HarmoniRiB River Flow-Ecology Case Study on the River Kennet

Mike Dunbar and Tracey Goodwin

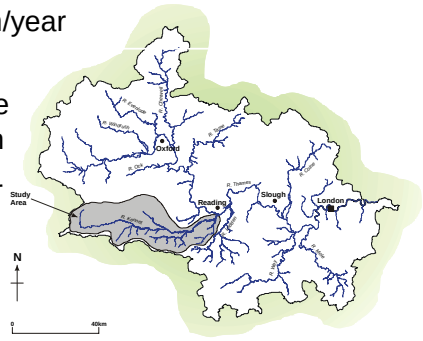
Centre for Ecology and Hydrology

Key questions

- How does uncertainty in the calibration affect a river flow-ecology model?
- How do both historical river flows and water abstractions combine to affect river macroinvertebrate communities on the River Kennet?

The River Kennet

- A tributary of the Thames, catchment ~ 1000 km²
- Underlain by Chalk, stable flow regime
- Mean runoff ~ 260mm/year
- Parts are designated under habitats directive and national legislation
- River and groundwater used for public supply and agriculture



The Data

- Biology: calculated index: LIFE score[2] from bi-annual macroinvert samples from 9 sites from 1990-2004
- Hydrology: gauged daily mean river flows
- Hydrology: locations of water abstractions and discharges, (actual or licensed monthly volumes)
- Hydrological data transposed to ungauged biology monitoring sites and summarised on bi-annual basis

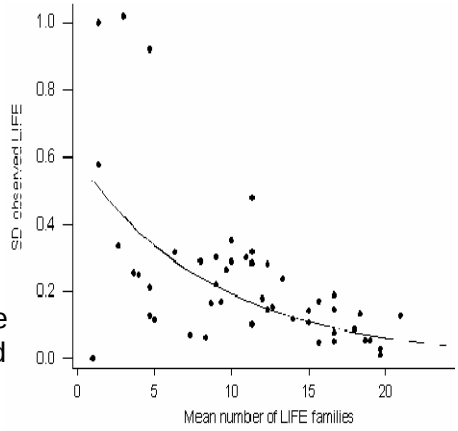
The Uncertainty

Hydrology

- Uncertainties based on licensed-actual relationships from real data
- Handled through Monte-Carlo simulation

Biology

- Replicate sampling standard deviation for LIFE score based on number of macroinvertebrate families in sample (fewer=more uncertain)
- Handled through use of variance-weighted regression



The Model

*LIFEij= b0j + b1j*Historical_flow + b2j*Historical_abst + b3j*Historical_flow*Historical_abst + eij*

- Where j represents sites j = 1…N, and i represents sampling occasion i = 1…nj
- (LIFE score and flow vary through time for each site)
- Focus on parameter uncertainty and goodness-of-fit

The Results

- Uncertainties associated with abstraction data 4-6 times less than inherent parameter uncertainty
- Using variance-weighted response variable slightly reduces parameter uncertainty, because outlying points also happen to be more uncertain
- LIFE score influenced by historical flows (positive), and abstractions (negative), although latter parameter not significant

Find out more…

2 Extence, C.A., Balbi, D.M. and Chadd, R.P. 1999. River flow indexing using British benthic macro-invertebrates: a framework for setting hydro-ecological objectives. Regulated Rivers Research and Management, 15(6), 543.

Contact: Mike Dunbar MDU@ceh.ac.uk