portate ad affrontare difficoltà fisiche al di sopra delle loro capacità** // *possible genetic disease of the frogs, [...] it is possible that over the years frogs from a certain place have developed a genetic change that has led them to face physical difficulties beyond their capacity* (Italy)

- 도시에서는 열 방출이 상대적으로 잘 안되기 때문에 그 열을 강이 받게 되고, 그로 인해 강의 온도가 높아져 개구리가 살 수 있는 수온이 아니게 되어 개구리가 점점 사라져 간다. // *In cities, heat is not released well, so the heat is taken up by the river, which increases the temperature of the river and makes it unsuitable for frogs to live in, causing frogs to gradually disappear.* (Korea)
- **V mestu ni primernega prostora za zadrževanje in razmnoževanje, saj je struga večinoma umetna ali protipoplavno ograjena.** // *There is no suitable space for staying and breeding in the city, as the riverbed is mostly artificial or flood proofed.* (Slovenia)

**Note:** Student responses are shown as they were submitted in the PISA 2022 creative thinking test, including creative spelling and grammar. The notation [...] indicates where student responses have been shortened for brevity.

### **What were common themes or features across creative responses?**

In this item, students demonstrated how scientific inquiry can be applied to complex ecological problems, integrating knowledge from fields of biology, chemistry, geography, ecology and environmental science to explore potential causes and solutions to the problem of a declining frog population. One recurring theme – despite the instruction in the prompt to think of alternate hypotheses – were ideas related to pollution and resulting environmental degradation. However, some students were still able to creatively connect potential explanations to pollution beyond more obvious ideas like leakage of toxic chemicals, for example changes in the river colour that have unsettled the frog population.

Another common theme amongst responses in general was the impact of urbanisation and resulting changes in the natural landscape due to the impact of humans. While most responses along these lines referenced more obvious human activities, such as increased noise or a general closer proximity to natural areas disturbing the frogs, some creative responses proposed “hidden” or unintended consequences as a potential cause of the issue. For example, a creative response from a student in Belgium suggested that a dam built by children may be preventing the frogs from leaving the river where it exits the town, connecting a seemingly harmless or innocent act (children building a dam) to the disruption of an ecosystem. Similarly, a student from Slovenia suggested that the artificial nature of urban riverbeds – designed for flood control for human development – might have unintended adverse effects for the frog population by removing suitable breeding spaces.

Common responses amongst students also suggested that new ecological pressures – whether from an invasive species or new predators – were responsible for pushing frogs out of their natural habitats. Numerous students also proposed that diseases or genetic mutations could be at the root of the decline in the frogs’ population. For example, a student from Hong Kong suggests that a bacterium controlling the reproductive function of frogs could be making them “deadly” to other frogs. Similarly, a student from Italy proposes that genetic changes over time could result in physical difficulties for frogs, potentially making them less fit to survive in their environment.

### **Example item 7: The Exhibit**

This item had more of an engineering problem-solving focus, with students asked to propose design ideas for constructing a separating wall in an animal park exhibit that would allow squirrels to pass from one room to the other while preventing the rats from doing so (Figure 7). The item specified that while the squirrels and the rats had the same body size, squirrels are heavier, faster and more agile than rats. Box 13 shows a selection of creative responses from students across countries for this item.