River infrastructure can **facilitate** the **establishment** and **introduction** of non-native species.

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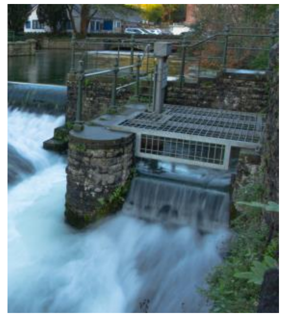
Background:

Non-native species are one of the greatest threats to freshwater biodiversity [1], and their invasion typically follows a four stage process: 1) transport, 2) introduction, 3) establishment, and 4) spread [2]. There is increasing recognition that river infrastructure (e.g. dams, weirs and culverts) may be used to stop the **spread** of non-native species [3], but little is known about the impacts on other stages of the invasion process.



Methods:

1. Standardised literature searches conducted across 4 databases.

2. Titles, abstracts, and then full texts screened to identify relevant studies.

3. Hedge's *g* calculated, and then recorded alongside information regarding climate, taxonomy and infrastructure characteristics.

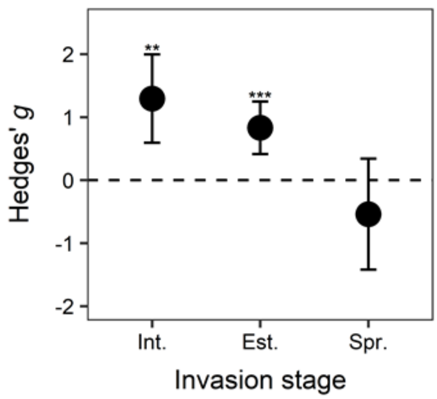


Fig. 1 – Overall effect sizes and 95% CIs at each invasion stage.

Key Results:

1. River infrastructure had a **<u>strong, positive effect</u>** on introduction and establishment, but **<u>no effect on spread</u>** (Fig. 1).

2. The magnitude of the effect was **<u>not influenced</u>** by climate, taxonomy or infrastructure characteristics.

3. **<u>Strong biases</u>** towards temporal regions (Fig. 2a) and fish (Fig. 2b).

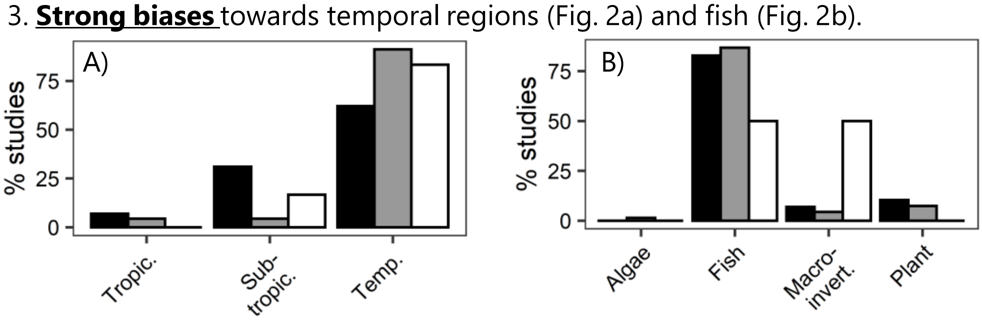


Fig. 2 – A) Climatic and B) taxonomic biases at each invasion stage (black = introduction, grey = establishment, white = spread).

Extra Information:

Screening Process:

5518 titles and abstracts screened.

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217 full texts assessed for eligibility.

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45 studies included in quantitative synthesis.

Effect Size Calculation:

Hedge's *g* used to compare metrics between areas where structures were present (*sp*) and where structures were absent (*sa*). It was calculated as:

$$g = \frac{\bar{X}_{sp} - \bar{X}_{sa}}{S} J$$

where S is the pooled standard deviation and J is a correction for small sample sizes, equal to:

$$1 - \frac{3}{4(n_{sp} + n_{sa} - 2) - 1}$$

The variance of g (v_g) was equal to:

$$\left(\frac{n_{sp} + n_{sa}}{n_{sp} n_{sa}} + \frac{g^2}{2(n_{sp} + n_{sa})} \right) J^2$$

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[1] Reid, A, J. *et al.* 2019. *Biol. Rev.* 94. pp. 849-873.
[2] Blackburn, T, M. *et al.* 2011. *Trends Ecol. Evol.* 26:7. pp. 333-339.
[3] Rahel, F, J. 2013. *BioScience*. 63. pp. 362-372.

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