

River flow and temperature limit trout numbers

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This is a trout in a Cantabrian river. Credit: Frank Black Noi / SINC

Over a 23-year study, Javier Lobón-Cerviá has found the mechanism that controls the number of salmonids found each year in Cantabrian rivers. His method has been to monitor population numbers in relation to river flow in March, when the juvenile fish emerge. He concludes that environmental conditions change each year and modify river flow, positively or negatively affecting survival rates. This information throws light on a long debate within ecological theory about the mechanisms that regulate the size of animal populations.

In 2000, populations of trout (*Salmo trutta*) in the rivers of north East Spain suffered an alarming decline, but fishing was never banned, and fish numbers fell still further. However, these populations recovered

"naturally" within a very short time period. Javier Lobón-Cerviá, lead author of the research study and a researcher at the National Museum of Natural Sciences (CSIC) has the answer, and has published it in the journal *Freshwater Biology*.

"If we use a small measurement and calculate the amount of water that was flowing in March (when the fish eggs emerge), we can predict how many trout there will be now, how many there will be in two years, how many should be fished, how many females are going to reproduce - in other words, we can monitor the entire population perfectly", the researcher tells SINC.

It has taken him 23 years of study to arrive at this conclusion. Contrary to conventional theories, which hold that populations have endogenous mechanisms to respond to variations, and that these depend upon the density of individuals, Lobón-Cerviá says populations "simply respond to the environmental conditions that exist at the time".

Since 1986, the scientist has been studying the Chaballos river in the basin of the Esva river in Asturias, where environmental conditions have varied widely year-on-year up to 2007. "Information as simple as river flow in the month of March is enough to enable us to predict everything that will happen in the river", stresses Lobón-Cerviá.

Rain and temperature are natural factors that create the ideal conditions for young trout. The number of juveniles is highest when river flow is average, because there is an ideal amount of useable river area for the larvae. "If the amount of water flowing rises, this space is reduced, because water velocity increases too much, which is harmful to the larvae", says the scientist. However, drought is the worst condition for this species, because "river sections dry up".

The river is a vital space for larvae

Rain determines river flow, and creates useable area in [rivers](#) for a particular size of trout. "Small larvae live in a certain river area, but when they grow they move to deeper waters. The river's flow determines how much useable area is available for each size group of trout", explains the researcher.

Temperature regulates the so-called "embryonic stream", in other words the two months that fertilised salmonid eggs remain in the river. For this reason, an increase in temperature affects embryonic development.

"Temperature also plays a role in the strength of recruitment, the number of juveniles, but there is an inverse relationship between river flow and temperature - when flow is very low, the water heats up more, and in years with much more water the river heats up less", adds the scientist. However, the great changes in temperature each year make it difficult to work out the direct relationship between this aspect and the number of juveniles born.

This research could also be applied to salmon (*Salmo*). Although they occupy different parts of the river, they have the same population dynamics processes as trout. Lobón-Cerviá is now looking at the possibility of a link between reproduction and reproductive success among populations swimming out into the Cantabrian Sea and those that swim into the Duero. "If this can be demonstrated, this study could be widely applied", the researcher concludes.

More information: Lobón-Cerviá, Javier. "Why, when and how do fish populations decline, collapse and recover? The example of brown [trout](#) (*Salmo trutta*) in Rio Chaballos (northwestern Spain)" *Freshwater Biology* 54(6): 1149-1162.

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