Invertebrates of the River Foss

A report for the River Foss Society



Illustrations of freshwater mussels from Martin Lister's *Historiae Animalium Angliae*, published in 1678. Lister was the first naturalist to record invertebrates from the River Foss.

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Introduction

Over 170 aquatic invertebrate taxa have been recorded from the River Foss, mostly identified to species level but a few identified only to genus, family or other level. The majority of data are from Environment Agency sampling stations at Marton Abbey, Lilling Green, Strensall, Huntington Church and Castle Mills for the period 1995 to 2016. Few records are available for the upper Foss, where a considerable number of additional species are likely to be found. For a few groups, especially molluscs, older records are available and these provide valuable insights into changes in the ecology of the river.

Archaeological investigations from riverside sites in central York also provide some interesting information about the past fauna of the Foss. For example, examination of deposits at Layerthorpe Bridge has revealed statoblasts of the bryozoan *Lophopus crystallinus* from several samples of fluvial sediment (statoblasts are pods of cells which allow asexual reproduction). These deposits ranged in age from the Anglo-Scandinavian period to the 19th century (Hall *et al*, 2000), indicating that *Lophopus* had a very long history of occupation of the lower Foss. The Crystal Moss-animal, to give its English name, is a colonial invertebrate which is a filter-feeder on microscopic algae and bacteria in nutrient-rich, slow-flowing waters.

Although once widespread, the Crystal Moss-animal has declined greatly. This is probably due to a combination of water pollution and river engineering: although the species needs nutrient-rich water, if a river becomes too eutrophic, it will lose the aquatic vegetation on which moss-animals anchor themselves. There is a small possibility that this intriguing creature could still be present in the river, as it is unlikely to be recorded by conventional invertebrate sampling methods.

Flatworms (Tricladida)

Sampling data suggests that flatworms are more abundant at Strensall and Huntington than at sites upstream or downstream. Flatworms do not preserve well in bulk samples of invertebrates so are usually only identified to family level, though five species have been identified from the river. The rather shapeless, white *Dendrocoelum lacteum* is a common species in the middle to lower reaches. The non-native *Dugesia tigrina* has been collected once, from Huntington in 2004.

Leeches (Hirudinea)

Eight widespread leech species are recorded from the River Foss, the most frequent being *Glossiphonia complanata, Erpobdella octoculata* and *Helobdella stagnalis*. The Duck Leech *Theromyzon tessulatum* occurs from Marton Abbey to the Ouse confluence but the Fish

Leech *Piscicola geometra* appears to be confined to the slow-moving lower reaches where its hosts are most abundant.

Molluscs

Small amounts of aquatic mollusc remains have been identified from archaeological deposits associated with the River Foss. Late medieval material from a site adjoining the King's Fishpool at Piccadilly, for instance, yielded Whirlpool Ramshorn snail *Anisus vortex*, Margined Ram's-horn *Planorbis planorbis*, Wandering Snail *Radix balthica*, Leach's Bithynia *Bithynia leachii* and a valve-snail *Valvata* sp. Deposits from the Anglo-Scandinavian period (10th or 11th century AD) at the same location, pre-dating the Fishpool, produced orb-mussel *Sphaerium* and pea-mussel *Pisidium* remains, Common Valve-snail *Valvata piscinalis*, *P. planorbis*, *A. vortex*, *R. balthica* and Dwarf Pond-snail *Galba truncatula* (York Archaeological Trust, 1992).

The first scientist to record wildlife from the Foss was Martin Lister (1639-1712), a doctor of medicine who lived in York in 1670-1683 and later became physician to Queen Anne. A true polymath, Lister made important contributions to arachnology (the study of spiders), conchology (the study of molluscs), archaeology, geology and several other sciences. His *Historiae Animalium Angliae*, published in 1678, comprised three sections covering spiders, terrestrial and freshwater molluscs and marine molluscs. In this work, the River Foss is mentioned as a location for Greater Ram's-horn *Planorbarius corneus* and Painter's Mussel *Unio pictorum.* The excerpt on the right below (in Latin) describes Painter's Mussel as "found in abundance in the rivers Ouse and Foss near York".

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From the late 19th century onwards, records of aquatic molluscs from the lower section of the river are plentiful. Table 1 collates records from a range of historic sources (North, 1860; Nelson & Taylor, 1878-1885; Christy, 1881; Hey, 1887; Taylor, 1894; Brode, 1906; Morehouse, 1939 & 46; Fife & Walls, 1981)¹ together with National Rivers Authority data for Monk Bridge for the period 1980-89; and more recent Environment Agency sampling data.

Family	Species	English name	1860- 1906	1950- 70	1980- 89 ²	>1999
Neritidae	Theodoxus fluviatilis	River Nerite	•			
Viviparidae	Viviparus viviparus	River Snail	•	•	•	•
Bithyiniidae	Bithynia leachii	Leach's Bithynia	•			•
	Bithynia tentaculata	Common Bithynia	•	•	•	•
Valvatidae	Valvata cristata	Flat Valve Snail	•	•	•	•
	Valvata piscinalis	Common Valve Snail	•	•	•	•
Acroloxidae	Acroloxus lacustris	Lake Limpet	•	•	•	•
Lymnaeidae	Galba truncatula	Dwarf Pond Snail	•			
	Lymnaea stagnalis	Great Pond Snail	•	•	•	•
	Stagnicola palustris	Marsh Pond Snail	•			•
	Radix auricularia	Ear Pond Snail	•	•	•	•
	Radix balthica	Wandering Snail	•	•	•	•
Physidae	Physa fontinalis	Common Bladder Snail	•	•	•	•
Planorbidae	Ancylus fluviatilis	River Limpet	•			•
	Anisus leucostoma	White-lipped Ram's-horn	•			
	Anisus vortex	Whirlpool Ram's- horn	•	•	•	•
	Bathyomphalus contortus	Twisted Ram's- horn	•			

¹ Fife & Walls (1981) cited old records of Lister's River-snail *Viviparus contectus* and Shining Ram's-horn *Segmentina nitida* from the Foss. However, examination of the literature does not reveal any records from the River Foss of *V. contectus*, which was present in the Ouse up to the mid-19th century. The nomenclature of the small ram's-horns has changed several times and it is unclear which species is referred to in listings from the Foss of *'Planorbis nitidus'* (Nelson & Taylor) and *'Planorbis lineatus'* (Christy, 1881).

² At Monk Bridge, NRA biological monitoring data indicated that most gastropod species declined in abundance during the 1980s. Smooth Ram's-horn *Gyraulus laevis* was recorded as rare but this may have been a mis-identification.

	Gyraulus albus	White Ram's-horn	•		•	•
	Gyraulus crista	Nautilus Ram's- horn	•			•
	Hippeutis complanatus	Flat Ram's-horn	•		•	
	Planorbarius corneus	Great Ram's-horn	•	•	•	
	Planorbis carinatus	Keeled Ram's-horn	•	•		•
	Planorbis planorbis	Margined Ram's- horn		•		•
Unionidae	Anodonta anatina	Duck Mussel	•	•		•
	Anodonta cygnea	Swan Mussel	•			•
	Unio pictorum	Painter's Mussel	•	•		
	Unio tumidus	Swollen River Mussel	•	•		
Sphaeriidae	Musculium lacustre	Capped Orb-mussel	•	•		
	Musculium transversum	Oblong Orb-mussel	•			
	Sphaerium corneum	Horny Orb-mussel	•	•		•
	Sphaerium rivicola	River Orb-mussel	•	? ³		•
	Pisidium amnicum	River Pea-mussel		•		•
	Pisidium milium	a pea-mussel		•		
	Pisidium nitidum	a pea-mussel		•		
	Pisidium personatum	a pea-mussel		•		
	Pisidium subtruncatum⁴	a pea-mussel		•		

An impressive 37 species of aquatic mollusc have therefore been recorded at some time from the River Foss though several have declined or disappeared altogether from the river. Christy (1881) noted mortality of river mussels when the river was drained down, presumably for maintenance of the navigation, and Adrian Norris (in Fife & Walls, 1981) commented on declines in species such as River Snail due to dredging. The apparent loss of species such as White-lipped Ram's-horn and Dwarf Pond Snail has no significance as these are snails of shallow ponds, seasonal pools and ditches rather than rivers and their occurrence within the channel was probably only ever casual. More significant is the

³ The Foss was referred to a site for *S. rivicola* by Morehouse (1939) and dead shells were found in 1967 (Adrian Norris per Fife & Walls, 1981).

⁴ Morehouse (1943) cited an undated record for a further *Pisidium* species, *P. supinum*, from the river.

apparent disappearance of River Nerite, Swollen River Mussel and Painter's Mussel and decline of River Snail, Ear Pond-snail and River Limpet. The only recent records of River Snail are from Castle Mills Lock and may represent inwash from the River Ouse. With the possible exception of Ear Pond-snail, these are molluscs which are sensitive to organic pollution, i.e. effluent which reduces dissolved oxygen levels, so deteriorating water quality is likely to have been the main driver of these declines.

The loss of Swollen River Mussel and Painter's Mussel is concerning since these large bivalves play a functionally important role as filter feeders, capturing suspended organic particles. Both species were repeatedly described as abundant in the lower Foss in the 19th century. Dredging can seriously impact large mussels by removing adults: these are slow-growing, long-lived animals which do not reach sexual maturity until around four years of age, so they cannot recover as quickly as invertebrates with an annual life-cycle. A single dredging operation has been shown to remove up to 20% of the population of large river mussel species (McIvor & Aldridge, 2007).

It is likely that river engineering such as the 1972 widening scheme has reduced the diversity of habitats within the channel and at the river's edge, which will have affected the diversity and abundance of molluscs.

The lack of recent records of Flat Ram's-horn and Twisted Ram's-horn could reflect a decline in submerged vegetation though these species might persist locally as they still occur in Oulston Reservoir. A relatively recent addition is Jenkins's Spire-snail *Potamopyrgus antipodarum*, a species of New Zealand origin which is now amongst the most abundant freshwater gastropods in Britain. It was first recorded on the Foss at Oulston Reservoir in 1951 (Morehouse, 1951).

Amongst the more notable species, Oblong Orb-mussel is a non-native which spread through parts of the English canal system in the 19th century (e.g. McMillan, 1990); it is variously named as *Cyclas ovalis*, *Sphaerium pallidulum* and *S. transversum* in old literature. It may now have disappeared from the Foss as there are no modern records.

An interesting record of the Small Amber Snail *Succinella oblonga* dates back to 1877, when a single shell was found in flood-borne debris at Yearsley Lock (Christy, 1881). This wetland Red List species is categorised as both Vulnerable and Nationally Rare (Seddon *et al*, 2014). Amber Snails are not aquatic but inhabit riparian or other wetland vegetation.

Crustacea

Amongst the macroscopic crustaceans, the ubiquitous Water Hoglouse *Asellus aquaticus* occurs throughout the river, with thousands of individuals sometimes present in biological monitoring samples. The less frequent *Proasellus meridinianus* has been detected only at Marton Abbey and Strensall. The native Freshwater Shrimp *Gammarus pulex* is most

abundant from Lilling Green upstream, though small numbers are found downstream. By contrast, the non-native amphipod shrimp *Crangonyx pseudogracilis* is tolerant of lower levels of dissolved oxygen and occurs only from Strensall downstream.



White-clawed Crayfish were first reported in the upper Foss in the early 1950s and were found again by John Skelton in 1989. An apparently healthy population was relocated in a short stretch of the river in 2017.

White-clawed Crayfish is classed as globally Endangered by the International Union for the Conservation of Nature (Füreder *et al*, 2010). It has a restricted distribution in western and central Europe in unpolluted, calcium-rich rivers and streams. Almost throughout its range, this species is seriously threatened by feral, non-native crayfish which have escaped from fish farms where they are reared for the restaurant trade. In Britain, the main threat is the rapid expansion of the North American Signal Crayfish which carries a fungal pathogen known as crayfish plague: this does not affect Signals but is 100% lethal to White-claws once it enters a watercourse. North Yorkshire was, until recently, a national stronghold for White-clawed Crayfish but most river systems have now been invaded by Signals, even in remote streams in the Yorkshire Dales. The upper Foss is therefore an important refuge and needs careful protection.

PLEASE NOTE: WHITE-CLAWED CRAYFISH IS PROTECTED UNDER SCHEDULE 5 OF THE WILDLIFE & COUNTRYSIDE ACT AND IT IS ILLEGAL TO SEARCH FOR IT WITHOUT A SPECIAL SURVEY LICENSE.

Mayflies (Ephemeroptera)

Thirteen species of mayfly have been identified from EA samples from the Foss plus *Ecdyonurus* identified only to genus. The most frequently recorded mayflies are *Caenis luctuosa* and the Dark Green Drake *Baetis rhodani*. The average number of mayfly larvae per sample (Figure 1) shows a rather different pattern to caddis (Figure 3). This is because more tolerant Caenidae and Baetidae can be present in large numbers in the lower Foss.



Figure 1: mean number of individual mayfly larvae per sample (based on EA biological monitoring data, 1995-2016)

However, the families Heptageniidae, Leptophlebiidae, Ephemeridae and Ephemerellidae are rare or entirely absent below Lilling Green (Figure 2). These families are highly sensitive to organic pollution, though their distribution will also be influenced by habitat quality.



Figure 2: mean number of Heptageniidae, Leptophlebiidae, Ephemeridae and Ephemerellidae individuals per sample (based on EA biological monitoring data, 1995-2016)

Stoneflies (Plecoptera)

Stoneflies were rarely recorded during biological monitoring of the Foss over the period 1995-2016, the only records being very small numbers of undetermined *Leuctra* and *Nemoura* species at Marton Abbey in 2002 and 2013. It is likely that more stoneflies would be encountered in the upper river immediately above and below Oulston Reservoir.

Damselflies and dragonflies (Odonata)

Environment Agency sampling data features occasional larval records of Blue-tailed Damselfly *Ischnura elegans* and Common Blue Damselfly *Enallagma cyathigerum* and occasional dragonflies including one record of Migrant Hawker *Aeshna mixta*. Observations of adults suggest that several Odonata are probably regular breeding species in the lower river including Common Darter *Sympetrum striolatum* and Brown Hawker *Aeshna grandis*.

The eye-catching Banded Demoiselle damselfly *Calopteryx splendens* is now a common sight on the lower Foss and larvae have been detected in small numbers in biological monitoring samples from Lilling Green downstream. Interestingly, this species was not mentioned from the Foss in natural history literature prior to Fife & Walls (1981) so it appears to be a relatively recent colonist of the river despite its long-standing presence in the Ouse. Banded Demoiselle was traditionally considered to be at the northern edge of its range in North Yorkshire and has increased its range in lowland rivers in northern England during the past 30 years. This is probably an example of a species colonising the Foss due to the wider effects of climate change rather than any improvement in water or habitat quality.

Alderflies (Megaloptera: Sialidae)

Common Alderfly *Sialis lutaria* larvae are widespread in small numbers in the middle and lower reaches of the river.

Water beetles (Coleoptera)

Early records of water beetles from the River Foss include the Two-toned Reed-beetle *Donacia bicolora*, collected by W.C. Hewitson and mentioned in J.F. Stephens *Illustrations of British Entomology* (Stephens, 1831)⁵. This species has undergone a marked reduction in range and is now categorised as Nationally Scarce (Hubble, 2014); it is no longer known in the north of England although its habitat, bur-reed beds in slow-flowing water, remains widespread. Two other reed-beetles, *Donacia marginata* and *D. semicuprea* were collected from the Foss by Robert Cook around 1828 (Stainforth, 1944; Bayford & Lawson Thompson, 1907). Reed-beetles develop as larvae and pupate attached to the roots of water plants, with the adults feeding on the aerial or floating parts of the same hosts. Many species are in

⁵ The species was called *Donacia sagittariae* by Stephens; Stainforth (1944) also cites this species as having been obtained from the Foss by Robert Cook, another early 19th century entomologist.

serious decline, not only in Britain but in other parts of their global range (Cox, 2007), probably due to deteriorating water quality or the effects of pesticide residues rather than direct loss of their food plants.

Water beetles have been moderately well-recorded from the Foss in recent years as a result of fieldwork for a Yorkshire atlas (Hammond, 2017). Some 34 species have been recorded from the river since 1995 though only 12 of these can be considered truly riverine species.



Elmis aenea, a riffle beetle which occurs locally in the middle reaches of the River Foss and more occasionally further downstream. Riffle beetles require well-oxygenated water and firm surfaces on which to cling. Illustration © Jonathan Graham.

The data suggests that the lower reaches of the river are characterised by tolerant species of slow-moving, nutrient-rich rivers such as the algivorous water beetle *Haliplus fluviatilis* and the small diving beetle *Nebrioporus elegans*. Riffle-beetles belonging to the family Elmidae occur locally; these require well-oxygenated water, suggesting that chemical water quality is at least fair in places, though these are probably confined to small areas with accelerated flow, such as under bridges. One scarce riffle-beetle, *Riolus subviolaceus*, was collected upstream of Sheriff Hutton Bridge in 2009. The fact that such insects survive in places shows that the biodiversity of the Foss could be restored to a more healthy balance if water and habitat quality could be improved.

Caddis-flies (Trichoptera)

Twenty-four species of caddis have been recorded as larvae from the Foss plus *Glossoma* species and the 'micro' caddis *Hydroptila*, which have only been identified to genus. All are widespread nationally, though *Molanna angustata* is close to the northern edge of its core range in the River Foss. The most frequently recorded species are *Hydropsyche pellucidula*, *H. siltali* and *Molanna angustata*. There are occasional records of caddis associated with fast-flowing streams, suggesting pockets of better habitat quality, but there are also species more typical of still waters such as the longhorn caddis *Mystacides nigricornis* and the large *Phryganea bipunctata* and *P. grandis*.

The number of caddis individuals declines downstream (Figure 3), from an average of 232 per sample at Marton Abbey to an average of just 2 at Castle Mills.



Figure 3: mean number of Trichoptera individuals per sample, 1995-2016 (based on EA biological monitoring data)

True-flies (Diptera)

Many flies have aquatic or semi-aquatic larvae, which can be very abundant and play an important role in the ecosystem. Environment Agency sampling data shows that cranefly (Tipuloidea) and black-fly (Simulidae) larvae are found predominantly in the middle reaches of the Foss, upstream of Strensall, while midges (Ceratopogonidae and Chironomidae) are more evenly distributed. This demonstrates differences related to water and habitat quality.

Non-native invertebrates

Many non-native invertebrates have colonised rivers and still waters since the 19th century, some of which have the potential to cause serious disruption to indigenous communities. Species recorded from the River Foss include the flatworm *Dugesia tigrina* (a single record); Jenkin's Spire-snail *Potamopyrgus antipodarum* from New Zealand (now locally-abundant in the middle river); Oblong Orb-mussel (now apparently extinct in the Foss); and the amphipod shrimp *Crangonyx pseudogracilis* (locally common in the lower reaches). None of these are likely to cause significant impacts. Fortunately, there are no records as yet of alien crayfish such as Signal Crayfish *Pacifastacus leniusculus*, which are much more damaging. This emphasises the need for anyone working in the river to follow best practice in biosecurity.

Oulston Reservoir

The creation of Oulston (or Pond Head) Reservoir was a result of the Foss Navigation Act of 1793, with construction apparently starting in 1795 or 1796.

Seventy-six aquatic macro-invertebrate taxa have been recorded from Oulston Reservoir (**Appendix 3**), mostly as a result of survey work in September 2017 (59 taxa) but with additional records from the Yorkshire Naturalists' Union excursion in 1951 and brief visits by the author in 2001 and 2008. Most records refer to the lower lake.

Water beetles make up the largest group of recorded species, followed by water bugs and molluscs (Figure 4). However, this is likely to reflect differences in recording effort and technique. It is likely that a considerably larger number of species could be recorded from the lake given further survey.



Invertebrate assemblages are variously associated with sparsely-vegetated open water, submerged weed beds (including stonewort-feeders such as the algivorous water beetles *Haliplus confinis* and *H. obliquus*), floating vegetation and marginal fen. One of the most notable species is the Nationally Scarce reed-beetle *Donacia thalassina*, which feeds on spike-rushes. The most recent survey recorded several southern insects which have only recently expanded into North Yorkshire including the Migrant Hawker dragonfly *Aeshna mixta*, the Water Stick-insect *Ranatra linearis*, the Saucer Bug *Ilyocoris cimicoides* and the Pondweed Bug *Mesovelia furcata*. This may be the most northerly currently-known location for the latter species, which runs over the floating leaves of Broad-leaved Pondweed and Amphibious Bistort.

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