

Biological Indicators in temporary rivers: lessons learned from TRivers

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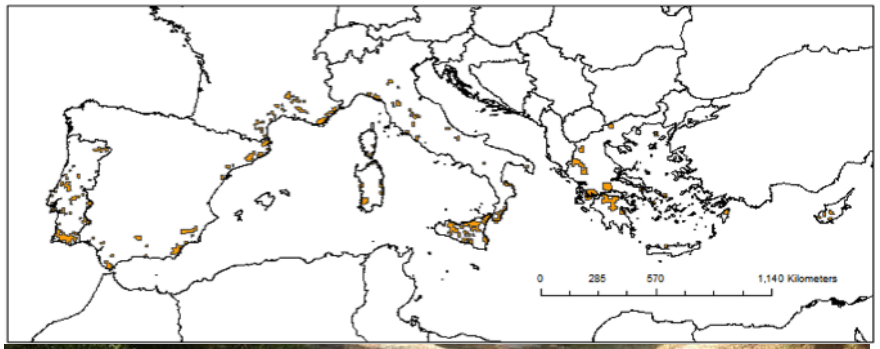
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Science- Policy efforts have been made

Establishment of **reference conditions** using current methods for **Mediterranean intermittent streams**:

- Regional level: reference values for **biological indices** were defined for wet and dry periods in **Spain** (Munné & Prat, 2011).

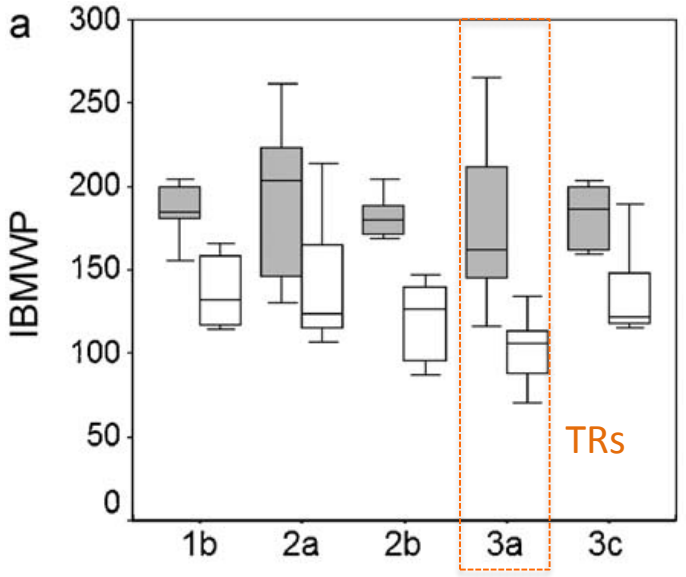
- EU level: reference values for **dissolved oxygen** were defined -> 60.34% compared to 73.72 % in perennial streams (Feio et al., 2013).





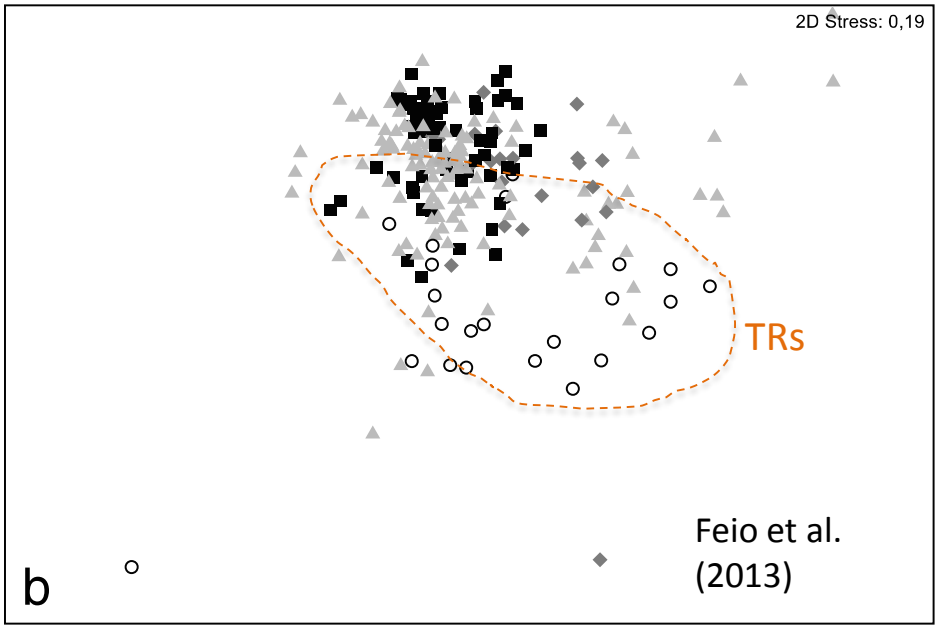
But…

- Temporary rivers (TRs) had the greatest **dispersion of reference values** due to highly variable hydrological conditions.



Munné &Prat (2011)

- During the *intercalibration* exercise, environmental typology did not match the biological communities (**TRs** appear as an **heterogeneous group**).

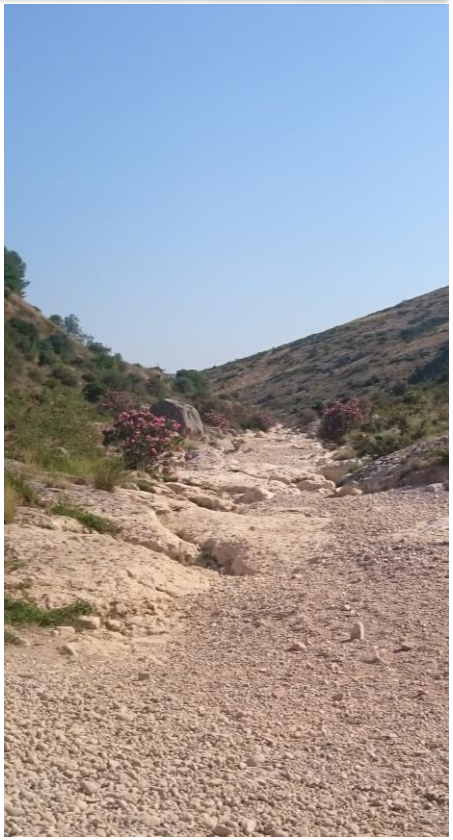


Feio et al. (2013)

The high variability of **hydrological regimes** of within temporary rivers was NOT distinguished!!!

Flowing (aquatic) ??? Dry (terrestrial)







Refugia ???

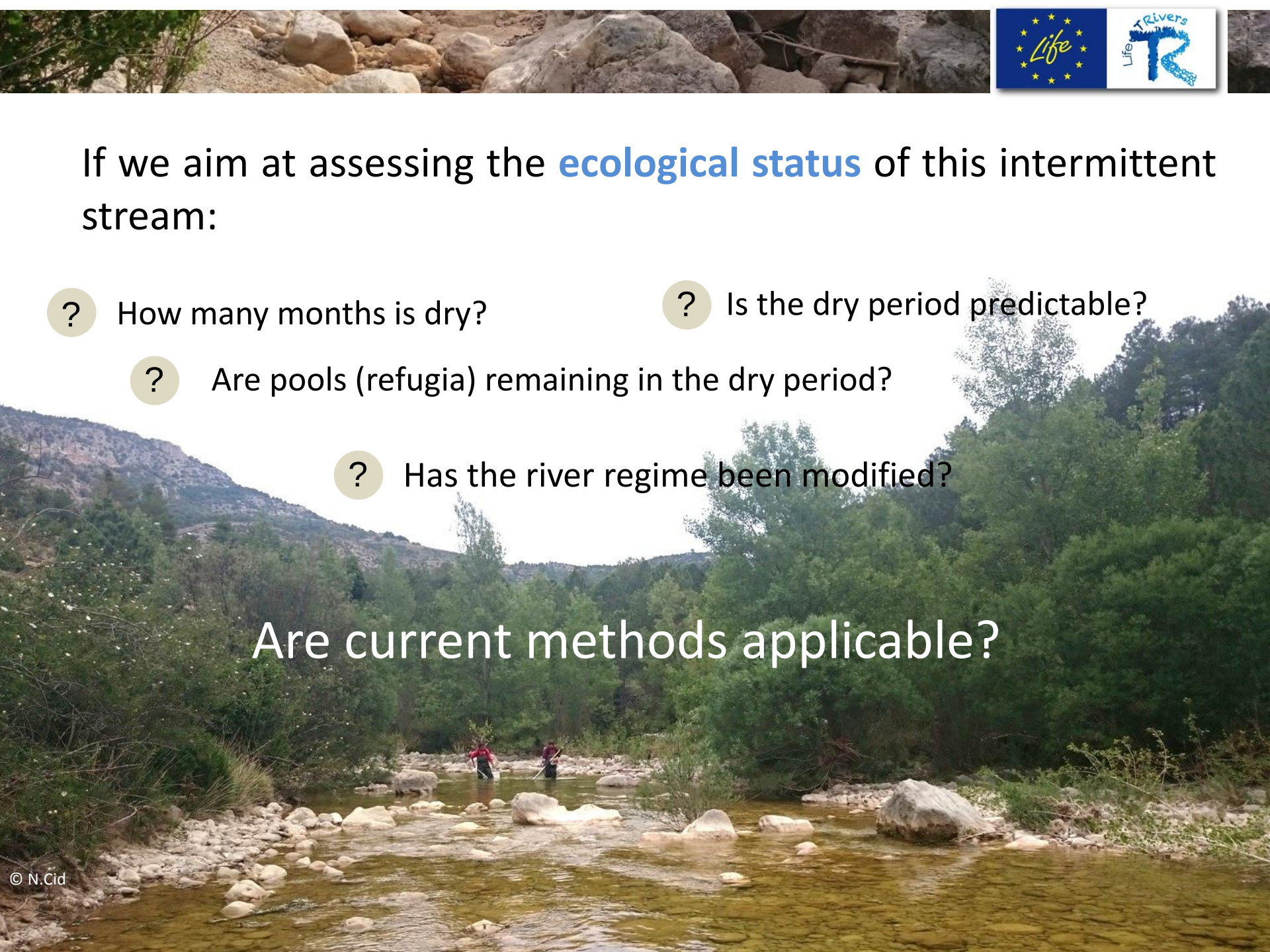
If we aim at assessing the **ecological status** of this intermittent stream:

? How many months is dry?

? Is the dry period predictable?

? Are pools (refugia) remaining in the dry period?

? Has the river regime been modified?

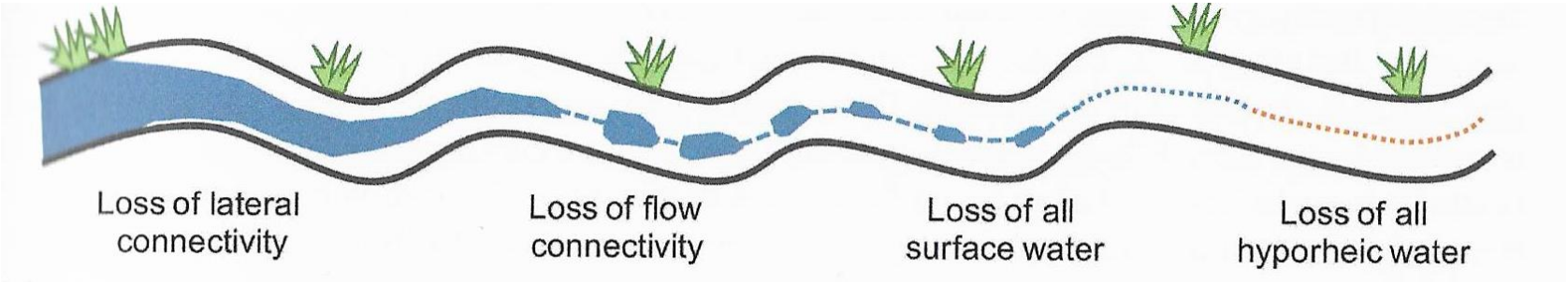


Are current methods applicable?

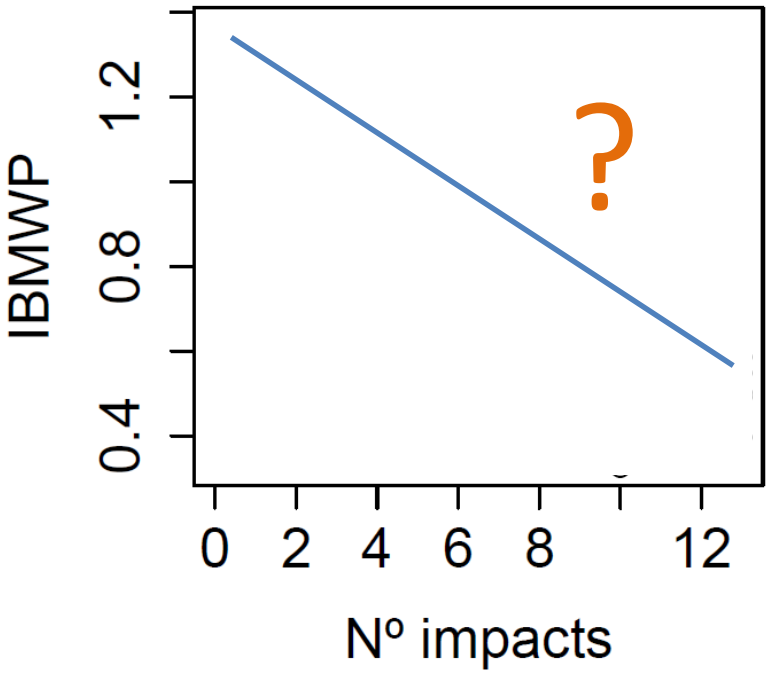
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BIOMONITORING

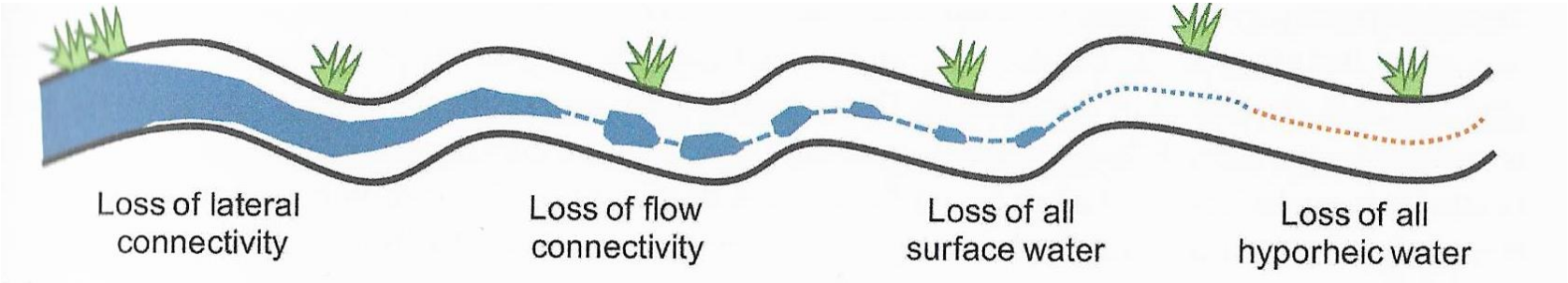
¿CAN TRADITIONAL MACROINVERTEBRATE METRICS DETECT ANTHROPOGENIC IMPACTS IN TEMPORARY RIVERS?



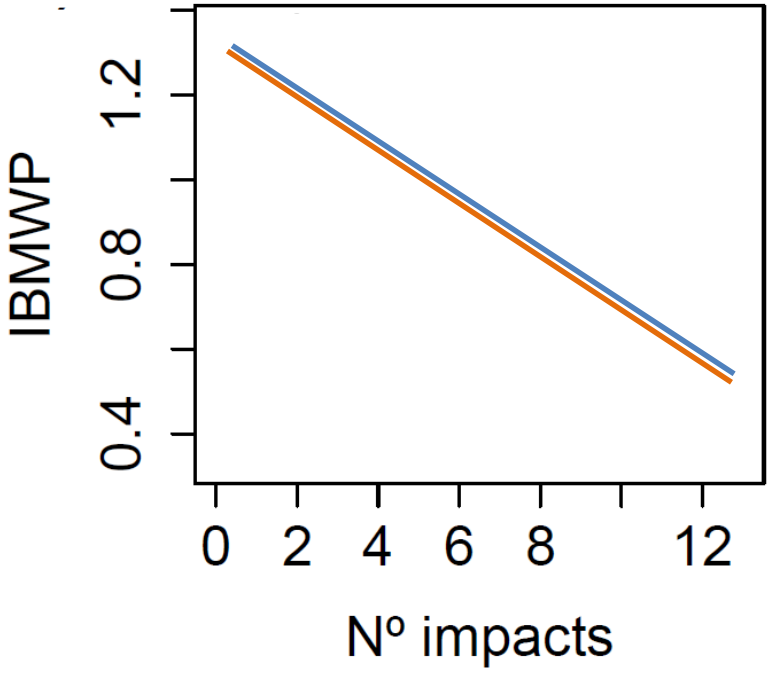
Common response of a biological index to anthropogenic impacts in perennial rivers



What can we expect in temporary rivers?



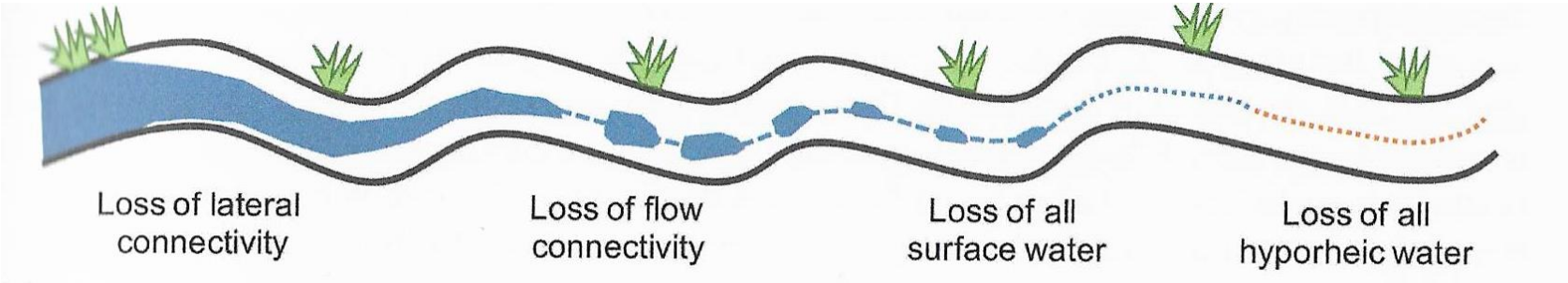
Common response of a biological index to anthropogenic impacts in perennial rivers



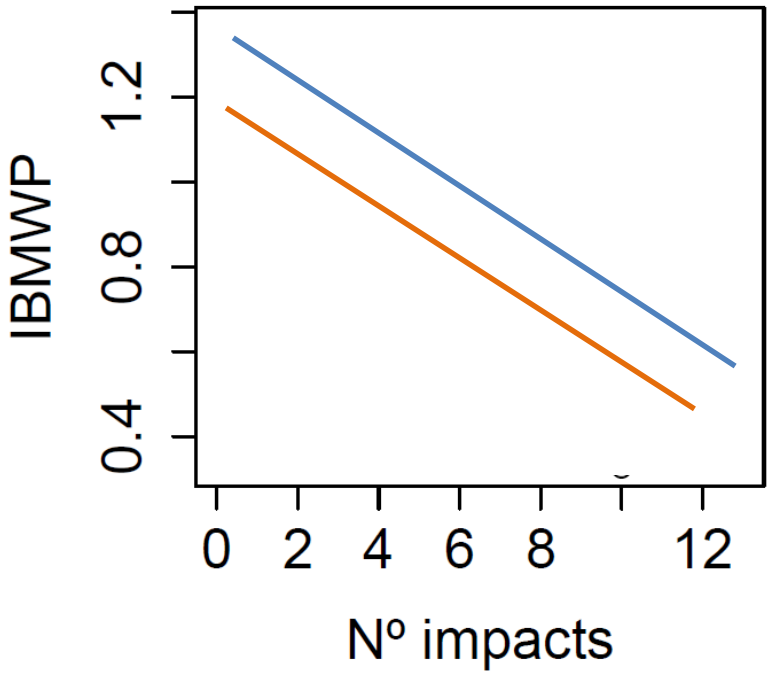
1) Same response

-> no effect of temporariness

✓ Suitable metric (no calibration)



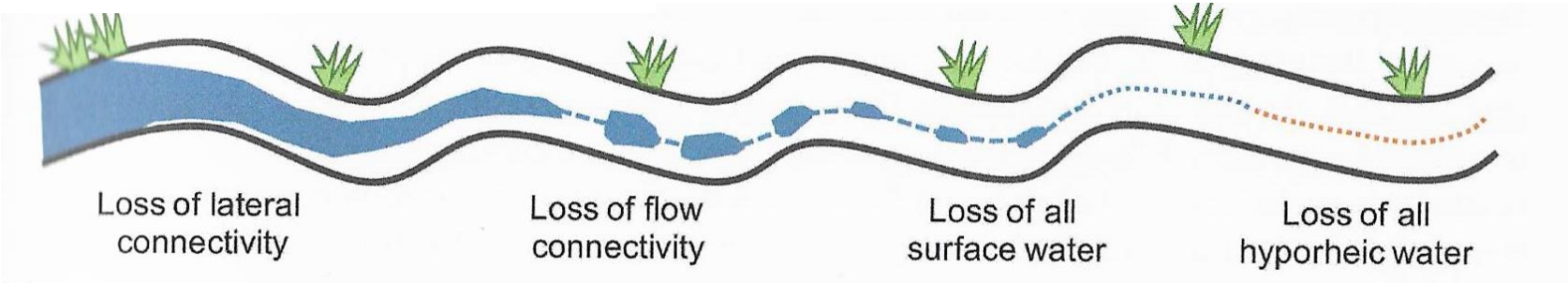
Common response of a biological index to anthropogenic impacts in perennial rivers



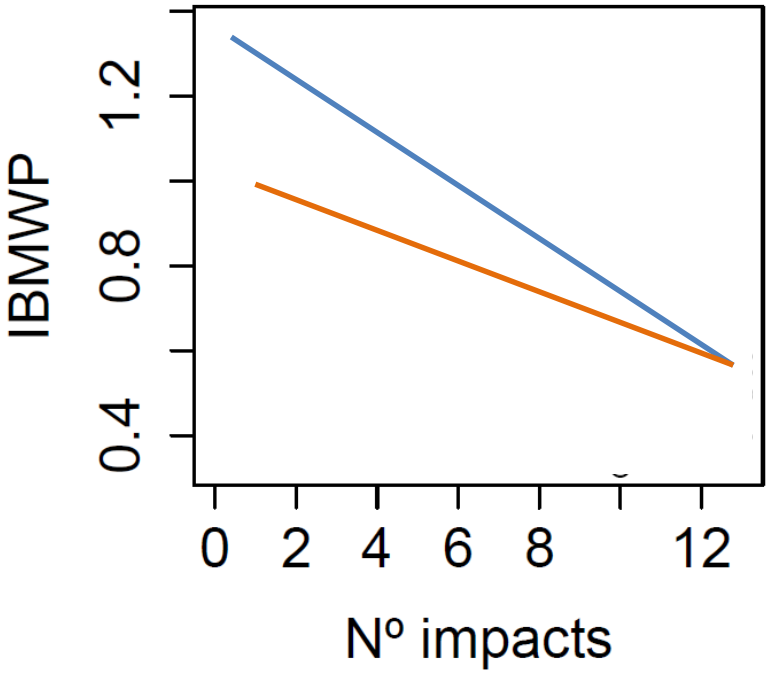
2) Proportional response to anthropogenic impacts

-> effect of temporariness.

✓ Suitable metric after **calibration** with a constant term (e.g. only adapting REF cond).



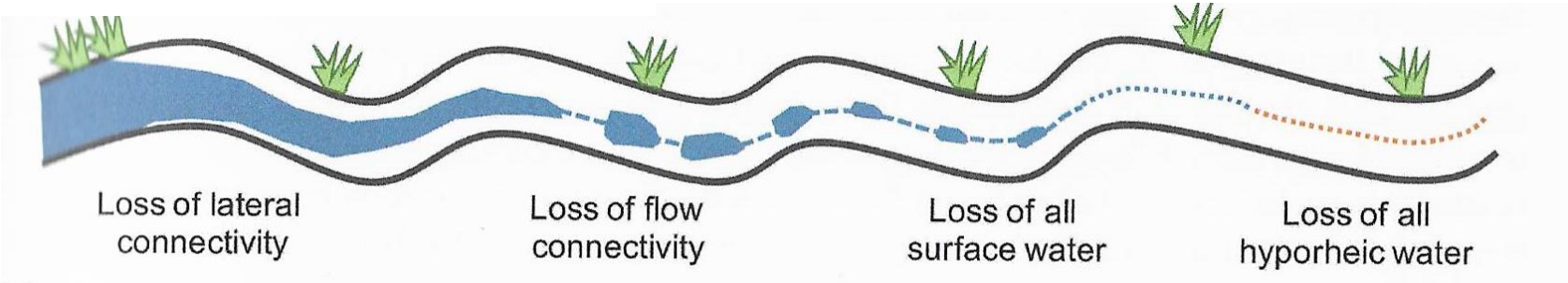
Common response of a biological index to anthropogenic impacts in perennial rivers



3) Non-proportional response to anthropogenic impacts

-> effect of temporariness. Affects perennial rivers in a greater proportion.

✓ Suitable metric after calibration (adapting REF cond+ response gradient).



Methods: study sites

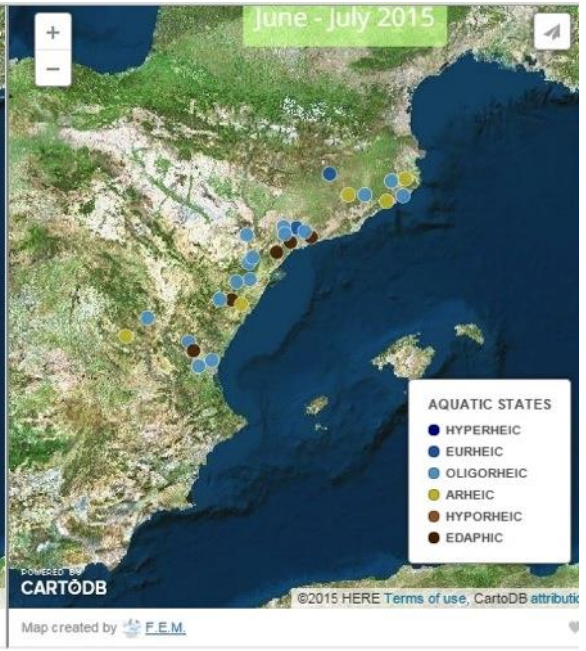


24 reaches located in Eastern Spain, including a gradient **perennial> intermittent-pools> intermittent-dry.**

Calcareous geology.

Elevation range: 10- 1100 m.









Methods: sampling + calculation of biotic indices

- Invertebrate sampling every 6 weeks (April-December 2015) to capture all **different aquatic phases**.





- Calculation of several **biological indexes** : IBMWP (Alba-Tercedor, 2004), IASPT and iMMiT (Munné & Prat, 2011).

Methods: flow regime and intermittence gradient

- Hydrological regime: TREHS.
- Estimation of nº days in disconnected pools and nºdays dry.

HOBOS + TREHS software tool

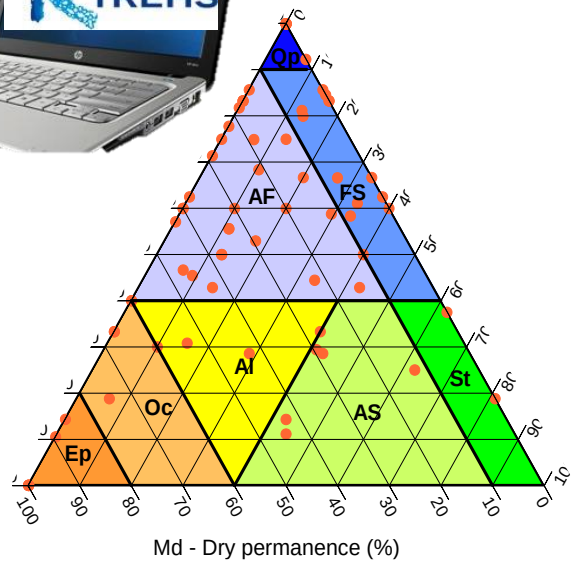






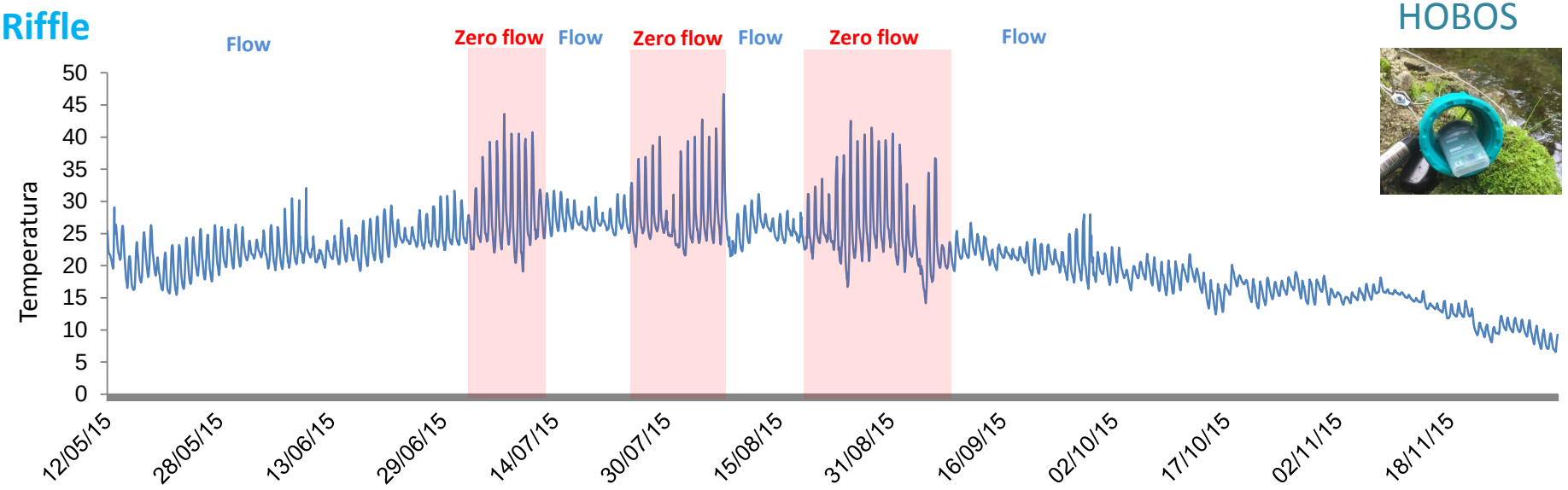


(Gallart et al., 2017)



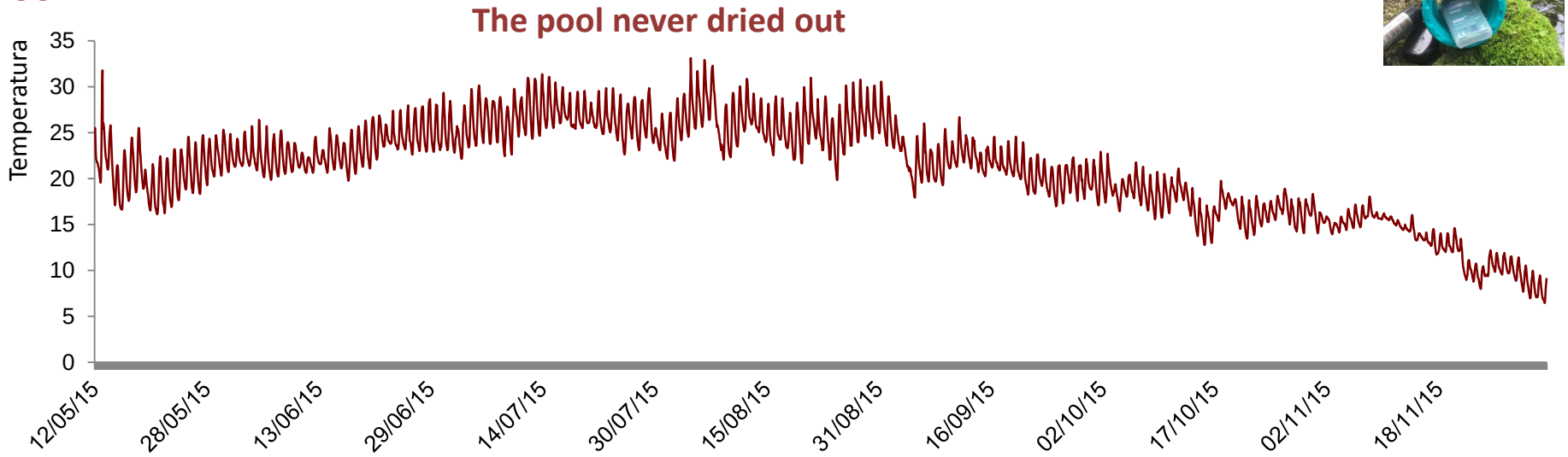


Riffle



HOBOS

Pool





Methods: anthropogenic impact gradient

MRC: Mediterranean Reference Criteria (Sánchez-Montoya et al., 2009)

- **Riparian** vegetation zone.
- **Alien species**.
- Diffuse sources of **pollution** and **land uses**.
- River **hydromorphology** and **habitat** conditions.
- **Hydrological alteration**.

20 items in total (adding values)

U = 20
Undisturbed

MD= 19-16
Minor disturbed

D= <16
Disturbed

Gradient





0

20

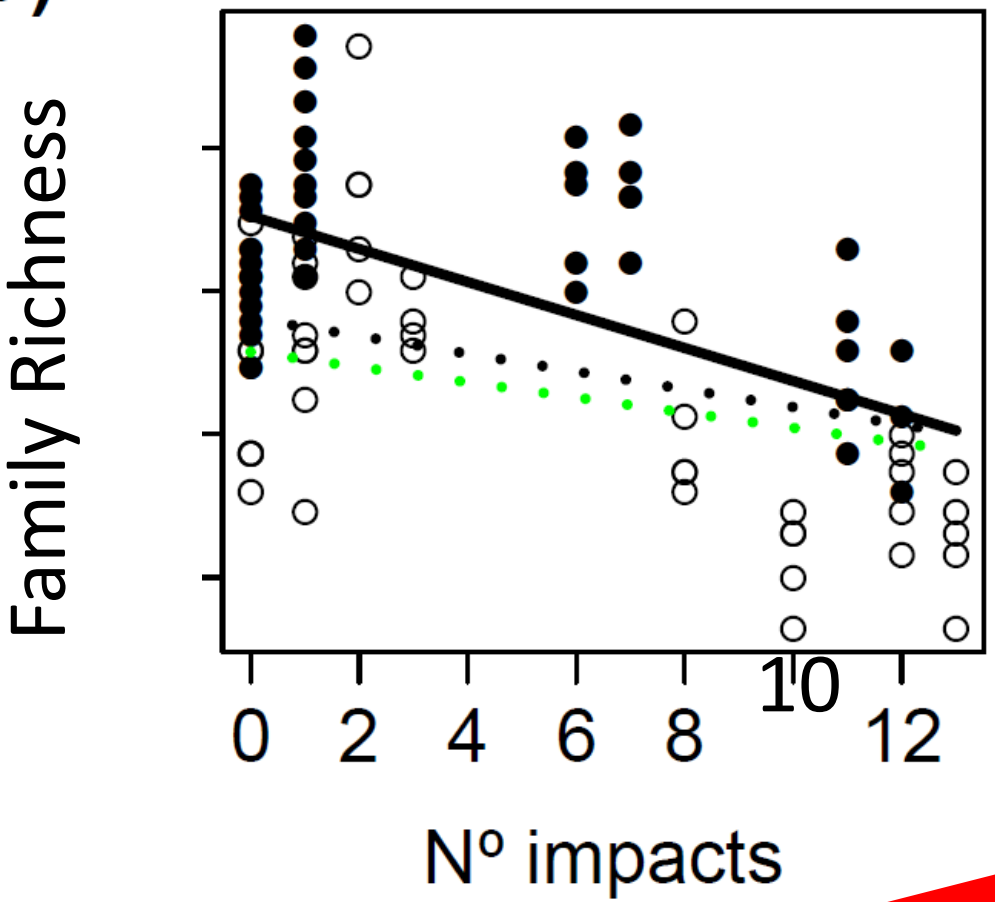


RESULTS

BIOMONITORING

Results: response of biotic indices

a)



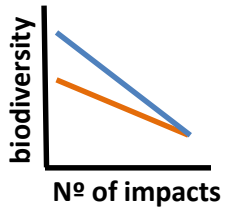
Samples:

- Perennial
- Temporary

Response to impacts:

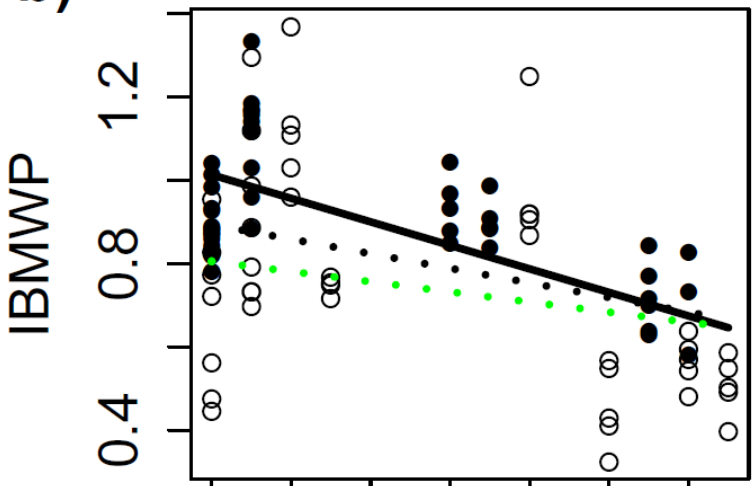
- Perennial
- Temporary during flow
- Temporary integrating all aquatic phases

CALIBRATION

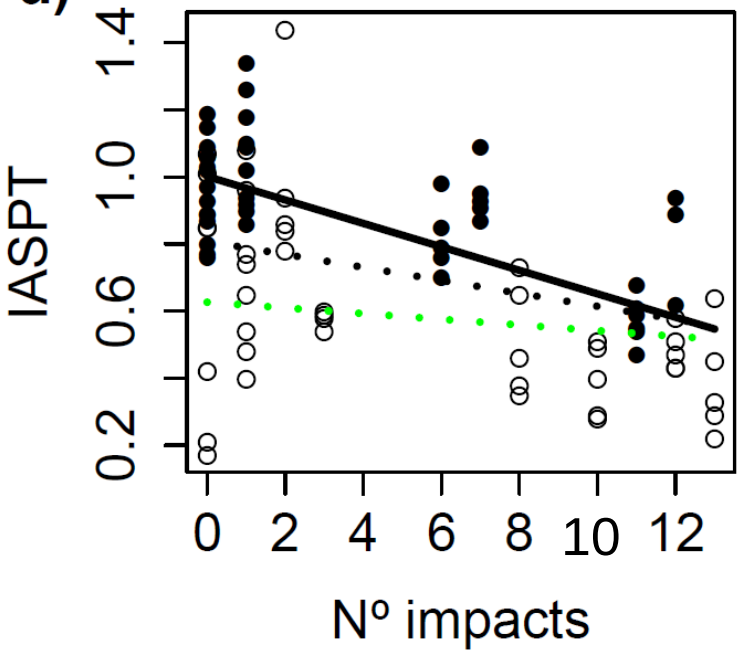




b)



d)



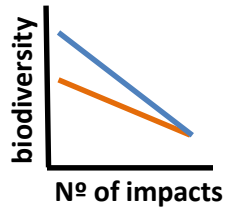
Samples:

- Perennial
- Temporary

Response to impacts:

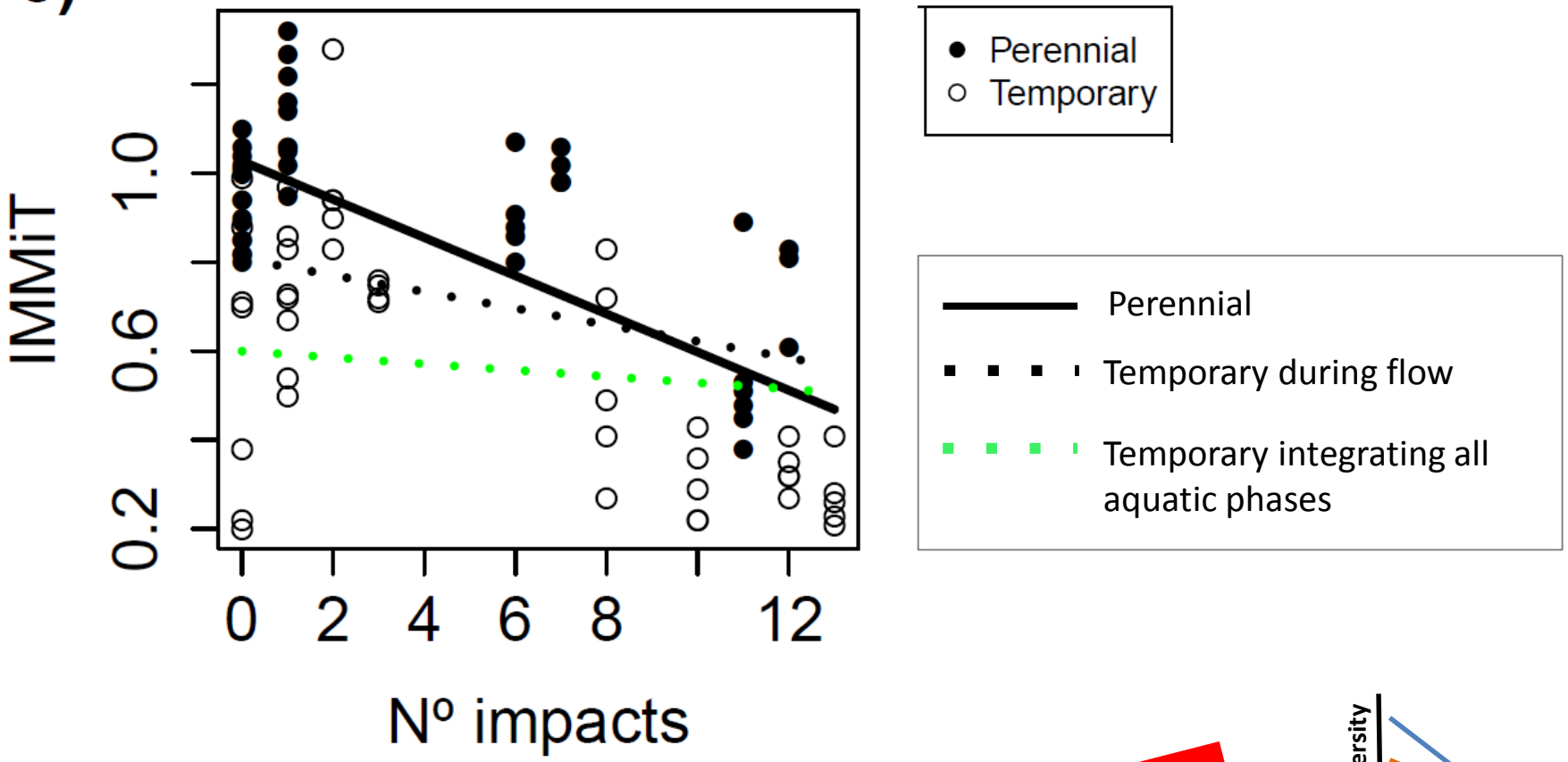
- Perennial
- Temporary during flow
- Temporary integrating all aquatic phases

CALIBRATION

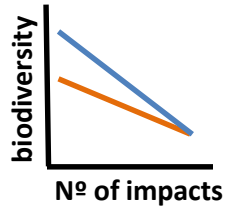




c)



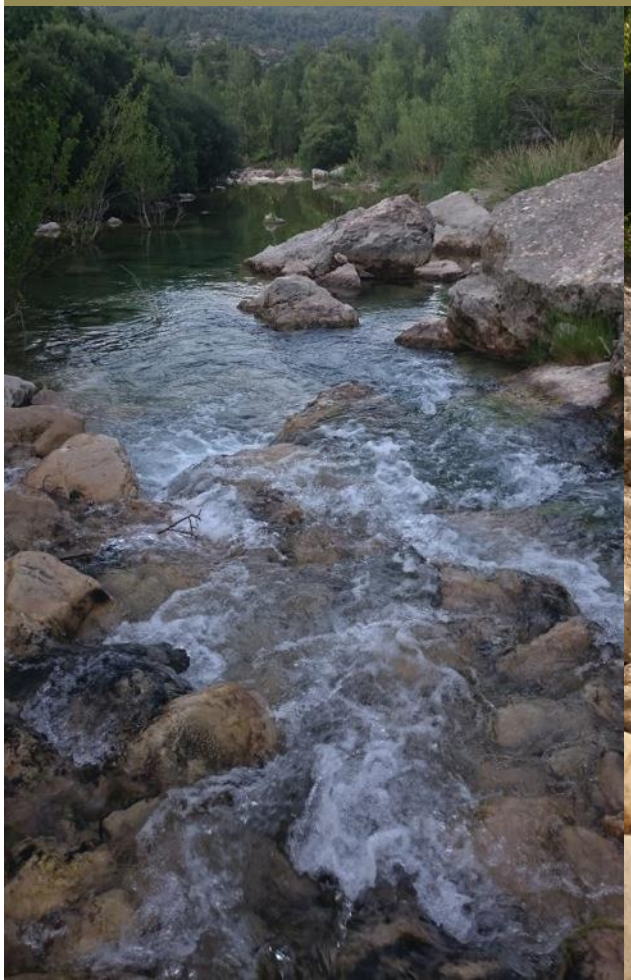
CALIBRATION

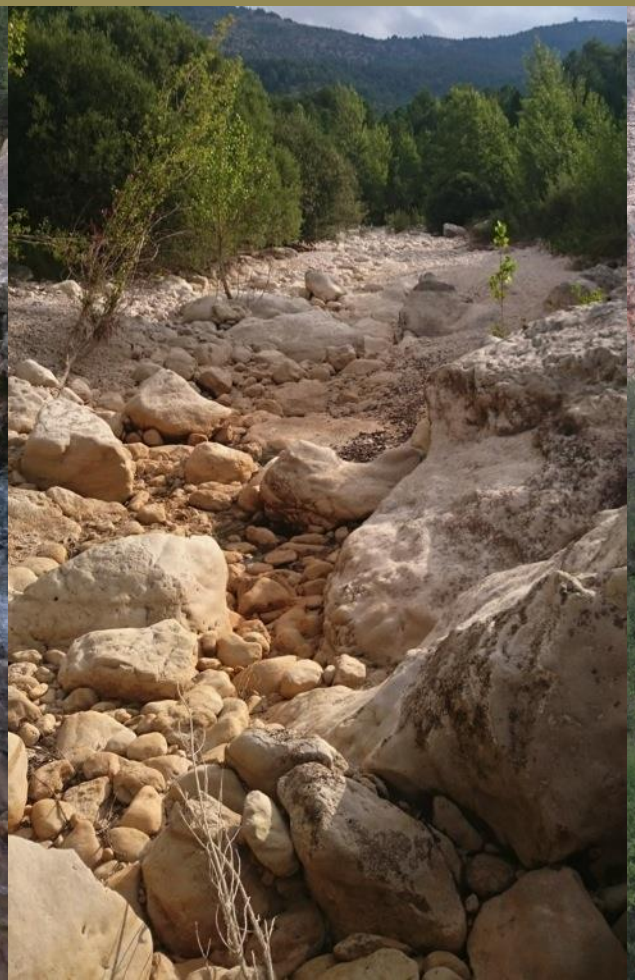


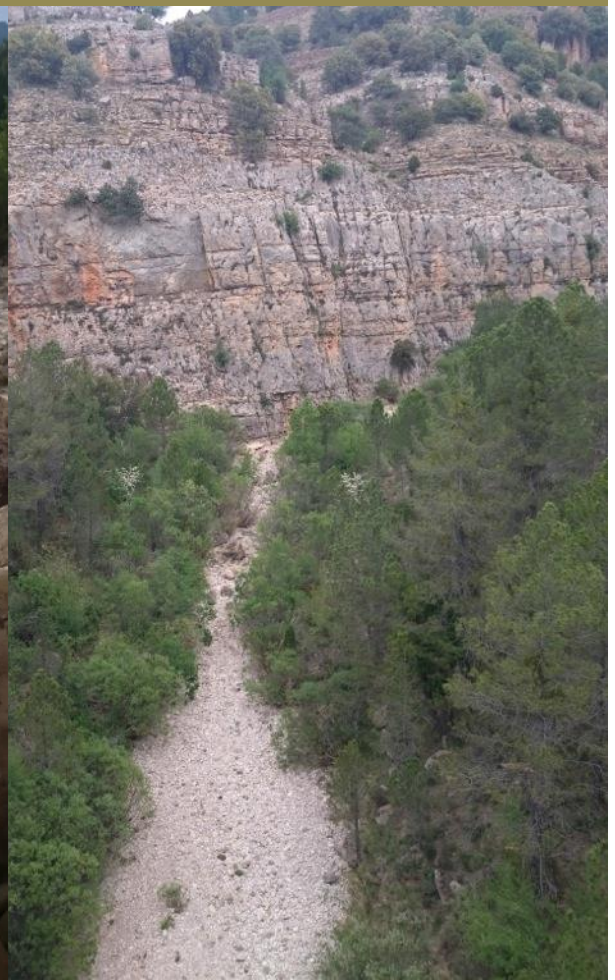
For example…

Monlleó River (Reference site, protected area) Intermittent-Dry, **VERY ISOLATED**

Official Spanish typology: R-T09 Mediterranean calcareous lowland mountains



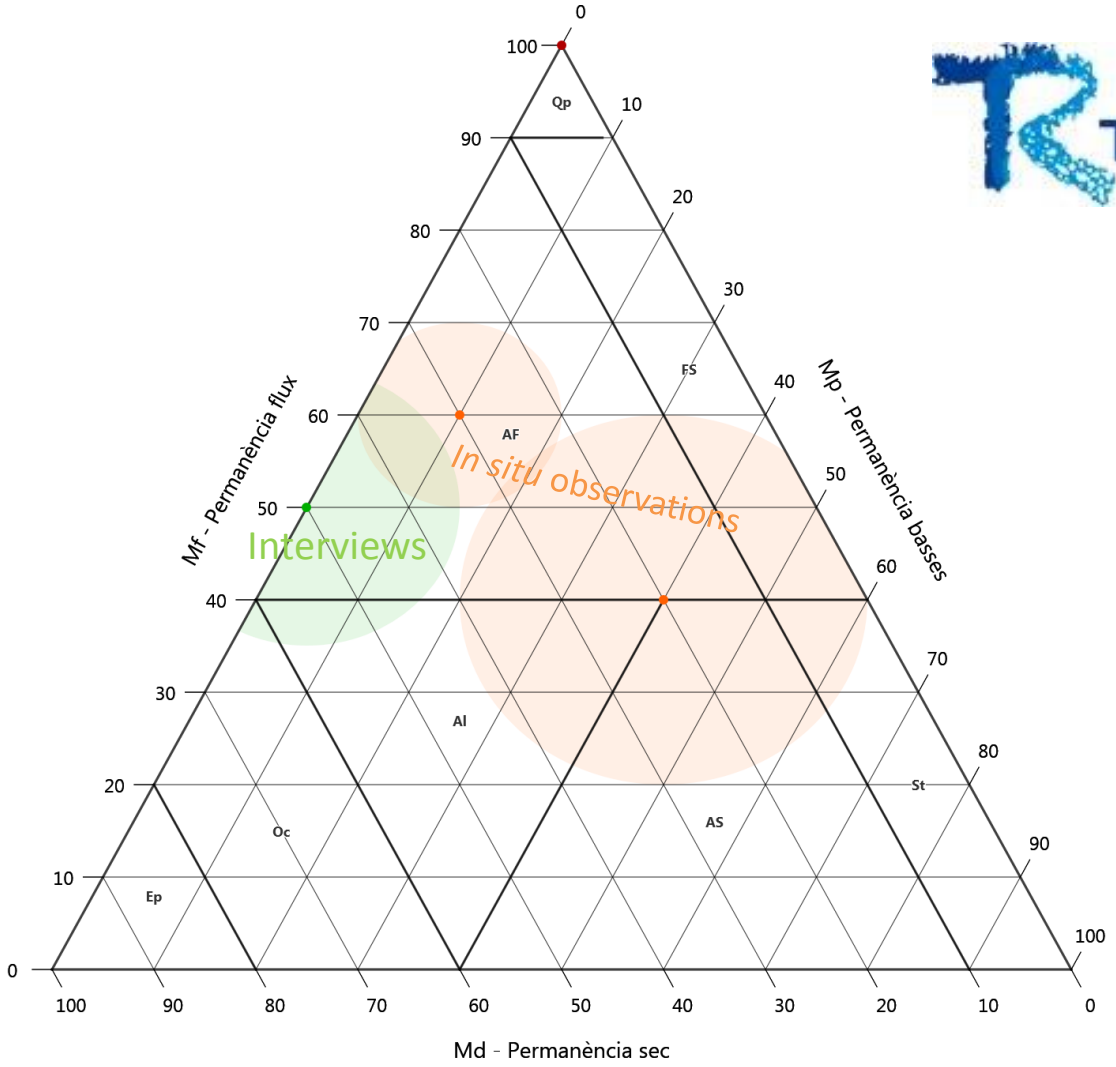


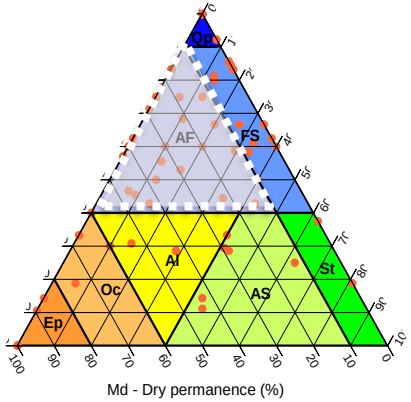




Monlleó River (Reference site, protected area) Intermittent-Dry, **VERY ISOLATED**

Official Spanish typology: R-T09 Mediterranean calcareous lowland mountains





Alternate-fluent

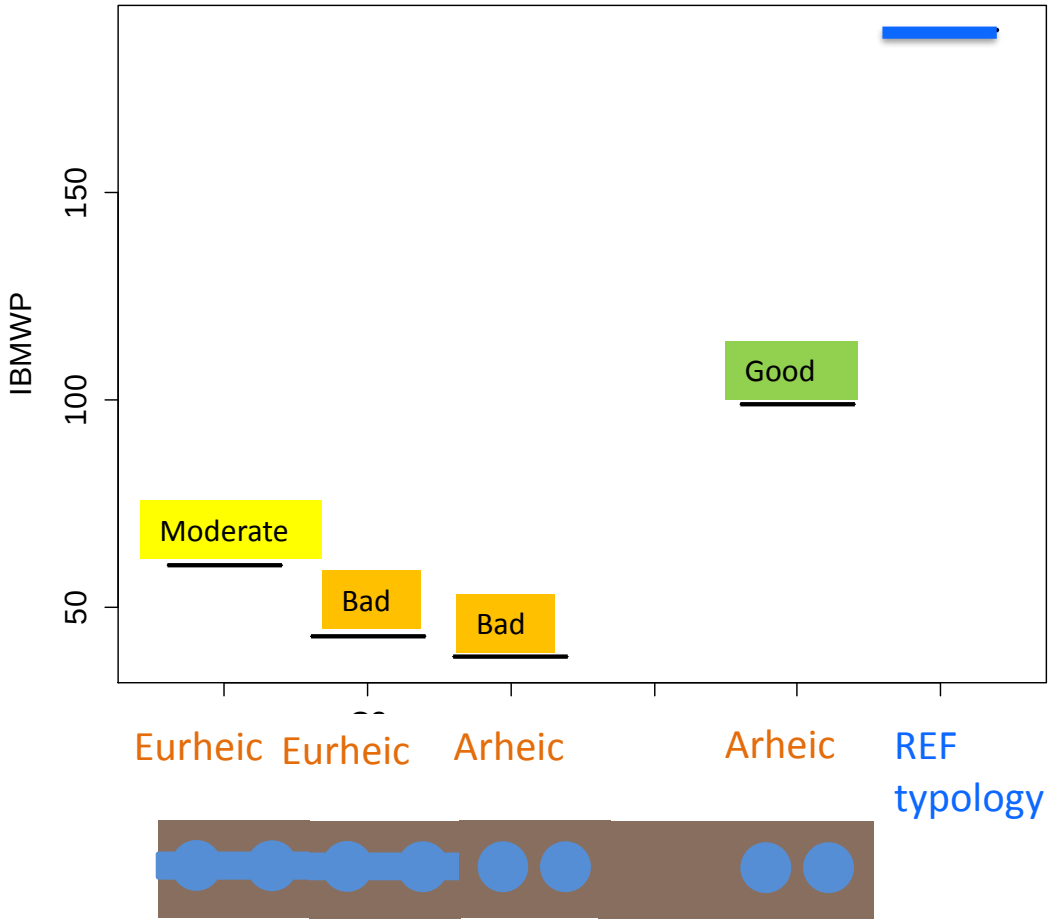
< 60% flow permanence

Low pool permance



Monlleó River (Reference site, protected area) Intermittent-Dry, **VERY ISOLATED**

Official Spanish typology: R-T09 Mediterranean calcareous lowland mountains



High variability, never reaches reference values.

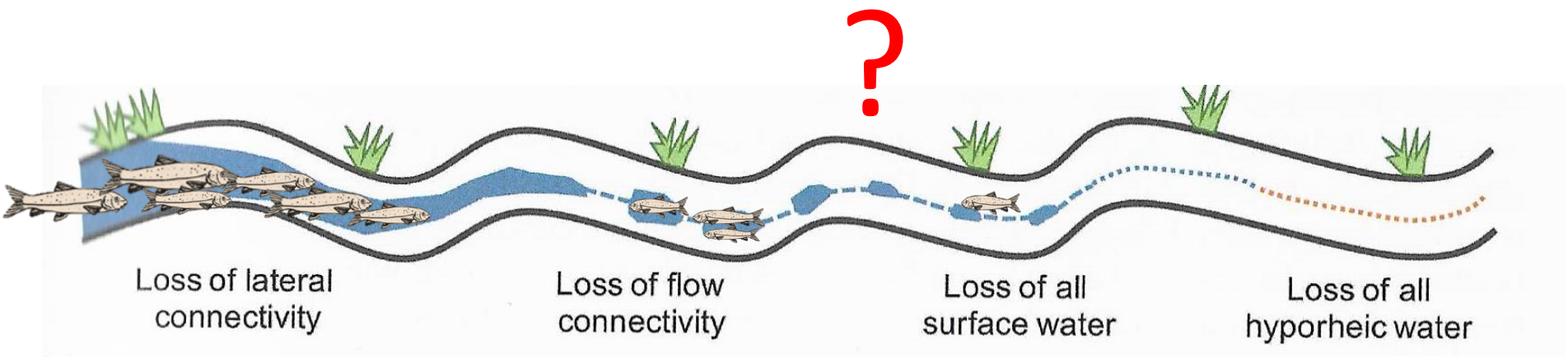
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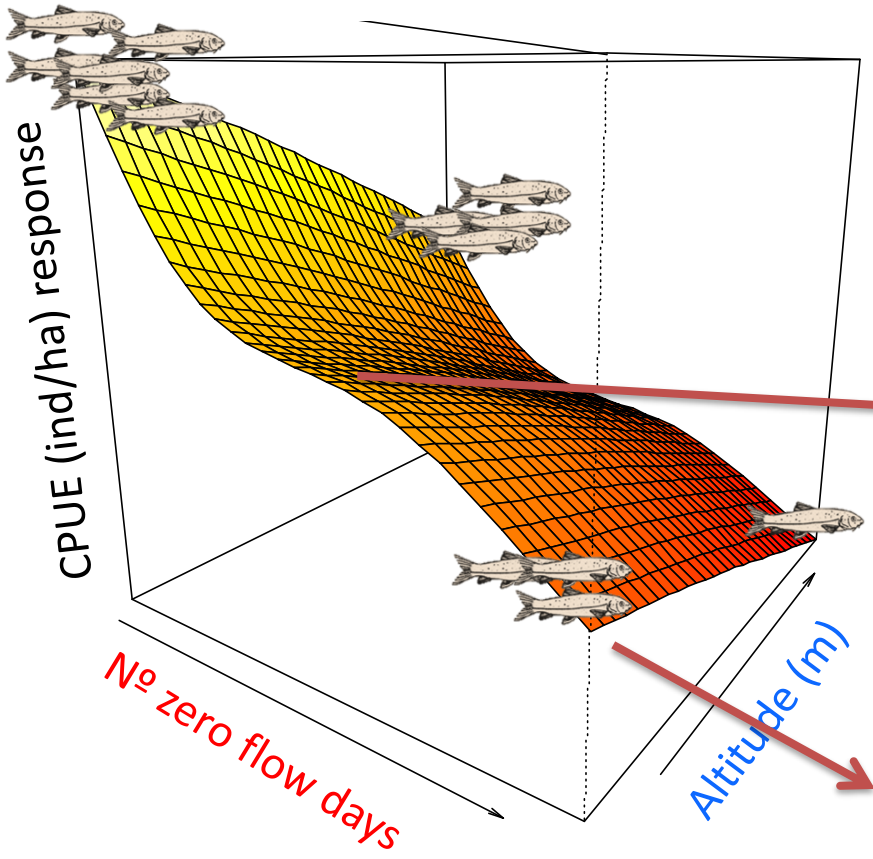
CONSERVATION ISSUES

The response of Mediterranean fish

to flow intermittence



Results: response of fish abundance



3. Buffer: **refugia**?

2. Headwater streams are likely to be the most affected by increased number of zero flow days.

1. With predicted changes in flow regimes and **increased flow intermittence**, fish populations are likely to be negatively affected.


Barbus meridionalis

Example

Cérvol River (Reference site, protected area), Intermittent

Species	CPUE (ind/ha) 2010	CPUE (ind/ha) 2015
Achondrostoma arcasii	3.666,67	no fish
Barbus haasi	866,67	no fish







Are current protected areas effective?

Carrizo et al. (2017)
Hermoso et al. (2011)



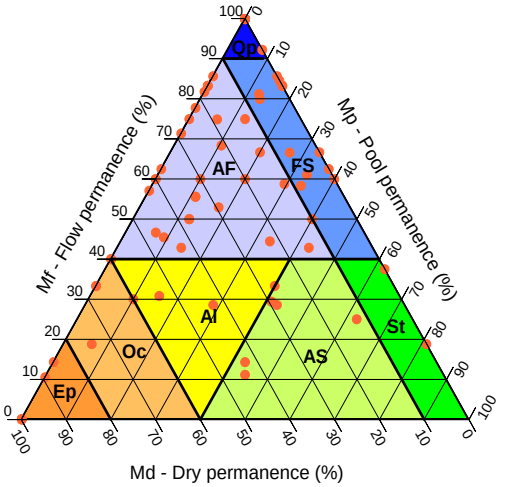
WHAT'S NEXT?



1. Propose new ecotypes for biomomitoring.

- Obtain **biological** and **hydrological data** from all River Basin Districts.

- **Adapting reference conditions** and **quality boundaries** for traditional metrics for each ecotype.



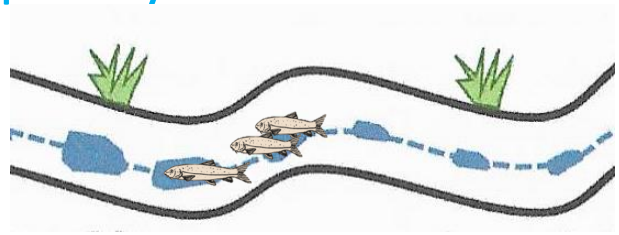
2. Test new indices and approaches.

- Use **funcional metrics** based on species traits related to resistance and resilience.
- Integrate **spatial connectivity** of sites and species **dispersal into bioassessment** (MECODISPER project)



3. Develop new conservation strategies in temporary rivers.

- Identification and conservation of **fish refugia** in temporary rivers.



Gràcies!



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