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The importance of freshwater fish in Early Holocene subsistence: Exemplified with the human colonization of the island of Gotland in the Baltic basin

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ABSTRACT

In this paper we explore the subsistence economy of the Mesolithic pioneers on the island of Gotland in the Baltic basin, in order to evaluate the importance of freshwater fish to the Early Holocene human population. By analysing faunal remains, the distribution of ^{14}C dates and the location of the settlement sites, we argue that earlier assumptions concerning the importance of marine mammals to the early human populations should be reconsidered. We suggest that the pioneering settlers of Gotland relied on fish to a significant extent. Radiocarbon dates taken from human bones are skewed by a freshwater reservoir effect, which can be used as an indirect indication of the significance of freshwater fish. The numerous, overgrowing lakes on the island, with their extensive biomass production and large amounts of freshwater fish, provided an important subsistence base. Even if the faunal assemblages that have survived are dominated by seal bones, the hunting season for seals was limited and the hunters mostly targeted young seals. Thus, the importance of seal have previously been overestimated and it appears that the human use of marine resources on Gotland was more limited and related to raw material needs rather than dietary necessity or specialization. Although presented as a case study; the results highlight the need to identify a freshwater fish diet among ancient foragers on a larger scale, as implications thereof can fundamentally change how foraging societies are perceived.

1. Introduction

It is notoriously difficult to investigate (freshwater) fish dependency among ancient human populations. Site refuse faunal remains are affected by preservation bias as the fragile fish bones may not be preserved and, furthermore, special field recovery techniques are required in order to secure sufficient retrieval efficiency (see e.g. Segerberg, 1999; Enghoff, 2007; Payne, 1972). However, as an understanding of the subsistence patterns profoundly affects our understanding of past societies, it is important that new venues constantly are being investigated and evaluated. A dependency on fish may be very important among foragers and, thus, the possibility to prove a (freshwater) fish dependency would significantly affect how to interpret the subsistence of such social groups or societies and also change our view on mobility, demography, complexity and territoriality, etc. These parameters may change in relation to the utilization of aquatic resources and are often connected to sedentism and growing social complexity (Ames, 1994; Binford, 2001; Kelly, 2013). We here present an attempt to investigate the importance of freshwater fish in an Island context, namely the pioneer Mesolithic population on the Island of Gotland in the Baltic Sea. The methodology presented can be applied elsewhere and is, in general, also applicable in other contexts.

The earliest colonization of the island of Gotland in the Baltic basin (Fig. 1) began c. 9200 cal. BP (Lindqvist and Possnert, 1999), i.e. in the late Early Mesolithic period in Scandinavia and during the initial phase of the Littorina Sea when small amounts of saline water entered the Baltic basin through the Dana river (Andrén et al., 2011). In earlier research of the refuse fauna from the pioneer settlements, evidence of rich marine resources, including grey and ringed seal colonies, has been interpreted as the major pull factor for attracting people to the island (Pira, 1926; Schnittger and Rydh, 1940; Clark, 1976; Österholm, 1989; Lindqvist and Possnert, 1999; Wallin and Sten, 2007; Andersson, 2016). In contemporaneous inland environments of mainland Scandinavia, terrestrial mammals have been seen as the most important subsistence source (Jochim, 2011; Schmitt et al., 2009; Blankholm, 1996), but as these animals were absent of the Island of Gotland seals were

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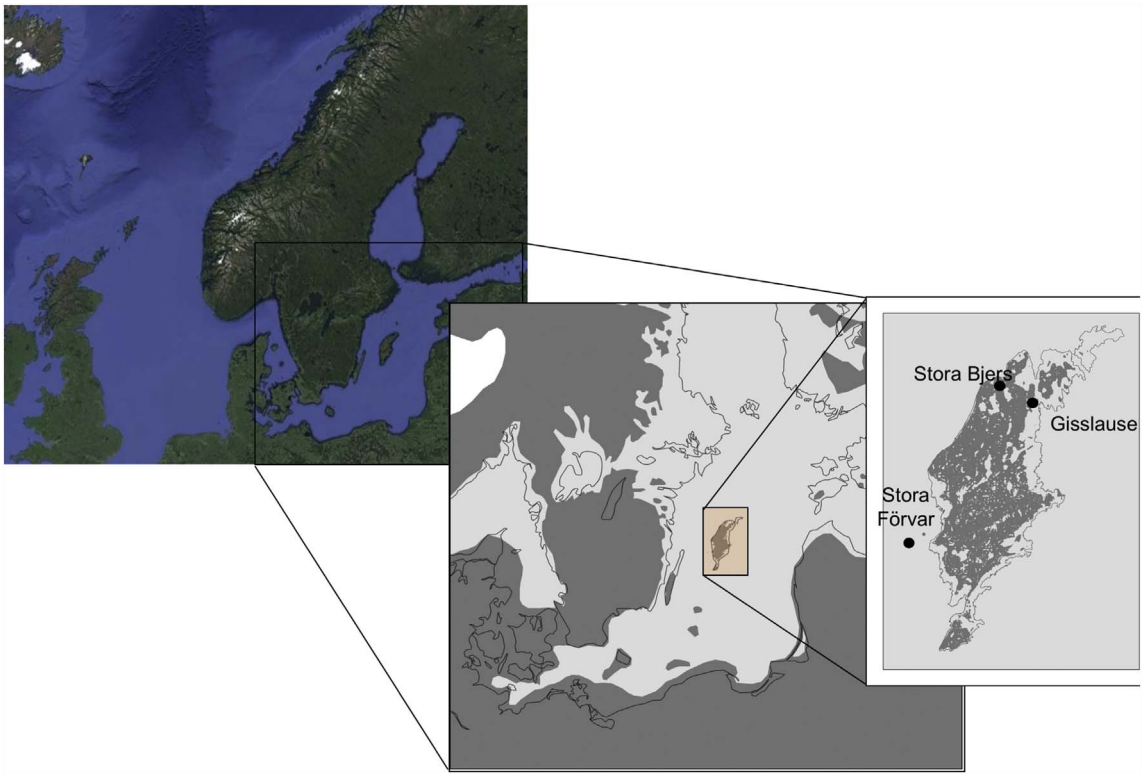

Fig. 1. A map of Gotland indicating the Mesolithic shorelines and sites discussed in the text.

considered the most important prey. The tendency to view terrestrial mammals on Scandinavian mainland and seals on Gotland as the primary food sources is probably related to the limited amount of fish bones found in Scandinavian Early Mesolithic contexts. As a result, the idea of a freshwater fish-dependent Mesolithic economy has not been considered, or been marginalized, even though numerous finds of bone leisters—finely toothed bone point used for spearfishing—in south Scandinavian bogs and submerged fish traps from Haväng in south-east Scandinavia, suggests otherwise (Andersen, 1978; Johansson, 2006; Hammarstrand Dehman and Sjöström, 2008; Hansson et al., 2016).

However; more than 30 years ago, and based on investigations of sediments including fish bones in the Spjälkö lagoon in south-east Sweden, Welinder (1978) stressed the possible importance of freshwater fish for Mesolithic demographics. He based his arguments on estimations of the biomass productivity of lakes that were becoming overgrown/silted up by excessive plant biomass production because of eutrophication, during the early post-glacial period (Welinder, 1978). Welinder suggested that the Maglemose culture in southern Scandinavia was an adaption to boreal environments, where overgrowing lakes, rich in biomass and freshwater fish, played a crucial role for human subsistence. This novel economic niche was utilized by hunter-gatherer groups that based their subsistence on freshwater fish complemented by large terrestrial game and hazelnuts, which were an abundant resource in the light birch-pine-hazel forests. A decade after Welinder made his initial suggestions, Ericson (1989) raised a general concern about underestimating the importance of fish (in comparison with seals) from a taphonomic viewpoint, i.e. an identification and preservation bias against fish, and he also highlighted the predictability of capture, regarding fish as a more stable and reliable resource than seal.

In southern Scandinavia, the interpretation of a subsistence based on hunting of terrestrial game has been enhanced by the general absence of evidence of settlements close to large water bodies during the Early Mesolithic period. This absence is largely the result of sea level transgressions following the last ice age, which left coastal areas submerged and in many areas inaccessible to 'standard' archaeological excavation. However, marine archaeological excavations have been an option for submerged sites (Fischer, 1995; Hansson et al., 2016). Furthermore, recent evidence also suggest that the primary reason for hunting terrestrial mammals may not have been meat (even though that was an important resource) but raw materials such as tendons, skins, bones and antlers (Boethius, 2017b).

The absence of fish bones in many archaeological faunal assemblages arises from poor preservation and inappropriate recovery techniques during excavation, but even when fish bones do occur at archaeological sites it is often difficult to evaluate their representation. Fish bones are more susceptible to diagenetic forces compared with mammal bones, because of their small size and fragility, and they are difficult to retrieve if smaller mesh sieves are not used (Segerberg, 1999; Olson and Walther, 2007; Enghoff, 2007; Boethius, 2016). However, despite the bias of both preservation and recovery methods, the importance of freshwater fish during the Early Mesolithic on mainland southern Scandinavia has recently been strengthened by the detailed recovery methods applied at the site of Norje Sunnansund in Blekinge on the south-east coast of Sweden. Extensive quantities of freshwater fish bones have been recovered (Boethius, 2016, 2017a) and the subsistence base is considered to have been fish, which could provide both a constant supply of fresh food and a surplus that could be processed for storage (Boethius, 2016). The calculated volume of fish consumed at Norje Sunnansund suggests that this resource could have supported a large sedentary population (Boethius, 2017a).

Human stable isotopes ($\delta^{13}C$ and $\delta^{15}N$) have also been used to study diet, and a freshwater fish presence has been suggested at the Kams burial on Gotland (Lidén, 1996), in Middle Mesolithic eastern Sweden (Eriksson et al., 2016) but also on the Early Preboreal site Friesack 4 in northern Germany (Terberger et al., 2012). However, while elevated levels of δN^{15} with corresponding low δC^{13} values in human bones rather reliably indicate large amounts of freshwater fish in the consumed diet, individuals who do not display an equally high elevation in δN^{15} values may still have consumed large amounts of