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The Bone Remains of Mammals and Birds from the Bjørnsholm Shell-Mound

A Preliminary Report

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During excavations 1985–91 at the Bjørnsholm settlement site and shell-mound organised by Søren H. Andersen, University of Aarhus, and Erik Johansen, *Aalborg Historiske Museum*, an extensive material of faunal remains was recovered. The finds were by and large restricted to the calcareous environment of the shell-mound itself, whereas the adjacent areas only provided a few badly preserved bone fragments. Beside the undisturbed Ertebølle and Funnel-Beaker deposits the shell-mound comprised some Iron Age pits. These readily recognizable features contained a mixture of Iron Age bones and redeposited Stone Age material, and will not be considered further here.

In the present preliminary report the result of the faunal analysis of two samples of bone remains from undisturbed Stone Age deposits of the shell-mound is presented. The samples comprise together about half of the excavated remains of mammals, birds, and amphibia. The by far largest sample, 2234 bone and antler fragments, comes from the Late Mesolithic deposits associated with the Ertebølle Culture (ETBK). The smaller sample of 362 fragments is Early Neolithic and associated with very Early Funnel-Beaker (TRB) finds. The two samples are thus representatives of the latest respectively the earliest discernable entities in a shell-mound accumulated around the transition from the Mesolithic to the Neolithic. Radiocarbon dates for oyster shells from the Ertebølle layer range from 5050 ± 100 B.C. (K-5304) to 4050 ± 90 B.C. (K-5068), whereas the Early Neolithic occupation is dated to 3960 ± 95 B.C. (K-5516) – 3530 ± 90 B.C. (K-5721) (calibrated C-14 dates, *cf.* S. H. Andersen 1993).

BONE PRESERVATION

In general the bone remains from the midden had an excellent surface preservation, but was badly fragmented: In both samples about 90% of the recovered pieces were less the 5 cms long. Between the Mesolithic and the Neolithic sample no remarkable differences concerning preservation was seen, neither in weathering nor in the degree of fragmentation. Despite the amount of material – as counted by fragments – less than 20% of the total of each sample could be determined to species, and only a fraction proved useful for an assessment of the seasonal aspects of the shell-mound economy.

The majority of the material consisted of very small fragments 1–3 cms long, lying solitary or 2 or 3 pieces together. In a few cases in the Mesolithic layers actual bone heaps were found. These usually comprised bones from several different species and, beside a number of indeterminable splinters, they contained the few large fragments found in the shell-mound, *i.e.* fragments more than 10–12 cms long.

Compared with the size classes of bone waste from lakeside dumps from other Stone Age sites, for example Ringkloster (S. H. Andersen 1975), where fragments less than 5 cms long are rare, the shell-mound material is much more fragmentary, having been exposed to rather strong mechanical fragmentation processes. Excepting the relatively rare instances where sediment pressure or other secondary factors are responsible for the fragmentation, the well preserved pieces predominantly seem to come from fractures in fresh bone, thus indicating marrow-fracturing or other deliberate bone fragmenting activities.

How, in detail, the intentional bone fracturing was carried out, will not be described here, as much as only a minority of the bones lend themselves to a detailed reconstruction. It must, however, be pointed out, that the very fragmented state of the material not necessarily was brought about by culinary practises involving bone crushing.

Considering the depositional history of the midden the

Size	Total		*Capreolus*		*Cervus*		Unidentified Large mammals	
	n	%	n	%	n	%	n	%
1	148	6.62	1	0.79	–	–	142	8.01
2	883	39.53	26	20.47	10	10.00	788	44.44
3	558	24.98	28	22.05	10	10.00	464	26.17
4	290	12.98	18	14.17	22	22.00	207	11.68
5	128	5.73	12	9.45	17	17.00	76	4.29
6	76	3.40	12	9.45	9	9.00	42	2.37
7	49	2.19	12	9.45	9	9.00	21	1.18
8	41	1.84	5	3.94	8	8.00	12	0.68
9	12	0.54	2	1.57	1	1.00	8	0.45
10	11	0.49	2	1.57	2	2.00	5	0.28
11	12	0.54	2	1.57	3	3.00	4	0.23
12	4	0.18	1	0.79	–	–	2	0.11
13	2	0.09	–	–	2	2.00	–	–
14	6	0.27	2	1.57	2	2.00	1	0.06
15	3	0.13	–	–	1	1.00	1	0.06
16	4	0.18	1	0.79	1	1.00	–	–
17	4	0.18	2	1.57	1	1.00	–	–
18	–	–	–	–	–	–	–	–
19	–	–	–	–	–	–	–	–
≥20	3	0.13	1	0.79	2	2.00	–	–
Sum:	2234	100.00	127	99.99	100	100.00	1773	100.00

Table 1. Bjørnsholm shell-midden. Size of bone (and antler) fragments in the Late Mesolithic, ETBK, sample. Size class number = Maximum length of fragments in centimetres. (Size class 3 thus all fragments between 2,0 and 2,9 cm long, size 4 all 3,0–3,9 cm long pieces a.s.o.). N: number of fragments.
Error: A total of 16 pieces (incl. 2 capreolus and 3 cervus) were not measured.

degree of fragmentation can be accounted for in another way, under the presumption that the recovered material is only a selection of the skeletal material once present. At least for the dominant Mesolithic parts of the midden traces of hearths, artefact use, etc., designate the midden as settlement and activity area and not a mere dump for adjacent habitations (S. H. Andersen & E. Johansen 1987; S. H. Andersen 1991). It thus seems plausible, that bulky waste from the processing of game animals was removed from the midden surface in use, if not for hygienic, then at least for practical reasons. This would logically include the removal of larger bones and bone fragments from marrow-fracturing, thus resulting in a predominance in the midden of fragments which had not been regarded as cumbersome, that is those of a size similar to or smaller than the shells.

The few larger bone heaps in the Mesolithic deposits do not contradict this general interpretation. The different skeletal elements and species identified from these entities are suggestive of an accidental association of the bones rather than their being the traces of specific activities. Such accidental bone depots are consonant with crevices or depressions between shell-heaps in periods of more intense accumulation. A further argument for the rapid accumulation of shell material at least at times, and in parts of the midden area in use, is the frequent fragments or even whole bones from neonate or juvenile animals in the Mesolithic sample, not the least in the bone heaps. In the presence of dogs – remains of which have been found – such fragments must be expected to have been covered by shells almost immediately, in order to have had any chance of preservation.

FRAGMENTATION AND SPECIES REPRESENTATION

Another imminent aspect of the very fragmented state of the material is its influence on the representation of the different species of game animals. As usual in Late Mesolithic (and Early Neolithic) samples, remains of red deer (*Cervus elaphus* (L.)), roe-deer (*Capreolus capreolus* (L.)), and wild boar (*Sus scrofa* (L.)) predominate in the identified portion of fragments from the Bjørnsholm shell-mound.

Between bone samples from various sites differences in the relative frequency of these species have often been noted, and interpreted as related to different hunting practices and differences in natural resources around sites.

In the case of the Late Mesolithic and Early Neolithic materials at least, any large scale comparison based on fragment counts from different sites must take the taphonomic aspects of fragmentation and sorting of bones into consideration, – not only as a limiting factor for the amount of bone remains deposited, but also as a factor influencing the possibility for determining species specificly and consequently for the analytical retrival of any given species.

A range of methods has been devised to deal with the quantification of bone samples, notably by weighing the determined fragments, or by calculating the minimum number of individuals (MNI) of different sex and age classes necessary to account for all determined fragments (*i.e.* Grayson 1984; Reichstein 1989).

None of these methods do, however, overcome the basic problem: That a bone fragment has to be recognized as

belonging to a species before any of the secondary procedures can be implemented.

The size distribution of the bone fragments in the larger Mesolithic sample from Bjørnsholm can be used to illustrate this (fig. 1 and table 1). If, for example, the number of fragments from the two anatomically related species, red deer and roe-deer, are compared, the higher fragment counts for roe-deer could be interpreted as indication of a higher frequency of roe-deer hunting.

Considering the size of the bone fragments, however, it becomes clear that the size distribution of the fragments belonging to the smaller species, roe-deer, corresponds better to that of the total sample found than the fragments from the larger species, red deer. When compared to the size distribution of unidentified fragments from larger mammals – that is the total sample minus remains of amphibia, birds, and rodents and thus that part of the material where red deer or roe-deer remains are probably hidden – this trend is supported. The bone fragments smaller than 3 cms constitute 78.62% of the unidentified mammals, 43.31% of the roe-deer but only 20.00% of the red deer remains. If fragments up to 5 cms' length are considered, the difference betweeen roe- and red deer are somewhat ameliorated, the percentages being 94.59%, 66.93%, and 59.00%, respectively.

On the average the red deer fragments are larger, thus suggesting that this species is underrepresented in the species list. This applies as well to the other large mammals, like wild boar, whereas the scarcity of the middle-sized and small carnivores most probably is fairly right. In the strongly fragmented material from Bjørnsholm large animals, species as well as individuals, are not as readily recognized, as in less fragmented samples. The validity of comparisons of the Bjørnsholm material and other contemporary finds whether from the settlement surfaces of other shell-mounds or lakeside dumps, should thus be preceded by careful analysis of possible inherent biases in each analysed sample.

The calculation of the MNI for small samples like the Bjørnsholm material has only limited value, as the recognition of individuals depends on the presence – or non-presence – of single bone fragments. Here the MNI first and foremost makes plain how very high the degree of bone loss in the shell-mound was. It can not, however, be taken at its face value as a representative age-structure of the hunted game, as no single skeletal element provided a comprehensive series through the age classes, and the MNI presented here is consequently a patchwork based on different skeletal elements. In such a case it may be predicted that young and subadult animals overweigh, as each fairly precise age-determination provides a new individual. Furthermore the strong fragmentation makes it predictable that those species whose teeth or jaw pieces are found most frequently offer the best possibilities for

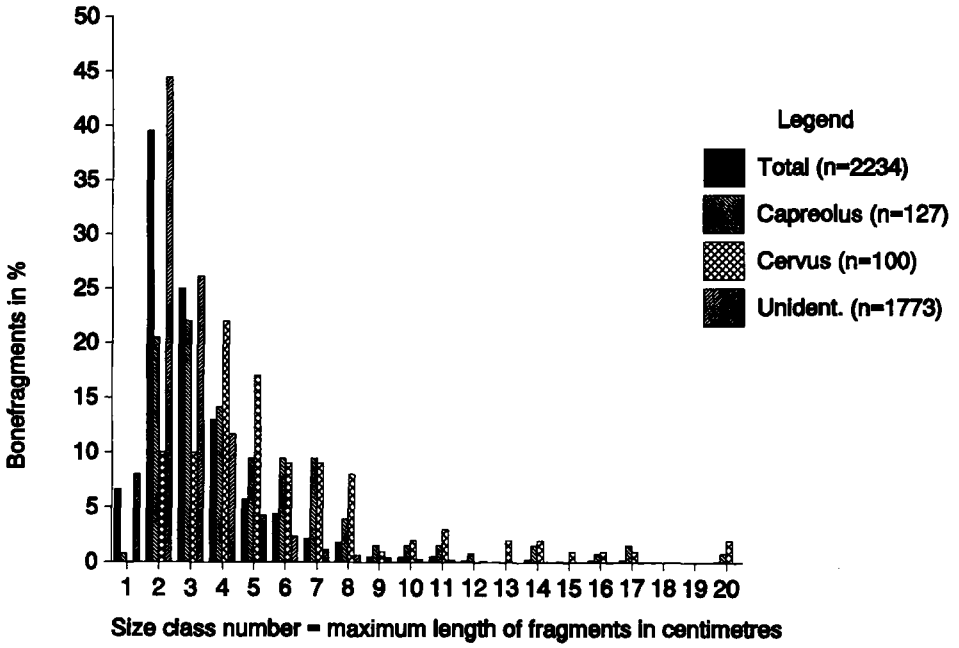

Fig. 1. Size distribution of bone fragments.

detailed age determination (here the wild boar) and thus give the highest MNI.

These problems also affect the determination of the seasons during which the shell-mound was used, and of the hunting methods. When all age groups are counted by 1 or 2 individuals, eventual quantitative preferences can hardly be detailed, and there is an imminent danger of missing periods of the year entirely. Basically the seasonal data from the shell-mound depend on two different criteria: 1) The mere presence, *i.e.* any fragment from a juvenile animal or migratory bird; 2) the quality of the fragment, *i.e.* the few pieces of jaw or antler suitable for determination. As the second criterion is rarely met amongst the strongly fragmented bone remains, the possible preference for particular periods of the year for settlement near the shell-mound will be based mainly on the presence of species.

THE LATE MESOLITHIC FAUNA

Summarizing the species list, Table 2, red deer (*Cervus elaphus* (L.)), roe-deer (*Capreolus capreolus* (L.)), and wild boar (*Sus scrofa* L.)) must be regarded as the most important game animals in the Bjørnsholm hunting territory together accounting for about three quarters of all specified fragments. From these three species adult and subadult animals as well as juveniles, and even neonates, were brought to the shell-mound.

The wild boar material comprised 83 fragments, whereof 32 came from neonate or juvenile pigs, the rest from adults or subadults. All parts of the skeleton are represented, with single teeth, small pieces of upper or lower jaw, and toe bones being most frequently encountered. The MNI counts 9, perhaps 10 different individuals: 2 neonates, 2 juveniles (one of which is 2–3 months old), 2 young subadults (one of which is 6–12 months old), 1 (perhaps 2) older subadults (at least one is 18–24 months old), and 2 adults. The wild boars could thus all have been hunted in the late spring – early summer between March and June, but some might have been hunted earlier, in the winter half of the year.

Four fragments from pig (*Sus sp.*) come from comparatively small animals and could not be determined with absolute confidence as wild boar. Three of these pieces were from juveniles and one from a young subadult. These fragments might add one young subadult, 10–16 months old, to the MNI for wild boar.

Roe-deer was identified from 129 pieces comprising two pieces of antler and bone fragments from all parts of the skeleton with pieces from skull and metapodials somewhat more common than other bones. Five bone fragments were from neonate or juvenile animals, the rest from adults or subadults. The MNI counts 7, perhaps 8 roe-deer: 1 neonate, 1 or 2 juveniles, 2 very young subadults (yearling?), two older subadult or adult females, and 1 adult male. The latter was shown by an unshed three-tined antler, thus indicating a time of death in the summer half of the year, between April and October. The neonates and juveniles could have been killed from June until July or August.

The red deer remains amount to 103 fragments including 14 pieces of antler. The antler fragments often carried traces of working, and for at least 5 pieces the determination of red deer antler has to be taken with a grain of salt. The bone fragments come from all parts of the skeleton, single teeth, toe bones, and metapodial fragments being the most often encountered. Sixteen bone fragments are from neonate and juvenile red deer calves. The MNI counts four individuals, 1 neonate, 1 juvenile, one young subadult, and one adult deer. The presence of the very young calves suggests hunting in the early summer, in June or July, whereas the antler remains are inconclusive.

Besides the three most common ungulates, wild boar, roe-deer, and red deer, the genus *Bos* was recorded, but in only two cases. One of these could by the small size of the bone be attributed to the domestic form, *Bos primigenius f. taurus* (L.). The bone fragment comes from the uppermost part of the ETBK oyster deposits, but it should rather be considered in connection with very early TRB finds in the immediate vicinity (see S.H. Andersen, this volume). The second bone fragment could not be determined further than to the genus *Bos*. As the aurochs (*Bos primigenius* (Boj.)) has been recorded in the ETBK section of the not finally evaluated part of the Bjørnsholm material, both the domesticated and the wild form of *Bos* may be considered as candidates for the moment.

Marine hunting is documented by remains of porpoise (*Phocaena phocaena* (L.)) and grey seal (*Halichoerus grypus* (Fabr.)), but both species by a few bone fragments only, and consequently with an MNI count of 1 per species. The fragments comprise pieces of humerus (grey seal) and vertebrae (porpoise), thus indicating that the marine mammals just as the land mammals were brought to the site complete and were butchered there.

Species (or higher category)		No. of fragments:	
Animals:			
Amphibians:	Amphibia:		
Toad unspec.	*Bufo sp.*	6	
Frog unspec.	*Rana sp.*	1	
Amphibians unspec.		7	
Amphibians unident.		2	
Summa,amphibians:		9	9
Birds:	Aves:		
Black-throated diver	*Gavia arctica* (L.)	2	
Rednecked grebe	*Podiceps griseigena* (Bodd.)	1	
Gannet	*Sula bassana* (L.)	3	
Whooper swan	*Cygnus cygnus* (L.)	4	
Barnacle goose	*Branta leucopsis* (Bechst.)	1	
Velvet scoter	*Melanitta fusca* (L.)	3	
Duck unident.	*Anas sp.*	6	
White-tailed eagle	*Haliaeetus albicilla* (L.)	1	
Osprey	*Pandion haliaetus* (L.)	1	
Capercaillie	*Tetrao urogallus* (L.)	2	
Curlew	*Numenius arquata* (L.)	1	
Sandpiper unspec.	*Tringa sp.*	1	
Ural Owl	*Strix uralensis* (Pall.)	1	
Thrush unspec.	*Turdus sp.*	3	
Birds ident.		30	
Birds unident.		49	
Summa, birds		79	79
Mammals:			
Insectivores:	Insectivora:		
Northern mole	*Talpa europaea* (L.)	1	1
Rodents:	Rodentia:		
Northern water-vole	*Arvicola terrestris* (L.)	5	
Vole unident.	*Microtus sp.*	1	
Yellow-necked mouse	*Apodemus flavicollis* (Melch.)	1	
Mouse unident.	*Apodemus sp.*	4	
Red squirrel	*Sciurus vulgaris* (L.)	1	
Rodents ident.		12	
Rodent unident.		7	
Summa, rodents		19	19
Carnivores:	Carnivora:		
Wolf	*Canis lupus* (L.)	3	
Dog	*Canis lupus f. familiaris* (L.)	5	
Red fox	*Vulpes vulpes* (L.)	15	
Wild-cat	*Felis silvestris* (Schreb.)	2	
Lynx	*Lynx lynx* (L.)	1	
Pine marten	*Martes martes* (L.)	2	
Western polecat	*Mustela putorius* (L.)	2	
Common otter	*Lutra lutra* (L.)	3	
Badger	*Meles meles* (L.)	6	
Grey seal	*Halichoerus grypus* (Fabr.)	2	
Artiodactyles:	Artiodactyla:		
Wild boar	*Sus scrofa* (L.)	83	
Swine unspec.	*Sus sp.*	4	
Roe-deer	*Capreolus capreolus* (L.)	129	
Red deer	*Cervus elaphus* (L.)	103*	
Cattle	*Bos primigenius f. taurus* (L.)	1	
Ox unspec.	*Bos sp.*	1	
Whales:	Cetacea:		
Porpoise	*Phocaena phocaena* (L.)	1	
Large mammals ident.		363	
Large mammals unident.		1780	
Summa, large mammals		2143	2143
Man:			
Man	*Homo sapiens sapiens*	1	1
Total number of fragments in ETBK sample:			2252

Notes:
*antler: 21, bone: 82.

Table 2. Bjørnsholm shell-midden sample. Mammals, birds, and amphibia from Late Mesolithic (ETBK) layers. N = number of bone or antler fragments identified to species or higher category.

The same applies to the carnivores, where the sparse bone remains from each species generally comprise skeletal parts, which are in better agreement with the import of whole animals to the shell-mound than would be selected parts like untrimmed furs or pelts. Again the MNI count is restricted to the minimum of 1 each of a range of species: wolf (*Canis lupus* (L.)), dog (*Canis lupus f. domesticus* (L.)), lynx (*Lynx lynx* (L.)), wild cat (*Felis silvestris* (Schr.)), polecat (*Mustela putorius* (L.)), badger (*Meles meles* (L.)), and otter (*Lutra lutra* (L.)). The red fox (*Vulpes vulpes* (L.)) was, however, counted twice, but like the above mentioned species all bones were from adults or subadults. The pine marten (*Martes martes* (L.)) was represented by a MNI of 2 individuals, one adult or older subadult and one juvenile, probably a few months old.

In general the hunting of the smaller carnivores may be seen as associated primarily with the provision of furs, and thus – with due caution – perhaps indicating autumn or winter activities. The presence of an young pine marten does, however, suggest that potential furbearing animals were also taken in the summer months. Moreover, carnivore bones from better preserved materials, for example those from Tybrind Vig, display cutmarks, which can

hardly be attributed to skinning only (Trolle-Lassen 1986).

Even by modern Danish standards badgerham is considered a delicacy (Weitemeyer 1984), and that dogs and several species of rodents have been in culinary esteem at other times and places than modern Western Europe need not be discussed further here. Only, it should be pointed out that remains of carnivore carcasses do not necessarily have to be interpreted as refuse from skinning only or as traces of ultimate emergency foodreserves.

The rodents are represented by red squirrel (*Sciurus vulgaris* (L.), water-vole (*Arvicola terrestris* (L.)), and the yellow-necked mouse (*Apodemus flavicollis* (Melch.), and the insectivores by the mole (*Talpa europea* (L.)). Of these the red squirrel has most likely been hunted for its fur, whereas the remains of voles and mice, and the unspecified bones of toads and frogs as well, probably represent later intrusions.

The comparatively small number of identified bird bones comprise an extensive sample of mainly aquatic species. None of these have MNI counts of more than one individual, except the whooper swan (*Cygnus cygnus* (L.)), where at least two individuals had been brought to the shell-mound. The birds comprise seasonally indifferent (if not necessarily resident) species, which could have been hunted in the summer or in the winter, and a smaller group, whose presence in the Limfjord most probably was restricted to the winter months. The hunting of whooper swan, barnacle goose (*Branta leucopsis* (Bechst.)), gannet (*Sula bassana* (L.)), and blackthroated diver (*Gavia arctica* (L.)) may thus have taken place sometime between October and April. In addition a bone from a bird about the size of a goose, which unfortunately could not be determined to the species level, shows medullary bone deposits, thus indicating a time of death in the spring shortly before the begin of the breeding season.

Whereas the majority of the birds could have been taken on or near the water, only two point to inland hunting, namely the capercaille (*Tetrao urogallus* (L.)) and the ural owl (*Strix uralensis* (Pall.)). As a distinct forest species the latter indicates the presence of mature woodland within the Bjørnsholm foraging range – with more emphasis than the hints already given by the hunting of mammals like red squirrel, pine marten, and wild boar.

Last not least, a human molar was found. It may come from a destroyed grave and does thus, strictly speaking, not belong to the remaining faunal material.

Human modification of the bones

A scapula from an adult or older subadult red deer most probably show the traces of an unhealed hunting lesion. The lesion in question is seen as a deep, sharply cut groove running across the medial side of the collum, and containing several small indeterminable flint splinters. The doubt concerning the nature of the fracture is rooted in the likeness of the powerful blows of arrow-points to those from axes. A more or less superficial blow from for example an flake axe could possibly leave traces much like the groove found on the scapula, including the embedded splinters of flint. It is, however, hard to argue for the placement of such a single blow. Hitting in this place would most probably be done in connection with the severing of the scapula – humerus joint. As the blow is placed almost a handbreath too high to be effective, and – judging from the lack of further traces at least on the scapula – was not repeated, a hunting lesion caused by a flint-tipped arrow seems a likelier interpretation.

If so, the red deer had been shot from an almost frontal position. The ensuing lesion may not have proven immediately fatal itself, but by severing several muscles in the shoulder it would have been a severe hindrance to flight.

Cutmarks have been encountered on the identified bone fragments but both cutmarks and identified remains are too rare to warrant a description of the buthering technique used on any particular species. Traces of working and modification for artefact production were found on red deer antler fragments, wing bones from large birds (*Cygnus*) and metapodials from roe-deer.

The gross of the inidentifiable fragments are small splinters of massive bone as found in the diaphysis of longbones (or the lower jaw) of the larger (wild boar, red deer) or middle sized (roe-deer, wolf, badger, etc.) land mammals, and may indicate regular marrow fracturing in the shell-mound area. On the other hand bone pieces, which could be referred to vertebrae or ribs, are rare, even when the specified fragments are added, and may to a higher degree have been taken away or destroyed by humans or scavengers.

THE EARLY NEOLITHIC FAUNA

The very small Neolithic sample does, not surprisingly, comprise fewer species and by MNI count fewer individuals as well (table 3). All species found are documented by

Species (or higher category)		No. of fragments:	
Animals:			
Amphibians:	Amphibia:		
Toad unspec.	*Bufo unspec.*	2	
Amphibia unident.		2	
Summa, amphibia		4	4
Birds:	Aves:		
Gannet	*Sula bassana* (L.)	1	
Whooper swan	*Cygnus cygnus* (L.)	2	
Swan unspec.	*Cygnus sp.*	2	
Birds, ident.		5	
Birds, unident.		6	
Summa, birds		11	11
Rodents:	Rodentia:		
Western water vole	*Arvicola terrestris* (L.)	2	
Rodents unident.		2	
Summa, rodents		4	4
Carnivores:	Carnivora:		
Red fox	*Vulpes vulpes* (L.)	2	
Pine marten	*Martes martes* (L.)	1	
Artiodactyles:	Artiodactyla:		
Wild boar	*Sus scrofa* (L.)	3	
Swine unspec.	*Sus sp.*	2	
Roe-deer	*Capreolus capreolus* (L.)	9	
Red deer	*Cervus elaphus* (L.)	6*	
Cattle	*Bos primigenius f. taurus* (L.)	1	
Ox unspec.	*Bos sp.*	3	
Sheep	*Ovis ammon f. aries* (L.)	1	
Sheep or goat	*Ovis/Capra*	1	
Large mammals		29	
Large mammals unident.		314	
Summa, large mammals		343	343
Total number of fragments in TRB sample:			363

*antler 3, bone 3.

Table 3. Bjørnsholm shell-midden sample. Mammals, birds, and amphibians from Early Neolithic (TRB) layers.

a few bone fragments only, and consequently have the minimum MNI count of one each, adult or older subadult. For wild boar and roe-deer can be added one juvenile respectively, thus showing that the shell-mound has been used in the summer. On the other hand the presence of whooper swan and gannet suggests use in the winter half of the year, too.

With regard to the wild hunted species, wild boar, roe-deer, red deer, red fox, and pine marten, as well as the birds, there is no significant differences between this and the larger Mesolithic sample, considering the very small sample size.

The Neolithic sample does however further comprise the remains of domesticated animals, i.e. cattle, and – possibly of more consequence – of sheep (*Ovis ammon f. aries* (L.)). To these two may be added domestic pig (*Sus scrofa f. ?domestica* (L.)) from the shell-mound samples not evaluated here.

SUMMARY – AND COMMENTS ON THE FAUNAL EVIDENCE

Regarding first the seasonal evidence from the Mesolithic sample the period from late winter (January-February) to late summer (July-August) may be suggested as the shortest span of time necessary to account for all species or individuals found. This is, however, only a paraphrase for the fact that winter, spring and summer indicators have been found.

As the seasonal indications from the Neolithic sample is yet more inconclusive, only pointing to human presence in the summer as well as in the winter half of the year, the same may – or may not – be true for the TRB settlement as well.

For both samples possible use of the shell-mound in the autumn or early winter can not be ruled out. Positive evidence for that period would in practice depend on fairly undamaged antlers or wild boar jaws in the material.

The Mesolithic hunting economy presented by this preliminary sample concentrate on the three big ungulates, wild boar, red deer, and roe-deer, all of which were killed seemingly without age class restrictions. As a matter of fact juveniles are frequently encountered in well-preserved, carefully excavated Mesolithic bone samples, and were apparently hunted as was anything else. The species of marine mammals, carnivores and birds, are comparatively rare and may cautiously be interpreted in terms of occasional hunting, thus pointing to a flexible, opportunistic economy.

It can already be estimated, that the inclusion of the surveyed material would not bring about any significant change in relation to what has been stated here. First of all, the inclusion of the surveyed material will add more species of birds. To the list of mammals, only the aurochs will have to be added.

The rather extensive range of mammals in the Late

Mesolithic sample thus includes most, but not all, of the larger mammals to be expected in the comparatively complete fauna of Jutland in the Late Atlantic and the Subboreal (Aaris-Sørensen 1980). Thus the elk is not found in the Bjørnsholm sample, but it is present, as is brown bear, however rare, on other sites in the Limfjord area (*i.e.* Ertebølle (Winge 1900), and Virksund (Winge 1904)). A more conspicuous absent is the beaver. Whereas this species is found on ETBK or TRB sites in East Denmark (*i.a.* Mulbjerg and Troldebjerg), and in East Jutland (Dyrholmen), as well as Schleswig-Holstein (Degerbøl 1942; Skaarup 1973; Aaris-Sørensen 1985), it has as yet not been reported from any of the Limfjord sites.

An interesting aspect of this concerns the possibility for roughly estimating when a shell-mound sample may be regarded zoologically significant.

Using the recently excavated faunal sample from Ertebølle as a starting point (S. H. Andersen & E. Johansen 1987) a sample of 632 identified bone fragments produced almost the same species list as the wast material excavated ninety years before (Winge 1900).

As mentioned above, the Mesolithic sample of 412 identified fragments from Bjørnsholm presented here does not cover all species of birds from the site, but describes fairly well the relation between the three primary game animals and the rest. This may suggest that this kind of material, being rich in species, however very fragmented, may be roughly surveyed by means of some 500 identified bone fragments. With a percentage of identified fragments from both sites of about 20, this would be the equivalent of no more than 2500–3000 excavated pieces.

Taking these estimates into account the preliminary Neolithic sample from Bjørnsholm presented here must be considered far too small for a survey of the wild fauna around the shell-mound. It does, however, support the suspicion that the presence of the two odd fragments of domestic species may be the more significant. Not least in the case of the introduced species, the sheep, as a single bone fragment does not equal just one individual but a viable breeding population in the area.

More than showing signs of a distinct economic change, however, the Early TRB settlement in Bjørnsholm seems to have continued the Mesolithic way of life – just adding a few potentially powerful elements of their own.

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