

E-flows implementation in Spain: recent experiences



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Legal procedure before 2007

- Eflow regimes to consider:
 - Minimum fixed flows
 - Hydrological methods
- Specific procedures for:
 - Each Water District
 - % of MAR, or fixed value unconnected to MAR
 - Only some >% for touristic, sanitation or environmental issues
- Weak legal and social framework

Legal procedure after 2007

- Stronger legal framework, increasing social support for eflows, very heterogeneous implementation
- Combination of hydrological and physical habitat simulation methods.
- Eflow regimes must consider:
 - Minimum variable flows
 - Maximum variable flows
 - Maximum rates of change downstream from HEPPs
 - Discharge of ecological floods
- Specific procedures for:
 - Intermittent and ephemeral rivers
 - Lakes and wetlands
 - Transitional waters
 - HMWBs
 - Declared drought conditions
- Monitoring required



Eflow regimes calculated in 10% of natural water bodies (“strategic water bodies”)
Published in RBMPs

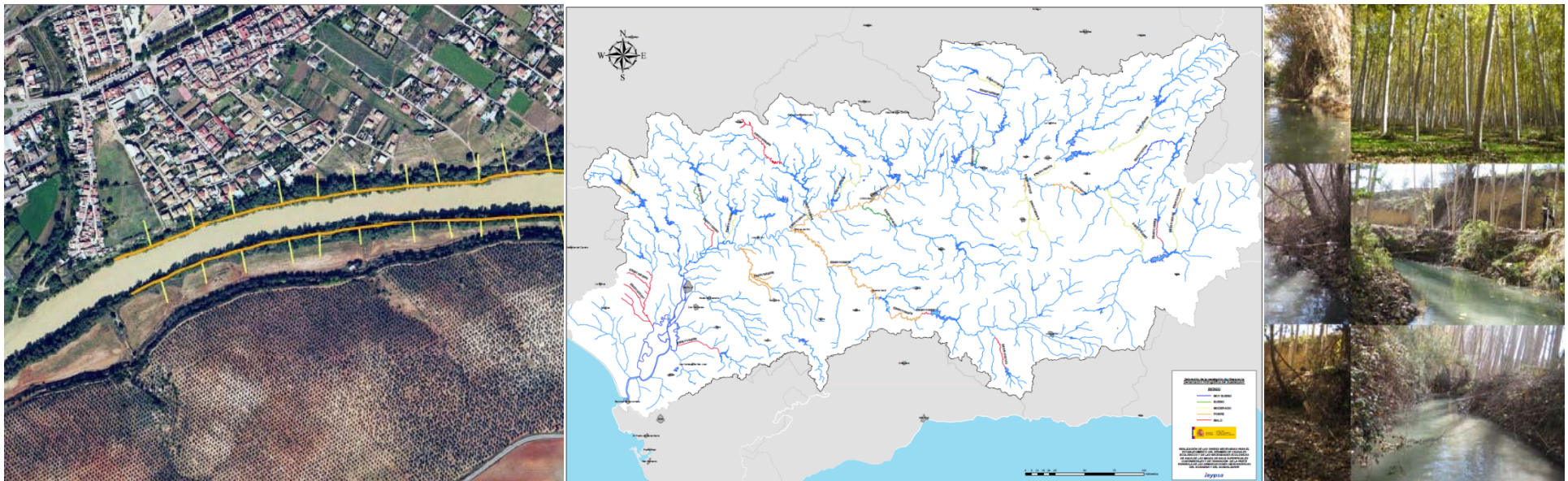
Main methodological obstacles

- Applicability of standard hydrological and habitat-based methods to new physical and environmental conditions
- Combination of methods when offering very different eflow values
- Consistency and length of flow series (at least 20 years of non-altered daily flows are demanded). Flow records Vs. Flow simulations.
- Quality of fish HSCs and eflow models (1D/2D)
- Lack of procedures for incorporating additional biological groups, and interactions with water quality, sediment transport, pressures, etc., etc., etc.

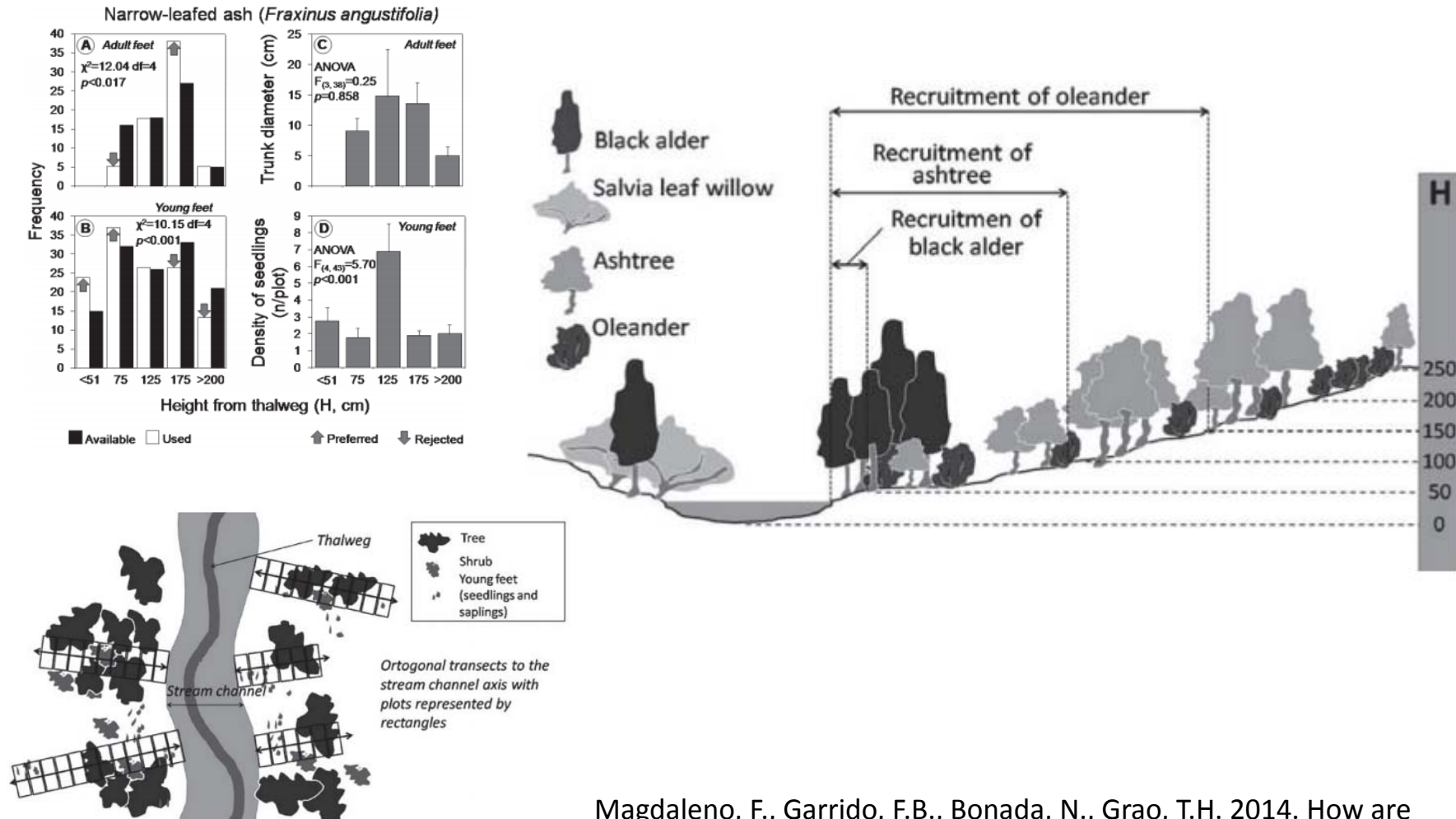


Pending tasks...EFR for riparian species and guilds

- Lack of knowledge about eflow requirements of riparian species and guilds.
- Spanish RBMPs incorporate an analysis of the status of riparian forests in each river reach where fish-based eflows were determined. Periodic monitoring should give insights into their specific requirements. But...
- Procedures: QBR index (Munné *et al.*, 1998, 2003) and RFV index (Magdaleno *et al.*, 2010, 2014).

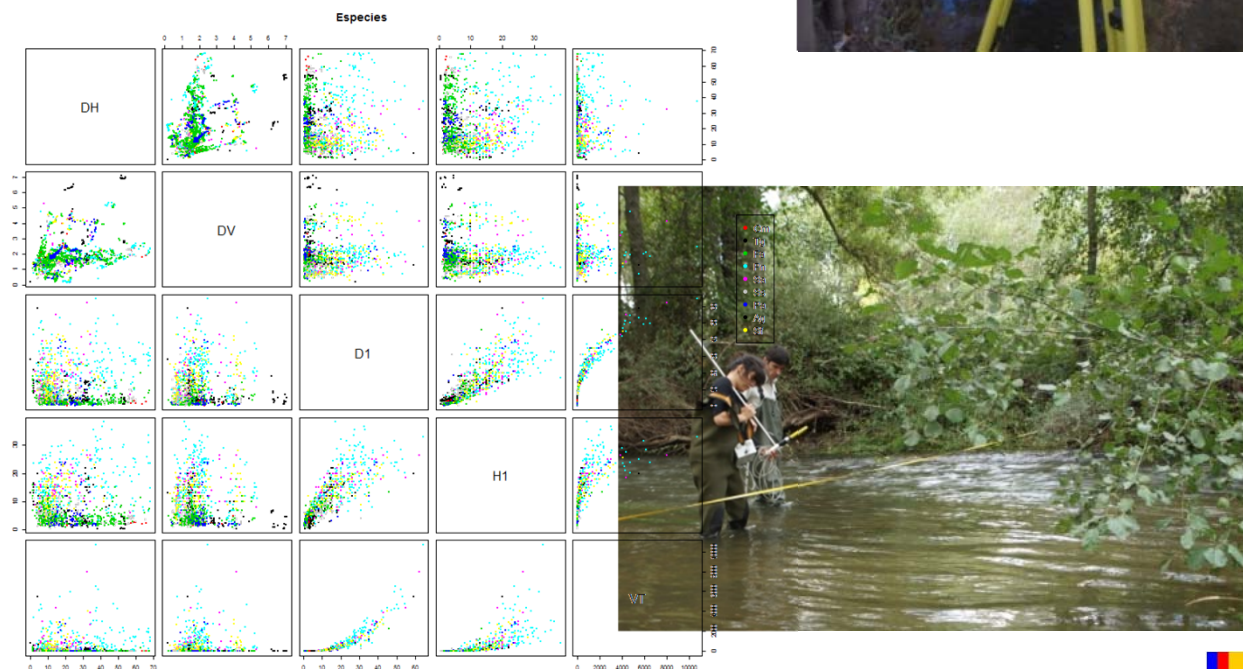
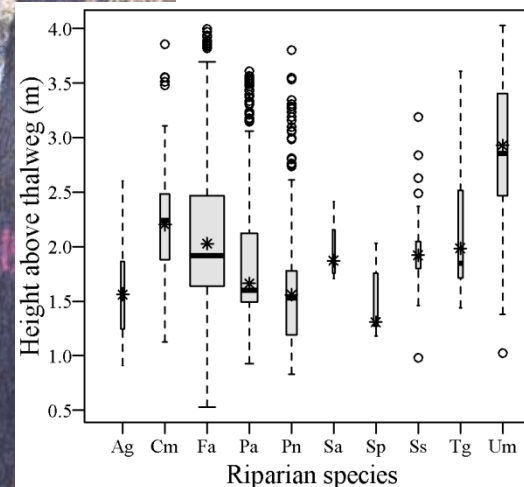
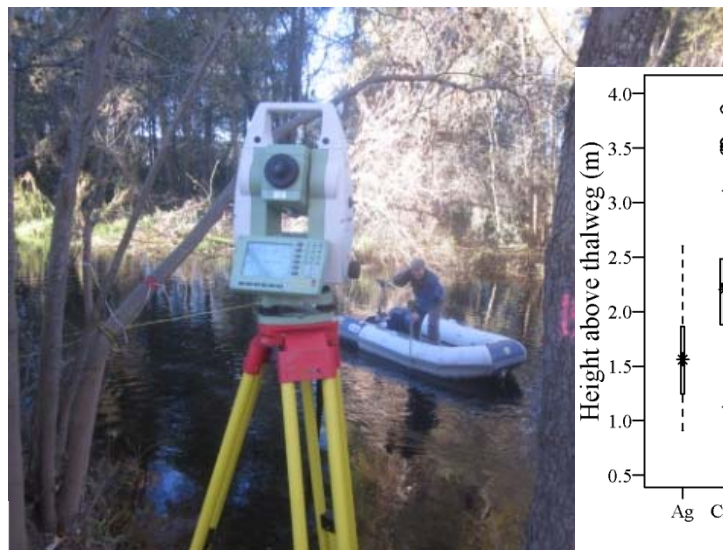


Pending tasks...EFR for riparian species and guilds



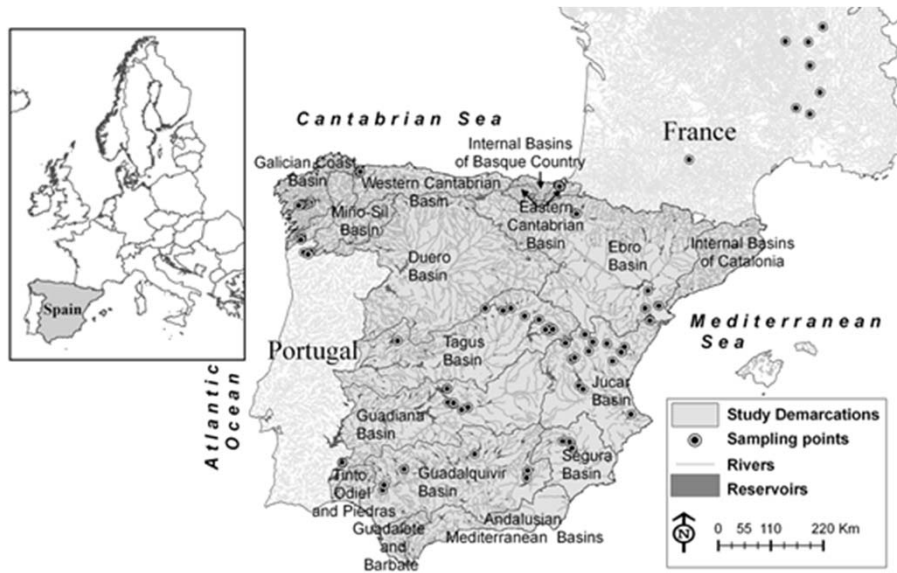
Magdaleno, F., Garrido, F.B., Bonada, N., Grao, T.H. 2014. How are riparian plants distributed along the riverbank **topographic gradient** in Mediterranean rivers? *Limnetica* 33(1): 121-137.

Pending tasks...EFR for riparian species and guilds

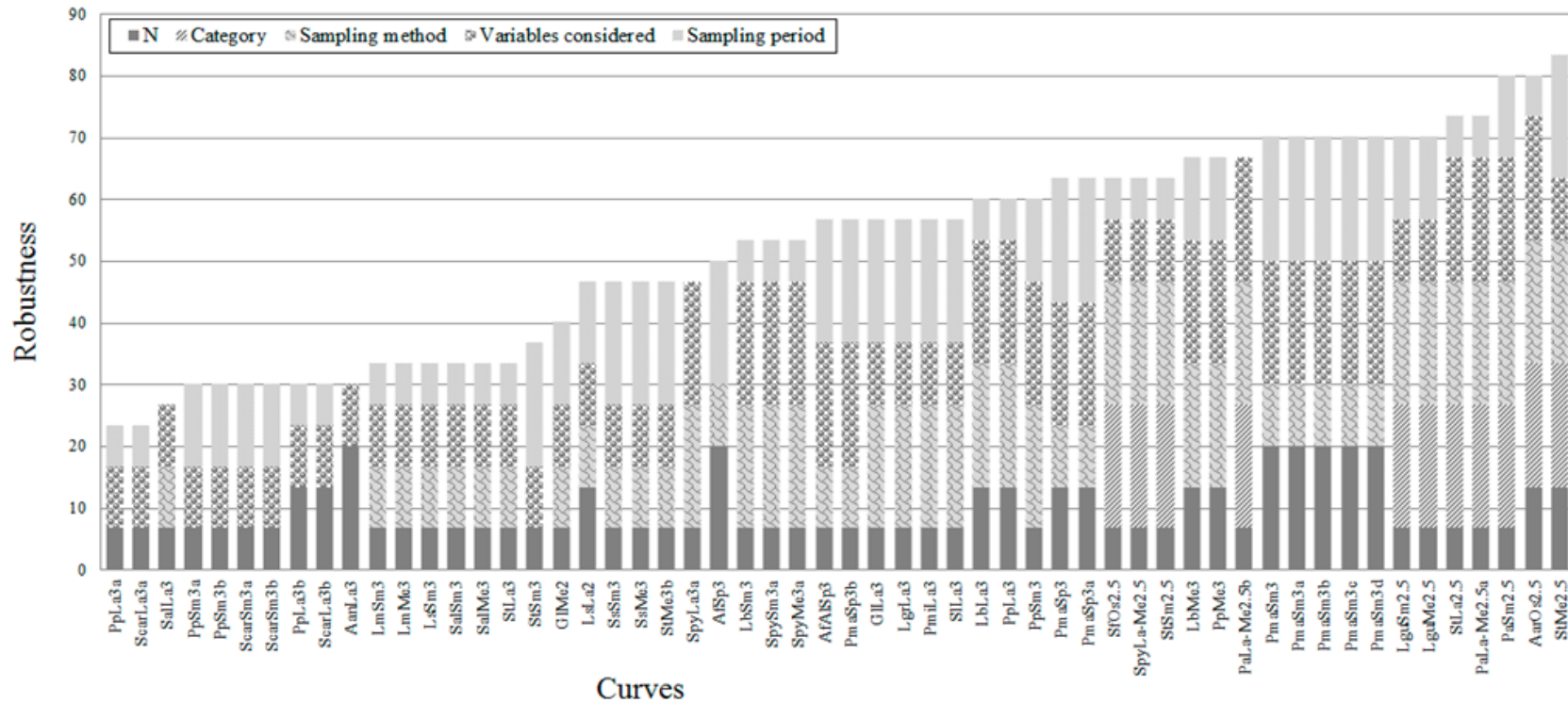


Fernández-Santamarina, A. & Magdaleno, F. 2015. **Spatial variation** of woody riparian vegetation across the river-bank topographic gradient in Mediterranean rivers: species and growth categories. Submitted to *River Research and Applications*.

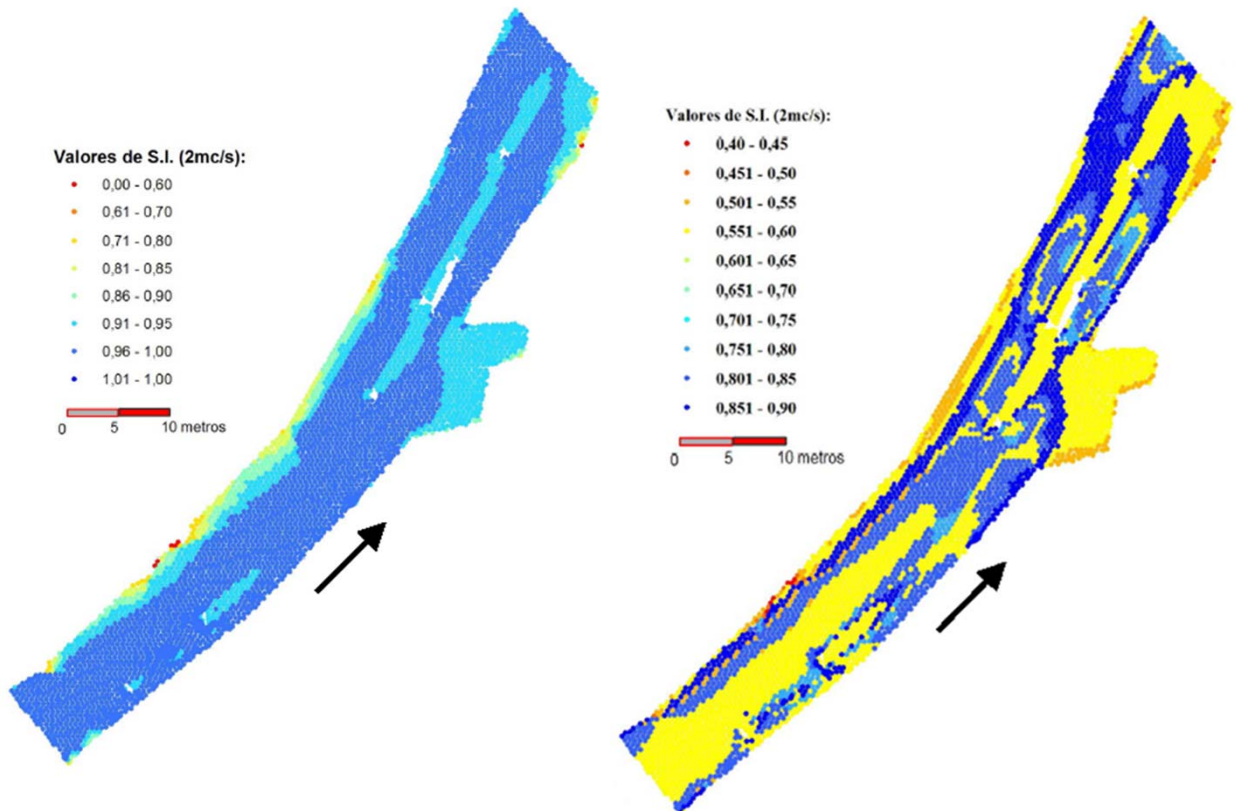
Pending tasks...uncertainty of fish HSC



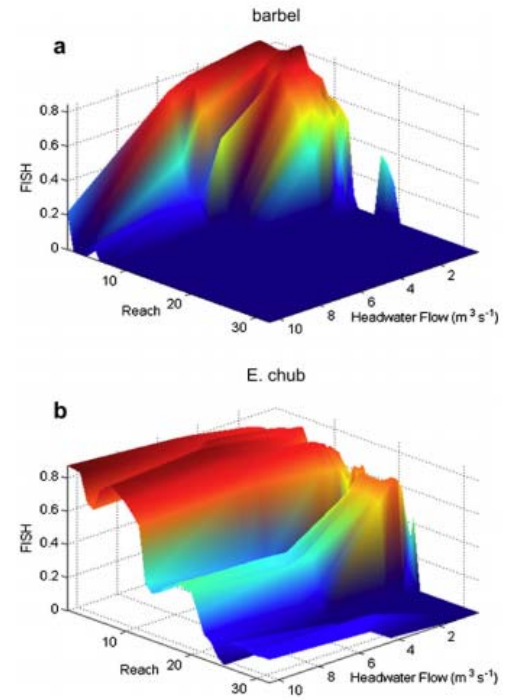
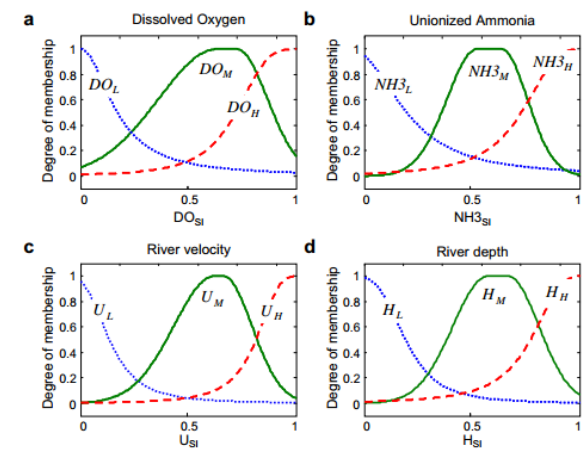
Fernández-Santamarina, A., Magdaleno, F., Muñoz-Mas, R., Martínez-Capel, F. 2015. **Fish habitat suitability curves** used for environmental flow assessments: a review. Submitted to *Mediterranean Marine Science (Inland Waters Issue)*



Pending tasks...uncertainties in ecohydrological modelization



Magdaleno & Martínez (2005)

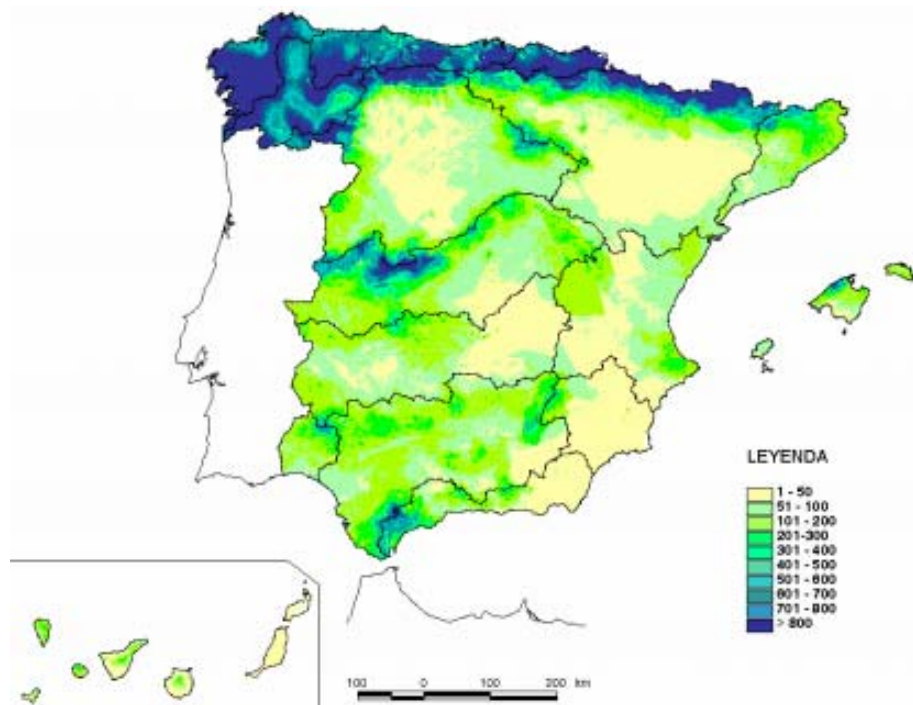


Marsili-Libelli *et al.* (2013)

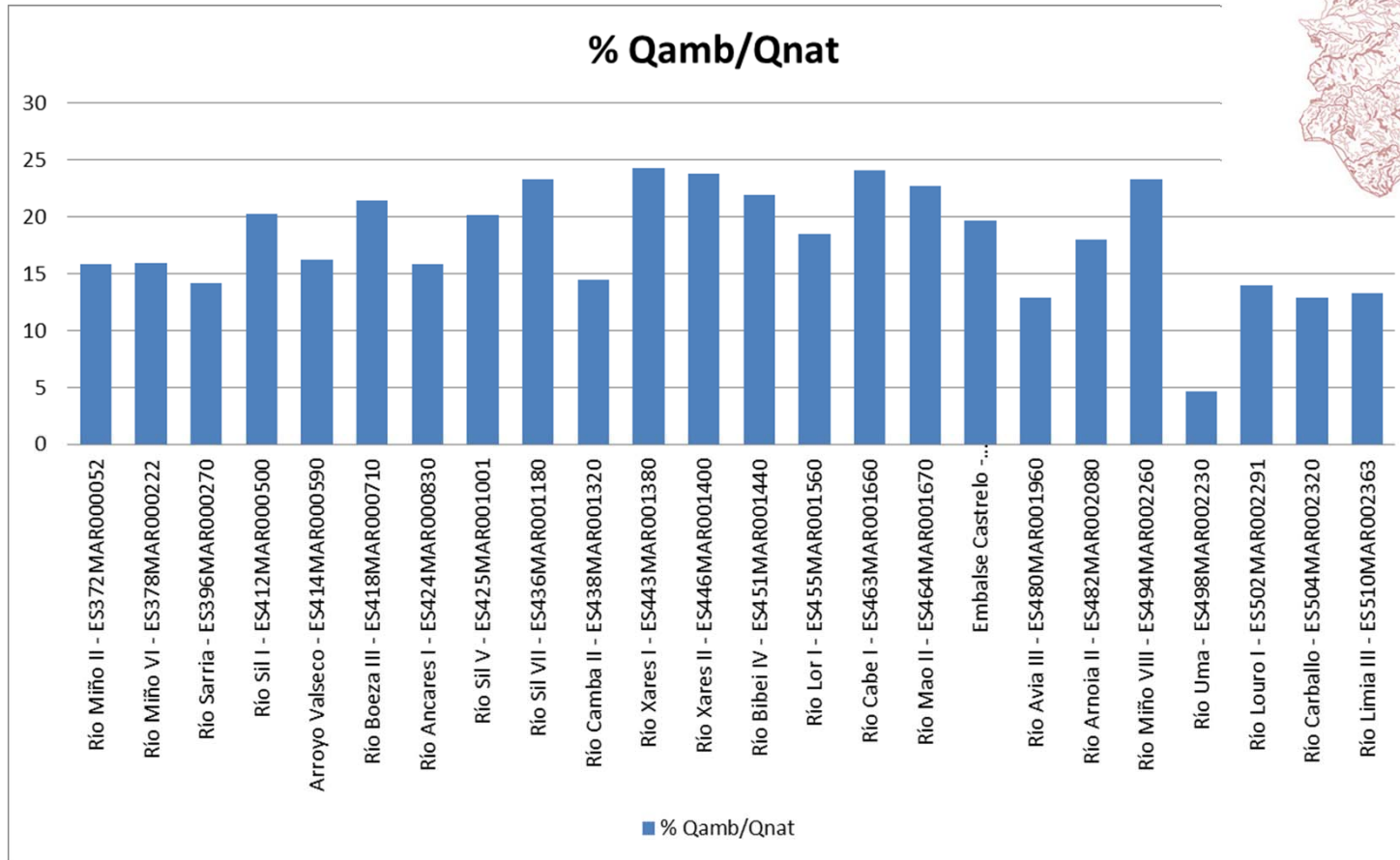
Revision of eflow regimes in the River Basin Districts (CEDEX, 2014)

Detailed comparison of eflow regimes as published in the RBMPs and natural flow regimes simulated (SIMPA2 model).

SIMPA2 is a nation-wide modelization (1km x 1km) of natural flows. It simulates rainfall-runoff processes.

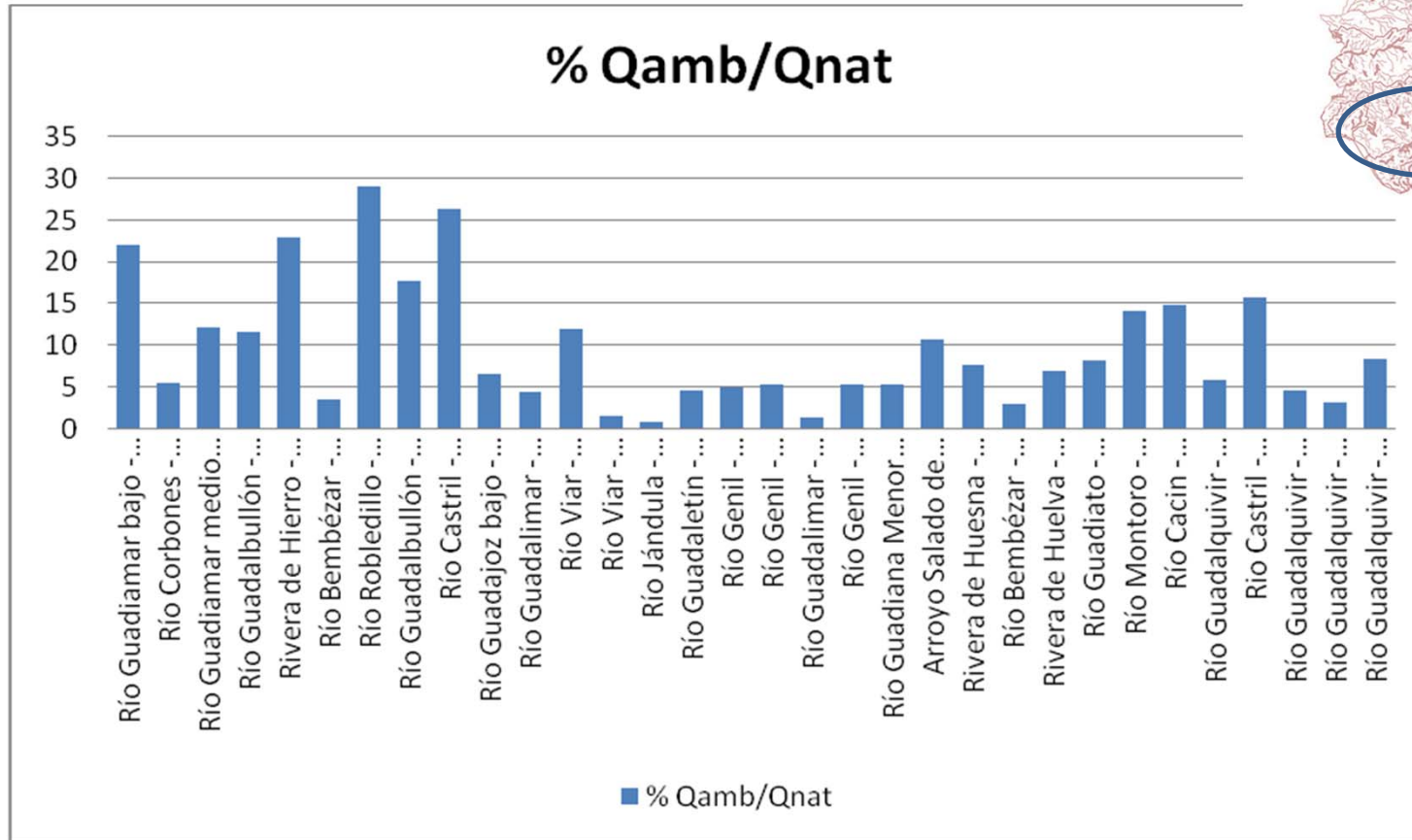


Revision of eflow regimes in the River Basin Districts (CEDEX, 2014)



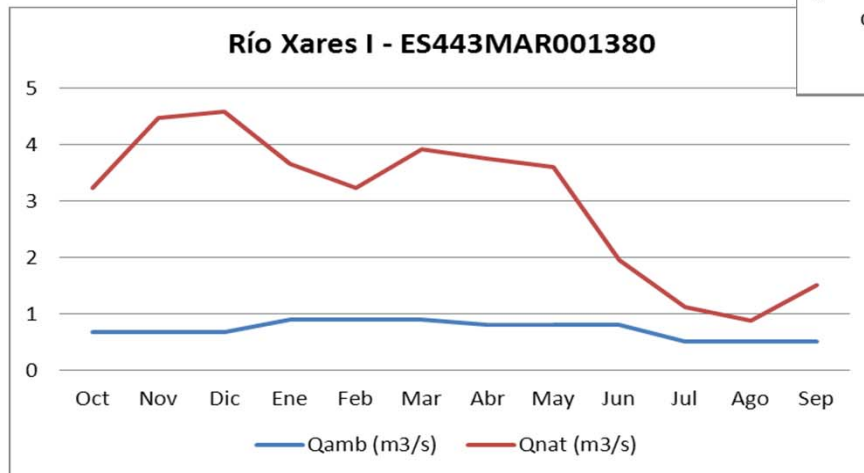
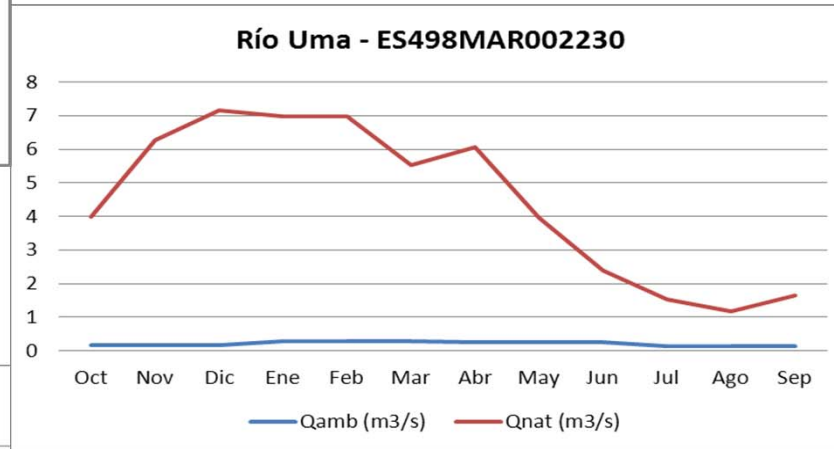
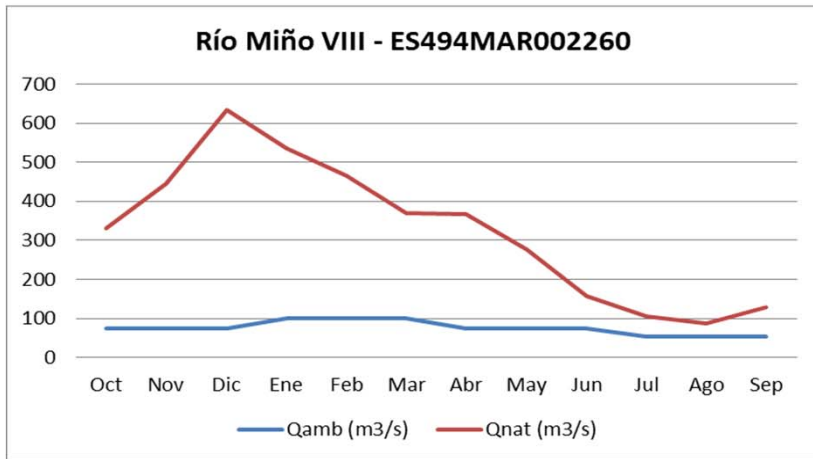
Ratio of annual Eflow discharge to Annual Nat-flow discharge in strategic water bodies of the Miño-Sil River District.

Revision of eflow regimes in the River Basin Districts (CEDEX, 2014)



Ratio of annual Eflow discharge to Annual Nat-flow discharge in strategic water bodies of the Guadalquivir River District.

Revision of eflow regimes in the River Basin Districts (CEDEX, 2014)



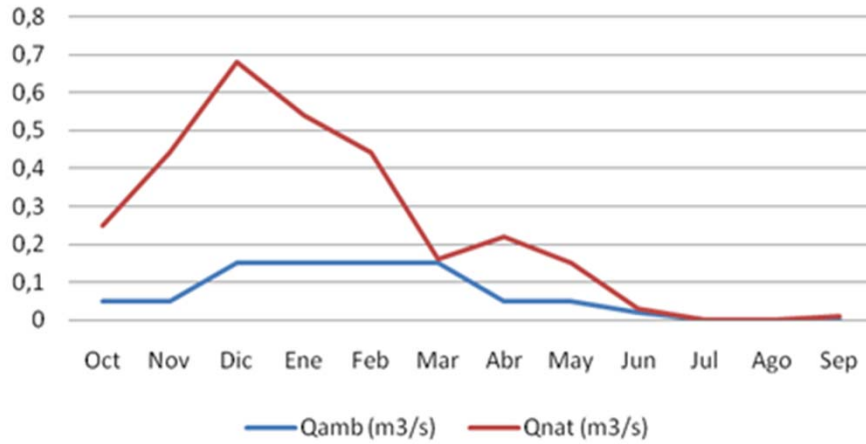
Some examples from Miño-Sil RBMP

Revision of eflow regimes in the River Basin Districts (CEDEX, 2014)

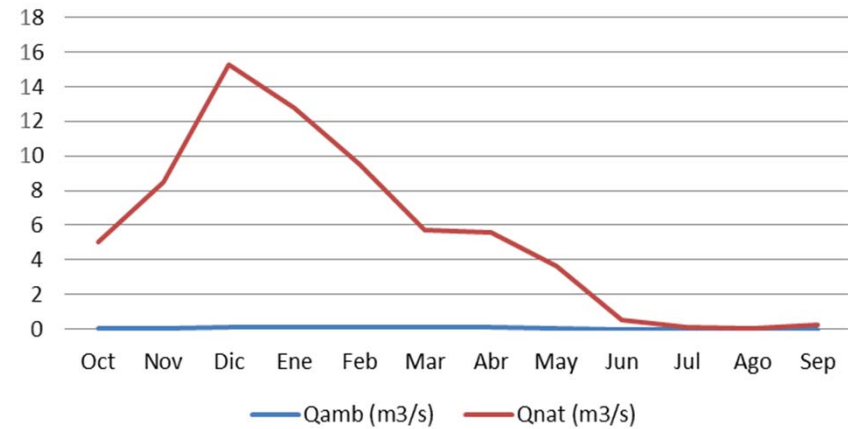
Some examples from Guadalquivir RBMP



Río Robledillo - ES0511008080



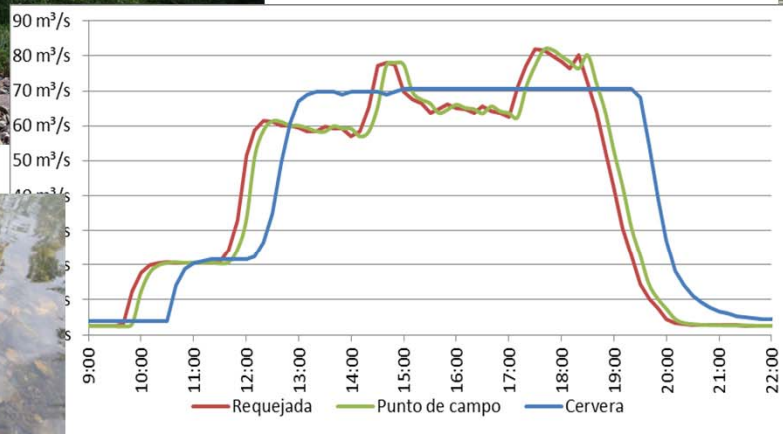
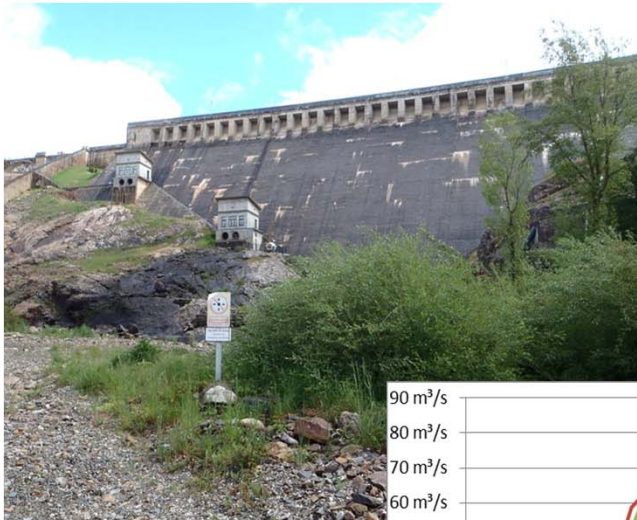
Río Jándula - ES0511100070



Revision of eflow regimes in the River Basin Districts (CEDEX, 2014)

E-Flood discharges: early experiences

Requejada Dam (Pisuerga River, Duero Basin District) – 2014
Cebrián et al. (2015). In: *Proceedings of the II Iberian River Restoration Congress*.



Revision of eflow regimes in the River Basin Districts (CEDEX, 2014)

E-Flood discharges: early experiences

Llosa del Cavall Dam (Cardener River, Catalonia Basin District) – 2015

Source: Catalan Water Agency



- 32 hours
- 6 times the average monthly eflow
- Monitoring of hydromorphological and ecological effects, and sediment transport downstream



Conclusions



- Large bias in the establishment of eflows in the different River Districts.
- Very limited intra-annual variability, which reduces their functionality.
- Only some River Districts have established practical commitments for discharging maximum summer flows, rates of change downstream of HEPPS, and efloods.
- Dispersion in monitoring processes between Districts.
- Lack of monitoring, despite being required by legislation and claimed by experts.
- Methodological uncertainties



- Unique methodology for all water bodies, but still with enough flexibility to consider the physical and environmental gradients.
- All eflow regimes must incorporate intra-annual variability.
- First eflood discharges.
- Incorporation of fishes and riparian plants as target species.
- Consideration of requirements of non-perennial rivers and lakes.
- Progressively assumed by most reluctant stakeholders.

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