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Eel Fishing in the Late Mesolithic and the Early Neolithic: A Preliminary Report from the Stratified Kitchen Midden at Havnø, Denmark

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ABSTRACT: Havnø is a stratified Danish kitchen midden which spans the Late Mesolithic Ertebølle and the Early Neolithic Funnel Beaker cultures, ca. 5000-3500 cal. B.C. This paper presents the results of a study conducted on the fish bones recovered from a complete column sample taken from all levels of a stratified midden. The material is quantified and estimations of total fish lengths are provided. Interpretation focuses on taphonomy, relative importance of the fish represented, especially the European eel (*Anguilla anguilla*), significance of three-spined stickleback (*Gasterosteus aculeatus*), distribution of fish bones, possible fishing methods employed, and season(s) of capture.

KEYWORDS: EUROPEAN EEL, LATE MESOLITHIC ERTEBØLLE CULTURE, EARLY NEOLITHIC FUNNEL BEAKER CULTURE, KITCHEN MIDDEN, FISHING, TOTAL LENGTH, DENMARK, COLUMN SAMPLE

RESUMEN: Havnø es un conchero danés bien estratificado que discurre desde la cultura Ertebølle del Mesolítico tardío y la cultura de los vasos de embudo del Neolítico inicial (5.000-3.500 cal a.C.). Este trabajo presenta los resultados de un estudio llevado a cabo con los huesos de peces recuperados en una columna completa de muestreo que incorpora todos los niveles del conchero estratificado. El material fue cuantificado y se proporcionaron estimaciones sobre las longitudes totales de los especímenes. La interpretación se centra sobre la tafonomía y la importancia relativa de los peces aparecidos. Entre éstos, destaca la anguila (*Anguilla anguilla*), la relevancia del espinoso (*Gasterosteus aculeatus*) así como la distribución de los restos de peces, los posibles métodos de pesca utilizados y la(s) estación(es) de captura.

PALABRAS CLAVE: ANGUILA, CULTURA ERTEBØLLE, MESOLÍTICO TARDÍO, CULTURA DE LOS VASOS DE EMBUDO, NEOLÍTICO TEMPRANO, CONCHERO, PESCA, LONGITUDES TOTALES, DINAMARCA, MUESTREO DE COLUMNA

INTRODUCTION

The stratified *køkkenmøddinger* (kitchen middens or shell middens) that span the Mesolithic-Neolithic transition in Denmark are renowned. Materials recovered from these sites can provide us with a wealth of information concerning the nature of socio-economic change and, in particular, the use of marine resources at this important juncture in prehistory when domesticated animals and plants were first introduced in northern Europe (Andersen, 2000a). While the majority of the kitchen middens belong to the Late Mesolithic Ertebølle culture (ca. 5400-3950 cal. B.C.), there is some site continuity into the subsequent Funnel Beaker or Tragtbæger culture (ca. 3950-2800 cal. B.C.), which represents the earliest phase of the Neolithic in the region. In these cases, one can observe the transition to agriculture in the midden stratigraphy. For instance, at the sites of Havnø, Bjørnsholm, Krabbesholm II, Norsminde, and Visborg (Andersen, 1989, 1991, 2000b, 2005, 2008a) on the Jutland peninsula, the Early Neolithic levels are stratified above the preceding levels of the Late Mesolithic Ertebølle culture (Andersen, 2007). Thus far, there have been numerous fish bone assemblages that have been analyzed, particularly from the Late Mesolithic Ertebølle culture, but fewer samples examined from the subsequent Early Neolithic Funnel Beaker culture (Ritchie, 2010; Enghoff, 2011). In this paper, we examine the fish bone assemblage recovered from the Havnø site, a stratified kitchen midden whose occupation spans the Late Mesolithic Ertebølle through the Early Neolithic Funnel Beaker cultural periods.

Investigations in Denmark over the past 160 years have revealed a rich archaeological record. Thousands of fish bones, millions of marine molluscan shells, and hundreds of fish procurement implements (including traps, weirs, nets, spears, hooks, dugout canoes, and paddles) (Andersen, 1995, 2011; Pedersen, 1995) have been recovered from numerous archaeological excavations. In addition, approximately 400 to 500 preserved kitchen middens (Andersen, 2007, 2008b) and several hundred other types of coastal sites (Fischer, 2007) have been recorded, also indicating extensive use of marine environments. In recent years, the application of stable isotope analysis on Late Mesolithic and Early Neolithic human bone collagen (Tauber, 1981; Fischer *et al*., 2007), as well as recent developments in molecular and isotopic characteristics of lipids extracted from ceramic vessels (Craig *et al*., 2007, 2011; Heron *et al.*, 2007), also demonstrate that an essential and sometimes significant proportion of human diets consisted of marine resources, even at inland sites.

ARCHAEOLOGICAL BACKGROUND

The kitchen midden at Havnø is located on the north side of the Mariager Fjord in east-central Jutland, Denmark (Figure 1). During the Atlantic (ca. 7000-3900 cal. B.C.) and early Subboreal (ca. 3900-2000 cal. B.C.) chronozones, the site was located on the southern shore of a small barrier island, approximately 2 km into the mouth of the fjord (Andersen, 2008a). The marine waters in the immediate vicinity of the site would have been a very favorable environment for supporting the kinds of marine resources recovered. Various species of fish, sea mammals, waterfowl, and shellfish most likely would have thrived in the warm shallow saline waters and tidal flats which would have surrounded the island (Andersen, 2008a). During these periods, the Mariager Fjord was more extensive, and its shores were lined with numerous coastal settlements, now represented by kitchen middens (Enghoff, 2011). Since the Subboreal, the fjord has narrowed substantially due to the continual rise of land (glacial isostatic rebound), resulting in extensive reclaimed land surrounding the middens (Milner, 2002).

In 1894, the Second Kitchen Midden Commission conducted a small excavation at Havnø, and the results were published by Madsen *et al*. (1900). It found two hearths as well as flint, bone, and pottery. Only seven fish bones were recovered: 5 European eel (*Anguilla anguilla*) and 2 flatfish (Pleuronectidae) specimens (Winge, 1900: 110). Archaeological work was not resumed till 100 years later, in the 1990s through the 2000s, by Søren H. Andersen (2008a) and is currently coming to a close. Radiocarbon dates indicate that midden deposition took place from ca. 5000-3500 cal. B.C., with a gradual vertical accumulation of material. The midden appeared to have grown fairly continuously as there was no clear evidence of an occupation hiatus (Andersen, 2008a).

The anthropogenic material from the Ertebølle cultural levels was diverse. Molluscan shells and

FIGURE 1

Distribution map of Denmark as well as selected sites mentioned in the text. Pink circle: Havnø. Green circle: Ertebølle, the *Locus classicus* of the Ertebølle culture. Orange circle: stratified coastal kitchen midden except Vængesø I which belongs to the Ertebølle culture only. Note the stratified kitchen midden at Visborg which is northwest of the kitchen midden at Havnø (map by Theis Zetner Trolle Jensen and H. K. Robson).

bones from fish, waterfowl, and sea mammals as well as the characteristic forest-dwelling ungulates that are known from many northern European Ertebølle assemblages, such as red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), and wild boar (*Sus scrofa*), have been identified. The Funnel Beaker cultural levels contained a similar spectrum of species, although the latter were found in association with domesticated cattle (*Bos taurus*), swine (*Sus* spp.), and ovicaprids (*Ovis*/*Capra* spp.) (Andersen, 2008a).

Cultural material remains included flint, bone and antler tools, including red deer ulna daggers, bird bone points/awls, fishhooks, and antler axes, in addition to pottery shards. The excavators also identified two types of hearths as well as pits and

stakeholes. The variety of materials recovered from the midden at Havnø is fairly similar in comparison to that of other Danish kitchen middens, such as at Norsminde and Krabbesholm II (Andersen, 1989, 2005, 2008a; Milner, 2002; Laurie, 2008).

MATERIALS AND METHODS

During the 2010 summer excavation, one complete column sample, measuring 50 x 50 cm, was excavated from a stratified deposit in the central part of the site (Figure 2). The matrices of the column sample were meticulously excavated solely by brush, as opposed to other hand tools, and the fish bones were collected by hand. The matrices were then screened through three sieves (2.5, 1.0, and 0.5 mm fractions), ensuring that even the smallest anthropogenic elements (especially fish bones) were recovered. Of the 11 stratigraphic levels that were identified, nine contained fish bones (Table 1). Level 1 was dated by seriation to the Early Neolithic (ca. 3950-3700 B.C.) based on ceramic typology, while the bottom of level 2 and the top of level 3 were radiocarbon dated to ca. 4767-4617 cal. B.C., or the Late Mesolithic (see Figure 2).

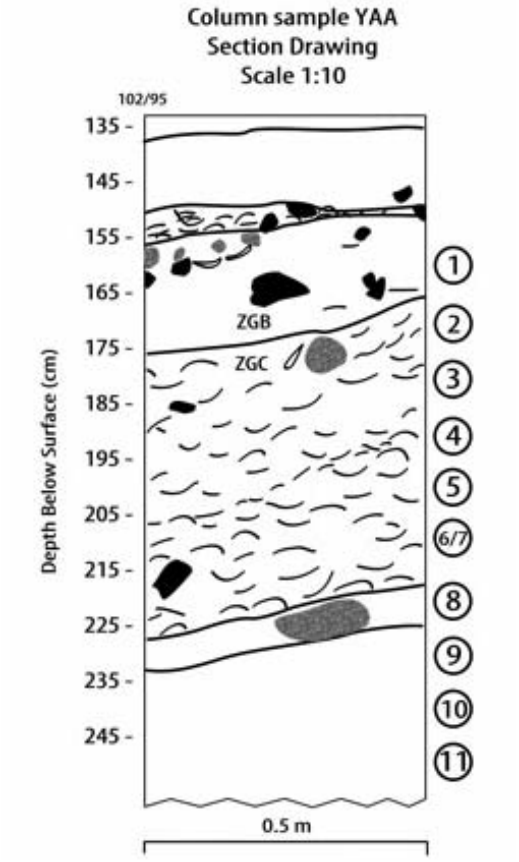


FIGURE 2

Stratigraphy and levels of the column sample at Havnø. ZGB refers to the oyster AMS radiocarbon dating sample which was taken from the bottom of level 2. ZGC refers to the oyster AMS radiocarbon dating sample which was taken from the top of level 3. Black: flint. Grey: stone. Curve: oyster shell (digitalized section drawing by Niklas Hausmann).

The fish bones were identified by comparison with modern reference skeletons housed at the University of York, United Kingdom. Due to their small size, a majority of the fish bones were examined under a stereomicroscope at 10-20x magnification. Measurements were undertaken with digital calipers to two decimal places according to Morales & Rosenlund (1979). Total fish length was estimated by comparison of bones confidently identified to species with modern fish skeletons. For eel, regression equations provided in Enghoff (1986) and Thom (1990) were used. Quantification included a count of the total number of identified specimens of each taxon, or NISP.

RESULTS

The fish taxa identified from the midden column sample are listed in Table 2. A total of 373 fish bone specimens were identified. Of these, 306 specimens could be identified to the species or family level. Ten fish families were represented. Vertebrae constituted 60.1% (NISP = 184) of the fish bone assemblage with 39.9% (NISP = 122) consisting of cranial and other skeletal elements. The data shown in Table 3 are based on those fish bones which were identified to the species or family level. The faunal materials have been divided into Mesolithic, Mesolithic/Neolithic (i.e. transitional), and Neolithic periods.

Taphonomy

The fish bones recovered were generally very well preserved, although neural and haemal spines and other projections were often broken, similar to

Stratigraphic level	NISP	Cultural epoch
Level 1	45	Early Funnel Beaker
Level 2	52	Early Funnel Beaker/Middle-Late Ertebølle
Level 3	95	Middle-Late Ertebølle
Level 4	53	Middle-Late Ertebølle
Level 5	39	Middle-Late Ertebølle
Level 6	12	Middle-Late Ertebølle
Level 7	2	Middle-Late Ertebølle
Level 8	6	Middle-Late Ertebølle
Level 9	2	Middle-Late Ertebølle
Level 10	0	Middle-Late Ertebølle
Level 11	0	Middle-Late Ertebølle
Total	306	

TABLE 1

Distribution of Fish Remains in the Havnø Column Sample by Level.

Family	Genus and Species	Common Name	Habitat	Salinity Tolerance	Seasonal Availability
Anguillidae	*Anguilla anguilla*	European eel	Various	Catadromous	Year round, concentrated at migrations
Gadidae	*Gadus morhua*	Atlantic cod	Pelagic, coastal and offshore	Age dependent, young - euryhaline	Warmer months, size dependant
Gasterosteidae	*Gasterosteus aculeatus*	Three-spined stickleback	Mud, sand	Euryhaline	Year round
Trachinidae	*Trachinus draco*	Greater weever	Demersal	Marine	Year round
Scombridae	*Scomber scombrus*	Atlantic mackerel	Pelagic (e.g., including sand, mud, plants)	Brackish, marine	Winter – open ocean Spring – inshore migration Summer – inshore spawning Autumn – offshore migration

TABLE 2

Fish Identified in the Havnø Column Sample with Data on Habitat, Salinity Tolerance, and Seasonal Availability (Sources: Pickard & Bonsall, 2007; Schmölcke & Ritchie, 2010).

the situation in other Danish fish bone assemblages (Enghoff, 1986, 1989, 1991). The remains most likely represented refuse from meals which were discarded along with the molluscan shells also composing the midden. Bones from the head, shoulder and pelvic girdles, vertebrae, and other skeletal elements were present. Since there was no evidence of butchering marks on the fish bones and there were relatively few specimens, it was unclear whether or not fish were processed at the site. Although a hearth was excavated from the uppermost levels in the column, only one bone showed evidence of having been burnt. The presence of crushed bone could, however, indicate that the fish remains had passed through a mammal gut (Jones, 1986). Animal gnawing was not recorded within the assemblage, though the presence of numerous bones of the three-spined stickleback could indicate that the European otter (*Lutra lutra*) played a role in the formation of the Havnø assemblage (Nicholson, 2000). Additional shells subsequently deposited over the refuse created optimal conditions for preserving the organic materials in the midden by providing protection and increasing the calcareous content ($CaCO_3$) of the soils (Noe-Nygaard, 1987). While the relative abundance of fish species present provided an estimate of the kinds of taxa caught in the immediate vicinity of the site, the much smaller sample size at Havnø (NISP = 373) in comparison to that of the fish bone assemblage from the kitchen midden at Ertebølle (NISP = 9,462) (Enghoff, 1986) could skew

results. Nevertheless, not all of the materials were sieved at Havnø (Ritchie, 2010), and therefore numerous smaller bones may have been lost during excavation. Moreover, individual species of fish have different numbers of bones (Casteel, 1976; Schmölcke & Ritchie, 2010) as well as differential degrees of preservation (Enghoff, 1986; Enghoff *et al*., 2007). For example, the tissue of eel, herring (*Clupea harengus*), salmon? (*Salmo* spp.), and flatfish is lipid-rich, and its decomposition may accelerate the structural decay of their bones when compared to non-oily fish (Lepiksaar & Heinrich, 1977; Enghoff, 1986, 2011; Wheeler & Jones, 1989; O'Connor, 2008 –but see Nicholson, 1996a, 1996b, 1998 for contrary evidence). Despite these taphonomic processes, eel bones dominated the fish faunal assemblage, and therefore they may have been an important resource at Havnø.

Fish taxa and their relative frequencies

Fish species from ten families were represented in the faunal assemblage. Specimens of five of these families, however, could not be further identified to the lower genus and species taxonomic levels (Table 3). Of these five families, two species of Clupeidae, three Salmonidae species, six Gadidae species, two Scophthalmidae species, and three Pleuronectidae species are known to naturally occur in the region. Consequently, archaeological specimens representing these families were identified, respectively, according to the following groupings: for Clupeidae, herring/shad (*Clupea harengus/Alosa* spp.); for Salmonidae, whitefish/Atlantic salmon/sea trout (*Coregonus* spp./*Salmo salar*/*Salmo trutta*); for Gadidae, Atlantic cod/haddock/ling/pollock/saithe/whiting (*Gadus morhua*/*Melanogrammus aeglefinus*/*Molva molva*/*Pollachius pollachius*/*Pollachius virens*/*Merlangius merlangus*); for Scophthalmidae, turbot/brill (*Psetta maxima*/*Scophthalmus rhombus*); and for Pleuronectidae, flounder/plaice/dab (*Platichthys flesus*/*Pleuronectes platessa*/*Limanda limanda*). Moreover, it was not possible to identify the Scorpaenidae specimens beyond the family level.

European eel (*Anguilla anguilla*) completely dominated the archaeological fish assemblage, constituting 71.2% of the total NISP of the fish bones identified. Next in relative frequency was three-spined stickleback (*Gasterosteus aculeatus*) at 17.6%. This was followed by flatfish (Pleuronectidae) at 4.2% and gadids (Gadidae) at 2.9%, which included 3 bones identified as Atlantic cod (*Gadus morhua*). Eight additional species together constituted the remaining 4.1%.

The majority of the identified specimens belonged to migratory species and included 218 eel bones and a single salmonid vertebra. The three-spined stickleback and the scorpaenids may have been caught in either fresh or saltwater. Combined with the migratory species they constituted 89.8% of the fish remains. Marine species constituted 10.2% of the total fish bone assemblage and included species requiring high salinity (e.g., pollock and saithe) and those frequenting brackish water (e.g., flounder).

Taxon	Mesolithic		Mesolithic/Neolithic		Neolithic	
	NISP	%	NISP	%	NISP	%
Anguilla anguilla (European eel)	153	72.9	43	82.7	22	50
Clupea harengus/*Alosa* spp. (herring/shad)	2	1				
Coregonus spp./*Salmo salar*/*Salmo trutta* (whitefish/Atlantic salmon/sea trout)	1	0.5				
Gadids	6	2.9			3	6.8
Including: *Gadus morhua* (Atlantic cod)	1	0.5			2	4.5
Gadus morhua/*Melanogrammus aeglefinus*/*Molva molva*/*Pollachius pollachius*/*Pollachius virens*/*Merlangius merlangus* (Atlantic cod/haddock/ling/pollock/saithe/whiting)	5	2.4			1	2.3
Gasterosteus aculeatus (three-spined stickleback)	34	16.2	2	3.8	18	40.9
Scorpaenidae	2	1				
Trachinus draco (greater weever)	4	1.9	1	1.9		
Scomber scombrus (mackerel)	1	0.5				
Psetta maxima/*Scophthalmus rhombus* (turbot/brill)			1	1.9		
Platichthys flesus/*Pleuronectes platessa*/*Limanda limanda* (flounder/plaice/dab)	7	3.3	5	9.6	1	2.3
Total	210	100	52	100	44	100

TABLE 3

Fish Identified in the Havnø Column Sample with Quantification.

Distribution of fish bones within column sample

Of the fish bones identified at Havnø, 85.7% (NISP = 262) were recovered from the Late Mesolithic Ertebølle cultural strata, and 14.3% (NISP = 44) came from the Early Neolithic Funnel Beaker occupation (see Table 1). In general, the fish bones were concentrated in levels 1 to 5 with a very uniform vertical distribution of species. European eel and three-spined stickleback dominated these levels. The concentration of fish bones, however, abruptly declined in the older Ertebølle cultural levels, though more fish bones were recovered from Ertebølle deposits in other parts of the kitchen midden (Ritchie, 2010; Enghoff, 2011). Numerous fish bones recovered from other excavation units at Havnø still await identification and analysis, and therefore a complete description of the horizontal and vertical distribution of fish bones from both the Ertebølle and Funnel Beaker cultural levels at the site is not yet possible.

Size classes

The column sample material contained 10 bones representing individuals whose total size was estimated by direct comparison with modern specimens of known length in the reference collections at the University of York. The results showed that four of the fish species in the Havnø material were represented by quite small individuals. The total length (TL) of the herring/shad (*Clupea harengus/Alosa* spp.) represented ranged from 15 to 25 cm (n = 2), while Atlantic cod (*Gadus morhua*) ranged from 10 to 30 cm (n = 3). Total fish length estimates for greater weever (*Trachinus draco*) were from 15 to 30 cm (n = 4), and the single mackerel (*Scomber scombrus*) measured between 25 and 35 cm in total length.

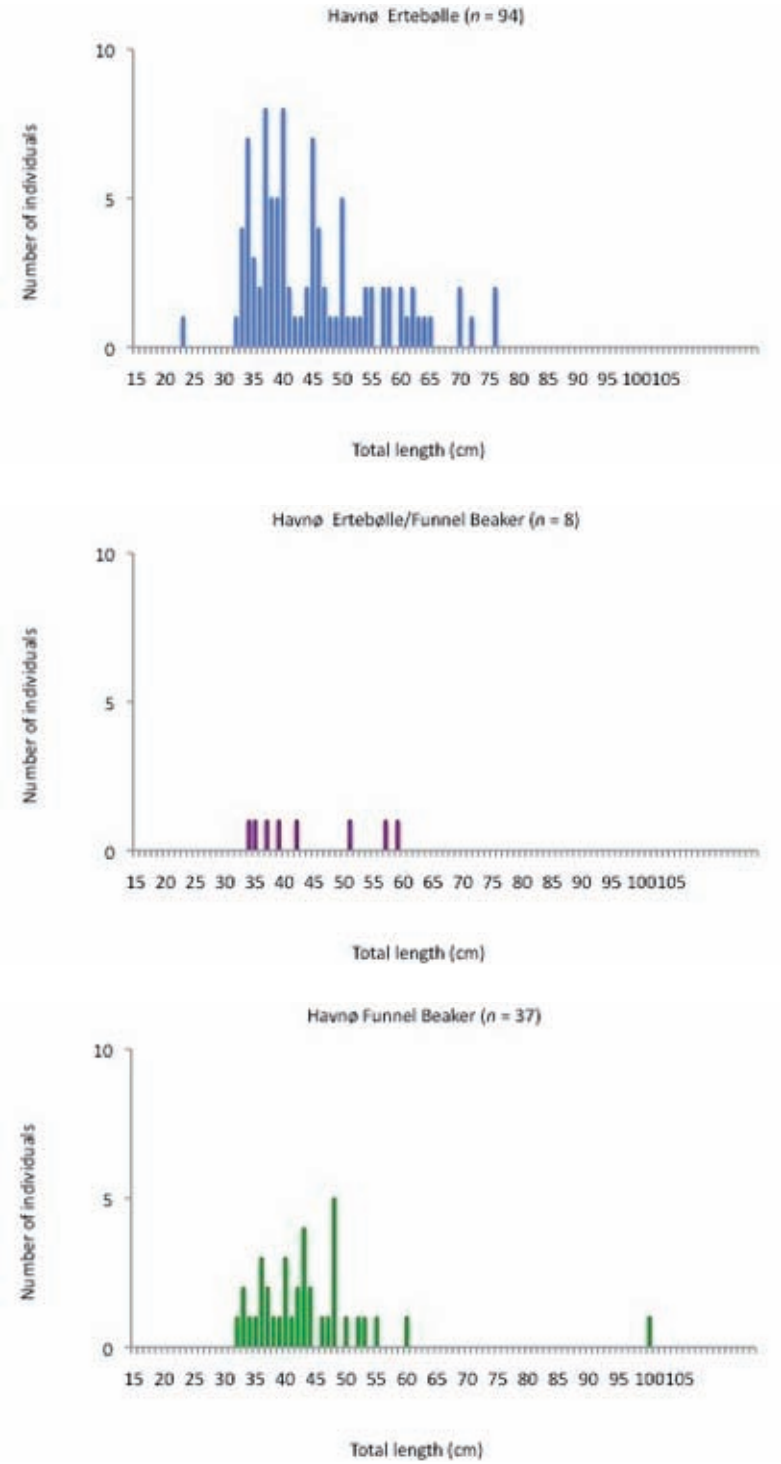
European eel

Total lengths of the eels represented in the fish bone assemblage were estimated on the basis of standard measurements taken of a number of archaeological skeletal elements, including dentaries (n = 2), ceratohyals (n = 4), cleithra (n = 11), thoracic vertebrae (n = 20), and caudal vertebrae (n = 49), according to established methods (Morales & Rosenlund, 1979; Enghoff, 1986). Total eel length was determined by means of regression equations based upon Enghoff (1986) and Thom (1990). In order to substantiate these data, the estimates were combined with data reported in Robson (2010). Additional eel bone samples recovered from Ertebølle (n = 28) and Funnel Beaker (n = 25) deposits from across the kitchen midden were included, as reported by Robson (2010). The resulting size-frequency diagrams are shown in Figures 3-5.

In order to determine whether there was a difference in the size of eels represented among the various levels, differences in the size of the individual specimens were tested for statistical significance. No significant differences in the total lengths of eels were noted for the various levels (Kruskal-Wallis, H = 6.1, P = 0.41), with the exception of levels 8 and 9 which had very low sample numbers (n = 5) (Figure 6).

The data showed that the majority of the eels represented at Havnø averaged 45 cm in length. The Ertebølle size-frequency diagram shows that eels in those cultural strata ranged from 23 to 76 cm in total length (n = 94), whereas the size-frequency diagram of eels from the transitional (Ertebølle/Funnel Beaker) levels showed a size range from 34 to 59 cm in total length (n = 8). The Funnel Beaker size-frequency diagram showed that eels in those strata ranged from 32 to 100 cm in total length (n = 37). The average total length of the Ertebølle eel was approximately 45 cm whereas the average total length of those eels from both the transitional and Funnel Beaker levels was about 44 cm.

Estimates from the 139 eel bones from across the kitchen midden indicate that 21 specimens representing individuals with a length greater than ca. 55 cm came from females since males do not exceed this limit (Muus & Dahlstrøm, 1977). Females are typically much larger, capable of reaching a maximum length of ca. 125-150 cm (Tesch, 2003). One individual in the Havnø material measured ca. 100 cm and most likely represented a mature female silver eel. The other size estimates indicate that 118 specimens could have been from either males or females.



FIGURES 3-5

Size-frequency diagrams of eel (*Anguilla anguilla*) from Havnø, based on the column sample material and data obtained on a previous study by Robson (2010).

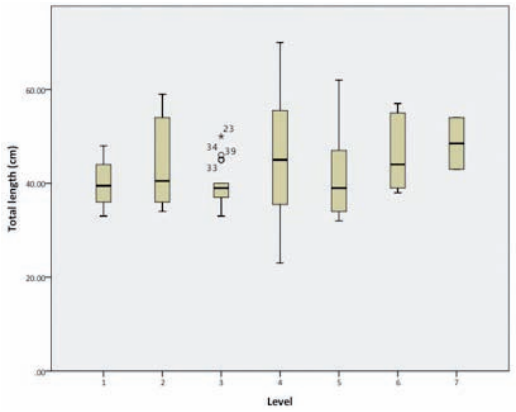


FIGURE 6

Box plot showing the median, lower and upper quartiles for the total eel length data per level for the column sample.

DISCUSSION AND CONCLUSIONS

According to the faunal assemblage analyzed here from the column sample excavated in the Havnø kitchen midden, the two most frequent fish species caught in the Mariager Fjord were eel, which was the more dominant species represented, and three-spined stickleback. Considering the small sample size, both diadromous (migrating between fresh and saltwater) and euryhaline (able to tolerate a wide range of salinity) fish were represented and were very important to the inhabitants at the site. Of the specimens identified, 10.2% were from marine fish. None of the specimens identified within the midden column sample belonged to exclusively freshwater species, though the latter have been recovered from Funnel Beaker deposits in other parts of the kitchen midden (Robson, unpublished data).

In comparison to contemporaneous kitchen middens and coastal settlement sites where large fish bone assemblages have been recovered, Havnø is one of several sites in northern Jutland distinguished by the dominance of eel, which constituted 71.2% of the overall fish bone assemblage. Similarly, eel dominated the fish bone assemblages from the kitchen middens at Ertebølle, Bjørnsholm, and Krabbesholm II in the Limfjord (Enghoff, 1986, 1991, 2011). Next in relative frequency at Havnø was the three-spined stickleback which constituted 17.6% of the total fish remains. A concentration of three-spined stickleback bones was also noted in the column sample from Ertebølle (Enghoff, 1986), whereas this fish had a more general vertical and horizontal distribution in the kitchen midden at Bjørnsholm (Enghoff, 1991). Next in decreasing order of relative abundance were pleuronectids (4.2%) and gadids (2.9%). Eight additional species combined constituted the remaining 4.1%. The kitchen middens at Norsminde and Vængesø II, on the other hand, were dominated by pleuronectids (flounder/plai-ce/dab group) (Enghoff, 1989, 2011), whereas, at the kitchen midden at Vængesø III and at sites in the northwest of the islands of Fyn and Zealand, gadids were the predominant species (Enghoff, 1995, 2011; Ritchie, 2010, in press). This evidence has consistently demonstrated that there were clear differences in the fisheries between east and west Denmark, perhaps reflecting a preference and/or specialization for certain fish species (Ritchie, in press).

The relative abundance of fish bones in the Early Neolithic Funnel Beaker cultural levels (14.7% of total NISP) at Havnø is greater than that in some of the Neolithic levels at other stratified kitchen middens on Jutland, such as at Krabbesholm II, Norsminde, and Visborg (Enghoff, 1989, 2011), though taphonomic factors and excavation techniques should also be taken into account. For example, at Bjørnsholm, a total of 11,742 fish bones were identified (Enghoff, 1991), and, of these, 252 were from the Early Neolithic levels (2.1% of NISP). Although the Havnø fish bone assemblage was reasonably small—n = 330 identified bones (Ritchie, 2010), n = 7 (Winge, 1900), and n = 306 (this study) —at least 72 fish bones came from the Funnel Beaker levels. In the column sample alone, 44 fish bones were attributed to the Funnel Beaker cultural strata whereas 262 came from the Ertebølle cultural levels. The Early Neolithic assemblage recovered from this kitchen midden is very significant (see Enghoff, 2011) as it demonstrates that Mesolithic eel fishing (as seen at Bjørnsholm, Ertebølle, and Krabbesholm II) continued in a similar manner across the Mesolithic-Neolithic transition at Havnø. Although a very uniform vertical distribution of fish species was identified in levels 1 to 5 of the column sample, a complete picture of the horizontal and vertical distribution of fish remains is not yet possible since numerous fish bones still await analysis.

The size estimates available for herring/shad, Atlantic cod, and greater weever indicated that small individuals were caught. These included

smaller individuals of species which can grow considerably larger, such as Atlantic cod, which can attain a maximum length of ca. 1.5 m, and numerous naturally smaller species, such as greater weever, which rarely exceeds a maximum length of ca. 42 cm. The kitchen midden at Havnø was located on the shore of a barrier island, and the small individual specimens caught suggest fishing took place during the warmer months of the year, using permanent structures or traps in shallow brackish coastal waters (Enghoff, 1986; Larsen, 2005).

The estimated total eel length data showed that the majority of the specimens represented smaller individuals. Based upon the absolute dominance of eel, which was identified not only in the column sample material but also from across the kitchen midden, and the most likely presence of both males and females, it is posited that an eel fishery existed at the site year-round and that a range of fishing methods were used. The occurrence of smaller gadids and mackerel indicate that these species were captured during the warmer months of the year. The presence of larger eel specimens in the earlier Ertebølle levels could thus indicate a warmer climate in the Atlantic chronozone (Enghoff *et al*., 2007) or perhaps other fishing and collection practices, such as the use of fish hooks. This conclusion may need to be revised after the materials from the kitchen midden have been more fully analyzed.

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