

The River Clyde  
Fishery Management Plan  
Review 2013





Delivery of the River Clyde Fishery Management Plan since 2009 has been supported by:

RAFTS



THE CROWN  
ESTATE



University  
of Glasgow



The Merchants House  
of Glasgow



*The John Spedan Lewis  
Foundation*



Scottish Natural Heritage  
Dualchas Nàdair na h-Alba  
All of nature for all of Scotland  
Nàdar air fad airson Alba air fad



Lamington & District  
Angling Improvement Association



Campsie Angling  
Association

Airdrie & District Angling Club

Halcrow

The George Clark Bequest

THE EQUITABLE CHARITABLE TRUST



The Grayling Research Trust

The Cobb Charitable Trust



[www.clyderiverfoundation.org](http://www.clyderiverfoundation.org)

[info@clyderiverfoundation.org](mailto:info@clyderiverfoundation.org) • 0141 330 5080



[www.facebook.com/ClydeRiverFoundation](http://www.facebook.com/ClydeRiverFoundation)

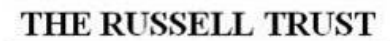


@ClydeRF

A Scottish Charity SC 029602

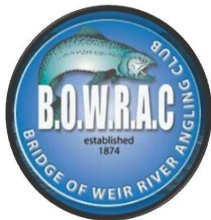
Company limited by guarantee SC 196438

Delivery of the River Clyde Fishery Management Plan since 2009 has been supported by:



THE W.M. MANN FOUNDATION

THE CRUDEN FOUNDATION



THE HUGH FRASER FOUNDATION



Joe Quigley

Zara Gladman, winner of



The Clyde River Foundation is a registered Scottish charity which researches the ecology of the Clyde and its tributaries, and promotes environmental education throughout the catchment.

[www.clyderiverfoundation.org](http://www.clyderiverfoundation.org)

5	Introduction
6	Science and Management: fisheries surveys and data
7	Science and Management: Clyde salmon
8	Science and Management: invasive, non-native species
9	Science and Management: biodiversity and water quality
10	Science and Management: environmental quality
11	Science and Management: habitat improvement
12	Education and outreach
13	Education: schools
14	Education: Universities
15	Outreach
16	What next?

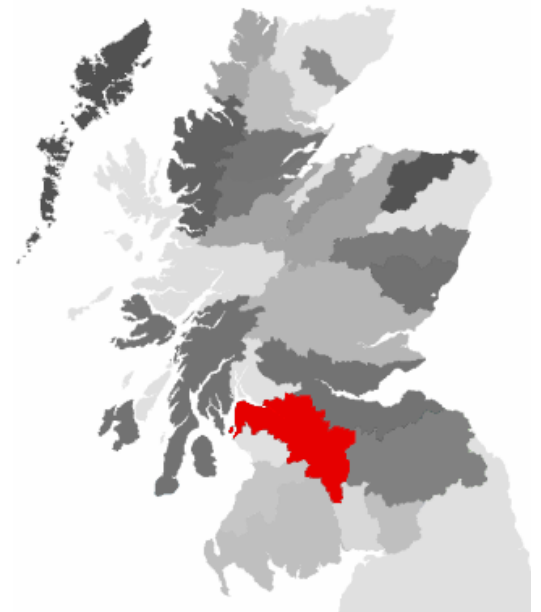


**The River Clyde Fishery Management Plan 2009-2014 (RCFMP) identified local management priorities for the Clyde catchment as part of a national programme supported by the Scottish Government and coordinated by Rivers and Fisheries Trusts Scotland (RAFTS). This review highlights some of the local science and education initiatives derived from both the RCFMP and the associated River Clyde Biosecurity Plan (see [www.clyderiverfoundation.org](http://www.clyderiverfoundation.org) ).**

**About us:** The Clyde River Foundation researches the ecology of the Clyde and its tributaries and promotes environmental education throughout the catchment. Founded in 1999, the charity works across the eight local authority areas within its management area. The organisation employs five full-time scientists and is based at the University of Glasgow. Our work can be broadly categorised as either “Science” or “Education”. The key features of the Clyde system are the variations in topography and land use across the district, and the high population density (and its effects) in the lower catchment.

**Our mission** is to pursue scientific understanding of the ecological health of the River Clyde and its tributaries, drive environmental improvements across the catchment and build capacity for its stewardship. We aim to achieve this by fulfilling the objectives of the RCFMP.

**Our vision** is for the River Clyde to become the most improved, well-cared for and best understood river system in Scotland, providing social and ecological benefits for all communities across the catchment.



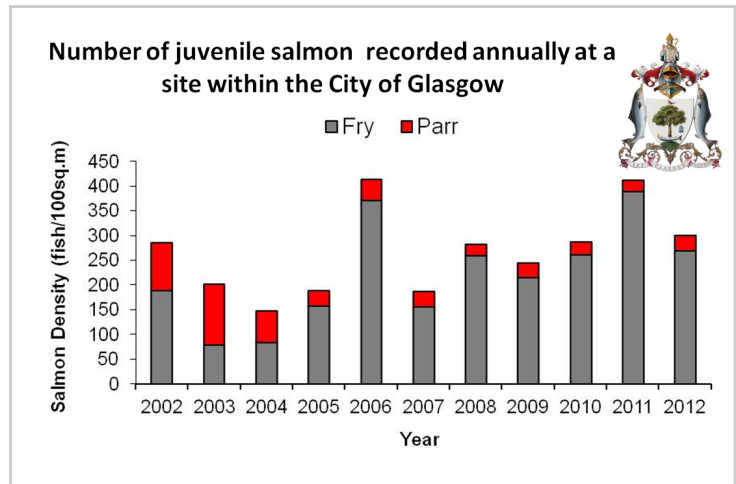
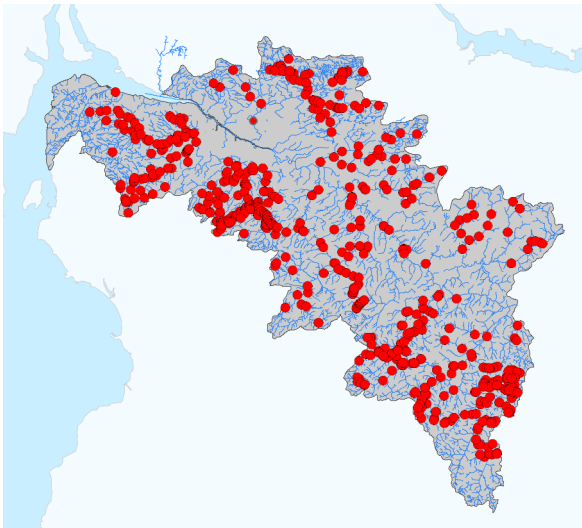
## Clyde catchment facts

- 1.75 million people (>30% of Scotland's population)
- 4,224 km of rivers
- 26.3 km<sup>2</sup> of freshwater lochs and reservoirs
- 33 species of freshwater fish
- 67% of water bodies at “less than good status” under the European Water Framework Directive classification
- No District Salmon Fishery Board (DSFB) so no statutory body overseeing fish and fisheries issues



## Fisheries surveys and data

We collect fishery data annually from across the River Clyde catchment. Since 2002 we have generated 1351 records from 723 different sampling sites and our unique understanding of the fish communities of the River Clyde system is already being used to inform evidence-based fisheries management. Our fisheries data contribute to sustainable development.



We monitor the **distribution** of all fish species, and the **numbers** of salmon, trout and grayling.

The fisheries data are collected for local management purposes including:

- Determining the inter-annual variation in salmon, trout or grayling production
- Researching the distribution of non-native species such as bullhead and signal crayfish
- Assessment of the requirement for, or efficacy of, fish passes
- Baseline surveys to inform development



## Salmon in the Clyde

The Clyde is the largest river on the west coast of Scotland and supported a productive Atlantic salmon fishery until the mid-19th century, when pollution and changes to the banks and beds drove the species to extinction. Salmon reappeared in the Clyde estuary during the 1960s, and improving water quality allowed its return to the River Clyde in numbers in 1983. In what is surely one of the best of all “good news” stories in freshwater biology, this iconic species is now thriving in the Clyde.



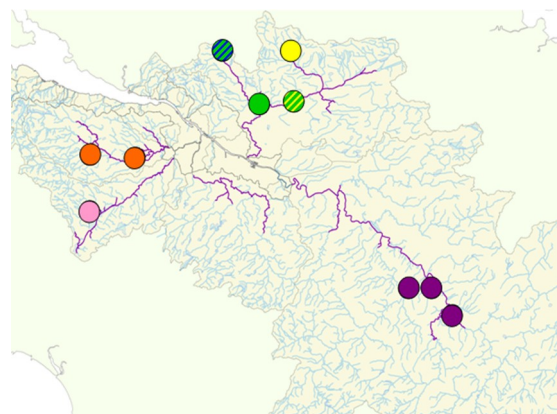
Since 2002 we have encountered juvenile salmon at 68 different sampling sites, indicating that some 279km of river length has been recolonised including major parts of the River Kelvin, the Black Cart, the entire accessible length of the River Clyde and much smaller parts of catchments still containing impassable structures (e.g. River Avon, North Calder Water). Recent habitat survey work has revealed the locations of actual or likely spawning areas in several parts of the catchment, including a site on the River Kelvin within the City of Glasgow.



To complement our juvenile survey work, we are currently commissioning a VAKI Riverwatcher fish counter at Blantyre Weir on the River Clyde in collaboration with our partners Scottish Natural Heritage and RWE NPower Renewables. This machine will generate independent measures of salmon and sea-trout run-sizes and timing in the main River Clyde.

## Focusing Atlantic Salmon Management on Populations - the FASMOP project

In 2009, a partnership between the RAFTS, Marine Scotland Science (MSS), and individual Fisheries Trusts and Boards was established to perform a countrywide survey of genetic structuring within all of Scotland's major salmon-producing rivers. The purpose of this sampling scheme was to define the genetic structure among locations in order to determine whether salmon within and among the various systems represent distinct breeding populations. The FASMOP genetics project has enhanced our understanding of the salmon which are now naturally repopulating the Clyde system. This work, alongside the EU SALSEA-MERGE and other MSS projects, is creating a genetic map of salmon populations across Scotland, to help inform management and conservation efforts.



Genetic structuring of salmon in the Clyde catchment - locations with the same colour are more similar to one another and belong in the same cluster. Those with a mixture of the two colours are due to a lack of ability to assign that site to one cluster or the other. Purple rivers contain salmon.

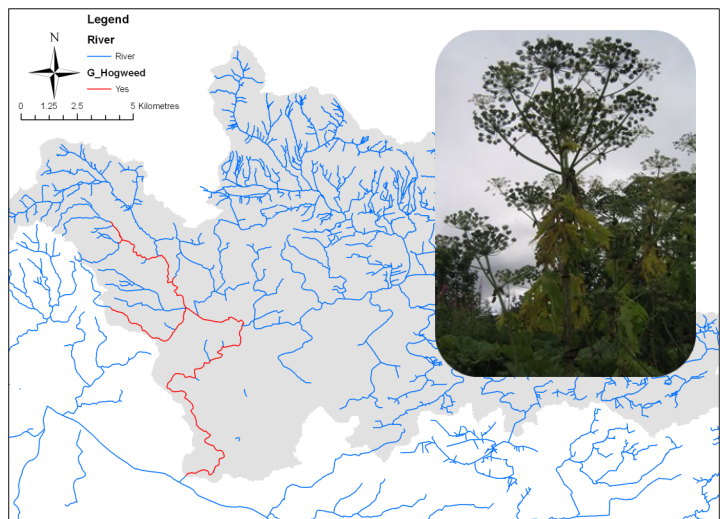
## Invasive, non-native species

The International Convention on Biological Diversity recognised invasive, non-native species (INNS) as “one of the greatest threats to biodiversity, and to the ecological and economic well-being of society and the planet”. In the River Clyde Biosecurity Plan we identified a range of INNS currently impacting upon the catchment, from riparian plants to signal crayfish and bullheads. Management strategies are complex, but an increasingly coordinated approach is emerging.

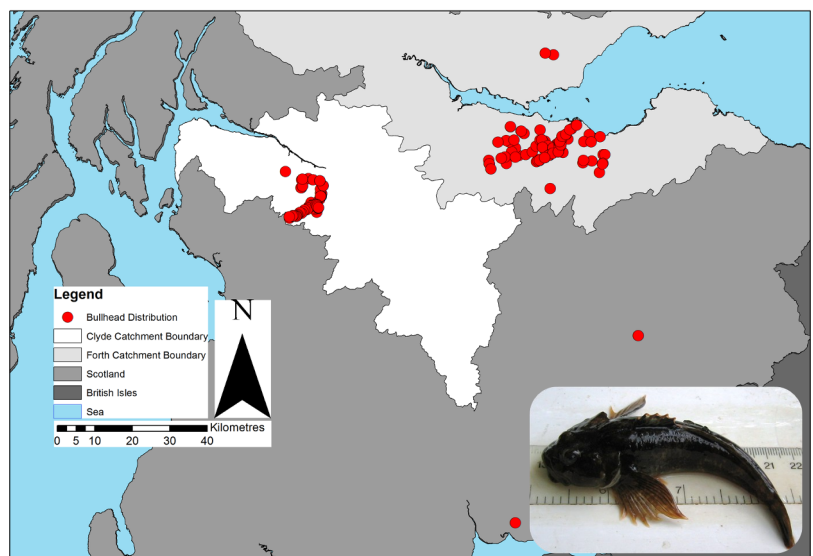
**Signal crayfish:** In partnership with the River Annan Fishery Trust, SNH and South Lanarkshire Council, we installed a barrier near the southern boundary of the catchment to try to halt the spread of signal crayfish from the Clyde catchment into the headwaters of the River Annan.



**Riparian plants:** Japanese knotweed, Himalayan balsam and giant hogweed, all of which are found within the catchment, are known to degrade riparian habitats. We have trialled a rapid survey method to determine the maximum extent of riparian INNS across the Kelvin catchment, as a prelude to detailed survey and consideration of control options.



**Bullhead:** The bullhead is now the most common fish species in a number of rivers in Central Scotland. This small fish occurs in very high densities in the White Cart Water and, while eradication is not an option to protect native biodiversity, there is some scope for constraining populations from spreading further by using artificial barriers. As a first step, we have produced a series of detailed maps describing the known distribution of the species in Scotland.





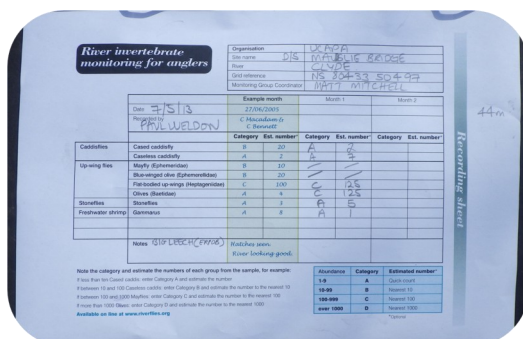
## Biodiversity and water quality

Investigation of invertebrate communities is an essential tool for assessing river ecosystem health. Building on the extensive datasets collected by the Scottish Environment Protection Agency (SEPA), invertebrate sampling has been a routine feature of our work since 2005. We now have data from over 400 sites, collected for impact assessments, student projects, fish feeding studies, biodiversity audits and for the long-term study of headwaters and climate change. This work has consolidated our expertise in species-level identification.

## Clyde Riverfly Monitoring Partnership (CRIMP)

We launched CRIMP in April 2013 - a citizen science project providing training in basic water quality monitoring to 100 volunteers across the River Clyde catchment. CRIMP is supported by SNH and was developed in collaboration with the Riverfly Partnership.

Volunteer participation is important to the delivery of this project and will allow us to assess the sustainability and practical benefits of using the method on a large-scale. The CRF will collate and check results, and report back every three months to contributing monitoring groups, with a facility for more rapid communication with SEPA if pollution is detected.



CRIMP provides a direct mechanism for anglers and other volunteers to contribute to the protection of their local rivers and fisheries.



## Metal Pollution

The Clyde and its tributaries are slowly recovering from centuries of human impact. Extractive industries (e.g. quarrying and mining) and their legacy are still having major effects on some Clyde tributaries.

Lead mining has taken a considerable toll on the health of the upper Glengonnar Water in South Lanarkshire. We have identified elevated lead levels in water, sediment, plants, invertebrates and trout. We have found developmental abnormalities in diatoms, pathology in trout and reduced invertebrate diversity in the worst-affected areas. This chronic heavy metal pollution is a significant human impact on ecosystem health and causes a high proportion of resident trout in the worst-affected areas to have “black tail” pathology. We hope to monitor the recovery of the Glengonnar Water in the coming years, although active intervention will be needed to minimise the environmental effects of the metals present in the watercourse.



## Is the Upland Summer Mayfly in hot water?



Photo: Stuart Crofts

We have a particular interest in the upland summer mayfly, *Ameletus inopinatus*, and are expanding our understanding of its biology and ecology to assess its potential utility as an indicator of climate change in conjunction with the Riverfly Partnership and Buglife. This mayfly has a discontinuous geographical distribution in Great Britain, appearing to be restricted to higher latitudes and higher altitudes, presumably because it requires colder climates to persist. We believe that increased air temperatures are likely to cause further reductions in suitable habitat and increased fragmentation of existing populations.

## Habitat Restoration

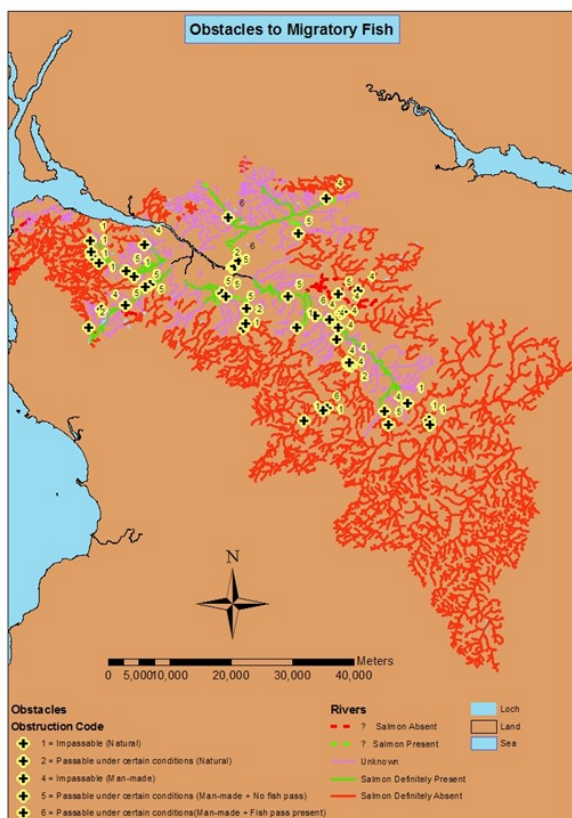
We have surveyed over 200km of the Clyde and its tributaries. In addition to the Scottish Government, our habitat work has been supported by the River Kelvin Angling Association, United Clyde Angling Protective Association Ltd, the Crown Estate, Central Scotland Forest Trust and South Lanarkshire Council. Quantitative and qualitative data has been collected for the various broad salmon and trout habitat types, with a view to initiating physical restoration where it would be most beneficial and cost effective.





## Barrier Removal

The industrial legacy of the Clyde and its tributaries means that considerable morphological changes have occurred to the banks and beds of many rivers. The most damaging of these changes for migratory salmon, sea trout, eels and lampreys, was the construction of weirs to harness water power during the 18th and 19th centuries. These structures helped drive Clyde salmon to extinction in the 19th century and, as water quality has improved in recent decades, some have prevented the recolonisation of potential spawning areas upstream.

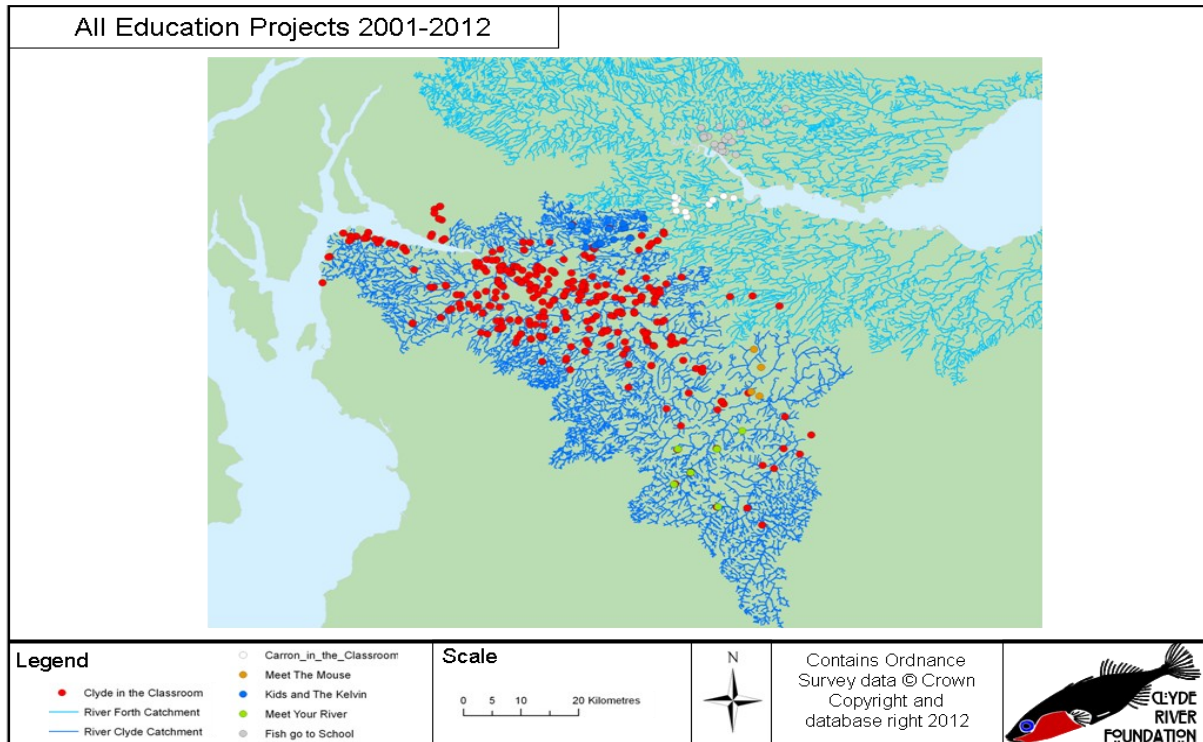


Our habitat surveys have identified many legacy barriers and, while fish passes have been provided at a small number, there are still significant proportions of the freshwater catchment denied to fish ascending to spawn. Through a combination of our fishery survey and habitat assessment data, we have been able to guide the Barrier Assessment and Easement project coordinated by RAFTS and supported by SEPA to target the potential removal or easement of barriers which know would have the largest impact. The biggest challenges to the restoration of salmon to its former, natural, range in the Clyde system are finding sufficient funding to support remedial works on those barriers which are subject to Controlled Activity Licences, and also addressing the large number of unlicensed structures (e.g. road and rail bridge aprons) which are strongly suspected to prevent upstream migration in some areas.

**Our data and local management experience provide a focus for national projects to drive improvements in the catchment; we will continue to identify and address habitat bottlenecks and locations where intervention will allow migratory fish species to recover their natural, pre-industrial range.**

## From P3 to PhD

Given the size of the human population, and the wide variety of education and outreach activities possible in a catchment the size of the Clyde, our approach has been to develop robust projects, targeted at specific sectors. The key to our schools work has been to harness economies of scale to deliver Curriculum for Excellence outcomes to large numbers of children simultaneously. We continue to supervise the research of students at the University of Glasgow, from undergraduate to PhD.



Since 2001, 16,221 pupils from 318 different Primary Schools have participated in 'Clyde in the Classroom'. In partnership with the Glasgow Science Centre, the project has involved 57% of all the Primary Schools located within the River Clyde Catchment and 15% of all Primary Schools in Scotland to date ([www.clydeintheclassroom.com](http://www.clydeintheclassroom.com)). The project is effectively crowd-funded, with the participating schools themselves contributing about 35% of the costs annually - an amazing confirmation of the value of Clyde in the Classroom to the participants.



*"Clyde in the Classroom has been the highlight of the year for Primary 5 children at Millersneuk for the last 10 years. It truly is an amazing interdisciplinary project which inspires and motivates pupils and staff alike. The children are captivated as carers of the trout, learning new skills in Social Studies, Science, Numeracy & Mathematics and Health & Wellbeing. This project is Curriculum for Excellence at its best!"*

Head Teacher, Millersneuk Primary School



## Environmental education across eight counties

The Clyde River Foundation enjoys productive relationships with schools throughout East and West Dunbartonshire, North and South Lanarkshire, East Renfrewshire, Renfrewshire, Inverclyde, and the City of Glasgow. Clyde in the Classroom was expanded into 'Meet Your River' and 'Meet the Mouse' where pupils from ten Primaries in South Lanarkshire were given guided tours of the fish and invertebrates of their local rivers.



In 2011, we delivered 'Kids and the Kelvin' to 357 children from 14 schools across the communities of the upper Kelvin catchment. This project featured trout rearing and release and one Meet Your River day for each class. Pupils from two of the schools involved, Chapelgreen and Twechar Primaries, were the first people alive to have seen juvenile salmon in the burns running through their villages.



These projects provided an impetus to provide "modular" projects and two have been running in parallel in 2013.

In the RCFMP we highlighted the need to develop a secondary school project. In 'Trout at Transition', a combination of Clyde in the Classroom and Meet Your River, we are joined by the artist Holly Keasey as a "Water Tourist". Trout at Transition has involved all P7 children in the Biggar High School learning community and, for the first time sees the CRF working with the same group of children across their transition from Primary to Secondary education.



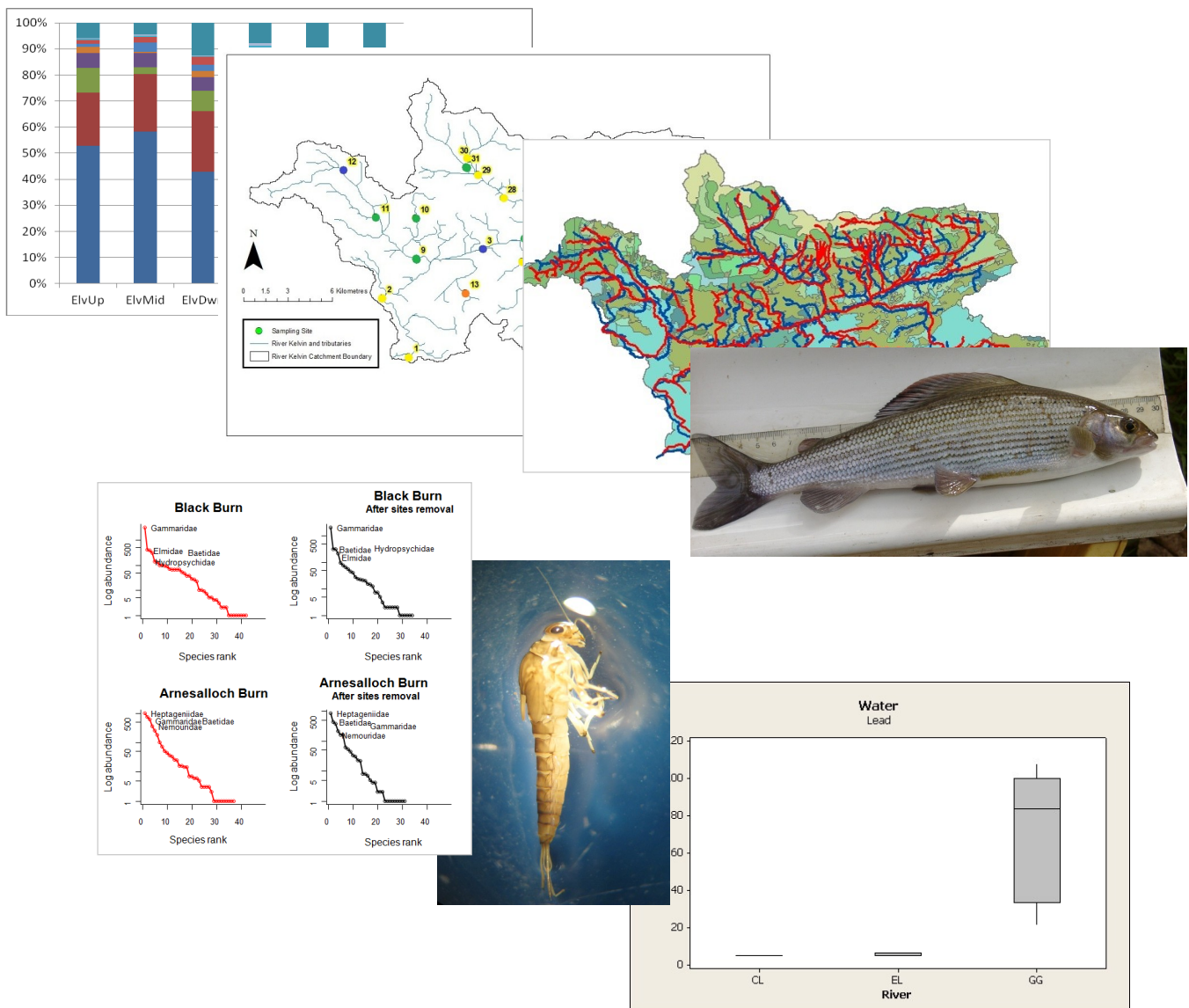
'Trout 'n' Trees' is explaining the relationships between rivers and their bankside vegetation (via nutrient and biological cycling) to children from 15 schools across the upper Kelvin Valley. We are working with the Central Scotland Forest Trust to develop aspects of this project for use in other areas of the catchment.



## University research projects

While school projects provide a mechanism to support broad changes in societal attitude towards the River Clyde, student dissertations provide the opportunity for CRF staff to become involved in more focused, targeted research into the Clyde and its tributaries. As Honorary members of staff of the University of Glasgow, we undertake some undergraduate teaching and we typically supervise 5-10 student projects per annum (Honours and MRes). Our first PhD student (in collaboration with Glasgow University, SNH and SEPA) recently completed her studies on the impact of the invasive American signal crayfish. We have also supervised students from Napier University and the University of the West of Scotland.

Projects usually involve a mixture of field and laboratory work (we maintain a small laboratory) on an ecological topic related to the Clyde or its tributaries. Recent projects have involved ecological impact assessments, conservation value of invertebrate communities, fish parasites, studies into the ecology of the upland summer mayfly, non-native species (bullhead, riparian plants, crayfish), fish behaviour, loss of trout and salmon habitat, and water quality studies (long-term data, heavy metal pollution).





## To the wider community...

The Clyde catchment contains both highly urbanised and rural areas, which present a variety of different challenges. We have an extensive outreach programme, involving schools and communities around the catchment. Sustained public engagement is an essential part of long-term river management and the Foundation contributes to a number of formal and informal events every year.

Our preliminary approach was to concentrate on Primary School science and also to recruit angling club members to contribute to our fish sampling programmes. To engage anglers with fisheries science, we promote appropriate training for volunteers from local angling clubs and associations. We now have a pool of approximately 20 SFCC-qualified electrofishing personnel.



Other volunteering opportunities have involved invasive riparian plant surveying and CRIMP, with training either provided by or funded via the CRF. Partnership work with TCV Scotland has involved the CRF in the training of three apprentices (Riverflies, Headwaters and Natural Communities) and each has made a significant contribution to the development of the Foundation. A progressive approach to the practical stewardship of the river - a key component of the River Clyde Fishery Management Plan - has been promoted by their work, with the Foundation and subsequently (with the Riverfly Partnership, the CRF, and Scottish Wildlife and Countryside Link respectively).

The Foundation has been involved in the training of three Fisheries Society of the British Isles Interns - undergraduates or recent graduates funded by the FSBI - to undertake practical research with experienced scientists. Two have worked on the bullhead problem, one on lead pollution and its pathology in trout. All three have contributed to the work of the Foundation during their training under this useful partnership.

We have recently employed a fifth team member, who will lead on the continued development of our websites and social media (Facebook and Twitter) and enable us to reach and communicate with a wider audience.

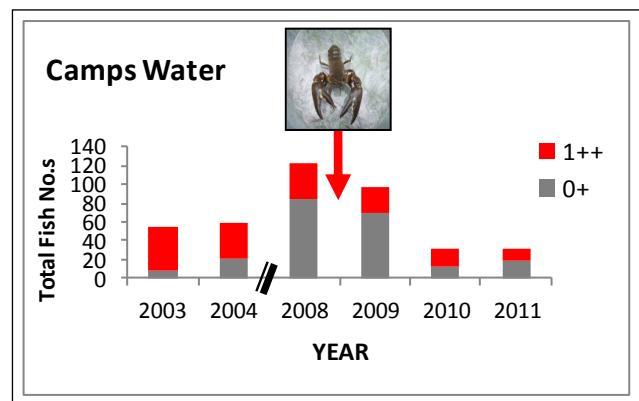


# What next?

## Incoming.....

The sometimes intense development pressure on the Clyde system, coupled with the work necessary to raise the general standard of the catchment under the Water Framework Directive, and a general desire within communities to simply know more about their rivers, means that there is a greater demand than ever for the services we can provide. The Clyde River Foundation will therefore strive to maintain and expand its portfolio of capabilities to pursue its aim of evidence-based, environmental quality improvement. To do this, we have the self-evident requirement to achieve a sustainable funding model with which to maintain the considerable experience of the team to enable us to continue to deliver our portfolio of science and education projects. This remains our highest priority.

Scientifically, we anticipate great interest in the data from the River Clyde fish counter when the data start to be made available in 2013. We are continuing our studies of the effects of invasive crayfish and bullhead on trout populations.



There is considerable scope for river restoration across the Clyde catchment and, as well as the national barrier assessment project, we are involved formally in the Glazert Water Project, which is one of four across Scotland commissioned by SEPA to assess the practicalities of generating multiple benefits (e.g. flood defence and biodiversity) using river restoration funding under the Water Framework Directive.

The River Clyde FMP contained an aspirational target to develop skills and retain in-house knowledge of survey techniques for mammals (particularly otter, mink and water vole) to allow us to contribute to wider riparian surveys. As a collateral benefit, our communications specialist has appropriate training and experience of otter, water vole and bat surveys.

The success of our education programme has given us the confidence to promote the concept of "Meet Your River" days to the Centre for Open Access at the University of Glasgow. We hope to run our first course in the autumn of 2013.

We were approached by the Nuffield Foundation to provide a placement for a student from James Watt College during the summer of 2013. We have, therefore now worked with the Further Education sector, and are looking forward to supervising a project on assessing the extent of organic pollution in a burn in Renfrewshire.

**We therefore have a full programme of work for 2013-2014 and, subject to appropriate funding being secured, subsequently. We gratefully acknowledge the generosity of our partners to date.**





[www.clyderiverfoundation.org](http://www.clyderiverfoundation.org)

[info@clyderiverfoundation.org](mailto:info@clyderiverfoundation.org) • 0141 330 5080



[www.facebook.com/ClydeRiverFoundation](https://www.facebook.com/ClydeRiverFoundation)



[@ClydeRF](https://twitter.com/ClydeRF)

A Scottish Charity SC 029602

Company limited by guarantee SC 196438