

Trophic Cascades and Endocrine Disrupting Chemicals in two Contrasting River Catchments

Supervisors

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Project description

Endocrine disrupting chemicals (EDCs) from wastewater treatment (WWTWs) induce gonadal feminisation in male fish and reduce fertilisation thereby affecting environmental policy. Ormerod and Morrissey have shown that Dippers (*Cinclus cinclus*) along rivers accumulate EDCs in their eggs but the suite of EDCs that predominate differ between environments (e.g. organochlorine pesticides in rural streams; PCBs/PBDEs in urban streams: Fig 1)². Almost nothing is known, however, on routes of food-web transfers and trophic cascades for EDCs from diffuse or point sources in UK freshwaters.

This studentship will investigate trophic cascades of EDCs from WWTW effluents and diffuse discharges (incl. agriculture) in invertebrates, fish (bullheads and brown trout, *Salmo trutta*) and birds (Dipper) in contrasting catchments - The Tamar (south-west England) and the wider Severn Catchment. The latter includes the rural Usk and Wye, along with the urban Taff/Rhondda/Rymney/Ebbw systems.

Hypotheses:

- EDCs bioaccumulate across trophic levels and differ for diffuse vs. point source river inputs
- Diffuse and point EDC sources interact with prevailing invertebrate traits (e.g. filtering/grazing/predation) to accumulate and affect fitness in fish or birds
- Expressions of EDC effects in birds and fish are reflected in altered abundance and composition of invertebrate communities

The student will:

- Map land use/management practices, EDC discharges, and analyse them against spatial distributions of the study organisms.
- Deploy Polar Organic Chemical Integrative Samplers to quantify EDCs (including steroids, PCBs, DDT/DDEs, PBDEs, perfluorinated compounds, various pesticides, and selected metabolites) across contrasting river zones.
- Sample invertebrates, bullheads, brown trout (blood, bile, liver and gonad) and dippers (blood, feather, egg samples) living in/along the river pollution gradients and apply stable isotope analysis together with target chemical analyses for specific EDCs to establish food web accumulation relative to trophic level/feeding guilds.
- Assess biological effects on fish and birds, including analysis of blood sex hormones, thyroid hormones and gonad development (histopathology, fish only).

This is ambitious, but draws directly on the successful, highly resourced work of the supervisors and project partners.

¹Harris CA[#], Hamilton, PB[#], Runnalls TJ, Vinciotti, V, Henshaw, A, Hodgson, DJ, Coe, TS, Jobling, S., **Tyler C.R.**, * Sumpter, JP * (2010). The Consequences of Feminisation in Breeding Groups of Wild Fish. **Environmental Health Perspectives 119:306–311** *Joint Senior Authors

²Morrissey, C.; Stanton, D.; Pereira, M.G.; Newton, J.; Durance, I.; **Tyler, C.R;** Ormerod, S. (2013). Eurasian dipper eggs indicate elevated organohalogenated contaminants in urban rivers. **Environmental Science and Technology 47:** 8931-8939

Fig 1: Concentrations of 2 groups of contaminants in Welsh Dipper eggs along rivers of Contrasting population density

