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A survey of the animal community of the main pond at Castor Hanglands National Nature Reserve, near Peterborough

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Summary

(1) This paper gives an account of the rich fauna of a pond in a hard-water district.

(2) A comparison is made with the fauna of Hodson's Tarn, which contains soft water.

(3) Some attempt has been made to correlate the presence of various species with the environmental conditions provided by the pond.

Introduction

A survey of the macroscopic fauna of the Main Pond at Castor Hanglands National Nature Reserve was undertaken between June 1971 and December 1972.

The Reserve lies 5·5 km west of Peterborough, on limestone and clays of Jurassic origin. The Main Pond is situated 16 m above sea level, at Grid Reference TF 119016. It is surrounded by a strip of marshy heathland about 100 m wide, which is bordered by deciduous woodland. A footpath runs along one bank. The pond is spring fed. It seems likely that it is an ancient pond, perhaps used for watering stock once grazed on the surrounding common land. In 1921 it was cleaned out, then left undisturbed until 1962, when it was dammed. It was dredged out in 1966 and 1967, and a dyke was cut at the southwest corner, to create a small island (see Fig. 2).

In 1971–72 the pond occupied an area of approximately 0·05 ha. The maximum depth was about 1 m, and the bottom was of clay with varying amounts of organic matter. Behind the dam and in the shallower margins there was an accumulation of rich black mud. There was a slight flow of water over the dam for much of the time, but the outlet dried up in summer. The water was very clear, and its pH in July 1971 was 7·7. The calcium concentration was approximately 100 ppm.

The bottom of the pond was almost completely covered with vegetation. Much of the centre part, over half the total area, was occupied by *Chara hispida*. Most of the remaining area was dominated by *Potamogeton natans*. Other aquatic plants present were *Spirogyra* and other filamentous algae, *Equisetum fluviatile*, *Ranunculus aquatilis*, *Rorippa nasturtium-aquaticum*, *Callitriche stagnalis*, *C. platycarpa*, *Groenlandia densa* and *Lemna minor*. Much of the emergent vegetation consisted of *Juncus inflexus*,

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J. articulatus, *J. subnodulosus* and *Schoenoplectus lacustris*. Also plentiful were *Mentha aquatica*, *Sparganium erectum*, *Apium nodiflorum*, *Eleocharis palustris*, *Carex nigra*, *C. disticha*, *C. flacca* and *C. otrubae*. *Phragmites* was absent. The few bushes and small trees around the pond had little shading effect on the water.

The following observations are based on half a dozen sessions of intensive collecting, and numerous casual visits to the pond at all seasons of the year.

Vertebrates

Adults of *Triturus cristatus*, *T. vulgaris* and *T. helveticus* were found in the pond, and newt tadpoles were numerous. *Bufo bufo* bred there very successfully in 1971, but although toads arrived in considerable numbers in March 1972, no spawn or tadpoles were subsequently found that year. Adults of *Rana temporaria* were present in 1972, but there was no evidence of breeding. No fish were found during this survey, but eels were removed from the pond in 1967 when it was pumped dry to facilitate dredging operations.

One pair of moorhen (*Gallinula chloropus*) nested on the island in 1971 and 1972, and one pair of mallard (*Anas platyrhynchos*) in 1971. The pond is frequented by grass-snakes (*Natrix natrix*) and fallow deer (*Dama dama*).

Invertebrate

See Tables 1 and 2.

Table 1. Commonly occurring invertebrate species

		Mud	Open water	Surface	Weeds
Platyhelminthes					
Rhabdocoelida		×			×
Tricladida	*Polycelis tenuis* (Ijima)				×
Annelida					
Oligochaeta	Tubificidae	×			
	Nais sp.	×			× ×
Hirudinea	*Erpobdella octoculata* (L.)	×			× ×
Mollusca					
Gastropoda	*Lymnaea peregra* (O. F. Müller)				× ×
	Planorbis planorbis (L.)				× ×
	Planorbis contortus (L.)	×			× × ×
	Zonitoides nitidus (O.F.M.)				×
Lamellibranchiata	*Pisidium obtusale* (Lamarck)	× × ×			
Crustacea					
Cladocera	*Simnocephalus vetulus* (O.F.M.)		×		× ×
	Ceriodaphnia reticulata var. *serrata* (Sars)	×			× ×
	Peracantha truncata (O.F.M.)	×			× ×
	Pleuroxus trigonellus (O.F.M.)	×			× ×
Ostracoda	2 species	× × ×	× ×		× × ×
Copepoda	*Cycoops agilis* (Koch, sars)		×		× × ×
	Cyclops viridis (Jurine)		×		× ×
	Cyclops fuscus (Jurine)		×		× ×
Isopoda	*Asellus meridianus* (Racovitza)	× × ×			× ×
Amphipoda	*Gammarus pulex* (L.)				× ×

Table 1.—*Continued*

		Mud	Open water	Surface	Weeds
Insecta					
Ephemeroptera	*Caenis horaria* (L.)	× × ×			×
(larvae)	*Cloeon dipterum* (L.)	×			× × ×
Odonata (larvae)	*Pyrrhosoma nymphula* (Sulzer)	×			× ×
	Ischnura elegans (Van der Linden)				× ×
	Enallagma cyathigerum (Charpentier)				× ×
	Coenagrion pulchellum (Van der Linden)				×
	Coenagrion puella (L.)				×
Hemiptera	*Gerris lacustris* (L.)			× ×	
	Gerris odontogaster (Zetterstedt)			× ×	
	Microvelia reticulata (Burm.)			× ×	
	Notonecta glauca (L.)	×	×		× × ×
	Cymatia bonsdorffi (C. Sahlb.)				×
	Corixa punctata (Illig.)				×
	Corixa dentipes (Thomson)				×
	Corixa panzeri (Thomson)				×
	Hesperocorixa sahlbergi (Fieber)				×
	Hesperocorixa linnei (Fieber)				× ×
	Hesperocorixa castanea (Thoms.)				× ×
	Sigara dorsalis (Leach)				×
	Sigara fossarum (Leach)	×			× ×
	Sigara falleni (Fieber)				×
	Sigara lateralis (Leach)				×
	Sigara nigrolineata (Fieber)				×
Megaloptera					
(larvae)	*Sialus lutaria* (L.)	× ×			
Trichoptera	*Phryganea varia* (Fab.)				× ×
(larvae)	*Limnephilus flavicornis* (Fab.)				× ×
	Limnephilus (*Colpotaulius*) *incisus* (Curtis)				×
	Leptocerus aterrimus (Stephens)				× ×
	Triaenodes bicolar (Curtis)				× × ×
	Holocentropus dubius (Rambur)				× ×
Lepidoptera (larvae)	*Nymphula nymphaeata* (L.)				× ×
Coleoptera	*Haliplus obliquus* (Fab.)				×
	Haliplus lineatocollis (Marsham)				× ×
	Haliplus ruficollis (Degeer)				× ×
	Hyphydrus ovatus (L.)				×
	Hygrotus inaequalis (Fab.)				×
	Oreodytes (*Hydroporus*) *halensis* (Fab.)				×
	Hydroporus (*Graptodytes*) *pictus* (Fab.)				×
	Hydroporus (*Hydroporus*) *palustris* (L.)				×
	Hydroporus (*Hydroporus*) *memnonius* (Nicolai)				×
	Gyrinus natator (L.)			×	×
	Laccobius biguttatus (Gerhardt)				× ×
Diptera (larvae)	*Paradixa aestivalis* (Mg.)			×	×
	Chaoborus crystallinus (Degeer)		× ×		× ×
	Anopheles claviger (Meigen)				×
	Culex pipiens (L.)				×
	Chironomidae	× × ×			× ×
	Ceratopogonidae		×		× ×
Arachnida					×
Hydracarina		×			× ×

The species of Trichoptera were determined by collecting larvae and identifying the adults which emerged.

Table 2. Invertebrate species taken only occasionally

Coelenterata	*Chlorohydra viridis*
Platyhelminthes	
Tricladida	*Dendrocoelum lacteum* (O.F.M.)
Nematoda	Mermithidae
Annelida	
Hirudinea	*Theromyzon tessulatum* (O.F.M.)
	Glossiphonia complanata (L.)
Crustacea	
Cladocera	*Daphnia pulex* (De Geer)
Copepoda	*Diaptomus vulgaris* (Schmeil)
Insecta	
Odonata (larvae)	*Lestes sponsa* (Hansermann)
	Brachytron pratense (O.F.M.)
	Aeshna grandis (L.)
	Anax imperator (Leach)
	Sympetrum sp.*
	Libellula quardrimaculata (L.)
Hemiptera	*Ilyocoris cimicoides* (L.)
	Nepa cinerea (L.)
	Ranatra linearis (L.)
	Notonecta obliqua (Thunb.)
	Notonecta maculata (Fab.)
	Callicorixa praeusta (Fieber)
	Sigara distincta (Fieber)
Coleoptera	*Haliplus confinis* (Stephens)
	Haliplus flavicollis (Sturm.)
	Hygrobia hermanni (Fab.)
	Laccophilus minutus (L.)
	Hydroporus (*Graptodytes*) *granularis* (L.)
	Hydroporus (*Suphrodytes*) *dorsalis* (Fab.)
	Hydroporus (*Hydroporus*) *discretus* (Fairmaire)
	Hydroporus (*Hydroporus*) *planus* (Fab.)
	Hydroporus (*Hydroporus*) *tessellatus* (Drapiez)
	Agabus didymus (Olivier)
	Agabus bipustulatus (L.)
	Ilybius fuliginosus (Fab.)
	Colymbetes fuscus (L.)
	Dytiscus sp. (larva)
	Acilius sulcatus (L.)
	Enochrus testaceus (Fab.)
	Laccobius alutaceus (Thoms.)
	Laccobius striatulus (Fab.)
	Anacaena globulus (Paykull)
	Helophorus flavipes (Fab.)
	Helophorus minutus (Fab.)
Diptera (larvae)	Tabanidae

* The single *Sympetrum* larva found was young, and identification to species was difficult. Adults of *S. sanguinium* (O.F.M.) and *S. striolatum* (Charp.) were seen over the pond.

Quantitative sampling

Sampling was carried out at seven stations in mid-June 1972. At each, a net sweep was made for 5 s, and the animals taken were counted. The method was obviously crude and subject to various errors. For instance, the numbers of rhabdocoeles, entomostraca, *Nais* and very young larval stages proved impossible to assess accurately, and so were omitted from the counts. Also, it was impossible when sampling the bottom to prevent the inclusion of some animals from the layers above. However, the results do give a fair indication of the distribution and relative abundance of many species.

Station 1 was a shallow arm of the pond, where the water was about 15 cm deep, and the bottom consisted of soft black mud with a little moss growing on it. Station 2 was the bottom under a bank. The water here was approximately 60 cm deep, and the bottom consisted of clay and organic material, in which were embedded the roots of aquatic plants, mainly *Potamogeton natans* and *Equisetum fluviatile*. Station 3 was a bed of rushes with water about 30 cm deep, and a few intruding *Potamogeton* leaves. Station 4 was an area of mixed vegetation, including *Groenlandia densa*, *Ranunculus aquatilis*, *Schoenoplectus lacustris* and *Equisetum fluviatile*, with water about 30 cm deep. Station 5 was amonst floating *Potamogeton* leaves, where the water was approximately 75 cm deep. Station 6 had the same depth of water, but the bottom was covered with a dense growth of *Chara hispida*. Here the sampling was carried out amongst the upper layers of *Chara*. Station 7 was near the dam, where the bottom was clear of vegetation and the water was about 1 m deep. The sample was taken from the upper layers of the water.

Fig. 1 shows the distribution of the more numerous species. Table 3 lists animals which occurred only once, and were not included in the figure.

Table 3. Species occurring only once, and not included in Fig. 1

	Station
Polycelis tenuis	6
Tubificidae	1
Coenagrion pulchellum	2
Gerris nymph	3
Cymatia bonsdorffi	2
Hesperocorixa sahlbergi	3
Sigara nigrolineata	1
Limnephilus flavicornis	1
Holocentropus dubius	6
Haliplid larva	6
Hyphydrus ovatus	3
Hydroporus discretus	3
Hydroporus planus	1
Hydroporus tesselatus	3
Ilybius fuliginosus	3
Helophorus flavipes	4
Paradixa aestivalis	3
Tabanidae	4

Discussion

The Main Pond at Castor Hanglands National Nature Reserve is a highly productive piece of water, with a very diverse fauna.

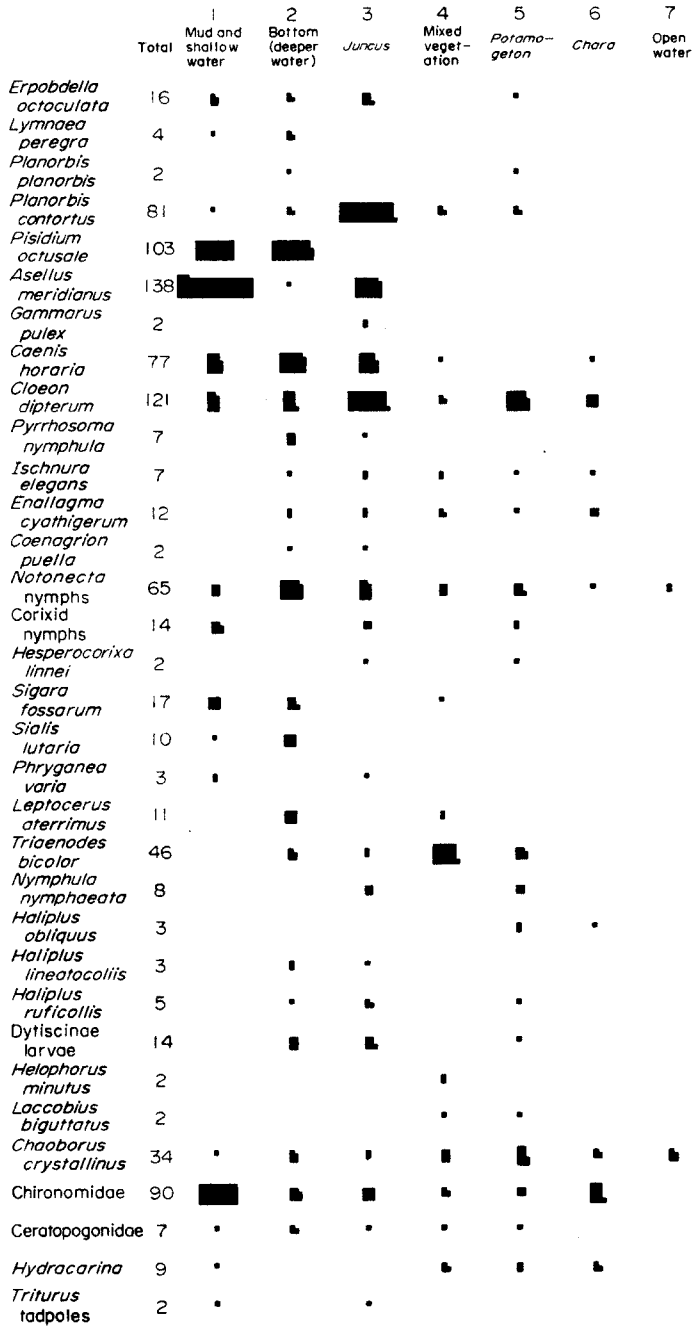

Fig. 1. Numbers per net sweep lasting 5 s. One small square equals one specimen (e.g. one *Lymnaea peregra* was caught at Station 1, and three at Station 2).

Hodson's Tarn, studied by Macan (1963), contains soft water, and affords an interesting comparison. *Nemoura cinerea*, and the soft-water species *Leptophlebia vespertina*, *L. marginata* and *Sigara scotti* are present in Hodson's Tarn and absent

from Castor Hanglands. The reverse is true of numerous species, notably *Polycelis tenuis*, *Dendrocoelum lacteum*, *Planorbis planorbis*, *P. contortus*, *Asellus meridianus*, *Notonecta glauca*, and the Corixids *Sigara dorsalis*, *S. falleni*, *S. fossarum*, *S. nigrolineata*, *S. lateralis*, *Corixa punctata*, *C. panzeri* and *Cymatia bonsdorffi*. *Planorbis planorbis* is only found in calcium-rich waters (Boycott, 1936) and *Asellus* is characteristic of richer conditions than those afforded by Hodson's Tarn.

At Castor Hanglands *Notonecta glauca* was abundant, but *N. obliqua* and *N. maculata* were taken only once. *N. obliqua* alone was recorded from Hodson's Tarn. *N. glauca* is a widespread species, *N. obliqua* is usually found in peaty localities, and *N. maculata* is typical of concrete-sided bodies of water where there are solid surfaces on which to lay eggs. The latter two species were probably temporary immigrants at Castor Hanglands.

Smyly (1955) has investigated the Cladocera and Copepoda of Hodson's Tarn. The only species common to the Tarn and Castor Hanglands pond was *Cyclops viridis*. The species present at Castor Hanglands are typical of weedy waters. Smyly (1952) has found *Peracantha truncata* to be most abundant amongst *Potamogeton natans*. *Simnocephalus vetulus*, *Peracantha truncata* and *Cyclops fuscus* were found by Smyly (1958) to occur frequently in tarns high in total ions. Gurney (1928) states that *Simnocephalus vetulus* is abundant on *Chara*, a plant of calcareous waters.

There was an unusually large number (fourteen) of corixid species present in the pond at Castor Hanglands. Macan (1954, 1963, 1967) has shown that in lakes there is a succession of corixid species with increasing amounts of organic matter in the bottom. In rich lakes, *Sigara dorsalis* is dominant in places with little organic matter in the bottom, often accompanied by *S. falleni*. *Hesperocorixa linnei* replaces these species as organic matter accumulates, and is in turn superseded by *H. sahlbergi*

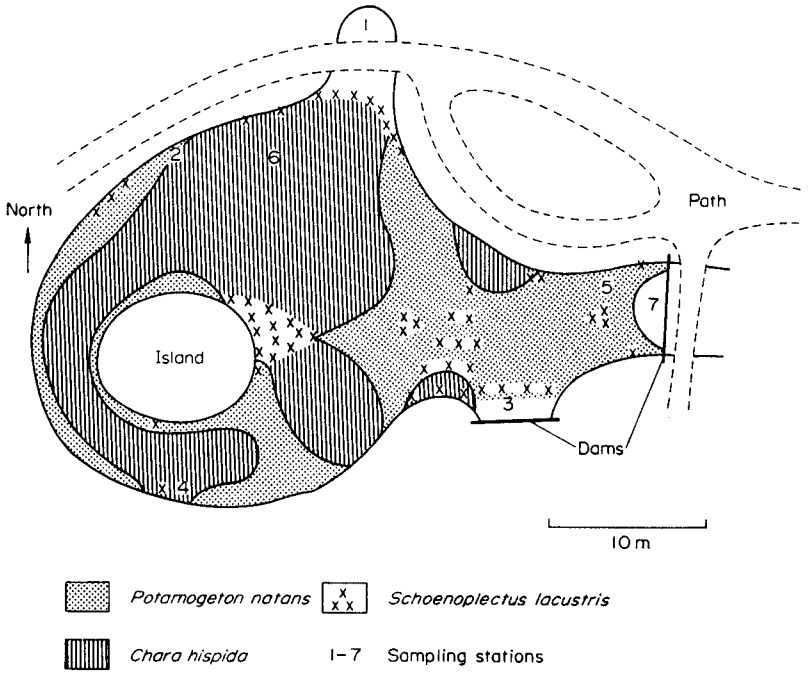

Fig. 2. Plan of Main Pond, Castor Highlands National Nature Reserve.

Table 4. Distribution of adult corixidae in the main pond at Castor Hanglands N.N.R.

	Dates of sampling	*Cymatia bonsdorffi*	*Callicorixa praeusta*	*Corixa punctata*	*Corixa dentipes*	*Corixa panzeri*	*Hesperocorixa sahlbergi*	*Hesperocorixa linnei*	*Hesperocorixa castanea*	*Sigara dorsalis*	*Sigara fossarum*	*Sigara falleni*	*Sigara lateralis*	*Sigara nigrolineata*
Deep water with leaves of *Potamogeton natans*	5 Sept. 1971	–	–	2	2	1	–	–	4	–	–	–	–	–
	9 June 1972	–	–	–	–	–	–	1	–	–	–	–	–	–
	24 Nov. 1972	–	–	–	–	–	–	–	–	–	–	–	–	–
	12 Dec. 1972	–	–	–	–	–	–	–	–	–	–	–	–	–
Mixed water weeds near margin	5 Sept. 1971	1	–	–	–	3	1	–	2	–	–	–	–	–
	9 June 1972	1	–	–	–	–	–	–	–	–	7	–	–	–
	24 Nov. 1972	–	–	–	–	–	–	2	2	1	–	1	–	4
	12 Dec. 1972	2	2	–	–	–	–	2	2	1	5	8	6	2
Thick *Juncus* bed	5 Sept. 1971													
	9 June 1972	–	–	–	–	–	1	1	–	–	–	–	–	–
	24 Nov. 1972	–	–	–	–	–	1	9	4	–	–	–	–	–
	12 Dec. 1972	–	–	–	–	–	–	7	1	–	–	–	–	–
Shallow bay (bottom muddy, with a little moss)	5 Sept. 1971	1	–	–	–	–	1	–	2	1	31	–	–	–
	9 June 1972	–	–	–	–	–	–	–	–	–	9	–	–	1
	24 Nov. 1972													
	12 Dec. 1972	–	–	–	–	–	–	–	–	–	–	–	–	–
Totals		5	2	2	2	4	4	22	17	3	52	9	6	7

The above figures are counts made after net sweeps of approximately 5 s. *Sigara distincta* was not taken on any of the above occasions. The *Juncus* bed was not sampled on 5 Sept. 1971, and the shallow bay was dry on 24 Nov. 1972, so no figures are available.

where reeds become fen. All these species in the succession are present at Castor Hanglands, *H. linnei* being the most numerous, especially in the *Juncus* (see Table 4). *S. distincta* and *S. fossarum* commonly occupy the intermediate levels in the succession in soft, only moderately productive lakes (Macan, 1967), so the fact that *S. fossarum* was the most abundant corixid at Castor Hanglands is unexpected. Even more surprisingly, *H. castanea* (Det. T. T. Macan) a species usually associated with waters deficient in bases, flourished in the pond. A long list of species is associated with diversity in a biotope (Thienemann's first law of biocaenotics) and Macan (1962) has suggested that instability of biotope may account for exceptionally large numbers of corixid species in bodies of water. Castor Hanglands pond did not appear unstable, as it seemed to have settled down thoroughly after the disturbances of 1966–67, and seasonal variation in, for instance, the water level, was not great. The fact that there was usually a slight flow through the pond may account for the presence not only of pond species such as *Corixa punctata, Sigara nigrolineata* and *S. lateralis*, but also of the lake/river species such as *S. dorsalis* and *S. falleni*. Castor Hanglands National Nature Reserve lies at the edge of limestone country, but within a radius of about 8 km

lie the dykes of the peat fenland, the River Nene, and numerous gravel and clay pits. This provides a variety of biotopes from which corixids could colonize the pond, which may help to account for the large number of species. Morris (1969) has shown that the presence of many species of corixid at Woodwalton Fen, Hunts. seems to be generally correlated with recently cut dykes and cuttings.

Dragonflies are well represented at Castor Hanglands. At least eleven species bred in the pond. *Aeshna grandis*, a common dragonfly of base-rich water, was present, and so was *Sympetrum sanguineum*. Larvae of this species have only been found amongst the roots of *Typha* and *Equisetum* (Corbett, Longfield & Moore, 1960), and the latter plant was plentiful in the pond. The larval distribution of the three most abundant species of Odonata at Castor Hanglands is interesting (see Fig. 1). *Pyrrhosoma nymphula* was found only near the margins of the pond, whereas *Enallagma cyathigerum* and *Ischnura elegans* were generally distributed in weeds throughout the pond. This presumably reflects differences in behaviour during oviposition. Macan (1963) has found a similar distribution pattern for *Enallagma cyathigerum* and *Pyrrhosoma nymphula*.

The presence of Tricladida together with a large number of dragonflies and newt tadpoles in the Castor Hanglands pond is noteworthy. Davies (1969) found that triclads could not be established in a pool in Wales because of predation by *Pyrrhosoma nymphula* and tadpoles of *Triturus helveticus*. At Castor Hanglands, triclads were not very numerous, and may have been on the verge of disappearing. If this was not the case, the slow-moving triclads may have been escaping the attention of the predators because of the abundant supply of other food species. I observed captive dragonfly larvae catching Cladocera and insect larvae, but could not tempt them to take triclads. Both *Dendrocoelum lacteum* and *Polycelis tenuis* are common species in productive waters and the distribution of *Dendrocoelum lacteum* is linked with that of *Asellus* (Reynoldson, 1967).

About 200 specimens of *Asellus* were examined during the survey of the pond at Castor Hanglands. All were *A. meridianus*. During recent limited investigations in the Peterborough district, in other ponds, and in dykes, rivers and the shallow parts of gravel pits, I have found many *A. aquaticus* and relatively few *A. meridianus*. Moon (1957) has suggested that *A. aquaticus* is the more recent arrival in the Lake District, and that in the littoral region *A. meridianus* is unable to compete with *A. aquaticus*. Hynes & Williams (1965) have done experiments with mixed populations, and have found that, under conditions in which both species survive and reproduce satisfactorarily, *A. aquaticus* replaces *A. meridianus*. Probably Castor Hanglands remains a stronghold for *A. meridianus* because *A. aquaticus* has never arrived there.

There are relatively few species of mollusc in the pond. Either some species which could flourish there have never arrived, or the draining of the pond in 1967 killed off much of the original population, and the mollusc fauna has not yet become fully re-established. Boycott (1936) has shown that a high calcium concentration favours freshwater molluscs, and whereas some species are able to live in soft as well as hard waters, the more exigent cannot tolerate less than twenty parts of calcium per million. Of the three aquatic gastropod species at Castor Hanglands *Lymnaea peregra* and *Planorbis contortus* are widely distributed but *P. planorbis* is confined to hard water.

The quantitative sampling of the pond shows clearly that the most productive parts were the bottom and the emergent vegetation (see Fig. 1). *Chara* harboured far fewer animals than did the other aquatic plants, although later in the year large

numbers of *Holocentropus dubius* were found in the *Chara*. Two beetles, *Haliplus obliquus* and *Oreodytes halensis*, generally associated with *Chara* (Balfour–Browne, 1950), were common in the pond.

Enochrus testaceus was an interesting find. Balfour–Browne (1958) considered it to be absent from a central band of England including Northamptonshire, Huntingdonshire and South Lincolnshire. It has since been recorded from Woodwalton Fen, Huntingdonshire, by Buck (1962).

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