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Insect remains from excavations at Buiston Crannog, Ayrshire, 1989: Technical Report

by

By H. K. Kenward, M. Hill, D. Jaques, A. Kroupa and F. Large.

Summary

Sixty samples of deposits at the Buiston Crannog site, Ayrshire, have been assessed for their content of insect remains and the assemblages from 34 of them recorded. Insects were usually present at rather low concentrations, but the large subsamples processed gave many interpretable groups. Some were dominated by aquatics and other natural-habitats species, indicating that natural waterlain sediments were imported to raise the mound, that there were periods of abandonment, or that flooding occurred (probably all three at various times).

A proportion of the assemblages included a decomposer component which must have colonised the debris resulting from human activity. There were indications of the presence of something akin to stable manure. There were also weak hints of the importation of cut, hay-like, vegetation. Parasites of humans and stock were recorded in small numbers from some of the deposits.

The decomposer component was of restricted diversity, by comparison with that at other occupation sites, possible as a result of isolation combined with limited duration of occupation at each phase.

Authors' address

Environmental Archaeology Unit
University of York
Heslington
York YO1 5DD

Telephone: (0904) 433843-51
Fax: (0904) 433850

Prepared for:

AOC Scotland Ltd,
The Schoolhouse,
4 Lochend Road,
Leith,
Edinburgh EH6 8BR, UK.

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Introduction and history of analyses

The crannog site at Buiston, near Kilmaurs, north of Kilmarnock, Ayrshire, was excavated in 1989. It originally lay at the head of Buiston Loch, long-since drained and only seasonally flooded. The excavation was carried out in order to monitor decay of the remains, chosen as representative of a number of crannog sites. An introduction to the findings is give by Crone (1992). The deposits were sampled quite intensively during excavation, the samples corresponding to `General Biological Analysis' (GBA) samples in the system used at the EAU (Dobney *et al.* 1992).

The study of the insect remains from Buiston proceeded in three stages. Initially, 60 samples were processed at the Department of Archaeology and Anthropology, University of Sheffield, and an assessment carried out in a series of stages by M. Dinnin (1992a-c; the first of these includes a report on the fly puparia by P. Skidmore). In general, large subsamples were processed for assessment rather than the 1 kg employed at the EAU. Priorities were assigned by discussion between Dinnin and AOC staff, a selection of samples being chosen for further analysis. Subsequently, the processed material was examined at York by HK, who produced a brief re-assessment (Kenward 1993), using 'assessment recording' as defined by Kenward (1992). The third, main, stage of the investigation is reported here.

In the re-assessment, the subsamples were assigned high, medium or low priority on the basis of their value in archaeological interpretation (although a few were regarded as medium-to-high or medium-to-low priority). These priorities were adjusted slightly following discussion with Anne Crone of AOC. There was a high degree of agreement between the samples chosen at the first stage and those assigned high priority at the second.

A detailed account of the Diptera of the site is given by Skidmore (1993).

Methods

Paraffin flotation of almost all of the subsamples dealt with here was carried out at Sheffield, as was sorting to extract insect (and some other invertebrate) remains. Material believed to include the flots and residues of some of these samples were supplied to the EAU by AOC. It was intended that those from nine would be recombined and re-floated using the methods described by Kenward *et al.* (1980; 1986) in order to allow study of remains which it was thought possible had not been recovered at Sheffield. In the event it was discovered that most of the bags contained what appeared to be very small subsamples of raw sediment, and only two flot/residue samples could be re-processed. Two other samples and a duplicate sample of a third were supplied as raw sediment, and processed using the same methods.

In the third stage of analysis, the high and medium-to-high priority samples were 'scan' recorded (*sensu* Kenward 1992). This recording method represents a compromise between speed and full identification of all remains and is now the standard technique employed at York. Typically, fossils of adult beetles and bugs are identified as far as is possible in a short period of time, the more difficult taxa being recorded at a higher taxonomic level (genus or family) unless it is believed that they will provide important interpretative or entomological information. In fact, during work at Buiston, many such fossils *were* identified, in an attempt to add detail to the characterisation of the natural/semi-natural environment of the crannog and water quality of the lake in which it stood. Recording thus sometimes approaches 'detail' recording as defined by Kenward (*loc. cit.*). Scan-recording of adult beetles and bugs, and of a few other remains, was

carried out on material sorted on to damp filter paper in most cases; a few groups were recorded in IMS. Individual sclerites (or fragments of them) were usually counted. Medium and medium-low priority assemblages were rapid-scan recorded (*sensu* Kenward, *loc. cit.*). In two cases, recording was semi-quantitative.

Invertebrates other than adults of the beetles and bugs used in calculating 'main statistics' for the assemblages were usually recorded semi-quantitatively. This method employs a five-point scale (Kenward *et al.* 1986), abundance for each taxon being estimated as 1, 2, 3, 'several' or 'many'. The last two are converted to 6 and 15 for statistical purposes, a conversion discussed by Kenward (1992).

Recording could, for almost all the samples, only be carried out on the remains picked out from the flots at the University of Sheffield. Normally, at York, material would be examined at least initially in the flot, most invertebrates other than beetles and bugs, and often even these, being recorded at this stage. Counts are for 'minimum number of individuals' represented by the recorded remains, and the figures given may include both positive and provisional identifications.

The manuscript lists and notes made during recording were entered to the University of York VAX mainframe computer and processed using a Pascal system written by HK, producing 'main statistics' and species lists in rank and taxonomic order for each assemblages, together with files of main statistics, species records and notes for the whole site. These were interrogated using the DATATRIEVE system.

The interpretative methods employed in this report are basically those used for a variety of sites by Kenward and co-workers (see, for example, Kenward 1978, with refinements discussed, for example, by Kenward 1982; 1988 and Hall and Kenward 1990). The interpretation of assemblages rests on certain 'main statistics' of whole assemblages of adult beetles and bugs, and upon ecologically-related groups of species. The main statistics used include: a measure of species-richness (or diversity), Fisher *et al.*s' (1943) α, for the whole assemblage and for components of it; proportions of 'outdoor' species, aquatics, waterside species, phytophages (plant feeders), species associated with dead wood, moorland/heathland taxa, and decomposers (species associated with decomposing matter of some kind). The last category is subdivided into species associated primarily with rather dry habitats, those found mostly in rather, to very, foul habitats, and a residuum not easily assignable to one of these. The identification of an 'outdoor' component in what are sometimes clearly natural or semi-natural assemblages may appear curious, but is in fact useful when working with any deposits associated, even if rather indirectly, with human occupation. The index of diversity offers a useful indication of the presence or absence of autochthonous fauna (i.e. remains of insects which bred in or on the developing deposit), low values indicating breeding communities, high ones faunas of mixed origins. Note that 'significantly' low values differ for the various components of assemblages; the more inherently rich a component is, the higher the value of the index of diversity for a living community will be. Thus, 'outdoor' communities associated with natural vegetation tend to give a relatively high value of α, while very specialised communities, such as those of decaying matter deposited by humans, or stored grain, have relatively low or very low ones.

A component of the assemblages referred to in this report is 'house fauna'. This is a group identified on the basis of archaeological records as apparently typical of primitive buildings housing people, stock, or stored organic material such as hay or straw. It is not necessarily suggested that they formed a single community; species living in timber, wattle, thatch, floors and stored products may be present in any particular case. The species are not likely to be found together today as a rule, since the habitats harbouring them have largely disappeared.

This component of archaeological insect assemblages is discussed by Hall and Kenward (1990), Kenward and Hall (forthcoming) and, largely by allusion, by Kenward and Allison (in press a).

A second group of species mentioned here is one believed to be indicative of rather foul open-textured rotting material such as mouldering straw or stable manure. Both this group and 'house fauna' were represented in somewhat impoverished form at Buiston, something which is considered in more detail in the discussion section.

A further group alluded to is that containing species which may be indicative of imported hay-like cut vegetation; this includes certain *Apion*, *Sitona*, and *Hypera* species and a variety of others.

Results

Introduction

The samples processed and the recording methods applied to them are listed in Table 1.

The species lists (in rank order) and main statistics for the 22 assemblages which were scan-recorded and 12 which were rapid-scanned (sometimes semi-quantitatively) are presented in the Appendix. The use of main statistics for rapid-scan recorded groups is discussed by Kenward (1992); in short, the statistics may be used for interpretation, but with suitable caution. In Table 2, main statistics averaged for the samples from each phase are presented; note the small number of assemblages used in some cases.

A complete list of invertebrate taxa recorded from the site is given in Table 3. The habitats of the 'outdoor' species (those coded 'oa' or 'ob', together with a few others) are summarised in Table 4.

Table 1. Samples from Buiston Crannog: material processed and recording methods applied. Key: P - priority (H - high; L - low; M - medium, these sometimes being combined); RM - recording method (A - assessment; RS - rapid scan; S - scan; SQRS - semi-quantitative rapid scan, all as defined by Kenward 1992); S? - was sample selected for full recording following the first assessment? Y = yes); SN - sample number; V - volume processed (litres).

SN	Phase	V	P	RM	S?
5	V	6	M	RS	Y
6	IV	3	L	A	
12	IV	4	H	S	Y
19	IV	3	M	RS	
20	IV	7	M	RS	
39	V	8	L	A	
41	V	7	H	S	Y
45	V	5	H	S	Y
46	III	4	L	A	
47	III	6	L	A	
48	III	6	H	S	Y
50	III	4	L	A	Y
52	III	6	LM	SQRS	
53	III	0.75	L	A	
55	III	2	H	S	Y
56	III	6	MH	S	Y
57	III	1.7	L	A	
59	III	1.5	MH	S	Y
60	III	5	L	A	
62	IV	7	L	A	
64/65	IV	5	L	A	
67	IV	5	L	A	

SN	Phase	V	P	RM	S?
71	III	5.5	MH	S	Y
74	IV	3	L	A	
77	V	1	M	RS	
89	IV	6	M	RS	
105	III	3	L	A	
108	III	?	H	S	Y
110	II	1.25	L	A	Y
115	I	4	MH	S	Y
117	I	4	L	A	
119	I	7	M	SQRS	Y
121	I	1.75	L	A	
126	I	1.5	L	A	Y
207	III	4	H	S	Y
213	III	1.5	H	S	Y
215	III	6	H	S	Y
223	III	?	H	S	Y
224	III	3.5	H	S	
226	III	7	M	RS	
227	III	6	H	S	Y
233	III	6	H	S	Y
234	III	2	M	RS	Y
235	III	5	M	RS	Y
238	III	4	L	A	
239	III	1.5	L	A	
301	V	5	L	A	
306	V	5	L	A	

SN	Phase	V	P	RM	S?
308	V	4	H	S	Y
309	V	8	LM	RS	Y
310	V	7.5	M	RS	
312	IV	8	H	S	Y
314	V	6	L	A	
316	IV	5	H	S	Y
327	IV	6	H	S	Y
339	IV	1.5	L	A	
341	IV	6	H	S	Y
342	V	5	L	A	
351	IV	1.3	L	A	Y
402	V	3	M	RS	Y

Table 2 (overleaf). Main statistics for the assemblages of adult beetles and bugs from scan- and rapid-scan recorded subsamples from Buiston Crannog, Ayrshire, by phase. For PNOB etc: Px - 'phase percentage', i.e. percentage based all individuals from that phase. For 'number of samples', the number in parentheses indicates the number of assemblages with 20 or more individuals. For the α values, the number in parentheses indicates the number of assemblages where the value of α exceeded its standard error; other values have been excluded from the calculation of means, and α values have not in any case been calculated for assemblages of less than 20 individuals. Note the small number of cases available for some phases.

Abbreviations for main statistics: N - number of individuals (MNI); S - number of taxa; α - index of diversity (alpha) of Fisher et al. *(1943); α OB - index of diversity of 'outdoor' component; α RT - index of diversity of decomposer component; PNOB - percentage 'certain' and probable outdoor individuals; PNW - percentage of aquatic individuals; PND - percentage of damp ground/waterside individuals; PNP - percentage of strongly plant-associated individuals; PNM - percentage of heathland/moorland individuals; PNRT - percentage of decomposer individuals; PNRD - percentage of 'dry' decomposer individuals; PNRF - percentage of 'foul' decomposer individuals; P 'house' - percentage of 'house fauna' (see text).*

Table 2.

Phase	I	III	IV	V
Number of samples	2 (2)	18 (18)	10 (8)	8 (8)
S	30.5	45.2	46.4	40.5
N	45.5	87.0	137.0	57.8
α	50 (2)	47 (18)	61 (8)	69 (8)
α OB	30 (2)	67 (8)	64 (3)	150 (2)
α RT	- (0)	8 (13)	7.8 (6)	14 (5)
	Px	Px	Px	Px
PNOB	78.8	36.7	16.6	29.8
PNW	41.1	14.7	1.8	4.8
PND	3.3	5.1	2.1	3.2
PNP	25.6	9.7	6.7	11.4
PNM	6.7	0.4	0.5	0.9
PNRT	16.7	42.7	61.1	44.3
PNRD	2.2	2.6	8.9	6.7
PNRF	3.3	2.5	1.4	5.6
P 'house'	1.1	2.0	12.2	8.2

Notes on some of the identifications

Lice - Remains of lice were present in small numbers in a few of the samples. Many were in very poor condition, the diagnostic characters being lost or obscured; some could be recognised as *Damalinia* sp., found on various large vertebrates including domestic stock. Others could only be recorded as lice in the broad sense, or were so poorly preserved that it was uncertain whether they might in fact belong to some other group. Some specimens represented by moderately well preserved heads appeared to be *D. bovis*, although this identification remains tentative. It is unfortunate that these lice were so poorly preserved in view of their potential importance as evidence of the presence of livestock, or a least skins or wool, on the crannog. Specimens of *Pediculus humanus* were more definitely identified, although not well preserved. Positive identifications of lice are mentioned under the headings for individual samples.

Scale insects - Coccids were occasionally present, and very abundant in the sample from one context (115). Representative examples were examined as slide mounts under high power of a transmission microscope. Where the diagnostic characters of the female abdomen could be seen, the specimens could reasonably confidently be identified as *Chionaspis salicis*.

Fleas - Some positive identification of fleas as *Pulex irritans*, the human flea, were made on the characteristic heads. It appears likely that the other flea remains (mostly thoracic segments) were also this species.

Pterostichus diligens/strenuus - The material of the subgenus *Argutor* from Buiston has proved difficult to identify. There is much variation in the shape of the sinuation in front of the hind angles of the pronotum, in the pronotal sculpture, and in the strength of the strial punctures, the characters of the dorsal surface used in identifying modern material (e.g. Lindroth 1974). A single, barely-punctate, prosternum appeared to be *P. diligens*, and a number of the pronota were also believed to be this species.

Olophrum species - The material from Buiston is probably all *O. piceum*, but a few of the pronota had a shape which tended towards that of *O. fuscum*.

Oulimnius sp. - The members of this genus can probably not be consistently reliably separated without examination of genitalia. The material from the present site is probably *O. tuberculatus*, however, on the basis of the form of the thoracic keels (Holland 1972, 12-9).

Elateridae larvae - Nine species of Elateridae larvae have been identified in the fossil material from Buiston. The part of these larvae most often recovered (or at least recognised) is the ninth abdominal segment, the 'abdominal apex'. It is currently possible to determine archaeological material of most species only by examination of this segment, and all the identifications for the present site are so based. Identifications have been made using van Emden (1945), Glen (1950), and reference material from the Natural History Museum, London.

The larva of *Melanotus erythropus* is very easy to identify, because the ninth abdominal segment is prolonged into a spiniform point, which is much longer than wide and rounded only at the apex, with one or two obtuse teeth on either side. *Hypnoidus riparius* is also very distinctive, having a deep U-shaped apical incision.

Larvae of *Ctenicera* species were fairly numerous. *C. cuprea* is characterized by a very long keel on the inner branch of the cerci, extending onto the dorsal surface of the stem of the cerci. To distinguish *C. cuprea* from *C. pectinicornis* it is necessary to examine the surface structure of the ninth abdominal segment. In *C. cuprea* it is more distinctly and closely punctured, in *C. pectinicornis* less distinctly and more diffusely punctured; it is also rather strongly transverse rugose.

However, in younger larvae it seems that the punctures are less distinct in *C. cuprea* and so the two species are difficult to distinguish in the early stages. It appears that most of the remains from Buiston were of *C. pectinicornis*, with a single *cuprea*.

In contrast to these two species, *Actenicera sjaelandicus* has a short inner branch of the cerci, which does not extend onto the dorsal surface of the stem of the cerci. It has also a pair of sub-basal setae on the disc of the ninth tergite. This was much the most abundant elaterid larva at Buiston.

Denticollis linearis has a short median furrow on the ninth tergite and the outer branch of the cerci is one-and-a-half to two times as long as the inner one.

Identification of larvae of *Athous haemorrhoidalis* is complicated by the fact that the descriptions of this species given by van Emden (1945) and Glen (1950) do not match determined material from the Natural History Museum. Following the key given by van Emden and the description provided by Glen, the fossil material is *A. haemorrhoidalis*. This seems likely, because it is a very common species and the adults found in fossil material at sites with larvae of this type appear to be *A. haemorrhoidalis*. A single Buiston specimen was identified as *A. vittatus.*

There was one specimen identified as *Selatosomus ?incanus*, identified on the form of the outer prong of the cerci.

Xantholinus gallicus/linearis - The characters for the separation of these species in fossil material are not clear. The material from Buiston has cautiously been assigned to *?linearis*; all the remains are probably in fact this species. *X. longiventris* was also present.

Neobisnius sp. - Specimens assignable to this genus are abundant in many archaeological occupation deposits; in general the remains appear to be of *N. villosulus*. The species are, however, difficult to separate as fossils. Most of the remains from Buiston are somewhat different from the material from other sites assigned to *N. villosulus*; they may be *N. procerulus*, but this identification is by no means certain.

Crataraea suturalis - This species, common in some kinds of archaeological deposits and previously recorded in the EAU as 'Aleocharinae sp. X', has only recently been identified (see Kenward and Allison, in press a).

Atomaria nigripennis - Identified on the basis of the very weakly punctured, shining, pronotum, with a characteristically-shaped transverse furrow at the base, together with associated, very weakly punctured, elytra. Some specimens represented by elytra alone may have been overlooked in a few samples.

General characteristics of the insect assemblages

Many of the subamples processed for insect remains were very large, commonly of 4-5 litres and in a few cases up to 8 litres. Although conversion of volume to weight is difficult, and both measures have disadvantages in quantifying archaeological material, for richly organic deposits such as those from Buiston it is probably not too inaccurate to assume a density close to unity. Thus, some of the samples were probably of several (up to 8) kilograms (in comparison with the standard 1 kg subsamples usually employed at the EAU). Bearing this in mind, the concentration of fossils was not usually very high. This may have been a result of rapid deposition, of dilution by large quantities of plant matter, or of low availability of remains; one of these three causes can be seen as likely for many of the contexts. There is little evidence that post-depositional decay was more than rarely an important factor at Buiston.

Preservation varied greatly from sample to sample, and even within samples and in different areas of single fossils, but was generally chemically good; fossils do not seem to have been withdrawn from the record, merely fragmented. The largest

groups of beetles and bugs included over 200, and in one case nearly 450, individuals, and were thus sufficiently substantial for confident interpretation. Many were much smaller, with less than 50 and a good proportion of these could not give very much information.

The broad ecological nature of the assemblages of beetles and bugs can be seen from Table 2. Many of the assemblages were very diverse (mathematically and ecologically), with large rich components of species associated with natural and semi-natural habitats. Some samples contained abundant decomposers, that is, species associated with decaying matter; in some cases there was good evidence from the insects that the decaying matter was deposited by human activity. Aquatics were occasionally very abundant, and some of the deposits were undoubtedly waterlain. Other invertebrates gave less indication of habitat range, although there were sometimes numerous larvae of aquatic insects. A few fleas and lice were recorded, including species associated with humans and with large domestic animals.

Although the descriptions of the insect assemblages given by Dinnin (1992a-c) generally matched the material seen in York quite closely, there were occasional discrepancies. These usually arose where Dinnin recorded taxa not included in the material sent to York; presumably they had been lost during handling or damaged beyond recognition in storage or transport. There were a few cases where Dinnin's reports suggested that a species was more abundant than in the sorted material available to the present writers; this is perhaps a result of the subjectivity inevitable in the rapid examination of material during assessment (problems of this kind are discussed by Kenward 1992).

Review of insect assemblages sample by sample

This site has produced some remarkable insect assemblages, certain aspects of which might be discussed *ad nauseam*. This report concentrates primarily on archaeological matters, although some points and records of more purely entomological interest are noted.

The material is considered in Phase and Group order, following the structural report; within groups the order is stratigraphical where possible, starting with the earliest layers.

The archaeological descriptions of the layers are taken from the structural report. The sediment description given by Dinnin (1992a-c) is given in quotes, together with his record of the volume of the flot. It is possible that the term 'peat' used by Dinnin, with its connotations of naturally-accumulated deposits of autochthonous plant remains, is in some cases inexact; many of the sediments would probably be more correctly described as coarse or fine organic (herbaceous or woody) detritus.

Phase I - Primary mound

Group 2 - Regularly alternating clay turves (contexts 117, 121) and wood litter (115, 119, and 126).

(Stratigraphy:
above - 126///121/119/117/115 - below.)

Context 117 - Clay turves [What was the source of this primary mound material?]

'Grey/brown clay silt with tangled fibrous plant remains.' (No flot size recorded.)

A subsample of 4 litres was processed and produced only seven beetle taxa of no interpretative significance.

Context 121 - clay turves [What was the source of this primary mound material?]

'Grey/brown clay rich organic material. A small flot.'

The processed subsample was of 1.75 litres; it produced only a single fossil insect.

Context 115 - wood litter [What was the source of this primary mound material?] 'Fine silt with plant and large, cut wood remains.' 'A small flot.'

The 4 litre subsample processed gave a small group of beetles and bugs, which was rapid-scan recorded (N about 31, S = 16). Preservation was good. There were 'many' *Sialis* larvae, of the order of 100 nematoceran fly larvae, of the order of 50 corixid nymphs and scale insects, two larvae of the click beetle *Athous haemorrhoidalis* and a few other remains. A selection of scale insects was examined, and the species present proved to be *Chionaspis salicis*. *C. salicis* is found on the twigs and small branches of a variety of trees and shrubs, particularly willow. When abundant it can probably be regarded as a useful indicator of the incorporation of brushwood into a deposit.

The great majority of the beetles and bugs of the groups used in calculating main statistics were 'outdoor' forms (% N OB = 91). The outdoor component was of low diversity, as indeed was the whole assemblage (α OB = 11, SE = 3; α = 15, SE = 5). Over half of the individuals were aquatics (% N W = 53), mostly 'many' *Sigara ?distincta*, with two *Corixa* sp. and a single *Gyrinus* sp. These, together with the abundant corixid nymphs, leave no doubt that this sediment formed in still water, with a autochthonous community of aquatic insects. *S. distincta* is typical of shallow waters with quite large quantities of organic matter in their sediments (see below) - just the conditions likely to occur at the fringes of the crannog.

The other remains offer little additional information. They may include species living close to the point of deposition and 'background fauna'.

This appears to have been an aquatic sediment, incorporated from the loch bottom during construction or dug or dredged up to raise the platform, or a mixture of such sediment with litter.

Context 119 - wood litter, 1950 ± 50 BP (GU 3000) [What was the source of this primary mound material?]

'Coarse organic material, with much wood (cut marks evident).' (No flot size recorded.)

The rather small group of beetles and bugs recovered from the 7 litre subsample processed was semi-quantitatively rapid-scan recorded; there were an estimated 59 individuals of 45 taxa. The material was rather fragmentary and identification and quantification consequently difficult in some cases. There were 'many' *Sialis* sp. larvae and 'several' scale insects and corixid water bug nymphs. Other remains were rare.

The recording method and small size of the assemblage make the statistics a little unreliable, but the gross nature of the fauna is so clear as to render the statistics somewhat otiose. Over a third of the beetles and bugs were aquatics, and these made up almost half of the very large 'outdoor' component. Decomposers were poorly represented (about a fifth of the assemblage). The only coded decomposer represented by more than a single individual was the very eurytopic *Cercyon analis* (3), although the records of *Typhaea stercorea* and *Anthicus formicarius* give clear hints of a human presence, unless the remains had been redeposited in some way.

Taxa from the moorland/heathland habitats were represented by *Scolopostethus ?decoratus* (3), *Ulopa reticulata* and *Strophingia ericae*. These may have been imported, for example in turf or heather for construction or animal bedding, but a natural origin cannot be ruled out.

This was an aquatic deposit by origin, either formed *in situ* or redeposited.

Context 126 - wood litter [What was the source of this primary mound material?]

'Peat containing large quantities of wood.' 'A very small flot.'

A subsample of 1.5 litres was processed. Five beetle taxa typical of the material from Buiston were present, representing aquatic and terrestrial habitats. They had no interpretative significance.

Phase I summary

Those of the Phase I deposits examined which had a substantial content of fossils seem to have included waterlain sediments dug or dredged up to provide make-up for the mound. There were small hints of pre-existing human occupation, but species associated with artificial habitats were rare, and no clear *communities* of such insects were recorded.

Phase II - Abandonment

Group 3.

Context 110 - Redeposited peat over uppermost turf layer of Phase I [What was the source of this primary mound material?]

'Dark brown silty organic material.' (No flot size recorded.)

A 1.5 litre subsample was processed; it produced only traces of insect remains, which provided no insights into the origin of this layer (c.f. Dinnin 1992c, who recorded a few aquatics).

Phase III - Early inhabitation south-east of the crannog centre

Group 6 - Dumping over the primary mound.

(Stratigraphy: above - 108/105 - below.)

Context 105 - Large spread of coarse charcoal, 1610 $\pm$ 50 BP (GU 3003) [?]

(No sediment description or flot size record.)

The processed subsample was of 3 litres. Three beetle taxa were present in the material submitted to York (c.f. five reported by Dinnin 1992b), with no interpretative value. They must have entered subsequent to burning.

Context 108 - Small spread of peat [What was the source of this primary mound material?]

'Highly organic, with much wood (cut marks evident) and some charcoal.' (No subsample volume or flot size recorded.)

A modest assemblage of beetles and bugs was recovered (N = 89, S = 55; scan recording) and there were a few other remains including 'many' beetle larvae and mites together with 'several' caddis larvae.

Diversity was quite high (α = 61, SE = 12), and the outdoor component substantial (%N OB = 42). The latter component was estimated to be of low diversity (for such a component): α OB = 39, SE = 14, and this was depressed by what was presumably an autochthonous or short-travelled group of aquatics (%NW = 24, 10 taxa). The ecological implications of the aquatics recorded from Buiston are considered in more detail in the discussion section.

Decomposers accounted for only a third of the assemblage, although the higher ranks of abundance included some such species and the value of Fisher et. al.'s α for the RT component was low (αRT = 11, SE = 3). It appears likely that *Cercyon analis* (6 individuals) and *Carpelimus ?bilineatus* lived in or very near to the developing deposit, and a number of the other recorded taxa may have lived with them in rotting plant remains.

There were no strong synanthropes, although most of the decomposers were species often found in accumulations of organic waste on occupation sites and litter deposited by human activity probably contributed to the deposit.

Group 8 - Early inhabitation to the south-east.

Context 59 - Moss litter [Was this clean, uncontaminated *Sphagnum* moss?]

'Moss peat with small pieces of wood and a little sand.' (No flot size recorded.)

A modest group of invertebrates was extracted from the 1.5 litre subsample and scan recording was employed. There were 'several' mites and insect larvae, and other remains included larval abdominal apices of *Ctenicera ?cuprea* and *Athous haemorrhoidalis*.

There were 45 individuals of 32 beetle and bug taxa. Over a third of the assemblage consisted of 'outdoor' forms (%N OB = 36). Although coded decomposers occupied the upper ranks of abundance, such taxa contributed only 38% of the individuals. There were four *Acrotrichis* sp. and *Xantholinus linearis* group and three *Othius myrmecophilus*; other taxa were represented by only one or two individuals. This fauna appears to be essentially a natural one, suggesting (like the material from samples 55 and 56) either natural litter or debris deposited by humans which was not colonized by any typical synanthropic decomposers. There were no species which can be regarded as clear indicators of *Sphagnum* peat.

Context 57 - Clay floor [What was this floor layer composed of? Can any activities be identified?]

'Light brown soil with loose crumbly texture, live worms present.' 'A small flot.'

A subsample of 1.7 litres was processed. There were only eight beetle taxa present, typical of the Buiston site but otherwise of no interpretative value.

Group 9 - Early inhabitation to the south-east.

Context 234 - Sand below hearth 51 [Characterise the deposit.]

'Dark brown peat with fragments of bone evident.' (No flot size recorded.)

Two litres of the material was processed, giving a rather large assemblage of beetles and bugs (rapid-scan recording; N approximately 131, S = 81), together with 'several' *Sialis* larvae and Hymenoptera-Parasitica and a few other remains. Recording was very rapid, and some taxa may have been miscounted or overlooked; the main statistics remain a useful general guide to the nature of the assemblage, since it was a very characteristic one. Diversity was high (α estimated at 90, SE = 15), the outdoor component very large (% N OB = 72), the aquatic component also very large (% N W = 44), the waterside group quite well represented (% N D = 10) and decomposers exceptionally rare (% N RT = 8). Aquatics dominated the upper ranks of abundance; there were 21 *Oulimnius* sp. (probably *O. tuberculatus*), five each of *Anacaena* sp. and *Hydraena* sp. and smaller numbers of some other species. Most of the terrestrial forms were species likely to have lived among litter and vegetation near water. The few truly terrestrial forms may simply have been 'background fauna'.

This appears to have originated as a naturally-accumulated sediment, undoubtedly waterlain, presumably redeposited on the mound.

Context 235 - clay below hearth 51 [What was burnt in this hearth?]

'Brown organic silt with blue-grey inclusions, large amounts of plant macrofossils, charcoal and wood.' (No flot size recorded.)

A subsample of 5 litres was processed, giving a large assemblage of beetles and bugs (rapid-scan recorded: N approximately 202, S = 101), and an assortment of other remains including 'many' mites and 'several' Nematocera larvae. Recording was carried out very rapidly, and the main statistics must be treated with caution. There is, however, no doubt as to the nature of the assemblage. Diversity was high (α approximately 80,

SE = 10), the outdoor component very large (% N OB = 61), the diversity of this component rather low (α about 35, SE = 5), and aquatics were abundant (% N W = 36). Decomposers were poorly represented (% N RT = 17). The more abundant taxa were *Oulimnius* sp. (16 individuals), *Hydraena* sp. (12), a *Helophorus* species (11), *Lesteva heeri* (10) and *Anacaena* sp. (7). Most of the terrestrial species would have found habitats by water, quite possibly on the crannog if it was abandoned. There was a small group of taxa which would be regarded as indicators of cut vegetation in a more synanthropic assemblage; they may well have found hosts on the upper parts of the crannog or have been 'background fauna'.

This material was thus clearly redeposited waterlain sediment or a flood deposit.

Context 50 - Fill over stone-built hearth 51 [Characterise hearth debris.]

'Brown organic soil with little clay and some sand. Wood macrofossils (birch?) and charred/burnt bone were present.' 'A moderately sized flot.'

The processed subsample was of 4 litres. Insect remains were abundant; the assemblage was assessment-recorded. There were numerous aquatics, including 'many' *Oulimnius* sp. (probably *O. tuberculatus*, see note above). This assemblage was, subjectively, identical to some others in this group which were dominated by aquatics, with donaciines, hydrophilids and *Microvelia* sp. Terrestrial forms included *Apion* and *Sitona* species and a few decomposers. The implications of the aquatics are considered further in the discussion section (below).

Although its inclusions clearly suggest that this was a hearth deposit, these insects are most unlikely to have survived its use. They may have been deposited by floodwater, or in material dredged up from aquatic sediments.

Context 233 - Fill of stone built hearth 51 [What was burnt in this hearth?]

'Brown organic silt, with blue-grey inclusions, large amounts of plant macrofossils, charcoal and wood.' (No record of flot size.)

Abundant insects were recovered. There were 117 adult individuals of 105 of the taxa used in calculating main statistics. In addition to these there were 'many' insect larvae, 'several' beetle larvae and mites, a human flea (*Pulex irritans*), a human louse (*Pediculus humanus*) two *Damalinia ?bovis* and a nymph of the large shield bug *Pentatoma rufipes*. *D. bovis* is associated with cattle; the identification is unfortunately not completely certain.

The beetle and bug assemblage consisted predominantly of 'outdoor' forms (%N OB = 62) and its overall diversity was high (α = 108, SE = 15); the outdoor component was, however, of much lower (mathematical) diversity (αOB = 57, SE = 10), suggesting that it included an autochthonous component. This is supported by the large aquatic and damp-ground/marginal components (%NW = 36, %ND = 10), and by the species list. Curiously, however, these aquatics were supplemented by nine *Monotoma picipes*, a beetle typical of mouldering plant debris, typically deposited by human activity. A few other insects may have had a similar origin to *M. picipes*, although there was no strong community of such species; the lice may have originated with them in a structure.

The aquatics included 23 taxa, most of them fairly typical of quiet waters with moderate to large quantities of nutrients. *Oulimnius* species are typical of flowing water, however, although there are records from clean lake margins. This appears to have been either (a) an aquatic deposit, but including a small component from human occupation and perhaps a good number of insects from natural/semi-natural terrestrial habitats which arrived as 'background fauna' or (b) an occupation deposit to which aquatic insects had been added by flooding or redeposition of waterlain

sediment. The sediment description and content of fossils do not seem compatible with the material having formed the base for a fire; if it was a hearth, any burned material must have become thoroughly diluted by subsequent deposition of organic material.

A single very characteristic *Cercyon* sp. elytron from this sample appears to be *C. littoralis*, generally restricted to the marine strandline, usually in rotting seaweed (Backlund 1945, 201; Hansen 1987, 62-3). Its presence cannot readily be explained; it may have arrived on the wing or in imported material. The latter might have been seaweed used for enriching agricultural land or even as animal feed or in the gut of a best which had grazed on saltmarsh vegetation.

Context 53 - Clay floor abutting hearth [What was this floor layer composed of?]

'Sandy and silty minerogenic soil.' 'A small flot.'

A subsample of 0.75 litres was processed. There were less than ten beetle species, all of which have been recorded elsewhere at this site. It would be foolish even to speculate on the implications of such a group.

Context 55 - Clay floor abutting hearth [What was this floor layer composed of? Can any activities be identified?]

'Active soil with live worms present. Moderate brown silty deposit with wood (<25 mm), some stones (>300 mm), and bone fragments.' (No flot size recorded.)

Two litres of sample material was processed, and the insect remains scan recorded. There were 'several' mites. Preservation was good, and 78 individuals of 48 beetle and bug taxa were found. Diversity was moderate (α = 53, SE = 11). A quarter of the assemblage was contributed by 'outdoor' forms (%N OB = 24). Coded decomposers were not abundant (%N RT = 41), but this component was of very low diversity (α RT = 5, SE = 1). The most abundant taxa were *Megasternum obscurum* (12 individuals), *Micropeplus staphylinoides* (6) and *Xantholinus ?linearis* and a small *Philonthus* or *Gabrius* sp. (4 each). Apart from *Acrotrichis* sp. (3), all the remaining taxa were represented by only one or two individuals.

It appears likely that this assemblage accumulated in slightly moist plant litter; it could be an entirely 'natural' group from such a habitat, supplemented by insects entering for shelter, together, perhaps, with some 'background fauna'. Alternatively it may represent occupation litter formed at a time when the familiar fauna of such material was unavailable for colonisation - at the inception of a new phase of occupation, for example (but see related context 233). No synanthropes were recorded. If the site *was* occupied, it is just conceivable that the fauna indicates hay-like cut vegetation; there were single individuals of three *Apion* species.

Context 56 - Twig litter in floor associated with hearth [Characterise deposits.]

'A detrital peat.' (No flot size recorded.)

A small group of in remains was recovered from the 6 litre subsample processed; it was scan recorded. Only 17 beetle and bug taxa were present, with 25 individuals. There was a strong (subjective) similarity between the assemblages from this sample and from sample 5. The present material may also have formed in natural plant litter or have originated in hay-like decaying matter deposited by human beings.

Context 238 - Plant litter in floor associated with hearth [Characterise the deposit.]

'Grey-brown organic clay silt with some bone fragments and small pebbles (9 cm^3 by volume).' (No flot size recorded.)

Four litres of sample material was processed. It gave a quite large group of insects, with a strong aquatic and

waterside component. There were 'several' *Hydraena* sp., *Oulimnius* sp., *Helophorus* sp. and *Lesteva heeri*, the first three being aquatics, the last living at the edge of water. Much of the rest of the fauna would have lived with these, but there were a few terrestrial decomposers including four *Lathridius minutus* group.

This assemblage had a strong subjective resemblance to several others from the site regarded as having accumulated in water with some input of terrestrial forms. It may thus have been a flood deposit, or a redeposited aquatic sediment.

Context 239 - Clay spread in floor associated with hearth [Characterise the deposit. Was it a floor surface?]

'Medium brown peat containing live worms. A small flot.'

A 1.5 litre subsample was processed; it gave only a single insect fragment (c.f. Dinnin 1993, who recorded two!).

Group 10 - Early inhabitation to south east.

Context 223 - Underlying hearth 32 [Characterise the deposit. Was it a floor surface?]

'This silty sample contained wood and very fragmented bone material.' (No flot size recorded.)

A subsample of 6 litres was processed and the small assemblage of beetles recovered was scan recorded (N = 28, S = 13). Apart from these, invertebrate remains were very rare. Whole assemblage diversity was low (α = 10, SE = 3), decomposers numerous (over two-thirds of the assemblage), and the diversity of the decomposer component very low (αRT = 2, SE = 1).

The first four ranks included the same species as sample 215: *Oxytelus sculptus*, *Cercyon analis*, *Monotoma picipes* and *Carpelimus ?bilineatus*. Many of the remaining insects may have co-existed with these, while the two aquatics were perhaps strays or background fauna.

This was quite probably a floor surface with somewhat damp, slightly foul, litter.

Context 46 - Fill of hearth 32, 1680 $\pm$ 50 BP (GU 3004) [What was burnt in this hearth?]

'Brown sandy soil with stones, much bone (fragments and powder) and burnt hazel nuts.' 'A small flot.'

Four litres processed, giving five beetle taxa preserved by 'waterlogging' (and thus unlikely to be contemporaneous with the use of the hearth) and a single charred *?Oulema* sp., as likely to have strayed into the hearth and consequently been burned as to have been introduced with fuel.

Context 47 - Fill of hearth 32 [Characterise hearth debris.]

'The peat sample contained wood, hazel nuts, charcoal and bone fragments.' (No flot size was recorded.)

The 6 litre subsample contained a small group of insects, including two *Monotoma* sp. (probably *picipes*) and a few other decomposers, and some natural habitats species. They give little information, but are of course unlikely to have been contemporaneous with the use of the hearth. The remains were a little more fragmentary than usual at this site.

Context 60 - Clay floor abutting hearth [What was this floor layer composed of? Can any activities be identified?]

'Dark brown mineral soil, with much gravel and fragmented bone, some stones and charcoal.' (No flot size recorded.)

Five litres processed; less than ten individuals of Coleoptera were present.

Context 48 - Clay floor abutting hearth; over context 60 [What was floor layer composed of? Can any activities be identified?]

(No sediment description or flot size recorded.)

The material was scan recorded. The 6 litre subsample gave 114 individuals of 63 taxa of adult beetles and bugs. There were also single larvae of the click beetles *Ctenicera cuprea* and *?Prosternon tessellatum* (see above) and a few other invertebrate remains including 'several' ants *?Myrmica* sp. During recording a systematic lack of parts of the paederine and staphylinine Staphylinidae other than heads was noted, probably a result of oversight during sorting.

This assemblage was not easy to interpret. 'Outdoor' forms, including phytophages, were fairly important (%N OB = 26; %N P = 13). There were no aquatics. The outdoor component was of a very high diversity (although the estimate of α at 195 has a very high SE, 133, the presence of 28 taxa in the 30 'outdoor' individuals provides adequate evidence of high diversity in itself, and hence points to random or very mixed origins for this component).

Half of the assemblage was accounted for by decomposers, and this component was of low diversity (α RT = 8, SE = 2). Including some uncoded probable decomposers would raise the proportion of species associated with decaying matter of some kind to about 70%. The decomposers included some, such as *Monotoma picipes* (five individuals), *Rugilus orbiculatus* (4) and *Oxytelus sculptus* (3), which might be found together on mouldering plant debris such as old hay or stable manure.

Two interpretations of this assemblage might reasonably be suggested: (1) that it is the fauna of semi-natural debris, invading plants and open ground on the platform and (2) that it represents a variant on the 'hay' or 'stable manure' fauna observed at a number of other archaeological sites (e.g. Hall and Kenward 1990, 400-4).

The second hypothesis is supported, perhaps, by the presence of several species (including most of the plant feeders) which might have been imported in cut, hay-like vegetation. Indeed, the list of phytophages fairly closely matches those suggested to be indicators of 'hay' by Hall and Kenward (1990). Almost all of the taxa in the assemblage were compatible with either model - denizens of an abandoned platform or autochthonous decomposers together with fringe dwellers which strayed into the intensively occupied area - but subjectively the latter appears more likely.

Context 52 - Peat layer co-extensive with 60 [Is this redeposited peat? Did it form on a floor surface?]

'Sandy relatively inorganic soil, with crumby texture. Live worms evident.' 'A small flot.'

A 6 litre subsample was processed; the insect remains were semi-quantitatively rapid-scan recorded. There were larvae of the click beetles *Melanotus erythropus*, *Athous haemorrhoidalis* and *Actenicerus sjaelandicus*, and about 54 adult individuals of 28 beetle and bug taxa.

Diversity was low (α estimated at 24, SE = 6), and decomposers abundant (three-fifths of the assemblage). The decomposer component was of low diversity (α estimated at 5, SE = 1), and the fauna was dominated by *Cercyon analis* ('many') and *Megasternum obscurum* ('several'). Some of the other decomposers may have co-existed with these, perhaps in 'compost-like' decomposing plant matter, although they may have exploited a rather more foul habitat. There was a total of five individuals of four *Aphodius* dung beetles, possibly of background origin but perhaps indicative of the presence of dung at or near the point of deposition.

'Outdoor' forms accounted for almost a third of this group, but offered no evidence for the layer having been redeposited

natural peat; instead, this layer seems more likely to have formed *in situ*, as a result of human activity. Whether it formed out-of-doors (as suggested by the outdoor component) or indoors ('outdoor' insects having been imported) is hard to judge; subjectively the former seems likely.

Context 213 - Redeposited peat extending westward from hearth [Characterise the deposit. Was it a floor surface?]

'Detrital organic material.' 'A relatively large flot.'

Only a rather limited group of arthropods was recovered from the 1.5 litre subsample processed; there were 50 individuals of 24 beetle taxa and a single mite (scan recording). There was, however, a strong hint from the fauna that the deposit included rather foul decaying matter. There were nine *Oxytelus sculptus* (rank 1) and eight *Carpelimus bilineatus* (rank 2), together with five *Cercyon analis*. The eurytopic *Xantholinus ?linearis* (six) may have lived with them. The diversity of the RT component was very low (α = 2, SE = 1) and it seems likely that it was autochthonous. Much of the remaining fauna may have exploited aspects of the same habitat, the remainder being strays.

This was probably a rather unclean occupation surface, but there was no 'house fauna' community or other evidence of the nature its usage.

Smaller dumps and litter deposits

Context 71 - Wood chips and twigs [What was the source of this dumped material?]

(No sediment description.) 'A medium sized flot.'

The processed subsample was of 5.5 litres; it produced a modest group of beetles (N = 61, S = 35; scan recording). Other remains were rare (or had not been picked out), although a single *Ctenicera ?cuprea* larva was present. Preservation was quite good.

Diversity was fairly low (α = 34, SE = 8), and the outdoor component proportionally small (about one sixth of the individuals), but both of these values were substantially affected by the presence of 13 individuals of the eurytopic decomposer *Cercyon analis*. Apart from this, all taxa were recorded as one or two individuals apart from a *Stenus* species and a *Neobisnius* species (both with four). There were weak hints of the presence of a synanthropic component in the form of two individuals each of *Xylodromus concinnus*, *Oxytelus sculptus* and *Lathridius minutus* group. This assemblage may have been a mixture of decomposers exploiting natural litter (or sheltering in it) and 'background fauna', but an origin in the debris of human occupation (or the keeping of stock) is equally possible.

Context 207 - Peat and twigs [Characterise the deposit. Was it a floor surface?]

'Dark brown to black humic material with much wood, a little bone and charcoal and some hazel nuts.' (No flot size record.)

The moderately large insect assemblage recovered from a four litre subsample included a distinctive component of decomposer beetles repeatedly found in archaeological deposits. In addition to the beetles and bugs used in the calculation of the main statistics there were 'many' mites and 'several' Hymenoptera Parasitica, *?Myrmica* sp. and beetle larvae with a few other arthropods. A larva of the click beetle *Actenicera sjaelandicus* was identified.

There was a (proportionally) fairly substantial outdoor component (%N OB = 24), some of it contributed by species characteristic of litter in natural habitats (*Ochthephilum fracticorne* and *Olophrum* sp., for example). Aquatic and waterside taxa were at frequencies likely to result from the presence of strays at a site surrounded by water, but the terrestrial outdoor species included some which might have been imported in cut grassy vegetation.

The presence of hay or stable-manure like plant debris is strongly supported by the decomposers. There were 20 individuals at least of *Carpelimus bilineatus*, eleven *Monotoma picipes* and three each of *Acrotrichis* sp. and *Oxytelus sculptus*. These form part of a group of taxa regarded as typical of stable manure in Roman deposits (e. g. Hall and Kenward 1990)). The limited range of species assignable to this community present in this deposit is perhaps not surprising bearing in mind the isolated nature of the site. This is discussed more fully below. Most of the remaining decomposer and uncoded species might have exploited variants of the same habitat.

This appears very likely to have been a floor or other occupation surface with abundant plant litter, probably somewhat like stable manure or moist hay.

Context 215 - Wood chips and twigs [Characterise the deposit. Was it a floor surface?]

'Wood fragments, charcoal, seeds and hazel nuts were evident in the sample.' (No flot size recorded.)

The material was scan recorded; 6 litres had been processed. Only 13 species of beetles were recovered but a distinctive community suggesting rather foul decaying matter (perhaps like old hay or stable manure) was present. This was undoubtedly a breeding group; whole assemblage and decomposer diversity were very low ($\alpha = 6$, SE = 1; $\alpha RT = 3$, SE = 1), 85% of the individuals were coded decomposers and 'outdoor' forms were rare (%N OB = 7). The more abundant species were *Oxytelus sculptus* (13 individuals), *Carpelimus bilineatus* (9), *Monotoma picipes* (8) and *Cercyon analis* (5).

It appears quite probable that this was a floor surface on which lay somewhat foul litter; as in other deposits from Buiston, the range of synanthropic decomposers was limited (something which is emphasised here by the very low value for αRT).

Context 224 - Mixed dump of moss, peat and twigs [Characterise the deposit. Was it a floor surface?]

'Woody peat.' (No flot size record.)

Insects from the 3.5 litre subsample were scan recorded. There were only 39 individuals of 24 beetle taxa, and other remains were rare. The upper ranks included the four taxa characteristic of foul, mouldering organic matter noted for samples 215 and 223, although in smaller numbers. Although diversity was higher, there is little doubt that this layer formed in the presence of much the same sort of decaying matter as the layers giving those samples; it was in all probability a rather mucky floor surface.

Context 226 - Peat [Characterise the deposit. Was it a floor surface?]

'This sample resembled modern soil and contained live worms. Field drain fragments and the presence of modern plant roots suggest that this sample may contain modern contaminants; the varying states of preservation displayed in the assemblage confirmed this suspicion.' (No flot size record.)

A subsample of 2 litres was processed. The material was scan recorded; 23 individuals of 19 beetle and bug taxa were found, together with a few fly puparia and a single larva of the click beetle *Ctenicera pectinicornis*. The main statistics for this assemblage were of limited value in view of its small size, although decomposers were rather well represented (well over half of the individuals). The species list included no species with more than two individuals. This group resembled a random extract from some of the decomposer-dominated assemblages from Buiston. None of the remains were recorded as appearing clearly to be modern.

Context 227 - Mixed dump of moss, peat and twigs [Characterise the deposit. Was it a floor surface?]

'Detrital peat with much wood and some hazel nuts.' (No flot size recorded.)

A large assemblage of insects was recovered from the 6 litre subsample. It was scan recorded. There were 'many' *?Myrmica* sp., 'several' beetle and fly larvae, and a few other remains including a probable human louse *Pediculus humanus*, two *?Damalinia* sp. (lice of large vertebrates), a flea, and larvae of the click beetles *Actenicerus sjaelandicus* and *Ctenicera cuprea*.

There were 218 individuals of 42 taxa of the beetles and bugs used in calculating assemblage main statistics. Diversity was thus low (α = 16, SE = 2). Outdoor forms were well represented (24 individuals of 15 taxa), but proportionally not very important (%N OB = 11). Decomposers were abundant (%N RT = 80) and of low diversity (αRT = 4, SE = 1). This assemblage shared in highly developed form the characteristics seen in samples 48, 207, 215 and 223. There were 65 *Oxytelus sculptus*, 51 *Carpelimus bilineatus*, 31 *Cercyon analis* and 11 *Monotoma picipes*. Many of the other species recorded may have lived in the same habitat complex as these; somewhat foul, mouldering, probably open-textured decaying matter, perhaps locally dung-like or even containing herbivore faeces. The abundant house-flies (*Musca domestica*) recorded by Skidmore (1992) strongly support this interpretation.

The presence of ten *Conomelus anceps*, a froghopper associated with *Juncus* spp. (rushes) (Le Quesne 1960, 38) is notable. Other insects in this sample likely to have occurred in similar places to *C. anceps* included *Cicadella viridis*, *Erichsonius cinerascens* and *Notaris acridulus*. These may have lived on and below vegetation which grew on the platform (and perhaps contributed to the litter exploited by the decomposers), but it seems much more likely that they were imported with cut 'hay' used as flooring, roofing or animal bedding.

Although there were no strongly synanthropic beetles, the ?human louse suggests a human presence, and the abundance and composition of the decomposer component suggests an artificial habitat. This was thus presumably an occupation surface, and indeed probably a floor.

Phase III summary

The substantial number of insect assemblages from Phase III deposits can be divided broadly into those with a large component of aquatic insects (for example Sample 108 in Group 6, and most of those from Group 9), and those with a significant decomposer fauna, generally including a community suggestive of occupation surfaces strewn with plant debris resembling mouldering straw or perhaps even stable manure.

It is not clear whether the aquatics were introduced in sediments used to raise the platform, were mixed into material of terrestrial origin as the latter were dumped into water, or were laid down during episodes of flooding. It is possible that all three mechanisms operated, some of the layers with a larger component of mineral particles being redeposited sediments, the litter-rich ones perhaps being mixed 'silt' and dumped litter, and those overlying hearths including material laid down during flooding.

The decomposers gave strong evidence for some of the layers having been formed as a result of occupation. Groups 6 and 8 each gave one assemblage with weak hints of occupation litter, but there were strong communities suggesting rather foul plant litter deposited by human activity (forming on house floors or where animals were penned) in some of the deposits of Groups 9 and 10.

There was a contrast between the insect evidence for Group 10 (for human activity) and the plant remains (more-or-less natural, non-economic taxa), which may perhaps be explained by the plants' having been cut for animal feed, or grazed direct, from semi-natural habitats.

Phase IV - Occupation in the north-west.

Group 11 - Dumping

Stratigraphy: above - 89/67//74..62/65/64 - below.

Context 64/65 - Clay [What was the source of this dumped material?]

'Pale brown sandy soil, with high inorganic content.' (No flot size record.)

The processed subsample was of 5 litres. Only five beetle taxa were noted, and these were of no interpretative value.

Context 62 - Clay [What was the source of this dumped material?]

'Poorly sorted sand, clay and silt and some pebbles. Small amount of bone, but very little organic matter.' (No flot size recorded.)

Seven litres of this sample produced only traces of insect cuticle. The lithology of this sample suggests that it consisted largely of redeposited waterlain mineral sediment.

Context 74 -Mixed materials [What was the source of this dumped material?]

(No sediment description or flot size record.)

A 3 litre subsample gave about ten beetle taxa, all typical of the present site but giving no clues as to the origin of the layer.

Context 67 - Peat [What was the source of this dumped material?]

(No sediment description or flot size record.) 'Live worms in sample material.'

The processed sample of 5 litres gave only a single insect fossil.

Context 89 - Spread of clay/sand [What was the source of this dumped material?]

'Sandy brown soil with clay inclusions and some wood remains. Live earthworms present (active soil?).' (No flot size record.)

Only a small group of insects was obtained; 6 litres of material had been processed, and the arthropods were rapid-scan recorded. Preservation was rather poor, but there was no evidence of complete loss of fossils - rather, input appears to have been low. This may have been essentially 'background fauna'; no taxon was represented by more than two individuals and both diversity and the proportion of outdoor individuals were high, while less than a third of the assemblage was contributed by decomposers. The sediment almost certainly had a terrestrial origin, but little more can be said of it.

Group 15 - first hearth

Context 351 - Spread of hearth debris adjacent to hearth 409 [Characterise the deposit. Is there any evidence of food processing or other activities?]

'Dark brown peat containing many carbonized seeds.' 'A medium flot.'

A subsample of 1.3 litres was used. About twelve beetle taxa were recovered. They were ecologically mixed, with two *Anotylus rugosus* and single specimens of the remainder. Of no interpretative significance, this group might represent a random subsample from some of the larger, ecologically-mixed, groups from Buiston. No indicators of foul conditions were recorded (c.f. Dinnin 1992c).

Context 327 - ?Ash and burnt bone [Characterise this deposit]

'Dark brown organic matter, with small amounts of stones (c. 1-2 mm).' 'A moderately sized flot.'

A very large number of insect remains were recovered from the 6 litre subsample. They were scan recorded. In addition to 449 individuals of 117 beetle and bug taxa there were assorted other remains including 'many' beetle and fly larvae, larvae of the elaterids *Actenicerus sjaelandicus* (1) and *Ctenicera cuprea* (5), lice (?*Damalinia* sp.) and mites. A single adult and a puparium of the sheep ked *Melophagus ovinus* and a human flea *Pulex irritans* were noted. There were probably several specimens of the latter, as a considerable number of thoracic segments were present.

The substantial beetle and bug assemblage was of moderate diversity (α = 51, SE = 4) and the outdoor component was also of intermediate diversity (αOB = 54, SE = 11). Decomposers were extremely abundant in absolute terms (227 individuals of 'r' coded taxa), and contributed 62% of the assemblage. RD and RF taxa were not abundant, although some of the former were notable (see below). Diversity of this decomposer component was fairly low (αRT = 10, SE = 1) and the numbers of individuals were high in several cases; there can be no doubt that a community of breeding insects is represented.

Two species, *Carpelimus bilineatus* (with 99 individuals) and *Cercyon analis* (with 51) were extremely abundant, but there were also 24 individuals of an aleocharine species (probably a decomposer), 17 *Cordalia obscura*, 13 *Xylodromus concinnus*, with *Xantholinus ?linearis* (10), a *Cryptophagus* species (10), a second aleocharine (9), *Atomaria nigripennis* (8), *Oxytelus sculptus* (7) and smaller numbers of a range of taxa. A 'house fauna' group was present: in addition to *X. concinnus*, *Cryptophagus* and *A. nigripennis* there were, notably, six *Lathridius minutus* group and two each of *Crataraea suturalis* and *Cryptophagus scutellatus*. Spider beetles and woodworm were notable absentees from this component (see discussion). The human flea(?s) (above) can be seen as additional confirmation that conditions resembled those in many humble structures of Roman to medieval date in Britain, Ireland, Iceland and Norway.

This component, in combination with taxa such as *O. sculptus*, *Gyrohypnus* spp. and others suggests slightly foul conditions; the presence of a considerable number of plant-feeding taxa likely to be imported in cut vegetation is thus interesting. In this category fall, in particular, the *Apion* species, *Hypera punctata*, *Sitona lepidus* and *Mecinus pyraster*, while *Conomelus anceps* may also have been brought with cut vegetation; the weevils indicate clovers and their relatives, *M. pyraster* plantains. and *C. anceps*, *Juncus* spp. Many of the other 'outdoor' taxa may have had a similar origin; the chafer *Phyllopertha horticola* has repeatedly been found in suspected 'hay' or 'stable manure' groups at other sites; it is discussed in this context by Kenward *et al.* (1992).

The record of *Melasis buprestoides* is of note.

This seems to have been an occupation surface, used by humans and perhaps also by stock.

Group 16 - second hearth

Stratigraphy: Above - 12/20=235/326/327 - below.

Context 20 - Clay floor around hearth [What activities took place on this floor?]

'Dry mineral soil with much gravel. Small amounts of wood, charcoal and bone present.' 'A relatively small flot.'

A modest group of beetles and bugs (N estimated at 40, S = 26) was rapid-scan researched from the 7 litre subsample processed. There were very few other invertebrates. Preservation was rather poor and many fossils had been etched patchily rather than being uniformly pale. Subjectively the assemblage resembled a random subset from a fauna like that represented by the material from Sample 12. *Carpelimus bilineatus* was the most abundant species (seven individuals), and

there were three *Cercyon analis* and *Cordalia obscura*. Main statistics, inasmuch as they may be employed for an assemblage of this size (and rapid-scan recorded) resemble those for Sample 12 very closely.

The insect remains suggest that the layer incorporated organic occupation debris, or that such material existed very close to it.

Context 326 - Peat [Characterise deposit.]

A small sample of 315 g of raw sediment was processed in the EAU.

Laboratory description - Very dark (near-black), moist, crumbly to plastic amorphous organic material with traces of coarse and fine herbaceous detritus.

Few invertebrate remains were recovered; there were 'many' mites, several *?Myrmica* sp., and a few other insects, but only single individuals of eight beetle taxa. All were typical of the present site, but the assemblage was of no interpretative value. Preservation was not very good. The material was scan recorded.

Context 325 (= 20) - Clay [Characterise this deposit]

A sample of 410 g of raw sediment was processed at the EAU.

Laboratory description - Moist, plastic, rather heterogeneous material. Mostly mid-brown slightly sandy clay, but with patches of humic ?silt on about the 5 mm scale, some small lumps of light grey silt and small amounts of fine and coarse herbaceous detritus.

A very small group of beetles and bugs was obtained (single individuals of 13 taxa; scan recording), and there were a few other remains including 'many' mites. The fauna resembled a random extract from an 'averaged' assemblage for the present site.

Context 12 - Spread of ash, part of complex around hearth [Characterise hearth debris.]

'Brown sandy soil with charred bone fragments.' (No flot size record.)

A subsample of four litres of sample material was processed, yielding a moderately large group of beetles (and a single bug; N = 159, S = 68). These were scan recorded. Other invertebrates were fairly numerous and included many mites and 'several' beetle larvae. Among the latter were single abdominal apices of *Actenicerus sjaelandicus* and *Denticollis linearis*. These are discussed below.

Although two distinct ecological groupings appeared to be represented in the species list, diversity was not very high (α = 45, SE = 6). 'Outdoor' forms were only moderately well represented (%N OB = 19), and this component was estimated to be of high diversity (α OB = 74, although with a large standard error of 35). A large proportion of the outdoor taxa seem likely to have been able to live on, or at least at the edge of, the platform. They are perhaps best regarded as having strayed into the accumulating deposit.

From the insects there is no evidence of flooding. Aquatics were (for the present site) not numerous (%N W = 4, seven individuals), and among them only *Chaetarthria seminulum*, of which there were two, was represented by more than a single individual. There were also small numbers of some obligate or facultative waterside taxa.

Decomposer taxa figured large in the higher ranks of the assemblage, and coded decomposers accounted for 54% of the individuals. The most abundant decomposers were *Carpelimus bilineatus* (38 individuals, 24% of the assemblage), *Cercyon analis* (7) and *Cordalia obscura* (6). There were also four individuals of each of the following: *Acrotrichis* sp.; *Anotylus rugosus*; *Oxytelus sculptus*; and *Lathridius minutus* group. Two Aleocharinae species in the upper ranks were also quite possibly decomposers.

Diversity of the RT group was low (α RT = 8, SE = 1). This together with the likelihood that much of the fauna forms a plausible community, leaves little doubt that a substantial quantity of slightly moist, slightly foul, decomposing plant remains was present at, or very close to, the point of deposition. This material was doubtless deposited by human activity. 'House fauna' taxa were only very weakly represented, however.

If this was a hearth deposit, it is plain that either material other than ash contributed to it, or large numbers of insects migrated into it; the insect remains could not have survived in such good condition if fires had been burned on the layer after they entered.

Context 339 - Fill of hearth 340 [What was burnt in this hearth?]

'Pale brown stony mineral deposit with low organic content. Small bone fragments and ash were present.' (No flot size record.)

A 1.5 litre subsample gave a small group of insects, mostly decomposers but with a *Bembidion* species and *Trechus ?micros*. There were abundant *Carpelimus bilineatus*, perhaps suggesting that the fauna had an affinity with that of some of the other contexts placed in this group.

These were presumably insects which became incorporated into the hearth deposit after in fell out of use.

Group 17 - associated with uppermost hearth

Context 6 - Uppermost hearth fill [What was burnt in this hearth?]

'Silty grey-brown peat with ash, charcoal and stones (<12 mm)'. 'A small flot.'

The 3 litre subsample produced about ten beetle taxa, all decomposers; preservation was not very good. Apart from three *Carpelimus bilineatus*, all were single individuals. These insects were presumably denizens of the floor in which the hearth was set, or invaded the deposit in disuse.

Context 19 - Ash debris near hearth [Characterise hearth debris.]

'Brown mixed mineral and organic deposit, with some small bone fragments, carbonized seeds, wood and hazel nuts.' 'A small flot.'

Insect remains were not abundant, and were poorly preserved; they were rapid-scan recorded. Only 18 beetle taxa were recorded, with an estimated 27 individuals. Remains do not seem to have rotted away, so input was presumably low, not surprising in a hearth area, but presenting a contrast with some of the deposits in Group 15. There was in addition a fragment of the weevil *Notaris acridulus*, apparently modern.

This assemblage was too small for much reliance to be placed on the main statistics. Over half of it was accounted for by decomposer taxa, with seven individuals of *Carpelimus ?bilineatus*, three *Megasternum obscurum*, two *Cercyon analis*, and single individuals of the remaining taxa. The fauna thus resembled a random extract from that of some of the other samples from Buiston, and probably mostly represents invaders of litter deposited by human activity.

Presumably these insects entered the debris after it had been raked from the hearth; the presence of organic matter in the deposit suggests that occupation debris became mixed into it.

Stratigraphy: Above - 312/341..316 - below.

Context 312 - Thin compacted spread of straw [What was this floor layer composed of? Can any activities be identified?]

'Dark brown organic material.' (No flot size record.)

This sample, of which 8 litres was processed, gave a large assemblage of beetles and bugs (N = 330, S = 82), together with various other invertebrates. The latter included a flea, 'many' *?Myrmica* sp. and mites, and larvae of *Athous haemorrhoidalis* (1), *Actenicerus sjaelandicus* (6) and *Ctenicera ?cuprea* (2). The *Melophagus ovinus* (adults or puparia not specified) recorded by Dinnin (1992b) were not found in the material sent to York.

Diversity was quite low (α = 35, SE = 3), the 'outdoor' component proportionally, though not absolutely, small (%N OB = 14, 47 individuals). The beetles included a striking community of what, in the context of sites in York, Carlisle and Northern Ireland, has been called 'house fauna' (see discussion). This contributed to a substantial decomposer component which included an appreciable proportion of 'dry' decomposers (ie. those typically exploiting *relatively* dry, generally open-textured, plant remains) (%N RD = 10). This 'house fauna' component included *Cryptophagus scutellatus* (10 individuals), *Xylodromus concinnus* (7), *Crataraea suturalis* (also 7), and *Anobium ?punctatum* (1). These, together indeed with almost all of the decomposer and uncoded taxa, might be found together in a sample from a house in Viking Coppergate, York (Kenward and Hall, forthcoming, Hall and Kenward, forthcoming), Early Christian Northern Ireland (Allison and Kenward, in press b) or Roman York or Carlisle (e.g. Hall and Kenward 1990).

Subjectively the outdoor component included possible 'cut vegetation' taxa, but these may have been strays, perhaps even having lived on the site.

This was clearly an occupation deposit incorporating rather foul mouldering litter, with a very typical fauna of the less salubrious type of house floor, or of stables and byres.

Material which appeared to be the residue from paraffin floatation of this sample was re-processed in the EAU but there was not time to make a detailed examination.

Context 316 Extensive layer of brush, under 312 [Characterise this deposit.]

'A woody peat.' (No flot size recorded.)

The material recovered from a 5 litre subsample was scan recorded. There were 99 individuals of 37 beetle taxa, and other invertebrates were rare. There was a single, whole, aleocharine staphylinid, clearly a modern contaminant, but there is no reason to doubt the antiquity of the remaining fauna.

Diversity of the whole beetle assemblage was quite low (α = 22, SE = 3), as was that of the decomposer component (αRT = 6, SE = 1). Outdoor forms were poorly represented (single individuals of eight taxa). The decomposers accounted for 73% of the individuals, and the RD component was strikingly large (%N RD = 26). Much the most abundant taxon was a *Cryptophagus* species (22 individuals), followed by *Carpelimus bilineatus* (14), *Xylodromus concinnus* (7), *Cercyon analis* (6) and *Crataraea suturalis* (5). Some of these taxa suggest the presence of a 'house fauna' community, and this is supported by the record of two *Cryptophagus scutellatus*.

This was probably the fauna of rather sweet, perhaps mouldering, decaying plant remains. Some of the other taxa may have co-existed with the listed species, of which there was also a small probable 'background' component - some or all perhaps strays from elsewhere on the crannog or from its margins.

Context 341 - Mixed layer of wood chips and twigs [Characterise the deposit. What was its source?]

'Dark brown peat with much wood (large amounts of which have never been cut), hazel nuts and some charcoal. Small amounts of quartz grains, sandstone and fine gravel were present.' 'The flot was large.'

There were abundant insects, and some mites and earthworm capsules, in the 6

litre subsample processed. Records included 'many' beetle larvae (among which there was a single *Athous haemorrhoidalis*), a puparium of the sheep ked *Melophagus ovinus*, a louse and a flea.

A total of 216 individuals of 62 bug and beetle taxa were recorded; the assemblage was of fairly low diversity (α = 29, SE = 3) and included only a rather small proportion of 'outdoor' forms (%N OB = 9, 19 individuals). Decomposers predominated (%N RT = 69), and an RD component was clearly present (%N RD = 10). Decomposer diversity was fairly low (αRT = 10, SE = 1) and this, together with the abundance of decomposers (and probable uncoded decomposers) in the upper ranks point clearly to a strong autochthonous community. As with sample 327 this decomposer group would not be thought out of place had it been recovered from a house floor of Anglo-Scandinavian date in York. The most abundant species was *Carpelimus bilineatus* (51 individuals), with 21 *Cercyon analis* and 14 each of *Neobisnius* sp. and *Cordalia obscura*. (The last of these is, however, rarely so abundant in urban archaeological assemblages so far analysed, see discussion). Other species in the higher ranks were a Euplectini sp. (9), *Acrotrichis* sp., *Crataraea suturalis* and *Cryptophagus scutellatus* (all seven), *Xylodromus concinnus*, *Cryptophagus* sp. and *Atomaria* sp. (all 5).

There were some hints (only) of a 'cut vegetation' component - from *Berytinus* sp., for example, but all of the 'outdoor' taxa might have found habitat on the crannog or have originated as background fauna.

This was almost certainly litter which accumulated on an occupation surface.

Phase IV summary

The small number of deposits of Group 11 examined each contained only a few insects. The samples thus gave little direct information as to the source of the sediments, except in as much as the lithology and low content of fossils are consistent with an origin as natural sediments, perhaps terrestrial (although doubtless originally glacial or postglacial drift or waterlain deposits). The remaining Phase IV deposits included several which contained quite, or very, large insect assemblages indicative of human occupation. Some contained a clear 'house fauna' component (see discussion). There were hints of the presence of cut, hay-like, vegetation. One deposit gave a substantial decomposer group deficient in 'house fauna', but still probably indicative of a litter-strewn occupation surface.

Phase V - Consolidation.

Group 19 - Dumps within buttressing in the north-west quadrant of the crannog

Stratigraphy: Above - 41/39..5/308/309 - below.

Context 309 - Reeds [What was the source of this dumped material?]

'The sample contained relatively large pieces of wood.' (No other description.) 'A large flot.'

The subsample of 8 litres processed gave only a small assemblage of insect remains and a few mites; the material was rapid-scan recorded. About 36 adult beetles and bugs were present, representing 27 taxa. Decomposers were dominant, with 'outdoor' forms weakly represented. There were four *Xylodromus concinnus* and three *Cercyon analis*, with all the remaining taxa represented by only one or two individuals. The position of *X. concinnus* at rank 1, combined with the records of *Lyctocoris campestris*, *Crataraea suturalis*, *Cryptophagus* and three *Atomaria* species, and *Lathridius minutus* group, suggest the presence of a community from fairly dry mouldering plant remains. This dump was probably redeposited from in or around a structure.

Context 39 - Compressed reeds or straw [What is the layer? Is there a human influence?]

'The unhumified peat contained no charcoal or wood.' (No flot size recorded.)

Eight litres processed; about ten beetle taxa recovered, all typical of the Buiston Crannog site. Interpretation of this group would clearly be unwise.

Mixed dumps of peat, moss, reeds and straw

Context 5 [Clean redeposited peat or a floor surface?]

(No sediment description.) 'A very large flot.'

The 6 litre sub-sample produced a small group of arthropods, including about 34 individuals of 22 beetle taxa (rapid-scan recording). Preservation was fairly good. Main statistics of such a small assemblage can only be taken as a very approximate guide to the nature of the fauna available at the time of deposition, but diversity was estimated to be low mathematically (α = 27, SE = 9). Ecologically the group was diverse, however; subjectively it included some species likely to occur together in moist (natural *or* human-deposited) litter.

The fauna does not give a clear answer to the question posed, but if this was redeposited peat at least a few insects probably entered it where it was found.

Material believed to represent the flot from this sample was re-examined in the EAU. It was necessary to re-process it to reduce its bulk and remove fine particles presumably resulting from decay in storage. Appreciable numbers of insect remains were present, although probably not sufficient to have an important effect on calculated statistics. There was not time to record the material fully.

Context 41 - Dark fibrous roots; redeposited turf, to 20 cm thick, extent about two square metres [What is the layer? Is there a human influence?]

'Peat, rich in moss, containing hazel nuts and small bone fragments.' 'A large flot (250 ml)'.

Invertebrate remains were moderately abundant in the 7 litre subsample processed. The material was scan-recorded. Preservation was rather good, although there were numerous fragmentary sclerites which were difficult to identify closely. In addition to 62 individuals of 44 beetle taxa there were many beetle larvae and ants (*?Myrmica* sp.) and a few other insects. The beetle larvae included four abdominal apices of *Actenicerus sjaelandicus*, and single apices of *Athous ?haemorrhoidalis* and *Denticollis linearis*. There was also a scutellum of characteristic shape, almost certainly *A. sjaelandicus*, and an adult *Athous ?haemorrhoidalis* to match the larval remains of these two species.

Diversity of the assemblage of adult beetles was quite high (α = 67, although SE = 18), and the 'outdoor' component fairly large (over a quarter of the individuals). Aquatics were rare (two individuals). Coded decomposers were weakly represented (%N RT = 37), and those present were taxa likely to occur in natural habitats (*Xantholinus ?linearis*, with five individuals, and *Megasternum obscurum* and *Aphodius ?prodromus*, each with three, for example). The only species regarded as a particularly characteristic synanthrope was *Xylodromus concinnus* (3) and this alone cannot stand as evidence of human occupation of the site when this deposit was formed.

Overall, it appears that this fauna represented abandonment, or at least very reduced human activity or the importation of sediment from elsewhere. There was no evidence of flooding.

Context 45 [What is the layer? Is there a human influence?]

'A detrital peat with some large wood fragments.' (No flot size recorded.)

The 5 litre subsample processed gave 118 adult beetles and bugs of the groups used in the calculation of main statistics; 80 taxa were scan recorded. Other invertebrates included 'many' Hymenoptera Parasitica, ants (?*Myrmica* sp.) and beetle larvae. This sample produced several click beetle (Elateridae) larvae: five *Actenicerus sjaelandicus*, four *Athous haemorrhoidalis* and two *Ctenicera cuprea*. These are discussed below.

Whole-assemblage diversity was estimated to be very high (α = 109, SE = 20); that of the 'outdoor' component was very high indeed (α OB = 269, although with a large standard error, SE = 183). There were a few aquatics, no more than expected as strays on a site such as this (six individuals, %NW = 5), and damp ground/water margin taxa were similarly poorly represented. Plant feeders were rather numerous (%NP = 14) and may have exploited plants *in situ* on the platform.

The decomposer component was of modest size (%N RT = 41) and included some taxa regarded as characteristic, as a community, of primitive human structures, including houses stables and byres and associated ejectamenta. There were eight *Cryptophagus* sp., two *Xylodromus concinnus* and a single specimen of *Lyctocoris campestris*, for example. Overall, however, the decomposers could equally have exploited semi-natural organic debris; there was no strong synanthrope component.

It appears that this deposit represents material deposited while there was some human influence, but there is no evidence for intensive occupation.

Context 77 [Characterise this deposit.]

'Organic fibrous humic peat.' (No flot size recorded.)

Few insects were recovered from the 1 litre subsample; the material was rapid-scan recorded. Preservation was not good. Arthropods noted included 'several' mites and a larva of *Actenicerus sjaelandicus*. The beetles (21 individuals of 18 taxa) were probably a mixture of 'background fauna' with a few invaders of litter. They offered no definite evidence of human activity, in contrast to the records of economic plants and species indicating disturbance.

Context 301 [Characterise this deposit.]

'Organic plant remains with little wood and no charcoal.' (No flot size recorded.)

The processed subsample was of 5 litres. About 10 insect taxa were noted, including decomposers, a single aquatic and a large brassy elaterid. The species present were typical of the present site, but the assemblage was of no interpretative significance otherwise.

Context 306 [What was the source of this dumped material?]

'Peat containing wood fragments.' 'A medium sized flot.'

The processed subsample was of 5 litres. Only four beetle taxa, all typical of the Buiston site, were found.

Context 308 - [What was the source of this dumped material?]

'This dark brown peat contained large quantities of wood, some with cut marks evident.' (No flot size record.)

A subsample of 4 litres was processed, the modest group of invertebrates recovered being scan recorded. There were two lice (*Damalinia* sp.), larvae of *Actenicerus sjaelandicus*, 'several' ants and mites and a small number of other remains, together with 47 individuals of 40 beetle and bug taxa. Only *Conomelus anceps* (of which there were three) was represented by more than two individuals, and clearly an

assemblage of this kind must be approached with caution. Decomposers accounted for less than a third of it, and 'outdoor' forms for two-fifths.

Much of the fauna may have exploited surfaces on the platform but, in addition to the lice, there were some rather typical synanthropes: *Xylodromus concinnus* and *Crataraea suturalis* in particular. These, if not redeposited, suggest the presence of humans (although they might occur together in birds, nests), but there is nothing to suggest prolonged intensive occupation as this layer formed.

Context 310 [What was the source of this dumped material?]

'Very dark brown fibrous peat with small pieces of cut wood.' (No flot size recorded.)

A subsample of 7.5 litres was processed. It gave a modest assemblage of insects (rapid-scan recorded). There were few other invertebrates, although 'several' ants and Hymenoptera Parasitica were noted.

The main statistics must be approached cautiously in view of the recording method. Outdoor forms were rather abundant (% N OB = 35) and this component appeared to be of low diversity (α OB = 32, SE = 12). Only *Olophrum* sp., *Aphodius ?prodromus*, and a second *Aphodius* sp. in the 'outdoor' category were represented by more than single individuals, however; there were four of each. It may thus be that this is essentially a decomposer assemblage with some background fauna and strays from adjacent habitats. There were 'several' *Cercyon analis* and *Carpelimus ?bilineatus*, with five *Anotylus rugosus* and smaller numbers of various species which might live with these more abundant ones. There were no strong synanthropes, but subjectively there were hints of a 'hay' fauna.

This may have been essentially natural material, or have represented invasion of litter deposited by human activity in the absence of intensive (or prolonged) occupation.

Context 314 [Is this redeposited peat?]

'Dark brown comminuted detrital peat with woody fragments.' (Flot size not recorded.)

Six litres processed, giving about ten beetle taxa. There were three *Cercyon analis*, suggesting that while this may have been redeposited peat, it probably incorporated other materials.

Context 342 [What was the source of this dumped material?]

'Woody peat.' (No flot size recorded.)

A 5 litre subsample gave a small group of insects. Most were typical of natural or semi-natural habitats, although several decomposers common in occupation deposits were recorded; none were strongly synanthropic. This group (subjectively) resembled several others from the Buiston site; the dumped material was probably essentially a natural deposit.

A single *Actenicerus sjaelandicus* larva was identified.

Context 402 [What was the source of this material?]

'Dark brown peat with much wood (some cut) and moss.' (No flot size recorded.)

A 3 litre subsample gave a modest group of beetles and bugs, which was rapid-scan recorded (N about 59, S = 42), although some of the identifications were pushed further than normal when using this technique. Remains other than these were rare, apart from 'several' mites; there were also larvae of the click beetles *Denticollis linearis* (1) and *Actenicerus sjaelandicus* (2).

In the context of the present site the main statistics for this assemblage were unexceptional. The most abundant taxa

were *Cercyon analis* and *Cordalia obscura* (both with six individuals); there were three *Acrotrichis* sp., but none of the other taxa were represented by more than two individuals. There thus appeared to be a small decomposer group of probable autochthonous or circumjacent origin. The 'outdoor' forms were a mixture of species likely to have found habitats on the platform, with others perhaps originating in 'background fauna' or even imported with cut vegetation.

This material seems likely to have been deposited as a result of human occupation.

Phase V summary

Deposits of Phase V (all those examined were assigned to Group 22) included some which gave insect assemblages suggesting abandonment, or at least very much reduced human activity. There were only weak hints of the presence of a 'house fauna' component.

Discussion

The quality of the record

The history of the analyses reported here introduces some minor uncertainties concerning the recording of the fossils, particularly of invertebrates other than beetles and bugs. The material picked out at the University of Sheffield included representatives of many invertebrate groups, so it was clear that sorting had generally been careful. Some samples gave almost no non-beetles, suggesting that in these cases sorting may have been more selective. Some of the assemblages included quite large numbers of only some parts of some species; this was the case with the paederine and staphylinine staphylinids in sample 48, for example, where only heads were present in the sorted material. Such a bias could conceivably occur naturally, but is much more likely to result from 'sorting blindness' of the kind mentioned by Kenward (1992).

It is possible that some other fossils were systematically left in the flots. Only a single sample from the 60 examined gave any *Daphnia* ephippia (resting eggs), for example; these might be expected to have been numerous in at least a few of the deposits. Unfortunately few of the flots were available for re-checking, which would, in view of their condition, have demanded reprocessing in any case. Check-sorting of flots is regarded as important (Kenward 1992). It must, however, be emphasised that these (possible) deficiencies are unlikely to have much effect on the main statistics for sample assemblages, and even less on the interpretations placed on them.

In general, only the larger assemblages selected as of potential archaeological value have been recorded in such a way as to allow the calculation of assemblage statistics and the incorporation of species lists into the site database. The means and distributions of the values for main statistics are thus not a fully accurate reflection of the content of fossils in *all* of the samples. Deposits with a low input of fossils are under-represented, as (less seriously) are those where preservation was particularly poor. The same bias exists for the record for most other sites examined in the past, and of course there is generally a much greater bias introduced by selection at the sampling and processing stages.

Aquatics

The aquatic component of the assemblages from Buiston requires some discussion. There can be no doubt that certain of the deposits formed in water (even if they were subsequently dug or dredged up and used in raising the crannog). Examples are two of the Phase I contexts and 233-235 in Phase III, with 36-53% aquatics in the groups used for the calculation of main statistics.

The significance of smaller aquatic components is uncertain. Aquatic insects, particularly good dispersers such as *Helophorus* and *Ochthebius* species, occur

frequently in small numbers in clearly terrestrial deposits on occupation sites, generally being assumed to have had an origin in the 'background fauna'. Presumably at Buiston the background fauna would have been rich in aquatics, and other specimens may have strayed from the banks of the island or have been introduced in trample, etc. Values of %N W less than 10 have thus been regarded as uncertain evidence of aquatic deposition, although it is not inconceivable that some of the values approaching this level may have resulted from intermixture of aquatic sediments with terrestrial litter and other material, or from deposition of insects during episodes of flooding. The analysed contexts of Phase I and three of those of Phase II (listed above) are thus probably waterlain.

The aquatics give a general guide to water quality around the mound (information from Macan 1965; Holland 1972, Friday 1988, Fowler 1891; see also Table 4). They can be divided into several groups. Some of the recorded beetles and bugs are fairly eurytopic, i.e. tolerant of a wide range of waters, although usually still or very slowly flowing; examples are *Colymbetes fuscus* and *Gerris*, *Helophorus* and *Gyrinus* species. A second group indicates rather rich waters, with emergent vegetation: *Microvelia reticulata* and *Sigara ?distincta*, and the phytophagous beetles *Donacia* spp. and *Hydronomus alismatis*. Others are typical of the muddy or vegetated edges of water: *Anacaena ?globulus*, *Chaetarthria seminulum*, *Coelostoma orbiculare* and *Ochthebius ?minimus*. Another group indicates flowing water or the active water at the edges of lakes: *?Deronectes latus*, *Oulimnius* species (the material from Buiston is probably *O. tuberculatus*), *Elmis aenea* (particularly strongly tied to flowing water) and *Stictotarsus duodecimpunctatus*. The first three groups doubtless found habitats on the fringes of the crannog and on nearby loch shores (and in the shallows between). The last group is harder to place, since there were probably no inflowing streams near to the crannog. The *Oulimnius* have been recorded in substantial numbers from too many samples for it to be likely that they were imported in silt over a great distance. It is possible that these beetles requiring moving, well-aerated water lived amongst timbers on the fringes of the crannog, where moderate wave action may have been sufficient to provide suitable conditions.

Synanthropy and the decomposer component

The synanthropic fauna of the Buiston settlement appears to have been limited by comparison with, for example English Roman (Allison *et al.* 1991a; b; Allison and Kenward, forthcoming, Kenward *et al.* 1991; Hall and Kenward 1990) and Anglo-Scandinavian towns (Hall *et al.* 1983; Kenward and Hall, forthcoming; Hall and Kenward, forthcoming). It was predicted that such an impoverished fauna would be found at the somewhat similar site of Deer Park Farms, co. Antrim, Northern Ireland, but this was not the case (Kenward and Allison, in press b); the contrast between the fauna of this site that and of Buiston is discussed below.

Synanthropic decomposer insects

The impoverished fauna of Buiston is illustrated by (a) the 'foul mouldering' group and (b) 'house fauna', and by certain aspects of the decomposer component as a whole.

Species associated with foul mouldering matter - In this group, the rarity of *Anthicus formicarius* is notable. It clearly colonised the site at least once, having been found in two contexts of Phase I. It was absent from some other assemblages where species which it often accompanies occurred, however. *Anthicus* species were well-established at Deer Park Farms.

In the same ecological group, only one *Monotoma* species has been recorded from the samples from Buiston - *M. picipes*. This is generally the most abundant species of the genus in archaeological

material from occupation sites, but is typically accompanied by other members of the genus, such as *M. longicollis*, *M. bicolor* or (more rarely) *M. spinicollis*. *M. picipes*, although sometimes quite abundant at the site, was restricted to contexts of Phase III (nine) and IV (one) (including material of '*Monotoma* sp.', probably this species). Presumably it became well-established in the earlier period, but was unable to gain a foothold later. The records of other species likely to occur with it indicate the probable availability of habitats. It is worth noting that *Oxytelus sculptus*, a very typical member of the 'foul mouldering matter' group, was also absent from Phase V layers. Thus, failure to invade might have restricted these species, or suitably specialised decomposer habitats may not have existed because human activity was relatively slight, or because stock were no longer being housed. The 'stable manure' group appeared often to occur in deposits with plants of 'pasture' or similar vegetation, possibly introduced in dung or brought as hay.

Some of the more generalised decomposer taxa typically favoured by human activity were present throughout the phases studied: *Cryptophagus* spp. other than *C. scutellatus*; *Gyrohypnus*, *Acrotrichis* and *Ptenidium* spp.; *Lathridius minutus* group, *Xylodromus concinnus* and *Cordalia obscura*, for example. Thus there is good reason to suppose that a range of decomposer habitats was available at least in Phases III, IV and V. *Carpelimus bilineatus*, one of the most abundant and frequently-occurring species at Buiston Crannog, is probably also a good indicator of artificial accumulations of organic matter. Although found in waterside litter in nature, there are good reasons for regarding it as a synanthropic decomposer typical of occupation sites, including some kinds of floor deposit, rather than primarily a waterside species (Hall et al. 1983, 212-4; Kenward and Hall, forthcoming; Kenward and Allison, in press a).

'House fauna' - The proportion of 'house fauna' taxa at Buiston was quite low (Table 2), with only more than a trace in Phases IV and V. The limited house fauna is exemplified by the fact that no *Ptinus fur* or *Tipnus unicolor* have been recorded. The first occurs with great regularity in occupation deposits, and is fairly common in nature, usually in birds' nests. Its apparent failure to colonise is thus rather surprising. *T. unicolor*, on the other hand, is probably a poor disperser, and may be a useful indicator of long-lived structures or persistent occupation. It is typical of Roman and later to post-medieval urban deposits, but was also recorded from a good number of the samples from Deer Park Farms. Other, much less surprising, 'absentees' include *Tenebrio* and *Blaps* species and the typical grain pests. The grain pests may have been absent from the British Isles as a whole at the time the occupation deposits examined in the present study were forming.

Aglenus brunneus (Gyllenhal), abundant in many urban deposits and very common at Deer Park Farms, was absent. Its powers of dispersal are probably very poor, the beetle doubtless generally having been carried to new sites by accident with stored products, animal litter, and so on, in the past.

Some of the species regarded a typical of 'house fauna' have been found, but generally in a limited range of samples. These include *Crataraea suturalis*, *Cryptophagus scutellatus*, *Atomaria nigripennis* and *Typhaea stercorea*. The comments concerning the limited nature of the decomposer component as a whole also apply to the house fauna group (most of which are decomposers).

C. suturalis has only very recently been identified with the fossils formerly recorded as 'Aleocharinae sp. X' within the EAU. It is a consistent component of archaeological 'house fauna' assemblages, and its modern ecology is wholly compatible with this (Kenward and Allison in press a). It has been recorded from Buiston from four contexts of Phase IV and one of Phase V, thus appearing to have been a late arrival at the site. *C. scutellatus* was restricted to Phases IV (four contexts)

and V (one), perhaps suggesting that it, too, only colonised in the former.

Acritus nigricornis - although not as strongly synanthropic as some of the other species discussed here, this tiny beetle is very typical of occupation deposits. Only a single individual was recorded from Buiston, however.

Atomaria nigripennis has only been recorded from one of the samples, although one or two individuals may have been overlooked in others (it is not easy to identify without good material). *Typhaea stercorea*, a rather strongly synanthropic species, was found in a single sample of Phase I date. Presumably this species, like several others, was limited in its ability to colonise and maintain persistent populations.

The decomposer component as a whole - A few decomposers which, although frequent at other occupations sites, are generally found in small numbers, were, subjectively, unusually common at Buiston. *Cordalia obscura*, *Micropeplus fulvus* and *M. staphylinoides*, in particular, stand out in this respect. *Megasternum obscurum*, *Xantholinus* species and *Othius myrmecophilus* provide other examples. It is hard to resist the speculation that they were prospering in the absence of species which normally competed with (or predated upon) them in the organic detritus created by human activity.

This hypothesis is supported by the low values for the index of diversity for the decomposer component compared with, for example, the Anglo-Scandinavian material from the urban site of 16-22 Coppergate, York. The mean value of α RT for 23 assemblages from Buiston was 9, compared with a mean of 25 for 419 assemblages from Coppergate; 62 assemblages from Deer Park Farms also gave a mean of 25. This substantial difference is probably a good indicator that there was an impoverished decomposer fauna at Buiston. Whether this resulted from difficulties of colonisation, the short duration of occupation at each phase, or the presence of a restricted range of habitats (through limited human activity or a particularly good waste disposal system), is open to discussion. A combination of all of these factors seems possible, but limited short-lived and intermittent occupation may have been the primary cause. Ease of waste disposal may sometimes have reduced habitat availability for decomposers, but this did not affect all species, while numbers of decomposer *individuals* were at time very large. In addition, cleanliness would not account for the rarity of 'house fauna' taxa, many of which would have exploited habitats inevitably present in a damp wooden building, including mounds on wood.

Two notable absentees at this site were *Anotylus complanatus* (Erichson) and *A. tetracarinatus* (Block), both frequently recorded, and sometimes very abundant, in occupation deposits. They are probably extremely effective dispersers, making their absence all the more surprising.

Overall, it appears that, while the prediction that the isolated site at Deer Park Farms would have a severely impoverished synanthropic fauna was proved wrong, Buiston Crannog provides a case where isolation did indeed cause impoverishment. The reason for this difference may be one which in archaeological terms is of considerable significance: the duration of *continuous* occupation. The settlement at Deer Park Farms may have accreted a synanthropic fauna over an extremely long period of time, perhaps even millennia. Buiston may have seen only intermittent periods of occupation of fairly short duration, the synanthropic fauna being largely eliminated between eposodes of occupation. The possibility of seasonal occupation might also be entertained. Climatic or geographical causes seem unlikely; both sites are very isolated and must suffer nearly-identical climatic regimes. Indeed, they are little more than 100 km apart, albeit separated by the Irish Sea. Insect remains may thus prove to be useful in determining the duration of phases of continuous occupation at archaeological sites.

Parasites of stock

The small number of sheep keds recorded from Buiston do not stand as evidence that there were live sheep on the platform (though animals may of course have been taken there for safety or arrived through their own efforts). The ked remains were probably deposited as a result of the cleaning of skins or wool. If the identification of *Damalinia bovis* is correct, there may have been cows on the crannog, but the remains but could equally have come from the skins of dead animals.

Insects associated with dead wood

The woodworm beetle, *Anobium punctatum*, extremely regularly-occurring and often quite abundant in occupation deposits, was represented only by two provisionally-identified individuals from Phase IV. The rarity of this species, so typical of wooden structures (and an excellent coloniser), is surprising at a site with immense quantities of timber. Equally surprising is the rarity of other species associated with timber, with twigs such as wattle or basketwork, and with rotten wood. There were only 10 individuals of such taxa from all of the samples. In addition to the putative woodworms, *Gracilia minuta*, a small longhorn beetle, may have lived in wattle or basketwork, *Grynobius planus* may have colonised timber, an unidentified scolytid and a salpingid may have lived in timber still bearing bark, and more rotten wood may have supported *Atrechus affinis* and *Melasis buprestoides*. All of these, and tentatively identified ?Cisidae sp. and ?Cerambycidae sp. may, however, have lived in natural habitats and been imported with firewood or arrived as 'background fauna'. The little bug *Temnostethus ?gracilis* may have lived amongst moss on dead wood or living trees.

A notable member of the deadwood component from this site is *Melasis buprestoides.* This eucnemid beetle is rather uncommon at the present day, being listed as 'notable B' by Hyman (1992). It bores into the wood of deciduous trees, including beech, birch and alder. An association with ancient woodlands and parklands is suggested by Garland (1985), but Harding (1977) records it from both primary and secondary woodlands, although considering it to be indicative of primary woodland when found in company with some other species.

Overall, it may be suspected that deadwood habitats were not abundant in the vicinity of the site. Problems of colonisation of the island would not be expected to have been limiting; even if wood-associated insects could not easily invade naturally because they were rare in the surrounding, huge amounts of timber of all kinds must surely have been carried to the crannog by humans. An alternative possibility is that only fresh timber was imported (for structural purposes), and that dead wood was not a major fuel, perhaps being substituted for by peat, which may have been safer to burn in a hearth set amongst timbers! This, however, is purely speculative.

Local vegetation

Some useful information concerning the kinds of vegetation and natural or semi-natural habitats which existed near to (and perhaps sometimes on) the crannog can be obtained by analysis of the 'outdoor' component of the insect assemblages. The habitats of these species are summarised in Table 4.

Firstly, and not surprisingly, insects from aquatic and aquatic-marginal habitats were abundant; they have been discussed above.

Although deadwood habitats seem to have been rare, there were numerous insects associated with living trees, or at least with scrubby vegetation. Birch (*Betula*) was indicated by the shieldbug *Elasmucha grisea*. Several of the recorded taxa are associated with willows (*Salix*) or poplars (*Populus*), including shrubby forms of the former. The scale insect *Chionaspis salicis* lives on various trees and shrubs, especially *Salix*. The weevil *Strophosomus melanogrammus* is particularly associated

with hazel (*Corylus*) and oak (*Quercus*). *Anoplus roboris* has been found on alder (*Alnus*) and oak, while *Pyrrhalta viburni* (?) occurs on *Viburnum*. Various other species found at Buiston live on a range of woody hosts. One of these, a nymph of *Pentatoma rufipes*, seems likely to have been imported. All of these 'tree' species may have lived on scattered trees or shrubs, but a few of the ground beetles offer hints (only) of shady woodland or scrub.

Herbaceous vegetation is indicated by many species. A substantial proportion are associated with waterside plants. Some of these offer a more precise host: *Donacia marginata* on *Sparganium* species and *Hydronomus alismatis* on *Alisma* species, for example.

Vegetation of waterside or damp soils is suggested by the records of *Conomelus anceps* (which was numerous) and *Livia juncorum*. Other plant feeders indicate Brassicaceae, *Plantago* species, docks and knotgrasses. Several species associated with vetches, clovers and their relatives were found. When the site record as a whole is examined, there is a strong hint that fauna from rough grazing land or hayfields found its way into the crannog deposits, probably in cut vegetation, although none of the individual assemblages gave an indisputable case for this. The dung beetles were perhaps just sufficiently numerous to hint that there was grazing land locally.

A heathland/moorland component, albeit modest, was present. *Scolopostethus decoratus* (?), *Ulopa reticulata*, *Bradycellus ruficollis* and *Micrelus ericae* have strong associations with the vegetation of such places, but there were several other taxa likely to have similar origins. This component was perhaps imported with cut heath/moor vegetation, or in peat and moss, presumably from nearby. Many of the numerous click beetle (Elateridae) larvae found at Buiston may have been imported in peat or turf, although most could perhaps have lived *in situ*. The possibility that a proportion (probably not all) of these larvae may have been fairly recent invaders of the buried peaty layers, burrowing down after they ceased to be permanently waterlogged, must, however, been entertained.

Conclusion

The study of the insect remains from Buiston has provided many useful insights into ecological conditions and human activity (or sometimes the lack of it) on a layer-by-layer basis. The assemblages show intensive occupation to have been associated with a limited number of layers. There are indications of the nature of occupation surfaces, and hints of the presence of stock. The synanthropic fauna included some species regarded as typical of 'house fauna', but the range of such species is limited, probably as a result of the combination of short periods of occupation and difficulties of colonisation. The vegetation and land-use of the surroundings is hinted at; there were at least some scrubby trees, and perhaps grazing land and hayfields.

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Archive

The insect material from the processed samples is stored in IMS at the EAU, together with a small number of card- or slide-mounted specimens. The manuscript records of identifications are also stored at the Unit; a few identifications made by MH and AK after the main listing was carried out were entered direct to the computer files. The computer input files and processed 'database' files for the site are stored in the University of York central mainframe computer at the time of writing. A set of hard copies of the processed data for each sample is stored at the EAU.

Table 3. Complete list of invertebrate taxa recorded from Buiston Crannog. Conventions: 'sp(?).' - indicates probable additional taxon; 'sp(?). indet.' - indicates may be (or include) previously listed taxon or taxa. Order and nomenclature for Insecta follows Kloet and Hincks (1964-77). Identifications marked '' are discussed in the text.*

BRYOZOA	
Cristatella mucedo Cuvier (statoblast)	
OLIGOCHAETA	
Oligochaeta sp. (egg capsule)	
CRUSTACEA: CLADOCERA	
Daphnia sp. (ephippium)	
INSECTA	
DERMAPTERA	
Dermaptera sp.	
MALLOPHAGA	
Damalinia ?bovis (Linnaeus) *	
Damalinia sp. indet. *	
SIPHUNCULATA	
Pediculus humanus Linnaeus *	
HEMIPTERA	
Elasmucha grisea (Linnaeus)	oap
Pentatoma rufipes (Linnaeus) (nymph)	
Picromerus bidens (Linnaeus)	oap
Stygnocoris pedestris (Geofffroy in Fourcroy)	oa
Stygnocoris sp. indet.	oa
Drymus ?brunneus (Sahlberg)	oap
Drymus sp. indet.	oap
Scolopostethus ?decoratus (Hahn)	oapm
Lygaeidae sp. indet.	oap
Lygaeidae sp. (nymph)	
Berytinus sp.	
Temnostethus ?gracilis (Horváth)	oa
Anthocoris sp.	
Lyctocoris campestris (Fabricius)	rd
Miridae sp?p.	
Saldidae sp.	
Microvelia reticulata (Burmeister)	oaw
Microvelia sp. indet.	oaw
Gerris sp.	
Corixa sp.	
Sigara ?distincta (Fieber)	oaw
Corixidae spp. indet.	oaw
Corixidae sp?p. (nymphs)	
Heteroptera sp.	
Heteroptera sp. (nymph)	

Aphrophora alni (Fallén)	oap
Ulopa reticulata (Fabricius)	oapm
Cicadella viridis (Linnaeus)	oap
Conomelus anceps (Germar)	oap
Auchenorhyncha spp	
Livia juncorum (Latreille)	oap
Strophingia ericae (Curtis)	oapm
Psylla ?pulchra (Zetterstedt) (nymph)	
Psylloidea sp.	
Chionaspis salicis (Linnaeus)	
Coccoidea sp.	
Aphidoidea sp.	

NEUROPTERA
Sialis sp. (larva)

TRICHOPTERA
Trichoptera sp. (larva)
Trichiptera sp. (case)

LEPIDOPTERA
Lepidoptera sp. (pupa)

DIPTERA
Bibionidae sp.
Melophagus ovinus (Linnaeus)
Melophagus ovinus (puparium)
Diptera spp.
Diptera spp. (larvae)
Diptera spp. (puparia)

SIPHONAPTERA
Pulex irritans Linnaeus *
Siphonaptera sp. indet. *

HYMENOPTERA
Proctotrupoidea sp.
Chalcidoidea spp.
Parasitica spp.
Formicidae sp. indet.
Myrmica sp.

COLEOPTERA

Cychrus rostratus (Linnaeus)	oa
Carabus nemoralis Müller	oa
Carabus violaceus Linnaeus	oa
Leistus sp.	oa
Notiophilus palustris (Duftschmid)	oa
Notiophilus sp. indet.	oa
Clivina fossor (Linnaeus)	oa
Trechus discus (Fabricius)	u
Trechus obtusus or *quadristriatus*	oa
Trechus micros (Herbst)	u
?Trechus sp. indet.	ob
Bembidion lampros or *properans*	oa

Bembidion bruxellense Wesmael	oa
Bembidion guttula or *mannerheimi*	oa
Bembidion (*Philochthus*) sp. indet.	oa
Bembidion spp. indet.	oa
Pterostichus diligens (Sturm) *	oad
Pterostichus melanarius (Illiger)	ob
Pterostichus niger (Schaller)	oa
Pterostichus nigrita (Paykull)	oad
Pterostichus strenuus (Panzer) *	oa
Pterostichus diligens or *strenuus* *	oa
Pterostichus spp. indet.	ob
Calathus sp.	oa
Synuchus nivalis (Panzer)	oa
Olisthopus rotundatus (Paykull)	oa
Agonum albipes (Fabricius)	oad
Agonum (*Europhilus*) sp.	oa
Agonum sp. indet.	oa
Amara sp.	oa
Harpalus sp.	oa
Trichocellus cognatus (Gyllenhal)	oa
Bradycellus ruficollis (Stephens)	oam
Bradycellus sp.	oa
Dromius (*Philorhizus*) sp.	oa
Carabidae spp. indet.	ob
Haliplus confinis or *obliquus*	oaw
Haliplus sp. indet.	oaw
Hygrotus ?inaequalis (Fabricius)	oaw
Hydroporus spp.	oaw
Graptodytes pictus (Fabricius)	oaw
?Deronectes latus (Stephens)	oaw
Potamonectes depressus (Fabricius)	oaw
Stictotarsus duodecimpustulatus (Fabricius)	oaw
Hydroporinae spp. indet.	oaw
Colymbetes fuscus (Linnaeus)	oaw
Colymbetinae spp.	oaw
Gyrinus sp.	oaw
Helophorus aquaticus or *grandis*	oaw
Helophorus spp.	oaw
Coelostoma orbiculare (Fabricius)	oaw
Sphaeridium ?bipustulatum Fabricius	rf
Cercyon analis (Paykull)	rt
Cercyon haemorrhoidalis (Fabricius)	rf
Cercyon littoralis (Gyllenhal)	rf
Cercyon sp?p and spp. indet.	u
Megasternum obscurum (Marsham)	rt
Cryptopleurum minutum (Fabricius)	rf
Hydrobius fuscipes (Linnaeus)	oaw
Anacaena ?globulus (Paykull)	oaw
Anacaena sp. indet.	oaw
Chaetarthria seminulum (Herbst)	oaw
Hydrophilinae spp.	oaw
Acritus nigricornis (Hoffmann)	rt
Histerinae sp.	u
Ochthebius ?minimus (Fabricius)	oaw
Ochthebius spp. indet.	oaw

Hydraena britteni or *rufipes*	oaw
Hydraena sp. indet.	oaw
Limnebius sp.	oaw
Ptenidium sp.	rt
Acrotrichis spp.	rt
Agathidium sp.	u
Leiodidae sp.	u
Catops fuliginosus Erichson	u
Catops sp. indet.	u
Catopinae sp.	u
Thanatophilus sp.	rf
Oiceoptoma thoracicum (Linnaeus)	rt
Silpha atrata Linnaeus	u
Scydmaenidae sp.	u
Micropeplus fulvus Erichson	rt
Micropeplus staphylinoides (Marsham)	rt
Micropeplus sp. indet.	rt
Metopsia retusa (Stephens)	u
Megarthrus sp.	rt
Olophrum piceum (Gyllenhal)	oa
Olophrum sp. indet.	oa
Acidota crenata (Fabricius)	oa
Acidota cruentata Mannerheim	oa
Lesteva heeri Fauvel	oad
Lesteva ?longoelytrata (Goeze)	oad
Lesteva sp. indet.	oad
Eusphalerum minutum (Fabricius)	oad
Phyllodrepa ?floralis (Paykull)	rt
?Dropephylla sp.	u
Xylodromus concinnus (Marsham)	rt
Omaliinae spp. indet.	u
Carpelimus bilineatus Stephens	rt
Carpelimus pusillus group	u
Carpelimus sp. indet.	u
Aploderus caelatus (Gravenhorst)	rt
Platystethus arenarius (Fourcroy)	rf
Anotylus nitidulus (Gravenhorst)	rtd
Anotylus rugosus (Fabricius)	rt
Anotylus sculpturatus group	rt
Oxytelus sculptus Gravenhorst	rt
Stenus ?brunnipes Stephens	u
Stenus spp. and spp. indet.	u
Euaesthetus bipunctatus (Ljungh)	oa
?Euaesthetus sp. indet.	oa
Lathrobium spp.	u
Ochthephilum fracticorne (Paykull)	oad
Rugilus orbiculatus (Paykull)	rt
Rugilus rufipes Germar	rt
Rugilus sp. indet.	rt
Paederinae sp. indet.	u
Othius myrmecophilus Kiesenwetter	rt
Othius punctulatus (Goeze)	rt
Othius sp. indet.	rt
Atrechus affinis (Paykull)	l
Leptacinus sp.	rt

Gyrohypnus angustatus Stephens	rt
Gyrohypnus fracticornis (Müller)	rt
Gyrohypnus sp. indet.	rt
Xantholinus ?linearis (Olivier) *	rt
Xantholinus longiventris Heer	rt
Xantholinus sp. indet.	u
Neobisnius sp. *	u
Erichsonius cinerascens (Gravenhorst)	oad
Philonthus ?politus (Linnaeus)	u
Philonthus spp.	u
Philonthus or *Gabrius* sp.	u
Staphylinus spp	u
Quedius boops group	u
Quedius mesomelinus (Marsham)	rt
Quedius spp. indet.	u
Philonthus or *Quedius* sp. indet.	u
Staphylininae spp. indet.	u
Mycetoporus sp.	u
Sepedophilus littoreus (Linnaeus)	u
Tachyporus nitidulus (Fabricius)	u
Tachyporus sp.	u
Tachinus laticollis or *marginellus*	u
Tachinus ?signatus Gravenhorst	u
Tachinus spp. indet.	u
Cordalia obscura (Gravenhorst)	rt
Drusilla canaliculata (Fabricius)	u
Crataraea suturalis (Mannerheim) *	rt
Aleochara spp.	u
Aleocharinae spp.	u
Euplectini sp.	u
Pselaphus heisei (Herbst)	u
Pselaphidae spp.	u
Geotrupes sp.	oarf
Colobopterus fossor (Linnaeus)	oarf
Aphodius ater (Degeer)	oarf
Aphodius ?contaminatus (Herbst)	oarf
Aphodius prodromus (Brahm)	obrf
Aphodius spp. and spp. indet.	obrf
Phyllopertha horticola (Linnaeus)	oap
Dascillus cervinus (Linnaeus)	oap
Clambus spp.	rt
Cyphon spp.	oad
Byrrhus sp.	oap
Dryops spp.	oad
Elmis aenea (Müller)	oaw
Oulimnius sp. *	oaw
Hypnoidus riparius (Fabricius)	oap
Hypnoidus riparius (larva) *	
Melanotus erythropus (Gmelin in Linnaeus) (larva) *	
Athous ?haemorrhoidalis (Fabricius)	oap
Athous haemorrhoidalis (larva) *	
Athous vittatus (Fabricius) (larva)*	
Ctenicera cuprea (Fabricius)	oap
Ctenicera cuprea (larva) *	
Ctenicera sp. indet. (larva) *	

?Actenicerus sjaelandicus (Müller)	oa
Actenicerus sjaelandicus (larva) *	
?Prosternon tessellatum (Linnaeus) (larva) *	
Selatosomus ?incanus (Gyllenhal) (larva) *	
Agriotes sp.	oap
Dalopius marginatus (Linnaeus)	oap
Denticollis linearis (Linnaeus) (larva) *	
Elateridae spp. and spp. indet.	ob
Elateridae sp?p. indet. (larvae)	
Melasis buprestoides (Linnaeus)	l
Cantharis ?figurata Mannerheim	oa
Cantharis rufa Linnaeus	oa
Rhagonycha femoralis or *testacea*	ob
Cantharidae sp. indet.	ob
Grynobius planus (Fabricius)	l
Anobium ?punctatum (Degeer)	l
Kateretes rufilabris (Latreille)	oapd
Kateretes sp. indet.	oapd
Meligethes sp.	oap
Rhizophagus cribratus Gyllenhal	u
Monotoma picipes Herbst	rt
Monotoma sp. indet.	rt
Cryptophagus scutellatus Newman	rd
Cryptophagus spp.	rd
Atomaria nigripennis (Kugelann) *	rd
Atomaria spp.	rd
Orthoperus sp.	rt
Lathridius minutus (Linnaeus) group	rd
Enicmus sp.	rt
Dienerella sp.	rd
Corticaria spp.	rt
Corticarina or *Cortinicara* sp.	rt
?Cisidae sp.	l
Typhaea stercorea (Linnaeus)	rd
Salpingidae sp.	l
Anthicus formicarius (Goeze)	rt
Anthicus sp. indet.	rt
Gracilia minuta (Fabricius)	l
?Cerambycidae sp.	l
Donacia marginata Hoppe	oad
Donacia versicolorea (Brahm)	oad
Donacia sp. indet.	oawp
Plateumaris discolor or *sericea*	oad
Donaciinae spp. indet.	oawp
Oulema sp.	oap
Chrysolina staphylaea (Linnaeus)	oap
Phaedon sp.	oap
Hydrothassa marginella (Linnaeus)	oap
Prasocuris phellandrii (Linnaeus)	oapd
Phyllodecta sp.	oap
Chrysomelinae spp. and spp. indet.	oap
Galerucella sp.	oap
Lochmaea caprea (Linnaeus)	oap
Phyllotreta nemorum (Linnaeus) group	oap
Phyllotreta sp.	oap

Longitarsus sp.	oap
Altica sp.	oap
Chalcoides sp.	oap
Mantura obtusata (Gyllenhal)	oap
Chaetocnema arida Foudras group	oap
Chaetocnema concinna (Marsham)	oap
Chaetocnema sp.indet.	oap
Halticinae spp. indet.	oap
Apion (*Oxystoma*) *?subulatum* Kirby	oap
Apion (*Protapion*) *dichroum* Bedel	oap
Apion (*Protapion*) sp.	oap
Apion spp.	oap
Phyllobius sp.	oap
Strophosomus melanogrammus (Forster)	oap
Strophosomus sp. indet.	oap
Sitona lepidus Gyllenhal	oap
Sitona suturalis Stephens	oap
Sitona spp. indet.	oap
Hypera punctata (Fabricius)	oap
Hypera sp.	oap
Alophus triguttatus (Fabricius)	oap
Anoplus roboris Suffrian	oap
?Cossoninae sp.	u
?Bagous sp.	oaw
Hydronomus alismatis (Marsham)	oawp
Dorytomus sp.	oap
Notaris acridulus (Linnaeus)	oadp
Micrelus ericae (Gyllenhal)	oapm
Ceutorhynchus sp.	oap
Rhinoncus pericarpius (Linnaeus)	oap
Limnobaris pilistriata (Stephens)	oapd
Anthonomus sp.	oap
Miarus sp.	oap
Mecinus pyraster (Herbst)	oap
Gymnetron sp.	oap
Rhynchaenus sp.	oap
Rhamphus pulicarius (Herbst)	oap
Curculionidae spp. and spp. indet.	oa
Scolytidae sp.	l
Coleoptera spp.	u
Coeloptera spp. (larvae)	
Insecta sp. (larva)	

Table 4. Brief summaries of the habitats of the 'outdoor' Hemiptera and Coleoptera recorded from Buiston Crannog. The probable identifications are marked '(?)' to avoid the impression that definite identifications were made for the present site. A few uncoded taxa (marked 'u') have been included as they add detail to the picture of the range of habitats near to the crannog.

HEMIPTERA	
Elasmucha grisea	In woodlands and scrub, associated with *Betula* spp. Adults overwinter in litter in birchwoods.
Pentatoma rufipes	On trees and shrubs in woods, woodland edge and gardens.
Picromerus bidens	In moist herb-rich meadows and damp woodlands.
Stygnocoris pedestris	Especially on somewhat dry sandy, chalk or light soils where there is good vegetation.
Stygnocoris spp.	Generally, open habitats, particularly on chalk- and sandy soils.
Drymus brunneus	In litter and mosses in woods and damp places.
Drymus spp.	In litter, mosses and turf in open habitats and woodland.
Scolopostethus (?)*decoratus*	On heathlands and moorlands; associated with heathers and ling.
Lygaeidae spp.	Eurytopic ground bugs as a group.
Berytinus spp.	Dryish, grassy habitats.
Temnostethus (?)*gracilis*	On lichen-covered tree trunks and rocks.
Anthocoris spp.	Predatory bugs found on a wide range of plants.
Miridae spp.	Exploit a wide range of habitats, and found among all vegetation types.
Saldidae spp.	Aquatic.
Microvelia reticulata	Margins of lakes and pools.
Microvelia spp.	Lakes, ponds and fens.
Gerris spp.	Aquatic.
Sigara (?)*distincta*	Aquatic, particularly lakes and ponds. Associated with organic-rich substrata.
Corixidae spp.	Aquatic.
Corixa spp.	Aquatic.

Aphrophora alni	On a variety of trees and shrubs.
Ulopa reticulata	Under *Erica* and *Calluna* spp.
Cicadella viridis	On grasses, in wet places.
Conomelus anceps	On *Juncus* spp.
Auchenorhyncha spp.	On a wide range of herbs, trees and shrubs in a variety of habitats.
Livia juncorum	On various *Juncus* spp. in wet meadows.
Strophingia ericae	On *Calluna vulgaris*.
Psylla (?)*pulchra*	Feeds on shrubby *Salix* species. Adult overwinters on various evergreen shelter plants.
Psylloidea spp.	On plants in a wide range of habitats.
Coccoidea spp.	On plants in a wide range of habitats.
Aphidoidea spp.	On plants in a wide range of habitats.

COLEOPTERA

Cychrus rostratus	Xerophylic eurytope, in dry woods and fields, etc.
Carabus nemoralis	Eurytopic, in habitats from light woodland to arable land.
Carabus violaceus	Predominantly in woodland.
Leistus spp.	Among debris in more or less shady places.
Notiophilus palustris	In damp, shady places.
Notiophilus spp.	In open country or light forests.
Clivina fossor	Eurytopic ground beetle.
Trechus discus (u)	Clayey soils with rich vegetation, beside water.
Trechus obtusus /quadristriatus	On open ground with short vegetation.
Trechus micros (u)	Banks of rivers and lakes, wet meadows.
Bembidion lampros/properans	Open ground.
Bembidion bruxellense	Very eurytopic.
Bembidion guttula/mannerheimi	Moist soil, riverbanks and waterside vegetation.

Bembidion (*Philochthus*) spp.	Near freshwater or estuarine and seashore habitats.
Bembidion spp.	Most species close to water, others in dry places.
Pterostichus diligens	Damp habitats; lake- and riverbanks, marsh, wet woods.
Pterostichus melanarius	Eurytopic. Common and widely distributed.
Pterostichus niger	Favours damp woodland.
Pterostichus nigrita	Damp places usually near water.
Pterostichus strenuus	In damp leaf litter beside water and in damp forests.
Pterostichus spp.	A group with a wide range of habits and habitats.
Calathus spp.	Mostly in dry places, under leaves, moss or stones, or amongst grass roots.
Synuchus nivalis	In open, not too dry country, usually sand or gravel. Not common.
Olisthopus rotundatus	A xerophilic species, found on open ground, especially sandy soils.
Agonum albipes	A shore-dweller, particularly beside eutrophic lakes.
Agonum (*Europhilus*) spp.	Hygrophilous species, generally in waterside vegetation.
Agonum spp.	Generally in damp habitats, waterside and moist woodlands; some in drier places.
Amara spp.	Open ground with short vegetation. Most species xerophilous.
Harpalus spp.	Open ground, often sandy soil. Most species more or less xerophilous.
Trichocellus cognatus	In bogs and moist heath.
Bradycellus ruficollis	Under *Calluna* bushes in heathland.
Bradycellus spp.	Eurytopic ground beetles as a genus.
Dromius (*Philorhizus*) spp.	Generally in open country, on dry or moist substrates.
Carabidae spp.	A group with a wide range of habits and habitats.
Haliplus confinis or *obliquus*	Fen ditches and pools (H. obliquus associated with *Chara* spp.).
Haliplus spp.	A range of aquatic habitats.
Hygrotus (?) *inaequalis*	Ponds and lakes.

Hydroporus spp.	Aquatic
Graptodytes pictus	Slow flowing streams, ponds.
(?)*Deronectes latus*	Rivers and streams.
Potamonectes depressus	Lochs and rivers.
Stictotarsus duodecimpustulatus	Lakes and rivers.
Hydroporinae spp.	Aquatic.
Colymbetes fuscus	Ponds and ditches.
Colymbetinae spp.	A range of aquatic habitats.
Gyrinus spp.	A range of fresh- and brackish water habitats.
Helophorus aquaticus or *grandis*	Pools and ditches.
Helophorus spp.	Most species found in still water.
Coelostoma orbiculare	Damp litter and moss, in fens, etc.
Hydrobius fuscipes	Ponds and ditches.
Anacaena (?)*globulus*	Running water, damp shaded ground.
Anacaena spp.	A range of aquatic habitats.
Chaetarthria seminulum	Damp litter and moss.
Hydrophilinae spp.	In or at edges of water.
Ochthebius (?)*minimus*	Most kinds of fresh water, occasionally brackish water. Shallow water among vegetation. Seems to avoid more oligotrophic waters.
Ochthebius spp.	Aquatic.
Hydraena britteni or *rufipes*	Fens, rivers, waterside vegetation.
Hydraena spp.	Various aquatic habitats from fen to flowing waters.
Limnebius spp.	Stagnant and running water.
Agathidium spp. (u)	Damp wood, leaflitter, fungi.
Metopsia retusa (u)	In damp vegetable refuse, moss, etc.
Olophrum piceum	In moss and litter, in woodland or moorland.
Olophrum spp.	Found in moorland and woodland leaflitter.

Acidota crenata	In damp leaves and litter.
Acidota cruentata	In damp leaves and litter.
Lesteva heeri	On moist woodland or meadow soils.
Lesteva (?)*longoelytrata*	On riverbanks, muddy ground and in damp leaves and moss.
Eusphalerum minutum	In flowers of shrubs and herbs, especially in damp places.
Carpelimus pusillus group (u)	In decaying matter and damp mud, often bywater.
Euaesthetus bipunctatus	In damp fields or moors.
Ochthephilum fracticorne	In litter on damp ground.
Erichsonius cinerascens	On damp ground, in leaves or moss.
Geotrupes spp.	Dung.
Colobopterus fossor	Usually in cow dung in open pasture.
Aphodius ater	Dung and decaying vegetable matter.
Aphodius (?)*contaminatus*	In dung.
Aphodius prodromus	Dung of various kinds (rarely cow dung) and decaying vegetable matter.
Aphodius spp.	Foul organic matter, usually dung.
Phyllopertha horticola	Larvae on the roots of grasses and herbs, often in poor pasture in hill areas. Adults feed on leaves and at flowers.
Dascillus cervinus	Larvae on plant roots, adults at flowers. Of local distribution in Britain.
Cyphon spp.	Usually amongst plants, on swampy ground.
Byrrhus spp.	Mainly ground-dwelling, living amongst moss and litter.
Dryops spp.	Mud by water
Elmis aenea	Running water.
Oulimnius spp.	Primarily in running water, sometimes also at shores of lakes.
Hypnoidus riparius	Larvae develop in soil. Found beside rivers, and other damp places.
Melanotus erythropus	Larvae in rotting wood. Adults overwinter in wood.
Athous (?)*haemorrhoidalis*	Larvae at plant roots, adults on trees and shrubs, generally

	in woodland edge habitats.
Ctenicera cuprea	Larvae in wood in damp places, adults on low vegetation, often flowering grasses and shrubs.
Ctenicera (?)*pectinicornis*	Larvae in soil or rotting wood, adults on flowering grasses and shrubs in damp meadows.
Actenicerus sjaelandicus	Larvae develop in soil. Adults found in damp meadows and woodland edges.
(?)*Prosternon tessellatum*	Larvae in conifer wood and soil, adults on flowering conifers, shrubs and low vegetation.
Agriotes obscurus	Larvae develop in soil, feeding on roots. Found in meadows, fields and gardens.
Agriotes spp.	Larvae (wireworms) feed on a variety of plant roots. Adults found amongst moss and litter, or on plants, in a variety of habitats.
Dalopius marginatus	Larvae in woodland soils and litter, adults in woodlands, scrub, hedges and gardens.
Denticollis linearis	Larvae in fallen wood and peaty soil, adults on shrubs and low vegetation.
Elateridae spp.	Mostly at plant roots as larvae, some dead wood feeders. Adults in a variety of woodland or open habitats.
Cantharis (?)*figurata*	On flowering herbs and shrubs.
Cantharis rufa	On flowering herbs and shrubs.
Rhagonycha femoralis or *testacea*	On flowers.
Cantharidae spp.	Larvae predatory ground-dwellers, adults found on sunny flowers, especially of the Apiaceae.
Grynobius planus	In dry wood on trees.
Anobium punctatum	Rarely, outdoors associated with dead wood on various trees; more frequently synanthropic.
Kateretes rufilabris	Larvae probably live on rushes and sedges. Adults in damp places, on grasses and herbs.
(?)*Kateretes* spp.	Adults on plants in damp places.
Rhizophagus cribratus (u)	At tree roots, grass, litter, fungi and carrion, and occasionally under bark.
Meligethes spp.	Larvae often hostplant-specific, adults on flowers (feeding on pollen).

Gracilia minuta	Chiefly on dead twigs and wickerwork.
Donacia marginata	On *Sparganium* spp.
Donacia versicolorea	Chiefly on *Potamogeton* spp.
Donacia spp.	On aquatic vegetation.
Plateumaris discolor or *sericea*	On aquatic vegetation, particularly Carices.
Donaciinae spp.	On emergent aquatic and waterside vegetation.
Oulema spp.	On grasses (including cereal plants).
Chrysolina staphylaea	On *Mentha* spp., *Ranunculus acris*, and *Veronica beccabungae*.
Phaedon spp.	Various plants.
Hydrothassa marginella	On various *Ranunculus* species and *Caltha palustris*, in wet places.
Prasocuris phellandrii	In damp places, especially on plants of the Apiaceae beside water. Larvae presumed to feed on *Sium* and *Oenanthe* spp.
Phyllodecta spp.	On willows (*Salix* spp.).
Chrysomelinae spp.	Usually associated with plants (often specific hostplants) in a variety of habitats.
(?)*Pyrrhalta viburni*	On *Viburnum* spp.
Galerucella spp.	On willows (*Salix* spp.), alder (*Alnus glutinosa*) and other trees.
Lochmaea caprea	On willows (*Salix* spp.).
Lochmaea caprea or *suturalis*	On willows, or heather (*Calluna*).
Phyllotreta nemorum group	On Brassicaceae.
Phyllotreta spp.	Mainly on Brassicaceae.
Longitarsus spp.	On a range of hostplants.
Altica spp.	On a range of herbs and shrubs.
Chalcoides spp.	On poplars and willows (*Populus* and *Salix* spp.).
Mantura obtusata	Predominantly in damp meadows, associated with small-leaved docks, *Rumex* spp.
Chaetocnema arida group	On various grasses and sedges.

Chaetocnema concinna	Chiefly on *Polygonum* spp.
Chaetocnema spp.	On a range of hostplants.
Halticinae spp.	On a range of hostplants.
Apion (*Oxystoma*) (?)*subulatum*	In hedgerows and woodland edges, feeding on *Lathyrus pratensis*.
Apion (*Protapion*) *dichroum*	On *Trifolium repens* and *T. hybridum*, in grassy and waste places, abundant and widespread.
Apion (*Protapion*) spp.	Generally on herbaceous Fabaceae, particularly *Trifolium* spp., in grasslands, hedgerows and waste places.
Apion spp.	Polyphagous as a group.
Phyllobius spp.	On trees, shrubs and herbs in a wide variety of terrestrial habitats.
Strophosomus melanogrammus	On various trees, especially oak and hazel.
Strophosomus spp.	Generally on shrubs and trees.
Sitona lepidus	On various herbaceous Fabaceae.
Sitona lineatus	On *Lotus*, *Trifolium*, *Medicago*, and *Pisum* spp.
Sitona suturalis	On *Lathyrus pratensis* and *Vicia* spp.
Sitona spp.	Larvae develop on root nodules of various Fabaceae. Adults on foliage of these plants, but well-dispersed by flight into a variety of habitats.
Hypera punctata	On Fabaceae, especially *Trifolium* and *Vicia* spp. In moss, at the roots of plants.
Hypera spp.	On various hostplants.
Alophus triguttatus	In damp places, particularly riverside meadows.
Anoplus roboris	On alder, *Alnus glutinosa*, also on oaks.
(?)*Bagous* spp.	On low plants in swamps and beside water, and underwater. Larvae feed on aquatic plants.
Hydronomus alismatis	Adults and larvae on water plantains (*Alisma* spp.) beside standing water.
Dorytomus spp.	Larvae develop in catkins of poplar(*Populus* spp.) and willows.
Notaris acridulus	On the aquatic sweet-grasses *Glyceria* spp., and *Polygonum* spp.

Micrelus ericae	On *Calluna vulgaris* and *Erica tetralix*.
Ceutorhynchus spp.	On a variety of plant hosts.
Rhinoncus pericarpius	On *Polygonum* and *Rumex* spp., mainly in damp places.
Limnobaris pilistriata	In swamps and marshes on *Juncus, Scirpus* and *Carex* spp. Larvae develop in *Scirpus* roots.
Anthonomus spp.	On various trees and shrubs, particularly woody Rosaceae.
Miarus spp.	On various herbaceous hostplants.
Mecinus pyraster	Larvae develop in *Plantago* spp.
Gymnetron spp.	On various herbaceous hostplants.
Rhynchaenus spp.	On various trees and shrubs.
Rhamphus pulicarius	Arboreal, on various tree and shrub species.
Curculionidae spp.	Associated with a wide variety of plant hosts in many different habitats.
Scolytidae spp.	Associated with a variety of trees and shrubs.