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Technical report.
Insect remains from the Seamer Carr landfill site: ecological reconstruction of a Mesolithic shore.

by Harry Kenward and Frances Large

Summary

Insect remains from six samples from the Mesolithic littoral deposits at Seamer Carr, near Scarborough, N. Yorkshire, have been reviewed and one of the assemblages recorded in detail.

Context 147 from Trench 83 provided a large assemblage of insect remains, although most were rather poorly preserved. The predominant component was of species associated with open water and emergent vegetation, indicating a fen environment. The island seems to have supported some scrub. There was evidence of areas of short grass, most probably resulting from human clearance then trampling. Adoxus obscurus*, a leaf beetle only recently found alive in Britain, was recorded.*

Keywords: SEAMER CARR NEAR SCARBOROUGH; MESOLITHIC; SHORELINE; ANALYSIS; INSECTS; CLEARANCE; ADOXUS (BROMIUS) OBSCURUS

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Introduction

During October 1996 excavations were carried out by Northern Archaeological Associates at Seamer Carr, near Scarborough, N. Yorkshire, as part of an evaluation of the archaeological potential of an area proposed for development as a landfill site. Members of the Environmental Archaeology Unit were engaged in an advisory capacity, and on 17.10.96 visited the site and collected samples from a series of trenches exposing organic deposits abutting and overlying a low 'island' of gravel believed to represent what was formerly an area of dry land formerly surrounded by fen. The primary interest of the deposits lay in their association with Mesolithic flint scatters, paralleling material recorded elsewhere in the Vale of Pickering, notably at the classic site at Starr Carr, but there was clearly also substantial biological potential.

The samples, 'GBAs' *sensu* Dobney *et al.* (1992), were collected from Trenches 83, 80, 82 and 48, representing a series from south to north from the former swamp or lake upslope onto the gravel island. Single samples were collected from thin, apparently wasted, peats in Trenches 48 (Sample 419) and 82 (815), three from the rather thicker sequence in Trench 80 (1094-6), and five from a much better developed sequence of muds and peats in Trench 83 (866-9). In Trenches 80 and 83, the samples were numbered down the sequence.

The laboratory evaluation

The samples were examined in the laboratory, where they were described using a *pro forma* and six were chosen for processing to extract insect and other macroinvertebrate remains, Subsamples of 1 kg were used in each case, and methods followed Kenward *et al.* (1980), as modified by Kenward *et al.* (1986).

Extracted fossils were examined in the 'flot' recovered by paraffin flotation, the material being stored in industrial methylated spirits. A record was made of the preservational condition of the remains, of the range and abundance of fossils representing various ecological groups, and of the principal taxa (Carrott *et al.* 1996). One of the assemblages (Sample 868 from Context 147, Trench 83) was selected as having particular value in reconstructing the past ecology of the site providing a larger subsample was processed, and subsequently funding was made available for its investigation.

Insect remains from the earlier excavations at Seamer were described by Osborne (1980).

Analysis

The bulk of the remaining material for Sample 868 (5.1 kg) was subjected to paraffin floatation and the resultant flot sorted for insect remains. The fossils were placed on damp filter paper for identification, and beetles and bugs listed

together with the minimum number of individuals able to provide the recorded parts. The numbers of other invertebrate groups were estimated semi-quantitatively (see Kenward *et al.* 1986; Kenward 1992).

Results and discussion

(1) The evaluation

The results are considered by trench from downslope to upslope, and within trenches from below to above. The sediment descriptions are those made in the laboratory prior to processing.

Trench 83

An irregularity in the floor of this trench appeared perhaps to represent a wave-cut shoreline. The lowest sample (869) was taken from beneath muds suspected on the basis of field observation to have formed in the lake shallows, the muds themselves being represented by Sample 868. Sample 867 included a thin horizon overlying the putative lake muds together with the lowest peats, while the remaining samples were taken from higher levels within the peat.

Sample 869, Context 183

Sediment description: Moist mid to dark grey (browner internally) fibrous sandy, silty, amorphous organic sediment. Appreciable quantities of stones in the 2-60 mm range. 1 kg processed.

A large volume of plant debris was recovered in the flot. There were only a few beetle remains, forming no clear ecological community, and a small number of other invertebrates. The rarity of remains did not appear to have resulted from in-ground decay, as none of the remains showed extreme chemical degradation. It was estimated that a subsample of about 20 kg might provide sufficient remains for ecological reconstruction.

Sample 868, Context 147

Sediment description: Moist dark grey (often browner internally) soft, fibrous amorphous organic sediment with traces of stones in the 6-20 mm range. The sediment appeared ‘jumbled’ (?disturbance at the lake edge) and contained abundant herbaceous detritus and some sandy patches. 1 kg processed.

The flot was of rather modest size and was rich in insect remains. Preservation ranged from rather poor to quite good, but in all cases the remains were in sufficiently good condition for identification. Aquatic, waterside/swamp and terrestrial beetles and bugs were abundant and rather diverse. The concentration of water beetles and bugs was sufficiently high in terms of both individuals and species for a very precise reconstruction of conditions to be made using a larger subsample, and similarly the range of waterside insects promised a clear view of the local aquatic marginal vegetation. The fauna of a larger subsample is considered in detail below.

Sample 867, Contexts 101/148

Sediment description: This sample represented the base of the peat and the somewhat greenish layer beneath it. Moist, dark grey-brown, fibrous but brittle, greasy (working crumbly then plastic) amorphous organic sediment with herbaceous detritus locally throughout. 1 kg processed.

A rather large flot resulted from paraffin extraction. It contained a small number of insect remains of variable preservation (although all were in an identifiable state). There were some aquatic, waterside and probable terrestrial taxa. A very large subsample (say 20 kg) would be needed to

recover an interpretable assemblage, although even then it is not certain that sufficient terrestrial species would be recovered for ecological reconstruction beyond the point of deposition to be accurate.

Sample 866, Context 101

Sediment description: Dark brown compressed and layered amorphous organic sediment with abundant woody and herbaceous detritus. Not processed.

Trench 80

Sample 1096, Context 130

Sediment description: Mid to dark greyish brown (locally strong brown and pale grey), soft and plastic to crumbly (working plastic) amorphous organic sediment, with some humic silty sand and grades between these extremes. Trace of flint. 1 kg processed.

The flot was large, consisting of what appeared to be fragments of fine plant roots, but only a single insect fragment was noted. Low input seems unlikely to be the cause of this extreme rarity invertebrates. There were no partly decayed remains, but it is possible that the deposit had undergone extreme humification at some stage, destroying the content of fossils, and then (or at the same time) had been invaded by plant roots.

Sample 1095, Context 129

Sediment description: Amorphous organic sediment with a little herbaceous detritus; just moist but subjectively appeared to have dried out completely at some time. Not processed.

Sample 1094, Context 106

Sediment description: Amorphous organic sediment with some wood; although moist it appeared to have dried out in the past. Not processed.

Trench 82

Sample 815, Context 141

Sediment description: Moist; variable in colour from dark slightly grey yellowish brown to dark brown, crumbly (working soft and plastic), silty amorphous organic sediment with traces of sand locally; in places pure amorphous organic matter. Some wood was noted. 1 kg processed.

The flot was large and contained abundant course fragments of plant root and ?stem. There were traces of invertebrate remains. It was considered doubtful whether even a 20 kg subsample would produce an interpretable assemblage of insects, although some information would be obtained.

Trench 48

Sample 419, Context 101

Sediment description: The sample was just moist and the sediment appeared to have undergone decay locally. It was a dark strong brown in colour, brittle, apparently indurated, amorphous organic sediment. There was some bark and wood. 1 kg processed.

The flot was large and notable for its content of fine charcoal, which from the excellently-preserved cellular structure appeared to be burned monocotyledon stems, perhaps grass. There were also some modern grass seeds still containing white endosperm, and it appears likely that these

two components had been carried down from the surface, probably in cracks or by the actions of burrowing animals. The small number of invertebrate remains noted must thus be discounted for archeological purposes, quite probably being of modern origin too.

(2) Analysis of Sample 868, Context 147

The species list is presented in order of abundance in Table 1, and some principal statistics for the assemblage of adult beetles and bugs are given in Table 2. Table 3 explains the ecological codes used in Table 1-2. The typical habitats of selected taxa are outlined in Table 4, and species are listed in taxonomic order in Table 5.

Preservation seemed a little poorer than that of the assessed material, and a significant proportion of the remains consequently could not be identified without excessive expenditure of time. (This was also the case for a few fragments which could not immediately be placed as familiar British species.) The remains may have degraded in storage since the assessment was carried out, but it is also possible that the assessed subsample represented the lowest part of the sequence, having been taken from the top of the tub (the lowest, and best preserved, material being collected last). This is supported to an extent by the subjective impression that the assessed assemblage included proportionally more terrestrial species than that listed in detail - perhaps marsh encroached over a formerly open shore, reducing the relative input of insects from adjacent 'dry land' habitats. Another possibility is that this is simply an artefact of the estimation of minimum numbers of individuals (Issitt *et al.* 1995).

Notes on certain taxa

Coriomeris denticulatus: This species was identified from an incomplete and strongly laterally-compressed head. First recognised only as having a tuberculate surface reminiscent of a coreid bug, careful comparison with reference material eventually allowed a specific identification. *C. denticulatus* has a rather southerly distribution in Britain today, and its presence in the Mesolithic Vale of Pickering perhaps suggests higher temperatures than now.

Auchenorrhyncha: there were abundant remains of parts of wings of froghoppers and their relatives, but these were of types found in many species. The more diagnostic heads and pronota were poorly represented, leaving three of the most common taxa in the assemblage unidentified.

Hydrophilinae: these water beetles were generally too poorly preserved for identification. Two *Enochrus* species were present, but could not be identified further, while some other abundant remains could not be placed confidently in a genus.

Adoxus (Bromius) obscurus: A fragment of a distinctive black pronotum proved identical with reference material of *A. obscurus* collected in Scandinavia by HK. *A. obscurus* has been recorded from Britain but is a great rarity, first being found in Britain (Cheshire) in 1979, although there is an obscure earlier record from Lincolnshire (Hodge and Jones 1995; Kendall 1982; Stephens 1839, 304). It is associated with light, sandy soils and hosts are members of the willow herb family (Onagraceae), particularly rose-bay willow herb, *Chamaenerion angustifolium* (L.) Scop. (Hyman and Parsons 1992). This record is significant in placing this enigmatic species in mid-Holocene Britain,

suggesting that the modern records may not represent a recent arrival.

Ecological reconstruction

The diversity (in crude terms, species richness, estimated using Fisher *et al.*'s (1943) alpha) of the whole assemblage was low by comparison with other 'natural' groups of fossils examined by HK. This was also true of its components (the aquatics, waterside taxa, plant feeders and decomposers all gave very low values). This strongly suggests a death assemblage of predominantly local origin, which can be used to reconstruct conditions in the immediate surroundings. It also indicates that a somewhat restricted range of habitats existed nearby.

Over one fifth (21%) of the adult beetles and bugs were of aquatic taxa. The nature of the aquatic environment is indicated by a series of water beetles. The more abundant specifically-named aquatics were *Hydraena britteni* (37 individuals), *Ochthebius minimus* (10), and *Tanysphyrus lemnae* (8). The first typically lives in fens, the second in stagnant water, usually in mud, and the third is associated with duckweeds (*Lemna* spp.). Less abundant water beetles included *Hydrochus brevis* (swamps). There were numerous remains of various Hydrophilinae, but although these included two *Enochrus* species (found in a range of aquatic habitats), closer identification was precluded by the condition of the material. The presence of hydroporine and colymbetine water beetles more likely to occur in open water is also noteworthy. There was thus at least some open water but the predominant picture is one of a wet fen. It was not clear whether this mixture represents a mosaic of contemporaneous habitats or a time succession at the island's shore from open water to marsh. If the general environment was overgrown swamp then it is conceivable that the shore had been trampled or otherwise modified by human activity, leaving colonisable pools. The lithology (see above) also gave some indication of disturbance at the water's edge.

The predominant habitat was certainly marsh and damp ground; about a third (31%) of the fauna indicated such habitats and much of the rest would be able to exploit them. Two *Cyphon* species (87 and 16 individuals respectively), *Cercyon convexiusculus* (20), *Pterostichus diligens* (11), *Carpelimus elongatulus* (10), *Chaetarthria seminulum* (6) and many of the less abundant species belong in this category, and indicate a rich and varied waterside environment.

Terrestrial insects were present in limited numbers (there were perhaps proportionally more in the assessed material, see above) but included some which suggested that the local dry-land vegetation may have included fairly short turf. *Serica brunnea* is a chafer whose larvae are typically found in grassy turf in sandy and chalky places, while the elaterid ?*Agriotes* sp. would probably have exploited similar soils (this and other '?' identifications can be regarded as 'probably'). *Coriomeris denticulatus* is typical of hot sunny places with short vegetation (the sandy south-facing slope of the island perhaps fitting this description), *Metabletus (?) truncatellus* is usually found in sunny places with short turf. Both British *Megophthalmus* species are associated with grasses, and *M. scabripennis* is often found in sandy places (Le Quesne 1965). *Adoxus obscurus* was perhaps exploiting rose-bay willow herb, a typical coloniser of disturbed ground (Clapham *et al.* 1962, 478), although hairy willow herb (*Epilobium hirsutum* L.), a waterside species, is a possible alternative host. There were thus some hints of modification of the vegetation by fairly intensive human

activity. It is just possible that open grassy areas might have been created and maintained by grazing wildfowl, but this explanation appears contrived in view of the abundant evidence of human exploitation of the island presented by the worked flint.

There were no indications of 'dry land' woodland. The only species in the main subsample associated with dead wood was *Scaphidium quadrimaculatum*, as likely to occur on fungusy wood in carr as on dry land. Scrub may have been present, for although only birch (*Betula*) was indicated by the insects a number of species were recorded which are typical of shady, often wooded, places (Table 4; *Pterostichus niger*, with 10 individuals, and *Dalopius marginatus*, with 18, were notable in this category). There was sufficient herbaceous vegetation to support a range of plant feeders and to create habitats for a variety of species favoured by shade. In addition to birch, some other other plants were indicated (Table 4), including mosses (many of the species often found amongst these). *Cidnorhinus quadrimaculatus* is normally found on nettles (*Urtica* spp.), which doubtless grew in the fen edges (Clapham *et al.* 1962, 561) and thus cannot be regarded as evidence of nitrogen-enrichment by deposition of waste from human occupation.

Dung beetles were extremely rare (and other species with an obligatory tie to foul matter were virtually absent), suggesting that there were few mammals and certainly that large herbivores were absent locally. Indeed, apart from that in waterside habitats, decaying matter seems to have been rare, for only 9% of the fauna was contributed by species typical of it.

Synanthropes (species favoured by artificial habitats created by intensive human occupation) were effectively absent (amounting to only 1% of the assemblage), and the few which were recorded are all regarded as species typical of natural habitats, capable of facultatively invading artificial ones.

It appears likely that formation this deposit was contemporaneous with Mesolithic exploitation of the adjacent land surface, in order for short turf to exist without any evidence of grazing by large mammals. It is just possible that waterfowl created such a turf, but human clearance and trampling seems as likely a cause. Both causes may have operated, so that the island was a hunting ground for wildfowl (thus the flint scatters), only temporarily occupied (thus the lack of evidence for more intensive human disturbance).

Osborne (1980) gave a preliminary report of insect assemblages from peats at Seamer Carr, not far from the present site. Although not dated in the report (it was guessed that they were from 8-9000 BP on the basis of the fauna), these peats appear to have been of Mesolithic date. Samples from the upper part of a column gave no useful remains, but there were increasing numbers of insects in the deeper layers, which yielded a rich fauna indicative of fen with some open water. Terrestrial (as opposed to aquatic, waterside or facultatively waterside) insects were not abundant; a range of species associated with dead wood probably exploited willows in the fen. Full analysis and publication of a final report on this material is highly desirable.

A full-scale research project on fossil insects from Seamer Carr, and the Vale of Pickering generally, would undoubtedly be most rewarding in terms of archaeological and biological information recovered. The discovery of sites with a larger terrestrial component in the fauna, and with better preservation, would be especially exciting,

and doubtless a range of now-extinct species would be identified and information about changing terrestrial climates obtained. Such a study would be particularly valuable if closely tied in with work on plant and other remains and related to known and suspected areas of human occupation. It is clear from field observations and the analyses reported here that the deposits have suffered damage from dehydration and, even if action is taken to maintain (and preferably raise) the local water table, further research should be undertaken urgently, before this important archaeological resource degrades too far to be of use.

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*Table 1. Invertebrate remains from Sample 868/1, Context 147, Seamer Carr landfill site. n - minimum numbers of individuals; R - recording method: blank = fully quantitative, s - 'several', m ='many' (sensu Kenward 1992); EC - ecological code (see Table 3); * - taxa not used in calculating the statistics given in Table 2. The list is arranged in order of abundance then taxonomically.*

Taxon	n	R	EC
Cyphon sp. B	87		oa-d
Auchenorhyncha sp. A	40		oa-p
Hydraena britteni	37		oa-w
Auchenorhyncha sp. B	20		oa-p
Cercyon convexiusculus	20		oa-d
Enochrus sp. A	18		oa-w
Dalopius marginatus	18		oa-p
Cyphon sp. A	16		oa-d
Pterostichus diligens	11		oa-d
Megasternum obscurum	11		rt
Auchenorhyncha sp. C	10		oa-p
Hydrophilinae sp. A	10		oa-w
Ochthebius minimus	10		oa-w
Carpelimus elongatulus	10		oa-d
Acrotrichis sp. A	9		rt
Hydrophilinae sp. B	8		oa-w
Tanysphyrus lemnae	8		oa-w-p
Acrotrichis sp. B	7		rt
Atomaria sp. A	7		rd
Chaetarthria seminulum	6		oa-w
Anthobium unicolor	5		oa
Lesteva heeri	5		oa-d
Eusphalerum minutum	5		oa-d
Bryaxis/Bythinus sp.	5		u
Serica brunnea	5		oa-p
Phyllobius roboretanus or viridiaeris	5		oa-p
Agonum fuliginosum	4		oa
Hydroporinae sp. A	4		oa-w
Enochrus sp. B	4		oa-w
Lathrobium sp. A	4		u
Aleocharinae sp. A	4		u
Aleocharinae sp. C	4		u
Limnobaris pilistriata	4		oa-p-d
Megophthalmus sp.	3		oa-p
Leiodidae sp.	3		u
Stenus sp. F	3		u
Othius sp.	3		rt
Philonthus sp. B	3		u
Philonthus sp. C	3		u
Sepedophilus sp.	3		u
Aleocharinae sp. E	3		u
Pselaphus heisei	3		u
Corticaria sp. B	3		rt-sf
Coleoptera sp.	3		u
Bembidion harpaloides	2		oa-d
Pterostichus niger	2		oa
Pterostichus nigrita	2		oa-d
Metabletus ?truncatellus	2		oa
Cercyon tristis	2		oa-d
Metopsia retusa	2		u
Stenus sp. D	2		u
Stenus sp. E	2		u
Lathrobium sp. B	2		u
Ochthephilum sp.	2		oa-d
Erichsonius cinerascens	2		oa-d
Tachyporus sp. A	2		u
Aleocharinae sp. B	2		u
Aleocharinae sp. H	2		u
Apion sp. A	2		oa-p
Apion sp. B	2		oa-p
Cidnorhinus quadrimaculatus	2		oa-p
Coleoptera sp. D	2		u
Coriomeris denticulatus	1		oa-p
Elasmucha grisea	1		oa-p
Lygaeidae sp. A	1		oa-p
Lygaeidae sp. B	1		oa-p
Heteroptera sp.	1		u
Aphrodes flavostriatus	1		oa-p-d
Loricera pilicornis	1		oa
Pterostichus minor	1		oa
Hydroporinae sp. B	1		oa-w
Hydroporinae sp. C	1		oa-w
Hydroporinae sp. D	1		oa-w
Agabus or Ilybius sp.	1		oa-w
Rhantus sp.	1		oa-w
Dytiscidae sp.	1		oa-w
Gyrinus sp.	1		oa-w
Hydrochus brevis	1		oa-w
Helophorus sp.	1		oa-w
Coelostoma orbiculare	1		oa-w
Limnebius sp.	1		oa-w
Scaphidium quadrimaculatum	1		l
Anthobium atrocephalum	1		oa
Acidota cruentata	1		oa
Omaliinae sp. A	1		u
Omaliinae sp. B	1		u
Anotylus rugosus	1		rt
Stenus sp. A	1		u
Stenus sp. B	1		u
Stenus sp. C	1		u
Stenus sp. G	1		u
Rugilus ?orbiculatus	1		rt-sf
Xantholinus linearis	1		rt-sf
Neobisnius sp.	1		u
Philonthus sp. A	1		u
Tachyporus sp. B	1		u

Tachinus ?signatus	1		u
Tachinus sp. A	1		u
Aleocharinae sp. D	1		u
Aleocharinae sp. F	1		u
Aleocharinae sp. G	1		u
Aleocharinae sp. I	1		u
Aleocharinae sp. J	1		u
Aphodius sp.	1		ob-rf
Clambus sp.	1		rt-sf
?Agriotes sp.	1		oa-p
Denticollis linearis	1		u
Kateretes sp.	1		oa-p-d
Meligethes sp.	1		oa-p
Atomaria sp. B	1		rd
Phalacridae sp.	1		oa-p
Coccinellidae sp.	1		oa-p
Corticaria sp. A	1		rt-sf
Melandryidae sp.	1		u
Scraptiidae sp.	1		u
Mordellidae sp.	1		u
Donacia sp.	1		oa-w-p
Adoxus obscurus	1		oa-p
?Chrysomelinae sp.	1		oa-p
Sitona sp.	1		oa-p
Curculionidae sp. A	1		oa
Curculionidae sp. B	1		oa
Curculionidae sp. C	1		oa
Coleoptera sp. D	1		u
*Coleoptera sp. (larva)	15	m	u
*Acarina sp.	15	m	u
*Diptera sp. (adult)	15	m	u
*Diptera sp. (larva)	15	m	u
*Insecta sp. pupa	15	m	u
*Oligochaeta sp. (egg capsule)	6	s	u
*Diptera sp. (puparium)	6	s	u
*Dermaptera sp.	2		u
*Aranae sp.	1		u
*Formicidae sp.	1		u

Table 2. Some principal statistics for the assemblage of adult beetles and bugs from Sample 868/1, Context 147, Seamer Carr landfill site. The codes are explained in Table 3. Values are rounded to the nearest whole number. Alpha (∀ of Fisher et al. *1943) values have not been calculated for a category where there were less than 20 individuals.*

S	124
N	552
ALPHA	50
SEALPHA	3
SOB	69
PSOB	56
NOB	426
PNOB	77
ALPHAOB	23
SEALPHAOB	2
SW	21
PSW	17
NW	117
PNW	21
ALPHAW	8
SEALPHAW	1
SD	15
PSD	12
ND	170
PND	31
ALPHAD	4
SEALPHAD	1
SP	26
PSP	21
NP	133
PNP	24
ALPHAP	10
SEALPHAP	1
SM	0
PSM	0

NM	0
PNM	0
ALPHAM	0
SEALPHAM	0
SL	1
PSL	1
NL	1
PNL	0
ALPHAL	0
SEALPHAL	0
SRT	13
PSRT	10
NRT	47
PNRT	9
ALPHART	6
SEALPHART	1
SRD	2
PSRD	2
NRD	8
PNRD	1
ALPHARD	0
SEALPHARD	0
SRF	1
PSRF	1
NRF	1
PNRF	0
ALPHARF	0
SEALPHARF	0
SSA	5
PSSA	4

NSA	7
PNSA	1
ALPHASA	0
SEALPHASA	0
SSF	5
PSSF	4
NSF	7
PNSF	1
ALPHASF	0
SEALPHASF	0
SST	0
PSST	0
NST	0
PNST	0
ALPHAST	0
SEALPHAST	0
SSS	0
PSSS	0
NSS	0
PNSS	0
ALPHASS	0
SEALPHASS	0
SG	0
PSG	0
NG	0
PNG	0
ALPHAG	0
SEALPHAG	0

Table 3. Abbreviations for ecological codes and statistics used for interpretation of insect remains in text and tables. Lower case codes in parentheses are those assigned to taxa and used to calculate the group values (the codes in capitals). See Table 1 for codes assigned to taxa from Seamer. Indivs - individuals (based on MNI); No - number.

No taxa	S
Estimated number of indivs (MNI)	N
Index of diversity (∀)	alpha
Standard error of alpha	SE alpha
No 'certain' outdoor taxa (oa)	SOA
Percentage of 'certain' outdoor taxa	PSOA
No 'certain' outdoor indivs	NOA
Percentage of 'certain' outdoor indivs	PNOA
No OA and probable outdoor taxa (oa+ob)	SOB
Percentage of OB taxa	PSOB
No OB indivs	NOB
Percentage OB indivs	PNOB
Index of diversity of the OB component	alphaOB
Standard error	SEalphaOB
No aquatic taxa (w)	SW
Percentage of aquatic taxa	PSW
No aquatic indivs	NW
Percentage of W indivs	PNW
Index of diversity of the W component	alphaW
Standard error	SEalphaW
No damp ground/waterside taxa (d)	SD
Percentage D taxa	PSD
No D indivs	ND
Percentage of D indivs	PND
Index of diversity of the D component	alphaD
Standard error	SEalphaD
No strongly plant-associated taxa (p)	SP
Percentage of P taxa	PSP
No strongly P indivs	NP
Percentage of P indivs	PNP
Index of diversity of the P component	alphaP
Standard error	SEalphaP
No heathland/moorland taxa (m)	SM
Percentage of M taxa	PSM
No M indivs	NM
Percentage of M indivs	PNM
Index of diversity of the M component	alphaM
Standard error	SEalphaM
No wood-associated taxa (l)	SL
Percentage of L taxa	PSL
No L indivs	NL
Percentage of L indivs	PNL
Index of diversity of the L component	alphaL
Standard error	SEalphaL
No indivs of grain pests (g)	NG
Percentage of indivs of grain pests	PNG
No decomposer taxa (rt + rd + rf)	SRT
Percentage of RT taxa	PSRT
No RT indivs	NRT
Percentage of RT indivs	PNRT
Index of diversity of RT component	alpha RT
Standard error	SEalphaRT
No 'dry' decomposer taxa (rd)	SRD
Percentage of RD taxa	PSRD
No RD indivs	NRD
Percentage of RD indivs	PNRD
Index of diversity of the RD component	alphaRD
Standard error	SEalphaRD
No 'foul' decomposer taxa (rf)	SRF
Percentage of RF taxa	PSRF
No RF indivs	NRF
Percentage of RF indivs	PNRF
Index of diversity of the RF component	alphaRF
Standard error	SEalphaRF
No synanthropic taxa (sf+st+ss)	SSA
Percentage of synanthropic taxa	PSSA
No synanthropic indivs	NSA
Percentage of SA indivs	PNSA
Index of diversity of SA component	ALPHASA
Standard error	SEALPHASA
No facultatively synanthropic indivs	SSF
Percentage of SF taxa	PSSF
No SF indivs	NSF
Percentage of SF indivs	PNSF
Index of diversity of SF component	ALPHASF
Standard error	SEALPHASF
No typical synanthropic indivs	SST
Percentage of ST taxa	PSST
No ST indivs	NST
Percentage of ST indivs	PNST
Index of diversity of ST component	ALPHAST
Standard error	SEALPHAST
No strongly synanthropic taxa	SSS
Percentage of SS taxa	PSSS
No SS indivs	NSS
Percentage of SS indivs	PNSS
Index of diversity of SS component	ALPHASS
Standard error	SEALPHASS
No uncoded taxa (u)	SU
Percentage of uncoded indivs	PNU

Table 4. Habitats of selected beetle and bug taxa recorded from Sample 868/1, Context 147, Seamer Carr landfill site. Very eurytopic taxa have been excluded. A, M, T - aquatic, marginal, terrestrial. Principal sources: Fowler (1887-1891); Friday (1988); Lindroth (1985-6); and Southwood and Leston (1959).

Taxon	**A,M,T**	**Summary ecology**
Elasmucha grisea	T	on birch (*Betula*)
Coriomeris denticulatus	T	ground-living; chalk and sand substrata; hosts include black medick, hare's foot trefoil and melilots; south-eastern but recorded from Yorkshire
Lygaeidae spp.	MT	groundbugs; various substrata
Megophthalmus sp.	T	Among grass roots, *M. scabripennis* often in sandy places.
Aphrodes flavostriatus	M	plant-feeder; in marshy places
Loricera pilicornis	MT	on at least slightly moist substrata, usually where there is shade
Bembidion harpaloides	M	on rather moist ground
Pterostichus diligens	M	waterside and other moist habitats, usually on nutrient-poor soils
Pterostichus minor	M	wide range of wet substrata with rich vegetation
Pterostichus niger	MT	eurytopic, but usually where there is shade
Pterostichus nigrita	M	waterside and other damp substrata, usually where there is rich vegetation
Agonum fuliginosum	M	moist, often shaded ground
Metabletus ?truncatellus	T	open rather dry ground exposed to the sun, usually with sparse vegetation
Hydroporinae spp.	A	wide range of waters as a group
Agabus or Ilybius sp.	A	ditto
Rhantus sp.	A	ditto
Dytiscidae sp.	A	ditto
Gyrinus sp.	A	wide range of open water
Hydrochus brevis	A	swamps
Helophorus sp.	A	wide range of waters as a group
Coelostoma orbiculare	M	damp places in fens and moss
Cercyon convexiusculus	M	fen litter
Cercyon tristis	M	bogs and fens
Megasternum obscurum	MT	eurytopic: waterside litter to compost to dung
Enochrus spp.	A	wide range of waters as a group
Chaetarthria seminulum	M	moss and mud in fens and bogs
Hydrophilinae spp.	AM	aquatic and waterside habitats
Ochthebius minimus	A	stagnant water, ponds, usually in mud
Hydraena britteni	A	fens, grassy streams in south
Limnebius sp.	AM	fens and in water
Acrotrichis spp.	MT	mostly in decaying matter
Scaphidium quadrimaculatum	T	associated with fungi on rotting wood
Metopsia retusa	T	grass roots, litter, fungusy wood
Anthobium atrocephalum	MT	moss, litter, fungi
Anthobium unicolor	MT	moss, litter, fungi
Acidota cruentata	MT	moss and litter
Lesteva heeri	M	grass roots, litter, moss, especially by water
Eusphalerum minutum	M	damp places

Taxon	**A,M,T**	**Summary ecology**
Carpelimus elongatulus	M	marshy places, at grass roots, in litter
Anotylus rugosus	MT	eurytopic in all kinds of decaying matter, waterside mud and litter
Lathrobium sp.	MT	litter and decaying matter
Ochthephilum sp.	M	waterside moss
Rugilus ?orbiculatus	T	litter, moss, grass roots
Xantholinus linearis	MT	eurytopic, in moss, plant roots and many kinds of decaying matter
Neobisnius sp.	M	marshy places, in moss and litter
Erichsonius cinerascens	M	litter and moss
Sepedophilus sp.	T	litter, moss, fungi, under bark
Tachinus ?signatus and T. spp.	T	moss, plant roots, many kinds of decaying matter
Bythininae sp.	MT	moss, grass tussocks, litter
Pselaphus heisei	MT	moss, tussocks, especially in wet places
Aphodius sp.	T	dung and (rarely) other foul decaying matter
Serica brunnea	T	sandy and chalky places, typically with short vegetation
Clambus sp.	MT	mostly in litter and moss
Cyphon sp.	MT	amongst vegetation in damp places
?Agriotes sp.	T	in soil below plants - species recorded probably associated with open, typically grassy, places
Dalopius marginatus	T	primarily in wooded places or scrub
Denticollis linearis	T	typically in woodland or scrub
Kateretes sp.	MT	amongst vegetation in damp places
Meligethes sp.	MT	on a wide range of plants
Atomaria sp.	MT	decaying matter and amongst vegetation
Phalacridae sp.	MT	herbaceous vegetation
Coccinellidae sp.	MT	wide range of plants including marginal
Corticaria sp.	MT	litter, under bark, at plant roots, etc
Donacia sp.	AM	in and on aquatic and waterside vegetation
Adoxus obscurus	MT	on *Chamaenerion angustifolium* and some of its relatives
Apion sp.	MT	on a wide range of plants
Phyllobius roboretanus or viridiaeris	MT	various herbaceous and woody plants
Sitona sp.	MT	wide range of plants, mostly vetches and their relatives
Tanysphyrus lemnae	A	on duckweed (*Lemna*)
Cidnorhinus quadrimaculatus	MT	on nettles (*Urtica*)
Limnobaris pilistriata	M	Waterside, associated with Juncaceae and Cyperaceae

Table 5. Invertebrates from Sample 868/1, Context 147, Seamer Carr landfill site, in taxonomic order. Nomenclature follows Kloet and Hincks (1964-77). Adults unless specified.

ANNELIDA
Oligochaeta sp. (egg capsule)
INSECTA: DERMAPTERA
Dermaptera sp.
HEMIPTERA
Coriomeris denticulatus (Scopoli)
Elasmucha grisea (Linnaeus)
Lygaeidae spp.
Heteroptera sp.
Megophthalmus sp.
Aphrodes flavostriatus (Donovan)
Auchenorhyncha spp.
DIPTERA
Diptera sp. (larva)
Diptera sp. (adult)
Diptera sp. (puparium)
COLEOPTERA
Loricera pilicornis (Fabricius)
Bembidion harpaloides Serville
Pterostichus diligens (Sturm)
Pterostichus minor (Gyllenhal)
Pterostichus niger (Schaller)
Pterostichus nigrita (Paykull)
Agonum fuliginosum (Panzer)
Metabletus ?truncatellus (Linnaeus)
Hydroporinae spp
Agabus or *Ilybius* sp.
Rhantus sp.
Dytiscidae sp.
Gyrinus sp.
Hydrochus brevis (Herbst)
Helophorus sp.
Coelostoma orbiculare (Fabricius)
Cercyon convexiusculus Stephens
Cercyon tristis (Illiger)
Megasternum obscurum (Marsham)
Enochrus spp
Chaetarthria seminulum (Herbst)
Hydrophilinae spp.
Ochthebius minimus (Fabricius)
Hydraena britteni Joy
Limnebius sp.
Acrotrichis spp.
Leiodidae sp.
Scaphidium quadrimaculatum Olivier
Metopsia retusa (Stephens)
Anthobium atrocephalum (Gyllenhal)
Anthobium unicolor (Marsham)
Acidota cruentata Mannerheim
Lesteva heeri Fauvel
Eusphalerum minutum (Fabricius)
Omaliinae spp.
Carpelimus elongatulus (Erichson)
Anotylus rugosus (Fabricius)
Stenus spp.
Lathrobium spp.
Ochthephilum sp.
Rugilus ?orbiculatus (Paykull)
Othius sp.
Xantholinus linearis (Olivier)
Neobisnius sp.
Erichsonius cinerascens (Gravenhorst)
Philonthus spp.
Sepedophilus sp.
Tachyporus spp.
Tachinus ?signatus Gravenhorst
Tachinus sp.
Aleocharinae spp.
Bryaxis/Bythinus sp.
Pselaphus heisei (Herbst)
Aphodius sp.
Serica brunnea (Linnaeus)
Clambus sp.
Cyphon spp.
?Agriotes sp.
Dalopius marginatus (Linnaeus)
Denticollis linearis (Linnaeus)
Kateretes sp.
Meligethes sp.
Atomaria spp.
Phalacridae sp.
Coccinellidae sp.
Corticaria spp.
Melandryidae sp.
Scraptiidae sp.
Mordellidae sp.
Donacia sp.
Adoxus obscurus (Linnaeus)
?Chrysomelinae sp.
Apion spp.
Phyllobius roboretanus or *viridiaeris* (Laicharting)
Sitona sp.
Tanysphyrus lemnae (Paykull)
Cidnorhinus quadrimaculatus (Linnaeus)
Limnobaris pilistriata (Stephens)
Curculionidae spp.
Coleoptera spp.
Coleoptera sp. (larva)
HYMENOPTERA
Formicidae sp.
Insecta sp. pupa
ARCHACHNIDA
Acarina sp.
Aranae sp.