Abington Institute
66 High Street
Great Abington
Cambridge
CB21 6AB

Abington Naturewatch

River Sampling Record 2006-2011

A record of species noted in the River Granta during the first 6 years of operation of Abington Naturewatch

1: Sampling at the Ford

2: Sampling at Hood's Reach

Table of Contents

3: Stream Deflectors in Sluice Wood

4: Installing Stream deflectors in Sluice Wood

FAUNA OF THE RIVER GRANTA – THE ABINGTONS SECTION

A report of the samplings done by Abington Naturewatch - 2006-2011

I. Introduction

1. Scope and purpose of the report

The report gives details of the seasons in which and sites at which the samplings took place (II below), followed by a detailed summary of the taxa recorded (III below).

The purpose is to enable Abington Naturewatch to possess an overview of what has been done, to take stock of this, and to solicit professional advice before planning further ways of observing and recording the fauna of our stretch of the river Granta.

2. The operations (see II, map of the river)

Naturewatch members met on three or four occasions in each of the six years 2006-2011, conducting between three and five samplings at one or two sites on each occasion. Since on some days samplings were taken at more than one site or section, we need to distinguish an 'occasion' (a given day on which samplings were taken), from a 'session' (the sampling or samplings taken at a given site or section on one day). In all over the six years we took 99 samplings at 40 sessions on 24 occasions.

Of these, 50 samplings at 19 sessions took place at the ford immediately above the road bridge between Little and Great Abington. There were 71 samplings at 31 sessions along what we may call the Home Stretch, between the ford and the Millennium Bridge (inclusive), this being the only part of the river to which there is public access. Fortunately, above all by the two bridges, this Home Stretch includes some of the fastest flowing and most riffled sites on our section of the river. For these reasons relatively few samplings were attempted above the ford (one session) or downstream between the Millennium Bridge and Bourn Bridge on the old A11 (seven sessions).

Almost all samplings were taken by the normal kick-and-net method from within the stream; only on a few occasions, where access to the water was impossible, did we net from the bank. Taxa taken were normally spooned from a main inspection tray into smaller trays or pots with magnifying lids.

3. Limitations and achievements

It hardly needs to be said that this whole activity has no pretension to scientific status; that is why this report is not described as a survey. The primary purpose of the activity was to enhance awareness of the fauna to be found in our river, and to make this knowledge available to Naturewatch members and other interested villagers by the inclusion of detailed reports, illustrated with photographs, in the Record which Naturewatch produces annually. This was, it must be admitted, not such a difficult task, since (apart from frequent sightings of trout and occasional ones of kingfishers, the activities of informal fishermen and the plundering of invasive crayfish by village boys) even the nature lovers among us knew almost nothing of the animal life flourishing in our river, let alone of what we have come (perhaps naively) to regard as the richness of its interest and diversity. It is satisfactory that this result tallies so well with the aims of English Nature to 'promote access, understanding and enjoyment.'

Whether anything of what we have recorded is of significance from a wider ecological point of view is no doubt far less evident. Though we have benefited from the

encouragement and advice of the then Community officer of the CPBRC and of Ruth Hawksley of Water for Wildlife, and from the participation by two of our members in a training session on the river Mel led by EA, one must add to our amateur lack of knowledge and experience the facts that we examined specimens briefly on site without a working surface and that our only aids to identification were Greenhaigh & Overton's *Freshwater Life* (Collins 2007), and the AIDGAP key to freshwater invertebrates. Our task therefore was to do what we could to improve the accuracy of our identifications without going beyond what the sometimes uncertain evidence would allow. As it turned out the variations between the levels of reasonable assignation were as great as possible: of the 25 items listed in Part III below, I have felt able to name seven by species, two by genus, seven by family, one by suborder, four by order, one by class and one by phylum only.

But apart from mere problems of identification we have had to be aware of the limits to what can be inferred from our records even when aggregated. For example, given the brevity of our sessions, the small number of them occurring beyond the Home Stretch and the size of the net we used, it follows that although it was uncommon for a large number of even the most frequently encountered taxa to be taken at any one session after several samplings, it would be quite wrong to infer a small population over our section of the river. Seasonal variation, again, though worth recording, may not signify much, in view of the small numbers involved. The same applies to the decline in numbers and specimen size recently observed among prominent taxa such as freshwater shrimps and mayfly nymphs; even if the figures have significance in themselves, it is not clear how far the phenomenon is due to contingent climatic irregularities or other, more deep-seated causes.

Yet it would be wrong to conclude that our operations had no - at least no potential - use beyond local, popular enrichment. For all its limitations, the sum of all we have recorded has a certain weight which (I suggest) justifies inviting professional answers to these two pairs of questions.

(1) Does this report already contain any findings that can contribute to scientific knowledge of the fauna of the river Granta? If so what are these elements and how and to whom should they be transmitted?

(2) Would it be possible for the Abington Naturewatch river sampling team to redesign its *modus operandi* (for example, by concentrating its work on certain taxa or sites or seasons; or by modifying its sampling or recording method) in such a way that its findings would serve an actual area of current interest of a governmental or non-governmental body - one that has both a stake in knowledge of the river fauna of the Cam valley and a belief that cooperation between professionals and amateurs of natural studies is capable of useful results? If so, what body would want to mandate Naturewatch as a partner in this way, and what would be the content and method of such collaboration?

4. Next steps for Naturewatch

At the minimum, the Naturewatch Project Team will want to decide, in the light of this report, whether to include river sampling among its activities for 2012 and beyond.

In what would (at least from Naturewatch's point of view) be a much more favourable outcome, Naturewatch would receive a professional invitation to discuss the ways and means for a collaboration which would ensure that any future work it does in this domain serves a well defined and clearly useful purpose.

With this hope in mind, I recommend that Naturewatch send copies of this report to a number of named professionals, with a cover letter both requesting them to respond to the report in whatever way they wished, but also asking whether they could envisage any

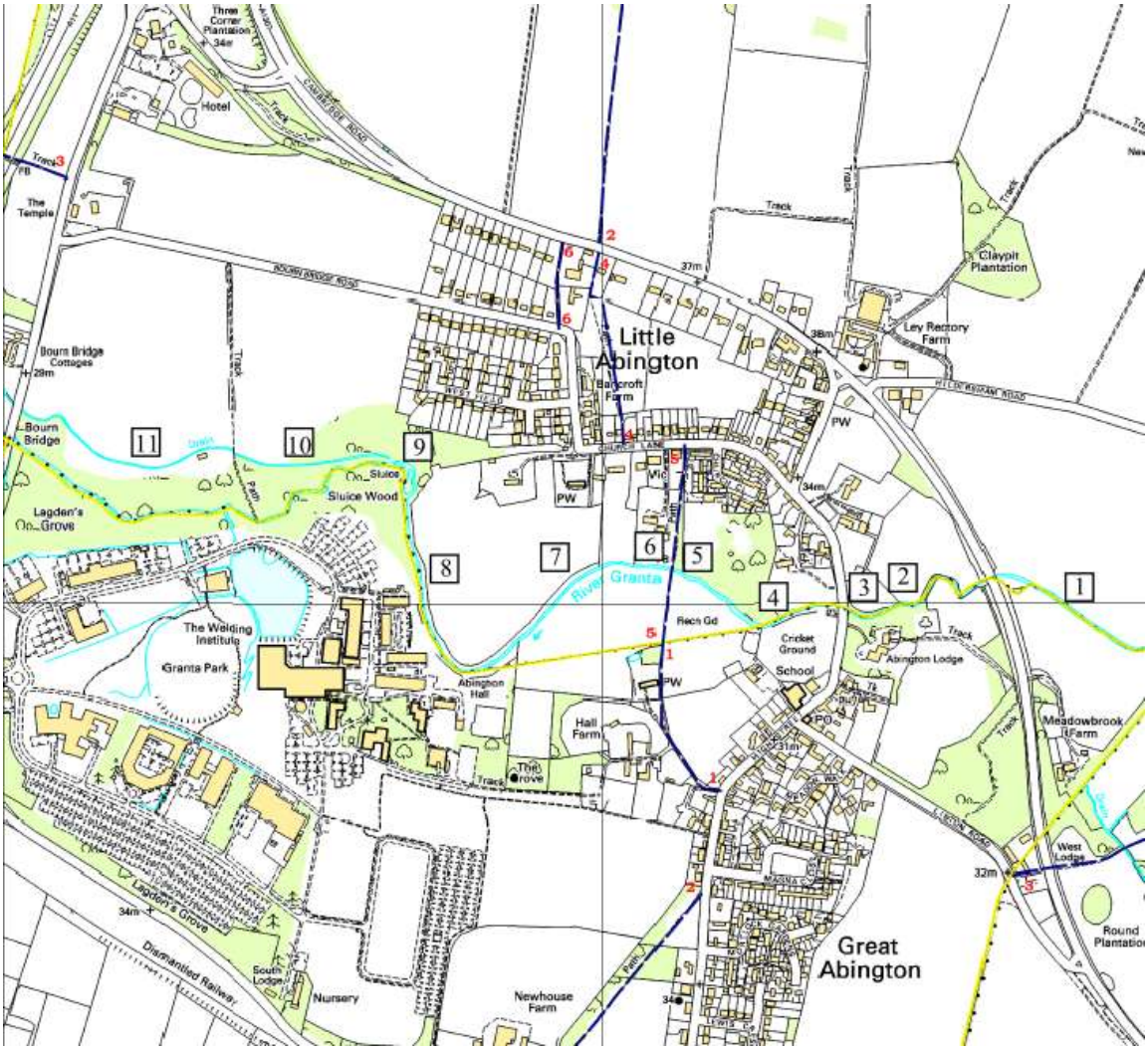
collaboration of the kind outlined above. I also recommend that those approached in this way should include a named contact person in these bodies:

- The Cambridgeshire County Council, Biodiversity Department
- The South Cambridgeshire District Council, Ecology Department
- The Wildlife Trust
- The Cambridgeshire and Peterborough Biological Research Centre
- Rivercare
- Water for Wildlife
- The Cam Valley Forum

5: River Granta - Cricket Reach

II. Map & Tables

1. *Map: The River Granta – Abingtons Section*



Legend of Sites

1. East Reach
2. Lodge Reach
3. The Ford
4. Cricket reach
5. Football Reach
6. Millennium Bridge
7. Hood's Reach
8. Welding Reach
9. Upper Sluice Wood Reach
10. Sluice Wood Reach
11. Cooke's Reach

Note: Sites 3-6 comprise the Home Stretch

2. TABLES

These tables have no pretension to statistical significance. They have two purposes. The first is to satisfy the obvious need to offer some at least of the details on which the more general conclusions in Part III are based. The second is to provide evidence that might elicit suggestions of ways in which Naturewatch might most profitably plan its future operations of this kind.

The figures given with the headings of the vertical columns give totals against which the figures in those columns may be compared. Throughout Table 1 the first of the pairs of figures gives the number of sessions which took place in a given season, and the second the total number of samplings. For Tables 2 and 3 only one figure is given, that of the number of sessions, as the records do not always allow us to specify the number of samplings within a session at which specimens of a taxon were taken.

Sites are numbered as on the map; there is no site numbered 1, as the East Reach was not sampled. Taxa are numbered as in Part III.

TABLE 1. Sites & Seasons (Number of sessions & samplings)

	Spring 10 - 26	Summer 20 - 48	Autumn 10 - 25	Total 40 - 99
2. Lodge		1-3		1-3
3. Ford	6-15	7-18	6-17	19-50
4. Cricket	1-2	1-1		2-3
5. Football	1-2		2-3	3-5
6. MM Bridge	3-4	2-4	2-5	7-13
7. Hood's	1-6			1-6
8. Welding		1-3		1-3
9. Upper Sluice		2-4		2-4
10. Sluice	1-3	1-6		2-9
11. Cooke's	1-4			1-4

TABLE 2. Taxa & Seasons (Number of sessions at which each taxon was taken)

	Spring 10	Summer 20	Autumn 10	Total 40
1.1. Minnow	5	2	4	11
1.2. Stickleback		1	2	3
1.3. Loach			2	2
1.4. Bullhead		1		1
2.1. Shrimp	10	14	7	31
2.2. Hoglouse	4	5	3	12
2.3. Crayfish		1	1	2
3.1. Mayfly	9	8	7	24
3.2. Caddis	8	4	4	16
3.3. Damsel	2	7	2	11
3.4. Stone	3	1	2	6
3.5. Midge	1	5	2	8
3.7. Beetle	1	5	1	7
4.1. Mite	2	3	1	6
5.1. Snail	2	7	2	11
5.2. Limpet	3			3
5.3. Ramshorn	4	8	1	13
5.4. Mussel	3	8	3	14
6.1. Leech	8	11	5	24
6.2. Sludge	5	10	2	17
7.1. Hairworm	1	1	1	3

3.6. Cranefly were found once in spring and once in autumn;
8.1. Sponge and 9.1. String Alga once in summer

TABLE 3. Taxa & Sites (Number of sessions at which each taxon was taken)

	Ford 18	All Home Stretch 31	Downstream 7	Total 38
1.1. Minnow	9	10	1	11
1.2. Stickleback	1	2	1	3
1.3. Loach	1	2		2
1.4. Bullhead		1		1
2.1. Shrimp	14	25	5	30
2.2. Hoglouse	8	10	2	12
2.3. Crayfish	2	2		2
3.1. Mayfly	13	20	3	23
3.2. Caddis	7	14	1	15
3.3. Damsel	5	6	4	10
3.4. Stone	5	5	1	6
3.5. Midge	4	7	1	8
3.7. Beetle	2	3	4	7
4.1. Mite	3	3	3	6
5.1. Snail	4	8	3	11
5.2. Limpet	3	3		3
5.3. Ramshorn	7	9	4	13
5.4. Mussel	7	10	3	13
6.1. Leech	15	19	4	23
6.2. Sludge	10	14	2	16

3.6. Cranefly was found once at the Ford, twice on the Home Reach; 7.1. Hairworm (three times), 8.1 Sponge (once) and 9.1. String Alga (once) were found at the Ford only.

Taken upstream (once, at the Lodge) were 2.1. Shrimp; 3.1. Mayfly; 3.2. Caddis; 3.3. Damselfly; 5.4. Mussel; 6.1. Leech and 6.2. Sludgeworm.

Note on numerous finds

It was not uncommon for relatively large numbers (12 specimens or more) of freshwater shrimps and mayfly larvae, often of very small size, to be taken in one sampling or at one session. Of other taxa, such 'big hauls' were infrequent:

2.3. Hoglouse	Ford, June 2007
3.2. Caddis larvae	Hood's, April 2009
3.7. Beetle larvae	Ford, Sept. 2009
5.3. Ramshorn	Ford, April 2011
5.4. Pea Mussel	Lodge, July 2010
Pea Mussel	Ford, Sept. 2011
6.1. Leech	Ford, July 2007
6.2. Sludge Worm	Lodge, July 2010

6: Football Reach

7: Millennium Bridge

8: Sluice Wood

9: Cooke's Reach

River Granta - Abington

III. The Taxa

1. FISH – phylum VERTEBRATA, order PISCES

1.1. Minnow (*Phoxinus phoxinus*). 13 have been netted at eight sessions, less often in summer (two) than in April (six), or September (five). All catches have been at the Ford except two, one at the MM Bridge and one on Hood's Reach, both in April. Length has varied from 3 cm to 8 cm. There have also been many sightings of what are probably Minnow, both fry and adults, especially in the Home Stretch. We have no evidence of increase or decline in numbers over the period.

1.2. Three-spined Stickleback (*Gasterosteus aculeatus*). Five have been netted at three sessions, three at the MM Bridge, one at the Ford and one (evidently a female in spawn) in the upper part of the Welding Reach, not far from the Hall. All were small, apart from the gravid female and one of those at the MM Bridge (length ca 4 cm). The one at the Welding was caught in June, the others in September.

1.3. Stone Loach (*Noemacheilus* or *Barbatula barbatula*). Two have been netted, one at the Ford, one 'lurking under a rock' at the MM Bridge, both in September. Neither was large (6-7 cm in length), but both finely marked.

1.4. Bullhead (Miller's Thumb or Sculpin; *Cottus gobio*). One was taken, near the MM Bridge in June, the broad head and foreparts, reverse V on the head and mottled flanks were noted.

1.5 Brown Trout (*Salmo trutta*). There have been many sightings, usually of solitary adults, and mostly at various points among the Home Stretch. Not surprisingly, none has been netted.

2. CRUSTACEANS - Superphylum ARTHROPODA, Phylum CRUSTACEA

2.1. Freshwater Shrimp (*Gammarus pulex*). This species and the various Mayfly nymphs comprise the most frequently encountered taxa in all situations and at all seasons. There was no sampling site at which shrimps were not taken, often in large numbers. An interesting feature was the adhesion of two specimens in what may have been mating; of nine cases recorded, five were at the Ford, the rest from four different sites. A striking factor has been the decline in size over the last two years: between 2006 and 2009, while many small shrimps were found, there was usually a number of moderate or good size (1.5 - 3 cm), taken at various times between April and July and at four different places as well as the Ford. Since April 2010 on the other hand we reported only one good-sized specimen; otherwise every record is of 'small', 'very small' or 'minute' ones.

One specimen taken at the Ford in April was so strange in colour that we wondered if it was *Crangonyx pseudogracilis*, an American invader 'spreading through the British Isles', but for this to be sure would need further corroboration.

2.2. Water Hoglouse (Water Slater, *Asellus aquaticus*). Hoglice were never abundant, but not rare either: they were taken on eleven occasions, at the Ford mostly, but also at four other places. In this small sample there was no evidence of seasonal variation. The largest were nearly 2 cm in length, the majority rather smaller. Often (five occasions) we found only one or two; no group comprised more than six, apart from one June sampling at the Ford when we netted 12. One group of several slaters were found together in September just above the road bridge under a stone.

10: Minnow

11: Stone Loach

12: 3-spined stickleback

13: Hoglouse

14: Crayfish

15: Crayfish

2.3. Signal Crayfish (*Pacifastacus lenuisculus*). In spite of known earlier sightings and catches, we did not when sampling encounter a crayfish until the last year covered by this summary, 2011. At the Ford in June we took four small crays (body length ca 5 cm) and in September one about double that size.

3. INSECTS - Superphylum ARTHROPODA, Phylum INSECTA

3.1. Mayfly (Order *Ephemeroptera*). This order and the freshwater shrimp species comprise the most abundant and ubiquitous of the taxa taken in the samples. On none of the sample sites did Mayfly **larvae** appear to be totally absent. Minute specimens, sometimes in large numbers, were taken on the majority of nettings, and no doubt many of these were mayfly nymphs too small to be identified.

In 24 of the 40 sessions we took larger specimens (ca 1-2 cm), for which some identification below Order level was possible; as with the shrimps, every sample site was able to provide at least one or two of these, though on only one occasion were many found at the same time and place (the Ford in November). Using only the criterion of gill position we were able with some confidence to distinguish members of fam. *Ephemeridae* from side-gilled species, but among the latter not able to tell members of the fam. *Heptageniidae* from *Baetidae.* The absence of prominent gills, dark colour and stocky shape made it likely that we had three examples of fam. *Caenidae* (perhaps Angler's Curse, *Caenis horaria*), one specimen at the Welding, three at the Ford, both of these taken in June, and one at the Lodge in July. Our other efforts to penetrate below Family level are better discounted, though the appearance of the few adult mayflies we were able to examine gives some support to our belief that *Ephemera danica* was among the species whose larvae we netted.

Of the good-sized Ephemerids a good majority was netted in spring or autumn rather than summer, and a bare majority at the Ford. Of those larger specimens with side gills, a bare majority was taken at the Ford, all bar one in spring or autumn. For these sizeable mayfly nymphs the decline in numbers noted for the freshwater shrimp, while not noticeable until 2011 for those with side gills, has been marked for Ephemerids; since April 2008 at only one of the 15 sessions have more than two been netted.

Twice we have found mayfly **imagines** floating on the water, one rather bedraggled in the Cricket Reach, two in perfect condition at the Ford. All three, not surprisingly, were found in June, and all looked like the typical mayfly, *Ephemera danica.*

16: Ephemerid Mayfly larva

17: Mayfly Imago

3.2. Caddis Fly (Order *Trichoptera*). Larvae of caddis flies are frequent in our river, occurring at 16 sessions; we took them on Hood's Reach and at the Lodge as well as at all the Home Stretch sites, though not further downstream than these. At only three sessions, all at the Lodge or the Ford, did we net uncased specimens (two in April, one in summer). Of the 13 sessions when cased insects were netted, 10 were in spring or autumn (six in spring) and nine at the Ford or MM Bridge. Yet only once were more than two found at any one sampling or session, on Hood's Reach in April when we took many of good size, 2 cm long or more. We noted a number of features in the cases themselves: 'gravelly', 'pebbly', 'sandy', 'made of big, flat, hard, fragments', 'with small, white spots' are among the observations noted. Once, the pale head of the insect was recorded. Although however members of the fam. Limnephelidae must surely have been represented, any serious attempt to distinguish below Order level was beyond our capacity.

3.3. Damselfly (Order *Odonata*, suborder *Zygoptera*). While damselfly larvae were confidently recorded on only 11 sampling sessions, they proved relatively widespread,

taken at six sites as well as the Ford. Although numbers were small, it may be significant that, unlike (for example) freshwater shrimps and mayfly nymphs, these larvae were found more often in the summer than in spring or autumn (seven sessions in June or July). Large specimens were rarely abundant, more than three being found in one session twice only. It is likely that most if not all were larvae of the Banded Demoiselle (*Calopteryx virgo*), the rather small central lamella having been clearly observed on a number of times.

Larvae of **Dragonfly** (Suborder *Anisoptera*) were not recorded; the mostly active, gravelly sections of our river where we worked may have precluded this.

18: Caddis Fly Larva

19: Caddis fly larva

20: Damselfly nymph

21: Damselfly nymph

3.4. Stonefly (Order *Plecoptera*). Records of larvae of Stonefly have been infrequent, from only six sessions, though there was at least one every year between 2007 and 2010. Apart from one (Sluice Wood Reach in July) all takes were at the Ford in spring or autumn. The Sluice Wood sampling was the only time when we netted more than a few; the size of specimens identified was however generally good (1.5-1.75 cm). Colour suggested that one was the larva of a Yellow Sally (fam. *Chloroperlidae*), but as with caddis flies identification below Order level was generally beyond us.

3.5. Midge (Order *Diptera*). While we have had some doubts about identification of midge larvae, we believe that soft bodies, feathery tails without claws, antennae small or absent and movement by 'snapping springs' comprise a fair set of criteria. Finds have been occasional, at only eight sessions; these were on the Football Reach and in Sluice Wood as well as on the Home Stretch, and occurred at various times between April and November, though more usually in summer. We made no attempt to identify below Order level, though it seems likely that some at least of our finds were **'non-biting' midges**, fam. *Chironomidae.* A soft-bodied larva attached to a stone by a basal pad, we found one September at the Ford may have been that of a **blackfly**, fam. *Simulidae.*

3.6. Cranefly (Order Diptera, fam. *Tipulidae*). Larvae of these were recorded at two sessions, the first time at the Ford in November 2007, the lobed plate at the rear clearly visible. In April the next year, three were taken on the Cricket Reach, one dark, chubby and of good size (ca. 5cm in length)

3.7. Water Beetle (Order *Coleoptera*, fams. *Dytiscidae* and *Gyrinidae*). That the habitats of almost all water beetles are described as ponds, ditches or still or slow-moving waters would seem to make it unlikely that any are to be found in our river unless in the most inactive parts such as Cooke's Reach. Yet in the Mel a diving beetle was recorded by professionals at a training session attended by Naturewatch members, and a number of small adult insects we recorded can hardly not have been beetles. Almost certainly the good number (ca 20) of larvae netted at the Ford one September were those of small Dytiscids, having tails without claws, tough bodies, dark heads and grey thoraces. Small or very small adult beetles were recorded in spring or summer at six sessions, probably small Dytiscids at four of these (two in Sluice Wood, one each at the Ford and the MM bridge), **'whirligigs'** (fam. *Gyrinidae*) at two sessions, one in deep muddy, slow water on Cooke's Reach, one at the Welding Institute. No whirligig has been recorded since 2009 and none of the others since 2008.

4. MITES - Superphylum ARTHROPODA, Phylum CHELICERATA, Class ARACHNIDA

4.1. Water Mite (Order *Acari*). Since the habitats of water spiders are described as 'weedy ponds and ditches' it is likely that water mites are the only arachnids likely to occur in our river. They have been taken at six of our sessions, twice in spring, four times in summer, three times each at the Ford and downstream, more than one or two specimens at only one of these; for all the small size of the specimens, the eight legs were always clearly seen. Both dark colour and habitat suggest that all belonged to genus *Arrhenurus***.**

5. MOLLUSCS - Phylum MOLLUSCA

5.1. River Snail (Class *Gastropoda*, subclass *Prosobranchia*, fam. *Viviparidae*). We netted empty shells at five sessions and live ones at 11, usually in summer (seven sessions). The snails were never abundant; only once (at the MM Bridge in June) did we find more than three at one session. They were however relatively widespread, taken in Sluice wood, at the Welding and on Cooke's Reach as well as on the Home Stretch (eight sessions). The only large one netted (ca 2cm tall) was empty. Three small more sharply pointed ones found at the MM Bridge in September may have been **spire shells** (fam. *Hydrobiidae*) and one pointed and bluish a **laver spire shell** of the same family.

5.2. River Limpet (*Ancylus fluviatilis*; Fam. *Ancylidae*). These we first found in 2010. Since then we have seen them established in a group on stones at the Ford, recorded there in April and May.

5.3. Ramshorn Snails (Subclass *Pulmonata*; fam. *Planorbidae*). We have found these snails, very much as we have river snails, to be relatively widespread (taken live at four sites besides the Ford) but hardly ever abundant, only once (at the Ford in April) recorded as 'numerous'. As well as the live snails netted at 13 sessions (nine in the summer), we took empty shells at seven others, including an additional site. Specimens were nearly always rather or very small, only one, netted at the Ford in July, described as large. We made no attempt at identification below family level.

5.4. Pea Mussel (Class *Bibalvia*; genus *Pisidium* or *Corbicula*). These again proved rather widespread (taken at five sites as well as the Ford), but until recently never in large numbers. Over twenty were netted in muddy, slow water at the Lodge in July 2010, and

many again at the Ford in September the next year; clearly, however, we cannot deduce a real population growth from so few instances. Specimens of a good size (up to 1 cm in width) were not all that uncommon; six large mussels are recorded, five of these taken between July and September, four in the one year 2008.

22: Mussel & Ramshorn

23: Leech

24: White Leech

25: Hairworm

6. WORMS & LEECHES - Phylum ANNELIDA

6.1. Leech (Class *Hirudinea*). Leeches occurred frequently, taken on as many as 24 sessions. Yet they were not commonly abundant, only once described as 'numerous' (at the Ford one July), with 'several' reported on three other occasions. As many as 15 takings were at the Ford where they were usually present, with only four beyond the Home Stretch. We found them at all times of the year from April to November, 11 times during the summer, 13 in spring or autumn. There was considerable variation in size, at least one large specimen (3-5 cm when extended) netted at 11 sessions. Identification below Class level proved problematic. The great majority were more or less dark brown. Two distinctly grey ones taken at the Ford may have been fish leeches (genus *Hemiclepsis*). Others resembled illustrations of *Glossiphonia* and *Haemopsis* (Horse Leech), but all such suppositions, though better than mere guesses, were extremely tentative.

Two records (one at the Ford, one in Sluice Wood) of lone large specimens which may have been river worms such as *Lumbriculus* or even *Criodrilus* are insufficiently solid to merit listing.

6.2. Sludge Worm (Class *Oligochaeta*, fam. *Tubificidae).* Occurences of *Tubifex* were similar to those of many other taxa: not infrequent (found at 17 sessions, 10 at the Ford), quite widespread (at six sites other than the Ford), but almost never abundant (only once

said to be 'quite numerous', at the Lodge in July). Summer was the preferred season (ten sessions). Though generally small (under 1 cm in length), larger specimens (1.25-3 cm) were taken on four occasions, and once at the Ford in July a very large one of ca 5 cm.

7. HAIRWORMS - Phylum NEMATOMORPHA

7.1. Hairworm. There are three records, at the Ford, one in each of the three seasons.

8. SPONGES - Phylum PORIFERA

8.1. Green River Sponge (*Ephydatia fluviatilis*). A good-sized greeny-brown group was found on a rock at the Ford in July 2009.

9. BLUE-GREEN ALGAE - Phylum CYANOPHYTA

9.1. "Green String Alga" (genus *Nostoc*). This was found under a stone as the same time and place as the sponge (8.1 above).

IV. Table of Illustrations