

# Characterizing and predicting the use of alluvial habitats by aquatic communities for a better management of large river ecosystems

**Bouloy A., Marle P., Riquier J., Castella E., Lamouroux N., Lebrun C., Mayor H., Olivier J.M., Piégay H., Tissot N.**

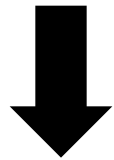
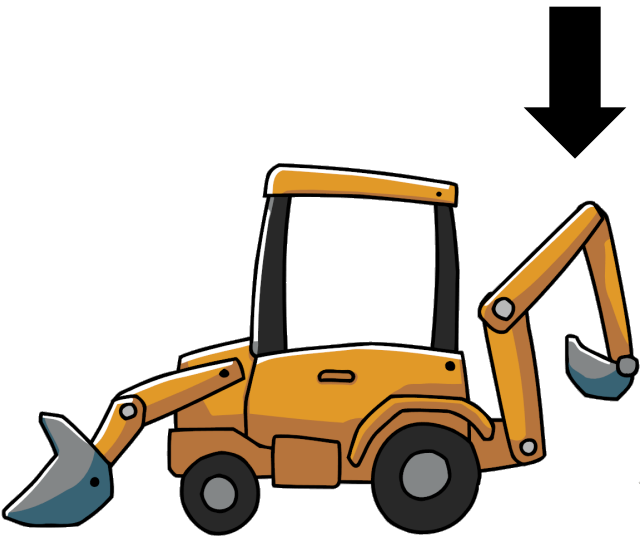


# Context

## Numerous anthropic impacts



## Flow alteration and habitat fragmentation



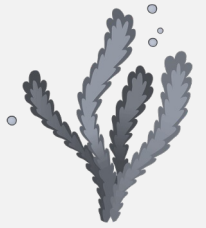
Minimum flows

Habitat diversity  
and connectivity

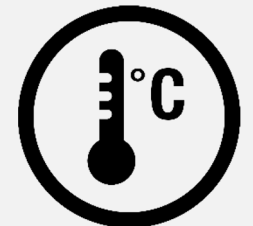
## RhônEco : a unique scientific monitoring programme

✓ Multi-sites (9 sectors and > 40 floodplain channels) + long term data (before and after restoration)

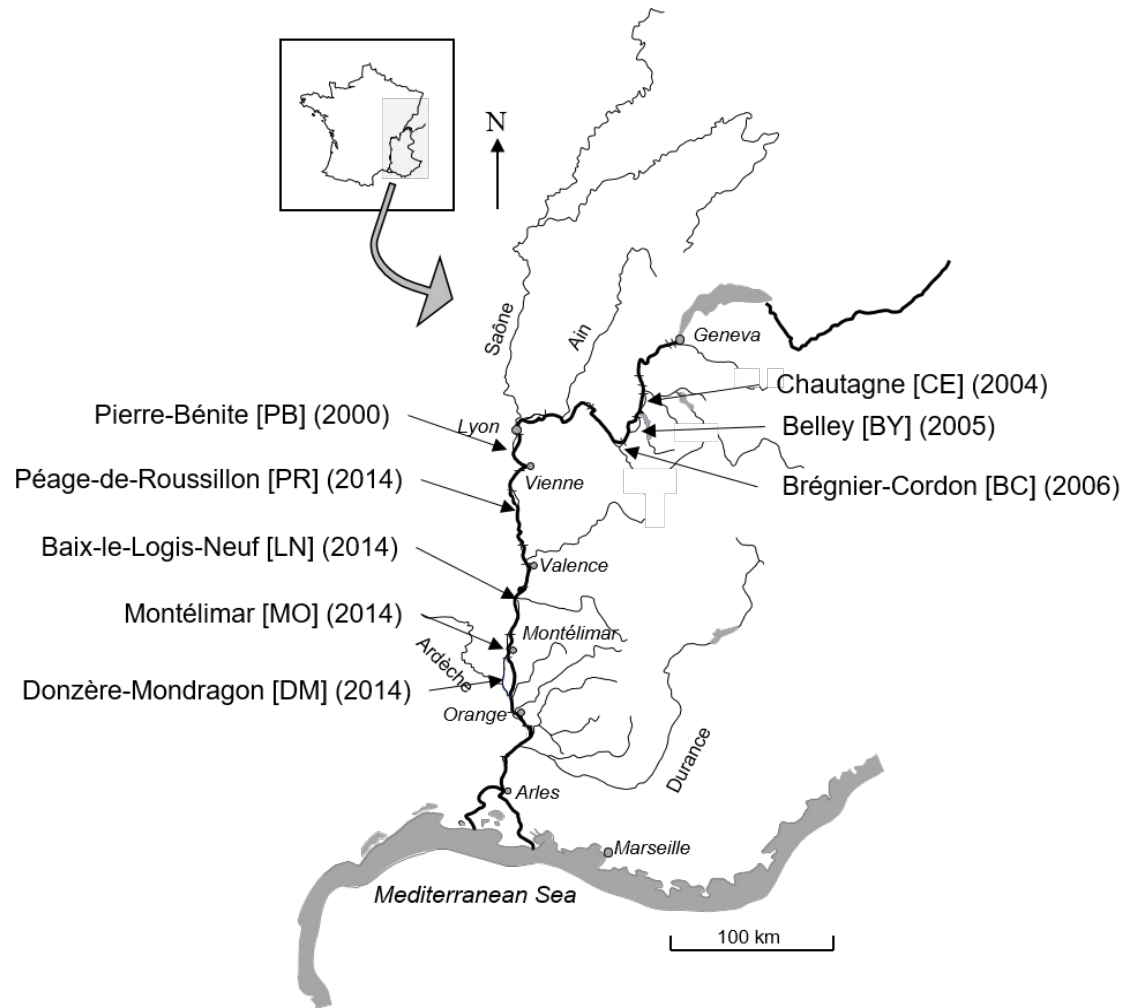
### ✓ Biotic monitoring



### ✓ Abiotic monitoring



# Context



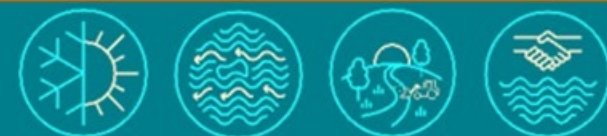
## Studies on Rhône

Compartmentalization between the different studies

- ✓ Fish in the main channels
- ✓ Macro-invertebrates in floodplain channels
- ✓ Sediment dynamics

## Objective

It is essential to make more **interdisciplinary studies** on these ecosystems to allow a more relevant definition of restoration objectives.



# Spatio-temporal dynamics of habitat use by fish in a restored alluvial floodplain over two decades

(Bouloy et al., in prep)



## Objectives

- 1 Describe the spatio-temporal use of floodplain habitats by fish and to identify complementary roles of habitat
- 2 Analyse how restoration and environmental variations (flow, connection frequency) influence habitat use by fish.

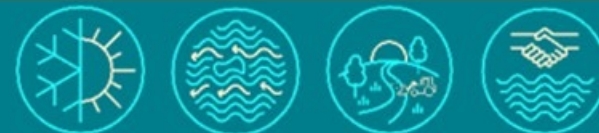
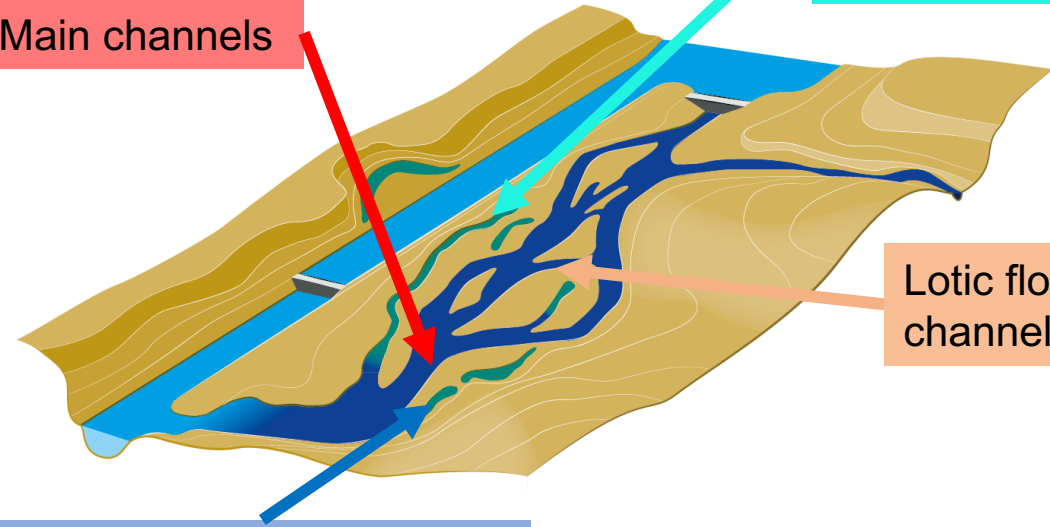
Main channels

Lentic floodplain channels with short lifespan (< 30 years)

Lotic floodplain channels

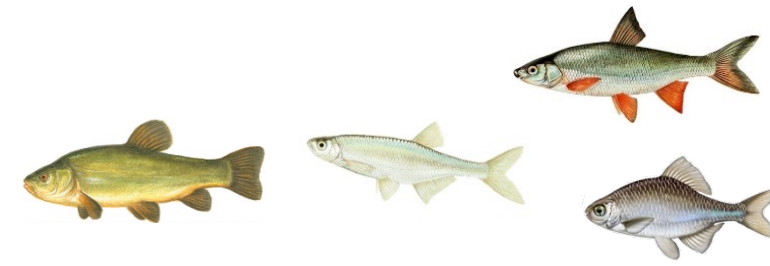
Lentic floodplain channels with long lifespan (> 30 years)

(Riquier et al., 2017)

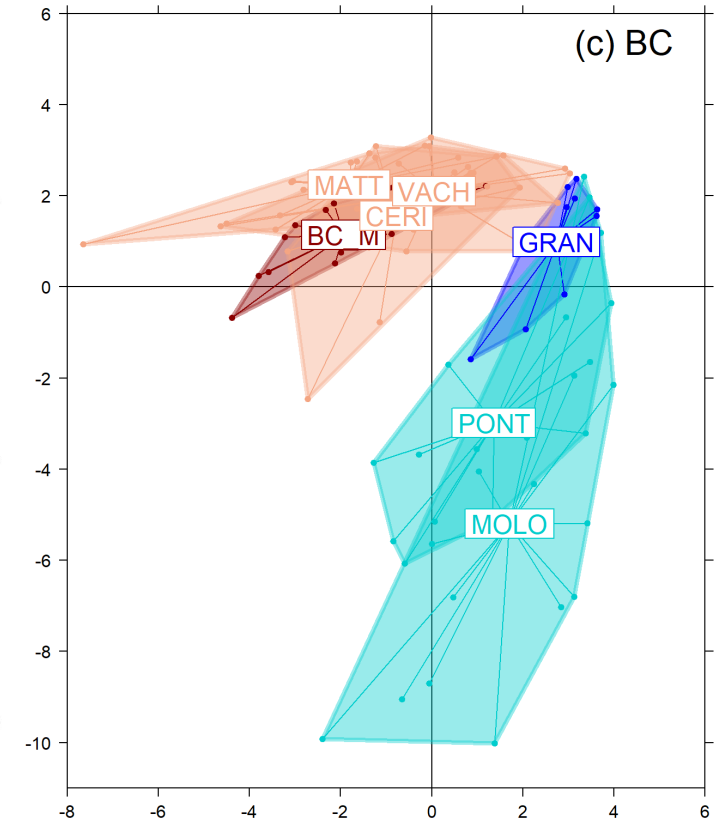
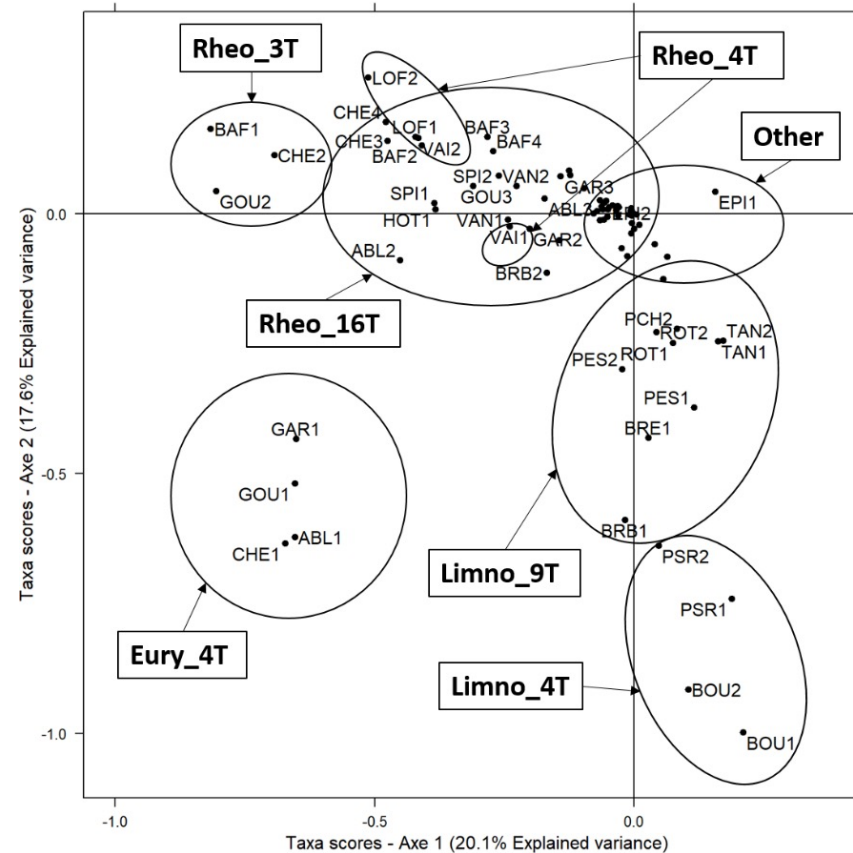




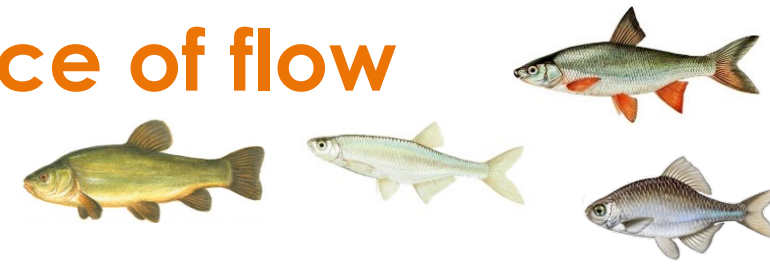
# Spatio-temporal use of habitats by fish



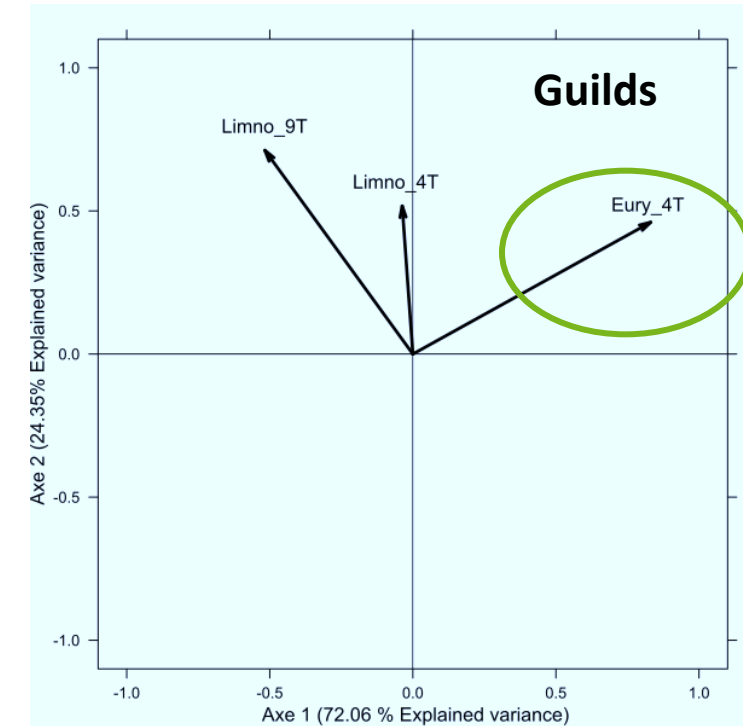
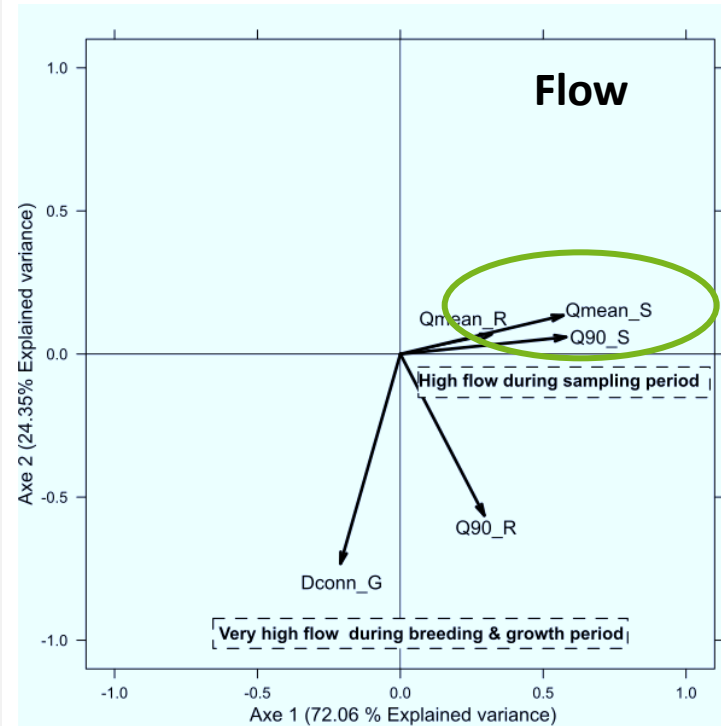
- ✓ **Rheophilic taxa** use both main channels and lotic floodplain channels
- ✓ **Limnophilic taxa** preferentially use lentic short-lived floodplain channels
- ✓ **YOY** of the eury\_4T guild use lotic habitats and lentic short-lived floodplain channels as nursery areas



# A Functional complementarity and influence of flow



- ✓ The **nursery** role of lentic short-lived floodplain channels is enhanced by high flows
- ✓ High flows during the breeding period influence fish **recruitment**
  - Eury\_4T in lentic channels
  - Rheo\_3T and Rheo\_16T in lotic habitats
  - Limno\_9T in lentic short-lived channels
- ✓ Floodplain channels act as **refuges** during high flows



## Coinertia analyses X4



# Focus on the effect of restoration



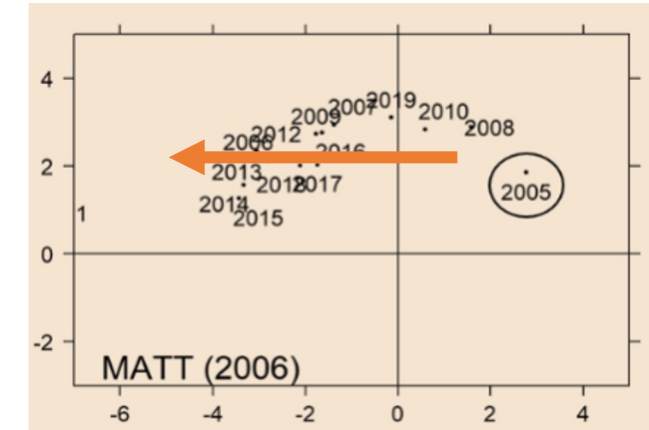
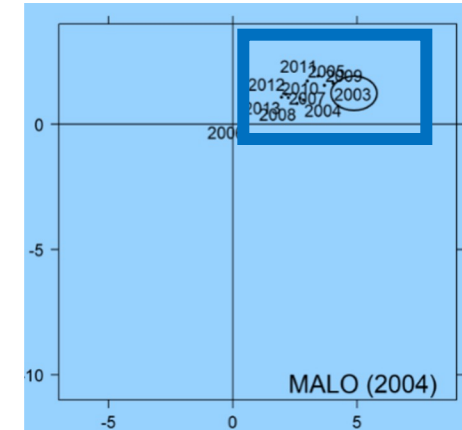
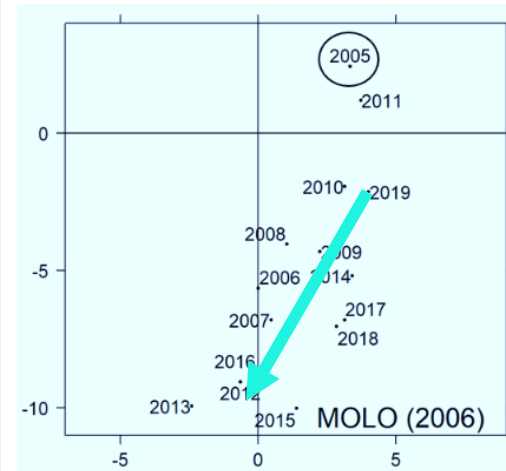
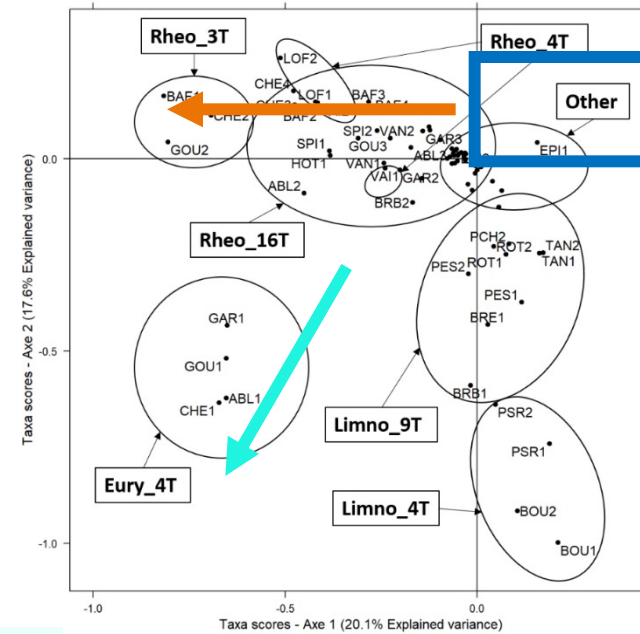
## In lentic short-lived floodplain channels:

- Nursery role
- Limnophilic taxa

## ✓ No significant effect in lentic long-lived floodplain channels

## ✓ In lotic floodplain channels

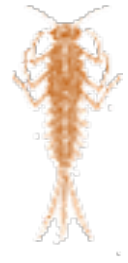
- Flow refuge
- Rheophilic taxa



# Sustainability of restoration ?



- ✓ The restoration has improved the functionality of the floodplain for fish but what about biological diversity in restored habitats?
- ✓ Are the effects of restoration perennial?
- ✓ What are the changes in macro-invertebrate composition during succession in a floodplain channel?



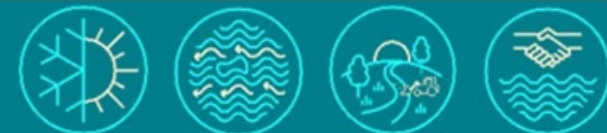


# Ecological succession of a floodplain channel

## The predictors

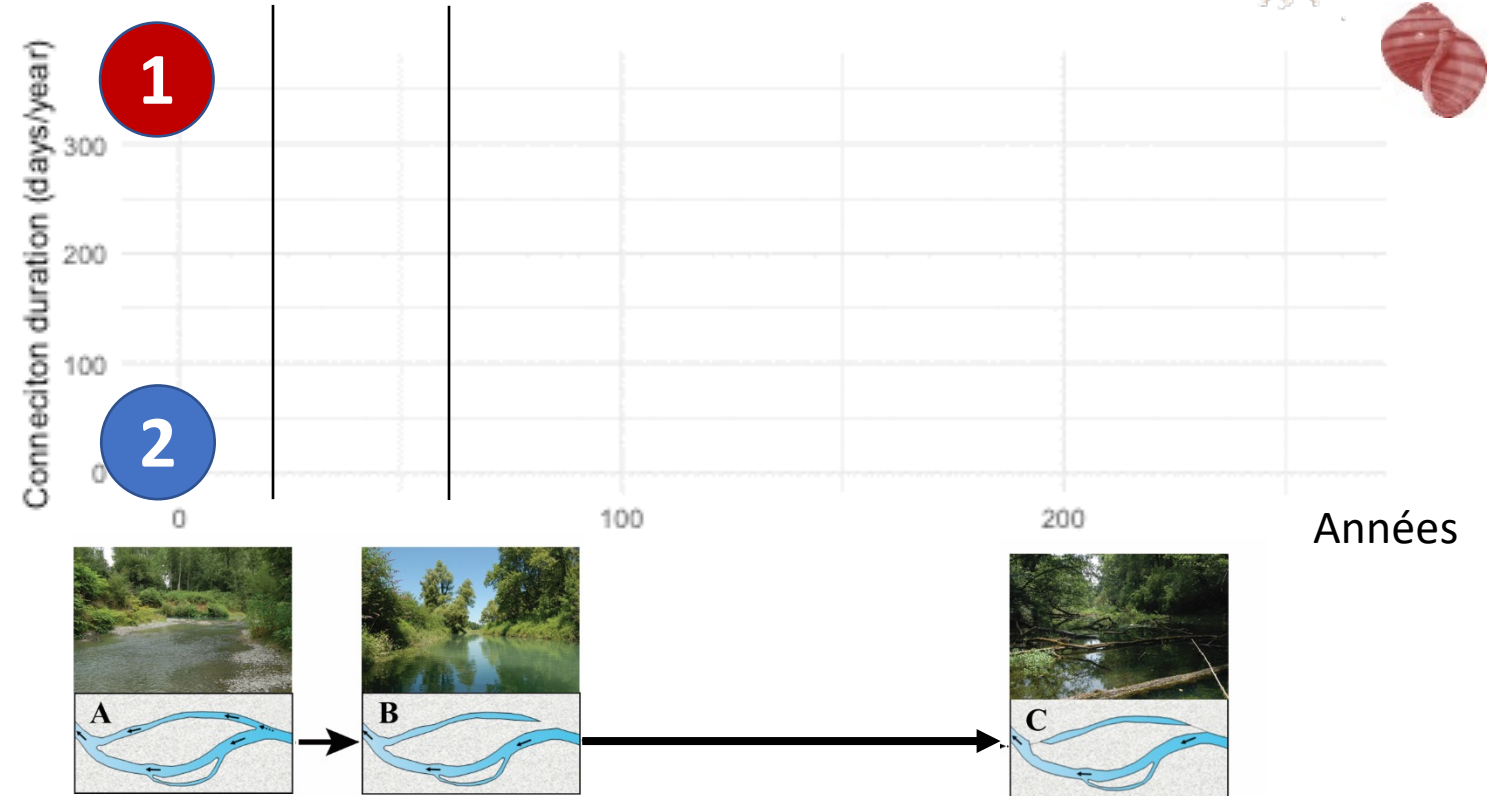


[2021. Marle P., et al. \*Science of the Total Environment\* 750 \(1\): 142081.](#)

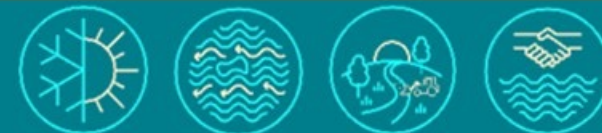


# Ecological succession of a floodplain channel

## The predictors

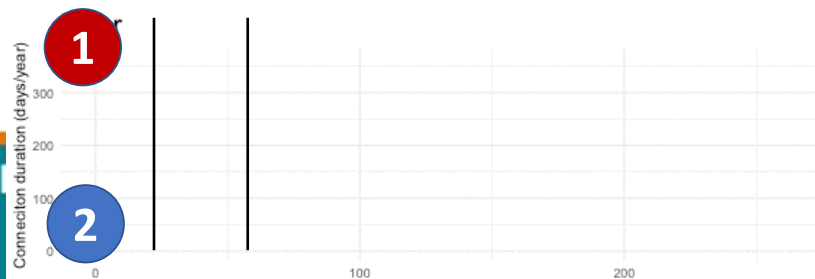
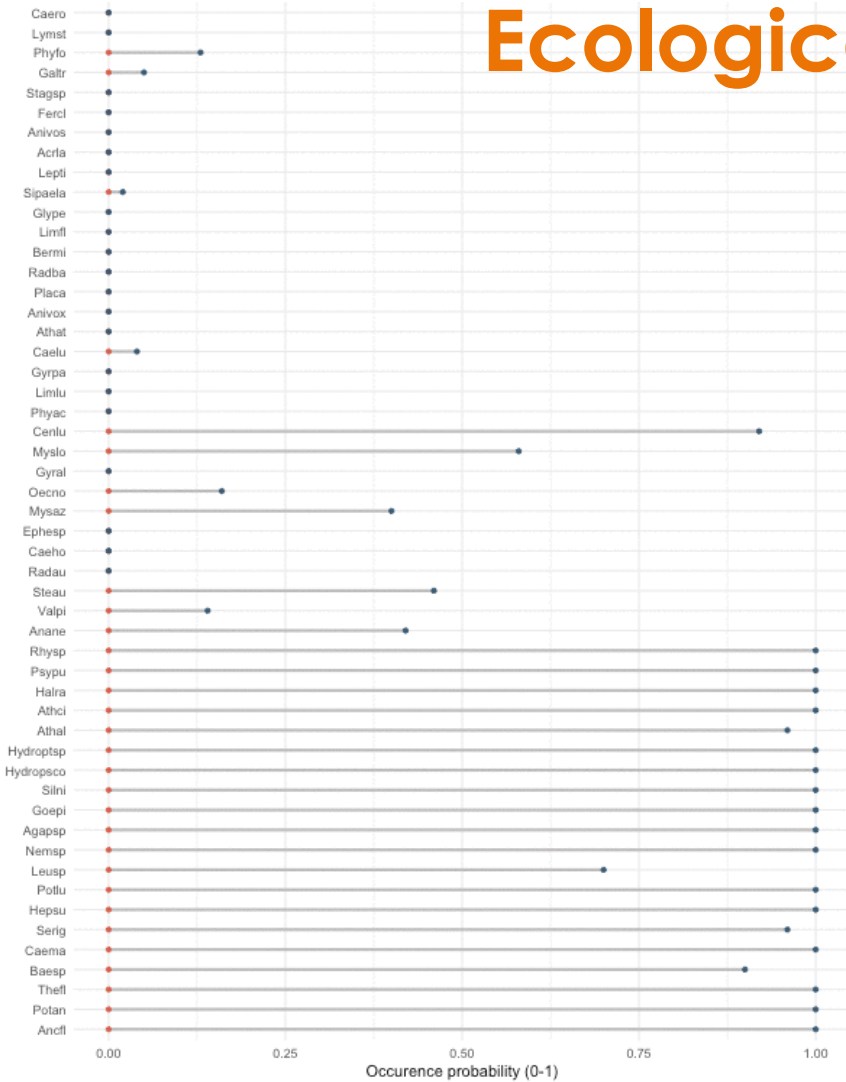


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# Ecological succession of a floodplain channel

## The biological responses



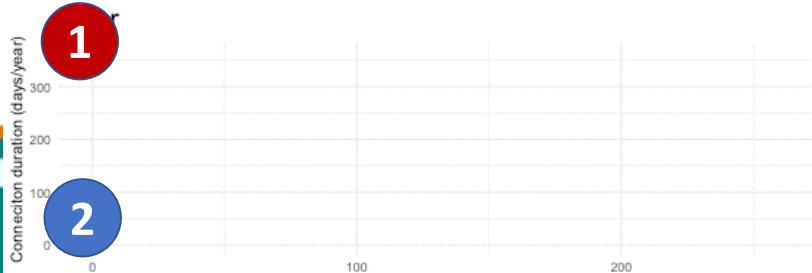
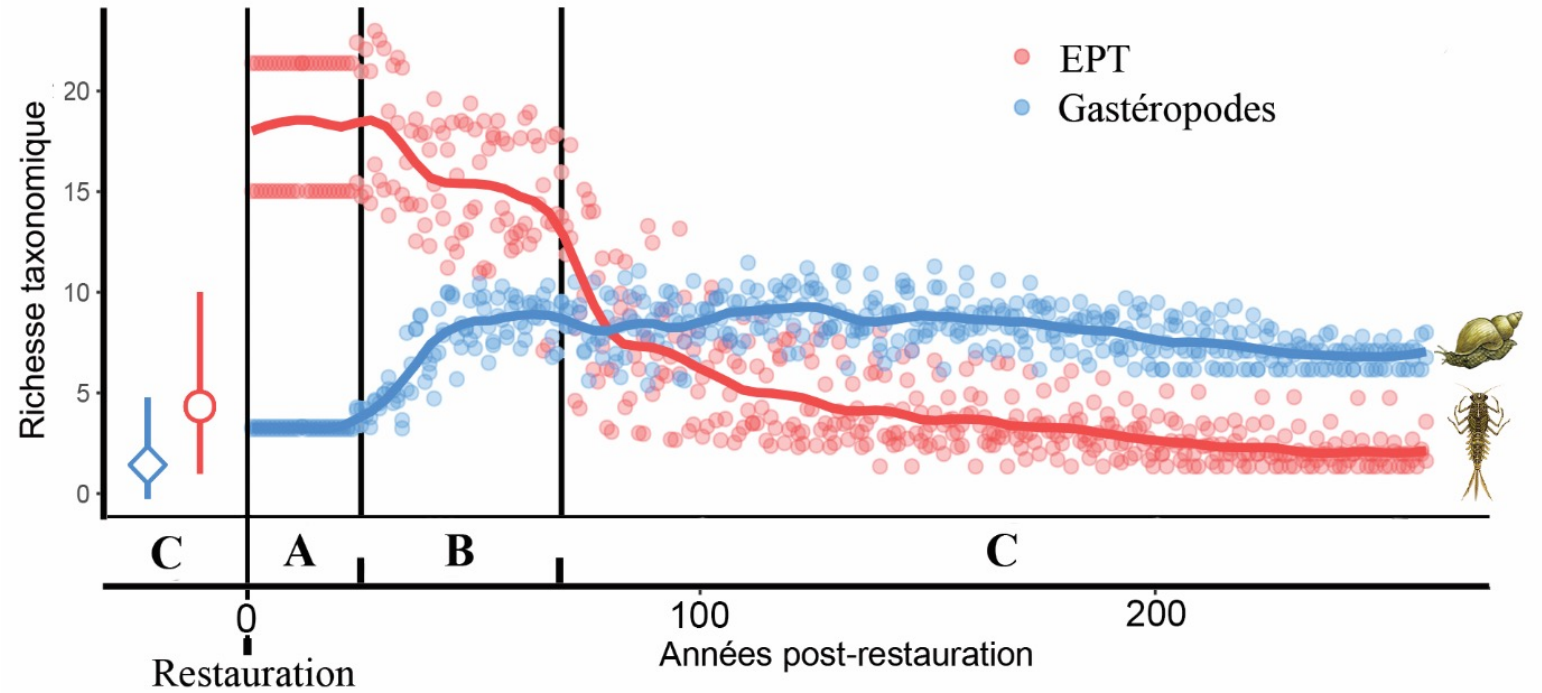
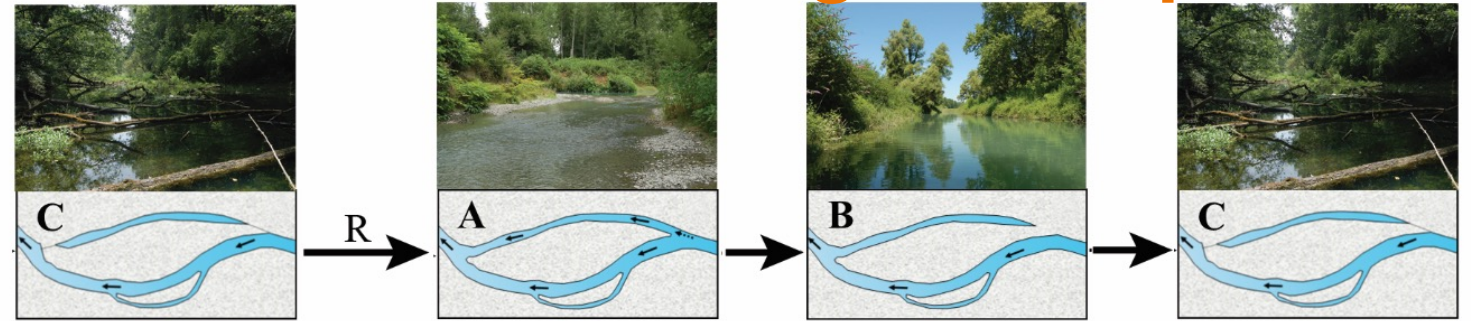
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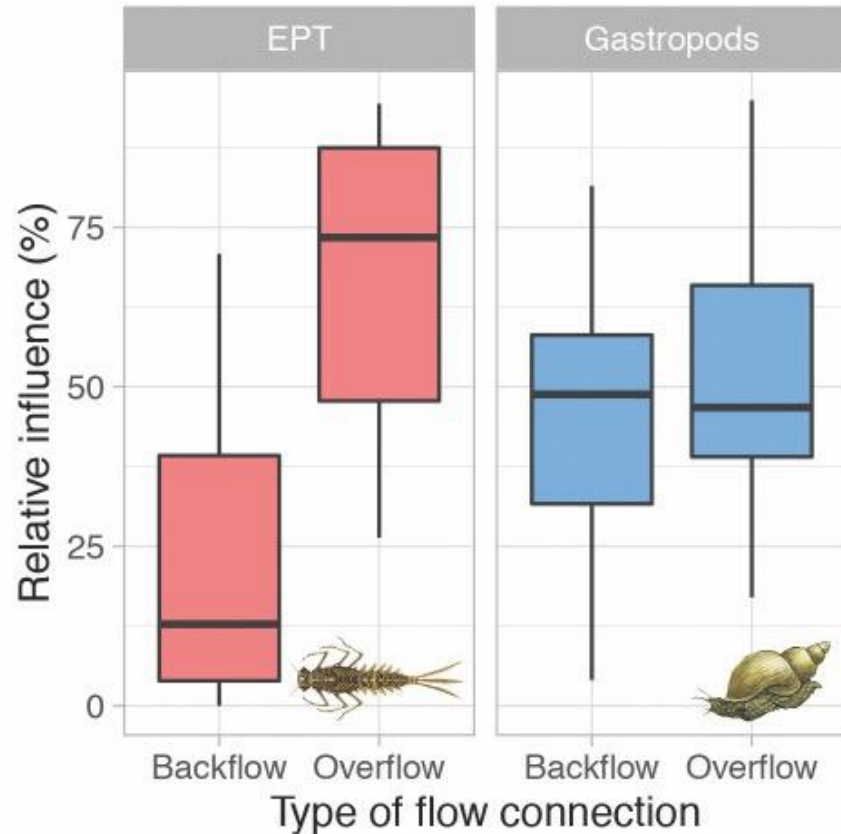
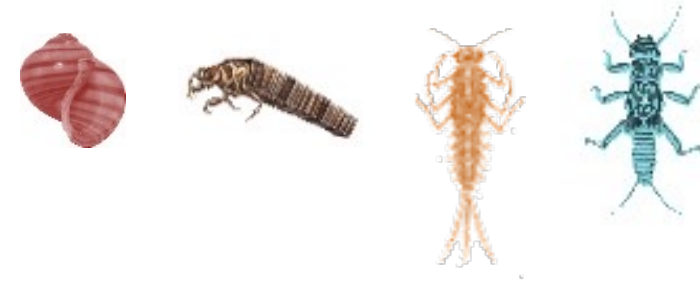
# Ecological succession of a floodplain channel

## The biological responses

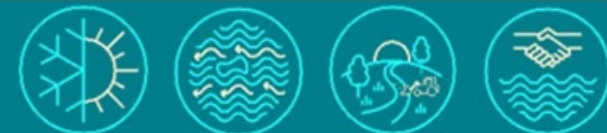




# Ecological succession of a floodplain channel



- ✓ Increased knowledge concerning the habitat preferences of benthic macroinvertebrates living in large river floodplains
- ✓ Effects of overflows vs. backflows on benthic organisms
- ✓ Increasing of backflow durations (> 25 days/year)
- ✓ Beneficial effects of restoration visible over 100 years (complete and partial reconnection of the main channel)



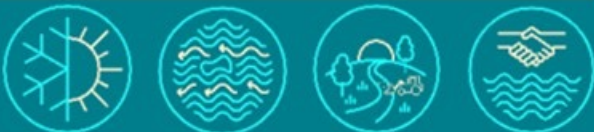
# Conclusion



Criteria	Fish	Macroinvertebrates
Priority habitat for restoration	Lotic and lentic short-lived floodplain channels	Heterogeneity of floodplain channels
Duration of restored habitats and their functions	From 15 to 30 years for lentic short-lived (i.e. nursery) and perennial for lotic channels (i.e. refuge)	Over 100 years for complete and partial reconnection
Which parameter to take into account to improve restoration effects ?	Promote low shear-stress habitats for nursery function Timing and frequency of high flows	Backflow connections duration (>25 days/year) Groundwater supply



These require an interdisciplinarity team, with hydrological, biological and geomorphological expertise to define the restoration objectives and their ecological benefits!



# Acknowledgements



Suivi scientifique  
de la restauration  
du Rhône



# References

- (Accepted) - Marle P., Riquier J., Timoner P., Mayor H., Slaveykova V. I. & Castella E. Thermal regime, together with lateral connectivity, control aquatic invertebrate composition in contrasted river floodplains. *Freshwater Biology*.
- (In prep) Bouloy A., Olivier J.M., Riquier J., Castella E., Marle P. & Lamouroux N. Spatio-temporal dynamics of habitat use by fish in a restored alluvial floodplain over two decades
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# Additional slides

