



Have birds ever mattered? An evaluation of the contribution of avian species to the archaeozoological record of Belgium (Iron Age to recent times)

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Received: 10 February 2017 / Accepted: 17 November 2017
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Abstract

This preliminary study aims to document general trends in the representation of bird remains in anthropogenic contexts from Belgian archaeological sites. A large dataset is analysed, consisting of 186 faunal assemblages from 79 different sites. The contexts included vary in terms of their taphonomic nature (refuse layers, latrines, pits, etc.) and date, ranging from the Iron Age to the modern period. The characteristics of the study area and the dataset as a whole are described, with a focus on identification rates, past and present avian taxonomic diversity, and relative abundance of bird remains compared with domestic mammal remains. The impact of recovery methods (sieving or hand collecting) on these various aspects is also evaluated. A taxonomic analysis describes the diversity and abundance of the different groups of species that are encountered and shows which habitats were preferentially exploited for the hunting of wild birds. The study shows that there is significant taxonomic diversity across the dataset. However, this diversity is not necessarily present in each separate archaeological context, as the number of remains identified by taxon is generally low. Some species or groups of species are ubiquitous and dominant, in particular domestic fowl. Although this analysis is broad and exploratory, it is believed that it will serve as a sound methodological basis for future, more detailed studies focusing on the role that birds played in past human societies during specific chronological periods.

Keywords Archaeology · Archaeozoology · Belgium · Birds · Dataset · Faunal record

Introduction

Over the past few decades, birds have received growing attention as a component of the zoological record of archaeological sites. This trend was made explicit by the foundation, under the auspices of the International Council for Archaeozoology, of a Bird Working Group, which held its first meeting in

Madrid, in 1992. It produced a first exploration of the main issues (at that time) relating to bird archaeozoology (see the papers published in *Archaeofauna* 2, 1993). Among others, a contribution was presented in which it was remarked that in medieval and post-medieval sites from Flanders, Belgium, bird remains were always rather rare (Ervynck 1993). Even extensive sieving campaigns, developed in Flanders from the late 1980s on, seemed—surprisingly—not to help the study of birds significantly (although they yielded a wealth of fish remains; see Van Neer and Ervynck 1993).

A number of possible explanations for this phenomenon were put forward, including pre- and post-depositional taphonomic factors, poor preservation, inadequate sampling techniques, identification problems and counting methodology. Two Flemish case studies were used to illustrate these issues: the medieval and post-medieval town of Gent and the late medieval castle of Londerzeel (Ervynck 1993). This paper only presented a preliminary approach. In contrast, in what follows, a thorough re-evaluation of the contribution of avian species to the archaeozoological record will be made on the basis of a complete survey of the avian archaeozoological

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s12520-017-0571-9>) contains supplementary material, which is available to authorized users.

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record from an enlarged study area, now covering the whole of Belgium (of which Flanders is only the northern part), and representing a broader chronology, including sites from the late Iron Age, the Roman period and later epochs. This exercise is part of a larger research project, run by the principal author, investigating the role and significance of birds in former human societies on the basis of the archaeozoological dataset from Belgium (Goffette in preparation). As a first step, a critical analysis of the characteristics of the data available was undertaken; the results of which are presented here.

It should be stated that the present survey discusses only numerical and taxonomical data; the role and meaning of birds in past human societies from the study area will be dealt with in future contributions. Besides their contribution to the human diet, numerous observations illustrate the symbolic meaning of birds; human appreciation of their aesthetic attributes; and their role in art, in animal sports and—as social companions—in daily life (Cocker et al. 2013). The frequency of bird remains in archaeological contexts is therefore certainly not an indication for their former cultural importance.

Material and methods

The basis for the present analysis is a survey of the archaeozoological publications from Belgium, which tries to cover as completely as possible both the published and grey literature. In this survey, assemblages from within the same site of different dates, taphonomy or sampling methodology were kept separate. Small handcollected assemblages have been excluded from the analysis, here defined as assemblages with less than 100 remains of the main mammalian domestic meat suppliers (cattle *Bos primigenius* f. *taurus*, pig *Sus scrofa* f. *domestica* and sheep *Ovis ammon* f. *aries*/goat *Capra aegagrus* f. *hircus*, hereafter called ‘the triad’). Exceptions are made for small assemblages that belong to a site that has also yielded larger finds collections. Theoretically, the threshold applied could exclude assemblages with numerous bird remains but hardly any mammalian bones, but in the authors’ experience, such a collection has not yet been encountered in Belgian archaeology.

The decision to exclude prehistoric sites older than the Iron Age was prompted by the rarity of sufficiently well-preserved and sufficiently large archaeozoological assemblages from those older periods, by their heterogeneous taphonomic nature (especially in terms of preservation conditions), and by the fact that a number of older studies on prehistoric bird material are currently under revision (Goffette unpublished data). Due to the rarity of Iron Age assemblages (see below), what follows will mainly deal with data from the Roman, medieval and modern periods. In the study area, the Roman period ranges from 57 BC to 402 AD and the medieval period ranges from 402 to 1500 AD, while the modern period comprises all

sites younger than medieval (Slechten 2004). Each of these periods is further subdivided, into three, three and two subperiods, respectively (again following Slechten 2004). Each assemblage has been placed within a certain subperiod on the basis of the mid-point of its dating range. When this mid-point falls on the dividing line between two chronological units, the assemblage is assigned to an intermediate period. This assignment process resulted in the following chronological subdivisions:

- 1: Iron Age (800–57 BC)
- 2: Iron Age–early Roman
- 3: Early Roman (57 BC–69 AD)
- 4: Early Roman–high Roman
- 5: High Roman (69–284 AD)
- 6: High Roman–late Roman
- 7: Late Roman (284–402 AD)
- 8: Late Roman–early medieval
- 9: Early medieval (5th–9th c. AD)
- 10: Early medieval–high medieval
- 11: High medieval (10th–12th c. AD)
- 12: High medieval–late medieval
- 13: Late medieval (13th–15th c. AD)
- 14: Late medieval–early modern
- 15: Early modern (16th–18th c. AD)
- 16: Early modern–late modern
- 17: Late modern (19th–20th c. AD)

Within the context of the present literature survey, we did not re-analyse any of the bird remains. Taking into account that many different researchers were responsible for the identifications presented in the publications surveyed, working with different reference collections of differing quality, it is thus inevitable that identification issues remain. In a few cases, for example, identifications to the species level are given for remains belonging to the songbirds (Passeriformes) (e.g. Ballmann 1978), while in most other publications, less taxonomic detail is presented. When the success rates with which species names could be attached to the bones appear to differ widely (a parameter difficult to evaluate in some studies, and even impossible when the unidentified bird bones are grouped with all other unidentifiable bones), this could indeed be the result of the identification skills and possibilities of the individual researchers, although it could also be the result of the taphonomic and preservation conditions of the assemblage being studied, and its taxonomic diversity. In any case, in addition to a number of taxonomic determinations that could be considered problematic, general unevenness in the level of precision of the identifications remains. Furthermore, as pointed out by Stewart (2005), the modern geographical distribution of the bird species also often influences the identification of archaeological remains. Indeed, species that archaeozoologists do not especially expect to

occur in a given geographical area today may have been present in the past, either because of their former, wider distribution or because of human transport. The number of candidate taxa to be taken into account is thus often larger than is generally thought.

Especially problematic is the categorisation of the remains of bird species of which both the wild and the domestic form occur in the study area. Without doubt, different researchers will have treated the distinction between mallard (*Anas platyrhynchos*) and domestic duck (*Anas platyrhynchos* f. *domestica*) and between greylag (*Anser anser*) and domestic goose (*Anser anser* f. *domestica*) differently. However, within the framework of the present survey, this problem could not be resolved. In general, it is the authors' impression that within the studied dataset, most of the *Anser anser* remains represent the domestic form, while most of the *Anas platyrhynchos* finds relate to wild birds. Without further analysis, this impression cannot be proven, but it would be in accordance with the general idea within northwestern European archaeozoology that the domestic form of the greylag goose (*Anser anser* f. *domestica*) was already present during the Iron Age (Benecke 1994: 376), while the local domestication of the mallard (*Anas platyrhynchos*) is a late, perhaps even medieval phenomenon (Harper 1972; Albarella 2005).

Regarding sampling methodology, the analysis will distinguish between handcollected and sieved assemblages. We acknowledge that even within the individual case studies, excavators did not always use the same mesh widths while sieving samples. Equally, sample volumes will have varied, and their precise dimension is not always noted in the publications or reports. Still, the common practice in Belgian archaeozoology of using at least a 1-mm mesh width more or less guarantees that sieved assemblages will be comparable among each other.

The inventories of the bird finds rely on specimen counts. We realise that, especially when such counts are compared with those for mammalian remains, methodological problems may arise. Alternative approaches, such as MNI estimates, have not been attempted because they, too, present methodological issues (O'Connor 2003). We therefore prefer using the original counts and not a derived estimation. Of course, we realise that sometimes, partial (or even complete) skeletons are present in some assemblages without this having been specifically noted in the publications. However, except for the Mithras temple at Tienen (see below), it is the informed guess of the authors that such occurrences are extremely rare.

The taxonomy of the wild bird species is based upon the IOC World Bird List (Gill and Donsker 2017), while that of the domestic forms follows Bohlken (1958, 1961). Before the numerical and taxonomical characteristics of the avian dataset from Belgium are described and analysed, a short introduction to the sites and archaeological contexts sampled, and to their geographical context, are presented.

Sites and assemblages

The characteristics of the sites and assemblages included in this survey are listed in Table S1 (Supplementary material). In total, 79 sites, comprising 186 archaeozoological assemblages, fulfilled the conditions for this survey. The bibliographical references to the archaeological and the archaeozoological studies can be found in Table S1.

From the Iron Age, there is almost no material at all, a general problem in Belgian archaeozoology. A single site from the Iron Age and two sites from the transition period to the Roman epoch are the only entries in the database.

Assemblages from Roman times are better represented, with a clear emphasis on the only two urban sites from the study area, Tongeren and Tournai, and a number of small towns (*vici*). Data are also available from two fortifications, Oudenburg and Braives, while *villa* sites with a good number of well-preserved items are only known from the south of the country. For both Flanders and Wallonia, Roman rural sites, i.e. smaller settlements and farms, are lacking in the database. Most Roman contexts represent general refuse layers or the secondary fills of pits. At Tongeren, some primary deposits of consumption refuse were unearthed, while other 'special' deposits were excavated at the ritual sites of Tienen and Liberchies. Tienen yielded a number of pits associated with a *mithraeum*, a temple for Mithras. They were mainly filled with the leftovers of a ritual banquet during which about 280 chickens (*Gallus gallus* f. *domestica*) had been consumed. The second site was defined as a *fanum*, a small temple, but the food remains are to a large extent comparable to those from a *mithraeum*.

For the post-Roman periods, the first millennium AD is poorly represented. There are some assemblages from sites that represent continuity with late Roman times, and some from early feudal fortifications (Brugge, Werken). Only after 1000 AD does a diverse spectrum of data become available, derived from varied social contexts, such as urban sites, abbeys and castles, and from archaeological features with taphonomic characteristics ranging from general refuse contexts to specific primary deposits linked to single households (cess-pits), the latter of which present excellent preservation conditions for animal remains. In general, rural sites are again underrepresented in the archaeozoological record of the post-Roman epoch.

The study area: geographical characteristics and site distribution

Belgium is a small country with an area of about 30,000 km² that has a rather flat relief, with altitudes rising progressively from the coast to ca. 700 m a.s.l. in the Ardennes (in the south of the country). For the purpose of our analysis, a geographical subdivision of the study area can best be made on the basis

of phytogeographical districts (Massart 1910; Tanghe 1975), which are the result of such factors as soil composition, climate and elevation (Fig. 1). The Lorraine district, in the southernmost part of Belgium, shows a hilly relief composed of an alternation of ‘cuestas’, or ridges. It is heterogeneous both in soil composition (although limestone is dominant) and climate, with higher temperatures in the south than in the north. The Ardenne district is a hilly plateau with an average elevation of 400 m, which is cut by valleys and covered by large forests growing on argillaceous and siliciclastic rocks. This landscape extends eastwards, where the subsoil composition turns into carbonate rocks, defining the Central Eifel district. The Meuse district extends southward from the valley of the river Meuse and is again strongly heterogeneous, with siliciclastic, carbonate and argillaceous rocks alternating with silt deposits. The Brabant (or Hesbaye) district is a plateau made of gently rolling hills mostly covered by thick deposits of fertile loess. Pleistocene sandy soils are present in the Flemish and Campine districts, the latter having very poor soils. The Flemish district is characterised by a maritime climate, while the Campine district is under much more

continental influence. Finally, the Maritime district refers to land at low elevation along the coast and the Scheldt estuary that is covered by Holocene clay deposits. Along the entire coast, a small strip of sand dunes is present.

Through time, major environmental changes have occurred as a result of anthropogenic pressure. The first wave of deforestation started as early as the Neolithic and culminated during the Roman period. However, the strongest modifications occurred later, with the progressive embankment in the Maritime district that took place between the end of the first millennium AD and the twelfth century, in order to mitigate the effects of the tidal system and allow permanent grasslands (so-called polders) to be maintained (Verhulst 1995). Further inland, deforestation took place between the tenth and the middle of the thirteenth century AD in the Flemish and Brabant districts (Tack et al. 1993) and somewhat later in the Campine district (during the late Middle Ages) (Arts et al. 2007), whereby wooded landscapes were converted into fields and pasture land. The vegetation history of the Meuse, Ardenne, Central Eifel and Lorraine districts is poorly known, but they seem to have been less impacted by deforestation processes, and at a

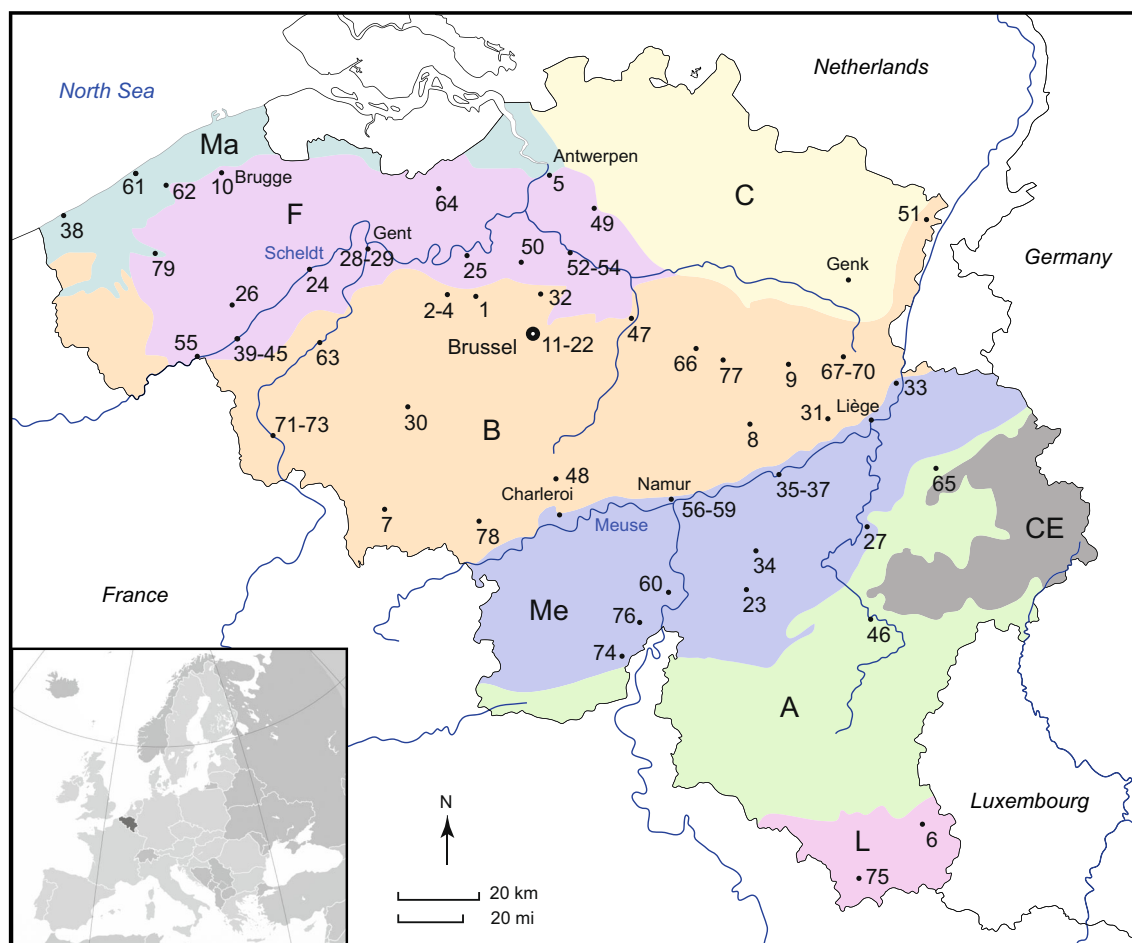


Fig. 1 Map of the study area (present-day Belgium), showing the phytogeographical districts used to differentiate the habitats in which wild birds occurred. The numbers correspond to the site codes listed in

Table S1. Ma Maritime district, F Flemish district, C Campine district, B Brabant district, Me Meuse district, A Ardenne district, CE Central Eifel district, L Lorraine district

later date, than the more fertile areas situated north of the river Meuse (Verhulst 1990).

The sites in the present overview cover the entire Belgian territory, but their distribution shows some discrepancies. Bones rapidly degrade in sandy soils, which explains the absence of sites in the Campine district. The same probably applies to the coastal zone of the Maritime district, where few sites with bird remains are present. Although the Flemish district is also characterised by sandy soils, more sites there contain bird remains because of the region's dense habitation, with sites containing anthropogenic structures offering better preservation conditions. Assemblages are also absent from the Central Eifel district and are scarce in the Ardenne district. Bone preservation was negatively impacted there by the (acidic) soil composition and probably also by the relatively thin organic cover on top of the bedrock. Moreover, these two districts are characterised by extensive forest cover, low habitation density and slow recent economic development, thus limiting chance finds and ensuing archaeological rescue excavations.

The numerical characteristics of the dataset

General

Table 1 provides an evaluation of the numerical importance of handcollected versus sieved assemblages for the dataset as a whole, and for the main three periods (Roman, medieval and modern). The data from assemblages belonging to a transitional period have been split equally between the two periods they cover.

Clearly, sieved assemblages are still a minority in the Belgian archaeozoological record, especially for the Roman period. The number of handcollected assemblages is spread fairly equally over the three main periods, although the average number of bird finds per assemblage differs per period, with the lowest number for the Roman and the highest for the modern period. As might be expected, handcollected assemblages in general yield higher below-class identification rates, in some cases exceeding two thirds, while from sieved

collections, only half of the finds could be identified to a more detailed taxonomic level than 'birds'. It should be noted that this last figure is distorted by the sieved content of a ritual pit near the Roman temple of Mithras, excavated at Tienen. This assemblage was dominated by domestic fowl, yielding 7644 identifications and a very high identification rate. The distortion caused by this context is demonstrated by the identification rates for sieved assemblages from the medieval and modern periods, which are clearly lower than the average for all periods together. Without the data from Tienen, the identification rate from the sieved collections falls to 42%.

Although the number of sieved assemblages is relatively low, the number of bird remains from these sieved contexts is similar to that from the handcollected contexts (all periods combined). Of course, the context from Tienen again biases the comparison, but even without this context, there is still a substantial number of remains from sieved samples.

Number of finds per assemblage

Although the total dataset is relatively large, the number of finds per assemblage varies. Within the combined handcollected dataset (Fig. 2), 42% of the assemblages contain fewer than 50 finds, 60% fewer than 100 and 79% fewer than 200, while only 9% contain more than 500 bird bones. Two assemblages, both from the medieval castle of Boussu, are characterised by more than 1000 finds each.

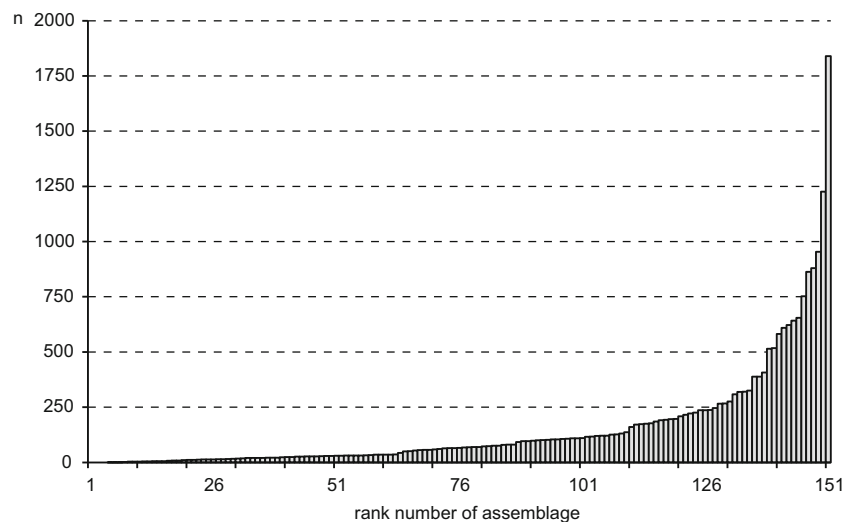
The picture is more or less the same when only the identified bones are taken into account (Fig. 3). In that case, 49% contain fewer than 50 below-class identifications, 70% fewer than 100 and 86% fewer than 200, while only 4% yielded more than 500.

The values for the sieved assemblages (Fig. 4) prove that high numbers of identifications can be achieved through detailed sampling, but that this is only the case for a minority of the samples, i.e. those from the cesspits from house 'De Cop' at Dendermonde and from the town prison 'Het Steen' at Mechelen, and those from the well at the Castle of Logne and the ritual pit from the Roman Mithras temple. In all four cases, the sample volume was very large. However, the

Table 1 Summary data for the collections studied (*HC* handcollected, *S* sieved). Three assemblages for which handcollected and sieved finds were treated together in the publications do not appear in the 'HC' or 'S' counts. In the detailed counts per historical period, a single Iron Age assemblage and two assemblages with broad dating (all handcollected) have been excluded

Period	All			Roman		Medieval		Modern	
	HC, S, HC + S	HC	S	HC	S	HC	S	HC	S
Collection	186	151	32	44.5	5	65.5	16	37	11
Number of assemblages	186	151	32	44.5	5	65.5	16	37	11
Total birds	49,026	22,775	26,051	3389	10,195	10,762.5	8866.5	7628	6989.5
Total birds identified	29,065	15,940	12,951	2671	7703	7515.5	3463	4880	1785
Total % identified	59	70	50	79	76	70	39	64	26
Average total birds per assemblage	264	151	868	76	2039	164	554	206	635

Fig. 2 Number of bird remains per site ranked in order of increasing abundance: handcollected finds ($n = 151$)



general lower identification rates for sieved material (see Table 1) have to be taken into consideration: out of the 32 sieved assemblages, 18 still yielded fewer than 100 bird identifications (Fig. 5).

Identification rates

In order to evaluate the variability in identification rates among the assemblages, collections containing fewer than 25 bird remains were excluded from the analysis. This was done in order to avoid random effects due to small sample size. In the handcollected assemblages, there is a strong tendency towards high identification rates (Fig. 6). It should be noted that the 15 assemblages for which the number of unidentifiable bird bones was not tabulated separately from other *indeterminata* (producing bird ‘identification rates’ of 100%) have been excluded from the analysis.

The sieved samples show wide variability in identification success (Fig. 7). In general, there is a tendency towards low

percentages, with eight of the 25 samples not reaching 20%. Here, four cases in which the number of unidentifiable bird bones is not counted separately from other *indeterminata* have been excluded from the analysis.

Taxonomic diversity

Any evaluation of the taxonomic diversity of the assemblages has to take into account that the number of taxa present will be statistically dependent upon the number of identified finds in the assemblage. Figure 8 shows this relationship for the handcollected assemblages. Two remarkable collections have relatively high finds numbers but a low number of taxa, namely, those from the *fanum* of Liberchies (a ritual deposit with 771 bird identifications and only two taxa present) and a well from the *vicus* of Waudrez (with 563 bird identifications and 7 taxa present).

The relationship between number of taxa and number of identifications shows more variation (Fig. 9). Again,

Fig. 3 Number of identified bird remains per site ranked in order of increasing abundance: handcollected finds ($n = 151$)

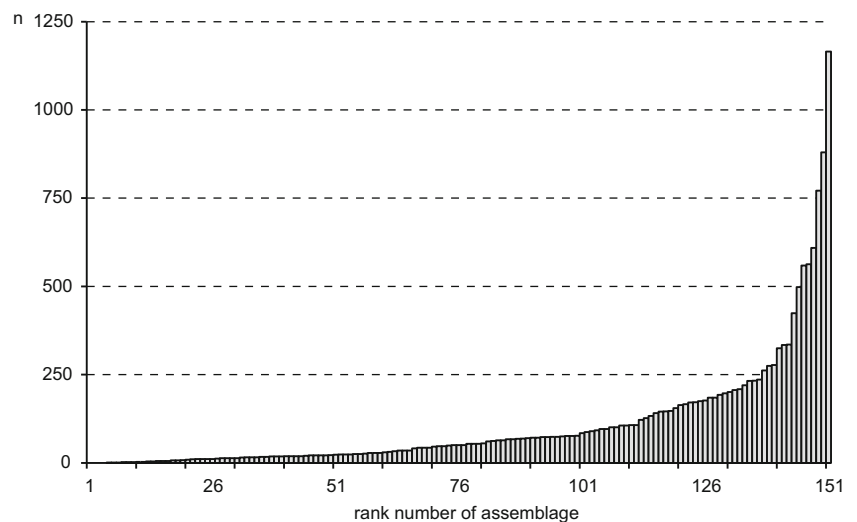
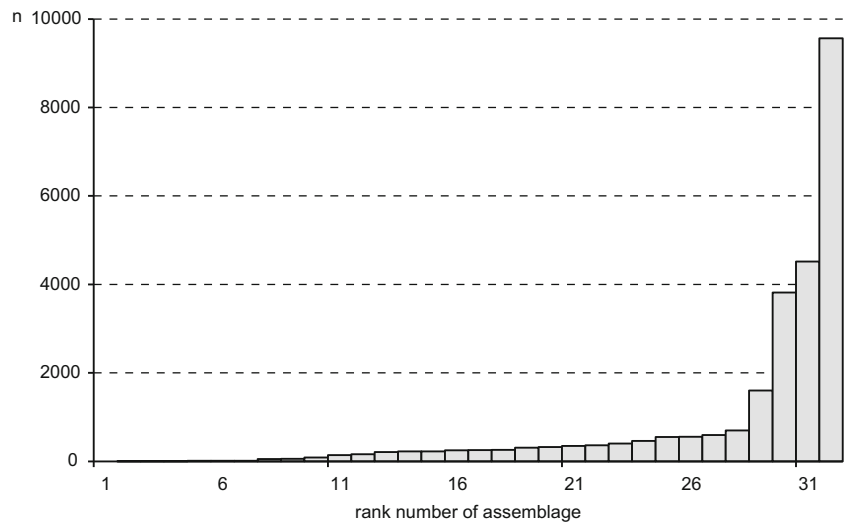


Fig. 4 Number of bird remains per site ranked in order of abundance: finds from sieved residues ($n = 32$)

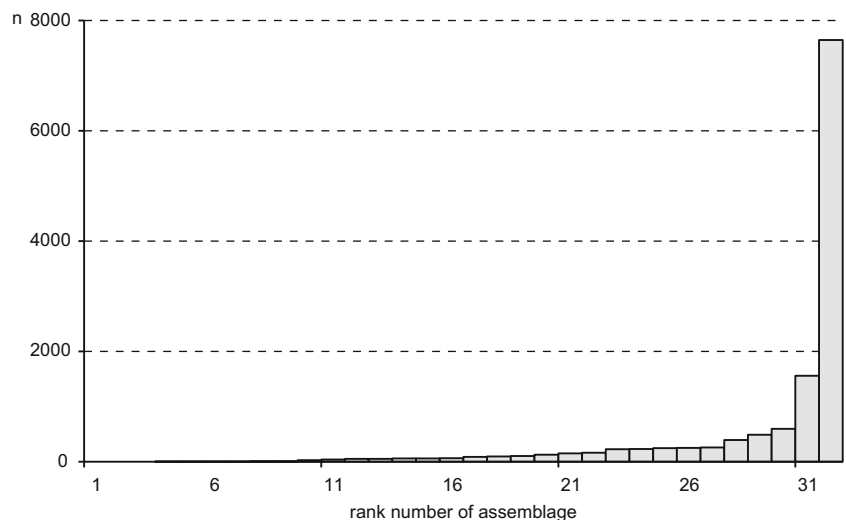


the Mithras context severely distorts the graph, because of its high number of finds and low number of taxa (as this collection is dominated by domestic fowl). A detail of the graph (Fig. 10) provides a better image. The curves for both the handcollected and the sieved samples have yet to reach a plateau.

Disregarding the effect of sample size, the frequency distribution of the number of taxa recognised in the handcollected assemblages shows that most collections have low diversity (Fig. 11). Even when small assemblages are left out, it remains the case that only a minority of the collections comprise more than 10 bird taxa. The maximum of 32 taxa is reached by an assemblage from the medieval castle of Boussu. The abbey of Boudelo, with 25 taxa, is next in terms of number of taxa.

Surprisingly, the sieved samples also show low taxonomic diversity, with a maximum of only 15. Most of the assemblages, even those with high finds numbers, yielded fewer than 10 taxa (Fig. 12).

Fig. 5 Number of identified bird remains per site ranked in order of abundance: finds from sieved residues ($n = 32$)

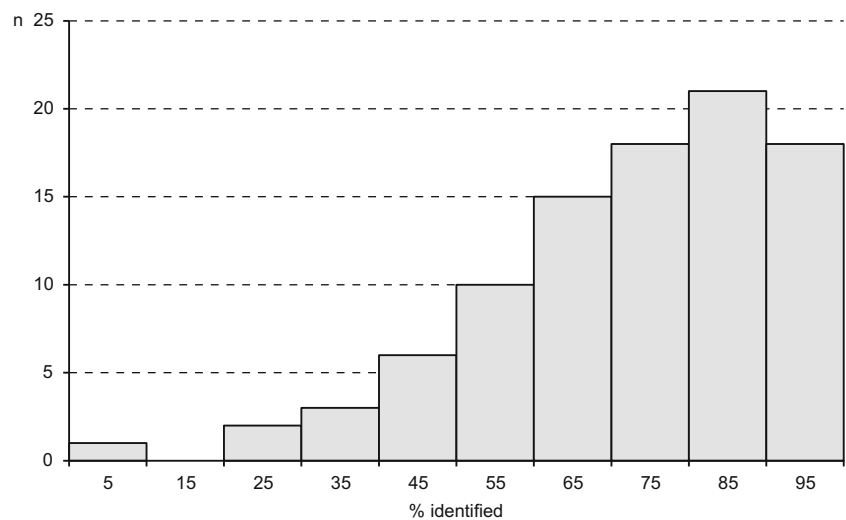


Relative abundance of bird remains

Methodologically, it is virtually impossible to evaluate the frequency of bird remains versus that of other groups of animal remains from the same archaeological features, because pre- and post-depositional taphonomic factors and the chance of recovery and identification differ widely. Acknowledging this, we compared the number of finds of the ‘triad’ of sheep/goat, cattle and pig with the total number of bird remains (identified and unidentified), not so much to evaluate the ratio of bird bones versus finds from the ‘triad’ per se, but, rather, to visualise the variation in this ratio among assemblages and, thereby, obtain some insight into the importance of bird remains in the archaeozoological record of the assemblages studied.

For most of the handcollected assemblages, the ratio is lower than 0.2 (Fig. 13), while for the sieved samples, it is in most cases lower than 3 (Fig. 14). These calculations are made by comparing all bird bones (including the unidentified

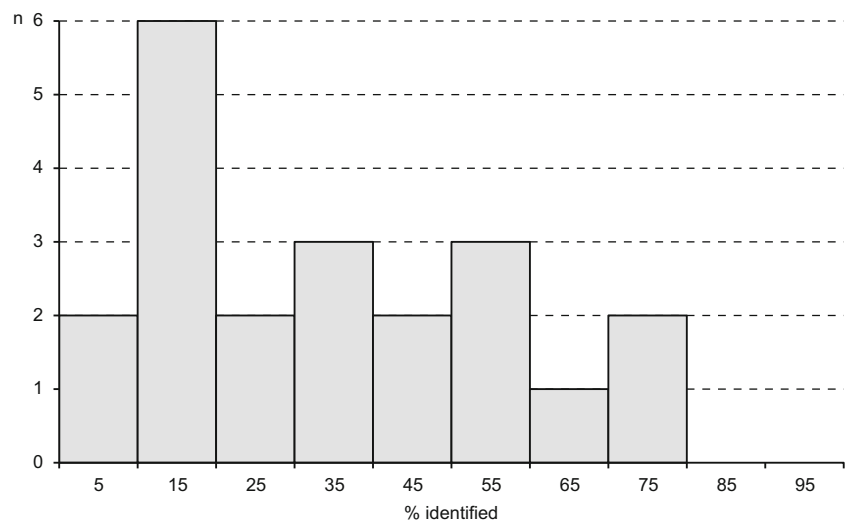
Fig. 6 Distribution of the identification rates per assemblage of handcollected material ($n = 109$; only assemblages with more than 25 finds have been taken into account)



ones) with only the identified bones from the ‘triad’. If only the identified bird bones had been taken into account, the ratios would be considerably lower (see Table 1). Using the total number (both identified and unidentified) of the remains of the ‘triad’ in the calculations is of course impossible because the unidentified bone fragments from sheep/goat, pig and cattle are not kept separate from other unidentified mammal remains.

That the ratio is generally higher for the sieved samples than for the handcollected assemblages seems logical, since bird bones are generally smaller (and often more fragmented) than skeletal elements from the ‘triad’. However, given the fact that sieved samples will always have low finds numbers for the ‘triad’, precisely due to the large size of these finds, the ratio of bird versus ‘triad’ is still surprisingly low. The taphonomic aspects of many assemblages (e.g. reworked refuse layers), and resulting poor preservation conditions, undoubtedly explain part of this pattern, but they probably do not completely explain the observed rarity of birds (see below).

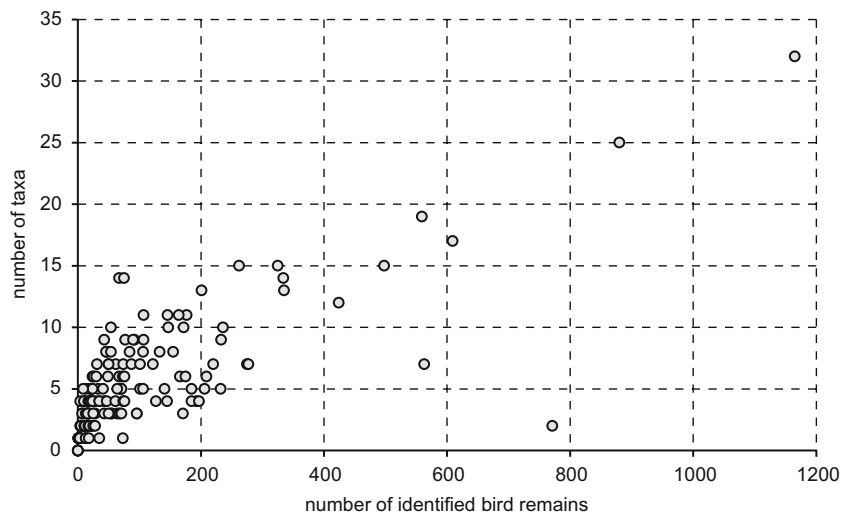
Fig. 7 Distribution of the identification rates per assemblage of sieved finds ($n = 25$; only assemblages with more than 25 finds have been taken into account)



Assemblages per period

General remarks on the chronological characteristics of the dataset per period have been made above (Table 1). Figure 15 shows the distribution of these assemblages by chronological period (see [Material and methods](#), above, for date ranges). Contexts from transitional periods are usually rare because of the short duration of occupation of sites producing these assemblages. In Belgium, this seems to be true up to the end of the high medieval period (period 11). However, this is followed by a richer dataset of assemblages that had to be placed into the transition phase from the high to the late Middle Ages (period 12). As might be expected, well-defined, chronologically restricted late medieval contexts (period 13) are abundant, as are assemblages representing the transition from the medieval to the modern period (period 14). Without doubt, these patterns result from the idiosyncrasies of the chronological attribution of archaeological ceramic finds, which often do not match the strict subdivision of

Fig. 8 Number of handcollected identified bird remains versus number of taxa identified, per assemblage ($n = 151$)



periods used in historical research. In earlier periods, the change in material culture, e.g. from the late Roman to the early medieval period, is much more pronounced.

An attempt was made to investigate whether the taxonomic diversity per assemblage differs among the three historical periods, but no significant differences or trends were revealed (data not shown here). Similarly, an evaluation of possible differences or trends in the ratio of bird remains versus bones from the ‘triad’ for the three historical periods yielded no results (data again not shown here).

The impact of recovery methodology

Given the results presented above, the issue of the impact of sieving on the composition of the bird remains within the assemblages can be reassessed (see [Introduction](#)). Figures 4 and 5 suggest that, taking into account the fact that bird bones are often rare on sites (Figs. 2 and 3), sieving can help to augment the number of bird remains recovered. However,

sieving campaigns seem only to have considerable success for a limited part of the assemblages (although the volume of some of the sieved samples will have been too small to be effective). This success is also negatively influenced by the lower identification rate for bird remains from the sieved samples (Fig. 7) compared with the handcollected specimens (Fig. 6). As a very rough conclusion, we can say that, in some instances, sieving leads to considerably more bird remains, which, however, are often unidentifiable below the taxonomic level of class. However, the sieving exercise can still be useful and informative for other reasons (see below).

Surprisingly, the taxonomic diversity is not higher in the sieved than in the handcollected assemblages (Figs. 11 and 12). Low identification rates for the sieved samples again play a role here, but the possibility should also be considered that many of the bones in the sieved residues are mainly small skeletal elements (or bone fragments) from the taxa already present in the handcollected group. For the 16 sieved samples that have a handcollected counterpart (Table S1), we checked,

Fig. 9 Number of sieved identified bird remains per assemblage versus number of taxa identified ($n = 32$)

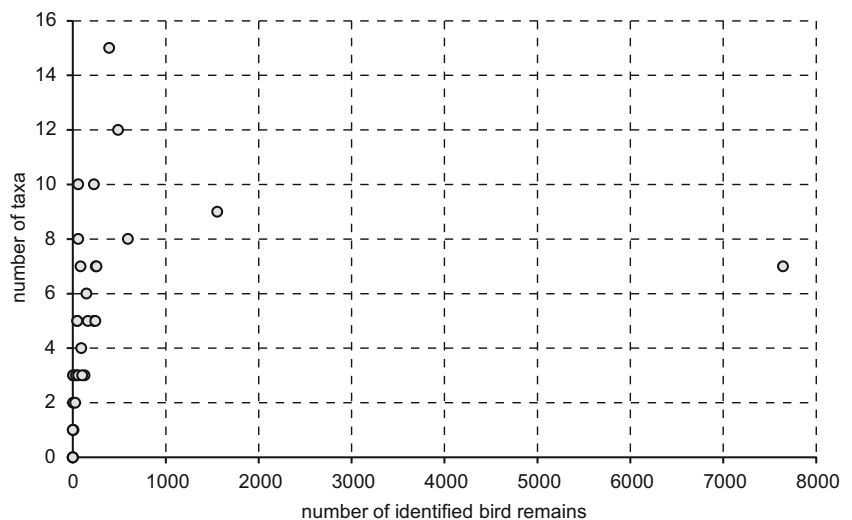
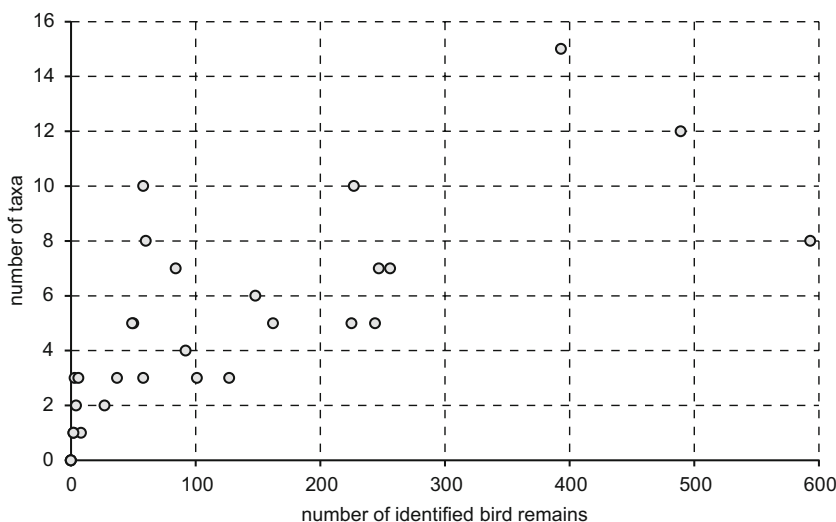


Fig. 10 Number of sieved identified bird remains per assemblage versus number of taxa identified (detail of Fig. 9)



using the original publications, how many new taxa were added through sieving. Of course, this is a coarse approach, as sample size will influence this comparison, as will the inherent local taxonomic diversity of the archaeozoological record. In ten of the cases, no new taxa were added by sieving, while in five of the cases, a single new taxon was added. For only one assemblage were two new taxa added to the identification list, which is the maximum yield to be detected from the databank. It should be stated that, in most cases, the taxa added are ‘truly’ new to the archaeological context studied, as they cannot represent a description at a different taxonomic level of bird remains already present in the handcollected assemblage. The new taxa yielded by five of the sieved samples are Passeriformes, one of which is identified as song thrush (*Turdus philomelos*). In these cases, it is clear that the tiny bones of small passerine species will have been missed by the archaeologist in the field during hand collection and could only have been recovered by sieving. Two contexts delivered bones of larger species: wood pigeon (*Columba palumbus*)

and Eurasian sparrowhawk (*Accipiter nisus*) in one case, and domestic pigeon (*Columba livia* f. domestica) in another. Bones of taxa of this size are regularly collected by hand. Therefore, their presence being limited to sieved samples in these two contexts is probably due to random effects or perhaps to less meticulous excavation.

As already mentioned, the taphonomic conditions of the sites and their assemblages will also influence the success of sieving for bird remains. At one end of the spectrum (for sites from the historical periods), one can imagine a general refuse layer in town representing poor preservation conditions and being characterised by low taxonomic diversity because it was mainly deposited by common people with low taxonomic variety in their diet. The other side of the spectrum is represented by cesspits associated with the houses of the well-to-do. In those contexts, preservation conditions are often excellent, and a higher species diversity can be expected due to the high purchasing power of the people who used the cesspit (Ervynck et al. 2007). Figure 16 compares a number of

Fig. 11 Distribution of the number of bird taxa per handcollected assemblage ($n = 151$)

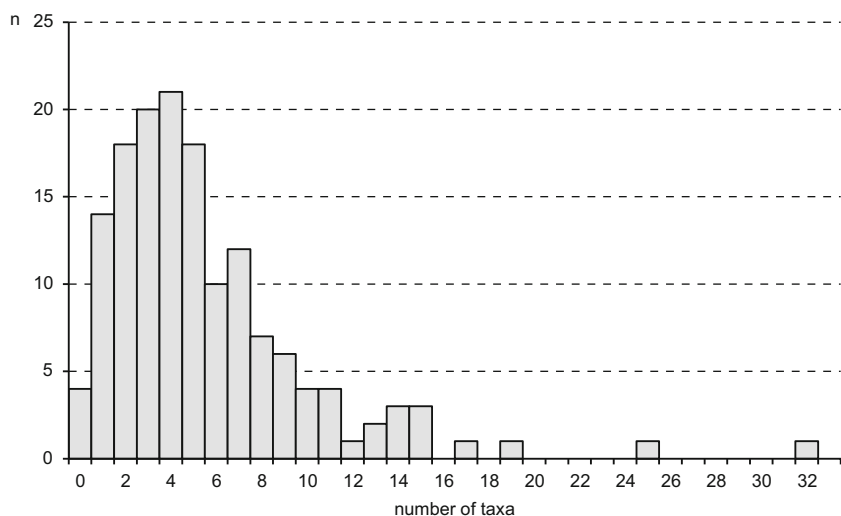
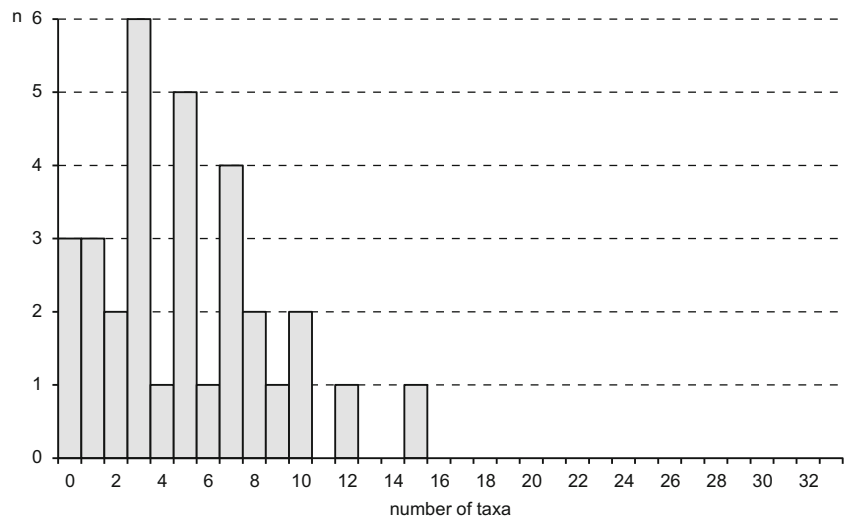


Fig. 12 Distribution of the number of bird taxa per sieved assemblage ($n = 151$)



assemblages from both ends of the taphonomic spectrum. Poor preservation conditions are certainly a characteristic of the late Roman to early medieval ‘black earth’ excavated at Tongeren. This reworked mix of many different contexts of consumption refuse, originating from different habitation periods of the Roman town, contained a small number of bird remains among the handcollected finds. An extensive sieving campaign did not result in better insight into the archaeological avifauna. Sieving produced a small number of fish remains, but birds were even scarcer there than in the handcollected assemblage. A fifteenth century cesspit from Aalst (from the Hopmarkt site) contained a fair number of handcollected bird bones, but their frequency was much lower in the sieved assemblage. The same pattern revealed itself with the investigation of a sixteenth century cesspit, again from Aalst (Stadhuis site). Finally, the entire contents of a sixteenth century cesspit from Dendermonde was sieved, and bird remains formed 15% of the combined residue larger than 4 mm. From the 4 mm and smaller fractions, only the fish

remains were studied, as these finer residues proved to contain hardly any identifiable bird bones. The overall conclusion from this small comparison must be that the Roman general refuse contexts indeed contained lower frequencies of bird remains compared with the cesspits (without doubt the result of taphonomic differences), but that for each site, sieving did not significantly expand our knowledge of the birds present among the consumption refuse. These results corroborate the ideas put forward by Ervynck (1993).

A taxonomic survey

Table S2 (Supplementary material) presents a list of taxa identified from the material studied. We plan to go into the exact finds numbers in a future analysis. Here, the abundance of these taxa is expressed as orders of magnitude: 0–10, 11–100, 101–1000, 1001–10,000 and 10,001–100,000. At first glance, when looking at the taxonomic list, the diversity appears rather high, with a total of 138 taxa listed. However,

Fig. 13 Distribution of the ratio of bird remains versus finds of the ‘triad’ for the handcollected assemblages ($n = 151$; one outlier has been excluded from the graph)

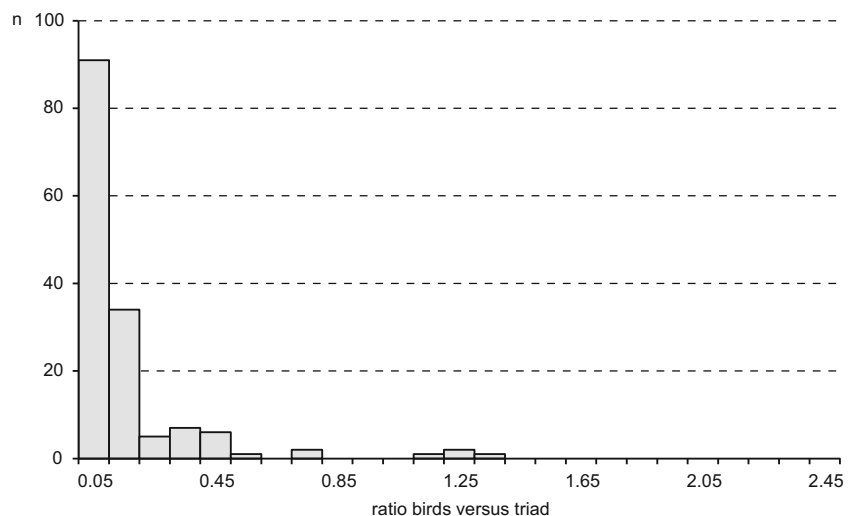
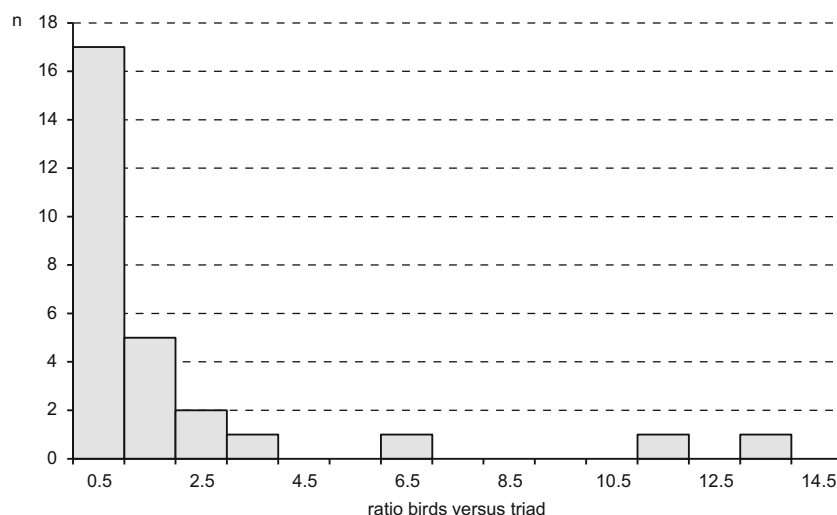


Fig. 14 Distribution of the ratio of bird remains versus finds of the ‘triad’ for the sieved assemblages ($n = 28$; four assemblages have been excluded from the analysis because the number of their ‘triad’ finds equals zero)



these taxa represent different taxonomic ranks, varying from order to species. Only 71 of these correspond to secure species identifications, while the identification of six other species is tentative. The abundance of the remains of the various species is very variable (Fig. 17). When only the 77 taxa identified to the species level are taken into account, we see that the vast majority of them (48) are represented by no more than 10 specimens, 21 species by more than 10 but fewer than 100 finds and only eight by more than 100 finds. This implies that, despite the fact that species diversity is rather high, the number of finds is generally low for most species.

Domestic fowl (*Gallus gallus* f. domestica) is the only species in the category with the most numerous finds (10,001–100,000; Fig. 17), and in fact, it dominates the whole avian archaeological record. This observation would not change even if the finds from the Mithras temple at Tienen were left out. The category with lower finds numbers per species (1001–10,000) comprises the greylag goose (*Anser anser* ? f. domestica) and the mallard (*Anas platyrhynchos* ? f. domestica), of which the former is generally considered to mainly represent domestic birds and the latter is believed to

mainly have been caught in the wild (see above). The category 101–1000 contains the grey partridge (*Perdix perdix*), the Eurasian woodcock (*Scolopax rusticola*), the domestic dove (*Columba livia* f. domestica), the Western jackdaw (*Coloeus monedula*) and the northern raven (*Corvus corax*). It is thus clear that the avian record from Belgian excavations from the Late Iron Age onwards is heavily dominated by a few domestic birds, while most species of wild birds only occur in small numbers in the contexts excavated.

In what follows, the 16 taxonomic orders occurring in the taxonomic list are briefly described, in order of decreasing abundance. The order Galliformes yielded the vast majority of the bird bones, as a result of the massive occurrence of domestic fowl. Other domestic landfowl are the turkey (*Meleagris gallopavo* f. domestica), the peafowl (*Pavo cristatus* f. domestica) and the pheasant (*Phasianus colchicus*). The scarcity of pheasant remains could partly be an artefact related to identification issues, as their bones are indeed easily misidentified as domestic fowl. However, the identification of the two other, larger domestic species is generally not problematic. Wild Galliformes are rare in general,

Fig. 15 Number of assemblages per period (handcollected, sieved, or both counted together) ($n = 184$; two assemblages with very broad dating have been omitted)

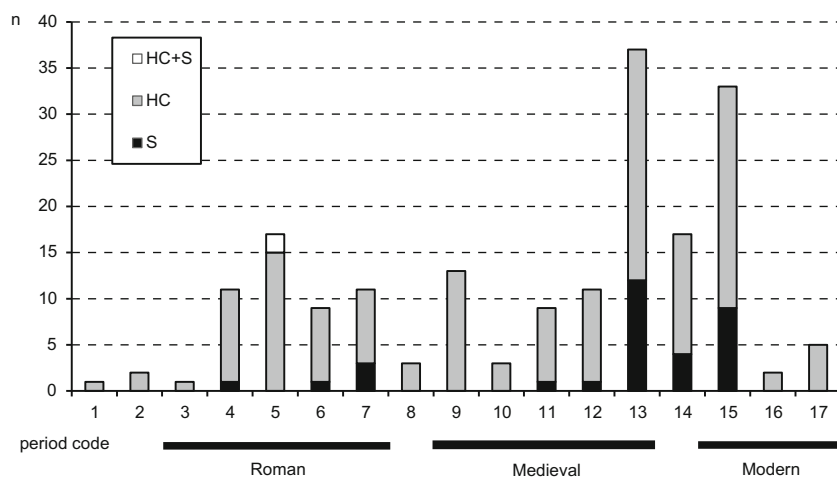
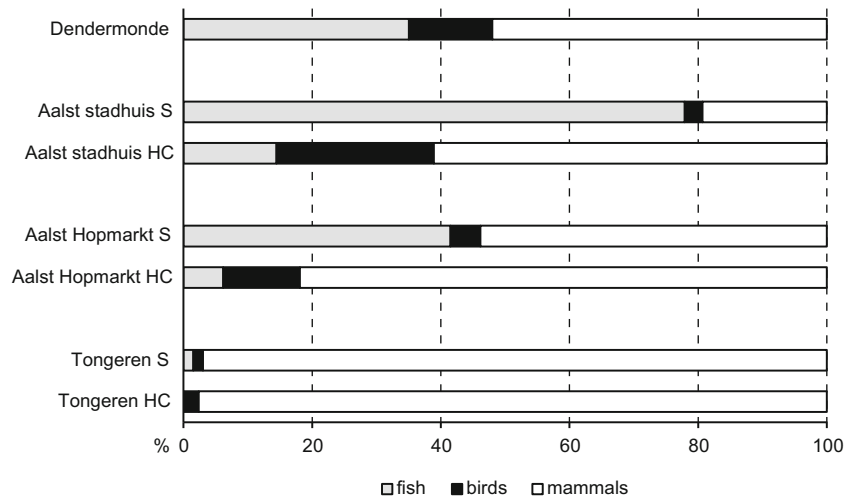


Fig. 16 Comparison of the relative abundance of the main animal groups within handcollected and sieved assemblages derived from the same archaeological structures (for sample sizes, see Table S1)



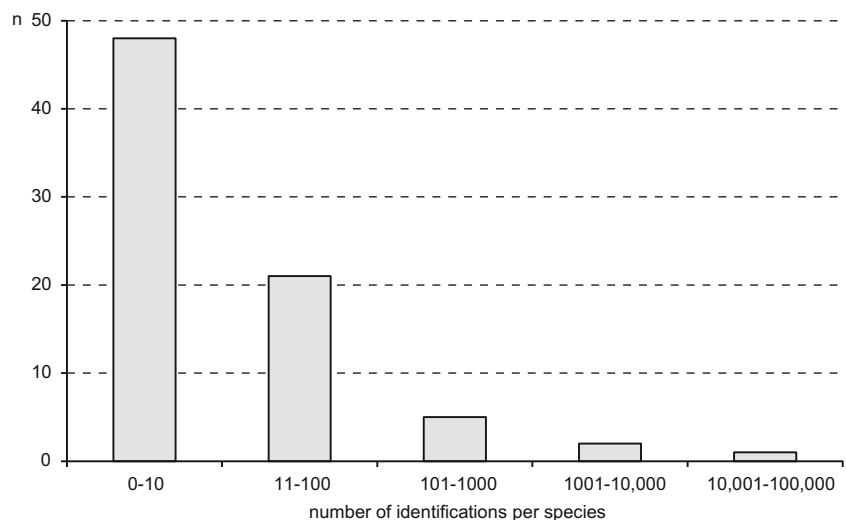
although two species typical of open landscapes, i.e. partridge and, to a lesser extent, quail, occur regularly. Few remains have been reported of hazel grouse and capercaillie, birds typical of forested areas.

Bones of Anseriformes occur in large numbers and belong to numerous taxa. Greylag goose (*Anser anser* ? f. domestica) and mallard (*Anas platyrhynchos* ? f. domestica) are the most abundant species, but in both cases, the morphological distinction between the wild and domestic forms is generally impossible. This hampers our understanding of their domestication history as well as of their role in the food procurement strategies of past human societies (hunting versus animal breeding). Besides greylag, several wild species of goose occur in low numbers, i.e. the barnacle goose (*Branta leucopsis*), bean goose (*Anser fabalis/serrirostris*), pink-footed goose (*Anser brachyrhynchus*) and greater white-fronted goose (*Anser albifrons*). Swans include two species, mute swan (*Cygnus olor*) and the much less frequent whooper swan (*Cygnus cygnus*). A wide variety of ducks has been reported, including,

in addition to the very common mallard (*Anas platyrhynchos* ? f. domestica), no fewer than six dabbling and six diving duck species, all much less frequent than common mallard. However, since identification of ducks is often problematic due to the lack of diagnostic anatomical features and because measurements tend to overlap among taxa (Woelfle 1967), the taxonomic list has to be approached with caution.

The Passeriformes are numerous in terms of identified specimens, but the number of taxa within the archaeological record is much lower than expected, taking into account the large species diversity of this bird order. This is a result of the difficulties relating to the identification of passerine bones, in particular of the smaller species. Illustrative of this is that the majority of the Passeriformes identified to species are larger in size than a thrush; they mainly consist of members of the corvid family, the identification of which has benefitted from the publication of an identification manual (Tomek and Bochenski 2000). That corvids are the most common passerines in the archaeological record is no doubt related to the fact

Fig. 17 Number of identified specimens by which bird species are represented in the archaeological record of the study area (n = 77)



that they are among the largest species and are therefore easily collected during excavation, even when no sieving is performed. Moreover, most of the corvids are scavengers that probably thrived in the surroundings of human settlements and thus would be more frequently encountered (O'Connor 1993). However, this explanation is insufficient, since other birds that probably also took advantage of this ecological niche, such as several raptor species (O'Connor 1993), are much less frequent. Therefore, the high frequency of corvids in human deposits may also reflect efforts at their extermination, as 'black birds' used to be persecuted (Desmet 1987). In the Belgian archaeozoological record, the jackdaw and the raven are the predominant corvid species. The massive presence of the latter species is noteworthy because it disappeared as a breeding bird from Belgium during the beginning of the twentieth century (Devillers et al. 1988). The fact that raven and jackdaw may also have been held in captivity by people, in particular as talking birds (Desmet 1987), may also partly explain their presence within human deposits. Passerines smaller in size than a thrush account for the majority of the remains of this order, but only a few bones, of house sparrow and house martin, have been identified to species. Most of the small passerines are labelled 'Passeriformes size house sparrow (? *Passer domesticus*)' illustrating the dearth of adequate reference collections and detailed osteometrical and comparative osteological studies (exceptions are Jánossy (1983) and Cuisin (1989)). Thrush-size birds, namely, thrushes and starling, are also present, and thrushes are sometimes identified to the species level, despite the large overlap in measurements among taxa (see, e.g. Wójcik 2002).

The archaeological record does not reflect the large species diversity in the Charadriiformes seen in the study area today. Within this order, identification issues due to similarities among taxa and lack of key publications may also explain the relatively low number of species identified, at least within the Scolopacidae and the Charadriidae families. Among the Charadriiformes, the woodcock is largely dominant, while the other waders are scarce and gulls are generally absent. An exception to this is the fifteenth century fishing village at Raversijde, the only coastal site in Belgium thus far with extensive faunal assemblages. The site yielded a substantial number of gull bones, from several species.

The Columbiformes are dominated by the domestic dove. Noteworthy is the scarcity of *Streptopelia* species; only one bone may pertain to the European turtle dove, a species that is nowadays widely hunted and sometimes still forms large groups during its periods of migration, in particular during fall.

Remains from other bird orders are less abundant. The Pelecaniformes are dominated by grey heron, but the Eurasian bittern and the great egret are also present. Among the Ciconiiformes, only the white stork has been identified. The total number of remains from Apodiformes is not low, but

all the bones come from a single site, a well located in a tower of the castle of Logne. They most probably represent the prey of a barn owl or the remains of birds nesting in the tower that died naturally. The Accipitriformes yielded seven species. Some are scavengers—either strict scavengers, such as the cinereous vulture, which is today only rarely observed in the region (see Groot et al. 2010), or opportunistic scavengers (O'Connor 1993), such as the common buzzard, the white-tailed eagle and the black kite. The other Accipitriformes are active hunters. They include the Eurasian sparrowhawk (*Accipiter nisus*), northern goshawk (*Accipiter gentilis*) and western marsh harrier (*Circus aeruginosus*). The apparent abundance of the Eurasian sparrowhawk (*Accipiter nisus*) probably is a bias related to the presence of complete skeletons. Most of the remains of Ralliformes pertain to the common crane (*Grus grus*), but other species are also present, both aquatic ones, such as the water rail (*Rallus aquaticus*), common moorhen (*Gallinula chloropus*) and Eurasian coot (*Fulica atra*), and terrestrial species, such as the corn crake (*Crex crex*). The Strigiformes include four species, among which the western barn owl (*Tyto alba*) is dominant. Its habit of breeding in human constructions probably explains this high proportion, combined with the fact that sometimes whole or partial skeletons become included in the archaeological deposits as a result of natural death. Other species include the little owl (*Athene noctua*), which breeds in open landscapes, and the tawny owl (*Strix aluco*) and long-eared owl (*Asio otus*), which breed in wooded habitats but hunt in clearances, pastures, etc. A few orders include only a single species and are notably scarce. The only Falconiformes found thus far is the common kestrel (*Falco tinnunculus*), which also frequently uses human constructions to nest. The Suliformes are represented by the great cormorant (*Phalacrocorax carbo*), the Gaviiformes by the red-throated loon (*Gavia stellata*), which is today only a migratory bird, and the Podicipediformes by the little grebe (*Tachybaptus ruficollis*). The identification of the sole Otidiformes, the great bustard (*Otis tarda*), is uncertain. No nesting records of this species are known for Belgium, even historically, but irruptions of groups including up to several tens of birds were reported in the nineteenth and twentieth centuries (Desmet 1987).

In Fig. 18, the importance of the different orders in terms of number of species nesting in Belgium today is compared with what is found within the archaeological record. Species lists from the most recent atlases of the breeding birds of Flanders (Vermeersch et al. 2004) and Wallonia (Jacob et al. 2010) have been used. Recently introduced and invasive species are excluded from the comparison. The trends observed for the archaeological record broadly follow the proportions observed within the current breeding avifauna, but some orders are absent from the archaeological material, such as Cuculiformes (now one species in Belgium), Caprimulgiformes (one

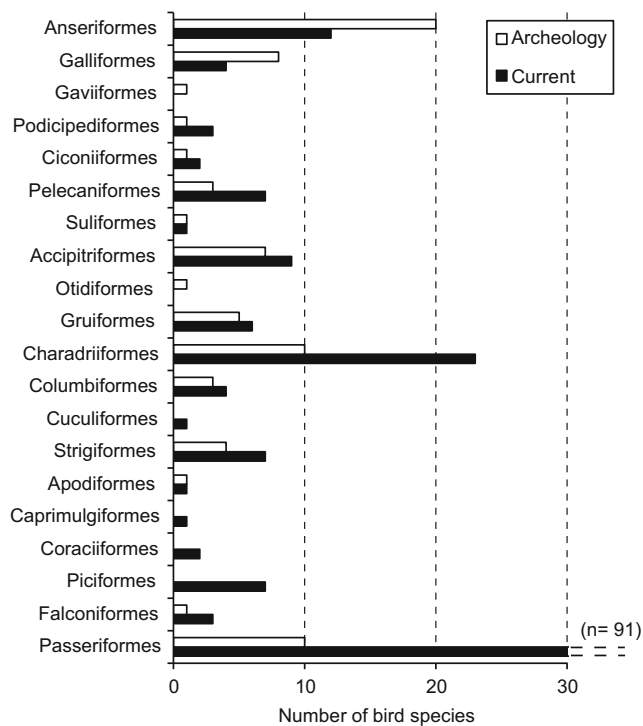


Fig. 18 Comparison of number of bird species nesting in Belgium today ($n = 184$) and the number of species recovered from the archaeological record ($n = 77$), by order

species), Coraciiformes (two species) and Piciformes (seven species). The fact that most of these orders are represented by so few species today could explain their absence as archaeological finds; the exception is the Piciformes. The strong discrepancy of Charadriiformes taxa recovered from archaeological assemblages compared with the current situation reflects the near absence of the smallest wader taxa (e.g. *Calidris* spp.) and the lack of some larid species breeding today. In contrast, orders that have had no species breeding recently in Belgium are represented by archaeological finds, namely, Gaviiformes (one species) and Otidiformes (one possible species). This can be explained by the fact that the hunting of birds was not restricted to the breeding season but, without doubt, took place throughout the year, including during the migration and overwintering periods, when species would have been present which were absent the rest of the year. This likely also accounts for the overrepresentation of Anseriformes in archaeological assemblages. Indeed, twice as many species of Anseriformes frequent the Belgian territory during migration and during the overwintering time, and some do so in large numbers. The case of the Galliformes is peculiar in the sense that the additional taxa yielded by the archaeological sites correspond to introduced species not nesting in the wild today, such as domestic fowl (*Gallus gallus* f. domestica), turkey (*Meleagris gallopavo* f. domestica) or peafowl

(*Pavo cristatus* f. domestica). As mentioned above, Passeriformes species are remarkably scarce among the archaeological finds, while they are represented by a large number of nesting species today, a discrepancy certainly caused by identification issues.

The taxa recorded from the archaeological deposits indicate some general trends concerning the natural habitats where the exploitation of wild birds took place. Of course, this is a coarse approach, since the same bird species can visit different habitats during the breeding season than it does during the rest of the year. Wet habitats and open, dry environments seem to have been favoured. Strikingly, more than half of the taxa identified from the archaeological assemblages are related to wet habitats, such as ponds and marshes, which are visited by Anseriformes, Gaviiformes, Podicipediformes, Pelecaniformes, Suliformes, Gruiformes and Charadriiformes. Wild Galliformes illustrate the preferred exploitation of dry open habitats over wooded areas, since almost no remains of forest species, such as western capercaillie (*Tetrao urogallus*) and hazel grouse (*Tetrastes bonasia*), are present, whereas remains of grey partridge (*Perdix perdix*) are plentiful (although some of these birds could have been kept in warrens, together with rabbits (*Oryctolagus cuniculus*; see Smit 1911)). The total absence of Piciformes, which are mostly found in wooded areas, is also indicative. Some forest species are nevertheless present, such as tawny owl (*Strix aluco*), long-eared owl (*Asio otus*) and woodcock (*Scolopax rusticola*), but these taxa also regularly occur in open habitats, where they can be hunted. Due to a lack of coastal sites with well-preserved bird assemblages, the exploitation of marine species, such as gulls, is poorly documented. However, the remains from the fishing village at Raversijde indicate that sea birds were indeed exploited by humans. Nowadays, gulls frequently occur inland in Belgium and other European countries, where they feed in agricultural fields, on rubbish dumps and even inside large towns, such as Brussels (Cramp 1983). From this perspective, the almost complete lack of larid remains from archaeological assemblages can be seen as surprising. However, the inland penetration of gulls is a recent phenomenon linked to an increase in their populations in Western Europe from the beginning of the nineteenth century onward, which became dramatic during the twentieth century mainly as a consequence of their protected status and the greater food supply in dumps (Cramp 1983; Rock 2005).

Conclusion

From the foregoing numerical analysis of the dataset concerning bird remains from the historical periods in Belgium, it is clear that it will be no easy task to study and evaluate the role that wild bird species played in the human societies of that time in that part of the world. Because their

taxonomic diversity and their find numbers per assemblage are generally low, many sites and assemblages will have to be studied in order to get a more than just an anecdotal view. Large finds collections will be needed, and that will not be achieved by sieving alone. Moreover, when sieving is applied, sample soil volumes will have to be large in order to obtain extra taxonomic information. Still, the potential for archaeological studies of wild bird species is high. The taxonomical survey presented here revealed an interesting pattern: while diversity is generally low per assemblage, it is rather high at the level of the entire dataset. Variation related to geography, time period or site type should thus be a major future research theme.

Concerning domestic birds, the archaeological record proves to yield sufficient material to reconstruct the history of the exploitation of these species, and their remains prove to be abundant in many handcollected assemblages from the different periods studied. Still, when the aim of economic reconstructions is to go into culinary detail, sieved samples will be needed to enable the study of the treatment of different parts of the body.

This contribution marks the start of an extensive research project. Of course, being confined to a small part of Europe, it inevitably has a limited geographical relevance, but it is hoped that similar accounts of the archaeozoological record from other parts of Europe, or from other continents, will contribute to the ideas put forward here, or, indeed, contradict them. Similarly, within the study area, the future juxtapositioning of data from prehistoric sites versus those from sites from the historical periods will hopefully provide more insight into the changing role of birds, through time, in local, evolving human societies.

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