

New approach to assess health status of intermittent rivers

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The results of the study will improve current tools for detecting human impact on water quality in intermittent rivers. Credit: Rebeca Arias-Real

More than 50% of the world's river network is made of temporary or intermittent rivers: these are rivers that, during a certain time of the year, mainly summer, present dry riverbeds or some isolated ponds. These rivers show high variability, both spatially and temporally, which makes it impossible for the same tools used to gauge the state of health of permanent rivers to be applied to them.

A study led by researchers of the University of Barcelona, recently published in the journal *Ecological Indicators*, has identified new potential biological indicators—organisms such as insects and other water invertebrates—that can be used to assess the [human impact](#) on the quality of the waters in these rivers, which are home to a very important fraction of both terrestrial and water biodiversity.

The study, based on data from 33 rivers in Catalonia, analyzed the aquatic invertebrates present in intermittent rivers and classified them according to their resistance to the duration and frequency of dry phases. These results could allow managers to adapt some of the indices currently used in Spain, such as the IBMWP index (Iberian BioMonitoring Working Party score system), which evaluates anthropic impacts on [water quality](#) that are not adapted to this type of intermittent river.

The study, led by Professor Isabel Muñoz, includes the participation of the researchers of the Department of Evolutionary Biology, Ecology and Environmental Sciences of the Faculty of Biology of the UB Rebeca Arias-Real, first author of the study, and Margarita Menéndez. Among the participants is also Cayetano Gutiérrez-Cánovas, researcher at the

Doñana Biological Station (EBD) of the Spanish National Research Council (CSIC).

Searching for indicators of anthropogenic impacts

Despite the extent and importance of intermittent rivers, these ecosystems have been excluded from almost all conservation and assessment programs, because it is very difficult to establish reference conditions, due to the different aquatic and dry phases they go through. "Current biomonitoring tools are based on species living in permanent rivers and are therefore not efficient if we apply them, without adaptations, to intermittent rivers," says Isabel Muñoz.

The organisms found in these intermittent rivers have adaptations that allow them to live in conditions of change between aquatic and terrestrial phases. The aim of the study is therefore to find out which species can live in intermittent rivers, or under which hydrological conditions they are able to do so, in order to adapt and modify the current indices for assessing the ecological status of rivers.

"Our approach could lead to the identification of taxa and indicators that respond to anthropogenic impacts and not to the stress of the dry or terrestrial [phase](#)," notes Rebeca Arias-Real. "In other words, the fact that a species does not appear in an intermittent river does not necessarily mean that it is due to anthropogenic pollution; perhaps it is because that species does not have the necessary adaptations to survive in such fluctuating ecosystems."

Aquatic invertebrates resistant and sensitive to dry phases

With this aim, the researchers measured hydrological variables of

intermittent rivers, such as the exact number of days the rivers were "dry" or the number of times they dried up during the course of a year. "In recent years, the use of sensors capable of measuring temperature or water level in situ has provided us with more and more quantitative approximations that help us to better understand the effect of intermittent flow on biodiversity," says Rebeca Arias-Real.

Using these variables and the detailed study of the characteristics, abundance and density of aquatic invertebrates in the different hydrological phases, the researchers were able to construct the hydrological niches of these organisms, i.e. their limits of resistance to desiccation. With the results ready, four different groups of invertebrates were established: one sensitive to desiccation and three with different levels of resistance.

Thus, species with niches resistant to the dry phase could be used to develop or adapt current biomonitoring indices and establish reference conditions for intermittent rivers, while species with sensitive niches "should be excluded from the indices, since their absence is not due to anthropic impacts but to the impossibility of their presence," says Rebeca Arias-Real.

"For instance, we identified pollution-sensitive taxa with partial desiccation tolerance, such as *Lepidostoma*; moderate, such as *Corduliidae*; or high, such as *Nemoura*, which could serve as potential bioindicators for intermittent rivers."

Intermittent rivers and climate change

These results open the door to implementing this methodology in other regions and using it with other species in order to improve the conservation of these ecosystems, which are expected to increase in the coming years. "Due to climate change (increase in temperature and

decrease in rainfall), it is expected that many rivers that are now permanent will become intermittent and that those that are already intermittent will increase in frequency and duration of their dry phases," warns Rebeca Arias-Real.

Therefore, it is very important "to continue working to understand how biodiversity responds to the continuous cycles of water and dry phases and how this affects its functioning in order to make progress in the conservation of these unique ecosystems," concludes the researcher.

More information: Rebeca Arias-Real et al, Drying niches of aquatic macroinvertebrates identify potential biomonitoring indicators in intermittent and ephemeral streams, *Ecological Indicators* (2022). [DOI: 10.1016/j.ecolind.2022.109263](https://doi.org/10.1016/j.ecolind.2022.109263)

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