

# A medieval herring industry in Denmark and the importance of herring in eastern Denmark

INGE BØDKER ENGHOFF

Zoological Museum, University of Copenhagen  
Universitetsparken 15. DK-2100 Copenhagen Ø, Danmark

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**ABSTRACT:** Fishbones from the 8<sup>th</sup>-13<sup>th</sup> century AD site of Selsø-Vestby in Roskilde Fjord in Denmark were analysed. Part of the material apparently constitutes waste from a medieval herring industry. The importance of this clupeid in the eastern part of Denmark and the southern Baltic area seems to be documented by finds from other sites.

**KEYWORDS:** HERRING, HERRING INDUSTRY, VIKING AGE, MEDIEVAL PERIOD, PREHISTORIC FISHING, DENMARK

**RESUMEN:** Se valoran los restos de peces recuperados en Selsø-Vestby, un yacimiento localizado en el fiordo de Roskilde en Dinamarca, datado entre los siglos VIII-XIII d.C. Parte de los materiales representan desechos procedentes de una planta medieval de procesamiento de arenques. La importancia de este clupeido en el oriente danés así como en la zona meridional del mar Báltico parece venir confirmada a través de hallazgos procedentes de otros yacimientos.

**PALABRAS CLAVE:** ARENQUE, INDUSTRIA ASOCIADA AL ARENQUE, PERIODO VIKINGO, MEDIOEVO, PESCA PREHISTORICA, DINAMARCA

## INTRODUCTION, MATERIALS AND METHODS

The fishbone material which is the object of this analysis was excavated at the locality Selsø-Vestby. The site is situated in the eastern shore of Lake Selsø, which was earlier part of the Roskilde Fjord in Sjælland, Denmark. The cove at Selsø-Vestby formed an ideal natural harbour where, for instance, a fleet could be hidden during inactive periods. An excavation in 1994 revealed 36 pit-houses from the Viking Age which seem to have been abandoned in the beginning of 11<sup>th</sup> century, as well as remains from a subsequent medieval village which seems to have been established at the earliest in the beginning of the 12<sup>th</sup> century (Sørensen & Ulriksen, 1995).

Based on analyses of archaeological remains, especially pottery, the fishbones can be dated to the 8<sup>th</sup>-13<sup>th</sup> century AD. The part of the material which belongs to the Viking Age can be further separated into three phases (see Table 2).

Most of the bones were part of refuse thrown into abandoned Viking Age pit houses and were retrieved by sieving sediment through 4 mm mesh. Bulk samples were taken from medieval holes and pits with concentrations of fishbones and brought to the laboratory.

A representative part of the material was analysed in detail and the rest was simply examined to ascertain that the material analysed in detail was representative.

The fishbones were identified using the comparative fishbone collection at the Zoological Museum, University of Copenhagen, where the material is now kept.

## RESULTS

### *Bulk samples*

Sediment sample no. 56 AMP X 1, total weight 1239 g, was very rich in fishbones and only 10%

Skeletal element	Number
	left:right:unspec.
Hyoid arch:	
Hyomandibulare	2
Epihyale	34
Keratohyale	47
Hypohyale	+
Branchiostegale	+
Urohyale	134
Gill arches:	
not specified	+
Shoulder girdle:	
Supracleitrals	51
Cleithrum	182 : 195 : 88
Scapula	79
Coracoideum	219
Pinna pectoralis	+
Squama	+

TABLE 1

Bones of herring, *Clupea harengus*, represented in 10% of sample no. 56 AMP x 1. In addition, 21 pteroticum, dentale, maxillare, articulare, ectopterygium, præoperculare, operculare and suboperculare were found. Note: + means not counted but abundantly recorded.

of the sample was analysed. According to the excavators this sample belongs to a medieval village, but <sup>14</sup>C dates are not yet available.

Figure 1 shows the intact bulk sample, which is composed almost entirely of fishbones. All bones in the sample belong to herring, *Clupea harengus*. A closer study revealed that only a very limited selection of bones is represented, viz., bones from the hyoid arch, the gill arches, and the shoulder girdle. Of the hyoid arch bones, the hyomandibular is poorly represented (two bones), and the stylohyale and basihyale are absent; for the latter, this is probably due to their small size. Of the shoulder girdle bones, the posttemporal is missing (Table 1 and Figure 2). The hyomandibular and posttemporal connect the hyoid arch and shoulder girdle to the neurocranium. In addition, a lot of scales are present, as are a small number of bones from parts of the skeleton adjacent to the hyoid arch, gill arches and shoulder girdle.

To obtain an idea of the size of this herring find, the minimum number of individuals (MNI) of the sample was estimated. The most frequent bone is the right cleithrum, of which 195 were found in the 10% subsample (Table 1). On the basis of the foregoing, an MNI of about 1150 specimens can be estimated for the total sample. There are more sediment samples of this kind in the laboratory and still more sediment with herring bones remains at the site. All in all, a very large number of herrings must have been present in the site.

Species	8th-9th century	9th-10th century	10th-11th century
Herring, <i>Clupea harengus</i>	18%	3%	42%
Plaice/flounder/dab, <i>Pleuronectes platessa/Platichthys flesus/Limanda limanda</i>	49%	92%	38%
Gadids, <i>Gadidae</i>	33%	2%	17%
Garfish, perch, eel, <i>Belone belone/Perca fluviatilis/Anguilla anguilla</i>	1%	2%	3%
Number of identified bones	3485	251	860

TABLE 2

Results of the identification of fish bones from the Viking Age separated into three phases; further details in text.



FIGURE 1

Part of the untreated sediment sample no. 56 AMP x 1.

Such a large accumulation of herring bones could be the result of some kind of industrial activity. Most likely the herring were preserved according to a method which is still known today. A knife is inserted behind the head and the gills and adjacent parts are removed with a twist of the knife. This interpretation is supported by the absence of the two bones which connect the hyoid arch and shoulder girdle to the neurocranium. Immediately after this procedure, the fish is salted. The fish is cut to make the blood run out and ena-



FIGURE 2

The bones of herring, *Clupea harengus*, from sample 56 AMP x 1 belong to the hyoid arch, the gill arches and the shoulder girdle.

ble the salt to penetrate into the soft tissues. This method is still practised, especially in The Netherlands. In Skagen, one of the most important fishing towns in Denmark, there is a season every summer during which herrings are processed as described above for export to The Netherlands.

In order to compare the Selsø-Vestby material with refuse known to derive from the above-mentioned method, a woman employed in the herring industry was asked to process five herrings. Figure 3 shows one of the processed herrings. It turned out that the bones that are represented in Selsø-Vestby are precisely those that were removed by this process!



FIGURE 3

Recent processed herring showing the removed part of the gill region and the corresponding triangular notch in the fish.

The herring industry was also visited in order to see how the method is practised today. The newly caught herrings are placed on a belt conveyor and pass by the workers, who remove the gill region with a twist of their knives; the most experienced workers use a finger. The fish is held in the left hand with its head pointing away from the worker's body. After the removal of the gill region, the herring has a characteristic triangular notch behind the head. The herrings are then salted with handfuls of salt and packed into barrels which are topped up with a salty brine. The barrels are then ready for export. The waste is gathered and used as animal fodder in the form of fish meal.

### Sieved samples

Sieving of refuse from the Viking Age pit houses resulted in fishbones which can be dated to three different phases, 8<sup>th</sup>-9<sup>th</sup> centuries, 9<sup>th</sup>-10<sup>th</sup> centuries and 10<sup>th</sup>-11<sup>th</sup> centuries. The result of the identifications are presented in Table 2. The most important groups of fishes seem to be flatfish, [among which only flounder (*Platichthys flesus*) has been identified to species], herring and gadids. Among gadids only cod, *Gadus morhua*, is of importance. From the 8<sup>th</sup>-9<sup>th</sup> centuries, one bone of saithe, *Pollachius virens*, was identified; from the 10<sup>th</sup>-11<sup>th</sup> centuries eight bones of haddock, *Melanogrammus aeglefinus* were retrieved. Garfish, *Belone belone*; perch, *Perca fluviatilis*; and eel, *Anguilla anguilla*, were identified from all phases. In addition, tench, *Tinca tinca*, and mackerel, *Scomber scombrus* were identified from the 8<sup>th</sup>-9<sup>th</sup> centuries, and unspecified cyprinids and salmon/trout, *Salmo* sp., from the 10<sup>th</sup>-11<sup>th</sup> century. In all phases, marine fishes dominate at 95%.

The herring bones from all these phases of Viking Age seem to represent whole skeletons, with various types of skeletal elements being equally represented.

### DISCUSSION

Even though the location of Selsø-Vestby seems to have been determined by the presence of a natural harbour rather than by good fishing grounds (Sørensen & Ulriksen, 1995), many fishbones have been found.

Fishbones excavated in the pit-houses from the Viking Age indicate a rather varied marine or brackishwater fishing. The presence of seasonal species like garfish and mackerel indicate activity during the summer half-year. The most important species are flatfishes, gadids and herring. The frequency of herring is 18% of the identified bones in the 8<sup>th</sup>-9<sup>th</sup> centuries but reaches up to 42% in the 10<sup>th</sup>-11<sup>th</sup> centuries. The relative frequencies of fish from the 9<sup>th</sup>-10<sup>th</sup> century are very different from the two other phases, but the number of bones from this phase is so small that the differences cannot be regarded as significant. Therefore, this sample will not be discussed any further.

It looks as if the importance of herring increased throughout the Viking Age, an increase which

may eventually have produced a surplus that formed the basis of a herring industry as evidenced during the medieval period.

Seeman (1986) reports herring bones from a whaling station at Spitsbergen in the 17<sup>th</sup> century, where the bones from the back of the head are missing. These finds were interpreted as salted herrings, whose gills and adjacent parts had been removed—the same method as now evidenced for Selsø-Vestby. Seeman states that the method was invented by a Dutchman in the 14<sup>th</sup> century, but the find from Selsø-Vestby seems to be older. Eryvnek & Van Neer (1992) also demonstrate processed herring, in this case from a Flemish abbey (1450-1550 AD).

The abundance of herring in the Øresund during medieval times and the famous herring markets in Scania are well known from written sources. Now we have demonstrated in Selsø-Vestby that this abundance goes back to the Viking Age. On other contemporaneous sites nearby in the eastern part of Denmark herring bones have been also found. At Birkely (8<sup>th</sup>-11<sup>th</sup> centuries), 3% of the total number of 1106 fishbones belonged to herring (Enghoff, 1995a) and the fishbone material from the chieftain's hall in Gammel Lejre (7<sup>th</sup>-11<sup>th</sup> centuries) contained 63% herring bones (total number of identified fishbones 1537) (Enghoff, 1995b). At both these Viking sites near Roskilde Fjord, all kinds of herring bones are represented, and there is no sign of processed herrings. This is also true for the medieval (13<sup>th</sup>-15<sup>th</sup> centuries) town of Holbæk (Enghoff, 1994a) on Sjælland, where herring bones constitute 19% of a total of 3843 fishbones, and in Tårnby Torv at the Øresund (Enghoff, 1994b), also medieval (14<sup>th</sup>-15<sup>th</sup> centuries), where herring bones not surprisingly amount to 71% (total number of fishbones: 2385).

Herring fishing seems to have been important during the medieval period not only in eastern Denmark but also further east in the region of the southern Baltic (Benecke, 1982, 1984, 1987; Lepiksaar & Heinrich, 1977; Hallström, 1979). Benecke (1982) reviewed the sites in the southern Baltic area; herring bones have been found only at some of these, but their absence, according to Benecke, might have methodological causes (i.e., no sieving of sediments).

## CONCLUSIONS

In Selsø-Vestby at the Roskilde Fjord in Denmark, a herring industry developed during the medieval period. During the processing, the hyoid arch, gill arches and shoulder girdle were removed and the herrings must have been salted afterwards. What is now left at Selsø-Vestby is the waste of this industry. From the same site many herring bones from the Viking Age have been found, but these herrings have not been processed in this way. The same is true for other Viking sites in the area. In general, herring seems to be important in the eastern part of Denmark during the Viking Age and medieval periods. This applies also to the area of the southern Baltic.

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