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# Joint temporal trends in river thermal and hydrological conditions can threaten the downstream migration of the critically endangered European eel

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## Résumé

Global climate change is modifying the hydrological and thermal regimes of rivers, threatening organisms whose key life-cycle processes are synchronized by these environmental cues. European eel (*Anguilla anguilla*) is a critically endangered fish species that migrates over several thousand kilometres between its spawning area in the Sargasso Sea and its rearing habitats in continental waters. Downstream migration of maturing ("silver") adult eels occurs during periods of decreasing river water temperature associated with high discharge. Changes in these environmental cues due to global change may result in migrations occurring under suboptimal conditions. Understanding joint temporal trends in environmental conditions and their implication for silver eel migration is needed to facilitate their migratory conditions. An innovative multivariate method was developed to analyse 50-year datasets of daily water temperature, discharge and eel passage in two European rivers (the Imsa River in Norway and the Burrishoole River in Ireland) to explore whether joint temporal trends in environmental variables may have affected eel migration. For the past 50 years, water temperature and discharge increased in both rivers during the downstream migration period from August to November. Silver eels preferentially migrated at temperatures between 10 and 20°C combined with high discharge. However, environmental changes have resulted in the migration of silver eels under warmer water temperatures (*i.e.*, eels have more frequently used water temperature > 15°C than in the past). Our method aims at identifying joint trends in environmental conditions and examining whether environmental changes have been associated with changes in the preferences under which ecological processes occur. The example of eel downstream migration illustrates how the changes in river thermal and hydrological regimes have led to a growing mismatch between the preferentially selected conditions and those actually used. This method can be applied to any environmental cues and species life-cycle events they trigger.

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\*Intervenant

**Mots-Clés:** *Anguilla anguilla*, Bivariate time series, Climate change, Spawning migration, Ecological niches, chocR package