

Stow Cum Quy Fen pond survey



A report for the Freshwater Habitats Trust

July 2017

(Version 2)



1. Introduction

Stow-cum-Quy Fen Site of Special Scientific Interest (SSSI) covers 29.6 hectares and is located 7.5 km north-east of the centre of Cambridge. It features a number of ponds, the largest being a coprolite pit from which phosphate-rich deposits were excavated in the mid to late 19th century for fertiliser (O'Connor, 2001 & 2011). Originally believed to be fossilised dinosaur dung, the 'coprolite' seams were in fact phosphatic nodules derived from the remains of marine molluscs, cephalopods and other organisms deposited during the Jurassic (Cambridgeshire Archaeology Field Group, 2015). The elongate shape of some smaller ponds suggests that these too originated as coprolite pits but others are likely to be stock watering ponds.

This survey was commissioned by the Freshwater Habitats Trust as part of the Flagship Ponds project. Fieldwork for was undertaken by Jonathan Graham (botanical survey) and Martin Hammond (invertebrates) on 17th May 2017. This was followed by a second visit on 21st June 2017 to seek out additional species.

2. Survey methods

Eight ponds (refer to location map below) were surveyed using PSYM (**P**redictive **S**ystem for **M**ultimetrics), the standard methodology for evaluating the ecological quality of ponds and small lakes (Environment Agency, 2002). A PSYM survey involves:

- Obtaining environmental data such as pond area, altitude, grid reference, substrate composition, cover of emergent vegetation, degree of shade, accessibility to livestock and water pH
- Collecting a sample of aquatic macro-invertebrates using a standard protocol (three minutes' netting divided equally between each 'meso-habitat' within the pond basin, plus one minute searching the water surface and submerged debris)
- Recording wetland plants

PSYM generates six 'metrics' (measurements) representing important indicators of ecological quality. The three botanical metrics are:

- diversity of emergent and submerged plant species
- the number of uncommon plant species
- Trophic Ranking Score (TRS, an estimation of nutrient status based on plant indicators)

The three invertebrate metrics are:

- Average Score Per Taxon (ASPT, an estimation of biological water quality based on the sensitivity of different invertebrate families to organic enrichment)
- diversity of dragonfly, damselfly and alderfly families¹
- diversity of water beetle families

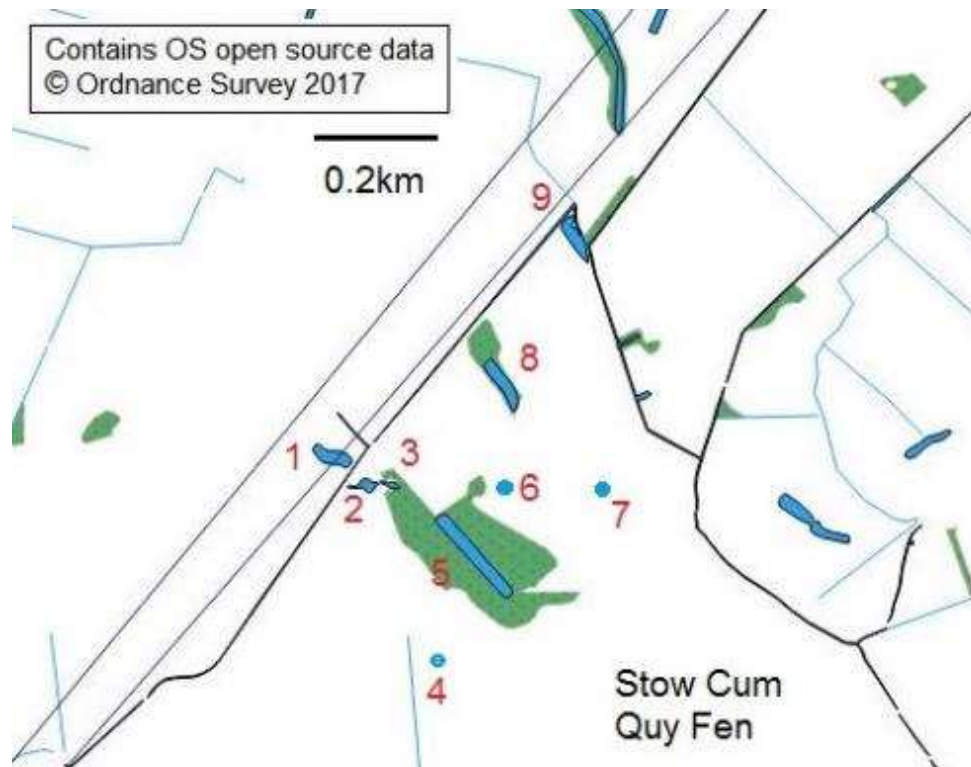
The results are analysed using software which compares the observed data with values predicted from a large reference dataset of undegraded ponds. PSYM predicts how a high quality pond with similar attributes *should* score for each metric, and compares the

¹ As no alderflies were recorded in the survey, this metric is referred to simply as diversity of Odonata families.

predictions with the survey results. The scores for each metric are combined to produce an Index of Biotic Integrity (IBI) which provides an overall indication of the ecological quality of the pond. Ponds are then categorised as Very Poor, Poor, Medium and Good.

Whilst PSYM requires only family-level identification of invertebrates, material was identified to species level wherever possible. As a departure from normal procedure, the sample was sorted on the bankside to avoid the risk of removing large numbers of individuals of rare species.

In order to record larger dytiscid beetles (which often elude capture by hand-netting), baited bottle traps were placed in several of the ponds the evening before the survey. Details of captures are given on the accompanying spreadsheet. Bottle trap captures did not form part of the PSYM samples.



Location map for ponds surveyed

On 21st June, Ponds 1, 2, 3, 5 and 6 were re-examined to search for additional species

3. The ponds surveyed

Pond 1

Grid reference	TL 51122 62848
Size	1634 m ²
pH	7.3
Conductivity ($\mu\text{S}/\text{cm}^{-1}$)	1070
% shading	30
% emergent	20
Substrate	Clay/silt
Grazing	Ungrazed



A partly shaded pond with dense marginal willow scrub. Its elongate shape suggests it may have originated as a coprolite pit. The northern and eastern margins support Common Reed *Phragmites australis* fringe while the southern margin has stands of Common Club-rush *Schoeneoplectus lacustris*. A few other emergent species are present in small quantity including False Fox-sedge *Carex otrubae*, Greater Willowherb *Epilobium hirsutum*, Blunt-fruited Rush *Juncus subnodulosus*, Gipsywort *Lycopus europaeus*, Purple Loosestrife *Lythrum salicaria*, Water Mint *Mentha aquatica*, Amphibious Bistort *Persicaria amphibia*, Clustered Dock *Rumex conglomeratus* and Woody Nightshade *Solanum dulcamara*. There are no submerged aquatics and the bed is dominated by filamentous algae (*Spirogyra* sp.) Exposed logs, marginal willow trunks and roots are colonised by Kneiff's Feather-moss *Leptodictyum riparium* and Greater Water-moss *Fontinalis antipyretica* was noted from a single willow trunk (N side of pond at the water's edge).

This pond yielded 46 aquatic macro-invertebrate taxa (40 from the PSYM sample). These included two Near Threatened water beetles (*Enochrus nigrinus* and *Limnebius papposus*) along with a few local species such as Hairy Dragonfly *Brachytron pratense* and the scavenger water beetle *Cercyon sternalis*.

Moorhen, Sedge Warbler and Common Toad tadpoles were observed. Three-spined Sticklebacks were abundant.

Evaluation using PSYM gave Pond 1 an Index of Biotic Integrity (IBI) of 72%, placing it at the top end of the **Moderate** category for ecological quality, just below the 75% threshold for Good quality. It scored poorly for diversity of submerged and emergent plants, and for representation of uncommon species but Trophic Ranking Score (TRS) was favourable. Scores for biological water quality (ASPT) and diversity of water beetle families were high but representation of Odonata families was only moderate.

Pond 2

Grid reference	TL 51207 62797
Size	600 m ²
pH	7.6
Conductivity (µS/cm ⁻¹)	690
% shading	0
% emergent	20
Substrate	Clay/silt
Grazing	Accessible to livestock

This is an open, cattle-grazed pond with grass mats and mixed low emergent vegetation in the shallows. In the open water, submerged vegetation features Nuttall's Waterweed *Elodea nuttallii*, Horned Pondweed *Zannichellia palustris* and stoneworts. The latter comprised the Nationally Scarce Clustered Stonewort *Tolypella glomerata* in addition to Common Stonewort *Chara vulgaris* and Bristly Stonewort *C. hispida*. Twenty-eight wetland plant species were recorded with other noteworthy species including Water Violet *Hottonia palustris* (categorised as Vulnerable in England), Orange Foxtail *Alopecurus aequalis* and Brookweed *Samolus valerandi*.

Fifty-eight aquatic taxa were identified (51 from the PSYM sample). These included three Nationally Scarce species: the algivorous water beetle *Peltodytes caesus* (which was plentiful on both visits), the scavenger water beetle *Enochrus quadripunctatus* and the Pink Water-speedwell Weevil *Gymnetron villosulum*. Local species included Hairy Dragonfly, the water-singer *Micronecta scholtzii* and the scavenger water beetle *Cercyon sternalis*.



Three soldierfly taxa were collected as larvae: the widespread but local Common Green Colonel *Oplodontha viridula*, and two *Oxycera* species. The latter included one species with indented posterior corners to the final abdominal segment and another without.

Common Frog and Common Toad tadpoles were noted along with Nine-spined Sticklebacks.

Evaluation using PSYM gave Pond 2 an Index of Biotic Integrity (IBI) of 94%, placing it in the top (**Good**) category for ecological quality. It scored highly for diversity of submerged and emergent plants, and for representation of uncommon species. Indeed for both of these metrics, the pond scored much better than the model predicted. Trophic Ranking Score (TRS) was moderate, suggesting that the flora was more indicative of high nutrient status than expected for an undegraded pond with similar characteristics. Pond 2 scored well for all three invertebrate metrics.

Pond 3

Grid reference	TL 51251 62795
Size	240 m ²
pH	7.3
Conductivity (µS/cm ⁻¹)	670
% shading	2
% emergent	65
Substrate	Clay/silt
Grazing	Accessible to stock



This pond forms an eastwards extension of Pond 2 but is separated by a track; it merges into a shallow, seasonal drain. Twenty-eight wetland plant species include three which are categorised as Vulnerable in England: Lesser Water-plantain *Baldellia ranunculoides*, Water Violet and Lesser Spearwort *Ranunculus flammula*. Also of note are Marsh Pennywort *Hydrocotyle vulgaris* (listed as Near Threatened in England), Orange Foxtail, Bristly Stonewort and Brookweed.

This pond yielded 54 aquatic macro-invertebrate taxa (42 in the PSYM sample). These included two Near Threatened water beetles (*Enochrus nigritus* and *Limnebius papposus*) along with the Nationally Scarce beetles: the hydrophilid *Enochrus quadripunctatus* and the aquatic weevil *Pelenomus canaliculatus*. Also of note were the scavenger water beetle *Hydrobius rothenbergii*, the Pink Water-speedwell Weevil *Gymnetron villosulum* and the Black Colonel soldierfly *Odontomyia tigrina*.

Evaluation using PSYM gave Pond 3 an Index of Biotic Integrity (IBI) of 94%, placing it in the top (**Good**) category for ecological quality. It scored highly for all three botanical metrics. It scored well for biological water quality (ASPT) and diversity of water beetle families, though only moderately for diversity of Odonata families.

Pond 4

Grid reference	TL 51342 62492
Size	320 m ²
pH	8.4
Conductivity (µS/cm ⁻¹)	460
% shading	0
% emergent	0
Substrate	Clay/marl
Grazing	Ungrazed (fenced)



This newly-excavated pond has been created in a fenced off enclosure on the boundary of the Fen, with arable land to the south. It has an exposed chalk-marl substrate. Pioneer vegetation is dominated by Common Stonewort, Bristly Stonewort and the scarce Clustered Stonewort. Small numbers of Common Frog and Common Toad tadpoles were present.

The PSYM sample included invertebrate 21 taxa. Prominent amongst these were pioneer species such as the diving beetles *Agabus nebulosus*, *Hygrotus confluens* and *Hydroglyphus geminus* and the lesser water-boatman *Sigara lateralis*. The scavenger water beetle *Berosus affinis*, a local but apparently increasing species of shallow ponds with exposed clay substrates, was abundant.

Evaluation using PSYM gave Pond 4 an Index of Biotic Integrity (IBI) of 78%, placing it in the top (**Good**) category for ecological quality. Diversity of submerged and emergent plants was very poor but representation of uncommon species and Trophic Ranking Score were good. This was expected as the pond is only recently created and supports pioneer stonewort vegetation. Pond 4 scored well for biological water quality (ASPT) and diversity of water beetle families, though only moderately for diversity of Odonata families.

Pond 5

Grid reference	TL5140262668
Size	3700 m ²
pH	7.6
Conductivity ($\mu\text{S}/\text{cm}^{-1}$)	900
% shading	5
% emergent	15
Substrate	Marl/ gravel
Grazing	50% grazing (E margin), partly fenced



This is the main coprolite pit: it is the largest and most botanically diverse water body at Stow-cum-Quy Fen.

Forty-nine wetland plant species were recorded including the Nationally Scarce Fringed Water-lily *Nymphoides peltata*. Tufted Sedge and Marsh Pennywort are categorised as Near Threatened in England whilst Lesser Water-plantain, Water Violet and Lesser Spearwort are listed as Vulnerable. Also of note are Narrow-leaved Water-plantain *Alisma lanceolatum*, Flowering Rush *Butomus umbellatus*, Soft Hornwort *Ceratophyllum submersum* and Bristly Stonewort.

Sixty aquatic invertebrate taxa were recorded (44 in the PSYM sample). These included, on 21st June, the Red List (Vulnerable) reed-beetle *Donacia sparganii* and the Nationally Scarce Pink Water-speedwell Weevil *Gymnetron villosulum*. In addition, local insects included Hairy Dragonfly (amongst nine larval Odonata species), Water Stick-insect *Ranatra linearis*, the water singer *Micronecta scholtzii*, the Pondweed Bug *Mesovelia furcata* and the great diving beetles *Dytiscus circumflexus* and *D. semisulcatus*.

Evaluation using PSYM gave an Index of Biotic Integrity (IBI) of 100%, placing Pond 5 in the top (**Good**) category for ecological quality. It achieved the maximum score for all six metrics, meaning that it met or exceeded predictions for all measures of ecological quality.



Fringed Water-lily, Flowering Rush, Mare's-tail and mixtures of the stoneworts *Chara hispida* and *C. vulgaris* in Pond 5

Pond 6

Grid reference	TL 51477 62754
Size	230 m ²
pH	7.9
Conductivity (μS/cm ⁻¹)	1020
% shading	15
% emergent	10
Substrate	Silt
Grazing	No grazing (fenced)

This permanent pond supports submerged beds of Soft Hornwort *Ceratophyllum submersum* and has a broad belt of mossy vegetation in the draw-down zone. It is fenced off from livestock. Twenty wetland plant species were recorded. Fifty aquatic macro-invertebrate taxa were recorded (42 in the PSYM sample). These included the Near Threatened scavenger water beetle *Enochrus nigritus* and the Nationally Scarce aquatic weevil *Pelenomus canaliculatus*.

Evaluation using PSYM produced an Index of Biotic Integrity of 94%, placing Pond 6 in the top (**Good**) category for ecological quality. It scored highly for all metrics apart from diversity of Odonata families, which was moderate.



Pond 7

Grid reference	TL 51646 62779
Size	360 m ²
pH	7.9
Conductivity ($\mu\text{S}/\text{cm}^{-1}$)	810
% shading	10
% emergent	17
Substrate	Silt
Grazing	No grazing (fenced)



This pond is also fenced-off to exclude livestock. It has submerged stonewort beds, a small stand of Fen Pondweed *Potamogeton coloratus* and more extensive growth of Broad-leaved Pondweed *P. natans*. Twenty-eight wetland plant species were recorded, Fen Pondweed being categorised as Nationally Scarce. Also of note are Lesser Spearwort and Meadow-rue *Thalictrum flavum*. The water-lily *Nymphaea marliacea* has been introduced.

Thirty-four aquatic macro-invertebrate taxa were identified from the PSYM sample. None of these are species of national conservation concern but local species included Hairy Dragonfly, the stonewort-feeding beetle *Halipplus obliquus* and the scavenger water beetle *Hydrobius subrotundus*. Purple Loostrife Leaf-beetle *Galerucella californiensis* was present on its host plant on the pond banks.

A Water Vole was seen and grazing lawns and burrows observed.

Evaluation using PSYM gave an Index of Biotic Integrity (IBI) of 100%, placing Pond 7 in the top (**Good**) category for ecological quality. It achieved the maximum score for all six metrics, meaning that it met or exceeded predictions for all measures of ecological quality.

Pond 8

Grid reference	TL 51451 62990
Size	1902 m ²
pH	7.6
Conductivity (µS/cm ⁻¹)	930
% shading	70
% emergent	30
Substrate	Silt
Grazing	No grazing (fenced)

This is a coprolite pit now surrounded by trees at the eastern edge of the Fen. It supports extensive cover of Common Reed with sprawling vines of Woody Nightshade but Kneiff's Feather-moss was the only other wetland plant recorded. Only nine aquatic macro-invertebrate taxa were recorded, the great diving beetle *Dytiscus circumflexus* (bottle-trapped) being the only uncommon species.

Evaluation using PSYM produced an IBI of 33%, placing Pond 8 in the **Poor** category for ecological quality. Diversity of submerged and emergent plants was very poor with a null score for representation of uncommon species. Trophic Ranking Score was good but since this was based on only two species the metric means little. Biological water quality was moderate and diversity of water beetle families poor, with a null score for Odonata.



Pond 9

Grid reference	TL 51598 63245
Size	1500 m ²
pH	7.5
Conductivity ($\mu\text{S}/\text{cm}^{-1}$)	1030
% shading	90
% emergent	80
Substrate	Silt
Grazing	No grazing (fenced)

This water body is connected to Commissioners' Drain and has a throughput of moving water. Deep, unstable silt made it too hazardous to sample invertebrates properly, so it was not assessed using PSYM. Seven wetland plants were recorded, none of which are species of conservation concern.

4. Results

4.1 Physico-chemical status

All water samples indicated near-neutral to moderately alkaline water chemistry, with a pH range of 7.3 to 8.4 and a mean reading of 7.68.

Electrical conductivity (a measure of solute content) ranged from 460 to 1070 $\mu\text{S}/\text{cm}^{-1}$ with a mean reading of 842. This is a relatively high range indicative of eutrophic conditions but may also reflect the naturally mineral-rich substrates on the Fen.

4.2 Wetland plants

Seventy-one species of wetland vascular plants², stoneworts and bryophytes were recorded (Appendix 2). The most frequent species (i.e. those found in more than half the ponds surveyed) were Creeping Bent *Agrostis stolonifera*, Common Water-plantain *Alisma plantago-aquatica*, Bristly Stonewort, Common Spike-rush *Eleocharis palustris*, Jointed Rush *Juncus articulatus*, Hard Rush *J. inflexus*, Water Mint *Mentha aquatica*, Thread-leaved Water-crowfoot *Ranunculus trichophyllus* and Brookweed. This list indicates clayey, base-rich, eutrophic or mesotrophic conditions.

4.3 Aquatic macro-invertebrates

One hundred and thirty macro-invertebrate taxa were recorded (Appendix 3) with 112 identified from the PSYM samples. Just under half the total (49%) were water beetles with water bugs, molluscs and dragonflies being the next most diverse groups, making up 14%, 11% and 8% of the list respectively (Figure 1). Caddis-flies (Trichoptera) were under-represented in the list as larvae of several *Limnephilus* species were not identified.

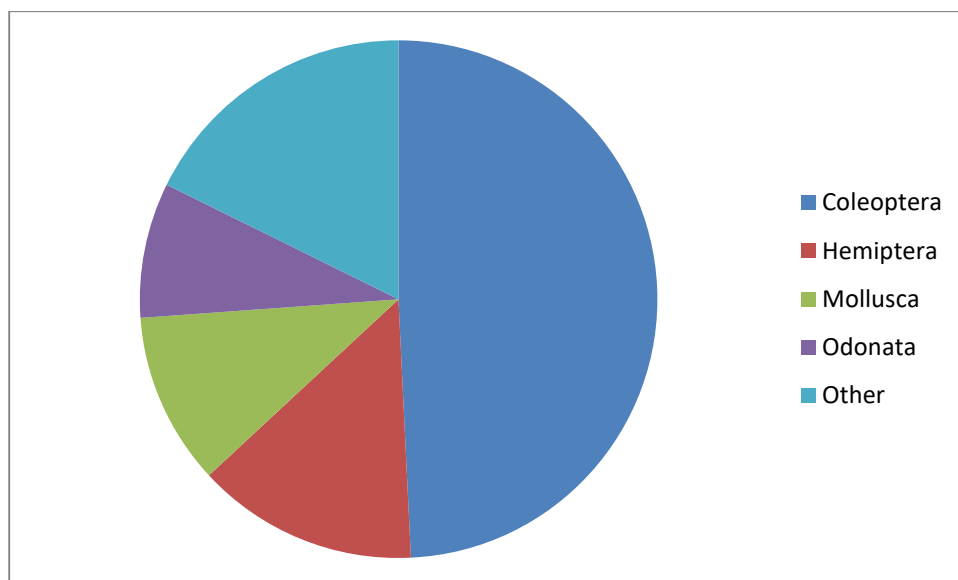


Figure 1: taxonomic composition of the aquatic macro-invertebrate list

Further water bugs could doubtless be recorded in early spring or autumn when more lesser water-boatmen (Corixidae) and backswimmers (Notonectidae) would be in the adult stage

² Wetland vascular plants are those listed on the PSYM/National Pond Survey pro-forma

(immature are difficult or impossible to identify to species). Although water snails were reasonably well represented in the PSYM samples, additional species could probably be found by more exhaustive sampling. Historic water beetle records indicate that more recording would be needed to assess fully the current status of these insects, old records of rarities such as the Great Silver Water Beetle *Hydrophilus piceus* and the reed-beetle *Donacia aquatica* being particularly notable.

It would be worth drawing Stow-cum-Quy Fen to the attention of dipterists interested in soldier-flies (Stratiomyidae) since at least four species were recorded as larvae. These insects are often considered indicative of high-quality wetland habitats.

5. Species of conservation concern

5.1 Plants

Clustered stonewort, *Tolypella glomerata*

GB status: Nationally Scarce³

Tolypella glomerata is a widespread, but scarce and apparently declining stonewort (John, Whitton & Brook, 2002). It is often a winter annual visible from October to May, but persisting at some sites throughout the year, particularly in deeper water. It was recorded in quantity from Pond 2 and also present in the newly-excavated Pond 4. In both locations it co-occurred with Common Stonewort and Bristly Stonewort.

During a recent survey of 175 farmland drains in the Cambridgeshire Fens, *T. glomerata* was found at just two locations (Graham & Hammond, 2015).



Lesser Water-plantain, *Baldellia ranunculoides*

GB status: Near Threatened. English status: Vulnerable

Lesser Water-plantain is an increasingly scarce plant of fluctuating water margins on calcareous substrates, growing in habitats where disturbance such as cattle grazing limits competition from taller vegetation. Its distribution in England has diminished by 43% (Stroh

et al, 2014). In June 2017, around 150 flowering plants were present in Pond 3 and an adjoining shallow channel with a further 50 or so in the margins of Pond 5.

³ Conservation status of charophytes is taken from Stewart (2013)

Tufted Sedge, *Carex elata*

English status: Near Threatened⁴

This tussock-forming sedge is associated with fluctuating water margins in base-rich fens. Its British distribution is centred on the belt of former fenland extending from East Anglia to the Vale of York with outlying centres in the Lake District, the Cheshire Plain and Anglesey. Its range (Extent of Occupancy) in England contracted by 29% during the second half of the 20th century (Stroh *et al*, 2014). At Stow-cum-Quy Fen it grows locally at the margin of the main coprolite pit (Pond 5).

Water-violet *Hottonia palustris*

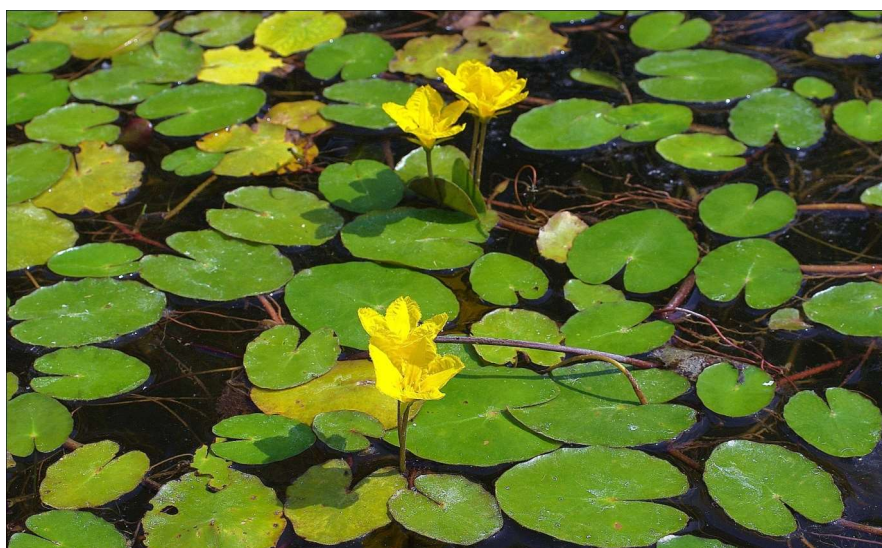
English status: Vulnerable

A widespread but local and declining plant in eastern England, the distribution (Area of Occupancy) of Water Violet declined by 33% in England during the latter part of the 20th century with a similar (37%) loss of range (Stroh *et al*, 2004). The Great Britain status of this species is also likely to be upgraded to Vulnerable in the near future⁵. Water Violet was recorded from Ponds 2, 3 and 5 at Stow-cum-Quy Fen.

Marsh Pennywort, *Hydrocotyle vulgaris*

English status: Near Threatened

A humble plant of short vegetation in water margins and wet fens which, like many species of less fertile wetlands, is undergoing a long-term decline in distribution in England. It was recorded from Pond 3 and the bank of Pond 5.



**Fringed Water-lily
*Nymphaeodes peltata***

GB status: Nationally Scarce⁶

The native distribution of Fringed Water-lily is considered to be restricted to the Fens and the Thames basin (Preston *et al*, 2002). It is therefore considered to be Nationally Scarce.

However, this species has been widely introduced elsewhere. Fringed Water-lily grows locally in the main coprolite pit (Pond 5) at Stow-cum-Quy Fen.

⁴ England conservation status for vascular plants is based on Stroh *et al* (2014).

⁵ *BSBI News* no 135, p59.

⁶ GB rarity status for vascular plants is based on Leach & Rusbridge (2006).

Fen Pondweed, *Potamogeton coloratus*

GB status: Nationally Scarce

This scarce, translucent pondweed is restricted to calcareous but oligotrophic still-waters. Its main centres are in East Anglia and Cambridgeshire, the Somerset Levels, Anglesey and the Hebrides. A small patch was found in Pond 7.

Lesser Spearwort, *Ranunculus flammula*

English status: Vulnerable

Although still widespread and locally frequent, Lesser Spearwort underwent a 32% decline in distribution in England during the latter half of the last century (Stroh *et al*, 2014). At Stow-cum-Quy Fen it was found in Ponds 3, 5 and 7.

5.2 Invertebrates

***Peltodytes caesus* (Haliplidae), an algivorous water beetle**

GB: Nationally Scarce⁷

This is a scarce beetle of base-rich ponds and ditches found in the coastal counties between Hampshire and the Wash, in the levels at either side of the Bristol Channel and inland in the Home Counties (Foster & Friday, 2011). It is rarely recorded in ditches in the Cambridgeshire Fens (Graham & Hammond, 2015) so it was surprising to encounter large numbers of adults in Pond 2 on both visits.

***Enochrus nigrinus* (Hydrophilidae), a scavenger water beetle**

GB status: Near Threatened

This small hydrophilid occurs amongst fen vegetation in shallow water margins. It has a very limited distribution in East Anglia, Cambridgeshire, the New Forest, Herefordshire and a handful of sites elsewhere in southern England and Wales. “It is mainly found in relict fens but also occasionally in recently created habitats in old fen areas” (Foster *et al*, in prep).

Enochrus nigrinus was collected from Ponds 1, 3 and 6 on 17th May. As this species was only recognised as British in 1984, there are no previous records for Stow-cum-Quy Fen.

***Enochrus quadripunctatus* (Hydrophilidae), a scavenger water beetle**

GB: Nationally Scarce

A mid-sized, brownish scavenger water beetle associated with clayey or silty water margins. Although older records are confused by taxonomic changes, the true *E. quadripunctatus* has a restricted British distribution strongly centred on the east of England; it appears to have extended its range in recent years (Foster *et al*, 2014).

⁷ Status designations for water beetles were reviewed by Foster (2010), with the exception of the reed-beetles of the Donaciinae, which were reviewed by Hubble (2014), and weevils, which were last reviewed by Hyman (1992)

On 17th May, *E. quadripunctatus* was found in two adjacent, unshaded cattle-grazed ponds (2 & 3). In the farmland at either side of the Ouse Washes, *E. quadripunctatus* occurs very locally in drains which are grazed and trampled by livestock (Graham & Hammond, 2015).

Limnebius papposus (Hydraenidae), a small water beetle

GB status: Near Threatened

This small beetle is restricted to richly-vegetated ponds and drains in lowland fenland areas. The Somerset Levels remain a stronghold but *L. papposus* shows evidence of serious decline in other parts of its range (Foster, 2010). During this survey, single female specimens were collected from Ponds 2 and 3. There are six previous records from Stow-cum-Quy Fen, dated between 1913 and 1965.

Donacia sparganii (Chrysomelidae), a reed beetle

GB status: Vulnerable

An adult was collected from a mass of Fringed Water-lily on the main coprolite pit (Pond 5) on 21st June, and others were seen. This species is associated with floating bur-reed leaves in moving water (Cox, 2007), though it has also been found on Flowering Rush; adults may feed on pollen, including that of water-lilies. It is tempting to speculate that the main pit at Stow-cum-Quy Fen provides an environment not dissimilar to a lowland river backwater, albeit lacking water movement.

Hubble (2014) summarised the status of *D. sparganii* as follows:

Previously widespread in southern England with scattered records as far north as southern Scotland. Following a large decline, now known only from a few widely scattered locations in southern England and south Wales. Prior to 1990 it was recorded in forty-six hectads; since 1990 it has been found in nine...making it appropriate for the Vulnerable category. The increased survey effort associated with publication of the Atlas (Cox, 2007) suggests the decline is real.

The national water beetle recording scheme dataset shows concentrations of records from the Somerset Levels and the River Nene in Cambridgeshire.



Gymnetron villosulum (Curculionidae), an aquatic weevil

GB status: Nationally Scarce

The larvae of this weevil form distinctive spherical galls in the ovaries of Pink Water-speedwell, in which they also pupate. Although still formally listed as Nationally Scarce, *G. villosulum* appears to be fairly frequent where its host plant is plentiful, primarily in the fluctuating margins of silty lowland ponds. It was detected in five out of 175 farmland drains in the vicinity of the Ouse Washes in 2013-14 (Graham & Hammond, 2015).

Pelenomus canaliculatus (Curculionidae), an aquatic weevil

GB status: Nationally Scarce

This is one of a small group of fully aquatic weevils which feed on water-millfoils, though the collection of single specimens from Ponds 3 and 6 on 21st June is interesting since neither support *Myriophyllum*! Sampling of drains in the Cambridgeshire Fens suggests that another water-millfoil weevil, *Eubrychius velutus*, is fairly frequent (Kirby & Lambert, 2003; Graham & Hammond, 2015) but not *P. canaliculatus*. The species has a thinly scattered distribution across Britain but with no modern records from Scotland.

Comparison with historic water beetle records

The national recording scheme database shows that 95 water beetle species were recorded from Stow-cum-Quy Fen prior to the present survey (Appendix 2). Archival records span the period 1845 (Wollaston, 1845) to 1965, the main collectors being Professor F. Balfour-Browne during the period 1913 to 1919 and Professor G.N. Foster in 1964-65. Given the Fen's proximity to Cambridge, it is surprising that there are no later records.

Forty of the species represented by archival records were found in May/June 2017 (42%) but 22 species apparently new for the site were also collected. This brings the Quy Fen water beetle list to 117 species. The 'new' species include some which have only been recognised as British species relatively recently, or are liable to be overlooked (e.g. various *Helophorus* species, *Enochrus nigritus*, *E. quadripunctatus*, *Hydrobius rottenbergii* and *H. subrotundus*, *Cercyon sternalis*). However, there are others which have genuinely increased during in recent decades such as *Dytiscus circumflexus*, *Hydroglyphus geminus* and *Berosus affinis*. No aquatic weevils were recorded previously but two were found in the current survey.

By contrast, many of the species not found since Balfour-Browne's visits a century ago have seriously declined nationally (e.g. *Haliphus variegatus*, *Dytiscus circumcinctus*, *Berosus luridus*) or would once have been more widespread in Fenland (e.g. *Noterus crassicornis*, *Hydaticus transversalis*, *Hydrophilus piceus*). The reed-beetle *Donacia aquatica*, a Species of Principal Importance listed under Section 41 of the Natural Environment & Rural Communities Act, was found by C.E. Tottenham in 1906.

It therefore appears that there has been significant loss of rarer fenland water beetles from Stow-cum-Quy Fen during the past 100 years, though this may be a result of wider regional and national population declines rather than any dramatic deterioration in habitat quality within the site.

6. Priority Pond assessment

Priority Ponds are a *habitat of principal importance* as defined in Section 41 of the Natural Environment and Rural Communities Act 2006. All public authorities are obliged to consider the conservation of Habitats and Species of Principal Importance during the exercise of their duties. Priority ponds are considered to represent the best 20% of UK ponds in terms of

nature conservation value. They are identified using a number of criteria⁸. six of the nine ponds surveyed at Stow-cum-Quy Fen qualify as Priority Ponds, as summarised in Table 2.

Table 2: Priority Pond assessment for ponds at Spring Covert

Qualifying criterion	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5	Pond 6	Pond 7	Pond 8	Pond 9
Ponds with species of high conservation importance (UKBAP/Section 41 species, fully protected species, Red List species); ponds with 1 Nationally Scarce plant or 3 or more NS aquatic invertebrates ⁹ .		3 NS water beetles	2 NT + 2 NS water beetles		<i>Donacia sparganii</i> (Red List)		Water Vole		
Ponds with exceptional populations or numbers of key species (>29 wetland vascular plants; >49 aquatic invertebrates)		58 aquatic invertebrate taxa	54 aquatic invertebrate taxa		49 wetland plants & 60 aquatic invertebrates	52 aquatic invertebrate taxa			
Ponds of high ecological quality, classified as being of Good quality using PSYM.		✓	✓	✓	✓	✓	✓		

Ponds 1, 8 and 9 did not qualify, although Pond 1 was very close to the threshold for Good ecological quality.

⁸ See <http://freshwaterhabitats.org.uk/projects/pond-hap/priority-pond-criteria/>

⁹ It is assumed that since Near Threatened species have a higher conservation status than Nationally Scarce species, they also count towards this criterion.

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Appendix 1: PSYM data

<i>Site details</i>								
Site name	QUY FEN POND 1	QUY FEN POND 2	QUY FEN POND 3	QUY FEN POND 4	QUY FEN POND 5	QUY FEN POND 6	QUY FEN POND 7	QUY FEN POND 8
Survey date	17-May-17	17-May-17	17-May-17	17-May-17	17-May-17	17-May-17	17-May-17	17-May-17
Grid reference (e.g. SP123456 or higher precision)	TL 511628	TL 512627	TL 512627	TL 513624	TL 514626	TL 514627	TL 516627	TL 514629
<i>Plant metrics</i>								
No. of submerged + marginal plant species (not including floating leaved)	9	27	26	4	39	17	24	2
Number of uncommon plant species	2	10	8	3	16	4	9	0
Trophic Ranking Score (TRS)	8.26	9.16	8.22	7.3	9.01	8.93	8	8.65
<i>Invertebrates metrics</i>								
ASPT	4.85	5.19	4.90	5.5	4.86	5.21	5.67	3.75
Odonata + Megaloptera (OM) families	2	3	2	2	3	2	3	0
Coleoptera families	5	5	5	3	5	3	4	1
<i>Environmental variables</i>								
Altitude (m)	4	4	4	4	4	4	4	4
Easting	5516	5512	5512	5513	5514	5514	5516	5514
Northing	2628	2627	2627	2624	2626	2627	2627	2629
Shade (%)	30	0	2	0	5	15	10	70
Inflow (0/1)	0	0	0	0	0	0	0	0
Grazing (%)	0	100	100	0	50	0	0	0
pH	7.3	7.6	7.3	8.4	7.6	7.9	7.9	7.6
Emergent plant cover (%)	20	20	65	0	15	10	17	30
Base clay (1-3)	3	3	3	3	3	3	3	3
Base sand, gravel, cobbles (1-3)	1	1	1	1	1	1	1	1
Base peat (1-3)	1	1	1	1	1	1	1	1
Base rock (1-3)	1	1	1	1	1	1	1	1
Area (m2)	1634	600	240	320	3700	230	360	1902
Results								
Submerged + marginal plant species								
Predicted (SM)	23.7	19.0	16.2	16.8	26.7	16.1	17.4	24.9
Actual (SM)	9	27	26	4	39	17	24	2

EQI (SM)	0.38	1.42	1.61	0.24	1.46	1.06	1.38	0.08
IBI (SM)	1	3	3	0	3	3	3	0
Uncommon plant species								
Predicted (U)	4.1	3.1	2.7	2.7	4.4	2.7	2.9	4.4
Actual (U)	2	10	8	3	16	4	9	0
EQI (U)	0.49	3.19	2.96	1.10	3.60	1.48	3.11	0.00
IBI (U)	1	3	3	3	3	3	3	0
Trophic Ranking Score (TRS)								
Predicted (TRS)	8.74	8.72	8.68	8.76	8.74	8.73	8.73	8.77
Actual (TRS)	8.26	9.16	8.22	7.30	9.01	8.93	8.00	8.65
EQI (TRS)	0.95	1.05	0.95	0.83	1.03	1.02	0.92	0.99
IBI (TRS)	3	2	3	3	3	3	3	3
ASPT								
Predicted (ASPT)	5.11	5.07	5.10	5.08	5.11	5.09	5.09	5.11
Actual (ASPT)	4.85	5.19	4.90	5.50	4.86	5.21	5.67	3.75
EQI (ASPT)	0.95	1.02	0.96	1.08	0.95	1.03	1.11	0.73
IBI (ASPT)	3	3	3	3	3	3	3	2
Odonata + Megaloptera (OM) families								
Predicted (OM)	3.24	3.20	3.43	3.07	3.12	3.21	3.16	3.45
Actual (OM)	2	3	2	2	3	2	3	0
EQI (OM)	0.62	0.94	0.58	0.65	0.96	0.62	0.95	0.00
IBI (OM)	2	3	2	2	3	2	3	0
Coleoptera families								
Predicted (CO)	3.77	3.73	3.74	3.74	3.77	3.74	3.75	3.76
Actual (CO)	5	5	5	3	5	3	4	1
EQI (CO)	1.33	1.34	1.34	0.80	1.33	0.80	1.07	0.27
IBI (CO)	3	3	3	3	3	3	3	1
Sum of Individual Metrics	13	17	17	14	18	17	18	6
Index of Biotic Integrity (%)	72%	94%	94%	78%	100%	94%	100%	33%
PSYM quality category (IBI >75%=Good, 51-75%=Moderate, 25-50%=Poor, <25%=V Poor)	Moderate	Good	Good	Good	Good	Good	Good	Poor
Is this a Priority Pond? (Good quality category)	No	Yes	Yes	Yes	Yes	Yes	Yes	No

Appendix 2: Wetland plants recorded during the survey

Species	English name
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Alisma lanceolatum</i>	Narrow-leaved Water-plantain
<i>Alisma plantago-aquatica</i>	Common Water-plantain
<i>Alopecurus aequalis</i>	Orange Foxtail
<i>Apium nodiflorum</i>	Fool's Water-cress
<i>Baldellia ranunculoides</i>	Lesser Water-plantain
<i>Berula erecta</i>	Lesser Water-parsnip
<i>Butomus umbellatus</i>	Flowering Rush
<i>Calliergonella cuspidata</i>	Pointed Spear-moss
<i>Callitriche platycarpa</i>	Various-leaved Water-starwort
<i>Cardamine pratensis</i>	Lady's Smock
<i>Carex disticha</i>	Brown Sedge
<i>Carex elata</i>	Tufted Sedge
<i>Carex flacca</i>	Glaucous Sedge
<i>Carex otrubae</i>	False Fox Sedge
<i>Carex panicea</i>	Carnation Sedge
<i>Carex riparia</i>	Greater Pond Sedge
<i>Ceratophyllum submersum</i>	Soft Hornwort
<i>Chara hispida</i>	Prickly Stonewort
<i>Chara vulgaris</i>	Common Stonewort
<i>Deschampsia cespitosa</i>	Tufted Hair-grass
<i>Drepanocladus aduncus</i>	Kneiff's Hook-moss
<i>Eleocharis palustris</i>	Common Spike-rush
<i>Elodea nuttallii</i>	Nuttall's Waterweed
<i>Epilobium hirsutum</i>	Greater Willowherb
<i>Epilobium parviflorum</i>	Lesser Hairy Willowherb
<i>Epilobium tetragonum</i>	Square-stemmed Willowherb
<i>Eupatorium cannabinum</i>	Hemp Agrimony
<i>Fontinalis antipyretica</i>	Greater Water-moss
<i>Galium palustre</i> ssp. <i>elongatum</i>	Greater Marsh Bedstraw
<i>Glyceria fluitans</i>	Flote-grass
<i>Hippuris vulgaris</i>	Mare's-tail
<i>Hottonia palustris</i>	Water Violet
<i>Hydrocotyle vulgaris</i>	Marsh Pennywort
<i>Juncus articulatus</i>	Jointed Rush
<i>Juncus inflexus</i>	Hard Rush
<i>Juncus subnodulosus</i>	Blunt-flowered Rush
<i>Lemna triscula</i>	Ivy-leaved Duckweed
<i>Leptodictyum riparium</i>	Kneiff's Feather-moss
<i>Lycopus europaeus</i>	Gipsywort
<i>Lysimachia vulgaris</i>	Yellow Loosestrife

<i>Lythrum salicaria</i>	Purple Loosestrife
<i>Mentha aquatica</i>	Water Mint
<i>Myosotis laxa ssp. caespitosa</i>	Tufted Forget-me-not
<i>Myosotis scorpioides</i>	Water Forget-me-not
<i>Myriophyllum spicatum</i>	Spiked Water-millfoil
<i>Nasturtium officinale</i> s.l.	Water-cress
<i>Nymphaea alba</i>	White Water-lily
<i>Nymphaea marliacea</i>	Pink Water-lily
<i>Nymphoides peltata</i>	Fringed Water-lily
<i>Persicaria amphibia</i>	Amphibious Bistort
<i>Phalaris arundinacea</i>	Reed Canary-grass
<i>Phragmites australis</i>	Common Reed
<i>Pohlia wahlenbergia</i> var. <i>wahlenbergia</i>	Pale Glaucous Thread-moss
<i>Potamogeton coloratus</i>	Fen Pondweed
<i>Potamogeton crispus</i>	Curled Pondweed
<i>Potamogeton natans</i>	Broad-leaved Pondweed
<i>Ranunculus flammula</i>	Lesser Spearwort
<i>Ranunculus sceleratus</i>	Celery-leaved Buttercup
<i>Ranunculus trichophyllus</i>	Thread-leaved Water-crowfoot
<i>Samolus valerandi</i>	Brookweed
<i>Schoenoplectus lacustris</i>	Common Club-rush
<i>Scrophularia auriculata</i>	Water Figwort
<i>Scutellaria galericulata</i>	Skullcap
<i>Solanum dulcamara</i>	Woody Nightshade
<i>Sparganium erectum</i>	Branched Bur-reed
<i>Stachys palustris</i>	Marsh Woundwort
<i>Symphytum officinale</i>	Comfrey
<i>Thalictrum flavum</i>	Meadow-rue
<i>Tolypella glomerata</i>	Clustered Stonewort
<i>Typha angustifolia</i>	Lesser Reedmace
<i>Typha latifolia</i>	Greater Reedmace
<i>Veronica catenata</i>	Pink Water-speedwell
<i>Zannichellia palustris</i>	Horned Pondweed

Appendix 3: Aquatic macro-invertebrates recorded during the survey

Taxon	English name	Family	Order	GB Status
<i>Crangonyx pseudogracilis</i>	an amphipod shrimp	Crangonyctidae	Amphipoda	Common
<i>Gammarus pulex</i>	Freshwater Shrimp	Gammaridae	Amphipoda	Common
<i>Musculium lacustre</i>	Capped Orb Mussel	Sphaeriidae	Bivalvia	Common
<i>Pisidium</i> sp.	a pea-mussel	Sphaeriidae	Bivalvia	
<i>Haemopsis sanguisuga</i>	Horse Leech	Haemopidae	Hirudinea	Common
<i>Theromyzon tessulatum</i>	Duck Leech	Glossiphoniidae	Hirudinea	Common
<i>Erpobdella octoculata</i>	a leech	Erpobdellidae	Hirudinea	Common
<i>Donacia sparganii</i>	a reed beetle	Chrysomelidae	Coleoptera	Vulnerable
<i>Gymnetron villosulum</i>	Pink Water-speedwell Weevil	Curculionidae	Coleoptera	NS
<i>Pelenomus canaliculatus</i>	an aquatic weevil	Curculionidae	Coleoptera	NS
<i>Dryops luridus</i>	a long-toed water beetle	Dryopidae	Coleoptera	Common
<i>Dryops</i> sp. (other)	a long-toed water beetle	Dryopidae	Coleoptera	
<i>Acilius sulcatus</i>	a diving beetle	Dytiscidae	Coleoptera	Local
<i>Agabus bipustulatus</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Agabus nebulosus</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Colymbetes fuscus</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Dytiscus circumflexus</i>	a great diving beetle	Dytiscidae	Coleoptera	Local
<i>Dytiscus marginalis</i>	Great Diving Beetle	Dytiscidae	Coleoptera	Common
<i>Dytiscus semisulcatus</i>	Great Diving Beetle	Dytiscidae	Coleoptera	Common
<i>Hydroglyphus geminus</i>	a diving beetle	Dytiscidae	Coleoptera	Local
<i>Hydroporus angustatus</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Hydroporus palustris</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Hydroporus planus</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Hygrotus confluens</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Hygrotus impressopunctatus</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Hygrotus inaequalis</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Hygrotus versicolor</i>	a diving beetle	Dytiscidae	Coleoptera	Local
<i>Hyphydrus ovatus</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Ilybius ater</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Ilybius fuliginosus</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Ilybius quadriguttatus</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Laccophilus minutus</i>	a diving beetle	Dytiscidae	Coleoptera	Common
<i>Liopterus haemorrhoidalis</i>	a diving beetle	Dytiscidae	Coleoptera	Local
<i>Rhantus grapii</i>	a diving beetle	Dytiscidae	Coleoptera	Local
<i>Rhantus suturalis</i>	a diving beetle	Dytiscidae	Coleoptera	Local
<i>Gyrinus substriatus</i>	Common Whirligig	Gyrinidae	Coleoptera	Common
<i>Haliphus confinis</i>	an algivorous water beetle	Haliplidae	Coleoptera	Local
<i>Haliphus flavicollis</i>	an algivorous water beetle	Haliplidae	Coleoptera	Local
<i>Haliphus fluviatilis</i>	an algivorous water beetle	Haliplidae	Coleoptera	Common
<i>Haliphus immaculatus</i>	an algivorous water beetle	Haliplidae	Coleoptera	Common
<i>Haliphus lineatocollis</i>	an algivorous water beetle	Haliplidae	Coleoptera	Common

<i>Haliphus obliquus</i>	an algivorous water beetle	Haliplidae	Coleoptera	Local
<i>Haliphus ruficollis</i>	an algivorous water beetle	Haliplidae	Coleoptera	Common
<i>Peltodytes caesus</i>	an algivorous water beetle	Haliplidae	Coleoptera	NS
<i>Helophorus aequalis</i>	a scavenger water beetle	Helophoridae	Coleoptera	Common
<i>Helophorus brevipalpis</i>	a scavenger water beetle	Helophoridae	Coleoptera	Common
<i>Helophorus grandis</i>	a scavenger water beetle	Helophoridae	Coleoptera	Common
<i>Helophorus griseus</i>	a scavenger water beetle	Helophoridae	Coleoptera	Local
<i>Helophorus minutus</i>	a scavenger water beetle	Helophoridae	Coleoptera	Common
<i>Helophorus obscurus</i>	a scavenger water beetle	Helophoridae	Coleoptera	Common
<i>Limnebius papposus</i>	a small water beetle	Hydraenidae	Coleoptera	NT
<i>Ochthebius dilatatus</i>	a small water beetle	Hydraenidae	Coleoptera	Local
<i>Ochthebius minimus</i>	a small water beetle	Hydraenidae	Coleoptera	Common
<i>Anacaena bipustulata</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Local
<i>Anacaena limbata</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Common
<i>Berosus affinis</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Local
<i>Cercyon sternalis</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Local
<i>Coelostoma orbiculare</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Local
<i>Cymbiodyta marginella</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Local
<i>Enochrus coarctatus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Local
<i>Enochrus nigrinus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	NT
<i>Enochrus quadripunctatus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	NS
<i>Enochrus testaceus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Common
<i>Helochaes lividus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Local
<i>Hydrobius fuscipes</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Common
<i>Hydrobius rothenbergii</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Local
<i>Hydrobius subrotundus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Local
<i>Laccobius bipunctatus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera	Common
<i>Noterus clavicornis</i>	a burrowing water beetle	Noteridae	Coleoptera	Common
Scirtidae indet	marsh beetle larvae	Scirtidae	Coleoptera	
Chaoboridae indet	phantom midge larvae	Chaoboridae	Diptera	
Chironomidae	non-biting midge larvae	Chironomidae	Diptera	
Culicidae	mosquito larvae	Culicidae	Diptera	
Dixidae	meniscus midge larvae	Dixidae	Diptera	
Eristalini	hoverfly larvae	Syrphidae	Diptera	
<i>Odontomyia tigrina</i>	Black Colonel	Stratiomyidae	Diptera	Local
<i>Oplodontha viridula</i>	Common Green Colonel	Stratiomyidae	Diptera	Local
<i>Oxycera</i> sp. 1	a soldier-fly	Stratiomyidae	Diptera	
<i>Oxycera</i> sp. 2	a soldier-fly	Stratiomyidae	Diptera	
<i>Cloeon dipterum</i>	Pond Olive mayfly	Baetidae	Ephemeroptera	Common
<i>Bithynia tentaculata</i>	Common Bithynia	Bithyniidae	Gastropoda	Common
<i>Lymnaea stagnalis</i>	Great Pond Snail	Lymnaeidae	Gastropoda	Common
<i>Radix balthica</i>	Wandering Snail	Lymnaeidae	Gastropoda	Common
<i>Stagnicola palustris</i> agg.	Marsh Pond Snail	Lymnaeidae	Gastropoda	Common
<i>Physa fontinalis</i>	Common Bladder Snail	Physidae	Gastropoda	Common

<i>Anisus leucostoma</i>	White-lipped Ramshorn	Planorbidae	Gastropoda	Common
<i>Anisus vortex</i>	Whirlpool Ramshorn	Planorbidae	Gastropoda	Common
<i>Bathyomphalus contortus</i>	Twisted Ramshorn	Planorbidae	Gastropoda	Common
<i>Gyraulus crista</i>	Nautilus Ramshorn	Planorbidae	Gastropoda	Common
<i>Hippeutis complanatus</i>	Flat Ramshorn	Planorbidae	Gastropoda	Local
<i>Planorbis planorbis</i>	Margined Ramshorn	Planorbidae	Gastropoda	Common
<i>Potamopyrgus antipodarum</i>	Jenkin's Spire-snail	Hydrobiidae	Gastropoda	Common
<i>Corixa punctata</i>	lesser water-boatmen	Corixidae	Hemiptera	Common
<i>Hesperocorixa linnaei</i>	a lesser water-boatmen	Corixidae	Hemiptera	Common
<i>Hesperocorixa sahlbergi</i>	a lesser water-boatmen	Corixidae	Hemiptera	Common
<i>Micronecta scholtzii</i>	a water-singer	Corixidae	Hemiptera	Local
<i>Sigara dorsalis</i>	a lesser water-boatman	Corixidae	Hemiptera	Common
<i>Sigara fossarum</i>	a lesser water-boatman	Corixidae	Hemiptera	Common
<i>Sigara lateralis</i>	a lesser water-boatman	Corixidae	Hemiptera	Common
<i>Gerris lacustris</i>	Common Pond-skater	Gerridae	Hemiptera	Common
<i>Gerris odontogaster</i>	Toothed Pond-skater	Gerridae	Hemiptera	Common
<i>Gerris thoracicus</i>	a pond-skater	Gerridae	Hemiptera	Common
<i>Hydrometra stagnorum</i>	Water Measurer	Hydrometridae	Hemiptera	Common
<i>Mesovelvia furcata</i>	Pondweed Bug	Mesoveliidae	Hemiptera	Local
<i>Ilyocoris cimicoides</i>	Saucer Bug	Naucoridae	Hemiptera	Local
<i>Nepa cinerea</i>	Water Scorpion	Nepidae	Hemiptera	Common
<i>Ranatra linearis</i>	Water Stick-insect	Nepidae	Hemiptera	Local
<i>Notonecta glauca</i>	Common Backswimmer	Notonectidae	Hemiptera	Common
<i>Plea minutissima</i>	Pygmy Backswimmer	Pleidae	Hemiptera	Common
<i>Microvelia reticulata</i>	a pygmy water-cricket	Velidae	Hemiptera	Common
<i>Asellus aquaticus</i>	Water Hoglouse	Asellidae	Isopoda	Common
<i>Sialis lutaria</i>	Common Alderfly	Sialidae	Megaloptera	Common
<i>Aeshna grandis</i>	Brown Hawker	Aeshnidae	Odonata	Common
<i>Anax imperator</i>	Emperor Dragonfly	Aeshnidae	Odonata	Local
<i>Brachytron pratense</i>	Hairy Dragonfly	Aeshnidae	Odonata	Local
<i>Coenagrion puella</i>	Azure Damselfly	Coenagrionidae	Odonata	Common
<i>Enallagma cyathigerum</i>	Common Blue Damselfly	Coenagrionidae	Odonata	Common
<i>Ischnura elegans</i>	Blue-tailed Damselfly	Coenagrionidae	Odonata	Common
<i>Lestes sponsa</i>	Emerald Damselfly	Lestidae	Odonata	Common
<i>Libellula depressa</i>	Broad-bodied Chaser	Libellulidae	Odonata	Local
<i>Libellula quadrimaculata</i>	Four-spotted Chaser	Libellulidae	Odonata	Common
<i>Orthetrum cancellatum</i>	Black-tailed Skimmer	Libellulidae	Odonata	Local
<i>Sympetrum striolatum</i>	Common Darter	Libellulidae	Odonata	Common
<i>Athripsodes aterrimus</i>	a caddis-fly	Leptoceridae	Trichoptera	Common
<i>Glyptotaelius pellucidus</i>	a caddis-fly	Limnephilidae	Trichoptera	Common
<i>Limnephilus affinis</i>	a caddis-fly	Limnephilidae	Trichoptera	Common
<i>Limnephilus</i> sp. (other)	a caddis-fly	Limnephilidae	Trichoptera	
<i>Limnephilus stigma</i>	a caddis-fly	Limnephilidae	Trichoptera	Common
Phryganeidae early instar larva	a caddis-fly	Phryganeidae	Trichoptera	

Tricladida indet	a flatworm	Tricladida	Tricladida	
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Appendix 4: archival water beetle records for Quy Fen

(courtesy of the Balfour-Browne Club and Aquatic Coleoptera Conservation Trust)

Species	Dates	Recorders	2017?
<i>Acilius sulcatus</i>	1918, 1965	FBB, GNF	✓
<i>Agabus bipustulatus</i>	1964	GNF	✓
<i>Agabus didymus</i>	1925	FBB	
<i>Agabus nebulosus</i>	1965	GNF	✓
<i>Agabus paludosus</i>	1964	ACW	
<i>Agabus sturmii</i>	1918	FBB	
<i>Agabus unguicularis</i>	1918	FBB	
<i>Anacaena bipustulata</i>	1918-19	FBB	✓
<i>Anacaena globulus</i>	1913	FBB	
<i>Berosus luridus</i>	1913, 1918	FBB	
<i>Berosus signaticollis</i>	-1908, 1918	JAP, FBB	
<i>Brychius elevatus</i>	1965	GNF	
<i>Chaetarthria seminulum sensu lato</i>	1918	FBB	
<i>Hygrotus impressopunctatus</i>	1918	FBB	✓
<i>Coelostoma orbiculare</i>	1918	FBB	✓
<i>Colymbetes fuscus</i>	1918	FBB	✓
<i>Liopterus haemorrhoidalis</i>	1918	FBB	✓
<i>Cymbiodyta marginellus</i>	1913	FBB	✓
<i>Donacia aquatica</i>	1906	CET	
<i>Dytiscus circumcinctus</i>	1918-19	FBB	
<i>Dytiscus semisulcatus</i>	1913	FBB	✓
<i>Enochrus coarctatus</i>	1918	FBB	✓
<i>Enochrus melanocephalus</i>	1918	FBB	
<i>Enochrus ochropterus</i>	1913	FBB	
<i>Enochrus testaceus</i>	1964	GNF	✓
<i>Graptodytes granularis</i>	-1908, 1918	JAP, FBB	
<i>Graptodytes pictus</i>	1913	FBB	
<i>Gyrinus marinus</i>	1965	GNF	
<i>Gyrinus paykulli</i>	1920, 1925, 1943	EJP, THB, CET	
<i>Gyrinus substriatus</i>	1943	CET	✓
<i>Halipus confinis</i>	1913, 1918	FBB	✓
<i>Halipus flavicollis</i>	1918	FBB	✓
<i>Halipus fluviatilis</i>	1965-65	GNF	✓
<i>Halipus fulvus</i>	1918	FBB	
<i>Halipus heydeni</i>	1918	FBB	
<i>Halipus immaculatus</i>	1919	FBB	✓
<i>Halipus laminatus</i>	1964	GNF	
<i>Halipus lineatocollis</i>	1943	CET	✓
<i>Halipus obliquus</i>	1965	GNF	✓
<i>Halipus ruficollis</i>	1913, 1919	FBB	✓
<i>Halipus variegatus</i>	1918-19	FBB	
<i>Halipus sibiricus</i>	1918	FBB	
<i>Helochares lividus</i>	1918	FBB	✓
<i>Helophorus brevipalpis</i>	1913	FBB	✓
<i>Hydaticus seminiger</i>	1845	TVW	

<i>Hydaticus transversalis</i>	1845, 1918	TVW, FBB	
<i>Hydraena riparia</i>	1918	FBB	
<i>Hydrobius fuscipes sensu lato</i>	1919	FBB	✓
<i>Hydrophilus piceus</i>	1918	FBB	
<i>Hydroporus angustatus</i>	1918	FBB	✓
<i>Hydroporus erythrocephalus</i>	1913, 1921	FBB, EJP	
<i>Hydroporus memnonius</i>	1918	FBB	
<i>Hydroporus nigrita</i>	1913	FBB	
<i>Hydroporus palustris</i>	1913	FBB	✓
<i>Hydroporus planus</i>	1964	GNF	✓
<i>Hydroporus pubescens</i>	1913, 1918, 1965	FBB, GNF	
<i>Hydroporus striola</i>	1913, 1918	FBB	
<i>Hydroporus tessellatus</i>	1918, 1965	FBB, GNF	✓
<i>Hydroporus tristis</i>	1919	FBB	
<i>Hygrobia hermanni</i>	1943	CET	
<i>Hygrotus inaequalis</i>	1964	GNF	✓
<i>Hygrotus versicolor</i>	1918	FBB	✓
<i>Hyphydrus ovatus</i>	1964	GNF	✓
<i>Ilybius ater</i>	1913	FBB	✓
<i>Ilybius fenestratus</i>	1964	FBB	
<i>Ilybius fuliginosus</i>	1918	FBB	✓
<i>Ilybius quadriguttatus</i>	1965	GNF	✓
<i>Ilybius subaeneus</i>	1918, 1964-65	FBB, GNF	
<i>Laccobius ytenensis</i>	1965	GNF	
<i>Laccobius colon</i>	1919	FBB	
<i>Laccobius bipunctatus</i>	1965	ACW	✓
<i>Laccobius minutus</i>	1919	FBB	
<i>Laccobius sinuatus</i>	1964	GNF	
<i>Laccobius striatulus</i>	1965	GNF	
<i>Laccophilus hyalinus</i>	1918	FBB	
<i>Laccophilus minutus</i>	1918	FBB	✓
<i>Laccornis oblongus</i>	1918	FBB	
<i>Limnebius nitidus</i>	1965	GNF.	
<i>Limnebius papposus</i>	1913-1965	FBB, GNF	✓
<i>Limnebius truncatellus</i>	1919	FBB	
<i>Nebrioporus elegans</i>	1964	GNF	
<i>Noterus clavicornis</i>	1913	FBB	✓
<i>Noterus crassicornis</i>	1845, 1918-19	TVW, FBB	
<i>Ochthebius minimus</i>	1913, 1918	FBB	✓
<i>Platambus maculatus</i>	1925, 1965	FBB, GNF	
<i>Porhydrus lineatus</i>	-1937	TTM	
<i>Nebrioporus assimilis</i>	1925	FBB	
<i>Rhantus exsoletus</i>	1918, 1964-65	FBB, GNF	
<i>Rhantus grapii</i>	1891, 1913. 1918	DS, FBB	✓
<i>Rhantus suturalis</i>	1918	FBB	✓
<i>Scarodytes halensis</i>	1925, 1964-65	FBB, GNF	
<i>Sphaerius acaroides</i>	-1900		
<i>Stictonectes lepidus</i>	1918	FBB	
<i>Stictotarsus duodecimpustulatus</i>	1918	FBB	
<i>Hydroporus dorsalis sensu lato</i>	1964	GNF	

FBB = Professor F. Balfour-Browne, THB = Sir T.H. Beare, GNF = Professor G.N. Foster, TTM = Dr T.T. Macan, EJP = Rev E.J. Pearce, JAP = Dr J.A. Power, DS = Dr D. Sharp, CET = Rev C.E. Tottenham, ACW = Dr A.C. Warne, TVW = T.V. Wollaston