

# RIVER INVERTEBRATES SHOW THAT EUROPEAN FRESHWATER HABITATS HAVE STOPPED IMPROVING

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## YOUNG REVIEWERS:



HARMONY

AGE: 13



JACK

AGE: 10

Freshwater habitats have been harmed by pollution. People tried to fix this problem by reducing pollution from cities and farms, but we do not know if these efforts worked. To find out if they did, a group of scientists caught small animals, called invertebrates, from rivers across many European countries. Invertebrates can tell us if a river is polluted because we catch many different invertebrates in unpolluted rivers, but only a few in polluted rivers. If more invertebrates are caught each year, it means rivers are getting better. Researchers caught more invertebrates during the 1990s and 2000s. This was good news because it showed that reducing pollution helped many rivers. However, they did not catch more invertebrates in the 2010s. This means rivers stopped getting better, maybe because of other problems we have not fixed, like climate change. More work is therefore needed to help freshwater habitats improve again.

## FRESHWATER HABITAT

Places with water that is not salty, where animals and plants live. Examples are rivers, streams, wetlands, lakes, and ponds.

## SPECIES

A group of animals, plants, or other living things that are alike and can reproduce with one another.

## WASTEWATER

Water that has been used by people, such as in factories or houses.

## POLLUTION

Harmful material in water, air, and soil. Polluted water is not healthy to drink or swim in.

## INVERTEBRATES

Small animals that do not have backbones, such as insects like dragonflies, and other animals like snails and worms.

## FRESHWATER HABITATS ARE IN TROUBLE

**Freshwater habitats**, like rivers, lakes, and ponds, are very important. Many different **species** (kinds) of animals and plants live in these habitats. Freshwater habitats also provide people with drinking water, food from fishing, electricity from waterpower, and places to play and enjoy nature, like swimming and canoeing. However, freshwater habitats and the species that live there are in trouble. People like to build cities near freshwater habitats and use surrounding land for farms. Building and farming can harm freshwater habitats. **Wastewater** from our buildings, yards, and roads can also pollute them.

Many countries have tried to fix these problems in various ways. One common way is to build wastewater treatment plants. These are large buildings that collect wastewater from cities to remove chemicals and other harmful substances. Other helpful actions include reducing **pollution** from factories and cars, and using fewer fertilizers and pesticides on farms. These fixes can help, but we do not know whether they are helping as much as we need them to [1, 2]. We need data that can tell us if freshwater habitats and their species have improved. These data must come from many countries because we need to know what is happening *everywhere*, not just in one place.

## INVERTEBRATES CAN TELL US ABOUT FRESHWATER HEALTH

To find out what has happened to freshwater habitats and species, a group of scientists caught **invertebrates** from many European rivers [3]. Invertebrates are small animals that do not have backbones, such as insects like dragonflies, and other animals like snails and worms. River invertebrates tend to live underwater, especially under rocks or in mud at the river bottom. We collect river invertebrates because these animals have been used for more than 100 years to tell us how healthy a river is. How? Invertebrates are the most species-rich animal group on Earth, and many of these species cannot live in polluted rivers. We therefore find a lot of invertebrate species in healthy rivers, but only a few species in polluted rivers. If we catch river invertebrates every year and find more each year, it means rivers are getting better. If we do not catch more, it means rivers are not getting better, and if we catch less, it means rivers are getting worse.

## CAPTURING RIVER INVERTEBRATES

Scientists catch river invertebrates by going to the same part of a river each year, during the same season, kicking their feet along the river bottom, and trapping invertebrates in nets (Figure 1). This is simpler than testing the water because there are many different pollutants and



### Figure 1

(A) Example of a scientist collecting river invertebrates by kicking or sweeping along the river bottom. (B) Invertebrates are captured in large nets. Examples of invertebrates that can be found in European rivers and streams include (C) freshwater mussels and (D) stoneflies.

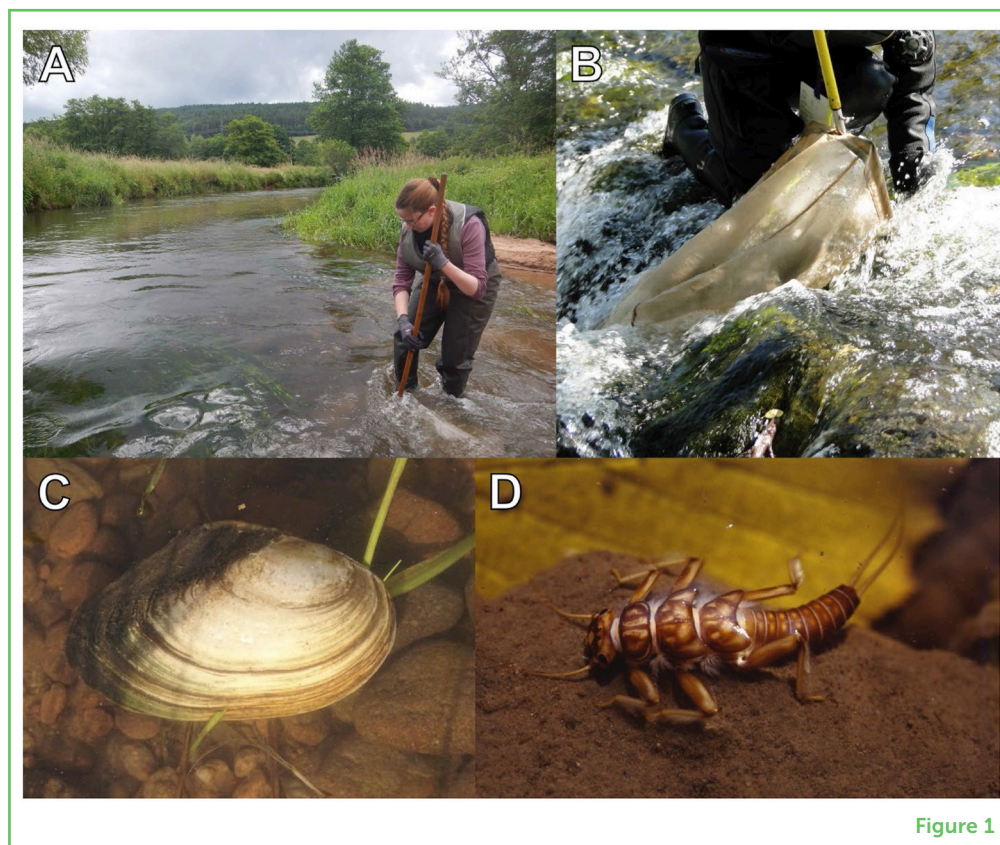


Figure 1

chemicals that could be affecting a freshwater habitat, making testing difficult and very expensive. Instead, it is easier and cheaper to collect invertebrates and use them to tell us if the water is generally good or bad.

River invertebrates were caught from 1,816 different sites in rivers from 22 European countries. The sites are in countries like Denmark, France, Germany, and the United Kingdom. All invertebrates were caught between 1990 and 2020, although invertebrates were caught at each site in different years. For example, invertebrates were collected from one river in Denmark from 1999 to 2016, and in a different river in France they were collected from 1992 to 2017.

### RIVERS STOPPED IMPROVING AROUND 2010

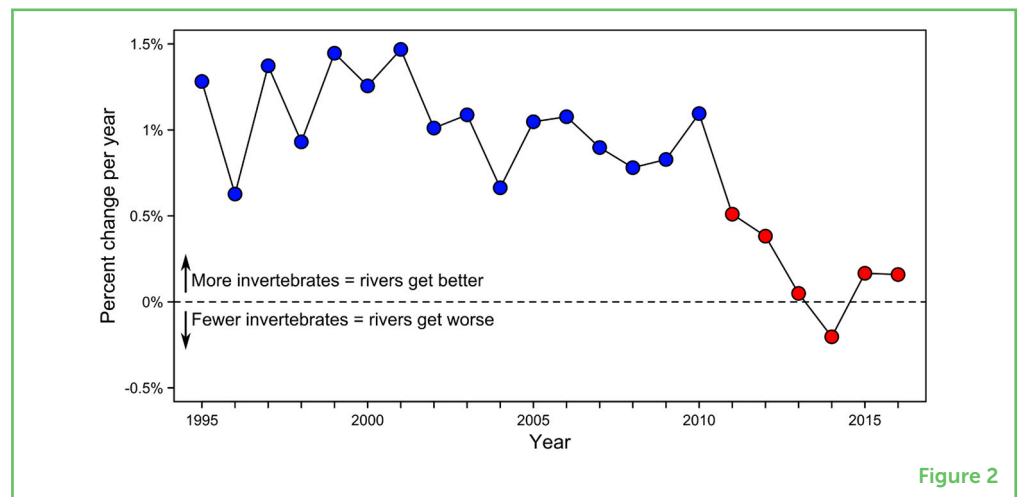
To find out if more invertebrates were being caught, the scientists measured the average percent change in the number of invertebrate species caught each year across all sites. They did this only for 1995 to 2016 because they did not have enough data from other years. For each year, if the number was above 0%, it meant they caught more invertebrates compared to the previous year. This would mean rivers improved. If the number was close to 0%, it means the scientists did not catch more invertebrates and rivers did not improve compared to the

previous year. If the number was below 0%, it means scientists caught fewer invertebrates and rivers got worse.

The scientists found that the number of invertebrate species in rivers increased in the earlier years of their work, during the 1990s and 2000s. However, in later years during the 2010s, they did not find more invertebrates (Figure 2).

**Figure 2**

Percent change in the number of invertebrate species each year. Numbers were around +1% before and up to 2010 (blue circles), showing that rivers were gaining species and thus were improving. However, the numbers shifted closer to 0% after 2010 (red circles), showing rivers stopped gaining new species and thus stopped improving.



**Figure 2**

Catching more invertebrates during the 1990s and 2000s means that European rivers got better during these years. This is an important finding because it shows people can help fix freshwater habitats and species, even if those habitats have been harmed in many countries. Improvements likely happened because of our efforts to clean up pollution in rivers. For example, many European countries use wastewater treatment plants to reduce pollution from cities. Many places have also increased the amount of river habitat. This can happen by removing dams or by planting trees along the riverbank to provide shade and food for river invertebrates.

Catching fewer invertebrates during the 2010s means that rivers *did not* continue to improve during this time. This data could even be an early warning sign that rivers may become worse in the future.

## WHY HAVE RIVERS STOPPED IMPROVING?

There are many reasons why rivers may have stopped getting better. One reason could be that invertebrate **diversity** is now at its maximum in many rivers. However, this explanation is unlikely because most monitored freshwater habitats across Europe still have a lot of room for improvement [4]. An alternative explanation is that, while people have fixed some problems, other problems have not been fixed. For example, pollution from cities is lower, but rivers are still being polluted by farms. The increasing size of the human population also means more water is being taken from rivers for human use. Many countries

### DIVERSITY

The number of different species.

are making laws right now to try to fix this [5]. Some problems have also gotten worse in recent years, such as climate change. Increasing temperatures from climate change, along with more floods and droughts, can harm river species [6]. These problems need to be fixed. We must keep working hard to help rivers improve again. By making rivers healthier, we help both the people who use rivers and the species that live in them.

## ORIGINAL SOURCE ARTICLE

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## YOUNG REVIEWERS

### HARMONY, AGE: 13

Harmony is a 12-year-old that loves birds, biology, and stick figures. Some of her favorite hobbies include birdwatching, bird photography, reading, and booping her bunny Spot.



### JACK, AGE: 10

I am a 10-year-old 4th grader who loves video games, anime, and anything Godzilla. I also like watching YouTube videos and learning cool new things. I am really into snorkeling especially when visiting family in Hawaii. One of my favorite hobbies is cooking, especially making my signature dish: fried calamari!



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