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.

Seminal references

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.

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 (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).

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.