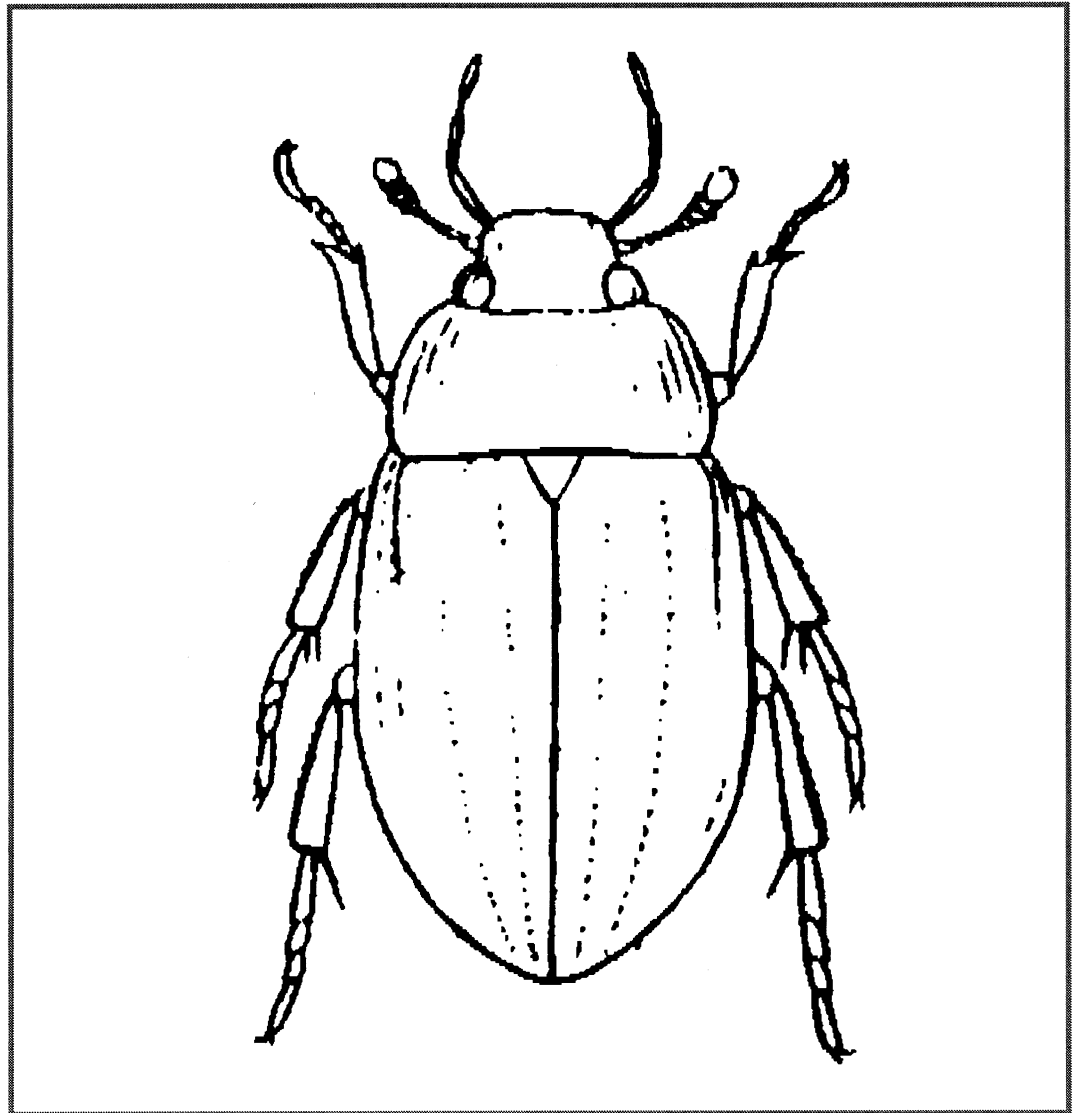


Survey of the lesser silver water beetle
Hydrochara caraboides in Cheshire

No. 248 - English Nature Research Reports



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English Nature Research Reports

Number 248
**Survey of the
Lesser Silver Water beetle *Hydrochara caraboides*
in Cheshire**

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1996

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ISSN 0967-876X
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1. Introduction

- 1.1 The Lesser Silver Water Beetle (*Hydrochara caraboides* L.) is listed as Endangered in the Red Data Book of Insects (Shirt 1987). It also receives full protection under Schedule 5 of the Wildlife and Countryside Act (1981) and is listed on the middle list of *Biodiversity: The UK Steering Group Report*. In a draft revision of the Red Data Book, Foster (8 June 1996) lists the species as Vulnerable rather than Endangered, this decision being influenced by discoveries during the present survey.
- 1.2 Within the last few years, there have been several records of the species in Cheshire. The first of these was of a single beetle netted in a pond at Reaseheath, near Nantwich, on August 18th 1990, during fieldwork for the Pond Action survey run by Oxford Polytechnic (now Oxford Brookes University) (Biggs *et al* 1991).
- 1.3 In May 1995 a single beetle was found by Jonathan Guest in a pond at Mickle Trafford, east of Chester, during survey work along the route of the then-proposed Littleton bypass. This beetle was photographed by Mike Dix, Countryside Officer at Chester City Council, and returned to the pond where caught. The identification was confirmed from the photographs by Dr Garth Foster. In a telephone conversation, Dr Foster described the egg cocoons of the species and advised that these should be looked for. Cocoons were sought but not found during the return visit to release the beetle.
- 1.4 In June 1995 J. Guest netted a single beetle in a pond on Brookhouse Farm, Little Budworth, during the Critical Biodiversity Survey for PondLife at Liverpool John Moores University. This was seen by S. Clarke, now of Cheshire County Council Environmental Planning, and by Mr T. Whitaker, the farmer, who were assisting in the survey, before it was released where caught.
- 1.5 In the light of this recent run of records of an Endangered species from Cheshire, a survey of the above sites was commissioned by English Nature, "to ascertain whether the three sites where *H. caraboides* has been found in Cheshire contain breeding populations and, if so, an indication of the size of the populations." This information would provide the first step in implementing the Species Action Plan that is being drawn up for this species.
- 1.6 The three areas to be surveyed were listed as:
 - pond at Reaseheath, Cheshire, SJ 63 54
 - pond at Mickle Trafford, near Chester, SJ 46 67
 - pond cluster at Brookhouse Farm, Little Budworth, SJ 61 63.

2. Method of survey

- 2.1 The initial intention was to sample ponds for the presence of *H. caraboides* using a standard pond net (supplied by GB Nets of Todmorden) to look for adult beetles, cocoons and larvae. This method was used during the first round of searching at Brookhouse Farm on 13 May 1996. Once the first egg cocoon had been found however, and its vulnerability to vigorous netting appreciated, a change in strategy was made. From then on a search was made in the first instance for the floating cocoons, this being followed by netting if no cocoons were visible.

- 2.2 The spring of 1996 was cold and late, with few aquatic invertebrates being evident until well into May. A first visit was made to Brookhouse Farm on 13 May, followed by a return visit on 25 May. Access could not be arranged at Mickle Trafford until 13 June, on which date the Reaseheath pond was also visited. Return visits were made to these last two sites in August to check again for the presence of the beetles.
- 2.3 At the ponds found to contain the species, or where its presence was considered a possibility, pH, substrate, plant species and vegetation structure, approximate size and depth were recorded. A sketch of the profile of the ponds was also made.
- 2.4 All species of molluscs found were recorded with an estimate of their abundance. This estimate was recorded either as O = occasional (fewer than 10 individuals per 3 minutes of sampling); F = frequent (11-100 individuals); or A = abundant (100+ individuals). Other macro-invertebrates were also recorded.
- 2.5 During survey work for the PondLife Critical Biodiversity Survey on 4 June 1996, larvae of *H. caraboides* were found in a pond at Bradley Common (SJ 5045). This pond was also included in the present survey and revisited on 17 June.

3. Results of the survey

- 3.1 Breeding populations were found in two ponds, one at Brookhouse Farm and one at Bradley Common. Both populations are judged to be small, with single figures of breeding females. The species was not found at Reaseheath or Mickle Trafford.

Reaseheath

- 3.2 *H. caraboides* was not refound at this site. The 1990 record is considered to have been of a wandering individual.
- 3.3 Two visits were made to this pond. On 13 June 1996 the pH was recorded as 8.37 (-075 mV) at a temperature of 20.2 degrees. On 13 August comparable figures were pH 9.13 (-114 mV) at 19.1 degrees. These figures suggest that the pond may have been dredged in recent years, with release of bases from the underlying clay. The bottom of the pond was covered in a fine sedimentary ooze containing a high proportion of unconsolidated clay and a relatively low proportion of organic matter.
- 3.4 The vegetation communities present also point to dredging within recent years. A narrow fringe of emergent vegetation covered only some 2% of the pond. Branched Bur-reed (*Sparganium erectum*) is the principal species in this fringe together with Plicate Sweet-grass (*Glyceria notata*) and Celery-leaved Buttercup (*Ranunculus sceleratus*). The Bur-reed is yellowed in places, which may point to agricultural run-off. Filamentous algae extend across some 15% of the pond, forming submerged webs which rise to the surface in places. Rigid Hornwort (*Ceratophyllum demersum*) and Curly Pondweed (*Potamogeton crispus*) are also frequent. At the water's surface, Duckweed (*Lemna minor*) and Ivy-leaved Duckweed (*L. trisulca*) cover 50% or more of the pond, with floating leaves of Broad-leaved Pondweed (*Potamogeton natans*) across some 15% of its area. A list of plant species appears as Table A.1 of Appendix A.

- 3.5 Four species of mollusc were present. Three of these, the Great Pond Snail (*Lymnaea stagnalis*), the Wandering Snail (*L. peregra*) and the orb-mussel (*Sphaerium corneum*) would be unlikely prey items for *H. caraboides*, but the Whirlpool Ramshorn (*Anisus vortex*) is a known prey species and was present in abundance. A list of invertebrates found in the pond appears as Table A.2 of Appendix A. No amphibians were recorded.

Mickle Trafford

- 3.6 *H. caraboides* was not re-found at this site. While the spring 1995 record was coincident with the breeding season, it is considered likely that only a single individual was involved. Thorough searching in 1996 revealed no sign of the species.
- 3.7 A search was made in May 1995 for egg cocoons and this was repeated on June 13th 1996. No cocoons were found, although information from elsewhere in the survey suggests that these may only be evident for a short season in spring. Having searched for cocoons, sweep-netting was employed to search for larvae around the whole of the perimeter of the pond, concentrating on that area around a stand of Bogbean (*Menyanthes trifoliata*) where the beetle was netted in 1995. No larvae were found. Further sampling during a return visit in August produced no evidence of *Hydrochara*.
- 3.8 Eleven species of mollusc were found including an abundance of *Anisus vortex* and *Bathyomphalus contortus*. Other small planorbids, present in smaller numbers, were *Armiger crista*, *Gyraulus albus* and *Hippeutis complanatus*. There is a rich supply of suitable prey for *H. caraboides* in the pond. A combined list of invertebrates recorded from this pond in May 1995 and June and August 1996 appears as Table A.4 in Appendix A. Great Crested (*Triturus cristatus*) and Smooth Newts (*T. vulgaris*) breed in the pond.
- 3.9 The pond has a dense fringe of Branched Bur-reed, up to 6 metres wide in places. At the outer edge, the rhizomes of the Bur-reed form a raft floating over an unknown depth of water. Probing through the vegetation with the handle of the pond net suggested that in excess of two metres of clear water were present beneath the outer edge of the raft. There are small stands of Yellow Flag (*Iris pseudacorus*) and Reed Canary Grass (*Phalaris arundinacea*) amongst the Bur-reed, while along the eastern edge, and occupying some 5% of the total fringe, is a mat of Bogbean. Other plants growing amongst the Bur-reed include Bittersweet (*Solanum dulcamara*), Marsh Bedstraw (*Galium palustre*), Water Horsetail (*Equisetum fluviatile*), Water Mint (*Mentha aquatica*) and Great Birdsfoot-trefoil (*Lotus pedunculatus*). The centre of the pond is 60% covered by Broad-leaved Pondweed, with smaller quantities of Common and Ivy-leaved Duckweed and the liverwort *Riccia fluitans*. A list of plant species noted at the pond appears as Table A.3 of Appendix A.
- 3.10 On August 13th 1996 a reading of pH 7.31 (-011 mV) was taken from amongst the Bogbean on the eastern side of the pond, where the adult beetle was found in 1995. Water temperature was 18.2°C.

Brookhouse Farm

- 3.11 Brookhouse Farm is an unusually rich site for many forms of wildlife and still contains dozens of field ponds. It was specified that the survey should include a search of ponds at Brookhouse Farm to locate and check any other likely breeding sites for the presence of the species. Breeding was confirmed in one pond and a single adult beetle was found in a second pond nearby.
- 3.12 While many ponds survive on the farm, the great majority are heavily shaded and unsuitable for *Hydrochara*. Searches were made on 13 May without success for beetles and cocoons in all ponds in which it was considered at all likely that the species might be present. 41 ponds were visited, comprising 72 discrete lobes which, while separate at the time of survey, may merge in very wet weather. The ponds are listed, with grid references, in Appendix B, where brief details of shading and suitability for restoration are also given.
- 3.13 One of the last ponds to be visited was that where the adult beetle had been netted in 1995 (the "Hydrochara Pond"). A brief spell of netting revealed two adult beetles in almost exactly the same spot as the 1995 record. Almost immediately thereafter a single egg cocoon was found folded into a detached, basal leaf of Lesser Spearwort (*Ranunculus flammula*). It was considered that any other cocoons present could easily be damaged by netting, perhaps without even being noticed, so a decision was made to discontinue netting. Instead a detailed, slow search was made of the periphery of the pond, checking closely for other egg cocoons. No more were found. The centre of the pond is occupied by scrub, so that only a narrow strip of potential habitat is present.
- 3.14 On 25 May a repeat visit was made to the pond. On this occasion the leaf encasing the first cocoon was seen to have faded to yellow, and the silk mast to have withered. The cocoon was lifted from the water, when two small holes were visible in the wide end of the cocoon, presumably marking the escape route of the hatched larvae. Three additional cocoons were found close by, two of these being folded into parts of blackened Oak (*Quercus robur*) leaves, fallen into the pond in autumn 1995, and one folded into a blackened Sallow (*Salix cinerea*) leaf. All the cocoons were in shallow water along a 12 metre length of shoreline (Table 3.1) amongst floating blades of *Glyceria fluitans* with *Ranunculus aquatilis* interspersed. None were found elsewhere around the pond margin, despite a close search.

Table 3.1. Cocoon substrates and water depth beneath the four cocoons on 25 May 1996

Cocoon	Substrate	Water depth
1	<i>Ranunculus flammula</i> leaf (mast withered and two emergence holes evident)	12.5 cm
2	<i>Quercus robur</i> leaf	10 cm
3	part of <i>Q. robur</i> leaf	28 cm
4	<i>Salix cinerea</i> leaf	15 cm

- 3.15 Figure 1 is a diagrammatic representation of the vegetation in the "Hydrochara Pond". This may have originated as three or four separate lobes which have merged as cattle have trampled down the banks. The eastern part of the pond is shaded by scrub of Common Sallow (*Salix cinerea*) over localised mats of *Sphagnum squarrosum* moss. Around the edges is a narrow zone of Floating Sweet-grass (*Glyceria fluitans*) with abundant filamentous algae tangled between the grass blades. Around the northern side of the scrub the grass mats are shaded for much of the day. The north-western lobe is occupied by a floating mat of fen vegetation which is species-rich and of a type now scarce in Cheshire. Such species as Bottle Sedge (*Carex rostrata*), Marsh Pennywort (*Hydrocotyle vulgaris*) and Bogbean are present. Again there is a narrow zone of floating grass blades around the margins, kept open by trampling cattle. The south-western corner has a further stand of Common Sallow, but its southern edge is well-lit with a belt of Floating Sweet-grass and Common Water-crowfoot. All records of the beetle come from this warm corner of the pond where algal growth is not so dense as elsewhere along the southern margin. A list of plant species noted appears as Table A.5.
- 3.16 The invertebrate fauna within the "Hydrochara Pond" includes three mollusc species. Of these *Bathymphalus contortus* is the most likely to form an important prey species for *Hydrochara*. *Gyraulus albus* may also be suitable, although its lens-shaped shell may be harder for the beetles to grip, while *Acroloxus lacustris* is considered unlikely to be eaten. The nationally Notable (Nb) diving beetle *Agabus unguicularius* is present in good numbers and the regionally uncommon *Dytiscus semisulcatus* has also been netted. Great Crested Newts breed in the pond, their egg folds being seen immediately adjacent to the egg cocoons of *Hydrochara*. Small numbers of Frog (*Rana temporaria*) tadpoles were also seen.
- 3.17 In profile the pond does not appear more than 30 cm deep anywhere around the grassy margins. There is certainly a greater depth of water beneath the fen raft in the north-western corner and under the floating Sallow scrub, but probing with the handle of the pond net could not distinguish between water and soft ooze. No pH meter was available during the visits in May 1996 but in 1994 a bottled sample was measured by the National Rivers Authority as having pH6.6. This sample was taken from the edge of the western fen raft.

- 3.18 Two ponds nearby were again searched on 25 May, since these showed similarities to the breeding pond and were considered to be potential breeding sites. These were the "Fox Pond" (SJ61 66) named after a decomposing carcass in one end of the pond, and the "Grass Pond" (SJ61 88).
- 3.19 In the "Fox Pond" a single adult beetle was netted but there was no sign of egg cocoons. Twenty-six invertebrate species netted (Table A.8) included 16 beetle species, with two Notable (Nb) species amongst these (*Agabus unguicularius* and *Enochrus melanocephalus*). [*Dytiscus semisulcatus* was netted in January 1997.] An almost complete lack of molluscs probably makes this pond unsuitable for breeding, since small planorbid snails are a principal prey item. Invertebrates present are listed in Table A.8. The pond had dried out in the summer of 1995. Tens of Frog tadpoles were seen, mostly feeding around the Fox carcass; tens of Smooth Newt eggs and three adult females were noted; and tens of Great Crested Newt eggs were present.
- 3.20 The Fox Pond has some resemblance to the Hydrochara Pond in that it has a central stand of Common Sallow growing emergent from a mat of Jointed Rush (*Juncus articulatus*), Lesser Water-parsnip (*Berula erecta*) and Tufted Forgetmenot (*Myosotis laxa*). This mat normally floats on the pond surface, but had settled during the drought of 1995 and had not yet risen by the time of survey, being then submerged beneath up to 60 cm of water. The greater part of the pond consists of mats of Floating Sweet-grass and Common Water-crowfoot which surround the central, temporarily sunken island of scrub (Figure 2). Few plant species were evident. These are listed in Table A.7 of Appendix A.
- 3.21 In the "Grass Pond", very few invertebrates were netted. This pond dries up in most summers. The only mollusc found to be present was the wandering snail *Lymnaea peregra*. No planorbids were present (Table A.10). The pond was up to 30 cm deep in places (Figure 3), with a complete cover of Floating Sweet-grass amongst which Common Water-crowfoot was abundant (Table A.9). The pond measures some 9 metres x 12 metres, around half of which was dry when surveyed. A single male Smooth Newt was netted.

Bradley Common

- 3.22 During fieldwork for the 1996 PondLife Critical Biodiversity Survey, on 4 June, a number of larvae with tracheal gills were netted in a pond at Bradley Common, near Malpas. The larvae were up to an estimated 12mm in length at this stage. One of these larvae was placed in a tray together with the mixed contents of a pond net, and seen to close its mandibles around an empty shell of *Anisus leucostoma*. It was then realised that these were larvae of *Hydrochara caraboides*, this being checked by comparison with line drawings of the larvae and by telephone conversation with Dr Garth Foster, the national water beetle recorder. Around a dozen of the larvae had been netted, amongst floating grasses and crowfoot.
- 3.23 A return visit to the pond on 17 June revealed that larvae were still present, then being around 20mm in length. Once again, because of the small extent of suitable habitat and the risk of damage, no netting was undertaken to quantify the numbers present. Given that each egg cocoon may hold in excess of 100 eggs, it is considered that the population

in this pond can have consisted of only a small number of females, probably low single figures.

- 3.24 Figure 4 is a diagrammatic representation of the vegetation of the pond, which shelves from a shallow western end to a maximum depth of perhaps 1.5 metres towards the east. Plant species recorded are listed in Table A.11. There is a sequence of vegetation communities from west to east, with Hard Rush (*Juncus inflexus*) dominant over trampled mud and pasture grasses at the western edge then a zone of wet rush pasture with Soft Rush (*Juncus effusus*) and Marsh Foxtail (*Alopecurus geniculatus*) in the shallow end. The greater part of the pond is covered by Floating Sweet-grass with much Pond Water-crowfoot. The Crowfoot becomes dominant in a narrow zone of vegetation surrounding the deepest part of the pond, which has open water. The eastern end of the pond is shaded by a Crack Willow tree. The larvae were netted amongst the Sweet-grass and Crowfoot to west of the open pool.
- 3.25 Only three mollusc species were found, and of these *L. peregra* and *Pisidium* are unlikely to be significant prey species. *Anisus leucostoma* was found to be abundant however, and empty shells were found which had been crunched by the beetle or its larvae. *A. leucostoma* has been found to be uncommon in Cheshire as its favoured habitat of fluctuating, grassy pools becomes scarce. A sizeable population of the notable (Nb) scavenger beetle *Helochaeres lividus* was also present. Invertebrate species recorded are listed in Table A.12.
- 3.26 On 17 June pH was measured at 6.99 (-008 mV) at a temperature of 20.8 degrees. The cross-section of the pond depicted on Figure 4 shows that the greater part of the pond is less than 50 cm deep.

4. Aspects of the breeding sites considered favourable to *Hydrochara caraboides*

- 4.1 In the Somerset Levels, *H. caraboides* is confined to peat areas where it may benefit from periodic cleaning of ditches (Foster 1996). The Cheshire sites are not on peat and are ponds rather than ditches, although a shallow water habitat within the ponds appears to be favoured. There are strong similarities between the two Cheshire ponds with breeding populations. The factors outlined in the following paragraphs may be critical.

Depth

- 4.2 Both breeding ponds are very shallow, with water that warms up quickly in spring. Part of the Little Budworth pond is covered by Sallow scrub and floating rafts of vegetation over water of unknown depth, but there is no open water of any great depth, and the egg cocoons were found in shallow water on the south side.

Both ponds dried up almost completely during the late summer of 1996. It is not known what effect this may have had on *Hydrochara*, but it is proposed to revisit both sites during the spring of 1997 to check for egg cocoons.

Vegetation

- 4.3 Both ponds have very similar vegetation communities, at least in those parts of the ponds where cocoons and larvae of the beetle were found. At Little Budworth the cocoons were found amongst floating blades of Floating Sweet-grass interspersed with Common Water-crowfoot (*Ranunculus aquatilis*). At Bradley there is a mat of *Glyceria fluitans* and Marsh Foxtail interspersed with Pond Water-crowfoot (*Ranunculus peltatus*). It was amongst this vegetation that the larvae were netted.

Vegetable matter for egg cocoon construction

- 4.4 Maillard (1970) reported that unlike the related *Hydrophilus piceus*, which will assemble its egg cocoon using plant material of various sizes, and may construct composite cases with several leaf fragments, *H. caraboides* always chooses a substrate of approximately even size and always uses a single leaf or leaf fragment rather than a composition. Leaf types listed included Frogbit (*Hydrocharis morsus-ranae*), Water Plantain (*Alisma plantago-aquatica*), various pondweeds (*Potamogeton* spp.), fallen leaves as of willow or sallow (*Salix* spp.) and even leaf segments of Common Reed (*Phragmites australis*). It seems unlikely from this list that availability of suitable leaves is often a limiting factor. At Little Budworth leaves of Oak, Sallow and Lesser Spearwort were used. At Bradley, where the species was detected after the larvae had hatched, it seems likely that leaves of the Crack Willow (*Salix fragilis*) beside the pond or other wind-blown leaves may be used, for the leaf dimensions of most pond plants present are unlikely to be suitable.

Predators

- 4.5 Neither pond contains fish. This may be a significant factor given that the larvae will float at the water's surface and must then be vulnerable to attack by fish. Both ponds contain breeding Great Crested Newts which may predate the larvae. Moorhens (*Gallinula chloropus*) occur at both ponds, and may also take larvae from the water's surface.

Prey species

- 4.6 Both ponds contain healthy populations of small planorbid molluscs, which are believed to be a favoured prey item. At Bradley a larva was seen to grip an empty shell of *Anisus leucostoma* between its mandibles. At Little Budworth, *Bathyomphalus contortus* may be an important prey species.

Surrounding land

- 4.7 Both ponds are set in permanent pasture with little or no fertiliser input. Enrichment by run-off is low. Trampling and grazing of the margins by livestock maintains the shelving margins in which floating *Glyceria* mats can persist. These shallow, grazed margins may be an important factor in that the water will warm up quickly in spring. Such climatic factors may be important at the edge of the species' range.

5. Suggestions for further work

- 5.1 On the basis of information gained from the present survey, it would appear that the requirements of the species in north-western England are quite specific. The sample of two ponds with breeding populations is admittedly small, and may eventually prove to be giving too narrow an impression of the favoured habitat, given that the beetle inhabits a wide range of standing water habitats in continental Europe (Foster 1996). On the other hand, some hundreds of ponds in north-western England have been surveyed in some detail in recent years without finding any evidence of *H. caraboides*, so the coincidence of habitat characteristics at the two known breeding ponds may well give an accurate indication of the requirements of the species.
- 5.2 Agriculture within north-western England is now for the most part so intensive that seasonally fluctuating ponds with shallow, grassy margins have become scarce. Few locations can exist where habitat conditions approach those in the known breeding ponds. Two areas which appear to offer similar conditions are parts of the Gowy Marshes adjacent to the M56 motorway (SJ47), and the Dee Meadows at Chester (SJ46). At the latter site there has been some recent dredging of ditch systems. It is suggested that the drainage systems on the Gowy Marshes and Dee Meadows should be surveyed for the presence of the species.
- 5.3 Further monitoring is also desirable of the known breeding ponds, especially to monitor effects of the 1996 drought which is said to have reduced the two ponds to muddy puddles by autumn.
- 5.4 It may be considered appropriate to begin to develop management proposals for the known breeding sites. Both ponds are of limited extent and could easily be lost by incautious management. However at both Little Budworth and Bradley Common there are adjacent ponds which could be improved for the species. *H. caraboides* is known to fly strongly and could easily move out from the known breeding ponds to newly suitable sites nearby.
- 5.5 The Hydrochara Pond at Brookhouse Farm appears to contain only a very limited area of suitable habitat. Much of the pond area is covered by Sallow scrub, a habitat which is generally considered to be of low nature conservation importance and has often been torn out of ponds for "restoration" purposes. A visit in early November 1996 with Mr J Taylor, fungus recorder for Cheshire, revealed the presence of several uncommon species, two of which could not be satisfactorily identified, under Sallows in the eastern lobe of the pond. Removal of this scrub would cause large-scale changes to the pond which might affect hydrology and encourage the arrival of predatory species. Moreover there are mats of *Sphagnum* moss under the Sallows - a habitat which is likely to be of high nature conservation value for semi-terrestrial invertebrates and for the uncommon water beetles *Dytiscus semisulcatus* and *Agabus unguicularius* which also occupy the pond.

- 5.6 Similarly the more open Sallow scrub at the western end of the Hydrochara Pond covers an area of rich fen vegetation with Bogbean, Bottle Sedge (*Carex rostrata*) and other species. Such vegetation is increasingly scarce in the regions's ponds and should be retained. At most some coppicing of Sallows should be considered. The requirements of *H. caraboides* for pupation or during the winter months are unclear, so winching out of scrub could be very damaging.
- 5.7 Despite intensive searching, no cocoons were found along the eastern lobe of the southern shoreline of the pond. Pruning back of Sallows from this edge could be combined with minor spadework to create a shallow shelf along this shoreline to replicate conditions along the southern edge of the western lobe, where beetles and cocoons have been found. This lobe floods in winter onto the grassy shelf to the south (Figure 1).
- 5.8 The Fox Pond at Brookhouse Farm appears to be a potential breeding site, with highly suitable vegetation conditions. The pond is susceptible to drought however and, perhaps for this reason, lacks planorbids. A single adult of *H. caraboides* has already been found here. Introduction of appropriate planorbids might lead to colonisation of the pond, provided that recurrent droughts do not intervene.
- 5.9 The Grass Pond at Brookhouse Farm also contains the same mixture of floating grasses and Crowfoot found at the two breeding sites, but it dries up regularly in summer. It also lacks planorbids. Dredging of this pond into a shallow, saucer-shaped depression might result in its remaining wet through the summer. Planorbids could then be introduced and a general increase in invertebrate prey items might lead to colonisation by the beetle.
- 5.10 Most of the ponds at Bradley Common have been dredged in recent years. The effects of this management on the status of *H. caraboides* on the Common cannot be assessed since no survey was carried out prior to management, but the species was certainly surviving in 1996. A damp hollow to north-west of the breeding pond, fed by a small rivulet, is now being considered for dredging by the Common Management Committee. It is recommended that this should be dredged only shallowly to create floating grass-mat conditions which may be suitable for the beetle. Other ponds on the Common have been dug rather too deeply to satisfy what appear to be the species' requirements, but may be expected to regain an appropriate profile over the years provided that cattle continue to trample the margins.
- 5.11 On the Dee Meadows at Chester, there are existing populations of molluscs characteristic of fluctuating ponds and drains. These include *Planorbis planorbis*, *Aplexa hypnorum* and *Anisus leucostoma* (PondLife Critical Biodiversity Survey 1996), the last of which is a valuable prey species for *H. caraboides*. All three mollusc species have become uncommon in Cheshire as seasonally wet hollows have been deepened or filled. It is not known whether any invertebrate survey was carried out prior to recent dredging of drains on the meadows, or indeed whether these contained water prior to this management work. The newly dredged ditches may become suitable for *H. caraboides* as vegetation thickens. Introduction of the species may then be considered.

- 5.12 The drain systems of the Gowy Marshes appear suitable for *H. caraboides*. The Marshes are underlain by peat beneath a blanket of alluvium and in many respects resemble the Somerset Levels. The Mickle Trafford pond where the species has been recorded is only a few minutes flying time away. If the species does not already occur here, there is a possibility that suitable breeding conditions could be created to justify a future introduction programme.

Acknowledgements

The following individuals devoted time and assistance towards this survey. Their contributions are gratefully acknowledged:

Mr Doug Hill, Farming and Wildlife Advisory Group, Reaseheath.

Mr Richard Parker, Farmer, Mickle Trafford.

Mr Tom Whitaker, Farmer, Little Budworth.

Mr & Mrs D. Adams and Mr S. Jones of Bradley Common Management Committee.

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Appendix A

Tabulated lists of plants and invertebrates found in the various ponds

DAFOR codes used in the botanical tables are as follows:

D = dominant, A = abundant, F = frequent, O = occasional, R = rare, COD = co-dominant, LA = locally abundant etc.

In the tables of invertebrates, A = abundant (more than 100 individuals netted per 3 minutes approx.); F = frequent (11 - 100 individuals); O = occasional (fewer than 10 individuals); R = rare (only 1 or 2 individuals).

Table A.1. Plant species noted at the Reaseheath Pond

Aquatics		
<i>Lemna minor</i>	Duckweed	D
<i>Potamogeton natans</i>	Broad-leaved Pondweed	A
<i>Cladophora</i> spp.	filamentous algae	LA
<i>Ceratophyllum demersum</i>	Rigid Hornwort	F
<i>Lemna trisulca</i>	Ivy-leaved Duckweed	F
<i>Potamogeton crispus</i>	Curly Pondweed	F
Emergents		
<i>Sparganium erectum</i>	Branched Bur-reed	LD
<i>Glyceria notata</i>	Plicate Sweet-grass	A
<i>Poa trivialis</i>	Rough Meadow Grass	LA
<i>Ranunculus sceleratus</i>	Celery-leaved Crowfoot	LA
<i>Alopecurus geniculatus</i>	Marsh Foxtail	F
<i>Epilobium hirsutum</i>	Great Willowherb	O
<i>Epilobium ciliatum</i>	American Willowherb	R
<i>Rumex crispus</i>	Curled Dock	R

Table A.2 Invertebrate species noted in the Reaseheath Pond

<i>Erpobdella octoculata</i>	leech	F
<i>Helobdella stagnalis</i>	leech	O
<i>Theromyzon tessellatum</i>	duck leech	O
<i>Sphaerium corneum</i>	orb mussel	F
<i>Lymnaea peregra</i>	wandering snail	F
<i>Lymnaea stagnalis</i>	great pond snail	F
<i>Anisus vortex</i>	whirlpool ramshorn	A
<i>Asellus aquaticus</i>	water hoglouse	A
<i>Cloeon dipterum</i>	mayfly	F
<i>Aeshna grandis</i>	Brown Hawker Dragonfly	egg-laying
<i>Sympetrum striolatum</i>	Common Darter Dragonfly	
<i>Coenagrion puella</i>	Azure Damselfly nymphs	O
<i>Ischnura elegans</i>	Blue-tailed Damselfly	Ads.
<i>Lestes sponsa</i>	Emerald Damselfly	Ads.
<i>Corixa punctata</i>	water boatman	A
<i>Sigara distincta</i>	water boatman	O
<i>Gerris sp. nymphs</i>	pondskaters	O
<i>Ilyocoris cimicoides</i>	saucer bug	F
<i>Notonecta glauca</i>	backswimmer	A
<i>Cataclysta lemnata</i>	Small China Mark moth	F
<i>Nymphula mymphaeata</i>	Brown China Mark moth	F
<i>Haliphus ruficollis</i>	swimming beetle	F
<i>Agabus bipustulatus</i>	diving beetle	O
<i>Agabus nebulosus</i>	diving beetle	O
<i>Agabus sturmii</i>	diving beetle	O
<i>Laccophilus minutus</i>	diving beetle	F
<i>Hydroporus planus</i>	diving beetle	O
<i>Hydroporus palustris</i>	diving beetle	F
<i>Anacaena limbata</i>	scavenger beetle	O
<i>Enochrus coarctatus</i>	scavenger beetle	O
<i>Enochrus testaceus</i>	scavenger beetle	O
<i>Helochares lividus</i>	scavenger beetle	O
<i>Helophorus grandis</i>	scavenger beetle	F
<i>Haltica cf lythri</i>	leaf beetle	O

Table A.3. Plant species noted at the Mickle Trafford Pond

Emergents		
<i>Sparganium erectum</i>	Branched Bur-reed	D
<i>Iris pseudacorus</i>	Yellow Flag	LD
<i>Menyanthes trifoliata</i>	Bogbean	LD
<i>Phalaris arundinacea</i>	Reed Canary Grass	LD
<i>Galium palustre</i>	Marsh Bedstraw	A
<i>Solanum dulcamara</i>	Bittersweet	A
<i>Equisetum fluviatile</i>	Water Horsetail	LA
<i>Alisma plantago-aquatica</i>	Water Plantain	F
<i>Lotus pedunculatus</i>	Great Birdsfoot Trefoil	F
<i>Mentha aquatica</i>	Water Mint	F
<i>Oenanthe fistulosa</i>	Tubular Water-dropwort	LF
Aquatics		
<i>Potamogeton natans</i>	Broad-leaved Pondweed	D
<i>Lemna minor</i>	Common Duckweed	F
<i>Lemna trisulca</i>	Ivy-leaved Duckweed	F
<i>Riccia fluitans</i>	liverwort	F

Table A.4 Invertebrate species noted in the Mickle Trafford Pond

<i>Polycelis</i> sp.	flatworm	F
<i>Erpobdella octoculata</i>	leech	O
<i>Helobdella stagnalis</i>	leech	O
<i>Theromyzon tessellatum</i>	duck leech	O
<i>Erpobdella octoculata</i>	leech	F
<i>Sphaerium corneum</i>	orb mussel	A
<i>Pisidium</i> sp.	pea mussel	F
<i>Lymnaea palustris</i>	marsh snail	F
<i>Lymnaea peregra</i>	wandering snail	F
<i>Oxyloma pfeifferi</i>	marshland snail	O
<i>Acroloxus lacustris</i>	lake limpet	O
<i>Anisus vortex</i>	whirlpool ramshorn	A
<i>Armiger crista</i>	nautilus ramshorn	O
<i>Bathyomphalus contortus</i>	whorled ramshorn	A
<i>Gyraulus albus</i>	white ramshorn	F
<i>Hippeutis complanatus</i>	flat ramshorn	O
<i>Asellus aquaticus</i>	water hoglouse	A
<i>Argyroneta aquatica</i>	water spider	F
<i>Nymphula nymphaeata</i>	Brown China Mark moth	F
<i>Caenis robusta</i>	mayfly	O
<i>Cloeon dipterum</i>	mayfly	F
<i>Aeshna grandis</i>	Brown Hawker	Ads.
<i>Coenagrion puella</i>	Azure Damselfly	F
<i>Ischnura elegans</i>	Blue-tailed Damselfly	F
<i>Pyrrhosoma nymphula</i>	Large Red Damselfly	O
<i>Enallagma cyathigerum</i>	Common Blue Damselfly	Ads.
<i>Sympetrum sanguineum</i>	Ruddy Darter	egg-laying
<i>Microvelia reticulata</i>	lesser water cricket	A
<i>Hesperocorixa linnei</i>	water boatman	O
<i>Hesperocorixa sahlbergi</i>	water boatman	F
<i>Notonecta glauca</i>	backswimmer	F
<i>Holocentropus picicornis</i>	caddis	O
<i>Triaenodes bicolor</i>	caddis	F
<i>Haliphus ruficollis</i>	swimming beetle	F
<i>Haliphus lineatocollis</i>	swimming beetle	O
<i>Noterus clavicornis</i>	diving beetle	O
<i>Copelatus haemarrhoidalis</i>	diving beetle	F
<i>Dytiscus</i> sp.	great diving beetle larvae	F

<i>Agabus bipustulatus</i>	diving beetle		A
<i>Agabus chalconatus</i>	diving beetle	Nb	O
<i>Agabus nebulosus</i>	diving beetle		O
<i>Agabus sturmii</i>	diving beetle		O
<i>Agabus unguicularius</i>	diving beetle	Nb	R
<i>Acilius sulcatus</i>	diving beetle		F
<i>Colymbetes fuscus</i>	diving beetle		O
<i>Hydaticus seminiger</i>	diving beetle	Nb	F
<i>Ilybius ater</i>	diving beetle		F
<i>Ilybius fuliginosus</i>	diving beetle		F
<i>Ilybius guttiger</i>	diving beetle	Nb	O
<i>Ilybius quadriguttatus</i>	diving beetle		O
<i>Hydroporus angustatus</i>	diving beetle		F
<i>Hydroporus nigrita</i>	diving beetle		O
<i>Hydroporus palustris</i>	diving beetle		F
<i>Hydroporus planus</i>	diving beetle		F
<i>Hydroporus tessellatus</i>	diving beetle		O
<i>Hygrotus inaequalis</i>	diving beetle		O
<i>Laccophilus minutus</i>	diving beetle		O
<i>Porhydrus lineatus</i>	diving beetle		F
<i>Suphrodytes dorsalis</i>	diving beetle		F
<i>Anacaena globulus</i>	scavenger beetle		F
<i>Anacaena limbata</i>	scavenger beetle		O
<i>Cercyon convexiusculus</i>	scavenger beetle	Nb	O
<i>Cymbiodyta marginella</i>	scavenger beetle		O
<i>Enochrus coarctatus</i>	scavenger beetle		O
<i>Enochrus testaceus</i>	scavenger beetle		F
<i>Helophorus grandis</i>	scavenger beetle		F
<i>Helophorus minutus</i>	scavenger beetle		O
<i>Hydrobius fuscipes</i>	scavenger beetle		O
<i>Helodidae</i>	helodid larvae		O
<i>Tanysphyrus lemnae</i>	duckweed weevil		O
<i>Anisosticta 19-punctata</i>	wetland ladybird		O

In May 1995 the reed beetle *Donacia clavipes* (Nb) was recorded. The specimen cannot be found and the record is regarded as uncertain. A nymph of a *Sympetrum* dragonfly netted in May 1995 keyed out to *S. flaveolum*, but consultation with D. Kitching gave rise to suspicion that the key used was inaccurate. In the summer of 1995 however adults of *S. flaveolum* were seen widely in north-western England and in 1996 there were confirmed breeding records in Cheshire.

Table A.5. Plant species noted at the "Hydrochara Pond", Brookhouse Farm

Aquatics		
<i>Callitriche stagnalis</i>	Common Water-starwort	O
<i>Lemna minor</i>	Duckweed	A
<i>Ranunculus aquatilis</i>	Common Water-crowfoot	LF
<i>Ricciocarpos natans</i>	aquatic liverwort	LA
<i>Sphagnum fimbriatum</i>	bog moss	LF
<i>Sphagnum squarrosum</i>	bog moss	LA
Emergents		
<i>Agrostis stolonifera</i>	Creeping Bent	LA
<i>Alisma plantago-aquatica</i>	Water-plantain	R
<i>Alopecurus geniculatus</i>	Marsh Foxtail	O
<i>Berula erecta</i>	Lesser Water-parsnip	F
<i>Cardamine pratensis</i>	Cuckoo Flower	F
<i>Carex flacca</i>	Glaucous Sedge	R
<i>Carex otrubae</i>	False Fox Sedge	O
<i>Carex rostrata</i>	Bottle Sedge	LF
<i>Cirsium palustre</i>	Marsh Thistle	O
<i>Digitalis purpurea</i>	Foxglove	R
<i>Dryopteris dilatata</i>	Broad Buckler Fern	O
<i>Eleocharis palustris</i>	Common Spikerush	LD
<i>Epilobium parviflorum</i>	Hoary Willowherb	O
<i>Galium palustre</i>	Marsh Bedstraw	F
<i>Glyceria fluitans</i>	Floating Sweet-grass	LD
<i>Holcus lanatus</i>	Yorkshire Fog	O
<i>Hydrocotyle vulgaris</i>	Marsh Pennywort	F
<i>Juncus articulatus</i>	Jointed Rush	O
<i>Juncus effusus</i>	Soft Rush	A
<i>Juncus inflexus</i>	Hard Rush	F
<i>Lychnis flos-cuculi</i>	Ragged Robin	O
<i>Mentha aquatica</i>	Water Mint	F
<i>Menyanthes trifoliata</i>	Bogbean	LF
<i>Myosotis laxa</i>	Tufted Forgetmenot	F
<i>Poa trivialis</i>	Rough Meadow-grass	LF
<i>Potentilla palustris</i>	Marsh Cinquefoil	R
<i>Ranunculus flammula</i>	Lesser Spearwort	LF
<i>Ranunculus lingua</i>	Greater Spearwort	R
<i>Ranunculus repens</i>	Creeping Buttercup	F
<i>Rorippa nasturtium-aquaticum</i>	Watercress	O
<i>Sparganium erectum</i>	Branched Bur-reed	LF
<i>Stellaria alsine</i>	Bog Stitchwort	F
<i>Salix cinerea</i>	Common Sallow	D

Table A.6 Invertebrate species noted at the "Hydrochara Pond", Brookhouse Farm

<i>Polycelis</i> sp.	flatworm	F
<i>Erpobdella testacea</i>	leech	F
<i>Glossiphonia heteroclita</i>	leech	O
<i>Acroloxus lacustris</i>	pond limpet	F
<i>Bathyomphalus contortus</i>	twisted ramshorn	F
<i>Gyraulus albus</i>	white ramshorn	F
<i>Asellus meridianus</i>	water hoglouse	F
<i>Sympetrum</i> sp.	darter dragonfly nymph	O
<i>Hydrometra stagnorum</i>	water measurer	O
<i>Limnephilus cf flavicornis</i>	caddis cases	O
<i>L. vittatus</i>	caddis	
<i>Dytiscus semisulcatus</i>	great diving beetle	R
<i>Agabus bipustulatus</i>	diving beetle	F
<i>A. unguicularius</i>	diving beetle	Nb F
<i>Ilybius ater</i>	diving beetle	F
<i>I. quadriguttatus</i>	diving beetle	R
<i>Hydroporus angustatus</i>	diving beetle	F
<i>H. nigrita</i>	diving beetle	O
<i>H. planus</i>	diving beetle	F
<i>H. tessellatus</i>	diving beetle	O
<i>Anacaena limbata</i>	scavenger beetle	F
<i>A. lutescens</i>	scavenger beetle	F
<i>Cymbiodyta marginella</i>	scavenger beetle	F
<i>Enochrus coarctatus</i>	scavenger beetle	F
<i>Helophorus grandis</i>	scavenger beetle	F
<i>H. minutus</i>	scavenger beetle	O
<i>Hydrobius fuscipes</i>	scavenger beetle	F
<i>Hydrochara caraboides</i>	lesser silver water beetle	O
<i>Limnebius truncatellus</i>	scavenger beetle	O

Table A.7. Plant species noted at the "Fox Pond", Brookhouse Farm

Emergents		
<i>Salix cinerea</i>	Common Sallow	LD
<i>Glyceria fluitans</i>	Floating Sweet-grass	D
<i>Juncus articulatus</i>	Jointed Rush	LA
<i>Berula erecta</i>	Lesser Water-parsnip	LF
<i>Myosotis laxa</i>	Tufted Forgetmenot	LF
<i>Juncus effusus</i>	Soft Rush	O
<i>Ranunculus flammula</i>	Lesser Spearwort	O
<i>Ranunculus repens</i>	Creeping Buttercup	O
<i>Stellaria alsine</i>	Bog Stitchwort	R
Aquatics		
<i>Ranunculus aquatilis</i>	Common Water-crowfoot	A
<i>Callitriche</i> sp.	Water-starwort	LF

Table A.8 Invertebrate species noted at the "Fox Pond", Brookhouse Farm

<i>Erpobdella testacea</i>	leech		O
<i>Haemopsis sanguisuga</i>	horse leech		LF
<i>Lymnaea palustris</i>	marsh snail		R
<i>Limnephilus vittatus</i>	caddis larvae		O
<i>Gerris lacustris</i>	pondskater		O
<i>Gerris odontogaster</i>	pondskater		O
<i>Gerris thoracicus</i>	pondskater		O
<i>Hesperocorixa linnei</i>	water boatman		O
<i>Hesperocorixa sahlbergi</i>	water boatman		O
<i>Notonecta glauca</i>	backswimmer		O
<i>Haliplus ruficollis</i>	swimming beetle		O
<i>Agabus unguicularius</i>	diving beetle	Nb	F
<i>Coelambus impressopunctatus</i>	diving beetle		O
<i>Colymbetes fuscus</i>	diving beetle larvae		O
<i>Copelatus haemarrhoidalis</i>	diving beetle		F
<i>Hydroporus angustatus</i>	diving beetle		O
<i>Hydroporus planus</i>	diving beetle		F
<i>Laccophilus minutus</i>	diving beetle		F
<i>Coelostoma orbiculare</i>	scavenger beetle		O
<i>Enochrus melanocephalus</i>	scavenger beetle	Nb	1
<i>Helophorus brevialpis</i>	scavenger beetle		O
<i>Helophorus grandis</i>	scavenger beetle		F
<i>Hydrobius fuscipes</i>	scavenger beetle		F
<i>Hydrochara caraboides</i>	lesser silver water beetle		1
<i>Phaedon armoraciae</i>	leaf beetle		O
<i>Prasocuris junci</i>	leaf beetle		O

Table A.9 Plant species noted at the "Grass Pond", Brookhouse Farm

<i>Glyceria fluitans</i>	Floating Sweet-grass	D
<i>Ranunculus aquatilis</i>	Common Water-crowfoot	A
<i>Ranunculus flammula</i>	Lesser Spearwort	LF
<i>Callitriche</i> sp.	Water-starwort	O
<i>Ranunculus repens</i>	Creeping Buttercup	O

Table A.10 Invertebrate species noted at the "Grass Pond", Brookhouse Farm

<i>Erpobdella testacea</i>	leech	O
<i>Lymnaea peregra</i>	wandering snail	O
<i>dytiscid larvae</i>	diving beetle	O
<i>Helophorus grandis</i>	scavenger beetle	O
<i>Hydrobius fuscipes</i>	scavenger beetle	O

Table A.11 Plant species noted at the Bradley Common Pond

Aquatics		
<i>Lemna minor</i>	Duckweed	LF
<i>Lemna trisulca</i>	Ivy-leaved Duckweed	LF
<i>Ranunculus peltatus</i>	Pond Water-crowfoot	LD
	filamentous algae	LF
Emergents		
<i>Agrostis stolonifera</i>	Creeping Bent	LF
<i>Alopecurus geniculatus</i>	Marsh Foxtail	LA
<i>Apium nodiflorum</i>	Fool's Watercress	LF
<i>Cardamine pratensis</i>	Cuckoo Flower	R
<i>Galium palustre</i>	Marsh Bedstraw	LF
<i>Glyceria declinata</i>	Small Sweet-grass	LF
<i>Glyceria fluitans</i>	Floating Sweet-grass	LD
<i>Holcus lanatus</i>	Yorkshire Fog	LA
<i>Juncus effusus</i>	Soft Rush	LD
<i>Juncus inflexus</i>	Hard Rush	LD
<i>Myosotis laxa</i>	Tufted Forgetmenot	F
<i>Ranunculus repens</i>	Creeping Buttercup	O
<i>Rorippa nasturtium-aquaticum</i>	Watercress	O
<i>Rumex crispus</i>	Curled Dock	O
<i>Rumex obtusifolius</i>	Broad-leaved Dock	O
<i>Senecio aquaticus</i>	Marsh Ragwort	R
<i>Urtica dioica</i>	Nettle	R
<i>Salix fragilis</i>	Crack Willow	LD

Table A.12 Invertebrate species noted at the Bradley Common Pond

<i>Lymnaea peregra</i>	wandering snail	LF
<i>Anisus leucostoma</i>	button ramshorn	A
<i>Pisidium sp.</i>	pea mussel	A
<i>Corixa punctata</i>	water boatman	F
<i>Hesperocorixa sahlbergi</i>	water boatman	O
<i>Gerris lacustris</i>	pondskater	O
<i>Limnephilus vittatus</i>	caddis	F
<i>Dytiscus sp.</i>	great diving beetle larvae	O
<i>Agabus bipustulatus</i>	diving beetle	O
<i>Laccophilus minutus</i>	diving beetle	O
<i>Hydroporus memnonius</i>	diving beetle	O
<i>H. planus</i>	diving beetle	O
<i>H. striola</i>	diving beetle	R
<i>Coelambus impressopunctatus</i>	diving beetle	O
<i>Anacaena limbata</i>	scavenger beetle	F
<i>Cymbiodyta marginella</i>	scavenger beetle	F
<i>Enochrus coarctatus</i>	scavenger beetle	O
<i>Helochares lividus</i>	scavenger beetle	Nb F
<i>Helophorus grandis</i>	scavenger beetle	A
<i>H. brevipalpis</i>	scavenger beetle	O
<i>H. minutus</i>	scavenger beetle	A
<i>Hydrobius fuscipes</i>	scavenger beetle	F
<i>Ochthebius minimus</i>	scavenger beetle	O
<i>Cyphon hilaris</i>	scirtid beetle	O
<i>Hydrothassa marginella</i>	leaf beetle	O
<i>Phaedon armoraciae</i>	leaf beetle	F
<i>Prasocuris phellandri</i>	leaf beetle	R

Appendix B

Grid references and brief descriptions of ponds at Brookhouse Farm

This table lists the ponds visited, supplies grid references, and specifies the numbers of discrete, unconnected lobes at the time of survey. Most of the seasonally wet pools were dry, if not in May, then by late summer (per T. Whitaker).

The right-hand column gives details of the suitability of the pond for *H. caraboides*, assessed on the basis of the survey and of apparent physical characteristics of the ponds. The ponds are graded as follows: C = pond capable of modification (eg by scrub removal; dredging); D = pond not capable of easy modification.

The following species codes are used to identify shading species or swamp dominants:

Ag = *Alnus glutinosa*
 Cm = *Crataegus monogyna*
 Cx = *Carex c.f. acutiformis*
 Cxpan = *Carex paniculata*
 Eqf = *Equisetum fluviatile*
 Pc = *Phragmites australis*
 Pha = *Phalaris arundinacea*
 Qr = *Quercus robur*
 Sx = *Salix* sp.
 Sxci = *Salix cinerea*
 Sxf = *Salix fragilis*
 Tl = *Typha latifolia*

Pond No.	Grid Ref (SJ)	No. of separate lobes	Details of actual or potential suitability for <i>H. caraboides</i>
1	6079 6648	1	D: shaded by Ag, Sxf, Sxci
2	6079 6654	2	D: shaded by Qr, Sx
3	6086 6648	3	D: shaded by Ag; some Cx
4	6087 6672	1	D: shaded by Sxf, scrub to S
5	6098 6679	1	D: Tl swamp
6	6110 6622	2	C: part shaded by Ag, part dredged 1995-6; new lobe to SW could be made suitable
7	6102 6638	1	C: part shaded by Sxci
8	6103 6655	1	C: open pond
9	6101 6660	1	C: part shaded by Sxci
10	6110 6661	1	C: shaded by Sxci; could be cleared and dredged
11	6114 6657	2	D: deep hollows, shaded by Ag.
12	6118 6645	1	C: seasonally wet hollow; could be dredged
13	6123 6643	3	C: shaded by Sxci etc.; remove scrub.
14	6121 6623	2	D: part shaded by Ag; dredged 1994-5.

Pond No.	Grid Ref (SJ)	No. of separate lobes	Details of actual or potential suitability for <i>H. caraboides</i>
15	6141 6619	1	C: large, open pond
16	6140 6601	1	D: deep hollow with pond heavily shaded.
17	6113 6591	3	D: partly shaded, Ag; little emergent vegetation
18	6135 6587	1	C: seasonally wet, grassy hollow, dry 1996; could be deepened and hedge trimmed to west.
19	6111 6571	2	D: shaded by Sxci scrub
20	6144 6577	1	D: shaded by Ag, Cm
21	6161 6571	1	D: shaded by Sxci
22	6123 6567	1	D: partly shaded by Ag
23	6122 6554	1	D: open with fringe of Eqf and stand of Cxpan on vegetation raft
24	6147 6551	5	D: shaded by Ag
25	6151 6551	1	D: shaded by Sxci
26	6113 6531	2	C: seasonally wet hollows, dry in 1996; could be deepened
27	6130 6530	1	D: seasonally wet hollow, soaks into drain beneath
28	6131 6527	1	C: shaded pond from which Sxci has been recently cut back; winching of scrub might be beneficial
29	6151 6525	1	D: shaded by Sxci, Qr
30	6161 6518	6	D: shaded by Ag; stands of Cxpan, Pha
31	6166 6509	1	D: shaded by Qr
32	6179 6508	1	C: damp hollow by hedge; could be dredged
33	6185 6500	2	D: shaded by Sxci
34	6161 6500	2	D: shaded by ring of Ag
35	6133 6499	5	D: shaded by Ag
36	6127 6501	1	D: stand of Pc in fluctuating pool
37	6113 6500	1	D: shaded by Sxci, stand of Cxpan and Tl at one end
38	6191 6496	1	C: damp hollow with Pha
39	6199 6488	1	D: shaded by Qr
40	6178 6490	3	D: shaded by Ag
41	6146 6498	3	D: ringed by Ag

Pond diagrams

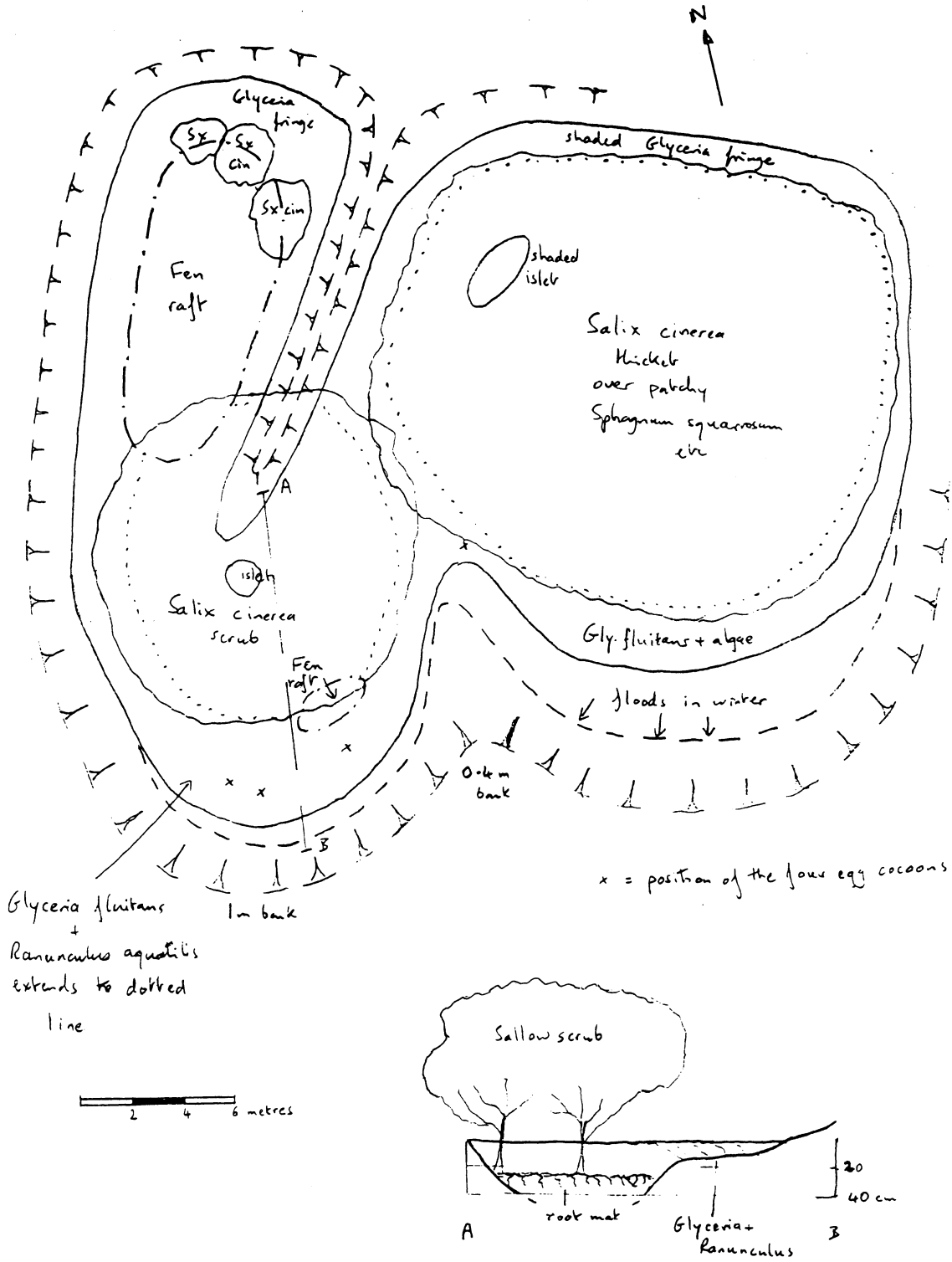


Figure 1. Brookhouse Farm 'Hydrochara pond'

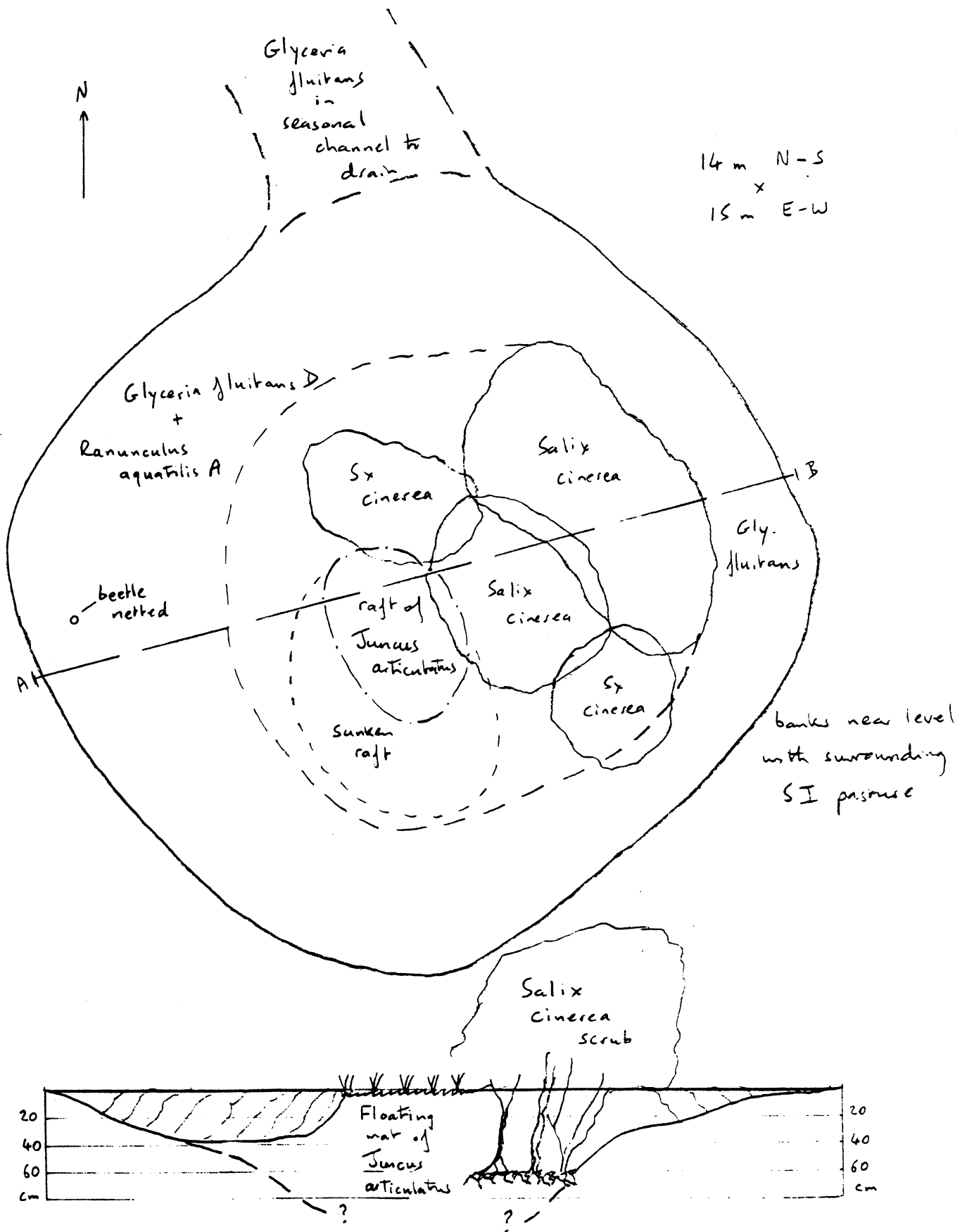


Figure 2. Brookhouse Farm 'Fox Pond'

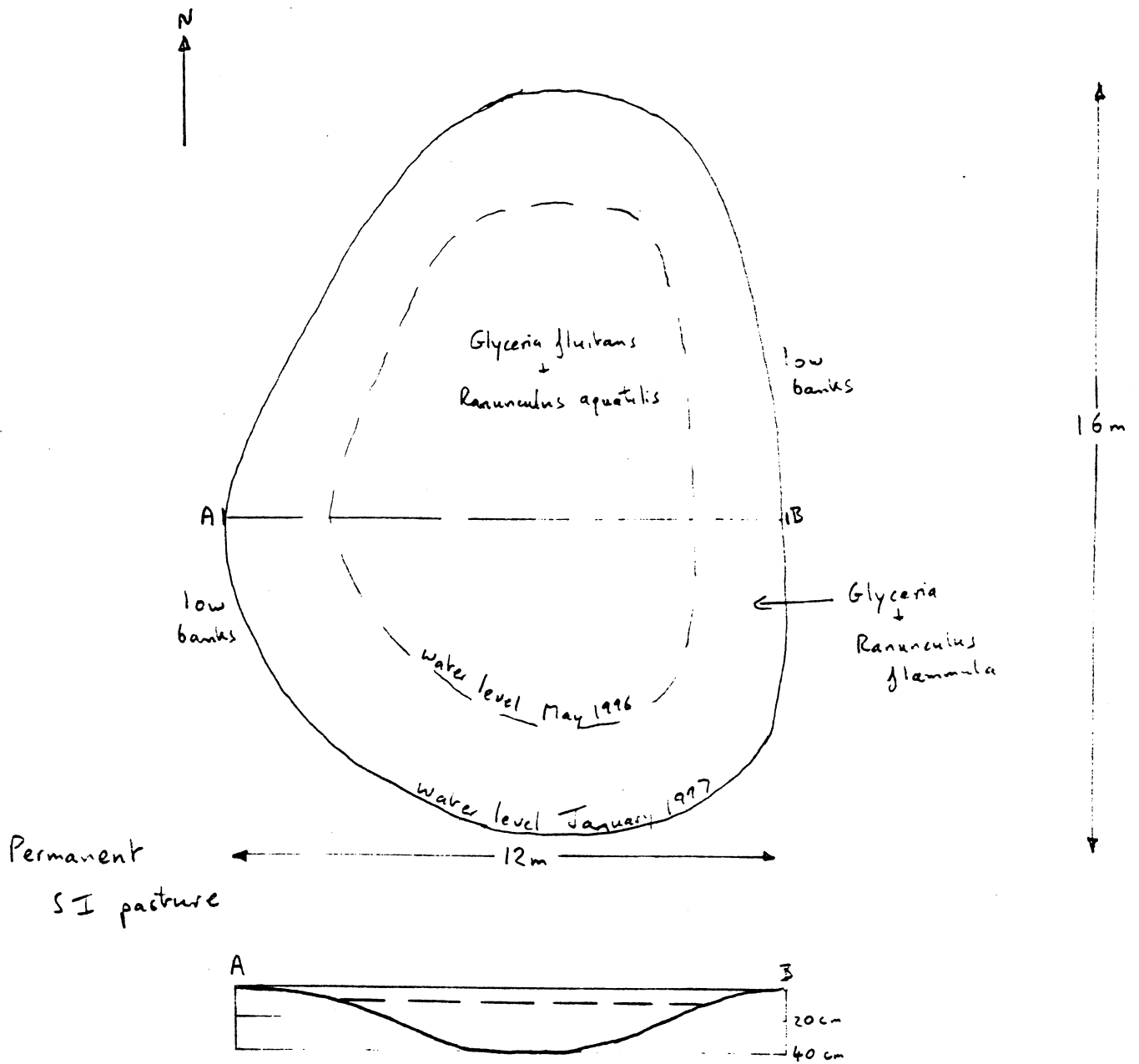


Figure 3. Brookhouse Farm 'Grass Pond'

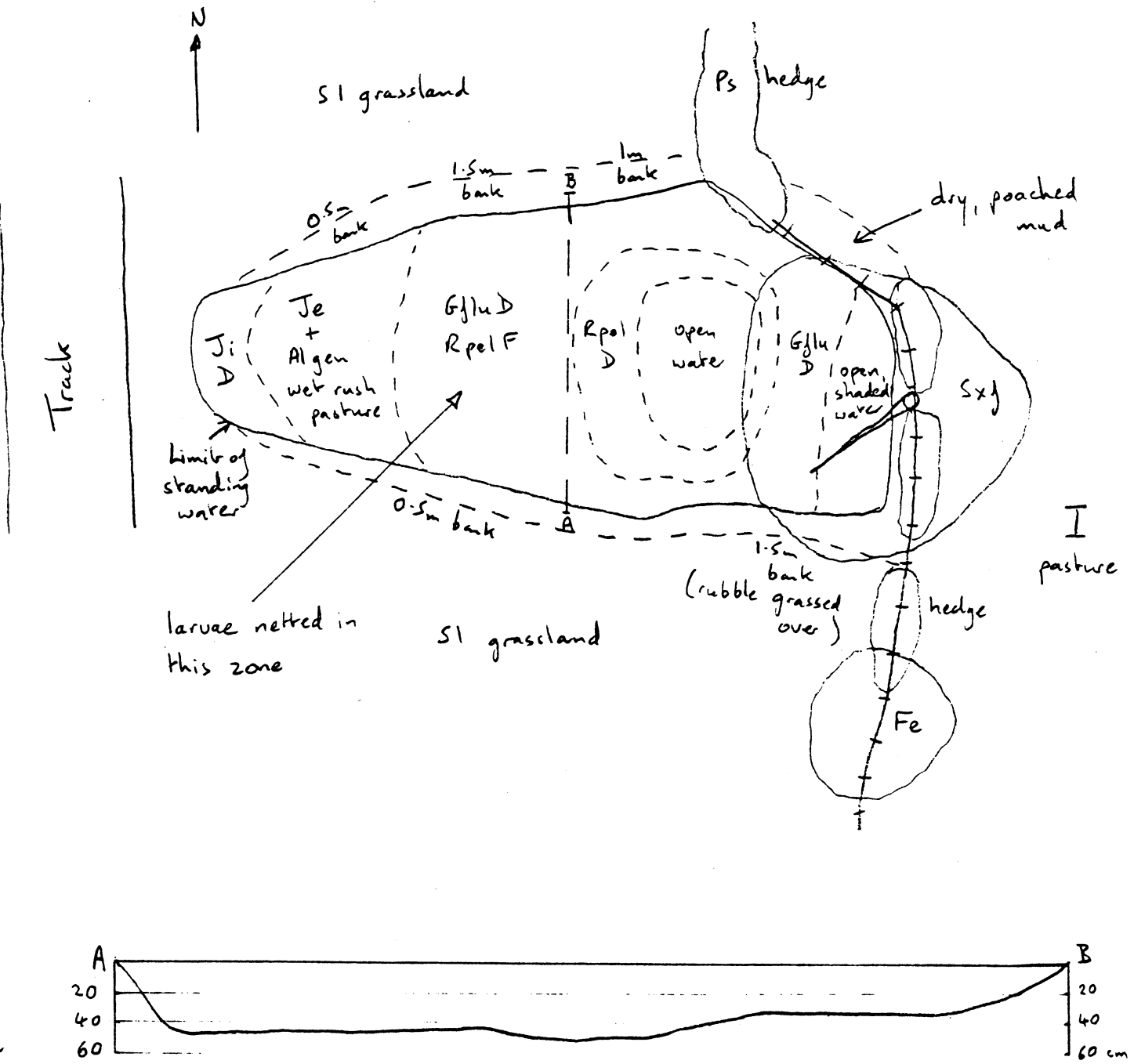


Figure 4. Bradley Common

WORD PROCESSING CENTRE

REQUISITION FORM

WHEN RE-SUBMITTING WORK FOR CORRECTION/EDITING PLEASE ATTACH THE ORIGINAL REQUISITION SLIP

To: WP Operator Job No: 3465

From: Martin Drake Date Sent: 7-10-97

Division/Section: Lowlands Ext: 5264

Description: (Title of Document) EN12R 248 - lesser silver water Seettle

Author's Instructions

WP Operator Notes

HOLD TEXT: I didn't keep the original Requisition form.

Operator Name Mary

W (One Week) []

Document Title p3465ind

M (One month) [] Plain []

T (Three months) [] L/head []

Disk Title Disks

P (Permanent) []

SPACING Single, One/half, Double

ONE COPY ONLY WILL BE SUPPLIED

DATE REQUIRED 16 October (Allow a 3 day turnround for routine work)

Date returned 9/10

CORRECTIONS/AMENDMENTS

Op/W/Station Name

DATE REQUIRED

Date returned

SPACING Single, One/half, Double

Op/W/Station Name

DATE REQUIRED

Date returned

SPACING Single, One/half, Double

Op/W/Station Name

DATE REQUIRED

Date returned

COMMENTS/SPECIAL INSTRUCTIONS

Author

WP Operator

I had complaints that this report allowed collectors to get their specimen without any effort, so I've changed details of sites etc, & will re-issue the whole report.

WHERE WORK HAS BEEN REQUESTED TO BE KEPT ON PERMANENT HOLD, CAN YOU PLEASE RETURN THIS FORM WHEN IT CAN BE DELETED.

Corrections on pp - title page, 1, 4, 6, 23-24