

The changing biodiversity of the River Foss

The wildlife of the River Foss has undergone marked changes since the publication of Michael Fife and Peter Walls' *The River Foss – its history and natural history* back in 1973. On the debit side, the river's plantlife is rather poorer and floodplain wetlands have largely disappeared. More positively, the Otter has made a remarkable return and the fortunes of the beleaguered Water Vole look rather brighter than they did 44 years ago. But what can we learn if we delve further back in the archives?

Firstly, there is much to discover from plant and invertebrate remains preserved in waterlogged silts on the river banks, made accessible through the painstaking work of the Environmental Archaeology Unit of the University of York. A long sequence of deposits spanning over a thousand years has been examined at Layerthorpe Bridge, for example. This shows that during the medieval period the lower Foss supported a diverse aquatic and marginal flora including many of the species subsequently recorded by Georgian, Victorian and Edwardian naturalists. Indeed, there appears to have been remarkable continuity between the medieval flora of the lower Foss and species lists compiled at the beginning of the 20th century. A notable exception is River Water-dropwort, a rare member of the carrot family found in clean, calcium-rich rivers – its distinctive seeds are preserved in medieval sediments excavated at Layerthorpe Bridge but it was never recorded from the river by botanists.

Flora

'Modern' botanical records for the river stretch back to the late 18th century: Reverend James Dalton, an eminent Yorkshire parson-naturalist, found Greater Water-parsnip "in plenty" on the Foss Navigation in York in 1787. Archdeacon Pierson, a contemporary of Dalton's, collected Small Water-pepper, now a rare annual of muddy water margins, from Foss Islands.

Plentiful plant records are then available through to 1906, at least for the section between Huntington and central York. Unfortunately, data is then scarce until the publication of Fife and Walls's study in 1973 – but it is clear that a massive decline in botanical diversity took place during the 20th century with at least 25 aquatic and emergent species disappearing. Many of the plants lost from the river and its adjoining wetlands are now scarce and declining throughout lowland England including Water Violet, Alternate Water-millfoil, Least Bur-reed, Red Pondweed, Flat-stalked Pondweed, Opposite-leaved Pondweed and the now-endangered Greater Water-parsnip.

Even during the medieval period, the vegetation of the lower Foss was characterised by plants of fertile, mineral-rich waters including species like Yellow Water-lily, Arrowhead and Fennel Pondweed which survive to this day. However, there were also numerous species which prefer less nutrient-enriched conditions, so increased levels of nitrates and phosphates have almost certainly been a major driver of botanical decline. Analysis of the data shows that species lost from the lower Foss prefer significantly less nutrient-rich conditions than those which remain. Changes in river management, the drainage and reclamation of Foss Islands in the late 19th century and the loss of floodplain ditches and other wetlands have also contributed.

A few losses have occurred since the publication of 'Fife and Walls' and there have been some changes in the abundance of individual species since the early 1990s but the good news is that few species have been lost during the past 25 years.

Regrettably, we know little about the historic or current flora of the middle-to-upper reaches of the river. We need to find out more about the distribution of environmentally-sensitive indicator species such as Stream Water-crowfoot in the Foss upstream of Sheriff Hutton.

Fish

Archaeologists have shown that Burbot, a fish now extinct in Britain, was on the menu for Anglo-Saxon and Viking era human inhabitants of York. Documentary records of this enigmatic, cold-water fish date back to 1721 and continue to 1900. Up to the mid 20th century, the Yorkshire Ouse catchment was a stronghold for Burbot but it was last reliably recorded in Britain in 1969. In a national context, this species may have been an early victim of climate change though contemporary sources attributed its demise in the Foss to pollution from York Gas Works.

There is little evidence of change in the status of other fish species in the Foss, though it would be useful to determine whether Ruffe and Silver Bream still occur. Along with Burbot and Barbel, these fish are considered indigenous only to the river systems of eastern England, which they colonised at the end of the last Ice Age when the east coast was still physically connected to continental Europe. As such, populations in the Humber basin may constitute distinct genetic lineages.

Molluscs and other invertebrates

Aquatic snails and mussels make up a significant part of river invertebrate communities, in terms of both biomass and number of species. They also play important roles in the river ecosystem, with grazing snails preventing algae from smothering submerged plants and filter-feeding mussels clearing the water of suspended sediment. Some molluscs are

remarkably tolerant of water pollution while others are sensitive, so they provide useful indicators of the health of the water environment.

There is a remarkably long and detailed set of data on the molluscs of the lower Foss, possibly surpassing most other rivers in the world. Martin Lister, a York physician and renowned polymath, is often referred to as the 'father of conchology' (the study of molluscs). His *Historiae Animalium Angliae*, published in 1687, represents the first attempt to catalogue English molluscs and includes specific records of Painter's Mussel and Great Ram's-horn Snail from the River Foss as well as more general references to species occurring in the vicinity of York. During the mid 19th to early 20th century, the study of molluscs was a popular pursuit amongst naturalists with a series of publications on the Yorkshire fauna including detailed records from the lower Foss. This historic baseline can be compared to the lists for 1950-1973 provided by Fife & Walls and National Rivers Authority/Environment Agency biological monitoring data for the period 1990 to present. This shows that more sensitive species such as Freshwater Nerite, River Snail and River Limpet have declined or disappeared while there are no recent records for Painter's Mussel and Swollen River Mussel, which once abounded in the lower Foss.

Archaeological investigations at Layerthorpe Bridge have shown that one of Britain's most threatened freshwater invertebrates, the Crystal Moss-animal, was plentiful in the lower Foss from the medieval period right through to the 19th century. This delicately beautiful colonial organism releases bud-like propagules contained within a hardened cyst known as a statoblast, and it is these cases which archaeologists have identified from riverbank sediments. Although it is believed to have declined massively, the Crystal Moss-animal is relatively tolerant of nutrient pollution and there is a remote possibility that it might still survive in the Foss.

We have relatively little historic evidence for other invertebrates. One notable exception is early 19th century records of the Two-toned Reed-beetle from the Foss at York, published in J.F. Stephens' seminal *Illustrations of British Entomology* in 1835. This is yet another formerly widespread species which is now very rare in Britain, reed-beetles being sensitive ecological indicators in aquatic and wetland environments.

Over 170 species of aquatic invertebrate have been recorded from the Foss, mostly as a result of biological monitoring by the Environment Agency. Recent data suggests that invertebrate communities on the Foss are characterised by relatively tolerant species of slow-moving, silty and nutrient-enriched rivers though more sensitive groups like mayflies, caddisflies and riffle beetles persist locally, especially in the middle reaches around Lilling Green and Marton Abbey. The overall pool of species is considerably healthier than in the degraded urban rivers of the conurbations of West and South Yorkshire, suggesting that the biodiversity of the Foss is capable of recovery if water and habitat quality can be improved.