



CESAB
CENTRE FOR THE SYNTHESIS AND ANALYSIS
OF BIODIVERSITY

Project summary

IRBAS

Analysis and synthesis of intermittent river biodiversity

Principal Investigator: **Thibault DATRY (IRSTEA)**

Start and finish: **2012-2015**

Co-funding organization :  **ONEMA**
Office national de l'eau et des milieux aquatiques

With climate change and the increasing water needs of human populations, many rivers, rich in biodiversity, are becoming intermittent. What is the influence of this phenomenon on the communities of animal and plant species living in these environments? The IRBAS team undertook to collect and analyze the relevant data to answer this question.

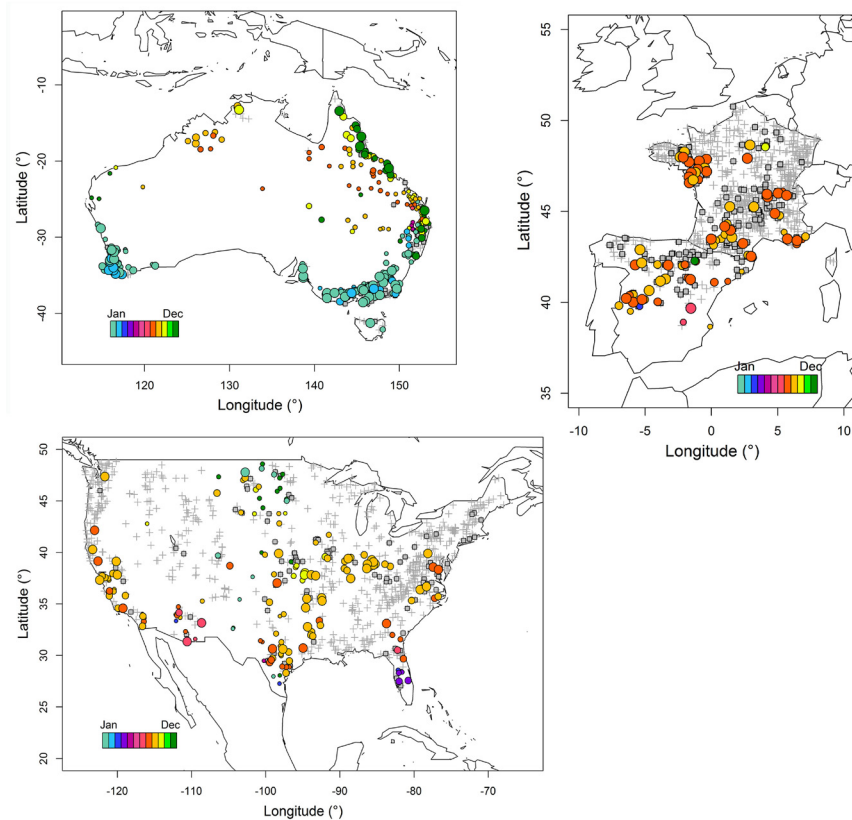
Context and objectives

Across the globe a large number of rivers periodically stop flowing. These rivers are called intermittent rivers. They are found in most terrestrial biomes, not only in arid zones, where they are relatively common. Studies show that over the next century, their numbers and size will increase in regions affected by droughts, notably caused by climate change. Intermittent rivers, however, have been little studied. Aquatic and terrestrial ecologists have long considered that they do not fall within their scope. It has also been assumed for some time that intermittent rivers harbored only a small amount of biodiversity and were inhabited only by poor communities of drought-resistant species. In recent years, ecological studies of intermittent rivers have developed, in part because of the severity of drying in areas where water requirements are being felt. Many countries now have data and metadata available on these intermittent rivers.

While these studies have led to the recognition that intermittent rivers need to be protected for their biological values, current management practices, intermittent river protection policies and legislation are often inadequate or non-existent. Effective management of intermittent river systems requires knowledge of the relationships between river flow components (e.g. drought periods, floods, base flow) and ecological responses.

Methods and approaches used for the project

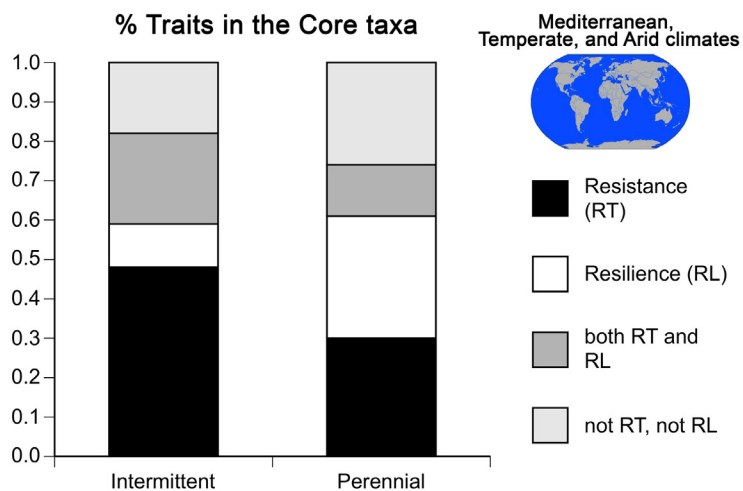
The CESAB activity brought together an international team of European, American, Australian and New Zealand researchers. Each contributed their biological, hydrological and environmental data on intermittent rivers, which the group compiled and analyzed. The biannual work sessions allowed us to exploit and analyze these databases in depth to produce new knowledge in river ecology.



- Gauging stations compiled and analysed by the IRBAS group showing the occurrence of zero flow events during the year** (the size of each symbol is proportional to the duration of the event). Key: dot = intermittent river; square = weakly intermittent river; cross = perennial river. Colours refer to the month in which there was no flow.

A gauged river was "intermittent" when the mean number of zero-flow days in the 1970-2013 record was ≥ 5 days/year. Rivers with < 5 days/year but a strictly positive frequency of zero-flow days in their record are "weakly intermittent". All other rivers were considered "perennial".

CESAB had the effect of an incubator for the IRBAS project. In 2016, the project became a European project H2020. Entitled 'Science and Management of Intermittent Rivers and Ephemeral Rivers', this project brings together more than 100 researchers and 20 stakeholders from 29 European countries to improve the management of intermittent rivers by converting the current state of knowledge into concrete tools. In addition, the project of the 1000 intermittent rivers - from the IRBAS project - aims, for its part, to compensate for the lack of data on intermittent rivers. This unique collaborative research network now brings together 120 researchers from 26 countries.



Proportion of species in twelve aquatic invertebrate communities of intermittent rivers located in contrasting contexts with either Resistance (RT) or Resilience (RL) traits, both or none. Following Leigh et al. (2016) *Aquatic Sciences* 78: 291-301.

Main conclusions

- There is no clear trend towards increasing intermittency in the countries studied. Current hydrological classifications are greatly improved when drying out is taken into account.
- Intermittent natural river communities are resilient to drying out through resistance and resilience strategies.
- Aquatic communities in intermittent rivers are generally less diverse than in conventional rivers.
- Intermittent river communities are dynamic. The current conceptual and empirical models in ecology are not suitable for their study.
- Human societies derive many ecosystem services from intermittent rivers, such as recharge of aquifers or provision of water for livestock during droughts.
- The presence of dewatering in hydrological regimes is a major determinant of the biodiversity of intermittent rivers.

The data, obtained in Australia and South-West Europe over large spatial and temporal scales, revealed different and unexpected results. Indeed, the difference in species diversity between sites (beta diversity) and the drying time of rivers follow a bell-like relationship; in other words, the difference in site diversity is greatest when the drying time is intermediate, and minimal when the river is rarely or often dried out. If this result is true when all taxa are considered, this is not always the case when the dispersal capacity of the different species is taken into account. Studies have shown that species with high aquatic dispersal (such as some ephemera) follow this pattern well, but for species with high aerial dispersal (such as some beetles and dragonflies), the drying time of the rivers had no influence. This is because the dispersion of aquatic species, even the most robust ones, is constrained by the available water surface because of the low capacity of this group to extend beyond bridges and dams.

Anticipated (or actual) impact of these results for science, society, and public and private decision making

Conservation and restoration efforts of dynamic ecosystems, such as intermittent rivers, should take their unique nature into account in order to be effective.

- The results of the IRBAS project made it possible to formulate



recommendations and guidelines for water managers. For example, under a Water Directive, ONEMA and the Water Agencies were able to draw on the results of IRBAS and advise on how and when to monitor the ecological status of intermittent rivers.

- In order to support the decision, the IRBAS team wrote *Intermittent Rivers and Ephemeral Streams: Science & Management*, published in 2017 by Elsevier. The book should become a reference in the academic, managerial and decision-making spheres.
- In order to encourage the scientific community to work on the theme of intermittent rivers and to pool existing data, the IRBAS team has created a web portal on a set of data synthesizing the biodiversity of intermittent rivers (irbas.cesab.org). By giving free access to this database, the objective is to encourage the development of large-scale research and synthesis on intermittent rivers.

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