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Archaeological structures as factors affecting bird abundance and spectra in archaeological contexts from medieval and modern Belgium

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ABSTRACT

The present study aims to evaluate the effect of archaeological structures in the preservation and recovery of bird remains, in particular by considering the overall shape, open or enclosed, of the structure. Indeed, hollow structures, sometimes of an enclosed shape that may be constructed in masonry, are supposed to have a protective effect on the fragile bones of birds. This is evaluated by considering different variables, such as the ratio of bird remains compared to those of the main domestic mammals used as meat suppliers, the number of bird taxa, or the identification rates for different types of archaeological structures. In a second step, once the impact of the type of structure is evaluated, the same variables are examined according to the social status, to verify their relevance to document this aspect. It transpires that the bird to mammal remains ratio is strongly influenced by the type of structure, as it is higher in enclosed structures. However, some open structures also deliver high bird ratios, in particular at high status sites. In contrast, the bird identification rate is lower in enclosed structures, but this is probably related to the recovery method. Finally, the number of taxa seems more affected by the social status of the consumers responsible for the accumulation of an archaeological assemblage than by the kind of archaeological structure the faunal assemblage was discarded into. This has implications for sampling strategies since open structures, when sieved, sometimes yield high bird to mammal ratios as well as a high number of bird taxa. Therefore, more systematic sieving of large samples of sediment should be applied not only to enclosed structures but also to open contexts such as refuse layers or floors, especially in sites of (potentially) high social status.

1. Introduction

From an archaeozoological point of view, the meat diet is generally dominated by domestic mammals during the medieval and post-medieval period in Belgium (Ervynck and Van Neer, 2017). This trend is observed in most sites from the Neolithic period onwards and is not restricted to Belgium as it also applies more widely in Europe (Albarella and Davis, 1996; Audoin-Rouzeau, 1995, 1997; Clavel, 2001a; Rodet-Belarbi and Forest, 2009). However, other groups of animals, such as molluscs, fish and birds, have contributed to the meat diet but determining their true importance is complicated by a series of factors principally related to taphonomy and recovery methods. The overall small size and greater fragility of bird remains limit their preservation and recovery, compared to mammal bones (Cruz, 2008). For bird bones, there have been studies addressing this issue based on faunal assemblages from Belgium (Ervynck, 1993; Goffette et al., 2017).

This article presents another approach and focuses on the influence of the type of archaeological structure and on the representativity of the bird remains they yield. More precisely, it questions whether enclosed hollow archaeological structures such as cesspits, wells or cisterns are more likely to deliver bird bones than open contexts such as refuse or levelling layers. Beyond the specific characteristics of bird bones set out above, the type of context might influence the kind of deposit (primary versus secondary deposits, butchery versus table refuse), the quality of the preservation and the recovery methods.

First, it can be assumed that enclosed structures, in particular cesspits, receive mainly primary deposits, at least when they are in use. Primary deposits represent the first point of disposal of rubbish, while secondary deposits have been transported (Meadow, 1980). Any transport of material increases the chance of loss and breakage, to which bird bones are particularly sensitive, considering their overall small size and lighter constitution than mammal bones (Cruz, 2008). Because cesspits need to be cleaned out regularly, it makes no sense to fill them with large quantities of secondary deposits, except to seal them off. The problem is that archaeozoological studies do not always distinguish between layers constituted during the use of the structure and those after it has been abandoned, which also affects the dataset exploited here. In addition, due to their proximity to the kitchen and

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Table 1
Summary data for the assemblages studied for each category of archaeological structure, by chronological period (*Ass.* Number of assemblage, *NISP* Number of identified specimens, *NISP/Ass.* Mean of the Number of identified specimens per assemblage).

	enclosed			semi-open			open			mixed			Total		
	Ass.	NISP	NISP/Ass.	Ass.	NISP	NISP/Ass.	Ass.	NISP	NISP/Ass.	Ass.	NISP	NISP/Ass.	Ass.	NISP	NISP/Ass.
Early medieval (5th–9th c.)	0	0	0	1	13	13	8	864	108	8	187	23	17	1064	63
Early medieval–high medieval	0	0	0	0	0	0	2	56	28	2	21	11	4	77	19
High medieval (10th–12th c.)	2	461	231	0	0	0	7	828	118	0	0	0	9	1289	0
High medieval–late medieval	4	286	72	3	267	89	4	1009	252	1	66	66	12	1628	136
Late medieval (13th–15th c.)	6	6504	1084	7	1245	178	24	4926	205	0	0	0	37	12675	0
Late medieval–early modern	5	2279	456	0	0	0	9	688	76	2	908	454	16	3875	242
Early modern (16th–18th c.)	15	8614	574	1	7	7	20	4423	221	2	1	1	38	13045	343
Early modern–late modern	0	0	0	0	0	0	2	220	110	1	276	276	3	496	165
Late modern (19th–20th c.)	2	272	136	0	0	0	3	448	149	0	0	0	5	720	0
Total	34	18416	542	12	1532	128	79	13462	170	16	1459	91	141	34869	247

eating areas, cesspits are favourite places to dispose of kitchen and table refuse (Ervynck, 2016). Therefore, they are more likely to receive bones from small species such as birds, which still contain their bones at the moment of consumption, even in the case of large birds (Witteveen, 1986, 1987a, b, 1989, 1990). In contrast, larger animal species, such as cattle, will first be deboned at the butchery site to eliminate the largest bone part.

Secondly, given its morphology, a hollow structure will preserve the bones it contains better than a horizontal deposit, such as a levelling layer, as it offers protection for the bones against trampling or compaction (Méniel, 1998; Serjeantson, 2009), especially if a lining existed. Moreover, structures such as wells and cesspits frequently deliver waterlogged sediments in which organic residues preserve perfectly. Although bone degrades less than other categories of organic residues (e.g. leather) under an oxidizing atmosphere, the smallest bones will especially benefit from the anaerobic conditions.

Thirdly, due to the good preservation and the wealth of artefacts expected from hollow structures such as cesspits, as well as the archaeological interest of having closed and chronologically homogenous contexts (but on that aspect, see van Oosten, 2017), they generally benefit from a greater attention by the excavator. In this respect, these structures are often sampled for sieving. The wealthiest people are also the most likely to afford wells or latrines in masonry, which are most beneficial for the preservation of the organic remains, potentially leading to a higher number of bird remains and a greater diversity of taxa. In contrast, in sites where such structures are absent, bird remains could suffer more from taphonomic phenomena, yielding to a biased perception of species diversity.

The impact of different variables linked with the physical characteristics of the archaeological structures on the preservation of animal bones has already been addressed by several scholars. Patrice Méniel (1998) examined the impact of the depth of the archaeological structures on the frequency of the main categories of animals at the Iron Age settlement of Acy-Romance, France. In this rural settlement, he noticed that the preservation of the bones increases significantly with the depth of the archaeological structures (mostly silos and pits), thus affecting the quantity of bones but also the representativity of the smallest species and the taxonomic diversity. Although birds are also impacted, the micromammals show the strongest decrease in frequency when getting closer to the surface. At Acy-Romance, bones present a fresh aspect and they are almost devoid of root etching in structures deeper than 60–100 cm. Other factors negatively impacting the preservation of the bones, such as sediment pressure, were limited by the structure of their filling.

In his synthesis about the animal exploitation during the medieval and modern periods in Northern France, Benoît Clavel (2001a) examined the proportions of the main categories of animals in rural and urban contexts according to the archaeological structures they were recovered from. He showed that the bones of large mammals, which are more resistant, are generally overrepresented in rural areas due, in part, to poor preservation conditions in this type of environment, which are detrimental to the more fragile bones, including those of birds. In contrast, urban settings are more favourable to the preservation of bird bones. Because of the heterogeneity of the dataset studied here, only the overall shape of the structures is considered, to complement the previous studies mentioned above.

Evaluating the importance of bird remains in different kinds of archaeological structures may help in targeting contexts potentially more suitable for diet reconstruction or, on the opposite, support the use of assemblages from various archaeological contexts to better understand the exploitation of birds by past populations.

2. Material and methods

The 34.869 bird remains examined here come from 141 distinct faunal assemblages, which were recovered from 55 archaeological sites dated to the medieval and the modern periods located on the territory of modern Belgium. The faunal data have been produced by different archaeozoologists and compiled in a dataset described in Goffette et al. (2017), to which the reader can refer for more details.

To study variations in the number of bird remains in different kind of structures, we divided them up into three different categories: enclosed, semi-open and open. The ‘enclosed’ category includes hollow structures, generally with casing, such as cesspits, water wells and cisterns. They are considered as highly protective for the organic content. The ‘semi-open’ category is devoted to hollow structures such as pits and ditches, which are more likely to remain open than the previous category of structures and are therefore considered less protective. In general, their walls are not consolidated. The ‘open’ category, finally, includes layers *sensu lato*, such as refuse layers, levelling layers or floors, in which the bones are more likely to be exposed to trampling, weathering and scavenging. Therefore, they appear to be less suitable for the preservation and recovery of bird remains. Some of the assemblages include bones from different categories of structures (e.g. from pits and refuse layers), they are grouped in the ‘mixed’ category (Table 1) and were not further considered in the analysis.

Some taxa such as corvids and birds of prey are included in this study even though they may have not been consumed. Nevertheless, uncertainty on the taphonomy did not allow us to exclude them.

To ease the lecture, halves of centuries are expressed by adding an uppercase letter after the century, i.e. ‘A’ = first half of a century and ‘B’ = second half of a century, and quarters of centuries by adding a lowercase letter, i.e. ‘a’ = first quarter of a century, ‘b’ = second quarter of a century, ‘c’ = third quarter of a century, and ‘d’ = fourth quarter of a century.

3. Results

3.1. Chronological and numerical characteristics of the dataset

Table 1 summarizes the data available for each category, per period and includes both the number of assemblages and the number of bird finds. On a chronological point of view, the Late medieval (13-15th c.) and the Early modern (16th–18th c.) periods yielded by far most of the remains, while the Late modern (19th–20th c.) period is the poorest with less than one thousand remains, apart from transition periods.

The Early medieval period has not delivered any bird bones from enclosed structures. In contrast, the latter are the most numerous during the Early modern period, which is likely to be related to the multiplication of cesspits built in masonry. The enclosed structures delivered the highest number of bird remains, followed by the open and then the semi-open structures. However, each category is represented by a various number of assemblages. When considering the number of finds per assemblage, the enclosed structures appear the richest with three to four times more bird remains than the other two categories, which delivered roughly the same density of bird bones per assemblage.

3.2. Assemblage richness in bird remains

Because of their greater fragility compared to mammal bones, it is expected that bird bones preserve better in enclosed structures than in open layers, where they are less protected. Fig. 1 presents for each category of structure the distribution of the ratio of the number of bird bones per assemblage versus the number of bones of the triad composed of cattle (*Bos taurus*), pig (*Sus domesticus*) and sheep/goat (*Ovis aries/Capra hircus*). Two assemblages from refuse (open) layers and one from a ditch (semi-open) were excluded because they yielded bird bones but no remains of the triad. A ratio inferior to one means that the number of bird remains is less important than that of the triad. In contrast, a ratio superior to one means a higher rate of birds compared to the triad, while a ratio of two means twice more birds than mammals, etc. As expected, the enclosed structures yield a higher ratio of birds (mean ratio per assemblage is 4.42) than the semi-open (0.39) and open structures (0.52).

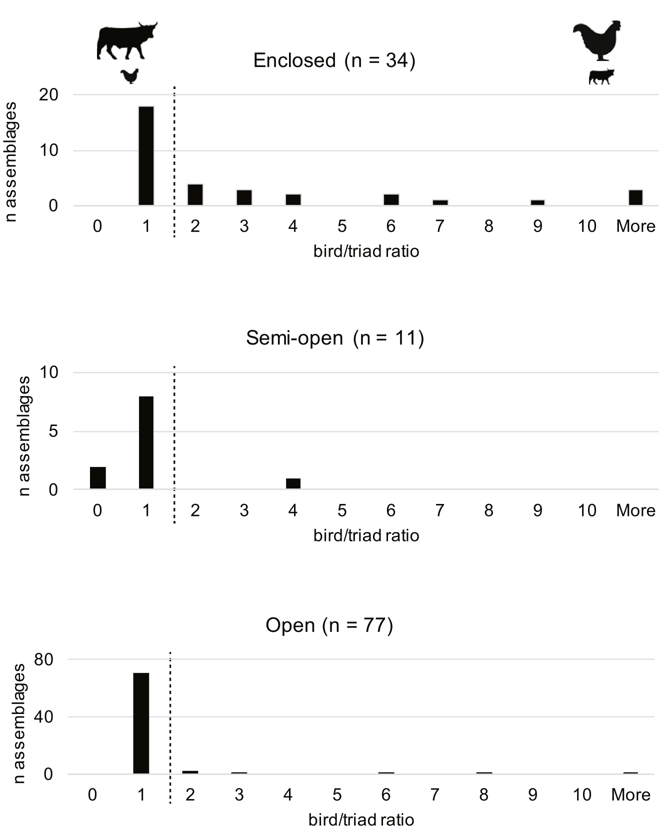

Fig. 1. Distribution of the ratio of bird bone numbers compared to the number of bones of the triad for each assemblage. Two assemblages from open layers and one from a semi-open structure have been excluded because they yielded no bones of cattle, pig, sheep or goat.

However, six of the open contexts (7.8%) deliver more bird remains than mammal remains, with ratios higher than two for four of the contexts. All are sieved samples recovered from high-status sites. One of those assemblages coming from the kitchen floor of the Benedictine abbey of Ename (15B-16A c.) presents a bird ratio of six, but it delivered only 12 remains of birds and two of the triad (Ervynck and Van Neer, 1992), which is too small to be statistically significant. The other assemblages come from refuse layers associated with sites of high social status. Two of them come from the Comtes castle in Namur (13d-14a c. and 14–15 c.; De Cupere and Boone, 2000), two from the castle of La Roche-en-Ardenne (13 and 15B-16A c.; Krznaric, 2004) and one from the castle (or Burcht) of Londerzeel (13d-14A c.; Ervynck et al., 1994). Among the assemblages excluded from Fig. 1, because they yielded no remains of the triad, two of them also represent sieved samples from high status sites; namely the castle of Boussu (bird NISP = 207, 17th c.; Alen et al., 2005) and the Cistercian abbey of Clairefontaine (bird NISP = 2, 13B-15A c.; Goffette, 2012).

Within the enclosed structures, the highest bird ratio is found in a cistern from the castle of Boussu, which delivered 365 bird bones but only nine bones of the triad (16d-17a c.; Alen et al., 2005). Other contexts with high bird ratios include two cesspits from abbeys, one from the Cistercian abbey of Clairefontaine (1730–1789; Goffette, 2012) and the second located in the priory of the Benedictine abbey of Ename (17th c.; Cooremans et al., 1993), one water well from the castle of Logne (13B-15A c.; Goffette, 2013) and one cesspit from the urban prison of Het Steen in Mechelen, which delivered no food refuses indicative of a rich diet, with the possible exception of a high proportion of poultry (13d-14a c.; Lentacker et al., 2007).

Surprisingly, the semi-open structures show lower quantities and ratios of bird remains than the open layers. From the dataset, it is unclear whether this is a consequence of the fewer semi-open structures considered (only 11) or whether it is related to taphonomic processes. Per se, a thick horizontal refuse layer could be as protective as a pit, at least for the deepest part of the material (see Méniel, 1998). The recovery method does not seem to play any role here, since more semi-open structures have been sieved (33%) than open layers (12%).

The analysis of Benoît Clavel (2001a) in Northern France highlighted a higher proportion of fragile bones in structures from urban contexts compared to those from rural contexts, which he linked with poorer conservation conditions in rural contexts. The results of the present study show the contrary: with a higher ratio of birds in rural contexts (3.4) compared to urban contexts (0.5). However, this is explained by the fact that most of the rural sites considered are in fact large establishments, such as castles or abbeys, which reproduce at a smaller scale the beneficial effects of the urban environments on the preservation of bird bones.

3.3. Taxonomic identification rate and richness

Here, we only consider the assemblages where unidentified bird counts have been performed (106 out of 141), excluding the assemblages mixing open and enclosed structures. Given the protective effect of the enclosed structures on bone material, one could expect higher taxonomic identification rates of bird remains, resulting in a smaller number of unidentified bird remains than in the other two categories. However, the mean identification rate in enclosed structures (56.4% of identified bird remains) is lower than in the open contexts (72.2%). It appears the lowest in the semi-open structures, which could again be a consequence due to the low number of assemblages in this category.

Table 2
Summary data of bird remains for the assemblages studied, for each category of archaeological structure (*HC* hand-collected, *S* sieved, *n. ass.* number of assemblage, *% ass.* percentage of assemblages).

	enclosed	semi-open	open
HC/S/HC + S (n. ass.)	15/16/3	8/4/0	67/8/4
HC/S/HC + S (% ass.)	44/47/9	67/33/0	85/10/5
Mean Bird/triad ratio	4.42	0.39	0.52
Mean identification rate	56.4% (n = 31)	55.7% (n = 7)	72.2% (n = 68)
Mean n. taxa	5.9	4	6.3
High social status (n. ass./% ass.)	9/28.1	0/0	23/71.9
Medium social status (n. ass./% ass.)	12/66.7	2/11.1	4/22.2
No high social status (n. ass./% ass.)	2/18.2	8/72.7	1/9.1
Under social status (n. ass.)	11	1	49

This lower identification rate in enclosed structures is probably related to the recovery method. Indeed, almost half of the faunal assemblages from enclosed structures have been recovered by sieving, while this rate is one-third in the semi-open structures and only one-tenth in the layers (Table 2). A previous paper highlighted the fact that identification rates of bird bones are often lower in sieved samples, because although sieving brings more remains, they are mostly small fragments hardly identifiable to a below-class taxonomic level (Goffette et al., 2017), a trend which does not apply solely to birds (e.g. Clavel, 2001b).

Following this idea, the taxonomic richness, expressed by the number of taxa identified, is expected to be lower in enclosed than in open structures, due to the lower identification rate. Fig. 2 compares the taxonomic richness to the identification rates, separately for the assemblages recovered by hand and by sieving, from enclosed structures and open structures. Whatever the method of recovery, a higher identification rate (identified versus unidentified bird remains) does not lead to the identification of more taxa. To the opposite, the type of structure seems to impact the taxonomic richness but in a limited extent. Although the number of taxa is indeed lower in the enclosed structures (mean number of taxa is 5.9) than in the open contexts (6.3), the figures are very close while the few semi-open structures present in the dataset yield a lower mean number of taxa (4).

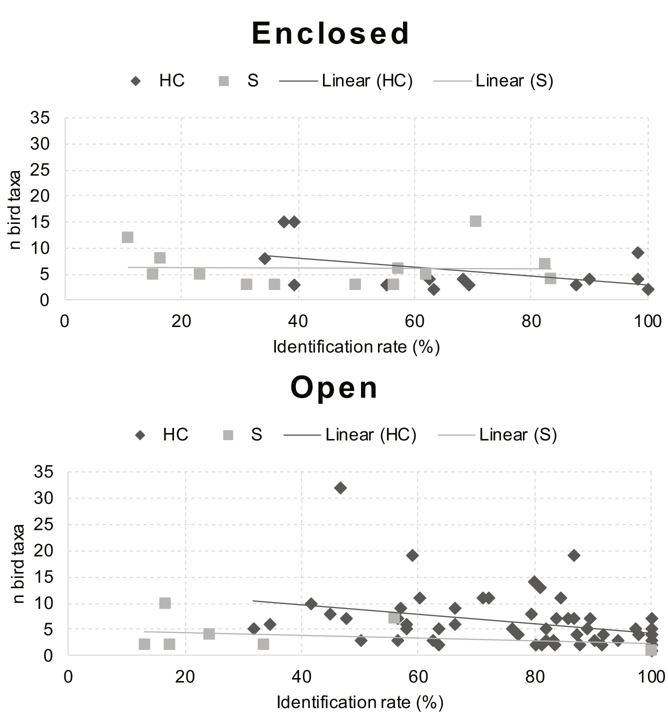

Fig. 2. Taxonomic richness compared to the identification rates, plotted separately for assemblages recovered by hand and by sieving from enclosed and open archaeological structures, with the linear trendlines. *HC* hand-collected, *S* sieved.

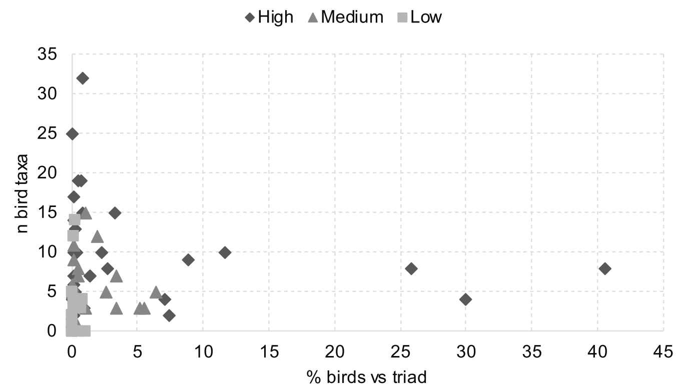

Fig. 3. Ratio of bird versus triad remains compared to the number of bird taxa identified for the assemblages of high, medium and low social status.

3.4. *What do bird remains say about social status?*

As part of the meat suppliers, birds play an essential role in the reconstruction of diet and social condition of past people. Determining the significance of birds used as a social marker can be studied by analyzing sites inhabited by people of known condition. The risk exists of a circular reasoning as the richness and diversity in bird taxa is frequently used as social marker (e.g. Albarella and Thomas, 2002; Jaques and Dobney, 2002; Serjeantson, 2006; Stone, 2006; Clavel, 2001a). However, this risk appears limited as the social status of a site or assemblage is not defined relying solely on bird remains, but also on all archaeological and historical information available.

In Figs. 3–4, the ratio of bird remains versus the triad is confronted to the number of bird taxa identified for the different assemblages whose social status have been discussed in the archaeological publications dedicated to the sites (see Goffette et al., 2017). Defining the social status of an assemblage based on faunal remains is not straightforward and several aspects need to be considered (e.g. Ervynck et al., 2003). On the opposite, identifying assemblages suggesting a low social status is perhaps even more difficult and sites clearly defined as of low social status are almost absent from the Belgian archaeological record (Ervynck and Lentacker, 2008). However, here we considered an assemblage to be from high status consumers when it delivered evidence

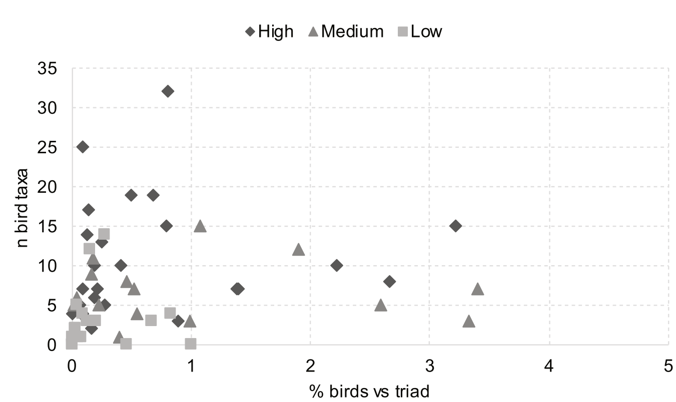

Fig. 4. Ratio of bird versus triad remains compared to the number of bird taxa identified for the assemblages of high, medium and low social status (detail of Fig. 4).

of rich and varied food, of medium status consumers when it delivered evidence of some purchasing power but without exclusive food, and of low status consumers when it only delivered basic food. Four sites delivered no remains of the triad and were excluded from the graphs.

It is interesting to note that sites of low social status all show a proportion of bird remains smaller than those of the triad, apart from one assemblage where they are equal. It is a faunal assemblage from the Raversijde fishing village in Oostende (15th c.; Pieters et al., 2013) that has only delivered two remains of the triad and two of unidentified birds and is therefore not significant. Sites with a higher proportion of bird remains are exclusively high or medium social status sites. On the other hand, most of those contexts characterized by a high social status show a proportion of bird remains lower than that of the triad. Therefore, while a high proportion of bird remains is indicative of high social status, not all assemblages associated with high social status sites yield high proportions of birds. The same applies to sites of medium social status.

This preponderance of bird remains over those of the triad in some contexts denoting a rich diet could be related to the type of archaeological structure from which they originate. As we have shown above, enclosed structures provide proportionally more bird remains. However, this argument can be rejected because most of the assemblages coming from rich contexts are of 'open' layers (71.9%, Table 2).

The other variable that can inform about social status is the taxonomic richness of birds. A high taxonomic richness automatically implies the presence of a diversity of wild birds, the access to which was a privilege of the nobility (Albarella and Thomas, 2002; Jaques and Dobney, 2002). As an example, a survey of seigneurial sites in Northern France dated between the 13th and the 16th c. highlighted the presence of no less than 23 different bird taxa (Clavel, 2001a). This trend reflects well in the dataset since the archaeological assemblages yield an average of 9.6 taxa in sites of high social status, 6.2 taxa in sites of medium social status and 3 taxa in sites of low social status. These sites with a lower social status all yielded five or fewer taxa (Figs. 3–4), apart from two 15th century pits excavated in the Raversijde fishing village located near the North Sea coast. They delivered 12 and 14 taxa respectively (Pieters et al., 2013), most of which are wild birds. This observation calls for caution because a large variety of game birds is generally seen as indicative of a high social status, which is not the case for the site considered. Raversijde is a fishing village where one would not necessarily expect such a high rate of wild birds, usually restricted to sites of high social status. But the wild birds found are mainly marine species, in particular gulls. The high presence of wild birds most probably refers to a rather opportunistic behaviour. On the Belgian coast, birds were literally fished; with hooks placed in fish pieces (Bauwens, 1995). The purpose of catching these birds is unclear, but the consumption of gulls on the Belgian coast by fishing communities is documented, even for recent periods (Rappé, 1995). In the Netherlands, gulls have sometimes been caught for the insulation power of their feathers. Duvets were filled with dried gull skins to which the feathers and down were still attached (Swaen, 1948). In contrast to the coastal site of Raversijde, seabirds are always rare during the medieval and modern periods at inland sites, before they spread through the continent during the last two centuries. Gulls have only been recorded in inland sites of high social status, such as a black-headed gull in the castle of Boussu (16B-17th c.; Alen et al., 2005) or in the Bourgeoise house of Schepenhuisstraat in Gent (17-18th c.; Brinkhuizen et al., 2018) and an unidentified larid at the castral motte of Hoge Andjoen in Werken (10-12th c.; Demandt, 1997).

On the contrary, most sites of medium and high social status deliver five or more taxa. Unsurprisingly, the richest assemblages in number of taxa (more than 15) come from sites of exceptional social status, such as the castle of Boussu (32 and 19 taxa; Alen et al., 2005), the Boudelo Abbey in Sinaai (25 taxa; Gautier and Van Neer, 1991), the castle (Burcht) of Londerzeel (19 taxa; Ervynck et al., 1994) or the castle of Franchimont (17 taxa; Gautier et al., 2005).

4. Conclusions

From the above-mentioned, it can be concluded that the type of archaeological structures has an influence on the faunal assemblage recovered. Enclosed structures yield higher ratios of birds with a lower identification rate, the latter being linked with the practice of sieving, which is more frequently performed for such structures. However, the taxonomic richness is little impacted by the type of structure. Although they appear less suitable for the preservation of bird remains, some open contexts yielded high bird ratios. These are sieved samples from high status sites. Bird ratio and taxonomic richness are also the highest in high-status sites, although not all high-status sites systematically yield high bird ratios, or bird assemblages with a lot of taxa. It should also be pointed out that sites with no indication of high social status can sometimes deliver a long taxonomic list (see the example of Raversijde above). In conclusion, our results call for a more systematic practice of sieving, even in open contexts such as refuse layers or floors, at least in sites of high social status. Dale Serjeantson (2001) already highlighted the importance of such structures by the study of sieved samples collected from the kitchen and refectory floors of St Gregory's Priory (England), which yielded a wealth of bird bones, including many songbirds. Other studies already pointed out the importance of using samples of large size (Bartosiewicz and Gál, 2007; Goffette et al., 2017; Lyman, 2015), which should be reflected in archaeological sampling strategies. Moreover, although sieving does not necessarily bring additional species to the taxonomic list (Goffette et al., 2017), it still allows the recovery of small skeletal parts that would be missed when the material is hand-collected. The conclusions of the present study may also apply to other categories of food animals, such as fish.

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