

Report on the Spring 2015 meeting of the Scottish Freshwater Group – Research Priorities for River Basin Management

The 94th meeting of the Scottish Freshwater Group took place on 16th April 2015 at the University of Stirling. The day's proceedings were co-organised with CREW (<http://www.crew.ac.uk/>), aiming to give freshwater scientists the opportunity to identify the most important knowledge gaps and research needs to support the development and implementation of the 2nd River Basin Management Plans (RBMP) for Scotland and the Solway-Tweed. The meeting format involved invited experts to deliver keynote presentations, followed by interactive breakout workshops to gather collective opinion from 46 attendees, who divided themselves into groups for discussing four topic areas:

1. Valuing Nature¹
2. Managing Invasive Non-Native Species (Invited speaker: Mike Dobson, APEM)
3. Improving the Physical Environment (Invited speaker: Trevor Hoey, University of Glasgow)
4. Water Quality: Diffuse Pollution (Invited speaker: Andy Vinten, James Hutton Institute)

Our meeting chair, Willie Duncan (SEPA) initially set the scene by presenting an overview of the current state of Scotland's water environment, highlighting that approximately two-thirds of our waterbodies are sitting at Good Ecological Status (GES) or better, whilst one-third are failing this EU Water Framework Directive (WFD) target due to a range of, and some cases multiple, pressures (e.g. water quality, physical habitat condition, barriers to fish, impacted flows and presence of invasive non-native species). Willie then went on to introduce each of our keynote speakers, who covered the aforementioned topics between them, which were then discussed in more detail during the afternoon breakout sessions. Mike Dobson (APEM Ltd) was first to take the stand with a view to discussing the distribution, environmental impact, risk management and spread of Invasive Non-Native Species (INNS) in UK freshwaters, with particular emphasis on the Scottish environment. Current WFD-UKTAG guidance prioritizes INNS into categories according to their potential ecological impact from high to low, or as yet, unknown (<http://www.wfduk.org/>). For example if a high impact INNS species is present in a waterbody then achieving High Ecological Status is considered impossible. To illustrate INNS distribution, Mike began with more renowned current species of concern such as the signal crayfish (*Pacifastacus leniusculus*: Fig 1) and killer shrimp (*Dikerogammarus villosus*) which been brought into the public domain through heavy media attention. There was also mention of the demon shrimp (*D. haemobaphes*), which first appeared in Preston and has since populated the interconnected lowland canal system in England, although boat trafficking may not be its primary pathway for 'jumping' sites. Mike also examined the timescales of zebra mussel (*Dreissena polymorpha*) distribution in UK freshwaters from 1974 – 2015, which demonstrated its dramatic expansion within the ~40 year period and included the recent 'secondary

¹Nick Hanley (Univ. of St Andrews) & Katherine Simpson (Univ. of Stirling) were invited but unable to attend

²Gallardo, B. & Aldridge, D.C. (2013) Priority setting for invasive species management: risk assessment of Ponto-Caspian invasive species into Great Britain. *Ecological Applications* 23, 352 – 364

wave' of a highly invasive genetic strain in the central canal network in England. The Ponto-Caspian Region is a major source of INNS and SE England is suitable access point for their arrival in the UK. However waterbodies characterised by alkalinity conditions $<120 \text{ mg L}^{-1}$ are unlikely to be invaded by Ponto-Caspian species², which may mean that relatively few will become problematic for Scottish freshwaters, but the question is whether we can afford to be complacent? Mike provoked other thoughts about appropriateness of existing monitoring surveillance for INNS in Scotland's freshwaters and ended by emphasising the point that biosecurity measures (i.e. check-clean-dry principle), tied into awareness-raising schemes, are integral to preventing their spread in the first place. Next up, Trevor Hoey (University of Glasgow) talked about the morphological pressures affecting the conditions of Scotland's waterbodies which are largely concentrated around urbanised regions and agricultural areas i.e. the Central Belt and Aberdeen. Trevor went on to discuss the fundamentals of river restoration that both planning and solutions need to be developed at the catchment scale (where physical pressures are acting on habitats). Management approaches may need to think of rivers as a series of punctuated steps functioning as a network and not necessary a longitudinal continuum because system discontinuities are often significant at tributary junctions. It is also important to recognise where nature is capable of doing that work itself, as in many cases, the river environment will improve by itself if the pressures are removed. This was illustrated using the River Calder as a case study: breach of a dam in 1983 (constructed c. 1850) facilitated sediment migration within the system and led to the formation of an extensive gravel front some 4 km of downstream of the original dam, hence naturalising river character. This also underpins the point that time is relevant to river management, as the scale of adjustment may occur over several decades. Management also needs to integrate different aspects of a river system (e.g. flow regime, habitat quality and morphology). The River Kerry was used exemplify where hydrological modifications i.e. stable compensation flows and absence of flood peaks, support an established pearl mussel population, in other words, organisms of high conservation value. There is clearly a fine balancing act between the costs and benefits gained from restorative intervention and management priorities concerned. To end Trevor noted that climate change will further complicate our current understanding of sediment balance in rivers (Figure 2): though adjustments to stream power are realised, the effects on sediment supply is less certain, and this makes impacts difficult to generalise. Andy Vinten (The James Hutton Institute) then led us through a catchment citizenship approach for engaging stakeholders, emphasising that convincing people there is an issue and how they can take steps help resolve it, is key to addressing water quality deterioration driven by rural diffuse pollution. This involves understanding different perspectives and SEPA has a successful record of getting citizens onboard through Priority Catchment work (e.g. R. South Esk) which includes catchment walkovers, farm inspections and re-visits, to raise landowner awareness of catchment pressures (in this case, mainly derived from cultivation activities and keeping of livestock). Knowledge-exchange is needed for demonstrating to stakeholders of what is happening in their local water environment. Often visualisation tools are most effective e.g. using 'Trichoptera (cased caddis larvae) on Tour' at Benholm Mill to highlight the impacts of emerging contaminants which may pose an adverse risk to human/animal health and the water environment (e.g. persistent organic pollutants; endocrine disrupting chemicals), facilitating a tie-in with ecosystem services and achieving shared values. Delivering workable solutions into real catchments to mitigate water quality issues is essential e.g. potato fields are major contributors of fine sediment within the Lunan catchment. Subsequently, research has focussed on the lowest corners of high risk potato fields and explored the practicality of implementing Rural Sustainable Drainage System (RSuDS) in these parts

to attenuate the problem of fine sediment transport in agricultural run-off. Lastly, Andy outlined that a sufficient data time-series (e.g. long-term monitoring) and robust experimental design (e.g. Before-After-Control-Impact or 'BACI' approach) are prerequisites for ascertaining the efficacy of any restorative intervention in delivering environmental improvements.

The forum then stopped for lunch and a poster session, before discussion resumed in each of the breakout groups to harness the broad freshwater community view, the key messages from which were then fed back to the entire audience and summarised during a plenary panel discussion at the end. Based on this, a research briefing has also been prepared by Laurence Carvalho (CEH, SFG Coordinator), Pauline Lang (SEPA, SFG Publicity Officer) and four rapporteurs from the day: Helen Woods (CEH, Valuing Nature), Alanna Moore (CEH, Invasive Non-Native Species), Anna Doeser (University of Stirling, Physical Environment) & Kenneth Porter (University of Stirling, Water Quality). The notes were reviewed by the invited speakers and Willie Duncan (SEPA, Meeting Chair). This briefing is now available to download from the SFG website.

The autumn SFG meeting was held on Thursday 29th October 2015, with an afternoon focus on river restoration. If you would like to receive further details please email Laurence Carvalho (laca@ceh.ac.uk) or visit the new SFG homepage (<http://www.ceh.ac.uk/scottish-freshwater-group>). It is now also possible to receive SFG notifications via Facebook (Scottish Freshwater Group) or follow us on Twitter @Scottish_FwGrp.

Pauline Lang, SFG Publicity Officer



Figure 1. Mike Dobson drawing on signal crayfish distribution as a notorious example of INNS distribution in UK freshwaters [photo credit – Pauline Lang]

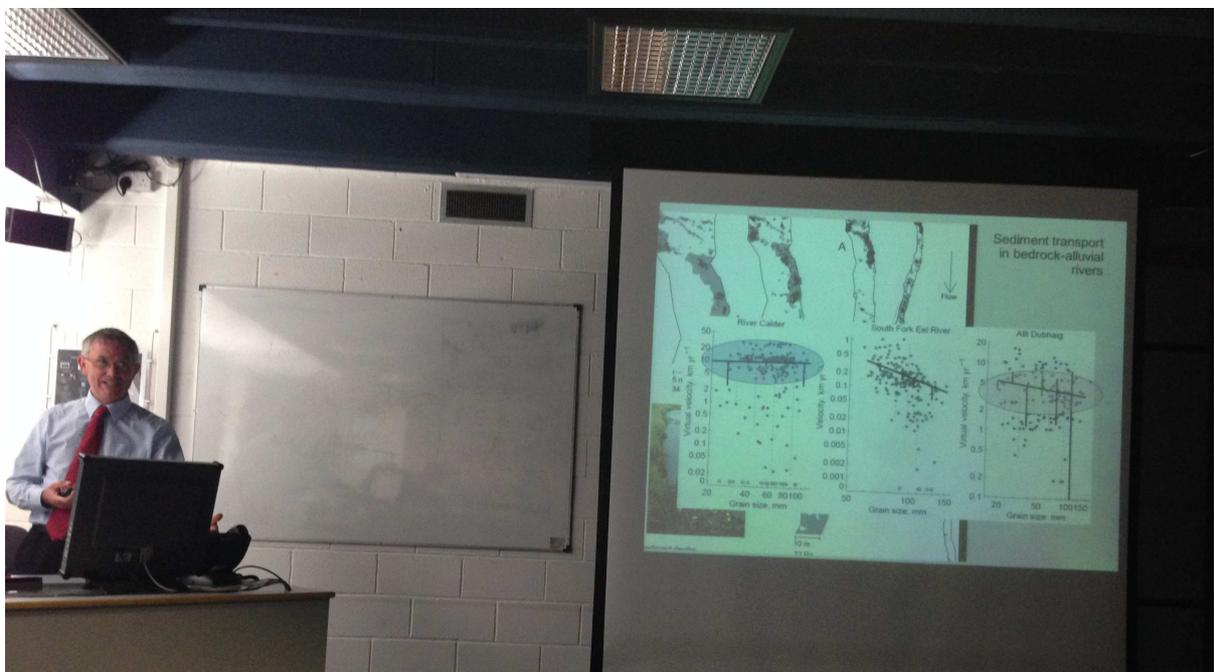


Figure 2. Trevor Hoey predicting sediment transport in Scottish rivers [photo credit – Pauline Lang]