ENGLISH NATURE

Chippenham Fen NNR Cambridgeshire

No. 78 - English Nature Research Reports

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ENGLISH NATURE RESEARCH REPORT
No. 78

Chippenham Fen NNR, Cambridgeshire

P Kirby

Report to the Nature Conservancy Council for England

January 1994

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1. Aims

The work reported here follows on from a baseline survey in 1991 and a monitoring survey in 1992 (Kirby 1992, 1993) to investigate the possible impact on invertebrate populations of changes in water quantity or quality resulting from compensation from an augmentation scheme. The aims of the 1993 survey were:

1 To sample the water beetles and molluscs at ten ditches monitored in 1992.

2 To write a brief report comparing the results with the previous two years' monitoring, highlighting any detrimental changes that may be ascribed an inadequate water supply to the fen.

2. Methods

The site was surveyed on 24 September 1993. The sampling methods and equipment were essentially the same as those used in 1991 and 1992. Samples were taken using a standard pond net in deeper water, supplemented by fine-meshed plastic sieves in shallow water and dense vegetation. Easily identified taxa were noted in the field and released. Other material was preserved on site in 70% iso-propyl alcohol. From each sample station, a small sample of the weed and detritus left in the net after removal of the more obvious organisms was placed in a polythene bag and taken away for extraction. Each of these samples was placed on a wire grid over a tray of water mixed with a little detergent and left for 48 hours, after which time any organisms which had fallen through the grid were removed from the water and washed in alcohol prior to identification. As in 1992, all ditches sampled had good depths of water, and each was sampled for between 30 and 40 minutes. Samples were taken from ten locations, these being the same sample stations that were used in 1992. Aquatic molluscs, water beetles and water bugs were identified (the latter group not specified in the contract). The abundance of each species in each ditch was estimated on a five-point scale (1 = abundant; 5 = rare). Each species recorded has been assigned a status. National statuses for scarce and rare species of water beetles have been taken from Hyman & Parsons (1992). The statuses "local" and "common" as used here have no precise definition, and have been applied on the basis of personal experience and the opinions of standard texts.

3. Descriptions of sample stations

All the sample stations have been described in previous reports; the descriptions given here are in part comparative, comparing the conditions of the ditches in 1993 with their conditions in earlier years.

1. 2.5 - 3 m wide, partly densely shaded by trees; more heavily shaded areas had local patches of *Apium nodiflorum* and over 70% bare mud, less shaded areas with dense *Apium* in places, also *Mentha aquatica*, frequent *Sparganium erectum*, plant cover approximately 70%; water depth 20 cm, water approximately 70 cm below bank-top; margins of *Eupatorium*-dominated tall herbs, grass, scrub.

2. Water level high, water clear, flowing; almost whole pool covered by dense *Apium nodiflorum* and *Berula erecta*, with *Mentha* less common and *Phragmites* encroaching, though sparsely as yet, over whole width, flooded vegetation at margins; margins mostly of *Phragmites* and tall herbs, with localised scrub; some flooded low grass/herbs at margins; localised shallows with moderate cover of emergents; water approximately 0.5 m below bank-top.

3. Width 3 m plus, max. depth approximately 30 cm, more than 80% cover of *Apium/Berula* and *Mentha*; margins of tall *Eupatorium*-dominated herbs, scrub and trees; scrub increasing at margins in comparison with past years; water clear, evident moderate flow; margins abrupt, water approximately 1 m below bank-top.

4. 2.5 - 3 m across, approximately 45 cm deep, largely covered by emergents: *Phragmites*; *Apium/Berula*; *Juncus*. Margins dominated by *Phragmites* and *Eupatorium* with slight scrub

shading; water clear, no obvious flow; emergents to 2 m tall; *Lemna trisulca* common; water approximately 50 cm below bank-top.

5. Approx. 3 m wide, 60+ cm deep, bottom with less than 10% plant cover, mostly *Elodea* with some filamentous alga. Margins reed-lined, the reed encroaching into water but only as sparse emergent stems; *Juncus* occasional on margins; margins rather abrupt; bottom firm; water approximately 40 cm below bank-top; bank partly cut - sample taken partly along cut edge (for ease of access) and partly amongst dense reed (for typicality); water clear, no obvious flow.

6. 2.5 - 3 m wide, 70 cm deep, bottom with approximately 70% cover of *Chara* and scattered *Apium* (submerged); scattered *Phragmites* across whole width, with localised denser *Juncus*; margins of tall *Phragmites* and *Eupatorium*; water clear, slight flow detectable, 60 - 80 cm below bank-top; some scrub/tree shading on north side.

7. 3 m wide, with total cover of emergents; *Juncus* in centre of sample area, *Phragmites* and *Apium/Berula* both sides; *Potamogeton ?coloratus* very localised, no other aquatic vegetation except scarce *Lemna trisulca*; margins abrupt, water level approximately 1 metre below bank-top; water clear, no obvious flow, depth 20-30 cm.

8. Little changed from 1992, but well-structured section rather more restricted, and *Phragmites* quite densely emergent over full width of ditch up- and down-stream and even, though sparsely, in the well-structured section; depth still uncertain because of high density of *Myriophyllum*, but more than 70 cm deep. There had been grazing on both banks, but recently only on west. Water only moderately clear, no detectable flow. Water approximately 40 cm below level of bordering fields, but edges very gentle and trampled.

9. Little free water, approximately 5 cm deep at most; complete cover of tall grassy vegetation of *Phragmites, Juncus, Carex* and *Molinia.*

10. 3.5 m wide, 30 cm deep, water clear, approximately 50 cm below bank-top, with gentle flow; edges rather abrupt. No submerged flora, shaded by dense *Phragmites* fringe and by overhanging scrub and trees; bottom of dead leaves and soft mud.

4. Comparisons of fauna with 1991 and 1992

4.1 Table 2 lists the occurrences and abundance ratings of Mollusca and Coleoptera at sample stations in 1991, 1992 and 1993. Since it is not easy quickly to visually disentangle the 1993 results from the remainder in Table 1, the results for 1993 alone, including Hemiptera. are given separately in Table 1. Table 3 summarises the results for all years, and gives totals for all species and also for species within the ecological categories identified and defined in the report of the 1991 baseline survey. These categories are: species associated with flowing water; species likely to be dependent on permanent water; species likely to be sensitive to changes in water quality; species tolerant of decline in water quality.

4.2 Some features of the recorded fauna are common to all years. As in 1991 and 1992, species numbers per sample station in 1993 were for the most part rather low (sample station 8 providing the only notable exception) and few of the recorded species were at all common. At four sample stations the numbers of species were higher than in 1992, at six lower; only seven sample stations were surveyed in both 1991 and 1993, and of these four had lower, two equal, and one higher numbers of species in 1993 than in 1991. The differences are in most cases fairly small. Changes in the faunas of individual ditches are discussed in section 7.

4.3 The total number of species recorded in each survey is remarkably constant over the three years; 58 in 1991, 56 in 1992 and 59 in 1993. These figures mask reality, however. Three more stations were sampled in 1992 and 1993 than in 1991. Taking just the seven sample stations which were recorded in all three years, the total number of species fell from 58 in 1991 to 40 in 1992, rising

slightly to 41 in 1993.

4.4 Within sample stations 1 to 7, the number of records per species rose from 2.05 in 1991 to 2.43 in 1992, but fell to 1.98 in 1993. The total number of records made from these ditches was also less in 1993 than in either of the previous two years; 81 in 1993 compared with 119 in 1991 and 97 in 1992. The number of species in these seven sample stations associated with flowing water was the same (four) in all years; the number of species dependent on permanent water, which fell from nine in 1991 to six in 1992, fell further to four in 1993. The number of species believed likely to be sensitive to changes in water quality, which fell from thirteen in 1991 to five in 1992, rose to eight in 1993.

5. The effects of water levels and flow rates

5.1 Water levels and flow rates in the ditches were high in 1993. No augmentation was necessary (N.M.C. Twyman-Musgrave pers. comm.). Conditions were thus more similar to those in 1992 than to those in 1991, when the fen was in drought and some ditches were almost dry. The fen as a whole appeared wetter in 1993 than in 1992, with large pools of shallow water in some beds of reed and mixed fen vegetation, though at the time of survey in 1993 the sampled ditches were at similar levels, or a little lower, than in 1992. It is not surprising, therefore, that the overall fauna in 1993 was more similar to that recorded in 1992 than that of 1991.

5.2 In interpreting the 1992 results, I suggested that the decline in total number of recorded species might arise from the sampled ditches being used, in the drought year of 1991, by species which would not normally be found in them, either because low water levels and low flow made them suitable habitat, or because they acted as refuges for species whose normal habitat elsewhere on the fen had dried up. The 1993 results, being basically similar to those of 1992, are consistent with this hypothesis. As in 1992, the rarer species associated with fen conditions were largely absent from sample sites 1 to 7, the sites selected as being on ditches most likely to be directly affected by water abstraction and augmentation. The rarest of the water beetles recorded during the survey, *Enochrus isotae*, has not been re-found since its first recording in the 1991 survey. One of the most conspicuously absent of the water beetles in both 1992 and 1993 has been *Hydaticus seminiger*, recorded from three sample stations in 1991. This species is still present on the fen; I was able to capture two specimens within a few seconds by sampling a shallow (less than 5 cm deep) partly shaded stagnant pool beside the main drove.

5.3 In seeking to explain the reduction in numbers of individuals of molluscs and beetles recorded from the ditches in 1992 compared with 1991, I suggested that the relative dilution of the invertebrate fauna by increased water volumes in 1992 could be a significant factor. The same factor could account for the still lower number of records in 1993, since water volume was similar in 1993 to that in 1992, and flow rate almost certainly higher.

5.4 There are two observations from the 1993 records which seem anomalous in view of increased water levels and flow rates in the last two years. The first is the continuing decline in the number of recorded species which are likely to be dependent on permanent water. All the species dependent on permanent water are molluscs, and it is possible that the effect seen is one specific to molluscs, rather than to species dependent on permanent water, but there is no obvious factor which could produce such a mollusc-specific effect. More significant may be that the relatively high number of mollusc species recorded in 1991 derived in considerable measure from high species richness in a small number of sample stations, and particularly in sample station 4. This sample station has experienced considerable decline in species richness over the three years of survey, for reasons which are explored in section 7. The second surprising observation is the decline of *Agabus paludosus*, a species associated with vegetated flowing water. This species was found commonly around the spring in 1991 and spread into nearby ditches in 1992, occurring with particular frequency at sample station 1. In 1993, despite high water levels and flow rates, only a single individual was recorded, close to the spring. Sample station 1 appeared as suitable for the species in 1993 as in 1992, indeed almost identical between the two years. It is conceivable, though on the

face of it unlikely, that the rate of flow from the spring in 1993 was too great for this species to thrive, but if this were the case it might be expected that *A. paludosus* would colonise sections of ditches further downstream and be recorded at new sample stations.

5.5 A possible factor influencing both molluscs and *Agabus paludosus* is water temperature. Water from the spring is inevitably cool, and the higher the flow rate the cooler will be the more directly supplied ditches, including those on which sample sites 1 to 7 are situated. The structure of the ditches, with rather steep sides, bank-tops well above the water surfaces, tall marginal vegetation, and often at least partial shade from bushes and trees, is such that the sun is likely to warm the water in such ditches only slowly. The cool wet summer in 1993 would have further exacerbated this effect. Cool water is likely to support fewer species of invertebrates, and those at lower densities, than warmer water, and this will be especially pronounced when the fauna of particular interest is a fenland one, whose members are likely to be adapted to shallow pools rather than to cool flowing water.

6. Characteristics of individual species

6.1 Table 4 is a summary of information gathered over the three years arranged by species. The table gives an immediate impression of how infrequently many species have been recorded; many have been recorded only once, or only in a single year, or only from a single ditch. The infrequency with which many of the species have been recorded is one of the chief factors hampering interpretation of the results. It is not clear how far the sporadic nature of the records of many species result from genuinely sporadic occurrence, and how far from populations being at such a low level that sampling regularly misses some species.

6.2 One way of examining the sporadic or otherwise nature of the occurrences of species is to determine whether they occur randomly over the site or regularly in particular places. A species which, though rarely found, showed strong association with one or more sample stations, would clearly be more valuable in interpreting effects of changes in the water supply than would a species which occurred more or less at random, for example as isolated wanderers from a population elsewhere on the fen. I have attempted to examine this by calculating a simple index of site faithfulness, explained and given for each species in Table 4. Three years of survey data are too few to give very meaningful results for many species, but some pattern is detectable. The figures emphasise how few species regularly, or ever, have been recorded at the sample stations in successive years. Table 5 compares the site faithfulness scores of members of the ecological groups with the assemblage of species as a whole. Flowing water species are more site-faithful than the average, species dependent on permanent water less than the average, and species likely to be sensitive to declining water quality still less site-faithful.

7. Notes on individual sample stations

1 The species total for sample station 1 was the same (two) in 1993 as in 1991, though the water level and vegetation structure was more similar to that in 1992, when seven species were recorded. It is not obvious why there should have been such a fall in species number. The species recorded from this sample station have in general been common species. The only exception, the flowing water beetle *Agabus paludosus*, has already been discussed.

2 The main spring, from which rather fewer species were recorded in 1992 than in 1991, apparently supported considerably fewer species in 1993. Increased flow rate and reduced water temperature seem the most apparent explanation. Any such effects may have been exacerbated by the difficulty of sampling vegetation in rather deep water with a soft bed. However, one of the richest areas sampled in 1992 was an area of partly shaded shallow water with a moderate cover of emergents, easily sampled and with a firm bed. This was equally easily sampled in 1993, but the number of species found there was very much reduced.

3 Rather more species were recorded from this sample station in 1993 than in 1992 (twelve compared with ten) which in turn showed an increase over the 1991 figure (seven). Despite the differences in species richness between years, and a rather greater turnover in species than is apparent from the totals alone, the species involved are generally common ones and the faunas in the three years have been essentially similar in character. This goes against the general trend of decline in species richness, and moreover this sample station is on a shaded ditch close to the main spring, where effects of any increase in flow or decrease in flow rate might be expected to be felt strongly; on the other hand, perhaps this station is so close to the spring and so shaded that it is cool in all years. The likeliest explanation for the increase in species richness is increasing vegetation cover, making it easier for still-water species to survive in a flowing ditch. The most interesting addition to the species list for this sample station in 1993 has been *Cercyon sternalis*, a species of dense vegetation and especially of wet rotting vegetation at water margins and in marshes, the presence of which may reflect the increasing density of floating vegetation mats in the ditch.

4 The continuing decline in species richness at this sample station, from 26 species in 1991 to eleven in 1992 and six in 1993, is the greatest change seen at any sample station over the three years of survey; it is considerably greater than the change observed at sample station 5, which was cleared in 1992. Structurally, the sample station had changed significantly but not grossly. It has not been managed during the three years of survey, and so vegetation has become denser, especially noticeable in the extent of cover of emergents. However, tall emergents which might cast shade were not dense, and overall the increased density of vegetation in the channel might be expected to result in increased invertebrate species richness and abundance. A change in water quality cannot be the reason for the decline in the ditch fauna, since such a change in water quality would have affected other ditches equally. The only obvious explanation for the change is an increase in water flow rate coupled with a decrease in temperature, as discussed in Section 5. The changes in the structure of the ditch vegetation over the three years of study would be such as to exacerbate the effects of reduced water temperature consequent on increased flow rate. The observed change in the fauna is at first sight surprisingly large, but data on water temperatures and flow rates from the various sample stations would be needed to determine whether this is in fact an adequate explanation.

5 This sample station is on a ditch which cleared in 1992, shortly before that year's monitoring survey. The pre- and post-management faunas were compared in the report of the 1992 survey. Table 6 extends this comparison to include the 1993 results. Overall, and considering the turnover of species observed at other, unmanaged, sample stations, the effects of management on the fauna have been remarkably small.

It was noted in 1992 that the fauna recorded in that year, though greatly reduced in numbers of individuals, still included many of the species found prior to management. In 1993 the similarity to 1991 results was even greater. The total number of recorded species of molluscs and water beetles fell from 26 in 1991 to sixteen in 1992, a significant fall but one which must be viewed in the light of a 30% reduction in species recorded from sample sites 1 to 7 in total between the two years. In 1993 the number of species rose to 21. Of these, fifteen were also found in 1991. Of the eleven species not re-found in 1993 three (*Agabus bipustulatus*, *Hydroporus angustatus*, *Ilybius quadriguttatus*) are generally common species whose absence from the list is probably of little significance; *Hydaticus seminiger* has not been recorded from any sample station since 1991; *Dytiscus semisulcatus*, rather frequent on the fen in 1991 and 1992, had declined greatly by the time of the 1993 survey and was absent in 1993 from other sample stations at which it was found in 1991; and *Hydraena riparia* was probably in fact present in 1993, but only unidentifiable female *Hydraena* were found.

Four species recorded in 1991 may have been to a greater or lesser extent dependent on the characteristics of relatively mature ditch vegetation and may not yet find conditions suitable for them in the cleared ditch: the mollusc *Bathyomphalus contortus* is usually found amongst fairly dense aquatic vegetation; the beetles *Enochrus coarctatus* and *Limnebius truncatellus* are usually found amongst dense vegetation in shallow water; and the beetle *Cercyon convexiusculus* lives

amongst decaying plant litter at water margins and in marshes rather than in open water. The last of the species found in 1991 but not in 1993, *Laccobius bipunctatus*, was seemingly replaced in 1993 by its congener *L. sinuatus*. This probably reflects a response to clearance of the ditch since, though *L. bipunctatus* can occur at the margins of ditches with both dense vegetation and fairly open margins, *L. sinuatus* occurs preferentially in partly-vegetated margins with a non-organic silty bed. Of the four remaining species recorded in 1993 but not 1991, the absence of *Lymnaea peregra* and of *Laccophilus minutus* from the 1991 list is surprising and probably results from sampling error (there was very little water in the ditch in 1991 and the extent of sampling was determined by the availability of points that could be sampled rather than by what might ideally be examined to gather a full species list). The same probably applies to the females of the *Haliplus ruficollis* group found in 1993 (probably *H. ruficollis* itself, which was found in the 1992 survey). *Gyrinus substriatus* is a species of open water, and its presence at the sample site in 1993 probably reflects the more open conditions following clearance.

6 The number of species recorded from this sample station was less than that found in 1992 and 1991, but the difference was not great and did not reflect any change in the general characteristics of the fauna.

7 This sample station was the least altered of any in superficial appearance over the three years of the survey, though emergent vegetation has increased somewhat at the expense of submerged vegetation. The number of species recorded has also been remarkably constant, with fifteen, fourteen and fifteen species recorded in 1991, 1992 and 1993 respectively. The similar totals, however, do not reflect similar species compositions. Only three species are held in common between all three years, and only between six and eight species (the number depending on the identity of undetermined female water beetles) have been recorded in two years. The total of species of molluscs and water beetles recorded from this sample station over the three years of survey is between 30 and 32. The changes involve not only common species but also a number which are local or Nationally Scarce.

8 This, the richest of all the ditches sampled, was little changed between the two years of survey, though emergent vegetation was noticeably more extensive in 1993 than in 1992. The fauna was essentially the same, the differences in species and numbers between the two years being trivial.

9 The number of species recorded from this very shallow ditch was much less in 1993 than in 1992 (nine compared with seventeen). This is probably because of the (surprisingly, for it was the reverse of the situation at all other sample sites) smaller amount of water present in the ditch in 1993, which almost certainly restricted sampling efficiency.

10 The number of species recorded from this ditch was much less than in 1992 (nine compared with twenty). Vegetation within the ditch was sparser than in 1992, possibly, though not obviously, because of increased shade from marginal trees and bushes. Lack of aquatic vegetation in 1993, and possibly adverse effects of shading, are the likeliest explanations for the reduction in the fauna, though an effect from cooler water and increased flow cannot be ruled out.

8. Notes on nationally scarce species not recorded in past surveys

Cercyon sternalis **(Coleoptera; Hydrophilidae)**
Notable B
A small water beetle associated with decaying vegetation at the water's edge and on waterlogged ground. It is a southern species, especially frequent in the south-east.

Haliplus laminatus **(Coleoptera; Haliplidae)**
Notable B
A widely distributed water beetle in England, most frequent in the south-east, perhaps significantly declined in recent decades. It is found in canals, rivers, clean-bottomed rivers and ponds with a mineral substrate.

9. Conclusions

9.1 Water levels at Chippenham Fen were high in 1993. Under such circumstances, no changes which might result from an inadequate water supply could possibly be found.

9.2 The fauna recorded in 1993 was broadly similar to that found in 1992; though there were many differences in detail in the distribution and abundance of species, they were for the most part trivial and formed no obvious pattern. There was no evidence of overall decline in the fauna, and the number of species recorded which are believed likely to be sensitive to changes in water quality was greater in 1993 than in 1992.

9.3 Several sample sites relatively have shown a reduction in species richness in 1993. This has been tentatively assigned to the effects of increased flow rate and reduced water temperatures.

9.4 One of the most consistent features of the fauna over the three years of survey is that many of the species recorded have been found rarely and irregularly, making detailed interpretation of results difficult. Species associated with flowing water have been more consistent in their occurrence and distribution than members of other ecological groupings.

9.5 The results of the 1993 survey are consistent with the hypothesis, formulated after the 1991 survey, that in times of high water flow on the fen the ditches most directly affected by the incoming flow hold a fauna which is a balance between a flowing coldwater fauna and a typical fen ditch fauna, with neither community very well represented, and that species richness and apparent conservation interest in these ditches alone is likely to increase in response to diminished water supply.

10. References

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Table 1. Records of water beetles, bugs and molluscs from sample stations 1 - 10, 1993, with abundance ratings

Species	Sample station 1	2	3	4	5	6	7	8	9	10
Mollusca										
Bathyomphalus contortus	.	.	.	.	.	.	5	4	.	.
Gyraulus albus	.	.	.	.	.	.	.	5	.	.
Lymnaea palustris	.	.	.	.	5	.	.	4	3	.
Lymnaea peregra	.	.	.	3	4	.	2	2	.	.
Lymnaea stagnalis	.	.	.	.	2	2	.	2	.	5
Physa fontinalis	3	.	3	.	1	1	3	2	.	.
Pisidium sp.	.	.	.	.	.	.	4	4	.	.
Planorbarius corneus	.	.	.	.	.	.	.	3	.	.
Planorbis carinatus	.	.	.	5	.	.	.	.	.	.
Valvata piscinalis	.	.	.	.	.	.	.	5	.	.
Hemiptera										
Corixa punctata	.	.	.	.	3	.	.	.	.	.
Cymatia coleoptrata	.	.	.	.	.	.	.	4	.	.
Gerris lacustris	.	.	.	5	2	3	.	.	.	4
Hesperocorixa sahlbergi	5	2	.	.	5	.	4	.	.	.
Hydrometra stagnorum	.	.	.	.	5	4	.	5	.	5
Microvelia pygmaea	.	.	.	.	.	5	.	.	.	.
Nepa cinerea	.	.	5	.	4	.	.	4	.	.
Notonecta glauca	.	.	.	.	2	3	4	3	.	5
Notonecta maculata	.	.	.	.	5	4	.	.	.	.
Notonecta marmorea	.	.	.	.	4	.	.	.	.	.
Plea minutissima	.	.	.	.	.	.	.	4	.	.
Sigara nigrolineata	.	.	.	4	.	2	.	.	.	.
Velia caprai	.	.	4	.	.	.	.	.	.	.
Coleoptera										
Agabus bipustulatus	.	4	.	.	.	.	5	5	4	2
Agabus didymus	.	3	3	4	5	4	.	.	.	.
Agabus nebulosus	.	.	.	.	.	.	5	5	.	.
Agabus paludosus	.	5	.	.	.	.	.	.	.	.
Agabus sturmii	.	3	3	.	4	.	.	3	.	4
Anacaena bipustulata	.	.	.	.	.	.	5	.	.	.
Anacaena globulus	.	.	3	3	2	.	4	.	4	.
Anacaena limbata	.	3	3	3	2	2	.	2	3	.
Anacaena lutescens	.	.	.	.	.	.	.	3	.	.
Cercyon sternalis	.	.	5	.	.	.	.	.	.	.
Coelambus impressopunctatus	.	.	.	.	.	.	.	4	.	.
Colymbetes fuscus	.	.	.	.	.	.	.	4	.	.
Copelatus haemorrhoidalis	.	.	.	.	.	.	.	4	.	.
Cymbiodyta marginella	.	.	.	.	.	4	.	4	.	.
Dytiscus marginalis	.	.	5	.	.	.	.	.	.	.
Enochrus testaceus	.	.	.	.	.	.	.	5	.	.
Eubrychius velutus	.	.	.	.	.	.	.	3	.	.
Graptodytes granularis	.	.	.	.	2	.	4	.	.	.
Graptodytes pictus	.	.	.	.	4	.	.	.	.	.
Gyrinus substriatus	.	.	5	.	3	3	3	4	.	4
Haliplus confinis	.	.	.	.	.	.	.	5	.	.

Species	Sample station									
	1	2	3	4	5	6	7	8	9	10
Haliplus laminatus	.	5	.	.	.	.	.	.	.	.
Haliplus lineatocollis	3	1	.	.	2	1	.	4	.	.
Haliplus obliquus	.	.	.	.	3	4	.	3	.	.
Haliplus ruficollis	.	4	.	4	.	.	.	.	.	.
H. ruficollis grp female	.	2	.	.	2	.	.	2	.	.
Helophorus nanus	.	.	.	.	.	.	.	.	5	.
Hydraena sp female	.	.	.	.	5	.	.	5	.	.
Hydrobius fuscipes	.	.	.	.	4	.	5	3	.	.
Hydroporus angustatus	.	.	.	.	.	.	.	4	5	.
Hydroporus gyllenhali	.	.	.	.	.	.	.	.	3	.
Hydroporus memnonius	.	.	.	.	.	.	.	.	4	.
Hydroporus palustris	.	2	2	.	3	.	.	.	.	3
Hydroporus planus	.	5	.	.	.	.	.	.	.	.
Hydroporus pubescens	.	.	.	.	.	.	.	5	.	.
Hydroporus striola	.	.	.	.	4	.	3	4	5	5
Hygrotus inaequalis	.	.	.	.	.	.	.	4	.	.
Hyphydrus ovatus	.	.	.	.	3	3	.	4	.	3
Ilybius fuliginosus	.	.	4	.	.	.	.	.	.	5
Ilybius 4-guttatus	.	.	4	.	.	5	.	5	.	.
Laccobius minutus	.	5	.	.	.	4	.	.	.	.
Laccobius sinuatus	.	.	.	.	5	.	.	.	.	.
Laccophilus minutus	.	3	.	.	3	.	.	5	.	.
Limnebius truncatellus	.	.	.	.	.	5	.	.	.	.
Noterus clavicornis	.	.	.	.	.	.	.	3	.	.
Noterus crassicornis	.	.	.	.	.	.	.	3	.	.
Ochthebius minutus	.	.	.	.	.	.	4	.	.	.
Potamonectes depressus	.	.	.	.	.	4	.	.	.	.
Rhantus exoletus .	.	.	.	.	.	5	.	.	5	
Stictotarsus 12-pustulatus	.	.	.	.	.	.	4	.	.	.

Table 2. Comparisons of species lists from 1991 - 1993

Species	Sample station 1	2	3	4	5	6	7	8	9	10
Mollusca										
Acroloxus lacustris	. . .	. . .	. . .	5 . .	. . .	. . .	. . .	. . .	. . .	. . .
Anisus vortex	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 3 .	. . .	. . .
Bathyomphalus contortus	. . .	. . .	. . .	. 2 5	3 . .	. . .	. . 5	. . 4	. . .	. . .
Bithynia tentaculata	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 2 .	. . .	. . .
Gyraulus albus	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . 5	. . .	. . .
Lymnaea palustris	. . .	. . .	. . .	. . .	4 5 5	. . .	. 5 .	. 3 4	. 3 3	. . .
Lymnaea peregra	. 4 .	. 4 .	. . .	4 . 3	. 5 5	. . .	. 2 4	. 3 3	. . .	. . .
Lymnaea stagnalis	. . .	5 . .	. . .	2 . .	3 3 2	4 4 2	. 4 .	. 2 2	. . .	. . 5
Lymnaea truncatulus	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 5 .	. 4 .	. 5 .
Physa fontinalis	. 2 3	2 2 .	2 2 3	2 2 .	3 4 1	2 2 1	1 2 3	. 3 2	. . .	. 2 .
Pisidium milium	. . .	. . .	. . .	. . .	. . .	. . .	4 . .	. . .	. . .	. . .
Pisidium nitidum	. . .	. . .	3 4 .	3 3 .	. . .	2 3 .	2 3 .	. 4 .	. . .	. 4 .
Pisidium sp.	. . .	. . .	. . .	. . .	. . .	. . .	. . 4	. . 4	. . .	. . .
Planorbarius corneus	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 2 3	. . .	. . .
Planorbis carinatus	. . .	. . .	. . .	. . 5	. . .	5 . .	. . .	. 3 .	. . .	. . .
Planorbis planorbis	. . .	. . .	. . .	. 4 .	. . .	. . .	. . .	. 2 .	. . .	. 5 .
Potamopyrgus jenkinsi	. . .	. . .	4 4 .	5 4 .	. . .	. . .	. . .	. . .	. 5 .	. . .
Segmentina complanata	. . .	. . .	. . .	3 . .	. . .	. . .	. . .	. . .	. . .	. . .
Valvata piscinalis	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . 5	. . .	. . .
Coleoptera										
Agabus bipustulatus	. . .	3 4 4	. . .	. . .	3 . .	. . .	. . 3	. . 5	. 2 4	. . 2
Agabus chalconatus	. . .	. 5 .	. . .	. . .	. . .	. . .	. . .	. . .	. 5 .	. . .
Agabus didymus	. . .	3 4 3	3 . 3	. . 4	4 . 5	. 5 4	. . .	. . .	. . .	. . .
Agabus nebulosus	. . .	5 3 .	. . .	. . .	. . .	. . .	. . 5	. 5 5	. . .	. . .
Agabus paludosus	. 2 .	4 2 5	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Agabus sturmii	5 5 .	3 2 3	. . 3	2 4 .	3 3 4	. 3 .	3 4 .	. 4 3	. . .	. 4 4
Anacaena bipustulata	. . .	. . .	. . .	. . .	. 5 .	. . .	4 5 5	. . .	. . .	. 5 .
Anacaena globulus	. . .	. 3 .	. . 3	. . 3	4 5 2	. 4 .	. . 4	. . .	. . 4	. . .
Anacaena limbata	5 . .	. 3 3	. 4 3	3 5 3	2 2 2	3 2 2	2 5 .	. 3 2	. 2 3	. 5 .
Anacaena lutescens	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 5 3	. 4 .	. . .
Cercyon convexiusculus	. . .	. . .	. . .	. . .	5 . .	. . .	. . .	. . .	. . .	. . .
Cercyon sternalis	. . .	. . .	. . 5	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Coelambus impressopunctatus		. . .	. . .	. . .	. . .	. . .	. . .	. . 4	. . .	. . .
Colymbetes fuscus	. . .	4 . .	. . .	4 . .	. . .	. 4 .	. . .	. 3 4	. . .	. 5 .
Copelatus haemorrhoidalis		5 . .	. . .	. . .	. . .	. . .	. . .	. 5 4	. . .	. . .
Cymbiodyta marginella	. . .	. . .	. . .	. . .	. . .	. . 4	. . .	. 5 4	. . .	. . .
Dryops sp. female	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 5 .	. . .
Dytiscus marginalis	. . .	2 . .	. 4 5	. . .	. . .	. . .	4 . .	. . .	. . .	. 4 .
Dytiscus semisulcatus	. . .	3 . .	3 3 .	3 . .	5 5 .	. . .	4 5 .	. . .	. . .	. . .
Elmis aenea	. . .	. . .	. 3 .	. . .	. . .	3 5 .	. . .	. . .	. . .	. . .
Enochrus coarctatus	. . .	5 . .	. . .	. . .	5 . .	. . .	. . .	. . .	. . .	. . .
Enochrus isotae	. . .	. . .	. . .	. . .	. . .	. . .	5 . .	. . .	. . .	
Enochrus testaceus	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . 5	. . .	. . .
Eubrychius velutus	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 2 3	. . .	. . .
Graptodytes granularis	. . .	. . .	. . .	3 . .	3 . 2	. . .	. . 4	. . .	. . .	. . .
Graptodytes pictus	. . .	. 5 .	. . .	4 . .	5 . 4	3 5 .	. . .	. . .	. . .	. . .
Gyrinus substriatus	. 2 .	2 . .	. 5 5	2 . .	. . 3	3 3 3	. . 3	. . 4	. . .	. . 4
Haliplus confinis	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . 5	. . .	. . .

Species	Sample station 1	2	3	4	5	6	7	8	9	10
Haliplus fluviatilis	. .	4 4 .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Haliplus laminatus	. . .	. . 5	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Haliplus lineatocollis	. 2 3	3 2 1	3 4 .	3 3 .	3 2 2	. 2 1	3 . .	. 3 4	. . .	. 3 .
Haliplus obliquus	. . .	. . .	. . .	4 . .	4 3 3	4 . 4	. . .	. . 3	. . .	. . .
Haliplus ruficollis	. . .	3 4 4	. . .	. . 4	. 3 .	4 5 .	. . .	. 2 .	. . .	. 3 .
H. ruficollis grp female	. . .	. . 2	. . .	. . .	. . 2	. . .	. . .	. . 2	. . .	. . .
Haliplus wehnkei	. . .	. . .	. . .	. . .	. . .	4 . .	. . .	. . .	. . .	
Helophorus brevipalpis	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 5 .	. . .
Helophorus nanus	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . 5	. . .
Helophorus obscurus	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 4 .	. . .
Helophorus strigifrons	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 5 .	. . .
Hydaticus seminiger	. . .	4 . .	. . .	. . .	4 . .	5 . .	. . .	. . .	. . .	. . .
Hydraena riparia	. . .	. . .	. 5 .	5 . .	3 . .	. . .	. 5 .	. 4 .	. . .	. . .
Hydraena sp female	. . .	. . .	. . .	. . .	. . 5	. . .	. . .	. . 5	. . .	. . .
Hydraena testacea	. . .	. . .	. . .	5 . .	. . .	. . .	. . .	. . .	. . .	. . .
Hydrobius fuscipes	. . .	4 4 .	. . .	. . .	4 . 4	. . .	. . 5	. . 3	. 4 .	. . .
Hydroporus angustatus	. . .	. 4 .	. . .	. . .	4 . .	4 . .	. . .	. . 4	. 5 5	. 5 .
Hydroporus erythrocephalus		. . .	. . .	4 . .	. . .	3 . .	. . .	. . .	. . .	. . .
Hydroporus gyllenhali	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 2 3	. . .
Hydroporus memnonius	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 5 .	. . 4	. . .
Hydroporus nigrita	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 5 .	. . .
Hydroporus palustris	. 4 .	4 3 2	. . 2	3 . .	3 4 3	4 3 .	. . .	. 4 .	. . .	. 4 3
Hydroporus planus	. . .	. . 3	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Hydroporus pubescens	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . 5	. . .	. . .
Hydroporus striola	. . .	. . .	. . .	. . .	4 5 4	4 . .	. . 3	. 5 4	. 5 5	. . 5
Hydroporus tristis	. . .	. . .	. . .	. . .	. . .	. . .	5 . .	. . .	. . .	. . .
Hygrobia hermanni	. . .	. . .	. . .	. 5 .	. . .	. . .	. . .	. . .	. . .	. . .
Hygrotus inaequalis	. . .	. . .	. . .	. 5 .	. . .	. 3 .	. . .	. 5 4	. . .	. 5 .
Hyphydrus ovatus	. . .	. 5 .	. . .	2 . .	4 2 3	3 3 3	. 3 .	. 3 4	. . .	. 3 3
Ilybius ater	. . .	5 . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Ilybius fuliginosus	. . .	. . .	. . 4	. 3 .	. . .	. 3 .	. . .	. . .	. . .	. . 5
Ilybius 4-guttatus	. . .	5 . .	. . 4	. . .	4 . .	. . 5	. . .	. 5 5	. . .	. 5 .
Laccobius biguttatus	. . .	. . .	. . .	. . .	. . .	. . .	. 5 .	. 5 .	. . .	. . .
Laccobius bipunctatus	. . .	. 3 .	. . .	. . .	4 . .	3 5 .	. . .	. 4 .	. . .	. . .
Laccobius minutus	. . .	. . 5	. . .	. . .	. . .	. . 4	. . .	. . .	. . .	. . .
Laccobius sinuatus	. . .	. . .	. . .	. . .	. . 5	. . .	. . .	. . .	. . .	. . .
Laccophilus minutus	. . .	2 3 3	. . .	. . .	. 4 3	. . .	. . .	. 3 5	. . .	. 5 .
Limnebius nitidus	. . .	. . .	. . .	. . .	. . .	5 . .	. . .	. . .	. . .	. . .
Limnebius papposus	. . .	. . .	. . .	. . .	. . .	. . .	4 . .	. . .	. . .	. . .
Limnebius truncatellus	. . .	. . .	4 . .	. . .	4 . .	. . 5	4 . .	. . .	. . .	. . .
Noterus clavicornis	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 4 3	. . .	. . .
Noterus crassicornis	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. 3 3	. . .	. . .
Ochthebius minimus	. . .	. 5 .	. . .	5 . .	. . .	. . .	. . 4	. . .	. . .	. . .
Potamonectes depressus	. . .	. . .	. . .	. . .	. . .	. . 4	. . .	. . .	. . .	. . .
Rhantus exoletus	. . .	. . .	. . .	5 . .	. . .	. . .	. . 5	. . .	. . .	. . 5
Rhantus grapii	. . .	4 4 .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Scarodytes halensis	. . .	. . .	. . .	5 . .	. . .	. . .	. . .	. . .	. . .	. . .
Stictotarsus 12-pustulatus	. . .	. . .	. . .	. . .	. . .	. . .	3 5 4	. . .	. . .	. . .
Suphrodytes dorsalis	. . .	. . .	. . .	. . .	. . .	. . .	4 5 .	. . .	. . .	. 4 .

Table 3. Summary of records from all ditches in all years

tot spp number of species of molluscs and water beetles recorded in a single year.
av spp average number of species recorded per year.
tot F number of species associated with flowing water.
tot P number of species believed likely to require permanent water.
tot S number of species believed likely to be sensitive to declining water quality.
tot N number of species which are Nationally Scarce or Red Data Book.

For each sample station there are three entries in each column, except the av spp column. These correspond to the three years over which monitoring has so far taken place. The figures for 1991 are given first.

sample station	tot spp	av spp	tot F	tot P	tot S	tot N
1	2	3.7	0	0	0	0
	7		1	1	0	0
	2		0	1	0	0
2	24	19.3	2	1	2	2
	21		2	2	2	2
	13		2	0	1	1
3	7	9.7	1	2	1	0
	10		1	2	0	0
	12		1	1	1	1
4	26	14.3	0	6	5	3
	11		0	4	1	0
	6		1	1	0	0
5	26	21.0	1	3	5	3
	16		0	2	2	1
	21		1	2	3	2
6	19	16.7	1	4	3	2
	18		2	3	2	1
	13		2	2	2	0
7	15	14.7	1	3	4	3
	14		1	3	2	1
	15		1	2	3	2
8	-	34.5	-	-	-	-
	33		0	8	3	2
	36		0	6	3	2
9	-	13.0	-	-	-	-
	17		0	0	2	2
	9		0	0	1	1
10	-	14.5	-	-	-	-
	20		0	3	1	1
	9		0	1	1	0

total	58	57.7	4	9	13	10
	56		4	6	5	5
	59		4	7	11	8
total all years	93		5	14	23	17

Table 4. Summary of species information 1991-1993

This table summarises information by species based on all records 1991 to 1993. Each species is assigned to ecological category based on its habitat requirements and sensitivity to water quality. These categories are the same as those used in 1991 and 1992, and, except that some species recorded in 1993 were not recorded in previous years, the categorisation of species has not been changed from earlier years. The abbreviations used in the table is as follows:

status: c common.
l local.
Nb Nationally Notable (Nationally Scarce) category B - (believed to occur in more than 30 and no more than 100 10-kilometre squares of the National Grid in Britain).
Na Nationally Notable (Nationally Scarce) category A - (believed to occur in more than 15 but no more than 30 10-kilometre squares of the National Grid in Britain).
RDB3 Red Data Book category 3 (Rare).

F species associated with flowing water.
P species believed likely to require permanent water.
S species believed likely to be sensitive to changes in water quality.
T species believed likely to be relatively tolerant of decline in water quality: 1, very tolerant; 2, moderately tolerant.
d-tot total number of sample stations from which the species was recorded.
s-tot summation of abundance scores for all sample stations from which the species was recorded (the scores are the reverse of the abundance ratings given in previous tables; thus a species with a rating of 1 (abundant) scores 5, a species with a rating of 5 (rare) scores only 1).
mean mean abundance score per sample station.
faith site faithfulness; estimated as summation of repeat records (i.e. the number of times a species was recorded at a sample station from which it had been recorded in an earlier year) divided by the total number of sample stations from which the species was recorded, to provide partial correction for the effect of overall abundance on the faithfulness scores.

species	status	F	P	S	T	d-tot	s-tot	mean	faith
Mollusca									
Acroloxus lacustris	l	-	+	-	2	1	1	0.143	0
						0	0	0	
						0	0	0	
Anisus vortex	c	-	+	-	1	0	0	0	0
						1	3	0.428	
						0	0	0	
Bathyomphalus contortus	c	-	+	-	2	1	3	0.428	0.250
						1	4	0.400	
						3	4	0.400	
Bithynia tentaculata	c	-	+	-	1	0	0	0	0
						1	4	0.400	
						0	0	0	
Gyraulus albus	c	.	+	.	.	0	0	0	0
						0	0	0	
						1	1	0.100	

species	status	F	P	S	T	d-tot	s-tot	mean	faith
Lymnaea palustris	c	-	-	-	1	1	2	0.286	1.000
						4	8	0.800	
						3	6	0.600	
Lymnaea peregra	c	-	-	-	1	1	2	0.290	0.667
						6	14	1.400	
						4	9	0.900	
Lymnaea stagnalis	c	-	+	-	1	4	10	1.430	0.714
						4	11	1.100	
						4	13	1.300	
Lymnaea truncatulus	c	-	-	-	1	0	0	0	0
						3	4	0.400	
						0	0	0	
Physa fontinalis	c	-	+	-	1	6	24	3.430	1.333
						8	29	2.900	
						6	23	2.300	
Pisidium milium	c	-	+	-	1	1	2	0.290	0
						0	0	0	
						0	0	0	
Pisidium nitidum	c	-	+	-	1	4	14	2.000	0.667
						6	15	1.500	
						0	0	0	
Pisidium sp.	.	.	.	.	.	0	0	0	0
						0	0	0	
						2	4	0.400	
Planorbarius corneus	c	-	+	-	2	0	0	0	1.000
						1	2	0.200	
						1	3	0.300	
Planorbis carinatus	c	-	+	-	1	1	1	0.143	0
						1	3	0.300	
						1	1	0.100	
Planorbis planorbis	c	-	+	-	1	0	0	0	0
						3	7	0.700	
						0	0	0	
Potamopyrgus jenkinsi	c	-	-	-	1	2	3	0.429	0.667
						3	5	0.500	
						0	0	0	
Segmentina complanata	c	-	+	-	2	1	3	0.429	0
						0	0	0	
						0	0	0	

species	status	F	P	S	T	d-tot	s-tot	mean	faith
Valvata piscinalis	c	.	+	.	.	0	0	0	0
						0	0	0	
						1	1	0.100	
Coleoptera									
Agabus bipustulatus	c	-	-	-	1	2	6	0.857	0.500
						2	6	0.600	
						5	12	1.200	
Agabus chalconatus	Nb	-	-	+	-	0	0	0	0
						2	2	0.200	
						0	0	0	
Agabus didymus	l	+	-	-	-	3	8	1.143	1.000
						2	3	0.300	
						5	11	1.100	
Agabus nebulosus	c	-	-	-	2	1	1	0.143	0.667
						2	4	0.400	
						2	2	0.200	
Agabus paludosus	c	+	-	-	-	1	2	0.286	1.000
						2	8	0.800	
						1	1	0.10	
Agabus sturmii	c	-	-	-	1	5	14	2.000	1.000
						8	19	1.900	
						5	13	1.300	
Anacaena bipustulata	Nb	-	-	+	-	1	2	0.286	0.667
						3	3	0.300	
						1	1	0.100	
Anacaena globulus	c	-	-	-	1	1	2	0.286	0.286
						3	6	0.600	
						5	12	1.200	
Anacaena limbata	c	-	-	-	1	5	15	2.143	1.100
						9	23	2.300	
						7	24	2.400	
Anacaena lutescens	c	-	-	-	2	0	0	0	0.500
						2	3	0.300	
						1	3	0.300	
Cercyon convexiusculus	Nb	-	-	+	-	1	1	0.143	0
						0	0	0	
						0	0	0	
Cercyon sternalis	Nb	-	-	+	-	0	0	0	0
						0	0	0	
						1	1	0.100	
species	**status**	**F**	**P**	**S**	**T**	**d-tot**	**s-tot**	**mean**	**faith**

Coelambus impressopunctatus	c	.	.	.	1	0	0	0	0
						0	0	0	
						1	2	0.200	
Colymbetes fuscus	c	-	-	-	1	2	4	0.571	0.200
						3	6	0.600	
						1	2	0.200	
Copelatus haemorrhoidalis	1	-	-	-	2	1	1	0.143	0.500
						1	1	0.100	
						1	2	0.200	
Cymbiodyta marginella	c	-	-	-	1	0	0	0	0.500
						1	1	0.100	
						2	4	0.400	
Dryops sp. female	.	.	.	.	.	0	0	0	0
						1	1	1.100	
						0	0	0	
Dytiscus marginalis	c	-	-	-	1	2	6	0.857	0.250
						2	4	0.400	
						1	1	0.100	
Dytiscus semisulcatus	1	-	-	-	1	5	12	1.714	0.600
						3	5	0.500	
						0	0	0	
Elmis aenea	c	+	-	-	-	1	3	0.429	0.500
						2	4	0.400	
						0	0	0	
Enochrus coarctatus	1	-	-	-	2	2	2	0.286	0
						0	0	0	
						0	0	0	
Enochrus isotae	RDB3	-	-	+	-	1	1	0.143	0
						0	0	0	
						0	0	0	
Enochrus testaceus	1	.	.	.	2	0	0	0	0
						0	0	0	
						1	1	0.100	
Eubrychius velutus	Nb	-	-	+	-	0	0	0	1.000
						1	4	0.400	
						1	3	0.300	
Graptodytes granularis	Nb	-	-	+	-	2	6	0.857	0.333
						0	0	0	
						2	6	0.600	

species	status	F	P	S	T	d-tot	s-tot	mean	faith
Graptodytes pictus	l	-	-	-	2	3	6	0.857	0.500
						2	2	0.200	
						1	2	0.200	
Gyrinus substriatus	c	-	-	-	1	3	11	1.571	0.222
						3	8	0.800	
						6	14	1.400	
Haliplus confinis	c	-	-	-	2	0	0	0	0
						0	0	0	
						1	1	0.100	
Haliplus fluviatilis	l	-	-	-	2	1	2	0.286	1.000
						1	2	0.200	
						0	0	0	
Haliplus laminatus	Nb	-	-	+	-	0	0	0	0
						0	0	0	
						1	1	0.100	
Haliplus lineatocollis	c	-	-	-	2	5	15	2.143	1.000
						8	27	2.700	
						5	19	1.900	
Haliplus obliquus	c	-	-	+	-	3	6	0.857	0.500
						1	3	0.300	
						3	8	0.800	
Haliplus ruficollis	c	-	-	-	1	2	5	0.714	0.333
						5	13	1.300	
						2	4	0.400	
H. ruficollis grp female	.	.	.	.	.	0	0	0	0
						0	0	0	
						3	12	1.200	
Haliplus wehnkei	l	-	-	-	2	1	2	0.286	0
						0	0	0	
						0	0	0	
Helophorus brevipalpis	c	-	-	-	1	0	0	0	0
						1	1	0.100	
						0	0	0	
Helophorus nanus	Nb	-	-	+	-	0	0	0	0
						0	0	0	
						1	1	0.100	
Helophorus obscurus	c	-	-	-	1	0	0	0	0
						1	2	0.200	
						0	0	0	

species	status	F	P	S	T	d-tot	s-tot	mean	faith
Helophorus strigifrons	Nb	-	-	+	-	0	0	0	0
						1	1	0.100	
						0	0	0	
Hydaticus seminiger	Nb	-	-	+	-	3	5	0.714	0
						0	0	0	
						0	0	0	
Hydraena riparia	l	-	-	-	2	2	4	0.571	0
						3	4	0.400	
						0	0	0	
Hydraena sp female	.	.	.	.	.	0	0	0	0
						0	0	0	
						2	2	0.200	
Hydraena testacea	Nb	-	-	+	-	1	1	0.143	0
						0	0	0	
						0	0	0	
Hydrobius fuscipes	c	-	-	-	1	2	4	0.571	0.200
						2	4	0.400	
						3	6	0.600	
Hydroporus angustatus	c	-	-	-	1	2	4	0.571	0.167
						3	4	0.400	
						2	3	0.300	
Hydroporus erythrocephalus	c	-	-	-	1	2	5	0.714	0
						0	0	0	
						0	0	0	
Hydroporus gyllenhali	c	-	-	-	1	0	0	0	1.000
						1	4	0.400	
						1	3	0.300	
Hydroporus memnonius	l	-	-	-	2	0	0	0	0
						1	1	0.100	
						1	2	0.200	
Hydroporus nigrita	c	-	-	-	2	0	0	0	0
						1	1	0.100	
						0	0	0	
Hydroporus palustris	c	-	-	-	1	4	10	1.429	0.750
						6	14	1.400	
						4	14	1.400	
Hydroporus planus	c	-	-	-	1	0	0	0	0
						0	0	0	
						1	3	0.300	

species	status	F	P	S	T	d-tot	s-tot	mean	faith
Hydroporus pubescens	c	-	-	-	1	0	0	0	0
						0	0	0	
						1	1	0.100	
Hydroporus striola	l	-	-	-	2	2	4	0.571	0.667
						3	3	0.300	
						5	9	0.900	
Hydroporus tristis	l	-	-	-	1	1	1	0.143	0
						0	0	0	
						0	0	0	
Hygrobia hermanni	c	-	-	+	-	0	0	0	0
						1	1	0.100	
						0	0	0	
Hygrotus inaequalis	c	-	-	-	2	0	0	0	0.250
						4	6	0.600	
						1	2	0.200	
Hyphydrus ovatus	c	-	-	-	1	2	5	0.714	0.857
						6	13	1.300	
						4	11	1.100	
Ilybius ater	c	-	-	-	1	1	1	0.143	0
						0	0	0	
						0	0	0	
Ilybius fuliginosus	c	-	-	-	2	0	0	0	0
						2	6	0.600	
						2	3	0.300	
Ilybius 4-guttatus	c	-	-	-	1	2	3	0.429	0.167
						2	2	0.200	
						3	4	0.400	
Laccobius biguttatus	c	-	-	+	-	0	0	0	0
						2	2	0.20	
						0	0	0	
Laccobius bipunctatus	c	-	-	-	1	2	5	0.714	0.250
						3	6	0.600	
						0	0	0	
Laccobius minutus	c	-	-	-	1	0	0	0	0
						0	0	0	
						2	3	0.300	
Laccobius sinuatus	Nb	-	-	+	-	0	0	0	0
						0	0	0	
						1	1	0.100	

species	status	F	P	S	T	d-tot	s-tot	mean	faith
Laccophilus minutus	c	-	-	-	1	1	4	0.571	1.000
						4	9	0.900	
						3	7	0.700	
Limnebius nitidus	Nb	-	-	+	-	1	1	0.143	0
						0	0	0	
						0	0	0	
Limnebius papposus	Nb	-	-	+	-	1	2	0.386	0
						0	0	0	
						0	0	0	
Limnebius truncatellus	l	-	-	+	-	3	6	0.857	0
						0	0	0	
						1	1	0.100	
Noterus clavicornis	c	-	-	-	1	0	0	0	1.000
						1	2	0.200	
						1	3	0.300	
Noterus crassicornis	Nb	-	-	+	-	0	0	0	1.000
						1	3	0.300	
						1	3	0.300	
Ochthebius minimus	c	-	-	-	2	1	1	0.143	0
						1	1	0.100	
						1	2	0.200	
Potamonectes depressus	c	+	-	-	-	0	0	0	0
						0	0	0	
						1	2	0.200	
Rhantus exoletus	l	-	-	+	-	1	1	0.143	0
						0	0	0	
						2	2	0.200	
Rhantus grapii	Nb	-	-	+	-	1	2	0.286	1.000
						1	2	0.200	
						0	0	0	
Scarodytes halensis	Nb	-	-	+	-	1	1	0.143	0
						0	0	0	
						0	0	0	
Stictotarsus 12-pustulatus	c	+	-	-	-	1	3	0.429	2.000
						1	1	0.100	
						1	2	0.200	
Suphrodytes dorsalis	l	-	-	-	2	1	2	0.286	0.333
						2	3	0.300	
						0	0	0	

Table 5. Comparisons of site faithfulness in different ecological groups

F species associated with flowing water.
P species likely to require permanent water
S species believed likely to be sensitive to changes in water quality.
N Nationally Scarce and Red Data Book species.
All all species recorded, including those falling into none of the above categories.

For each entry, the actual number of species is given first, followed, in brackets, by the proportion of the total of species in the ecological category (F, N, P, S, All), which it represents.

site faithfulness score range	**F**	**S**	**P**	**N**	**All**
0	1 (.20)	17 (.74)	9 (.64)	13 (.72)	47 (.51)
-.5	1 (.20)	2 (.09)	1 (.07)	1 (.06)	20 (.22)
-1.0	2 (.40)	4 (.17)	3 (.21)	4 (.22)	23 (.25)
-2.0	1 (.20)	0	1 (.07)	0	3 (.03)
totals	5	23	14	18	93

Table 6. Sample station 5: comparison of records from 1991 (before clearance), 1992 (shortly after clearance) and 1993 (after one year's recovery)

species	1991	1992	1993
Bathyomphalus contortus	+	-	-
Lymnaea palustris	+	+	+
Lymnaea peregra	-	+	+
Lymnaea stagnalis	+	+	+
Physa fontinalis	+	+	+
Agabus bipustulatus	+	-	-
Agabus didymus	+	-	+
Agabus sturmii	+	+	+
Anacaena bipustulata	-	+	-
Anacaena globulus	+	+	+
Anacaena limbata	+	+	+
Cercyon convexiusculus	+	-	-
Dytiscus semisulcatus	+	+	-
Enochrus coarctatus	+	-	-
Graptodytes granularis	+	-	+
Graptodytes pictus	+	-	+
Gyrinus substriatus	-	-	+
Haliplus lineatocollis	+	+	+
Haliplus obliquus	+	+	+
Haliplus ruficollis	-	+	-
H. ruficollis grp female	-	-	+
Hydaticus seminiger	+	-	-
Hydraena riparia	+	-	-
Hydraena sp female	-	-	+
Hydrobius fuscipes	+	-	+
Hydroporus angustatus	+	-	-
Hydroporus palustris	+	+	+
Hydroporus striola	+	+	+
Hyphydrus ovatus	+	+	+
Ilybius quadriguttatus	+	-	-
Laccobius bipunctatus	+	-	-
Laccobius sinuatus	-	-	+
Laccophilus minutus	-	+	+
Limnebius truncatellus	+	-	-
Totals	26	16	21

Map 1. Locations of sample stations