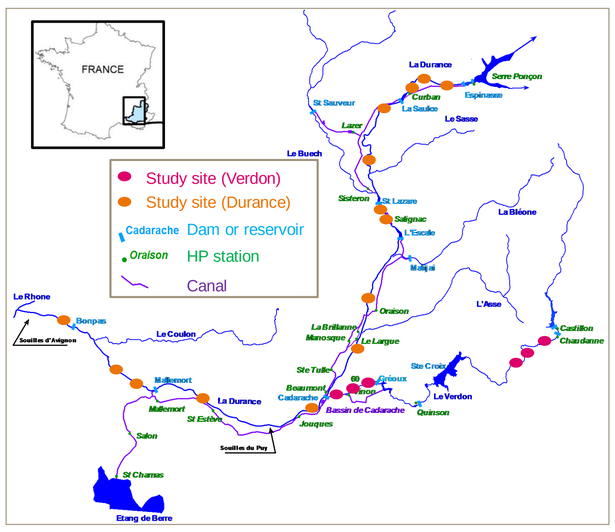
I.S.RIVERS LYON 2018

Influences du relèvement des débits réservés sur des biocénoses aquatiques des cours d'eau méditerranéens

Effects of minimum flow increases on aquatic communities in French Mediterranean-climate streams

Durance – Verdon River Basin



Context

- **Minimum flows increased in two large regulated Mediterranean Rivers (high interannual variability : droughts, floods)**
- **Large-scale long-term monitoring program to evaluate objectives (= improved fish communities)**

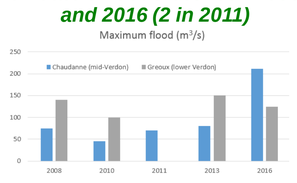
Are ecological gains observable (mid-term) ?

Verdon River

- **Minimum flows (MF) ↑ in 2011**
- **Releases (production, kayak, …)**
- **Monitoring : 2009-2018**

Hydrological context

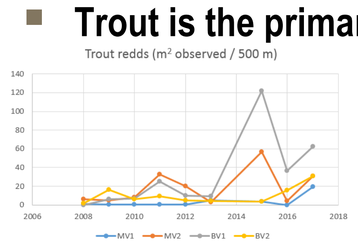
6 notable floods between 2008 and 2016 (2 in 2011)

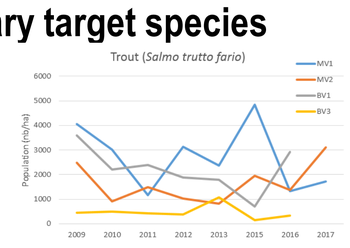


- **By-passed reaches influenced by floods and MF**
- **Reaches downstream of the HP are influenced by releases and floods**

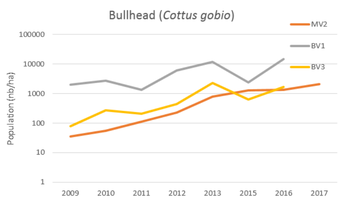
Mid-term results

- **Trout is the primary target species**





Despite increases in redd surface, trout populations vary considerably interannually, without exhibiting a clear effect after MF increases,.



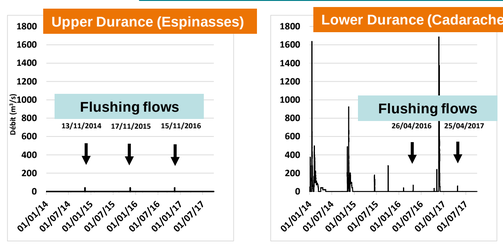
Bullhead (BH) populations have increased inotably. Habitat conditions are particularly favorable (high velocity zones increased)

Habitat changes (increased velocities, minor changes in wetted surface areas) have been favorable to bullhead, but not necessarily trout

Durance River

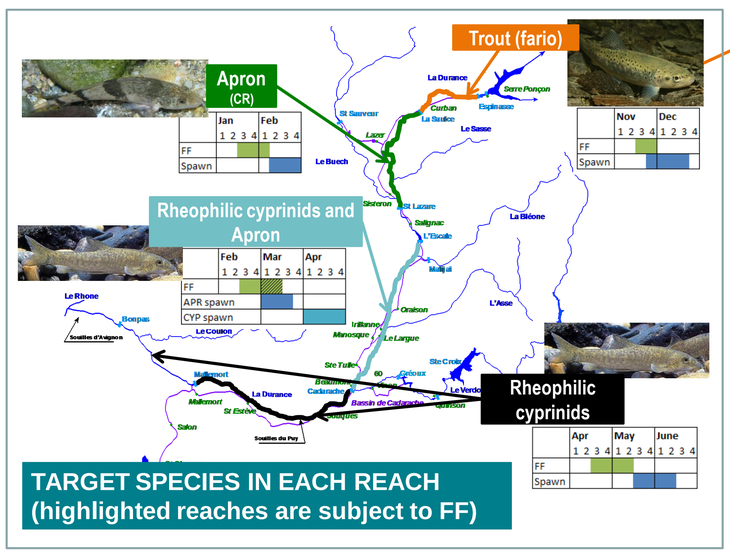
- **Minimum flows (MF) ↑ in 2014**
- **Flushing flows (FF) : 4 sectors**
- **Monitoring : 2013-2019** (some sites started before)

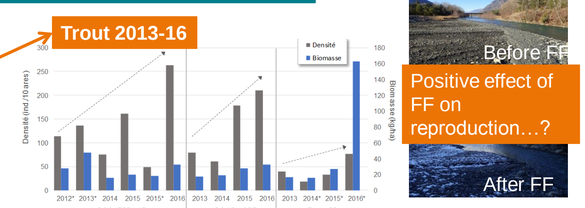
Hydrological context



- **In the upper reach, MF and FF are the only major contributions to hydrological variability**
- **In the mid to lower reaches, numerous tributaries lead to high hydrological variability. 2 major morphogenic floods occured (2014, 2016/2017).** FF are minor

Mid-term results





Positive effect of FF on reproduction…?

At Espinasses, trout recrutement has increased as has reproduction (redds). Bullhead populations have also increased inotably. FF may have a beneficial effect by redistributing favorable gravels along the reach.

The effects on other target fish species is more nuanced at this mid-term stage:
Positive efects on target or protected species were observed for two other reaches:

- **St Lazare (chabot)**
- **Escale (apron)**

Discussion / Conclusion

Ecological gains observed mid-term

	Reach	Invertebrates (as measured by WFD index)*	Fish (populations)
Verdon	Mid	Stable (good to v. good status)	Stable (TF) / *improvement (BH)*
	Lower	Stable (moderate to good)	Stable (TF) / *improvement (BH)*
Durance	Espinasses	Stable (v. good status)	*Very positive*
	La Saulce	Stable (v. good status)	Stable
	St Lazare	*Improved (mod → good)*	Stable / slight improvement
	Escale	Stable (good to v. good status)	Stable (CYP) / *improvement (apron)*
	Cadarache	*Improved (mod → good)*	Stable
	Mallemort/Bonpas	*Improved (mod → good)*	Stable

**IBGN index, for which there is no offiical reference value for the Durance River*

References:

Cattanéo, F., Gouraud, V., Tissot, L., Barillier, A., Carrel, G., Chappaz, R., Beaudou, D., Baril, D. (2015). Spring floods and temperature are main drivers of the fish assemblage of a Mediterranean regulated river (Durance River, France). *IS Rivers 2015.*

Vaudor L., Lamouroux N., Olivier J.-M. & Forcellini M. (2015) How sampling influences the statistical power to detect changes in abundance: an application to river restoration. Freshwater Biology, 60, 1192-1207

- **In particular cases (bullhead, trout at Espinasses), the responses were very positive**
  - **Linked to changes in the *primary limiting factors* (available rapid habiats, available gravels)**
- **Apparent lack of response to MF / FF in other cases, why?**
  - **High interannual variability : traditional monitoring programs are not sufficent.** Long-term monitoring efforts are unlikely to be sufficient to obtain statistically significant results in highly variable Mediterranean rivers (e.g. Vaudor et al. 2015). Need for a new approach…
  - **Fishes have long response times** (not good short-term indicators) and often **respond more to floods/droughts** (esp. in Mediterranean rivers) than baseflow (cf. Cattaneo et al. 2015).
  - **Inappropriate metrics** (WFD metrics not designed to determine effects of particular mitigation actions)
  - **Overly general objectives:** « improved quality » or « increased populations » are unlikely to bear satisfactory results. Monitoring programs cannot be adequately designed and there is no threshold for judging success. How much of an improvement is enough?
- **Perspectives**
  - **The actions undertaken in the Verdon/Durance River are promising despite limitations**
  - **Test other metrics / analyses for observing gains ; link objectives to limiting factors & mitigation**

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