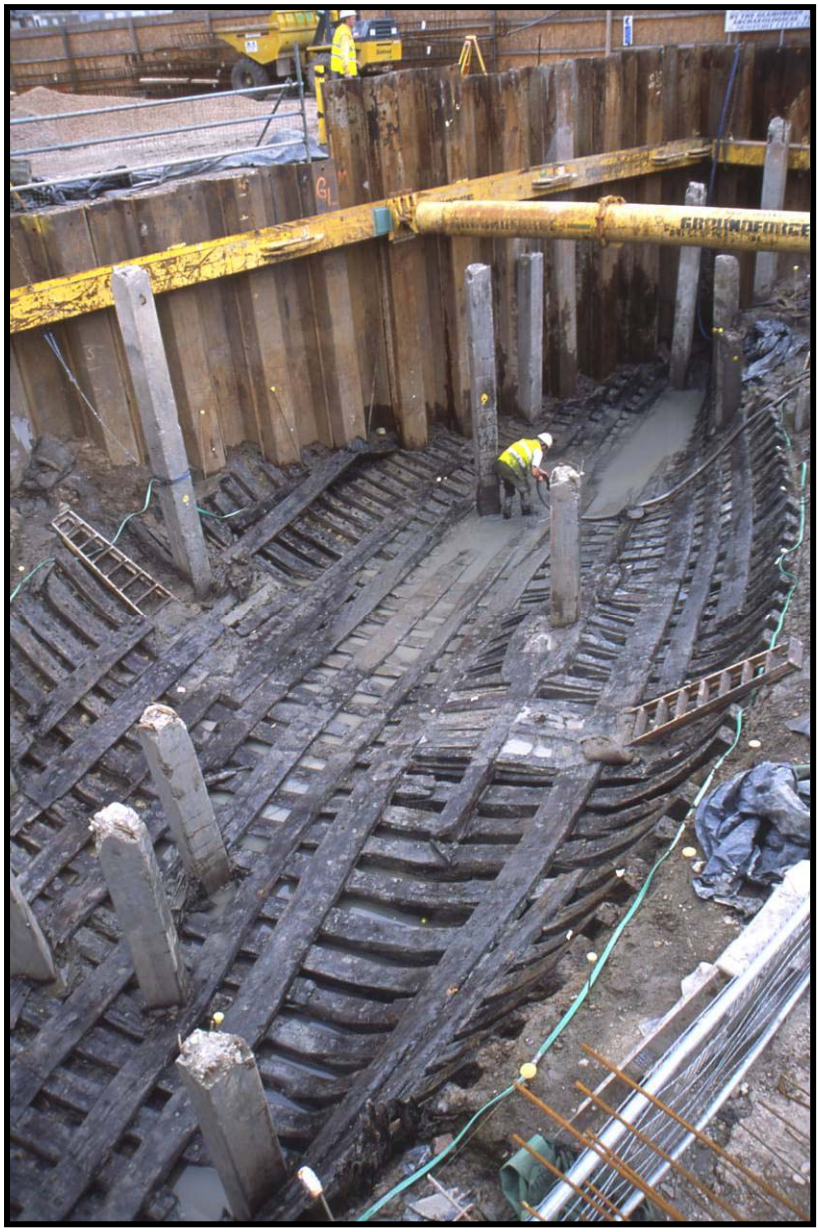
Newport Medieval Ship Project

Specialist Report: INSECTS



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University of Birmingham Environmental Archaeology Services Report Number 202

The Newport Ship Project

Introduction

In 2002, during the construction of the Riverfront Theatre, on the banks of the River Usk in Newport, South Wales, an archaeological find of great significance was unearthed. In the summer of that year, while undertaking the excavations for the theatre's orchestra pit, the well-preserved remains of a 15th century clinker built merchant vessel were discovered.

The site, which was surrounded by a cofferdam, was being monitored by the Glamorgan Gwent Archaeological Trust at the time of discovery. The ship lay in what is locally known as a pill or small inlet, with its stern closest to the river and its bow facing into the inlet. The timbers were covered in thick alluvial mud, which created an ideal anaerobic environment for successful preservation. Seventeen strakes of planking remained on the port side and thirty-five on the starboard side of the ship. The vessel was approximately 30m in length.

A silver French coin was found purposely inserted into the keel of the vessel, dating the ship to after May 1447. Dendrochronological research has shown the hull planking to be from the Basque country and after 1449 in date.

After a much publicised 'Save Our Ship' campaign, it was decided that the ship would not be recorded and discarded but excavated with the aim to conserve. The riders, stringers, braces, mast step, frames and overlapping clinker planks and keel were dismantled one by one and lifted. Almost 2000 ship components as well as hundreds of artefacts were excavated.

This report examines and lists the insect remains recovered during the Newport Medieval Ship excavation.

The Insect remains from the Newport Ship

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UNIVERSITY OF BIRMINGHAM ENVIRONMENTAL ARCHAEOLOGY SERVICES REPORT NUMBER 202

INTRODUCTION

Five samples of waterlogged material were presented for insect analysis from the 15th century ship recovered from the River Usk in Newport. The five samples come from a number of different frames in the ship. They also represent a number of different deposits within 'stratigraphy' associated with each frame. Samples 194 from context 171 in frame 61-62 and Sample 54 from context 152 in Frame 8-9a are both from the organic layer full of fish bone resting on the inboard face of the hull. Sample 68 from context 154 in frame 6-7 came from a layer alluvium above this basal coat associated with the possible location of a pump. Samples 156 and 159 from frames 1-2 and 5-6 respectively came from context 130 which was a layer of overlying clay which sealed the organic deposits. It has hoped that insect analysis would indicate the nature of conditions aboard ship and what materials may have been present.

SAMPLE PROCESSING AND ANALYSIS

The waterlogged samples were processed using the standard method of paraffin flotation as outlined in Kenward *et al.* (1980). The weights and volumes of the samples processed are presented in Table 1. The insect remains were sorted from the flots and stored in ethanol.

The Coleoptera (beetles) were identified by direct comparison to the Gorham and Girling Collections of British Coleoptera using a Meiji EMZ microscope at magnifications between x7 – x45. The various taxa of insects recovered are presented in Table 1. The taxonomy for the Coleoptera (beetles) follows that of Lucht (1987).

Where applicable each species of Coleoptera has been assigned to one, or more, ecological groupings and these are indicated in the second column of Table 1. These grouping are derived from the preliminary classifications outlined by Kenward (1978) and replicates the system that used in Kenward and Hall (1995). The groupings themselves are described at the end of Table 1. The various proportions of these groups, expressed as percentages of the total Coleoptera present in the faunas, are shown in Table 2 and Figure 1. Not all taxa have a coding and some taxa occur in more than one ecological group. As a result percentages do not equal 100%.

Some of the Coleoptera have also been assigned codes based upon their extent of synanthropy (dependence on human settlement) and these are indicated in the third column of Table 1. These codes are derived from those used by Kenward (1997). DNS is grateful to Kenward for supplying him with a listing of the species in each grouping. The synanthropic groupings are described at the end of Table 1 and the individual codes for the relevant species are shown in column 3 of Table 1. The proportions of these synanthropic groupings, expressed as a percentage of the total fauna, is presented in Table 3 and Figure 2.

Column 8 in Table 1 lists the plants with which the various phytophage (plant eating) species of beetles are associated. This information comes mainly from Koch (1992) and the plant nomenclature used is based on Stace (2010).

The dipterous (fly) pupae were identified using the drawings in K.G.V. Smith (1973, 1989) and, where possible, by direct comparison to modern specimens identified by Peter Skidmore. The various taxa of insects recovered from these samples are presented in Table 1. The taxonomy used follows that of K.G.V. Smith (1989) for the Diptera.

RESULTS

Sample 156/ context 120/ Frames 1-2

The insect fauna from this part of the ship clearly indicates that much of the material present is derived from human activity. In other circumstances much of this fauna would be described as 'settlement waste' since many of the Coleoptera recovered are from Kenward's (Kenward and Hall 1995) 'house fauna' and are clearly synanthropic (dependant on human settlement – ecological groups 'st', 'sf' and 'ss' in Tables 1and 3 and Figure 3) . The ship's fauna is dominated by a range of taxa that, in the archaeological record, are associated with dry, mouldering plant materials such as straw and hay (ecological group 'rd' in Tables 1 and 2). This part of the fauna is dominated by 44 individuals of the endomychid *Mycetea hirta.* This small beetle is often recovered from a range of settlement waste, but has been found to be common in the dry sheltered interior of roofing thatch and other similar materials (Moffett and Smith 1997; Smith *et al*. 1999; Smith *et al.* 2005). The 'rove beetle' *Xylodromus concinnus*, the various cryptophagids and lathridiids and the 'spider beetle *Ptinus fur* are also recovered from a range of similar dry plant materials (Smith 2000).

Also recovered are a number of taxa that are associated with dead wood and prepared timbers. These may of course have an origin within the frame of the ship itself, but also could have emerged from any timber that the ship may have carried as cargo. Amongst these is the 'common woodworm' *Anobium punctatum* and two scolytid 'bark beetles'. *Hylastes opacus* is normally found under the bark of pine (*Pinus* spp.) and *Leperisinus varius* under the bark of ash (*Fraxinus* spp.). The cujidiid *Uleiota planata* is relatively uncommon in the UK today (Hyman and Parsons 1992) and is associated with the deadwood of a range of deciduous trees, it is however more common on the continent (Buckland and Buckland 2006).

A number of taxa recovered are associated with a range of stored products, normally grain. This includes the 'Cadelle' *Tenebroides mauretanicus* which, on the continent is found under the bark of deciduous trees, but in northern Europe is usually restricted to flour mills and grain stores where it is a predator on a range of pests of stored products (Freeman 1980). *Tribolium castaneum* the 'rust-red flour beetle' is associated with stored grain and flour and is not thought to overwinter in unheated stores in the UK (Solomon and

Adamson 1956). *Oryzaephilus surinamensis* 'the saw toothed grain beetle' is also a pest of decayed grain (Freeman 1980). A single individual of the 'pea weevil' *Bruchus pisorum* was also recovered. This species is often a pest of pea and beans both in store and in the field (Koch 1992).

Other taxa recovered, notably the fly puparia, clearly suggest the condition that this material from the bottom of the ship had reached. There are clear indications for a saline rich blend of organic waste and possibly cess. The small flies Copromyzindiae are frequently associated with cess and animal dung (K.G.V. Smith 1989). The fly *Thoracochaeta zosterae* is a species which in the archaeological record is normally associated with cesspits with a rather fluid content (Belshaw 1989, Skidmore 1999). However, this fly is also associated with seaweed on the coast (K.G.V. Smith 1989). Similarly, the recovery of 16 individuals of the *Cercyon depressus* and a single individual of *Ochthebius marinus* also suggest saline conditions since both taxa are common in wet seaweed (Hansen 1986).

Sample 159/ context 130/ frames 5-6

The insect fauna from this location in the ship is very similar to that discussed for frame 1-2 above. Again the beetles are dominated by a range of synanthropic species (groups 'h', 'st', 'sf' and 'ss' in Tables 1 and 3 and Figure 2) such as *Xylodromus concinnus*, a range of cryptophagids and lathridiids, *Mycetea hirta, Aglenus brunneus* and *Ptinus fur*. *Monotoma quadrifoveolata* is also normally associated with this type of material but is considered to be relatively uncommon in the UK today and mainly limited to the South East of England (Buckland and Buckland 2006). A number of pests of stored products, usually of grain were again recovered, for example *Oryzaephilus surinamensis, Palorus ratzeburgi, Tribolium castaneum*, the 'granary weevil' *Sitophilus granarius* and the 'maize or rice weevil' *S. oryzae*. The later species is, despite the name, often a pest of stored grain but in Europe is really limited to heated stores and is still a relatively uncommon pest of grain in the UK today (Harde 1984). A number of individuals of the 'pea weevil' *Bruchus*

pisorum also were recovered. Taxa recovered associated with prepared wood and timbers included both the 'common woodworm' *Anobium punctatum* and the 'powder post beetle' *Lyctus linearis*. Several species of beetle such as *Uleiota planata, Leperisinus varius* and *Platypus cylindrus* live under the bark or in the rotting wood of a range of hardwood timbers such as oak and ash (Koch 1992). A single individual of the bostrychidid *Sinoxylon sexdentatum* was also recovered from this sample. This beetle has never been recovered in the British Isles before and is not native to the country. It is normally associated with either oak or vines were it can be a considerable pest in central and southern Europe.

As with the sample from frames 1-2 there is substantial evidence that a saline rich accumulation of waste and cess may have accumulated in this area of the ship. This is clearly indicated by the recovery of large numbers of individuals of the beetle *Cercyon depressus* and the flies *Copromyzidae* and *Thoracochaeta zosterae*. A single individual of the puparia which is probably the 'yellow dung' (?*Scathophaga* spp.) was also recovered. Lastly seven individuals of the human flea *Pulex irritans* were also recovered from this location on the ship.

Both sample 156 and 159 discussed above are from the clay context 130 which sealed the lower organic deposits. The insect fauna recovered suggests that these deposits are mainly composed of the same blend of organic waste and estuarine materials as are seen in the deposits which lay directly on the plants of the ship.

Sample 68/ context 154/ frames 6-7

The insect fauna from this location on the ship was relatively small (see Tables 1 and 2). It contains small numbers of individuals of the same range of insect taxa that were seen in the materials from frames 1-2 and 5-6 and suggests that the same materials and conditions were present at this location. The small numbers of individuals recovered may be related to this sample being composed of alluvium associated with the location of a possible pump.

Sample 54/ context 152/ frames 8-9a

The insect fauna from this location in the ship, lying directly above the inboard face of the ships planks indicates that conditions were saline, wet and rather foul. More than 400 individuals of the small fly Copromyzinae were recovered. This species is normally associated with a range of animal dung, cess and liquid wastes (K.G.V. Smith 1989). *Thoracochaeta zosterae*, another fly, is also associated in the archaeological record with this type of material, but is today normally found in wet seaweed (Belshaw 1989; Skidmore 1999). Another indicator for the presence of saline conditions is the thirty individuals of the beetle *Cercyon depressus* which today is a coastal species associated with seaweed (Hansen 1986). A single individual of the 'latrine fly' *Fannia scalaris* was recovered from this material, this species is normally associated with semi-liquid accumulations of cess (K.G.V. Smith 1989).

As with other deposits from the Newport ship, there is also evidence that some of this material may have consisted of dry mouldering plant materials similar to hay or straw. This is suggested by the recovery of large numbers of *Mycetea hirta* and a range of cryptophagids and lathridiids and the 'spider beetle' *Ptinus fur*. Similar conditions are also indicated by the recovery of the strongly synanthropic *Tenebrio obscurus* though this is also a minor pest of stored products (Brendell 1975). *Oryzaephilus surinamensis, Laemophloeus ferrugineus, Tribolium castaneum* and *Sitophilus oryzae* are all also pests of stored products, mainly grain (Freemen 1980).

Various species of beetle recovered are associated with infestations of prepared timbers such as 'the common woodworm' *Anobium punctatum* and 'the powder post beetle' *Lyctus linearis*. The 'bark beetle' *Leperisinus varius* is normally found under the bark of ash and *Phloeophthorus rhododactylus* is similarly associated with broom (*Cytisus* spp.) (Koch 1992).

Finally, thirteen individuals of the human flea, *Pulex irritans*, and a single dog flea, *Ctenocephalides canis*, were recovered from this location on board as well.

Sample 194/ context 171/ frame number

The insect fauna recovered from this deposit laying directly above the inboard face of the planks from the Newport Ship is essentially similar to that recovered from the other locations sampled. However, in addition to very large numbers of puparia of both Copromyzidae and *Thoracochaeta zosterae* flies which are often associated with cess in the archaeological record, a number of individuals of both 'the trickling filter fly' *Psychoda* spp. and 'the drain fly' *Scatopse notata* were found. These are both associated with mats of microbial slime often in sewage works and drains (K.G.V. Smith 1989). Again this material seems to have been quite saline in nature (suggested by the presence of *Cercyon depressus*) and initially derived from a range of materials including dry matter such as hay or straw. As with the other deposits from the Newport ship several taxa recovered, such as Oryzaeph*ilus surinamensis, Laemophloeus ferrugineus* and the 'grain weevil' *Sitophilus granarius,* are associated with grain and other stored products. Again, a number of taxa recovered suggest that woodworm and powder post beetles either infested the structure of the ship or any timber it the ship may have carried. The scolytids *Leperisinus varius* and *Orthotomicus laricus* suggest that ash and pine timbers were both present. Three individuals of the bostrychid *Sinoxylon sexdentatum* which is associated either with oak or vines also were recovered.

DISCUSSION

The nature of the material sampled

From the above discussion of the faunas studied from a number of locations in the Newport ship it is clear that the vast majority of the material sampled was, in part, derived for a range of dry organic matter. In other archaeological circumstances this would be described as 'settlement waste' (i.e. Hall and Kenward 1990; Kenward and Hall 1995; Carrott and Kenward 2001).

Some of this material also may have been derived from liquid cess, or at least have reached similar conditions. Many of the taxa of flies recovered, such as

Copromyzinidae and *Thoracochaeta zosterae,* are found in large numbers in archaeological cesspits (e.g. Belshaw 1989; Skidmore 1999; Smith, D. 2007; 2009a; 2011) and are normally interpreted as indicating the presence of foul, liquid wastes. However, in terms of the Newport ship, their presence also may be due to the material at these locations becoming saline in nature, perhaps as the result of seepage of seawater through the hull or from above decks. This could be argued since today both *T. zosterae* and *Cercyon depressus* are associated with spreads of seaweed on the shore (Hansen 1986; Belshaw 1989; K.G.V. Smith 1989) but may not be out of place in material in the damp hold of a seagoing ship.

Possible indicators for goods carried by the ship and its origin

This is a difficult subject to address directly from the insects recovered. For example there is evidence for the presence of beetles that are pests of stored products (*Tenebroides mauretanicus*, *Oryzaephilus surinamensis, Laemophloeus ferrugineus, Palorus ratzburgi, Tribolium castaneum, Tenbrio obscurus, Sitophilus granarius, S. oryzae and Bruchus pisorum*) which may have been carried on board with food or cargo. Two of these (*Tribolium castaneum and Sitophilus oryzae*) are not commonly encountered in unheated grain stores in the UK today and, certainly in the case of *Tribolium castaneum*, have been used to indicate the presence of imported grain in the archaeological record (Smith and Kenward 2011). However, if the deposit sampled is in part cess then there may be another explanation for their presence. It has been suggested that low quality food, such as gruel or horse bread, could often have contained infested grain and that fragments of grain pests will subsequently survive the journey through the human digestive tract (Osborne 1983).

Similarly, several species of beetle recovered are associated with different types of timber and wood. Several of these (*Uleiota planata, Sinoxylon sexdentatum, Orthotomicus laricus)* are very rare or do not occur in the Britain at all today (Hyman and Parsons 1992) or in the archaeological past (Buckland and Buckland 2006). However, it is difficult to establish if this

indicates that the ship had carried a cargo of timber from the continent, or if this range of woodborers infested the structure of the ship itself. However, there presence does clearly suggest that the ship must therefore have had considerable contact with the continent.

Although it is unsurprising to recover the human flea from a ship, their frequent recovered may suggest that high levels of infestation amongst the crew may have existed.

Comparison to insect faunas from other ships and deposits of this date

The insect faunas from archaeological ships have not been extensively investigated, the only other example being from the 2nd century ship from Laurium in Woerden, Holland (Pals and Hakbijl 1992). Though clearly not ship based a similar insect fauna, without the more exotic taxa, was recovered from a range of dated deposits from the Royal Navy Victualling yard, London (Smith 2010).

However, there are now a reasonable number of insect faunas from 15-17th century London (Smith 1999, 2007, 2009, 2010a, 2011; Smith and Chandler 2005; Smith and Morris 2008), Southampton (2009a), Birmingham (Smith 2009b) and Bristol (Smith 2010b) to suggest, with the exception of some of the notably 'exotic' taxa recovered from the Newport Ship, that the insect faunas described here are similar in nature to a large number of insect fauna from deposits with a similar date.

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Table 1. The insect remains from the Newport Ship

Context	Ecological codes	Syn-anthropic codes	130	130	154	152	171	
Sample number			156	159	68	54	194	
Frame number			1-2	5-6	6-7	8-9a	61-62	
Weight kg			11	1	6	8	4.5	
volume l			6	2	2.5	5	7	
HEMIPTERA								
Family, genus and spp. Indet.			-	-	-	6	-	
COLEOPTERA								
Carabidae								
Carabus spp.	oa		-	-	-	1	-	
Clivina fossor (L.)	oa		2		-	-	-	
Trechoblemus micros (Hbst.)	oa		1	-	-	-	-	
Bembidion minimum (F.)	oa		-	-	-	-	1	
Bembidion spp.	oa		-	1	-	-	1	
Asaphidion flavipes (L.)	oa-d		-	-	-	-	1	
Pterostichus melanarius (Ill.)	oa		1	-	-	-	-	
Syntomus truncatellus (L.)	oa		-	-	-	1	-	
Hydraenidae								
Ochthebius marinus (Payk.)	oa-w-c		1	-	-	-	-	
Helophorus spp.	oa-w		-	-	-	1	-	
Hydrophilidae								
Cercyon depressus Steph.	c		16	36	2	30	11	
Cercyon atricapillus (Marsh.)	rf	st	1	-	-	-	-	
Cercyon analis (Payk.)	rt	sf	1	1	-	2	-	
Megasternum boletophagum (Marsh.)	rt		-	-	-	1	-	
Histeridae								
Gnathoncus sp.	rt	sf	3	3	1	1	1	
Clamdidae								
Clambus spp.			-	-	-	1	-	
Orthoperidae								
Ptilidae Genus & spp. indet.	rt		-	2	-	-	-	
Staphylinidae								
Omalium spp.	rt		-	-	-	1	-	
Xylodromus concinnus (Marsh.)	rt-h		1	1	1	2	1	
Trogophloeus bilineatus (Steph.)	rt	sf	1	-	-	-	-	
Trogophloeus? corticinus (Grav.)	u		-	1	-	-	-	
Oxytelus sculptus Grav.	rt		2	4	-	5	1	
Oxytelus rugosus (F.)	rt		3	-	-	-	-	
Bledius spp.	oa-d		-	-	-	1	-	
Stenus spp.	u		-	-	-	-	1	
Gyrohypnus fracticornis (Müll.)	rt	st	1	-	-	-	-	
Xantholinus spp.			2	-	-	2	-	
Philonthus spp.			-	-	-	-	2	
Quedius spp.			-	1	-	-	-	
Philonthus spp.			-	2	-	1	-	
Tachinus spp.		sf	1	-	-	-	-	
Aleocharinidae Genus & spp. Indet.			2	-	-	-	-	
Elateridae								
Agriotes spp.	oa-p		-	-	-	1	-	
Ostomidae								
Tenebrioides mauretanicus (L.)	rd-h	ss	1	-	-	-	-	
Nitidulidae								

Meligethes spp.	oa		1	-	-	-	-	
Rhizophagidae								
Rhizophagus spp.	rt	sf	-	1	-	1	-	
Cucujidae								
M*onotoma quadrifoveolata Aubé*	rt	st	-	1	-	1	-	
Monotoma spp.	rt	sf	3	3	-	1	-	
Uleiota planata (L.)	l		1	1	-	1	-	
Oryzaephilus surinamensis (L.)	g	ss	2	2	-	1	1	
Laemophloeus ferrugineus (Steph.)	g	ss	-	-	-	1	1	
Cryptophagidae								
Cryptophagus spp.	rd-h	sf	7	18	3	-	22	
Atomaria spp.	rd-h	st	-	1	-	3	-	
Lathridiidae								
Enicmus minutus (Group)	rd-h	st	12	22	4	52	12	
Cartodere ruficollis (Marsh.)	rd	sf	-	2	-	1	1	
Corticaria/ corticarina spp.	rt	sf	-	-	-	1	-	
Colydiidae								
Aglenus brunneus (Gyll.)	rt-h	ss	-	1	-	-	-	
Endomychidae								
Mycetaea hirta (Marsh.)	rd-h	ss	44	46	9	55	12	
Lyctidae								
Lyctus linearis (Goeze)	l-h	sf	-	3	2	1	1	
Bostrychidae								
Sinoxylon sexdentatum (Ol.)	l		-	1	-	-	3	*Quercus* spp. and *Vitus vinifera* L. (oak and grape vine)
Anobiidae								
Anobium punctatum (Geer)	l-h	sf	5	1	-	2	2	
Ptinidae								
Ptinus fur (L.)	rd-h	sf	3	3	-	3	3	
Anthicidae								
Anthicus spp.	rt		-	-	-	1	1	
Tenebionidae								
Palorus ratzeburgi (Wissm.)	g	ss	-	1	-	-	-	
Tribolium castaneum (Hbst.)	g	ss	2	1	-	2	-	
Tenebrio obscurus F.	rf	ss	1	-	-	2	-	
Scarabaeidae								
Aphodius spp.	oa-rf		-	1	-	-	-	
Chyrsomelidae								
Phyllotreta spp.	oa		-	-	-	1	-	
Chaetocnema concinna (Marsh.)	oa		-	2	1	-	-	
Bruchidae								
Bruchus pisorum (L.)	oa-pu		1	3	1	-	-	
Scolytidae								
Scolytus intricatus (Ratz.)	oa-l		-	-	-	-	1	
Phloeophthorus rhododactylus (Marsh.)	oa-l		-	-	-	1	-	Often on *Cytisus* species (Brooms)
Hylastes opacus Er.	oa-l		1	-	-	-	-	Mainly *Pinus* spp. (Pine)
Leperisinus varius (F.)	oa-l		3	12	2	32	1	Mainly on *Fraxinus* (Ash)
Orthotomicus laricus(F.)	oa-l		-	-	-	-	1	Pines and conifers
Platypus cylindrus (F.)	oa-l		-	1	-	-	-	Normally under bark of *Quercus* and *Fagus* spp (oak and beech)
Curculionidae								
Apion spp.	oa-p		-	-	-	1	-	
Barypeithes spp.	oa		-	-	-	-	1	
Sitona spp.	oa		-	-	-	2	-	

Rhyncolus chloropus (L.)	l		-	2	-	-	1	
Sitophilus granarius (L.)	g	ss	-	1	-	-	2	
*Sitophilus oryzae (*L.)	g	ss	-	1	1	1	-	
Ceutorhynchus spp.	oa-p	-	-	-	-	-	1	
Rhynchaenus sp.	oa-l		-	-	-	1	-	
Rhamphus pulicarius (Hbst.)	oa-l	-	-	-	1	-	-	*Sallix* (Willow)
SIPHONAPTERA								
Pulex irritans (L.)			-	7	2	13	-	
*Ctenocephalides canis (*Curtis)			-	-	-	1	-	
DIPTERA								
Psychodinae								
Psychoda spp.			-	-	-	-	1	
Scatopsidae								
Scatopse notata L.			-	-	-	-	3	
Sphaeroceridae								
Copromyzinae Genus and spp. indet.			35	109	21	400+	583	
cf. *Telomerina flavipes* (Meigen)			-	-	1	-	-	
Thoracochaeta zosterae (Hal.)			13	65	27	80	450	
Carnidae								
?Meoneura spp.			-	2	-	-	1	
Scathophagidae								
?*Scathophaga* sp.			-	1	-	-	-	
Fanniinae								
Fannia scalaris (Fab.)			-	-	-	1	1	
HYMENOPTERA								
Formicoidea Family Genus and spp. indet.			-	-	-	40	-	

Ecological coding (Kenward and Hall 1995)
oa (& ob) - Species which will not breed in human housing.
w- aquatic species.
c-species associated with salt water and coastal areas
d- species associated with damp watersides and river banks.
rd- species primarily associated with drier organic matter.
rf - species primarily associated with foul organic matter often dung.
rt - insects associated with decaying organic matter but not belonging to either the rd or rf groups.
g- species associated with grain.
l - species associated with timber.
p – phytophage species often associated with waste areas or grassland and pasture
pu – species associated with pulses (peas and beans)
h - members of the 'house fauna' this is a very arbitrary group based on archaeological associations (Hall and Kenward 1990).

Synanthropic coding (Kenward 1997)
sf - facultative synanthropes - common in 'natural' habitats but clearly favoured by artificial ones.
st - typically synanthropes - particularly favoured by artificial habitats but believed to be able to survive in nature in the long term.
ss - strong synanthropes - essentially dependant on human activity for survival.
h- species thought to be particularly associated with human occupation (Kenward and Hall 1995).

Table 2. The proportions of the ecological grouping of Coleoptera from The Newport ship

	156	159	68	54	194
Total number of individuals	126	183	28	219	87
Total number of taxa	31	35	12	39	27
oa%	8.7%	10.9%	17.9%	19.6%	9.2%
w%	0.8%	0.0%	0.0%	0.5%	0.0%
d%	0.0%	0.0%	0.0%	0.5%	1.1%
c%	13.5%	19.7%	7.1%	13.7%	12.6%
oa-p%	0.0%	0.0%	0.0%	0.9%	1.1%
l%	7.9%	11.5%	17.9%	17.4%	11.5%
rd%	53.2%	50.3%	57.1%	52.1%	57.5%
rf%	1.6%	0.5%	0.0%	0.0%	0.0%
rt%	11.9%	9.3%	7.1%	8.7%	4.6%
pu%	0.8%	1.6%	3.6%	0.0%	0.0%
g%	3.2%	3.3%	3.6%	2.3%	4.6%

Table 3. The proportions of the synanthropic groupings of Coleoptera from the Newport ship

	156	159	68	54	194
st%	11.1%	13.1%	14.3%	25.6%	13.8%
sf%	19.0%	19.1%	21.4%	5.9%	34.5%
ss%	39.7%	29.0%	35.7%	28.3%	18.4%
h%	57.94%	52.46%	67.86%	53.88%	60.92%

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Figure 1. The proportions of the ecological grouping of Coleoptera from The Newport Ship (key to codes are shown at base of Table 1)

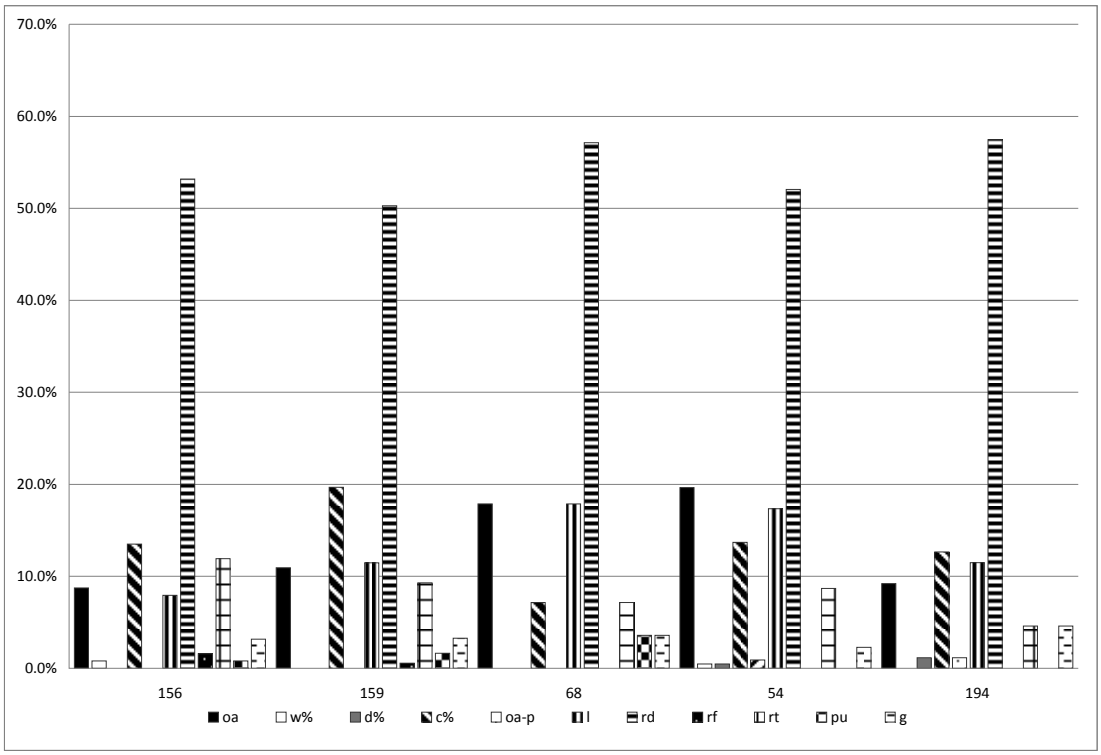

Figure 2. The proportions of the synanthropic groupings of Coleoptera from the Newport Ship (key to codes are shown at base of Table 2)