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Hanieh Seyedhashemi, Hilaire Drouineau, Anthony Maire, Florentina Moatar. Joint temporal trends in river discharge and temperature over the past 57 years in a large European basin: implications for diadromous fish. The European Geosciences Union (EGU), Apr 2023, Vienna, Austria. 2023, 10.5194/egusphere-egu23-7598 . hal-04148794

HAL Id: hal-04148794

<https://hal.science/hal-04148794>

Submitted on 3 Jul 2023

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Joint temporal trends in river discharge and temperature over the past 57 years in a large European basin: implications for diadromous fish

Hanieh Seyedhashemi¹, Hilaire Drouineau², Anthony Maire³, Florentina Moatar¹

¹ INRAE, UR RiverLy, Centre Lyon-Grenoble, 5 rue de la Doua CS 20244, 69625 Villeurbanne, France

² INRAE, Unité EABX – Écosystèmes Aquatiques et Changements Globaux, HYNES (Irstea-EDF R&D), 50 avenue de Verdun, 33612 Cestas Cedex, France

³ EDF R&D, LNHE - Laboratoire National d'Hydraulique et Environnement, 6 Quai Watier, 78401 Chatou, France



Introduction

DID YOU KNOW?

Climate change → modify river temperature (Tw), discharge (Q) and current velocity (V) → impact on migratory species

How upstream migration of diadromous species has been affected over the past decades in a large basin ?

The Loire River basin (10⁵ km²)



Atlantic salmon *Salmo salar*

Allis shad *Alosa alosa*

Sea lamprey *P. marinus*

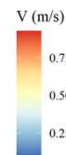
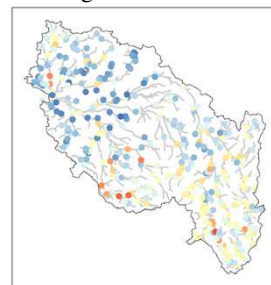
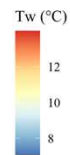
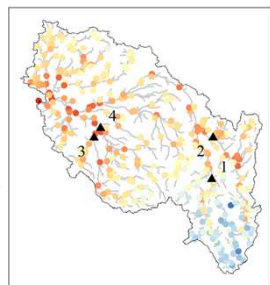


Materials and method

- Daily counts of migrating individuals recorded at 4 fish passage stations (LOGRAMI)
- Daily times series of Tw and V over 1963-2019 reconstructed by a physically-based thermal model, coupled with a semi-distributed hydrological model (Seyedhashemi et al., 2022, 2023)
- Innovative “Choc” method, allowing to detect joint temporal trends in two environmental variables → to detect trends in Tw-V associations favorable for migration

Fish passage stations:

1. Vichy on Allier
2. Decize on Loire
3. Châtelleraut on Vienne
4. Descartes on Creuse



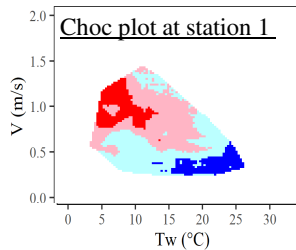
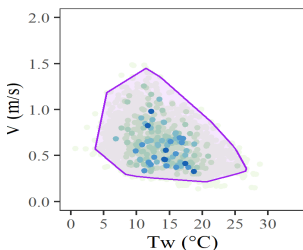
Arevalo et al., 2020

Choc method

Kernel density estimations
Mann-Kendall trend tests

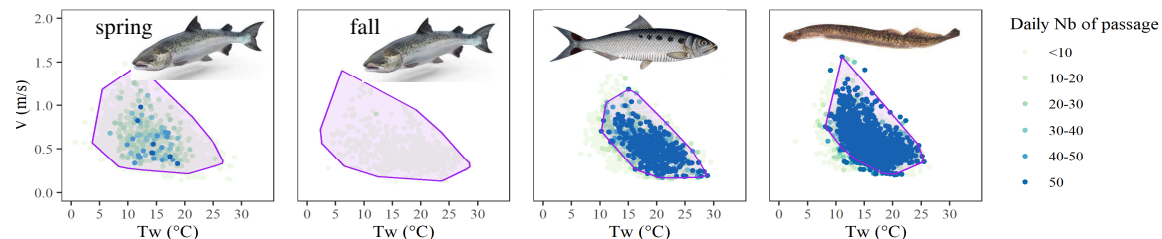
Associations that ...

- tend to become scarce
- are significantly scarcer
- tend to be more frequent
- are significantly more frequent



Results

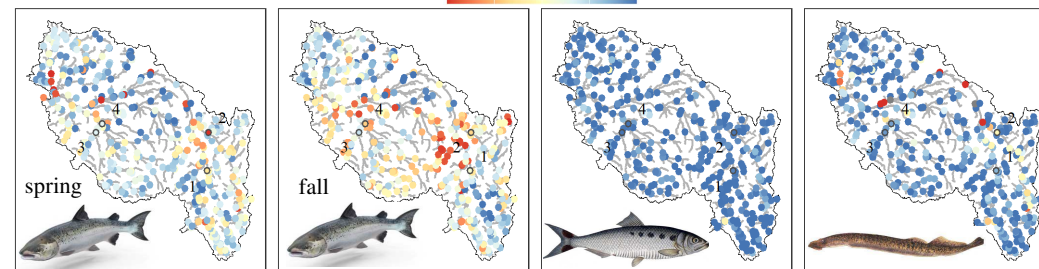
✓ Identifying the favorable Tw- V associations effectively used by fish individual to migrate upstream



✓ Detecting joint temporal trends in favorable Tw-V associations at the scale of the whole basin

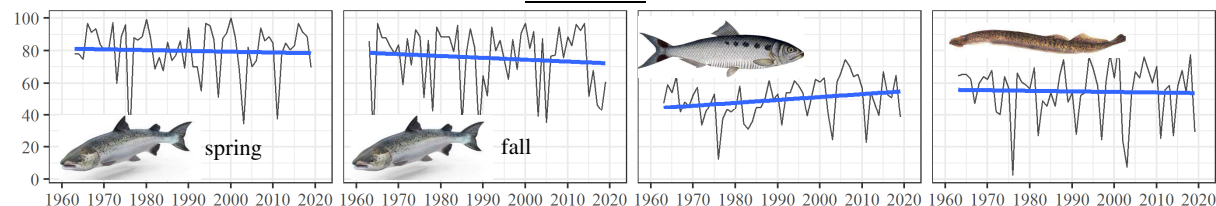
Dominant trend within favorable Tw-V associations :

Decreasing Increasing



Proportion of days with with favorable Tw and V over migration period (%)

At station 2



Take-home messages

- Significant decreases in the frequency of favorable Tw-V associations for upstream migration of Atlantic salmon with a considerable heterogeneity across the basin
- Significant increases for allis shad and sea lamprey at most stations
- Strong disparities in the consequence of global changes on fish migratory processes among species, seasons and tributaries.



References DOI:

Seyedhashemi et al., 2022: <https://doi.org/10.5194/hess-26-2583-2022>
Seyedhashemi et al., 2023: <https://doi.org/10.5194/essd-2022-451>
Arevalo et al., 2020 : <https://doi.org/10.1016/j.scitotenv.2020.141260>



SCAN ME