

FISH BEHAVIOURAL RESPONSES TO RIVER DISCHARGE TRENDS AND THE IMPORTANCE OF HABITAT CONNECTIVITY

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Rationale

Population behaviours associated with coarse fish migrations within river basins are amongst the most poorly understood dispersion mechanisms of temperate freshwater organisms, and river discharge is expected to have a major influence.

Specific objectives

- 1) compare numbers of fish moving during day and night using fish traps (Hohausová *et al.* 2003),
- 2) evaluate seasonal variations in taxonomic composition of fish movements from trapping results,
- 3) test for correlations between environmental trends and the intensity and direction of fish movement,
- 4) develop an empirical model of the interactions between fish movements and environmental trends

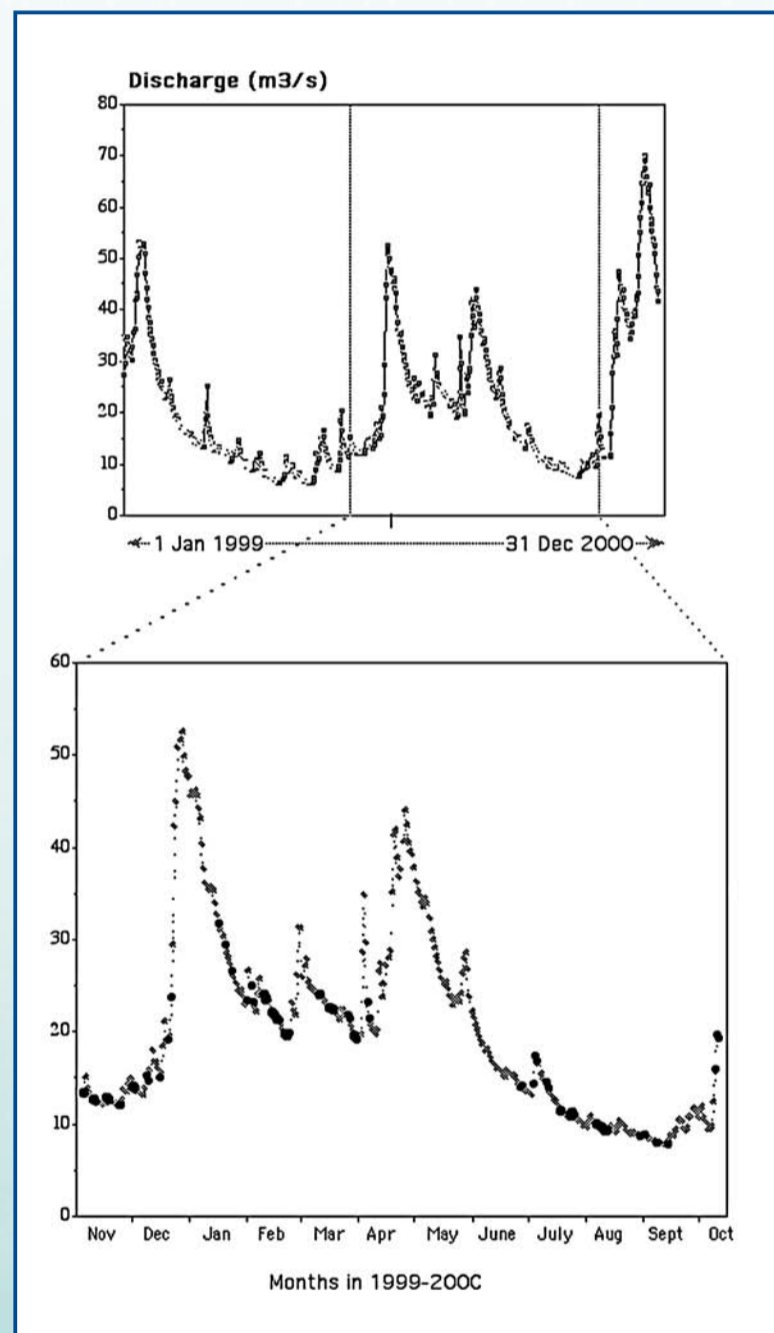


Figure 1: Discharge regime of the River Avon (Hampshire). Fish traps were exposed over 24-h (emptied at end of day and first thing in the morning on dates indicated by large, black dots) to record daytime and night-time movements of fish between the Avon and its small tributary, Ibsley Brook.

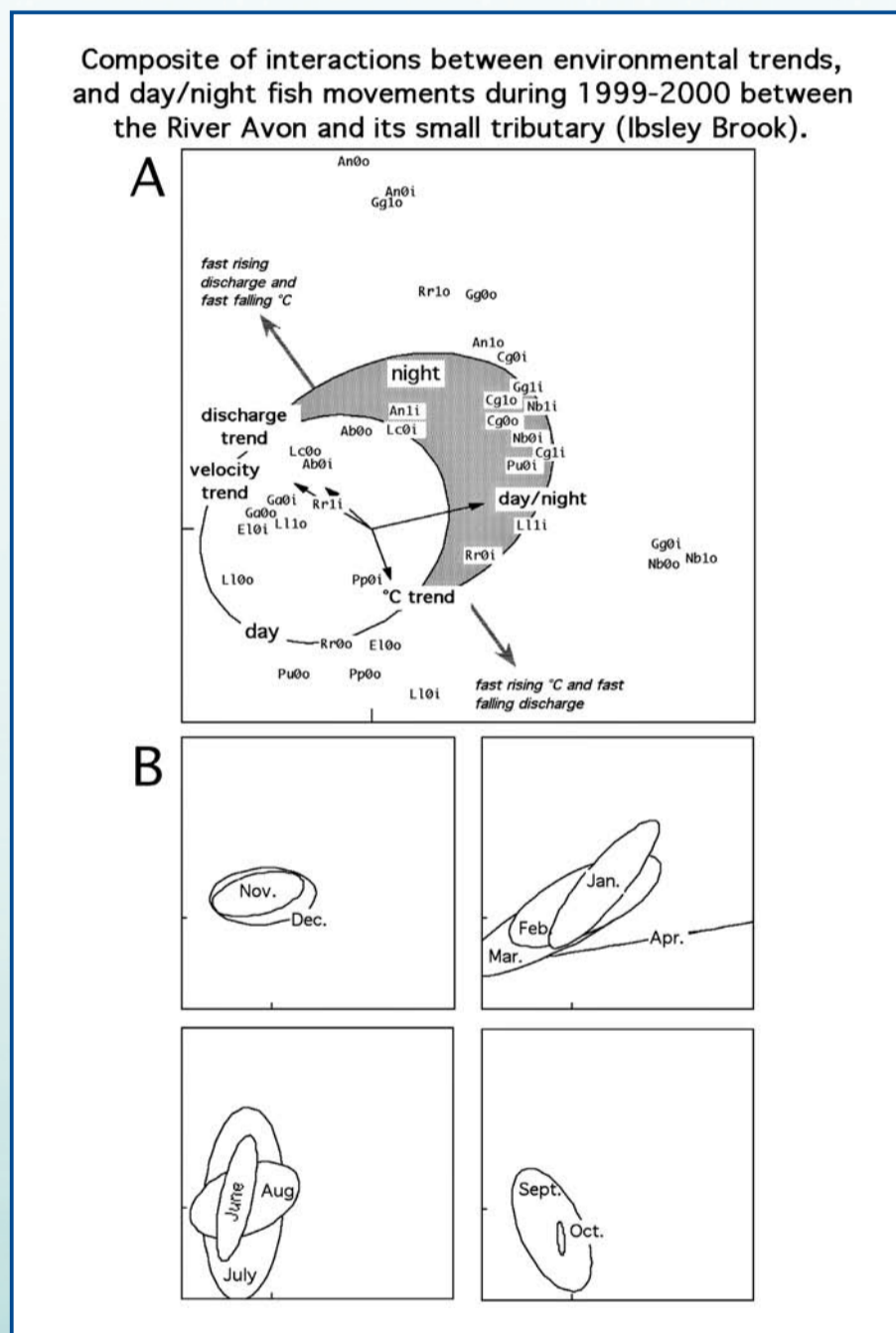


Figure 2: Composite patterns (combined data for entire year) revealed by canonical correspondence analysis triplot: A) fish species/age classes (0+, 1+, 2+) moving into (i) and out of (o) of the brook at similar times of day and following similar trends are ordinated closer together than those moving under different trends — benthic species appear to move mainly at night; B) 90% ellipses for each month of samples to reveal seasonal variations — reduced variation in early and late autumn, with increased variation in winter, spring and summer. Fish species codes: common bream (Ab), eel (An), bullhead (Cg), pike (El), 3-spine stickleback (Ga), gudgeon (Gg), chub (Lc), dace (Ll), stone loach (Nb), minnow (Pp), 9-spine stickleback (Pu), and roach (Rr).

Seminal references

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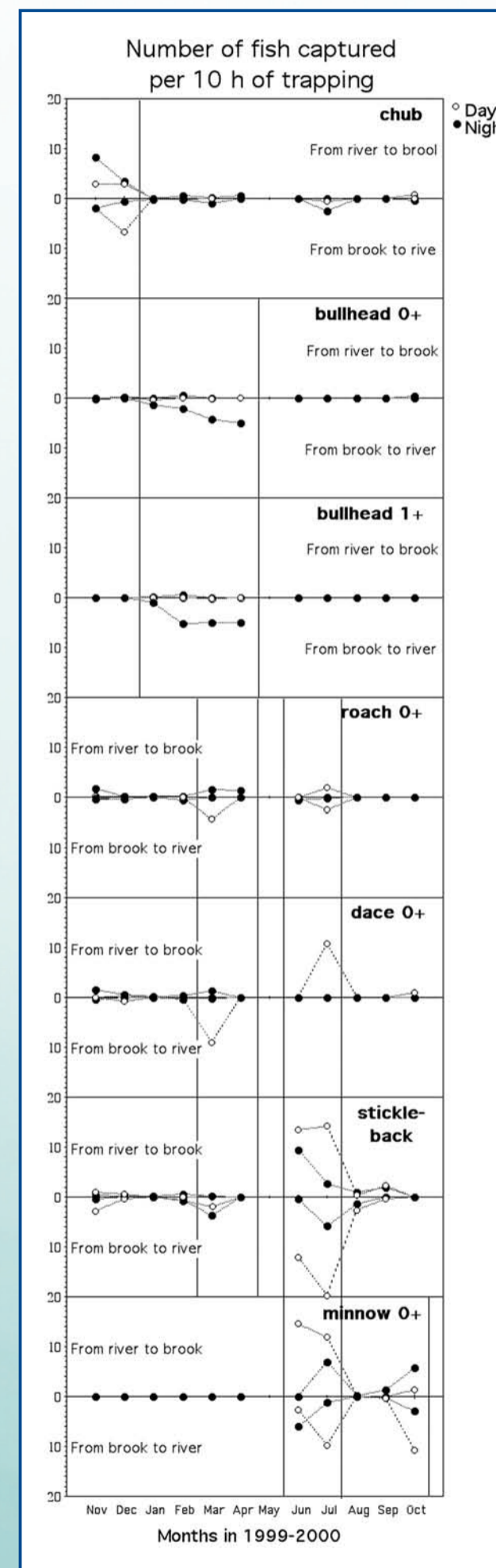


Figure 3: Seasonal movement patterns of fish species between the Hampshire Avon and Ibsley Brook, as revealed by trapping, suggest that monthly data could be grouped by seasonal intervals (Nov-Dec, Jan-Apr, June-Aug, Sept-Oct) for trend analysis given in Figure 4.

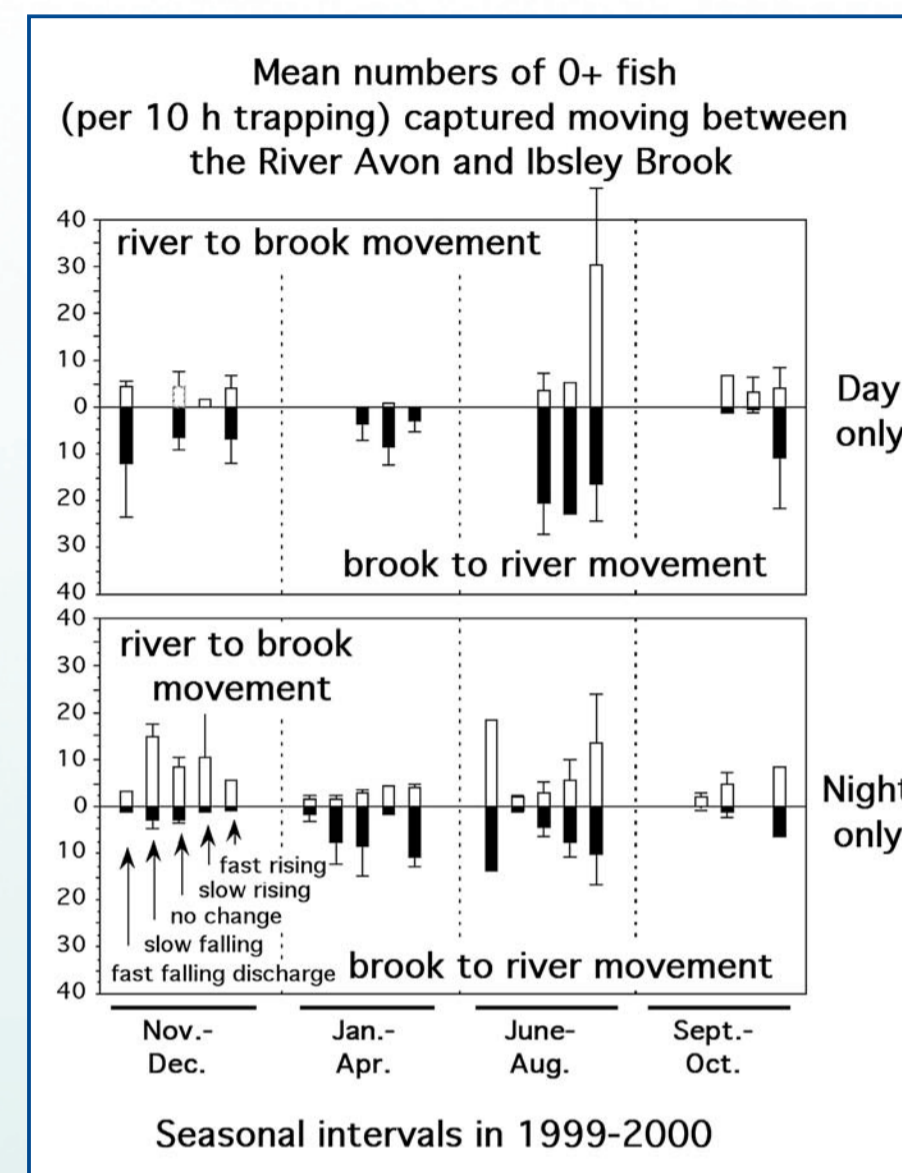


Figure 4: Day and night behavioural responses to discharge trends: For each seasonal interval defined in Fig. 3, the movement of 0+ fish (mean numbers trapped) between the River Avon and Ibsley Brook is presented by river discharge trend (left to right: fast falling, slow falling, no change, slow rising, fast rising) — no consistent pattern apparent, though some tendency for greater movement under fast rising and falling discharge.

Summary

- Age-0 fishes dominated the catches, with movement intensities similar most months (seasonal variations by species).
- Few significant differences in overall numbers of fish between discharge trends, but...
- Fish numbers in five species were correlated with river discharge trend.
- Movements in some species were correlated with the rate of temperature change, and with changes in brook water velocity.

Interpretations

- Daily movements between river and small tributary brooks were triggered by changes in light intensity and water velocity.
- Seasonal movements of species between the river and brook were driven by changes in river discharge and water temperature trends, in particular associated with flood events.
- Results emphasize importance river basin connectivity, as fish movement between the Avon and brook occurred under all flow regimes, but especially with rapidly rising discharge.
- Water regulation structures constructed in flood plains will impede fish movements during all seasons of the year, but most notably during spring and summer.