

SOME REMARKS ON THE OCCURRENCE OF BUZZARD (*Buteo buteo*) AND GOSHAWK (*Accipiter gentilis*) IN EUROPE

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Summary

Today in Europe the buzzard is far more abundant than the goshawk. In bone materials from archaeological sites, however, goshawk remains seem to be more frequent than those of buzzards. In order to confirm this impression all records of subfossil remains of these species from Northwest Europe were gathered and divided into two age groups dating before and after approximately AD 400-500. The amount of both species as well as their proportion is valued within each period, taking into consideration the relevant taphonomic factors. In contrast to the recent situation, a higher amount of goshawks was established for both periods, and in particular for the later one. The clearing of woodland in this epoch apparently favoured the goshawk which needs woodland intermingled with fields and pastures. A relatively open landscape, however, favours the buzzard too. Thus, the pronounced differences in the proportion between the remains of both species, especially in the later phase, probably are only partly an expression of differences in their population density depending on different ecological demands. Partly they may be caused by hawking which could have augmented the amount of goshawk remains. It may also be assumed that goshawks were killed as noxious birds because they preyed on poultry which led to a further imbalance. Thus the natural proportion of these species could have been similar in both periods. The recent pronounced preponderance of buzzard, however, may be an expression of the extensive open areas in today's landscape which promotes this species.

Résumé

Remarques sur l'abondance de la buse variable (*Buteo buteo*) et de l'autour des palombes (*Accipiter gentilis*) en Europe.

Dans l'Europe actuelle, la buse variable est beaucoup plus commune que l'autour des palombes. Dans le matériel osseux des sites archéologiques, il semble cependant que les restes d'autour soient en moyenne plus fréquents que ceux des buses. Afin de vérifier cette impression, toutes les données de restes sub-fossiles de ces deux espèces en Europe du Nord-Ouest ont été rassemblées et séparées en deux groupes correspondant à deux époques : approximativement avant 400-500 ap. J.-C. et après cette date. L'abondance des deux espèces et leur proportion sont estimées pour chacune des périodes en tenant compte des facteurs taphonomiques impliqués. Au contraire de ce que l'on observe de nos jours, une plus grande proportion d'autour est établie pour les deux périodes, et c'est particulièrement frappant pour la plus récente. L'éclaircissement des forêts à cette époque semble avoir favorisé la présence de l'autour qui affectionne les zones boisées entrecoupées de champs et de prairies. Un paysage bien ouvert favorise cependant également la présence de la buse variable. Les différences marquées dans les proportions entre les restes des deux espèces, en particulier pour la phase récente, expriment donc probablement des différences dans les densités de population, liées à des besoins écologiques différents. Elles peuvent aussi être en partie dues à la fauconnerie, qui a pu être responsable de l'accumulation d'un plus grand nombre de restes d'autour. On peut aussi supposer que les autours étaient

Zusammenfassung

Bemerkungen zum Vorkommen des Mäusebussards (*Buteo buteo*) und des Habichts (*Accipiter gentilis*) in Europa.

Heutzutage ist der Mäusebussard in Europa viel häufiger als der Habicht. Im archäologischen Fundgut sind aber anscheinend Knochen des Habichts im allgemeinen zahlreicher als solche vom Mäusebussard. Um diesen Eindruck zu sichern, wurden alle Fundnachweise beider Arten für Nordwesteuropa zusammengestellt und zwar unterteilt in eine älter als 400-500 n. Chr. datierte sowie in eine jüngere Gruppe. Der Anteil beider Arten in jedem dieser Zeitabschnitte wurde unter Berücksichtigung taphonomischer Faktoren bewertet. Im Unterschied zur heutigen Situation erwies sich der Habicht für beide Zeitabschnitte und insbesondere für den jüngeren als die häufigere Art. Die mittelalterlichen Rodungen hatten anscheinend den Habicht begünstigt mit seinen Ansprüchen an Waldgebiete, die von offenen Arealen durchsetzt sind. Da aber eine offene Landschaft auch für den Mäusebussard vorteilhaft ist, dürften die ermittelten Differenzen, besonders in der späteren Phase, im Anteil beider Arten an den Knochenresten nur teilweise Ausdruck von natürlichen Unterschieden in ihrer Populationsdichte sein. Der hohe Anteil der Reste des Habichts könnte zum Teil auch in der Nutzung dieser Art als Beizvogel seine Ursache haben. Auch wurde der Habicht als Schädling, der dem Federvieh nachstellte, bejagt. So könnte das natürliche Verhältnis zwischen Habicht und Mäusebussard in beiden Zeitabschnitten ähnlich gewesen sein. Das eindeutige Übergewicht des Mäusebussards in neuerer Zeit muss vor allem wohl im

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tués en tant qu'oiseaux nuisibles, en raison de leur prédation sur la basse-cour, ce qui augmente encore le déséquilibre. Ainsi, les proportions naturelles de ces espèces ont pu être identiques aux deux époques. La prépondérance récente et marquée de la buse variable reflète peut-être, cependant, les grandes zones ouvertes du paysage d'aujourd'hui, qui favorisent cette espèce.

Zusammenhang mit den weiten offenen Gebieten in der heutigen Landschaft gesehen werden, die diese Art begünstigen.

Key Words

Buzzard, Goshawk, Europe, Habitat, Falconry.

Mots clés

Buse variable, Autour des palombes, Europe, Habitat, Fauconnerie.

Schlüsselworte

Bussard, Habicht, Europa, Habitat, Falknerei.

Introduction

Today in Europe the buzzard is far more abundant than the goshawk, obviously due to the quality of landscape and vegetation. In Schleswig-Holstein, for instance, are living around 400 hatching couples of goshawk but 2 600 buzzard' couples on an average (minimum 1 700, maximum 3 600). Beyond that, a lot of buzzards from Northern Europe are wintering - in the lowland of the river Eider, together with the rough-legged buzzard (*Buteo lagopus*) -, but nearly no additional wintering goshawks are found (Looft, 1990).

Especially in Central Europe and adjacent regions, most of the land is cultivated. Fields and pastures give the impression of a partly steppe-like landscape, and the woodland is restricted, whereas under natural conditions the whole land would be covered by a great deal of woodland, except perhaps some marshes and fluvial wetlands. This open landscape favours the buzzard, a raptorial which, though nesting on high trees of smaller woods (nesting habitat), is looking for its prey - especially voles and other small mammals, but also young birds, amphibians, and insects - in the open landscape (food habitat). The goshawk, on the other hand, prefers wooded land intermingled by open areas. In such a multiform landscape, this bird will find its prey which are small mammals but especially birds. The males, smaller than the females, will look for small preys, perhaps up to the size of pigeons, while the females are also capable to seize larger birds and - as far as mammals are concerned - even hares (Bezzel, 1984; Looft, 1990).

The recent distribution areas of both species include nearly the whole of Europe except parts of the British Isles and Norway and further except extensive areas of the Netherlands, of France, and of Italy in the case of the goshawk, and Northern Scandinavia as the whole in the

case of the buzzard (Heinzel *et al.*, 1977; Cramp *et al.*, 1980; Jonsson, 1992).

Analysing bone materials from archaeological sites, occasionally bones of goshawk can be found, but rather seldom bones of buzzard. It is the aim of this investigation to test this impression. In the following, I shall try further to interpret differences as well as concordances in the frequency of the remains of both species in space and time. These especially species are suitable for such a purpose, for both are similar in size, therefore the taphonomic loss of the remains of either species must be equal as far as it is caused by the degree of preservation of bones and the ability to detect them. Furthermore both are raptorial of the family Accipitridae. According to this degree of relationship as well as the taphonomic conformity mentioned before, differences in the abundance of the remains of each species must be to a certain degree a parameter of their population density. That means that such differences probably could be partly explained by the different ecological demands of buzzard and goshawk. This concerns especially the vegetation cover which is primarily connected with landscape and climate, but which is also considerably influenced by man (see above). It is possible that some of the buzzard bones could come from wintering rough-legged buzzards, but such remains in our material could not falsify the results, for this species is, in any case more than the buzzard, obliged to treeless areas. Thus the expected differences mentioned before would even be accentuated.

In order to estimate the amount and distribution of the remains of both species correctly, the following taphonomic circumstances which comprise the influence of the earlier humans on the species-composition of the remains, also have to be taken into consideration:

1) It is to concede that in later epochs, e.g. the Middle Ages, the birds from which the bones come could have been captured elsewhere and afterwards traded to the site in question.

2) Especially goshawks were used for hawking. That could cause - at least partly - an overrepresentation of this species. In the case of hawking, too, probably bone remains to a certain degree come from goshawks which were caught perhaps far away from the place where they perished and where their bones were found.

3) Also beyond differences in the representation of both species caused by falconry, it is possible that dissimilarities existed in hunting between both species which could result in different frequencies of their remains.

4) The origin of a material can influence its components. For instance differences are expected between animal remains of a settlement and those enclosed in a grave.

Only if all taphonomic factors mentioned are balanced, the records of these species in space and time point to a certain degree to their former abundance and thus to an adequate habitat of either.

Material and methods

All sites which have yielded remains of buzzard or goshawk were extracted from literature and divided into two groups according to the epoch earlier than approximately AD 400 - 500 and to the one later than this period. Since then an influence of hawking is to be taken into

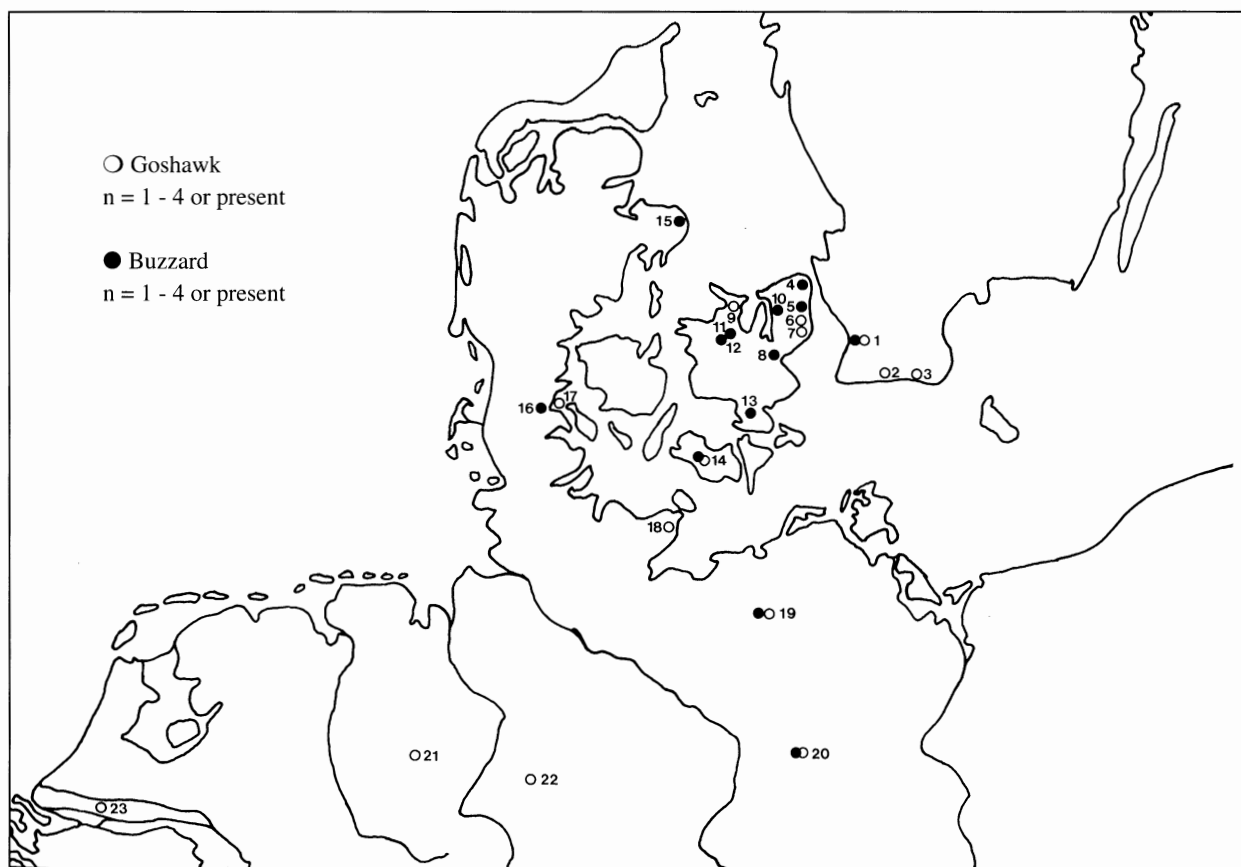


Fig. 1: Finds of buzzard and goshawk from sites of the period earlier than approximately AD 400-500 situated in the main investigation area.

- | | | | | |
|----------------|-------------------|-----------------------|------------------|--------------------|
| 1) Segebro | 6) Hvidegaard | 11) Ravnsbjerggård II | 16) Barsmark | 21) Hüde I Dümmer |
| 2) Skateholm | 7) Mariedals Mose | 12) Skellingsted | 17) Åbenrå Fjord | 22) Hildesheim |
| 3) Bredasten | 8) Olby Lyng | 13) Sværdborg I | 18) Rosenhof | 23) Hekelingen III |
| 4) Bergmansdal | 9) Troldhøj | 14) Vejleby | 19) Löddigsee | |
| 5) Vedbaek | 10) Havelse | 15) Mejlgaard | 20) Friesack | |

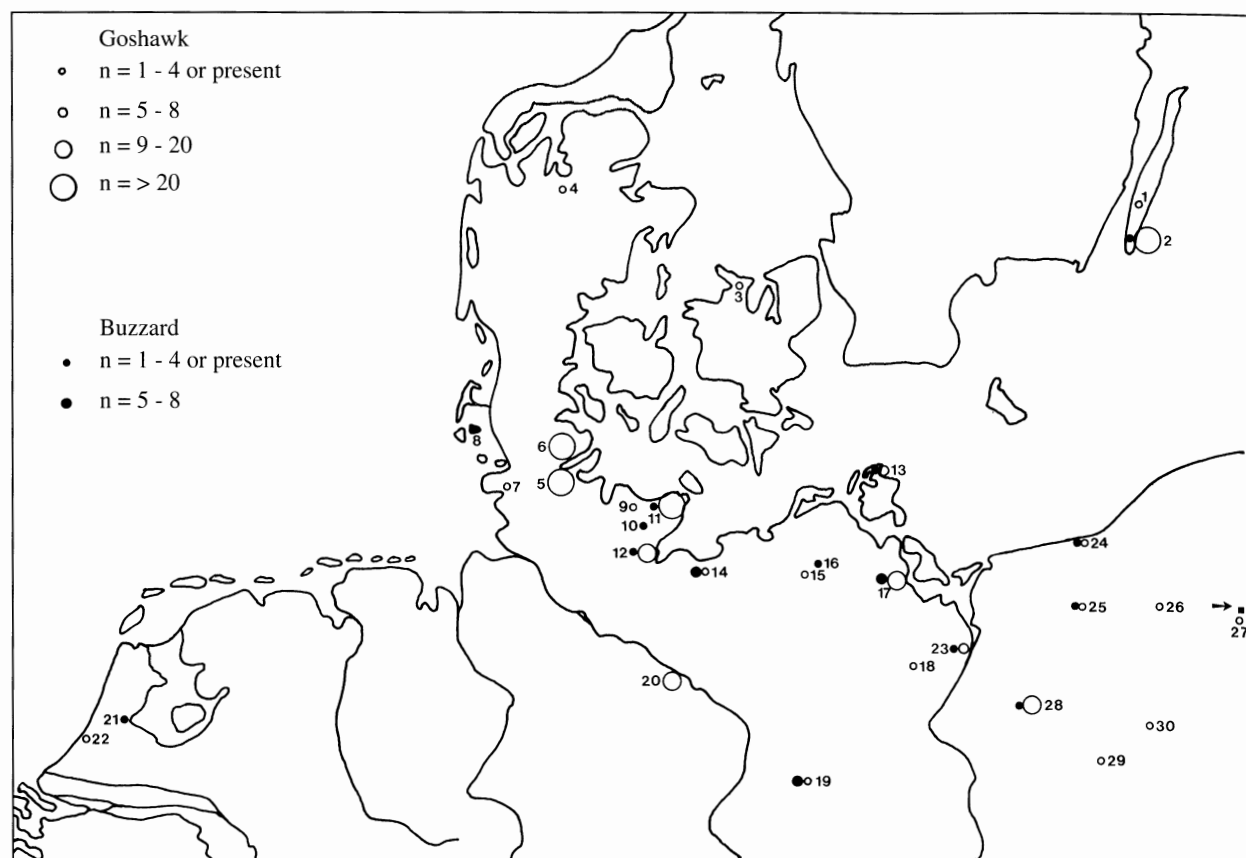


Fig. 2: Finds of buzzard and goshawk from sites of the period later than approximately AD 400-500 situated in the main investigation area.

1) Tornrör	7) Elisenhof	13) Arkona	19) Brandenburg	25) Stare Drawsko
2) Eketorp	8) Lembecksburg	14) Mecklenburg	20) Hitzacker	26) Barkowo
3) Næsholm	9) Futterkamp	15) Teterow	21) Amsterdam	27) Kaldus
4) Viborg	10) Bischofswar	16) Dargun	22) Valkenburg	28) Santok
5) Haithabu	11) Oldenburg	17) Menzlin	23) Szczecin	29) Bnin
6) Schleswig	12) Lübeck	18) Drense	24) Kolobrzeg	30) Gniezno

account (Lindner, 1976). The investigation is restricted to the north-western part of Europe, that means the area from Ireland in the West to Poland in the East, from Scandinavia in the North to France, Switzerland, Austria, and Hungary in the South. Of course, it was impossible to find out all records of the species in question, but the records within the main area of investigation should be listed rather completely. This comprises the Northern German lowland and the adjacent ones in the Netherlands and in Poland as well as the part of Scandinavia which is of similar character, that means Denmark and the southernmost part of Sweden (fig. 1, 2). The amount of both species as well as their proportion has been valued within

each period under consideration of the involved taphonomic factors.

Results

There are 81 sites of the earlier epoch which have yielded remains of buzzard or goshawk or of both species, but the buzzard is only proved for 47 of them and goshawk

Table 1: Remains of buzzard and goshawk as well as the total amount of bird remains from different sites according to chronological, chorological and functional aspects - earlier period (earlier than AD 400-500). + = present ≈ n = 1.

Country Site	Period	Type	Birds total NISP	Wild Birds NISP	Buzzard NISP	Goshawk NISP	Map No.	Reference
Sweden								
Segebro	Mesolithic	settlement	99	99	1	1	1	Lepiksaar, 1982
Skateholm	Mesolithic	settlement	?	?	—	1	2	Jonsson, 1988
Bredasten	Mesolithic	settlement	?	?	—	+ ?	3	Jonsson, 1988
Otterö	older 3500 BC	taphocoenosis	?	?	—	1		Lepiksaar, 1983
Korsnäs	middle Neolithic	settlement	35	35	—	1		Aaris-Sørensen, 1978
Denmark								
Bergmansdal	Mesolithic	settlement	?	?	+	—	4	Rosenlund, pers. comm.
Vedbæk	Mesolithic	settlement	?	?	+	—	5	Aaris-Sørensen, 1980
Ravnsbjerggård II	Mesolithic	settlement	?	?	+	—	11	Rosenlund, pers. comm.
Sværdborg I	Mesolithic	settlement	?	?	+	—	13	Rosenlund, pers. comm.
Mejlgaard	Mesolithic	settlement	?	?	+	—	15	Rosenlund, pers. comm.
Havelse	early Neolithic	settlement	?	?	+	—	10	Rosenlund, pers. comm.
Troldhøj	Neolithic	grave	?	?	—	+	9	Rosenlund, pers. comm.
Olby Lyng	3300-3200 BC	settlement	?	?	1	—	8	Möhl, 1970 (cit. in Piehler, 1976)
Hvidegaard	Bronze Age	grave	?	?	—	1	6	Winge, 1904 (cit. in Piehler, 1976)
Vejleby	Roman Iron Age	settlement	?	?	1	2	14	Winge, 1903 (cit. in Piehler, 1976)
Mariedalsmose	undated	bogfind	?	?	—	2	7	Winge, 1903 (cit. in Piehler, 1976)
Skellingsted	undated	bogfind	?	?	+	—	12	Rosenlund, pers. comm.
Barsmark	undated	marl-pit	?	?	2	—	16	Winge, 1903 (cit. in Piehler, 1976)
Åbenrå Fjord	undated	settlement	?	?	—	+	17	Rosenlund, pers. comm.
Germany								
Friesack	Mesolithic	settlement	547	547	3	1	20	Teichert, L., 1993
Jägerhaus-Höhle	Mesolithic	cave	12	12	1 (?)	1		Boessneck, 1978 a
Rosenhof	early Neolithic	settlement	?	?	—	+	18	Heinrich, in prep.
Müddersheim	early Neolithic	settlement	1	1	1	—		Stampli, 1965
Löddigsee Parchim	Neolithic	settlement	?	?	+	+	19	Lehmkuhl, 1989
Hüde I Dümmer	Neolithic	settlement	260	259	—	3	21	Boessneck, 1978 b
Wangen	Neolithic	lake dwelling settlem.	?	?	1 (?)	—		Vogel, 1933
Ehrenstein	Neolithic	settlement	9	9	—	2		Scheck, 1977
Niedererlbach	Iron Age	settlement	12	12	—	1		Kessen, 1991
Heuneburg	Iron Age	castle	359	334	—	6		von den Driesch and Boessneck, 1989
Altenburg-Rheinau	Iron Age	oppidum	127	12	—	5		Moser, 1986
Hildesheim	Roman Iron Age	settlement	12	9	—	1	22	Missel, 1987
Mühlberg	Roman Iron Age	settlement	19	5	3	—		Teichert, 1990
Bad Kreuznach	Roman Iron Age	palace villa	618	95	—	5		Johansson, 1987
Eggolsheim	Roman Iron Age	settlement	47	6	3	—		Brau, 1986
Abusina Eining	Roman Iron Age	Roman castle	320	?	—	1		Lipper, 1981/82
Marzell	Roman Iron Age	villa rustica	10	4	—	1		Streitferdt, 1972
Cannstadt	Roman Iron Age	castle	?	?	—	1		Hilzheimer, 1920 (cit. in Piehler, 1976)
Rainau-Buch	Roman Iron Age	settlement	454	35	3	—		Gulde, 1985
Lomersheim	Roman Iron Age	villa rustica	3	1	—	1		Kokabi, 1991
Burg Sponeck	Roman Iron Age	castle	283	33	—	3		Pfannhauser, 1980
Hüfingen	Roman Iron Age	Roman civil settlem.	297	21	—	1		Sauer-Neubert, 1968
Bad Wimpfen I	Roman Iron Age	settlement	747	74	—	3		Frey, 1991
The Netherlands								
Hekelingen III	Neolithic	settlement	87	87	—	4	23	Prummel, 1987
Belgium								
Bomal-sur-Ourthe	Neolithic-Roman	shelter (A1, A1/2)	56	37	4	—		De Coninck <i>et al.</i> , 1990
Great Britain								
Star Carr	Mesolithic	settlement	8	8	1	—		Möhl, 1979
Mount Sandel	Mesolithic	settlement	79	79	1	6		van Wijngaarden-Bakker, 1985
Quanterness	Neolithic	grave	133	133	2	2		Bramwell, 1979
Knap of Howar	Neolithic	farmstead	253	253	1	—		Bramwell, 1983
Danebury	Iron Age	fortified settlement	804	798	+	—		Grant, 1984 (cit. in Audoin-Rouzeau, 1993)
Gussage All Saints	Iron Age	rural settlement	?	?	+	—		Harcourt, 1979 (cit. in Audoin-Rouzeau, 1993)
Piecebridge	Roman	fort	?	?	+	—		Allison unpubl. (cit. in Parker, 1988)
Frocester	Roman	villa	?	?	+	—		Bramwell, 1979 (cit. in Parker, 1988)
Cirencester	Roman	town	?	?	+	—		Thawley, 1982 (cit. in Parker, 1988)
Barton Court Farm	Roman	villa	?	?	+	—		Bramwell <i>et al.</i> , 1986 (cit. in Parker, 1988)
Rudston	Roman	villa	?	?	+	—		Chaplin and Barnetson, 1980 (cit. in Parker, 1988)
Brancaster	Roman	town	?	?	+	—		Bramwell, 1985 (cit. in Parker, 1988)
Gadebridge	Roman	villa	?	?	+	—		Bramwell, 1974 (cit. in Parker, 1988)
Sheepen/Camulodunum	Roman	rural	?	?	+	—		Bate, 1947 (cit. in Parker, 1988)
Staines	Roman	town	?	?	+	—		Chapman, 1984 (cit. in Parker, 1988)
Ireland								
Dalkey Island	late Mesolithic	settlement	?	?	—	1		Hatting, 1968 (cit. in van Wijngaarden-Bakker, 1987)
New Grange	late Neolithic	settlement	26	26	—	8		van Wijngaarden-Bakker, 1974
France								
Videlles	Bronze Age	?	?	?	2	—		
Vernou-sur-Brenne	Iron Age	rural settlement	147	25	1	—		Poulain-Josien, 1958 (cit. in Piehler, 1976)
Cazères	end 1. cent. AD	grave	?	?	2	1		Poulain, 1985 (cit. in Audoin-Rouzeau, 1993)
Switzerland								
Birsätten-Basisgrotte	Mesolithic	cave	37	37	5	4		Schmid, 1964
Feldmeilen-Vorderfeld	Neolithic	lake dwelling settlem.	16	16	—	1		Eibl, 1974
Seematten-Gelfingen	Neolithic	lake dwelling settlem.	?	?	+	—		Hescheler and Kuhn, 1949
Wauwil	Neolithic	lake dwelling settlem.	?	?	+	—		Hescheler and Kuhn, 1949
Egölzwil II	Neolithic	lake dwelling settlem.	?	?	4	—		Hescheler and Rüeger, 1939
Burgäschisee-Süd	Neolithic	lake dwelling settlem.	81	81	8	—		Boessneck <i>et al.</i> , 1963
Burgäschisee SW	Neolithic	lake dwelling settlem.	?	?	1	—		Stampli, 1964 (cit. in Piehler, 1976)
Twann MS, OS	Neolithic	lake dwelling settlem.	687	687	16	21		Becker and Johansson, 1981
Twann US	Neolithic	lake dwelling settlem.	77	77	—	2		Becker, 1981
Moosseedorf	Neolithic	lake dwelling settlem.	?	?	+	+		Hescheler and Kuhn, 1947
Poland								
Kryzelawice	Neolithic	?	?	?	5	—		
Szontag-See	early Bronze Age	lake dwelling settlem.	?	?	—	1 (?)		Bochenski (cit. in Piehler, 1976)
Hungary								
Budapest	middle Bronze Age	?	?	?	2	—		Nehring, 1988
Mende-Leányvár	middle Bronze Age	?	?	?	—	1		Jánossy, 1985
Intercisa	Roman Iron Age	Roman camp + town	?	23	—	4		Jánossy, 1985
Tác Gorsium	Roman Iron Age	Roman town	2736	395	—	2		Bökönyi, 1984
Tác-Fövenpuszta	Roman	villa	847	46	—	1		Bökönyi, 1974
Total								
total sites map No. 1-23					96	110		
(main investigation area)					16	21		

Country Site	Period	Type	Birds total NISP	Wild Birds NISP	Buzzard NISP	Goshawk NISP	Map No.	Reference
Sweden								
Värby/Värberg II	younger Iron Age	cremation grave	3	?	-	+		Iregren 1972 (cit. in Liljegren 1977)
Eketorp II	younger Iron Age	fortified settlement	2116	~1615	2	8	2	Boessneck and von den Driesch 1979
Västhögen Gamla Upsala	500 AD	cremation grave	?	?	-	1		Sten and Vretemark 1988
Rinkeby Spånga	600 AD	cremation grave	?	?	-	1		Sten and Vretemark 1988
Rickeby Vallentuna	600 AD	cremation grave	?	?	-	1		Sten and Vretemark 1988
Landshammar Spelvik	600 AD	cremation grave	?	?	-	+		Sten and Vretemark 1988
Algö Överselö	600 AD	cremation grave	?	?	-	1		Sten and Vretemark 1988
Gunnerstad Gamleby	600 AD	cremation grave	?	?	-	1		Sten and Vretemark 1988
Örebro	700-800 AD	cremation grave	?	?	-	1		Sten and Vretemark 1988
Ingjaldshögen Vansö	800 AD	cremation grave	?	?	-	+		Sten and Vretemark 1988
Arninge Täby	800-900 AD	cremation grave	?	?	-	1		Sten and Vretemark 1988
Viby Kalmar	900 AD	cremation grave	?	?	-	1		Sten and Vretemark 1988
Skopintull Adelsö	900 AD	cremation grave	?	?	-	+		Sten and Vretemark 1988
Hoxla Sorunda	Vendel period	cremation grave	?	?	-	+		Sten and Vretemark 1988
Eketorp III	11 th /12 th century	fortified settlement	10679	6030	3	24	2	Boessneck and von den Driesch 1979
Gamla Lödöse	12 th -14 th century	urban settlement	131	3	-	2		Lepiksaar 1965
Skara	Middle Ages	urban settlement	?	22	-	6		Lepiksaar 1976-76
Tornrör	Iron Age-subrecent	taphocoenosis	364	339	-	3	1	Lepiksaar 1980
Norway								
Gamlebyen Oslo	11 th -14 th century	urban settlement	1198	256	1	31		Lie 1988
Denmark								
Næsholm	13 th /14 th century	castle	?	?	-	3	3	Mohl 1961
Viborg	11 th -17 th century	urban settlement	?	?	-	+	4	Rosenlund, pers. comm.
Germany								
Quedlinburg	5 th /6 th century	grave	?	?	-	+		Müller 1980
Alach	5 th -7 th century	grave	?	+	-	+		Timpel 1990
Eschwege	7 th century	grave	?	+	-	+		Sippel 1986 (cit. in Müller 1993)
Haithabu Siedlung	early Middle Ages	trading centre	4656	822	-	37	5	Reichstein and Pieper 1986
Haithabu Hafen	early Middle Ages	trading centre	2603	380	-	13	5	Hüster-Plogmann, in prep.
Bischofswardev	early Middle Ages	castle	94	60	1	-	10	Reichstein et al. 1980
Menzlin	early Middle Ages	settlement	942	177	5	17	17	Prillhoff 1988
Oldenburg	7 th -12 th century	castle	1442	322	-	32	11	Prummel 1993
Oldenburg	7 th -12 th century	castle	114	18	2	3	11	Boll 1987
Oldenburg	7 th -12 th century	castle	8	2	2	-	11	Stampfli 1961
Mecklenburg	7 th -12 th century	castle	?	106	5	4	14	Müller 1984
Arkona	9 th -12 th century	sanctuary castle	200	49	4	7	13	Müller 1974
Teterow	9 th -12 th century	castle	?	?	-	+	15	Müllerand Stephan 1977
Brandenburg	10 th -12 th century	castle	1075	174	6	4	19	Teichert, L. 1988
Drense	11 th -13 th century	castle	176	15	-	1	18	Bencke and Prillhoff 1989
Dargun	12 th -14 th century	fortified court	3	1	1	-	16	Bencke 1990
Schleswig	Middle Ages	urban settlement	8428	1307	-	80	6	Pieper and Reichstein 1995
Elisenhof	Middle Ages	rural settlement	547	347	-	1	7	Reichstein 1994
Lembecksborg	Middle Ages	fortified settlement	?	?	1	-	8	Requate 1956
Futterkamp	Middle Ages	fortified settlement	101	24	-	1	9	Candea and Heinrich 1981
Groitzsch	Middle Ages	castle	?	16	-	6		Müller 1982
Meissen	Middle Ages	castle	?	2	-	1		Müller 1982
Wülffingen	predom. Middle Ages	settlement	379	8	2	-		Hartl 1971
Hitzacker	7 th -16 th century	castle	3060	1120	-	17	20	Boessneck 1982
Burg Plesse	16 th century	castle (phase IV only)	191	78	-	2		Schoon 1989
Lübeck, Schranken	15 th -17 th century	urban settlement, cess-pit	660	122	-	8	12	Quade 1984
Lübeck, Hundestr. 9-11	MA-modern time	urban settlement	683	75	1	1	12	Paul 1977
The Netherlands								
Valkenburg	10 th /11 th century	castle	?	?	-	+	22	Clason and Prummel 1979
Amsterdam	14 th century	urban settlement	?	?	+	-	21	Clason and Prummel 1979
Great Britain								
London	early Middle Ages	urban settlement	?	?	+	-		West in litt. (cit. in O'Connor 1993)
North Elmham	7 th -9 th century	episcopal palace	?	?	+	-		Clutton-Brock 1976
York, Fishergate	8 th /9 th century	urban settlement (period 3)	863	38	1	-		O'Connor 1991
York, Coppergate	9 th -11 th century	urban settlement	1852	?	-	1		O'Connor 1989
Exeter	1250-1300 AD	urban settlement	578	53	1	-		Maltby 1979
Caerleon	Middle Ages	?	128	97	+	-		O'Connor 1986
Leicester	Middle Ages	urban settlement	?	?	+	-		Thawley 1981 (cit. in O'Connor 1993)
Southampton	Middle Ages	urban settlement	?	?	+	-		Bourdillon and Coy 1980 (cit. in Audoin-Rouzeau 1993)
Portchester Castle	Middle Ages	castle	?	?	-	+		Eastham 1976 (cit. in Audoin-Rouzeau 1993)
Coventry	post Middle Ages	urban settlement	?	?	+	-		Bramwell 1982 (cit. in O'Connor 1993)
France								
Grand Besle	11 th /12 th century	castle	80	14	2	-		Lepiksaar 1966-68
Saint-Avit-Sénieur	11 th -13 th century	well of an abbey	?	?	-	8		Gautier 1972 (cit. in Piehler 1976)
Chevreuse	Middle Ages	castle	?	?	-	+		Meniel 1980 (cit. in Audoin-Rouzeau 1993)
Carvin	Middle Ages	well	?	?	-	+		Poulain-Josien 1965 (cit. in Audoin-Rouzeau 1993)
Liechtenstein								
Burg Neu-Schellenberg	Middle Ages	castle	282	4	-	2		Schülke 1965
Poland								
Szczecin	early Middle Ages	?	?	?	1	5	23	Nogalski 1981
Kolobrzeg	early Middle Ages	?	?	?	3	1	24	Nogalski 1981
Santok	early Middle Ages	fortified settlement	?	?	3	12	28	Waluszewska-Bubien 1979
Santok	early Middle Ages	urban settlement	?	?	-	1	28	Waluszewska-Bubien 1979
Wroclaw (excavation I)	early Middle Ages	urban settlement	?	?	-	2		Waluszewska-Bubien 1979
Wroclaw (excavation VI)	early Middle Ages	urban settlement	?	?	-	22		Waluszewska-Bubien 1979**
Opole	10 th -13 th century	urban settlement	1529	639	-	11		Waluszewska-Bubien 1979
Stare Drawsko	Middle Ages	?	?	?	1	1	25	Waluszewska-Bubien 1979
Barkowo	Middle Ages	?	?	?	-	2	26	Waluszewska-Bubien 1979
Kaldus	Middle Ages	?	?	?	-	4	27	Waluszewska-Bubien 1979
Bnin	Middle Ages	urban settlement	?	?	-	3	29	Waluszewska-Bubien 1979
Gniezno	Middle Ages	cathedral	?	?	-	3	30	Waluszewska-Bubien 1979
Legnica	Middle Ages	castle	?	?	2	6		Waluszewska-Bubien 1979
Hungary								
Gyula Var	15 th -17 th century	castle	?	14	1	-		Jánossy 1985
Total								
total sites map No. 1-30					58	418		
(main investigation area)					42	299		

Table 3: Proportion of buzzard to goshawk according to number of fragments and according to number of sites for the total investigation area as well as for the main investigation area and the remaining one.

Investigation area	Period	Buzzard+ goshawk NISP		Buzzard: goshawk NISP		Buzzard: goshawk NISP		Buzzard+ goshawk sites		Buzzard: goshawk sites		Buzzard: goshawk sites	
		n	%	n	n	%	%	n	%	n	n	%	%
Total investigation area	early	206	100	96	: 110	47	: 53	81	100	47	: 44	58	: 54
	late	476	100	58	: 418	12	: 88	79	100	30	: 63	38	: 80
Main investigation area	early	37	100	16	: 21	43	: 57	23	100	13	: 14	57	: 61
	late	341	100	42	: 299	12	: 88	36	100	17	: 31	47	: 86
Remaining investigation area	early	169	100	80	: 89	47	: 53	58	100	34	: 30	59	: 52
	late	135	100	16	: 119	12	: 88	43	100	13	: 32	30	: 74

remains were found in 44 ones. Those sites which have yielded bones of both species are also included in this comparison. Whereas the number of sites which have yielded remains of buzzard and of sites which have yielded bones of goshawk are nearly balanced, a certain preponderance of goshawk is shown by the remains themselves: 96 ones of buzzard are facing 110 ones of goshawk (tab. 1-3; see also fig. 1).

In the case of the later period, however, the proportion of both species has altered much more: from 79 sites there are - including those with remains of both species - only 30 with bones of buzzard but 63 with those of goshawk, and if one takes the remains themselves into account the proportions of both species are even more unbalanced: there are only 58 remains of buzzard but nearly seven times more - that is 418 ones - of goshawk (tab. 2, 3; see also fig. 2). These differences in the proportion of both species between the two periods are significant ($\chi^2 = 95.46 > 6.64$: $P = 1\%$, $df = 1$; Cavalli-Sforza, 1972: 55 ff.).

Out of these 418 bones of goshawk from the later period, 214 come from 58 different sites (or parts of sites), but 204 - that is nearly half of them - from only five sites. These are Schleswig ($n = 80$), Haithabu-settlement ($n = 37$), Oldenburg ($n = 32$), Gamlebyen Oslo ($n = 31$), and Eketorp

III ($n = 24$). Thereby it is shown that the distribution is not uniform. However, it has to be considered that the amount of bones of this species is corresponding to the amount of all bird remains to a certain degree. Thus these five sites mentioned before have yielded at least more than 1,000 bird bones and more than 300 finds of wild birds. However, in the material from only two of them the buzzard is identified, that is Eketorp III with three remains and Gamlebyen Oslo with one single bone. Nevertheless it has to be mentioned that there are also sites providing more than 1,000 bones with only a relatively small number of bones of goshawk, such as Brandenburg or York (see tab. 2).

These general results - a slight preponderance of goshawk compared with buzzard in the earlier period and a pronounced predominance of this species in the later one and, according to the relative frequencies of the remains of both species, significant differences in the proportion of them between both periods - are valid for the north-western part of Europe on the whole. However, that concerns also the main investigation-area with its centre in the Central European lowland ($\chi^2 = 22.25 > 6.61$: $P = 1\%$, $df = 1$; see fig. 1, 2) as well as the peripheral remaining part ($\chi^2 = 42.11 > 6.61$: $P = 1\%$, $df = 1$). On the other hand there are no differences at all in the proportion of both species if the main investigation zone is compared with the remaining area within the earlier period and within the later one as well (earlier period: $\chi^2 = 0.73 < 3.84$: not significant, $df = 1$; later period: $\chi^2 = 0.0002 < 3.84$: not significant, $df = 1$; fig. 3). Therefore it has to be assumed that the influences on the abundance of both species within these periods were similar within a wide range. It means that the ecological factors affecting population density, as well as the complementary influences caused by earlier man as

Table 2: Remains of buzzard and goshawk as well as the total amount of bird remains from different sites according to chronological, chorological and functional aspects - later period (later than AD 400-500 - from approximately migration period respectively younger Iron Age (Scandinavia)). MA = Middle Ages; + = present $\approx n = 1$; * skeleton of a goshawk; ** according to Waluszewska-Bubien (1971) "goshawk or buzzard".

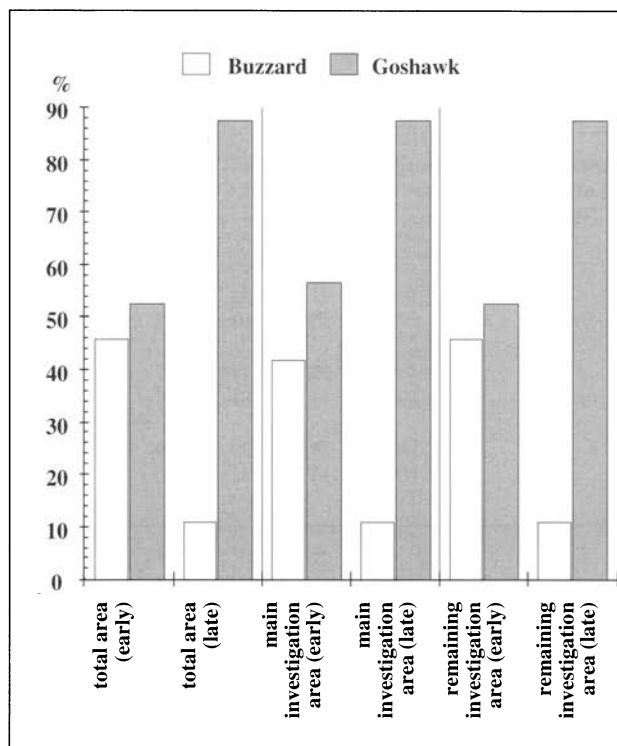


Fig. 3: Relationship between the remains of buzzard and goshawk from sites of the period earlier than approximately AD 400-500 and from those of the one later than this period. Total investigation area, main investigation area, and remaining part in comparison. Significant differences in the proportion of both species between earlier and later period, no differences in the proportion of both species within a period between main investigation area and the remaining one.

well as archaeologist, were more or less the same. Obviously that is not only true for the Central European lowland but also for North-Western Europe as the whole. This large area comprises beyond lowlands mountainous regions as well as areas exposed to the sea on the one hand and interior regions on the other. Furthermore it has to be mentioned that there exist today, and existed also in earlier times to a certain degree, distinct climatic differences and - connected therewith - vegetational ones according to the degree of latitude. However, it must be noted that these species, especially buzzard, are migratory or dispersive to a certain extent (Cramp *et al.*, 1980). Thus differences in their local abundance according to landscape, vegetation or climate are moderate.

In spite of this large-scaled similarity within a wide range, significant differences may obviously be observed in the proportion of both species which are linked to different periods. That is not only true for the two epochs

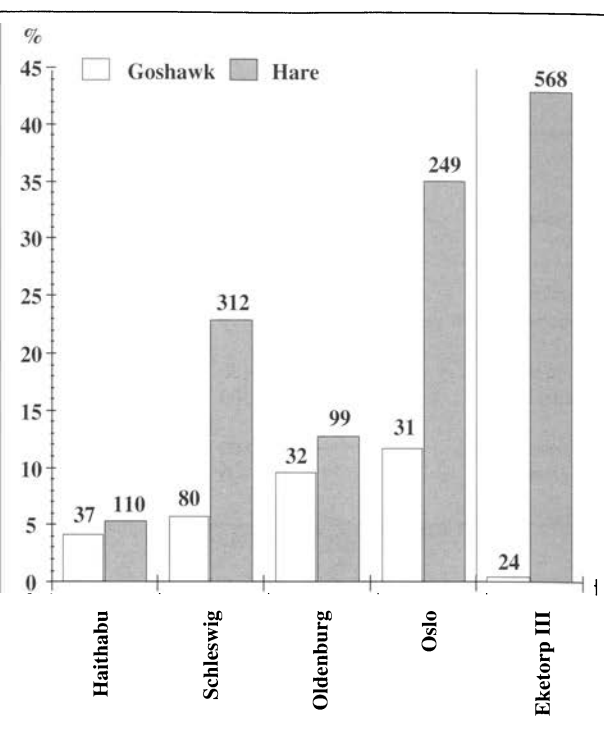


Fig. 4: Relative frequencies of goshawk referred to wild birds and hare referred to wild mammals of some sites.

distinguished here but also for the recent time with its inversion of the proportion of both species compared especially with that of the later period (see introduction). The reasons for these time-dependent differences are to be discussed.

Discussion

Taking the ecological demands of both species into consideration, a preponderance of goshawk was to expect especially for the earlier period in question. Since Neolithic times man has been cultivating land. For this purpose he had to clear woodland. Thus, the areas of woodland intermingled by fields and pastures were growing step by step favouring the goshawk more and more. Obviously this opening of the landscape was also extensive enough to turn out to a certain degree to the buzzard's advantage, too, which requires open land as food habitat (see introduction). That seems to be true only for the earlier period, but not - as expected - for the later one which includes especially the Middle Ages, an epoch which is known for its extensive clearing of woodland. In this later period the goshawk is even far more abundant than before compared with the buzzard!

That matter of fact may have a twofold reason. In the first place it has to be assumed that the increasing clearing activities were turning more and more out to the advantage of the goshawk, for the intermingling of both vegetational structures - wood and open areas - was growing, a process which led to an increasing forest fringe which is an optimal habitat-structure for this species. On the other hand the open areas perhaps were not large enough - and that may also be true for the later period - to be of decisive advantage for the buzzard with its preference for hunting over open tracts with low vegetation (Cramp *et al.*, 1980). Secondly it has to be taken into consideration that the - not expected - predominance of goshawk according to the bone remains in the later period is caused - at least partly - by special exploitation by man. Perhaps goshawks were killed as noxious birds for they preyed on poultry, but in any case they were caught for hawking. Thus it is possible that remains of goshawk are overrepresented compared with the natural abundance of the species. It has to be mentioned that the influence of falconry must be restricted to the later period, for this special hunting is known for Europe only since the 5th century AD (Lindner, 1976).

In connection with this special exploitation one can also suppose that people imported goshawks for falconry from elsewhere. It has been discussed by Lie (1988) for the remains of this species from Gamlebyen Oslo, particularly because it is known from Medieval documents that hawks were exported from Norway. According to Lindner (1976), too, in the Nordic countries the trade of birds for this purpose was of great importance, whereas in most parts of Scandinavia, falconry itself was not significant. Thus the large amount of goshawk remains in the later period, which includes especially a lot of Medieval sites, would be of direct anthropogenic reason. Beyond the mentioned material from Gamlebyen Oslo, which to all appearances points in contrast to Lindner's opinion (1976) to hawking activities in Norway too, the lots of goshawk remains in the materials of some other sites like Schleswig, Haithabu, and Oldenburg give a hint to this direction. The goshawk remains from Oldenburg for instance are interpreted by Prummel (1993) in connection with falconry with reference to the predominance of bones of females, which according to their size are especially suitable for this purpose. The occurrence of prey species in the Oldenburg-material which point to hawking with goshawks and which are not identical according to species and frequencies with their natural prey give a further hint. Thus, the abundance of

remains of hare ($n = 99$) can be seen in connexion with hawking. The same could be true for Haithabu ($n = 110$) and Schleswig ($n = 312$) and also for Eketorp III ($n = 568$) and Gamlebyen Oslo ($n = 249$) with the only difference that the hare remains of these last mentioned sites do not come from the brown hare (*Lepus europaeus*), but from the mountain hare (*Lepus timidus*). With the exception of Eketorp III, a positive correlation may also be established for these sites between the relative frequencies of goshawk and hare referred to the total amount of wild birds and wild mammals (fig. 4).

Whereas most of the time the conclusion on hawking must be indirect, like in the case of the sites mentioned, sometimes it can be proved directly, as could be shown by Sten and Vretemark (1988). They recognized among the finds of a lot of graves, dated to the Swedish Iron Age, remains of falcons and hawks - for the most part of goshawk - which obviously come from hawking birds which were sacrificed together with other animals on the funeral pyres in honour of the dead. Another example of a direct proof is the skeleton of a female goshawk which was found together with those of two dogs as well as some remains of further animals in a burial pit of the 5th/6th centuries in Quedlinburg in Thuringia/Germany (Müller, 1980). An additional one from the same region shows evidence of this species in a Franconian grave of the 5th to 7th centuries (Timpel, 1990).

In any case, it has to be considered that the proportion of both species in the later period is considerably influenced by falconry with goshawks. That means the proportion of goshawk bones is augmented by those of individuals used for this purpose which have perhaps even been caught elsewhere. It has to be assumed that the natural proportion of both species in the later period would have been like that of the earlier one or that it would have been even balanced.

The modern proportion of both species is in contrast to that of their bones from archaeological sites and especially from sites of the later period. That would also be correct if the influence of hawking is excluded. The recent pronounced preponderance of buzzard compared with goshawk is caused by several reasons. Firstly the large amount of open areas in today's landscape favours the buzzard considerably. Secondly the goshawk suffers more from pollution than the former species. Last but not least, the number of goshawks is decreasing markedly due to human persecution.

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