

Daniel Groß · Harald Lübke · John Meadows · Detlef Jantzen (eds.)

Working at the Sharp End: From Bone and Antler to Early Mesolithic Life in Northern Europe



10

Untersuchungen und Materialien
zur Steinzeit in Schleswig-Holstein
und im Ostseeraum

**UNTERSUCHUNGEN UND MATERIALIEN ZUR STEINZEIT
IN SCHLESWIG-HOLSTEIN UND IM OSTSEERAUM**

BAND 10

Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum
aus dem Museum für Archäologie Schloss Gottorf und dem Zentrum für Baltische und Skandinavische
Archäologie
in der Stiftung Schleswig-Holsteinische Landesmuseen Schloss Gottorf
Band 10

Begründet von
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Herausgegeben von
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Working at the Sharp End:
From Bone and Antler to Early Mesolithic
Life in Northern Europe

Daniel Groß, Harald Lübke, John Meadows and Detlef Jantzen (eds.)

Wachholtz



1. Auflage 2019

Redaktion: Gundula Lidke, SSHLM Schloss Gottorf, Schleswig

Satz: Daniel Groß, SSHLM Schloss Gottorf, Schleswig

Einbandgestaltung: Jürgen Schüller, SSHLM Schloss Gottorf, Schleswig; Foto: Markus Wild, SSHLM Schloss Gottorf, Schleswig

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Bibliografische Informationen der Deutschen Nationalbibliothek: Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet unter <http://dnb.n-nb.de> abrufbar.

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ISBN 978-3-529-01861-9

ISSN 2510-313X

Druck und Vertrieb: Wachholtz Verlag, Kiel/Hamburg

Printed in Europe

Besuchen Sie uns im Internet:

www.wachholtz-verlag.de



Laserscan of the wooden sign that was attached to the excavation hut during the Hohen Viecheln excavations ('To the sharp harpoon'; Laserscan: J. Nowotny, ZBSA).

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VORWORT DER HERAUSGEBER

Die Schriftenreihe „Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein“ wurde von dem ursprünglichen Herausgeber Jürgen Hoika vor mittlerweile 25 Jahren im Jahre 1994 begründet, um am damaligen Archäologischen Landesmuseum Schleswig (ALM) und heutigem Museum für Archäologie Schloss Gottorf (MfA) ein Publikationsorgan für die Veröffentlichung von Forschungsergebnissen zur Steinzeit Schleswig-Holsteins zu schaffen. Dabei sollte es sich zum einen um Sammelwerke mit Beiträgen von vorzugsweise auf Schloss Gottorf veranstalteten Symposien, Workshops und Tagungen mit steinzeitlicher Thematik und zum anderen um zumeist in Dissertationen zusammengestellte ausführliche Materialvorlagen handeln. Entsprechend enthielt der 1994 vorgelegte erste Band der Reihe die Beiträge zum 1. Internationalen Trichterbechersymposium, welches, von Jürgen Hoika gemeinsam mit Jutta Meurers-Balke initiiert, 1984 am Archäologischen Landesmuseum in Schleswig stattgefunden hatte. In der Folge wurden dann aber beginnend mit den Arbeiten der beiden heutigen Herausgeber nunmehr acht überwiegend am Institut für Ur- und Frühgeschichte der Christian-Albrechts-Universität zu Kiel fertiggestellte Dissertationen veröffentlicht, die ganz wesentlich mit der wissenschaftlichen Vorlage und Auswertung von Forschungsgrabungen in Schleswig-Holstein und – seit der Beteiligung des Zentrums für Baltische und Skandinavische Archäologie an der Herausgeberschaft – aus dem gesamten Ostseeraum befasst sind.

Deshalb ist es eine besondere Freude für die Herausgeber, mit dem vorliegenden Band 10 „Working at the Sharp End: From Bone and Antler to Early Mesolithic Life in Northern Europe“ der Schriftenreihe „Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum“ wiederum einen Sammelband mit den Beiträgen eines Workshops vorlegen zu können, der vom 14. bis 16. März 2016 auf Schloss Gottorf stattgefunden hat. Dabei handelt es sich um den Abschlussworkshop des von der Deutschen Forschungsgemeinschaft geförderten Projektes „Neubewertung von Chronologie und Stratigraphie des frühholozänen Fundplatzes Hohen Viecheln (Mecklenburg-Vorpommern) unter besonderer Berücksichtigung der diagnostischen Knochenartefakte“ (DFG-Projektnummer 271652103) unter Leitung von Daniel Groß, Harald Lübke, John Meadows (alle ZBSA) und Detlef Jantzen (Landesamt für Kultur und Denkmalpflege Mecklenburg-Vorpommern; Landesarchäologie). Entsprechend enthält dieser Band neben dem Abschlussbericht des Forschungsprojektes insgesamt 17 Beiträge der eingeladenen Workshop-Teilnehmer, die entweder ergänzende Studien zum Fundplatz Hohen Viecheln enthalten oder sich grundsätzlich mit verwandten Themen zur Erforschung des frühholozänen Mesolithikums im nördlichen Europa befassen.

Alle Beiträge wurden nach internationalem Standard von jeweils zwei anonymen Gutachtern in einem Peer-review-Verfahren bewertet und danach den Autoren zur erneuten Überarbeitung übergeben, bevor die abschließende redaktionelle Bearbeitung der Manuskripte erfolgte. Die Textredaktion für alle Beiträge wurde von Gundula Lidke durchgeführt, Jana Elisa Freigang und Jorna Titel leisteten dabei unterstützende Arbeiten. Das Layout übernahm Daniel Groß, Titelbild und Umschlag entwarf Jürgen Schüller. Die meisten Karten und Zeichnungen wurden von den Autoren selbst bereitgestellt. In einzelnen Fällen erfolgte eine Überarbeitung durch Daniel Groß. Allen sei dafür an dieser Stelle herzlich gedankt.

Neu im Rahmen der Schriftenreihe ist, dass die Beiträge unmittelbar nach Fertigstellung und Freigabe der Autoren in einem „online-first“-Verfahren auf der Homepage des Verlages im Open Access zum freien Download bereitgestellt wurden. Für die Umsetzung dieser Forderung der Herausgeber danken wir dem Wachholtz Verlag, insbesondere Herrn Henner Wachholtz, sehr.

Besonderer Dank gilt dem Vorstand des Zentrums für Baltische und Skandinavische Archäologie Schleswig, besonders dem Direktor, Claus von Carnap-Bornheim, und der Forschungsleiterin, Berit Valentin Eriksen, die die Veröffentlichung dieses Bandes durch die Bereitstellung der erforderlichen Mittel für den Druck der Arbeit maßgeblich unterstützten.

Sönke Hartz und Harald Lübke
Schleswig, im Oktober 2019

EDITORS' PREFACE

The series 'Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein' was founded by its first editor, Jürgen Hoika, in 1994, 25 years ago, in order to establish a possibility to publish Stone Age research results from Schleswig-Holstein at the then Archaeological State Museum (Archäologisches Landesmuseum [ALM]), today's Museum for Archaeology (Museum für Archäologie, Schloss Gottorf [Mfa]). Publications should, on the one hand, reflect proceedings of symposia, conferences and workshops with Stone Age topics primarily held at Gottorf Castle, on the other hand, dissertations presenting comprehensive material. According to that, the first volume, published in 1994, contained the contributions to the 1st International Funnelbeaker Symposium, which, initiated by Jürgen Hoika and Jutta Meurers-Balke, had taken place at the Archaeological State Museum in 1984. Following that, eight dissertations, mainly accomplished at the Institute for Pre- and early History at the Christian-Abrechts-University Kiel, were published, starting with those by today's editors. All these volumes contributed substantially to the scientific presentation and analysis of excavation materials from Schleswig-Holstein and – since 2012, when the Centre for Baltic and Scandinavian Archaeology (ZBSA) also became involved in editing the series – the whole of the Baltic Sea area.

Therefore the editors are especially happy to once more present conference proceedings with volume 10 of the series 'Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum': 'Working at the Sharp End: From Bone and Antler to Early Mesolithic Life in Northern Europe' collects contributions to a workshop held at Gottorf Castle on 14th–16th March, 2016. This represented the closing workshop of the DFG-funded project 'Neubewertung von Chronologie und Stratigraphie des frühholozänen Fundplatzes Hohen Viecheln (Mecklenburg-Vorpommern) unter besonderer Berücksichtigung der diagnostischen Knochenartefakte' (DFG project no. 271652103), directed by Daniel Groß, Harald Lübke, John Meadows (all ZBSA) und Detlef Jantzen (Landesamt für Kultur und Denkmalpflege Mecklenburg-Vorpommern; Landesarchäologie). In addition to the project's final report the volume contains 17 papers by researchers invited to participate in the workshop, representing either additional studies on material from the site Hohen Viecheln or related topics in research of the early Holocene Mesolithic in northern Europe.

Each paper was, according to international standards, peer-reviewed by two anonymous reviewers and then returned to the author for reworking before final editorial work. Copy-editing was performed by Gundula Lide, supported by Jana Elisa Freigang and Jorna Titel. Daniel Groß realised the layout; cover and cover illustration were designed by Jürgen Schüller. Most maps and figures were provided by the authors themselves, some were reworked by Daniel Groß. We express our sincere thanks to all involved!

It is a novelty for the series to have papers published online first immediately after completion and authors' approval in open access for free download on the website of Wachholtz Publishers. We would like to thank Henner Wachholtz, Wachholtz Publishers, very much for making this possible!

Special thanks are due to the board of the Centre for Baltic and Scandinavian Archaeology (ZBSA) Schleswig, particularly to the director, Claus von Carnap-Bornheim, and the head-of-research, Berit Valentin Eriksen, who substantially supported this publication by providing financial means for its printing.

Sönke Hartz and Harald Lübke
Schleswig, October 2019

GRUSSWORT DES LANDESARCHÄOLOGEN VON MECKLENBURG-VORPOMMERN

Mit seinen großflächigen, oft noch weitgehend unberührten Niederungen und Binnengewässern bietet Mecklenburg-Vorpommern beste Voraussetzungen, um die gewässeraffinen Kulturen des Mesolithikums zu erforschen. Die Überreste ihrer Wohn- und Jagdstationen sind im feuchten Milieu hervorragend erhalten geblieben. Störungen durch Torfabbau, Begradiung von Gewässern oder Meliorationsmaßnahmen blieben im Wesentlichen auf das 19. und 20. Jahrhundert beschränkt. Sie haben zwar einen gewissen Schaden angerichtet, aber, weil sie zumindest im 20. Jahrhundert oft von aufmerksamen ehrenamtlichen Bodendenkmalpflegern beobachtet wurden, überhaupt erst zur Entdeckung vieler Fundstellen geführt.

Welche Fundstellen eingehender erforscht werden und damit das Bild einer Epoche besonders prägen, unterliegt oft dem Zufall. Hohen Viecheln rückte in den Fokus der Forschung, weil die Entdeckung mehrerer Knochenharpunen zu Beginn der 1950er Jahre auf eine günstige Konstellation traf: 1953 war aus der Vorgeschichtlichen Abteilung des Staatlichen Museums das Museum für Ur- und Frühgeschichte Schwerin entstanden, das auch für die Bodendenkmalpflege in den drei Nordbezirken der DDR zuständig war. Der ehrgeizige Direktor des Museums, Ewald Schuldt, hatte sich durch Ausgrabungen auf der Burgwallinsel Teterow einen Namen gemacht und war nun auf der Suche nach einem geeigneten Fundplatz für ein eigenes Forschungsprojekt.

Wegen der sehr guten Erhaltungsbedingungen versprach Hohen Viecheln, zusätzlich zu dem bekannten Spektrum an Steinartefakten auch ein umfangreiches Geräteinventar aus organischen Materialien bergen zu können. Die ebenfalls ausgezeichnet erhaltenen Tierknochen sollten Aufschluss über das Jagdwild geben. Hinzu kam die Aussicht, aus der Stratigraphie neue Erkenntnisse zur Chronologie und zu den Veränderungen der naturräumlichen Verhältnisse zu gewinnen. Diese Erwartungen wurden nicht enttäuscht: Hohen Viecheln entwickelte sich zu einem der bedeutendsten Plätze mesolithischer Forschung, gleichrangig mit Duvensee, und inspirierte weitere Forschungen, u. a. in Friesack und Rothenklempenow.

Hohen Viecheln gehört nach wie vor zu den legendären archäologischen Fundstellen in Mecklenburg-Vorpommern, auch wenn es aus heutiger Sicht nicht mehr so einzigartig dasteht. Dank einer intensiv betriebenen ehrenamtlichen Bodendenkmalpflege ist die Zahl der bekannten mesolithischen Fundplätze im Land deutlich gestiegen, von denen vermutlich mehrere ein ähnliches Potenzial wie Hohen Viecheln aufweisen. Verändert haben sich aber nicht nur die Verbreitungskarten, sondern auch die Möglichkeiten archäologischer Forschung. Es drängte sich deshalb geradezu auf, Hohen Viecheln noch einmal unter die Lupe zu nehmen, bisherige Erkenntnisse kritisch zu prüfen und neue hinzuzufügen. Der DFG und allen Projektpartnern gebührt herzlicher Dank dafür, dass sie das ermöglicht haben.

So wird Hohen Viecheln auch weiterhin als exemplarischer Fundplatz für das Mesolithikum in der norddeutschen Tiefebene stehen – eine hochinteressante Umbruchszeit, in der Klimawandel, Anstieg des Meeresspiegels und andere Veränderungen eine ständige Anpassung der Menschen an ihre Umwelt erzwangen.

Detlef Jantzen
Schwerin, im September 2019

WELCOME ADDRESS BY THE STATE ARCHAEOLOGIST OF MECKLENBURG-WESTERN POMERANIA

Mecklenburg-Western Pomerania with its large, often unspoiled lowlands and inland waters offers outstanding possibilities for research into the water-oriented cultural groups of the Mesolithic. Remains of their settlement and hunting sites are often well preserved in wet conditions. Disturbances by peat extraction, straightening of watercourses or melioration measures mainly took place during the 19th and 20th centuries. They did some damage, but – as at least during the 20th century they were often supervised by vigilant amateur archaeologists – many sites were discovered this way in the first place.

But often it is left to chance which sites can be thoroughly investigated to largely characterise the picture of a whole timespan. Hohen Viecheln became the focal point of research interest under favourable circumstances: the discovery of several bone points there at the beginning of the 1950s fell together with the establishment of the Museum of Pre- and Early History in Schwerin (out of the former Department of Prehistory at the State Museum) which was also responsible for the preservation and care of field monuments in the three northern districts of the GDR.

The ambitious museum director, Ewald Schuldt, had already gained reputation through his excavations of the Slavic ring wall island near Teterow, and he was looking for a suitable site for another research project. Due to the very good preservation conditions at the site, Hohen Viecheln promised, in addition to the spectrum of artefacts known from other places, a substantial organic inventory. The well-preserved animal bones were expected to shed light on game species and hunting strategies. Furthermore, important results were expected concerning chronology and environmental changes. These hopes were not disappointed: Hohen Viecheln has become, alongside Duvensee, one of the most important sites for Mesolithic research, and research there has inspired further excavations, e.g. at Friesack or Rothenklempenow.

Hohen Viecheln is still one of the legendary archaeological sites in Mecklenburg-Western Pomerania, even if it no longer stands alone. Thanks to intensive voluntary archaeological surveys the number of Mesolithic sites has increased significantly; and several of these may have a potential similar to that of Hohen Viecheln. But not only distribution maps have changed during the last years, but also the possibilities of archaeological research. Therefore, the idea to have another look at Hohen Viecheln, to challenge old results and add new ones, suggested itself. I want to thank the German Research Foundation (DFG) and all project contributors for having made this possible. In this way, Hohen Viecheln will continue to be an exemplary North German Lowland site of the Mesolithic – a highly interesting time when climate change, sea-level rise and other changes enforced constant human adaptions to the environment.

Detlef Jantzen
Schwerin, September 2019

ACKNOWLEDGEMENTS

This volume of the series ‘Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum’ represents the proceedings of a workshop held at the Centre for Baltic and Scandinavian Archaeology (ZBSA) in Schleswig in March 2016. It is a part of the editors’ project ‘Neubewertung von Chronologie und Stratigraphie des frühholozänen Fundplatzes Hohen Viecheln (Mecklenburg-Vorpommern) unter besonderer Berücksichtigung der diagnostischen Knochenartefakte’, funded by the German Research Foundation (DFG) under the project number 271652103.

While the project was dealing with the re-evaluation of the site Hohen Viecheln 1 for chronological and stratigraphical aspects, this volume does not only cover its final publication but comprises additional modern studies about the site by different scholars. These are furthermore embedded into the international research landscape by adjacent studies covering an area from modern day Britain in the west to the Urals in the east.

All contributions are representing the authors’ point of view and respective terminologies. Therefore differences in the vocabulary may appear to the careful reader. While a homogenisation of terms and data recording is relevant for comparative studies, it was beyond the scope and means of this project. As a consequence, terminologies may differ between the contributions, as exemplified by the terms ‘uni-serial’ and ‘uni-lateral’ bone points: both are characterised by barbs or notches on one lateral side. At the British site Star Carr those have ever since been named uni-serial, whereas uni-lateral is a more common term in other parts of Europe.

We, as editors, would like to thank all contributors for being part of this volume and their interesting and high-quality articles; also we are grateful for the voluntary support of all anonymous peer-reviewers and their help in improving the articles. Furthermore, we thank the German Research Foundation (DFG) for funding our research and the workshop as well as the Centre for Baltic and Scandinavian Archaeology represented by its director, Claus von Carnap-Bornheim, and the head-of-research, Berit Valentin Eriksen, for support of the project and its presentation in the current form. A tremendous help in the course of making this book was Gundula Lidke who was responsible for text editing, proofreading, and correspondence with the authors and publishers. Thank you very much! Further editorial support was provided by Jana Elisa Freigang, Jorna Titel, Matthias Bolte, Isabel Sonnenschein and Jürgen Schüller. The latter is also responsible for the cover drawing. Much help and support was provided by Peter Teichert-Köster with respect to handling the finds and accessing them in the depot of the Landesamt für Kultur und Denkmalpflege Mecklenburg-Vorpommern; Landesarchäologie in Schwerin. Close collaboration with Mathieu Boudin of the Royal Institute for Cultural Heritage, Brussels, improved our radiocarbon measurements and the analysis of the consolidant.

We thank all people, mentioned and unmentioned here, who were involved in this book and the different research projects, who helped by further pushing the boundaries of our understanding of the cultural remains and chronologies of the past.

Daniel Groß, Harald Lübke, John Meadows, Detlef Jantzen
Schleswig, October 2019

THE EARLY MESOLITHIC FISHERIES OF SOUTHERN SCANDINAVIA

Harry K. Robson and Kenneth Ritchie

Abstract

Southern Scandinavian Mesolithic research has one of the longest traditions within archaeology, dating back to the 1820s and 1830s. However, a combination of site visibility and an emphasis on the Mesolithic–Neolithic transition has meant that research has primarily been directed towards the Late Mesolithic Ertebølle culture (c. 5400–4000 cal. BC) at the expense of the Early Mesolithic Maglemose culture (c. 9600–6400 cal. BC). Whilst fishing during the Ertebølle culture is well studied (ENGOFF 2011; RITCHIE 2010), fishing during the Early Mesolithic is rarely discussed in any detail. In this contribution we attempt to rectify this imbalance by collating all readily available data on fish remains and related technologies within the literature. Although our primary focus is the Early Mesolithic Maglemose culture of Southern Scandinavia, an area encompassing Denmark, Scania in Sweden and Schleswig-Holstein in Northern Germany, we draw on contemporaneous sites within the broader region to provide a more nuanced picture of the exploitation of this important resource, fish.

1 Introduction

On June the 8th, 1900, Georg Frederik Ludvig Sarauw was sent by the National Museum to the ‘Magle Mose’ peat bog in western Zealand, Denmark. Here, excavations were undertaken in an area known as Mullerup where charcoal, faunal remains and worked flints had been unearthed during peat extraction. In 1903, a monograph on the excavations was published, and the term Maglemose was coined (SARAUW 1903). Sarauw argued that the site represented a culture that predated the Late Mesolithic Ertebølle kitchen middens (*køkkenmøddinger*), which had been previously investigated by the First and Second Kitchen Midden Commissions (MADSEN et al. 1900; STEENSTRUP et al. 1851), with an economy that was based on the exploitation of aquatic and terrestrial resources (SARAUW 1903). Owing to additional excavations at other Danish peat bog sites located on Zealand, including Sværdborg I (FRIIS JOHANSEN et al. 1919), Holmegård I (BROHOLM 1924), Holmegård IV, V, and VI (BECKER 1945), Lundby II (HENRIKSEN et al. 1976; 1980), Ulkestrup I and II (ANDERSEN 1951; ANDERSEN et al. 1982), and the Åmose bog (MATHIASSEN et al. 1943), as well as lithic typo-chronologies (BECKER 1945; 1953; PETERSEN 1966; 1973), the Maglemose culture as an archaeological construct was born.

Moreover, broadly contemporaneous peat bogs and sites from the Maglemose and similar cultures were examined throughout the wider region. In 1937, Mathiassen published on the site of Klosterlund on Jutland, which at the time yielded the largest Preboreal assemblage from Southern Scandinavia.

Almost simultaneously, Early Mesolithic sites were investigated in Germany, for instance Friesack in Brandenburg (SCHNEIDER 1932), and the Duvensee peat bog in Schleswig Holstein (SCHWANTES et al. 1925; SCHWANTES 1928). In 1938 and 1939 further sites were investigated, including Pinnberg (RUST 1958), which led to an established chronology before the start of the Second World War. Early Mesolithic research in Northern Germany resumed in 1946 at the Duvensee peat bog (SCHWABEDISSEN 1949), whilst several years later Schuldt excavated the Hohen Viecheln site between 1953 and 1955 (SCHULDT 1961). Early Mesolithic research has continued intermittently to this day. Additional excavations have since been undertaken at some previously investigated localities, for instance Friesack (GRAMSCH 1987; 2000), and the Duvensee peat bog (BOKELMANN 1971; 2012), and new sites have been found, for example Bedburg-Königshoven in Westphalia (STREET 1991), and Rothenklempenow in Mecklenburg-Vorpommern (SCHACHT 1993; KAISER 2003).

The Maglemose culture is the earliest Mesolithic culture of Southern Scandinavia. Preceding the Middle Mesolithic Kongemose and Late Mesolithic Ertebølle cultures, it is dated from c. 9600–6400 cal. BC (PETERSEN 1973; MØLLER HANSEN et al. 2004). Although the majority of the investigated sites on Zealand listed above are dated from the Boreal to Atlantic chronozones, there are some Maglemosian sites that are dated to the Preboreal or Preboreal/Boreal transition, for example Favrbo, Lundby Mose, Prejlerup, and Vig on the island of Zealand (AARIS-SØRENSEN 1999; AARIS-SØRENSEN/PETERSEN 1986a; 1986b; MØLLER HANSEN 2003; MØLLER HANSEN/BUCK PEDERSEN 2006; MØLLER HANSEN et al. 2004; NOE-NYGAARD 1973), as well as Skottemarke on the island of Lolland (MØHL 1978; SØRENSEN 1978).

Despite the substantial number of excavations (see above), fishing during the Early Mesolithic Maglemose is still not fully understood. The oft-discussed imbalance between a predominance of Middle and Late Mesolithic sites in Southern Scandinavia along the coasts with mostly marine fishes (see ENGHOFF 2011; RITCHIE 2010 for comprehensive overviews) and Early Mesolithic sites in inland locations with freshwater fishes is an intriguing situation with possible environmental and cultural explanations.

From an environmental standpoint, isostatic and eustatic changes occurring in response to the melting of the Pleistocene ice sheets have served to veil some sites, and have also dramatically altered the nature of the available waterscapes. The paucity of Early Mesolithic (generally Maglemose) sites along the shores of the North and Baltic Seas is undoubtedly related to flooding of the relevant zones in many areas of interest. To take the most obvious example, Doggerland (the region of the North European plain that once connected the British Isles with continental Europe) is now an underwater landscape where much of the relevant evidence is submerged under many metres of sea. Human occupation of this zone dating back to at least 11,700 BC has been recognised since the 1930s, but only recently has archaeological methodology advanced to the point where some of this evidence can begin to come to light in sufficient quantity and quality that discussions about its significance are possible (BONSALL/SMITH 1989; STEWART et al. 2016; VAN DER PLICHT et al. 2016). Furthermore, in Denmark, underwater survey and trial excavations have begun to reveal evidence for Early and Middle Mesolithic coastal occupations in areas of the Western Baltic Sea at, for example, Amager on Zealand, and around Århus Bay off the eastern coast of Jutland (e.g. JOHANSEN 2004; SKRIVER/BORUP 2012). Similar new and exciting developments off the southern coast of Sweden at Haväng suggest that our picture of this period is about to undergo a period of rapid paradigm adjustment (HANSSON et al. 2016).

In addition to its role in obscuring sites under modern seas, changes in the relationship between land and water in Southern Scandinavia have had major impacts on the environment with which prehistoric peoples interacted. Most notably, perhaps, is the succession of salt- and freshwater seas and lakes that occupied the area today known as the Baltic Sea during the period of the Early Mesolithic. It is not just the gradual variation in salinity regimes and sea levels that must be considered, but also the sudden, dramatic changes such as the proposed catastrophic drainage of the Baltic Ice Lake (BERGLUND et al. 2005) that

would have had major repercussions for groups' relationships to and understanding of the aquatic environment, probably for generations. The high degree of variability affecting the regions comprising the shorelines of the various stages of what is now the Baltic Sea may have been one reason that Early Mesolithic peoples often turned to the resources of the inland waterways, when they exploited aquatic resources at all. However, as noted above, this picture is necessarily incomplete and subject to change from new evidence – and there were at least some groups who relied extensively on the archaic seas for their livelihoods, for example the Komsa/Fosna/Hensbacka cultures that colonised the coasts of Norway and parts of Sweden in the early Holocene (e.g. BJERCK 2009). Despite some sites with fish bone assemblages discussed here, our knowledge of Early Mesolithic fisheries remains rather sparse.

In this contribution we collate the currently available information on fish remains and related technologies from Early Mesolithic sites in Southern Scandinavia and adjoining regions. With the data at hand, some interesting patterns are apparent that point to the importance of aquatic resources, while at the same time noting that they were generally exploited in a more limited fashion than that of the maritime hunter-gatherers of the Middle and Late Mesolithic that followed.

2 Some notes about the data

Several of the entries in Tables 1 and 2 appear more than once, which, for the most part, is due to more than one excavation campaign, for example Hohen Viecheln. In these cases, NISP (Number of Identified Specimens) values deriving from the two investigations are listed separately. In addition, some of the material has been subjected to varying degrees of re-analyses, which has also resulted in it being reported more than once in the literature. In general, the most recent data available were used. Furthermore, some of the assemblages listed are lacking definitive NISP values, whereas for others there is a complete absence of data; thus, sites with an absence of data were omitted from Fig. 1. Since some of the assemblages had disaggregated the fish remains according to certain skeletal elements, for example bones and scales, we decided to combine all NISP values per site. Finally, while acknowledging the importance of excavation methodology (especially sieving) on the results, we use the assemblages as reported without further exploring these limitations.

3 The dataset

As of December 2016, a total of 34 fish faunal assemblages are available (Table 1; Fig. 2). Whilst some sites are listed more than once, for instance Mullerup in Denmark, at least 29 different archaeological sites are represented. Of these, 17 assemblages are affiliated with or have been dated to the Early Mesolithic Maglemose culture of Southern Scandinavia, whilst the remaining have varying lengths of intermittent occupation, for instance Friesack 4, which is represented by at least four primary occupation phases dating to the Mesolithic, from c. 9340–5430 cal. BC (ROBSON 2016). One Maglemose-Kongemose transitional site, Ringsjöholm in Sweden, and five unaffiliated sites are also present in the dataset. Moreover, we have incorporated three Estonian sites, Lammasmägi, Pulli, and Umbusi, affiliated with the Kunda culture that bears remarkable similarities with the Maglemose culture.

Regarding distribution, the majority of the sites listed in Table 1 and shown in Figs. 1–2 are located in Denmark. Of the 29 archaeological sites, 23 yielded NISP values, and of these, ten are located in present day Denmark. Four sites are situated in Germany and Poland, respectively, whilst three are located in Estonia. Lastly, only two localities in Sweden are represented. Interestingly, of the sites listed not one would have been situated on the coast during occupation.

Table 1. Early Mesolithic archaeological sites with fish remains. Blank space – cultural epoch not provided; n.d. – data not reported.

Number	Site name, country (years, excavator)	Period	Cultural epoch	NISP	Reference
1	Barmosen I, Denmark	Early Mesolithic	Maglemose	<10	JOHANSSON 1990
2	Bedburg-Königshoven, Germany	Early Mesolithic	Maglemose	242	STREET 1993
3	Bølling Sø, Denmark	Early Mesolithic	Maglemose	30+	ROSENlund 1976
4	Calbe, Germany	Early Mesolithic		n.d.	CLARK 1936
5	Dudka I, Poland	Early Mesolithic-Early Neolithic		1104	MAKOWIECKI 2000
6	Duvensee, Germany	Early Mesolithic	Maglemose	n.d.	CLARK 1936
7	Esperöds Mosse, Sweden	Early Mesolithic	Maglemose	n.d.	CLARK 1936
8	Friesack 27a, Germany	Early Mesolithic	Maglemose	12	GROSS 2014
8	Friesack 4, Germany	Early Mesolithic-Early Neolithic	Maglemose-Funnel Beaker	1733	ROBSON 2016
9	Hohen Viecheln, Germany (1953–1955)	Early Mesolithic	Maglemose	32	SCHULDT 1961
9	Hohen Viecheln, Germany (1995)	Early Mesolithic	Maglemose	14+	SCHAHT 1996
10	Holmegård, Denmark (1922–1923, H. C. Broholm)	Early Mesolithic	Maglemose	27	ROSENlund 1976
10	Holmegård, Denmark (1944–1950, C. J. Becker)	Early Mesolithic	Maglemose	93+	ROSENlund 1976
11	Krzyż Wielkopolski, Poland	Early Mesolithic		2395	ZABILSKA-KUNEK et al. 2015
12	Lammasmägi, Kunda, Estonia	Early Mesolithic	Kunda	73	LÖUGAS 1995; PAAVER/LÖUGAS 2003
13	Lundby I, Denmark (1929–1931, T. Thomsen)	Early Mesolithic	Maglemose	82	ROSENlund 1976
13	Lundby II, Denmark (1945, C. J. Becker)	Early Mesolithic	Maglemose	115	ROSENlund 1980
14	Maglemose, Mullerup, Denmark (Neergaard's Island)	Early Mesolithic	Maglemose	3	ROSENlund 1976
14	Maglemose, Mullerup, Denmark (Neergaard's Island)	Early Mesolithic	Maglemose	6+	ROSENlund 1976
14	Maglemose, Mullerup, Denmark (Sarauw's Island)	Early Mesolithic	Maglemose	109	LEDUC 2013
14	Maglemose, Mullerup, Denmark (Sarauw's Island)	Early Mesolithic	Maglemose	c. 95	ROSENlund 1976
15	Miluki 4, Poland	Early Mesolithic		16	MAKOWIECKI 2000
16	Mszano 14, Poland	Early Mesolithic-Early Neolithic		74	MAKOWIECKI 2000
17	Præstelyngen B II, Denmark	Early Mesolithic	Maglemose	n.d.	ROSENlund 1976
18	Pulli, Estonia	Early Mesolithic	Kunda	99	LÖUGAS 1996
19	Ringsjöholm, Sweden	Early Mesolithic-Middle Mesolithic	Maglemose-Kongemose	405	SVENSSON 2006
19	Rönneholm, Sweden (2008–2009)	Early Mesolithic-Late Mesolithic	Maglemose-Ertebølle	30	MAGNELL 2010
20	Rothenkempenow, Germany	Early Mesolithic	Maglemose	n.d.	SCHAHT 1993
21	Sværdborg I, Denmark (1943–1944, C. J. Becker)	Early Mesolithic	Maglemose	1013	AARIS-SØRENSEN 1976
21	Sværdborg II, Denmark (1946, C. J. Becker/M. Ørsnes)	Early Mesolithic	Maglemose	22	ROSENlund 1976
22	Ulkestrup Lyng Øst, Denmark (1947–1951, K. Andersen)	Early Mesolithic	Maglemose	867	NOE-NYGAARD 1995
22	Ulkestrup Lyng Øst, Denmark (1947–1951, K. Andersen)	Early Mesolithic	Maglemose	586	RICHTER 1982
23	Umbusi, Estonia	Early Mesolithic	Kunda	38	LÖUGAS 1996
24	Vinde-Helsinge, Denmark	Early Mesolithic	Maglemose	n.d.	DEGERBØL 1943

Table 2. Fish identified in the assemblages listed in Table 1. P – presence indicated.

Site name, country	
Barmosen I, Denmark	<i>P</i>
Bedburg-Königshoven, Germany	108
Bølling Sø, Denmark	1
Dudka I, Poland	353
Friesack 27a, Germany	10
Friesack 4, Germany	703
Hohen Viecheln, Germany (1953–1955)	35
Hohen Viecheln, Germany (1995)	9
Holmegård, Denmark (1922–1923, H. C. Broholm)	24
Holmegård, Denmark (1944–1950, C. J. Becker)	87
Krzyż Wielkopolski, Poland	<i>P</i>
Lammämägi, Kunda, Estonia	66
Lundby I, Denmark (1929–1931, Th. Thomsen)	82
Lundby II, Denmark (1945, C. J. Becker)	115
Maglemose, Mullerup, Denmark (Neergaard's Island)	3
Maglemose, Mullerup, Denmark (Neergaard's Island)	6
Maglemose, Mullerup, Denmark (Sarauw's Island)	109
Maglemose, Mullerup, Denmark (Sarauw's Island)	95
Mihuki 4, Poland	8
Mszano 14, Poland	11
Pulli, Estonia	
Ringsjöholm, Sweden	225
Rönneholm, Sweden (2008–2009)	21
Sværdborg I, Denmark (1943–1944, C. J. Becker)	1006
Sværdborg II, Denmark (1946, C. J. Becker/M. Ørsnes)	22
Ulkestrup Lyng Øst, Denmark (1947–1951, K. Andersen)	536
Ulkestrup Lyng Øst, Denmark (1947–1951, K. Andersen)	794
Ümbusi, Estonia	31
<i>Gasterosteus aculeatus</i>	
<i>Anguilla anguilla</i>	
<i>Sander lucioperca</i>	
<i>Perca fluviatilis</i>	
<i>Periculidae</i>	
<i>Silurus glanis</i>	
<i>Rutilus rutilus</i>	
<i>Blicca bjoerkna</i>	
<i>Abramis brama</i>	
<i>Leuciscus aspius</i>	
<i>Leuciscus idus</i>	
<i>Scardinius erythrophthalmus</i>	
<i>Tinca tinca</i>	
<i>Carassius carassius</i>	
<i>Cyprinidae</i>	
<i>Corégonus lavaretus</i>	
<i>Esox lucius</i>	
<i>Lota lota</i>	

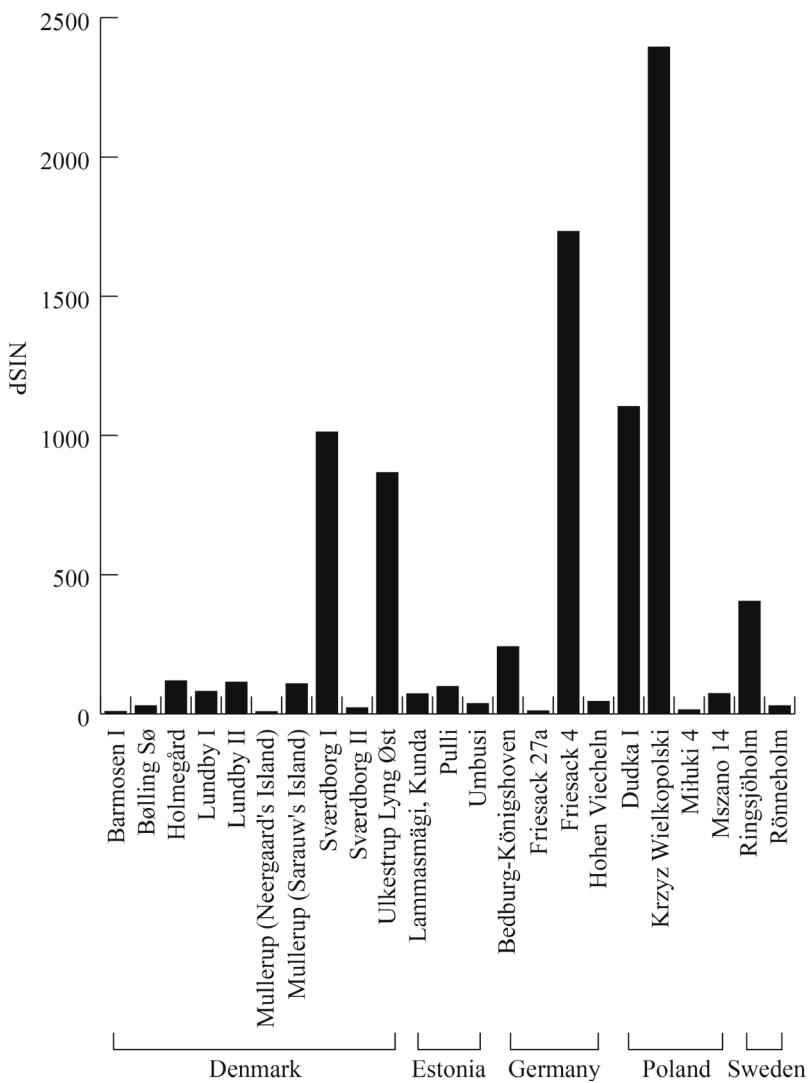


Fig. 1. NISP values for the archaeological sites according to country.

In terms of NISP values, 18 of the assemblages yielded a NISP <100. These assemblages are included with some reservations about whether they present an accurate picture of fish use at a site due to strong taphonomic biases, or because they may represent natural death assemblages (see NOE-NYGAARD 1995, 170). Moreover, there are five assemblages present in the dataset that yielded a NISP >100 but less than <500, and two assemblages that yielded a NISP >500 but <1000. Only four assemblages (Dudka I, Friesack 4, Krzyż Wielkopolski, and Sværdborg I) throughout the region yielded a NISP >1000.

4 Fishing technologies

Barbed and bone points (as well as harpoons) are one of the most ubiquitous types of Early Mesolithic artefacts. Routinely recovered from present day peat bogs that were once aquatic landscapes, they provide indirect evidence for fishing during the period. Generally it is assumed that they were hafted onto wooden shafts for spearing or throwing (ROBSON et al. 2018), alternatively two or more could have been hafted together, as evidenced at the Early Mesolithic site of Star Carr in the United Kingdom (CLARK 1954), or complemented with the addition of a central point to form a leister. Barbed and bone points have been recovered from a number of the Early Mesolithic sites listed in Table 1, for example Holmegård, Lundby I and II, Mullerup, Ulkestrup Lyng, Sværdborg I and II and Vinde-Helsingør (in Denmark), Duvensee, Friesack 4, Friesack 27a and Hohen Viecheln (in Northern Germany) (AARIS-SØRENSEN 1976; BROHOLM 1924; CLARK 1948; GRAMSCH/BERAN 2007/2008; GROSS 2017; JESSEN et al. 2015; NOE-NYGAARD 1995; ROBSON 2015; ROSENLUUND 1980; SCHULDT 1961). The most evocative description of their use is provided by INDREKO (1934, 283; see CLARK 1952), noting the presence of a barbed point alongside the remains of a northern pike (*Esox lucius* L., 1758) at the eponymous site of Kunda in Estonia.

Bows and arrows as well as clubs and spears are other classes of artefacts that may have been used for fishing (AARIS-SØRENSEN 1976). At least one probable bow made of pine is known from the lakeshore settlement of Friesack 4 in Germany (GRAMSCH/KLOSS 1989, 322). Recovered from a middle Preboreal context, it is currently the oldest known example from Northern Europe (GRAMSCH pers. comm. 2016). An unknown number of arrows as well as spears have also been recovered from this site (GRAMSCH/KLOSS 1989). Although scarce when compared to evidence from the Kongemose and Ertebølle cultures, other Early Mesolithic examples are known. From the Duvensee peat bog an unknown number of arrow shafts have been documented (HOLST 2007; SCHWANTES et al. 1925), whilst at least five bows were recovered from Holmegård in Denmark that are dated by proxy to the younger Maglemose culture, between c. 8000 and 6500 cal. BC (BECKER 1945). A further example was recovered from Ulkestrup Lyng (ANDERSEN et al. 1982).

More evidence of fishing equipment derives from floats made of wood or birch bark rolls. Routinely recovered throughout southern Scandinavia and the wider region, their prevalence indicates an established methodology for fish procurement at the start of the Holocene. Birch bark rolls are known from several Early Mesolithic sites, including Friesack 4 and Mullerup Syd (GRAMSCH 1992; GRAMSCH/KLOSS 1989; SARAUW 1903) as well as Flixton Island and Star Carr in the UK (CLARK 1954; ROBSON et al. 2018). In addition, at least two examples were recovered from Ulkestrup Lyng, which were radiocarbon (^{14}C -) dated to 8170 ± 120 BP (K-1507; ANDERSEN et al. 1982; TAUBER 1971; calibrated to 7514–6815 cal. BC at 95.5 % confidence), i.e. the Maglemose culture. On the other hand, wooden floats including discs with perforations have been recovered at Friesack 4 (GRAMSCH 1992; ROBSON 2016), as well as Hohen Viecheln (SCHULDT 1961) and Holmegaard IV (TROELS-SMITH 1960).

Dugout canoes and paddles are additional fishing related implements that would increase the available fishing grounds and resource spectrum. Waterborne navigation during the Middle and Late Mesolithic

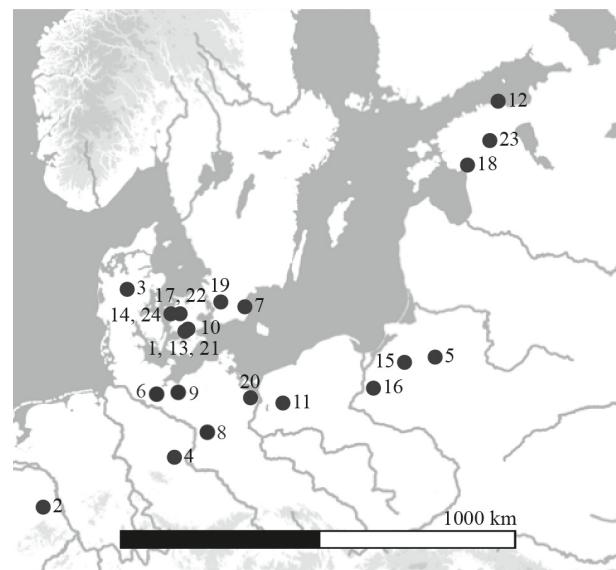


Fig. 2. Distribution of the Early Mesolithic sites listed in Tables 1 and 2.



Fig. 3. The paddle blade from Ulkestrup Lyng, Denmark (photo H. Robson).

in Northern Europe is well attested (see KLOOSS 2015), however, by comparison the Early Mesolithic evidence is very scant. Presently, the oldest known boating technology in Northern Europe, a paddle, was recovered from Star Carr (CLARK 1954). In addition, at least two examples were recovered from Friesack 4 and have been dated to the Younger Preboreal and Early Boreal, respectively (GRAMSCH 1987; 1992; GRAMSCH/KLOSS 1989). A further example is known from the Duvensee peat bog (HOLST 2007; HARTZ/LÜBKE 1999; 2000; JENKE 2009; 2011; SCHWANTES et al. 1925). It has recently been AMS dated to 8477 ± 49 BP (KIA-36362; JENKE 2009; calibrated to 7591–7482 cal. BC at 95.5 % confidence) and 8261 ± 38 BP (KIA-36363; JENKE 2009; calibrated to 7458–7173 cal. BC at 95.5% confidence). In addition, a slightly younger example was recovered from the Maglemose site of Holmegård (BROHOLM 1924), while a further specimen is known from Ulkestrup Lyng (Fig. 3; ANDERSEN et al. 1982).

5 Highlights

While acknowledging the source limitations discussed above and recognising the potential for new research to produce data that will require major shifts in how we view fishing in the earlier parts of the Mesolithic, based on the data at hand some discussion of fishing during the Maglemose and related periods is in order. First, the absolute dominance of pike on Danish Early Mesolithic sites is a striking phenomenon. Taking into account only those sites with more than 50 identified specimens, pike account for c. 93 % or more of the fish in the assemblage at each of these sites. While this predominance in the Maglemose and related cultures is also seen elsewhere to some extent (e.g. Lammasmägi, Estonia), at many other localities such as Ringsjöholm in Sweden and most of the Polish sites they are present in much lower percentages. Before looking for cultural or environmental explanations for this pattern, it must be stressed that many of the Danish sites were excavated before the widespread recognition of the importance of wet sieving to recover smaller artefacts such as the bones of fish from small individuals, whereas the Polish (and some of the other) sites were recently excavated. However, if the variability is not merely taphonomic, it is an intriguing difference that suggests flexibility in how fish resources were exploited across the region, especially as pike are clearly present in the other assemblages, merely in lower proportions.

Although pike are excellent fish for eating, their predominance in most Maglemosian assemblages is somewhat of a surprise, given their relatively solitary nature (MUUS/DAHLSTRØM 1964). Other fishes, especially diadromous ones such as sea trout (*Salmo trutta* L., 1758), Atlantic salmon (*Salmo salar* L., 1758) and European eel (*Anguilla anguilla* L., 1758) that aggregate in large numbers during their migrations, might appear to be more attractive resources from a human behavioural ecology perspective.

Following the absolute dominance of pike, the taxa most commonly present in the assemblages was Cyprinidae (carp and minnow family), found at c. 71 % of the sites (Table 2). At least eight Cyprinidae species have been identified in the fish faunal assemblages (Table 2): crucian carp (*Carassius carassius* L., 1758), tench (*Tinca tinca* L., 1758), common rudd (*Scardinius erythrophthalmus* L., 1758), asp (*Leuciscus aspius* L., 1758), ide (*Leuciscus idus* L., 1758), common bream (*Abramis brama* L., 1758), white bream (*Blicca bjoerkna* L., 1758), and roach (*Rutilus rutilus* L., 1758). Next in relative frequency was Percidae (perches) at 64 %, represented by the European perch (*Perca fluviatilis* L., 1758), and pike-perch (*Sander lucioperca* L., 1758), followed by wels catfish (*Silurus glanis* L., 1758) at 36 % and European eel at 21 % of the sites.

One further strand of evidence for the direct consumption of aquatic organisms, including fish, derives from stable isotope analysis. In recent years, carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) stable isotope analysis of human bone collagen has routinely been undertaken in order to reconstruct the long-term consumption practices of past populations. Despite certain limitations, including sample size, the lack of

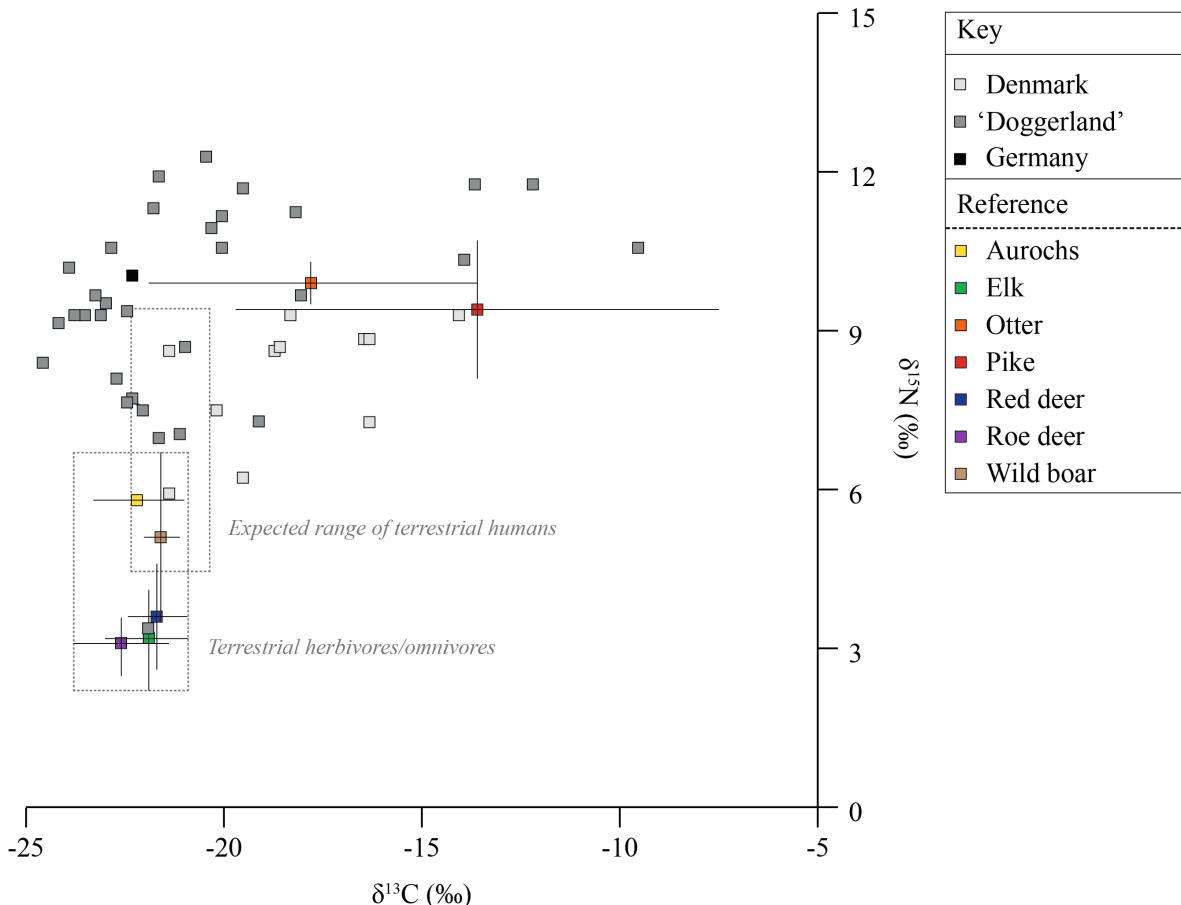


Fig. 4. Carbon and nitrogen stable isotope data obtained from human bone collagen dating to the Early Mesolithic Maglemose culture of Southern Scandinavia and Doggerland (human bone collagen data from FISCHER et al. 2007; TERBERGER et al. 2012; VAN DER PLICHT et al. 2016; reference data from FISCHER et al. 2007; NOE-NYGAARD et al. 2005). Since consumers will typically have $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values that are between +1–2 and +3–5 ‰ higher than those of their prey, respectively, the expected range of a diet derived from terrestrial protein is included.

a comprehensive ecological baseline for the Early Mesolithic, and the nature of the method (i.e. the data obtained reflect the last 10–15 years of diet), it has been usefully applied to assess Early Mesolithic human diet (Fig. 4). In general, $\delta^{13}\text{C}$ values primarily differentiate between marine and freshwater/terrestrial environments, whilst $\delta^{15}\text{N}$ values are an indication of position in the trophic level (RICHARDS/HEDGES 1999; SCHULTING/RICHARDS 2001). In light of this, the data can broadly distinguish what an individual has consumed due to the trophic level enrichment from prey to consumer. Since it is widely accepted that the marine and freshwater/terrestrial endpoints are -10.1 and -21.7 ‰, respectively (ARNEBORG et al. 1999; RICHARDS/HEDGES 1999), the data plotted in Fig. 4 demonstrate that the majority of the Early Mesolithic inhabitants of Southern Scandinavia (FISCHER et al. 2007; TERBERGER et al. 2012) as well as Doggerland (VAN DER PLICHT 2016) consumed freshwater resources, particularly fish.

6 Discussion and conclusions

Based on the evidence presented here (fish remains, fishing technology, stable isotope data), fish were without doubt an important resource for groups in the Early Mesolithic. Until now, the evidence points to a clear focus on freshwater fishes since not one marine species has been identified yet (Tables 1–2).

Some of the species do have limited brackish water tolerance, but only the catadromous European eel unequivocally spend part of their lives in the sea and thus prove exploitation of (semi-)marine resources (although they were in all likelihood taken from freshwater waterbodies). It is noteworthy that the presence of European eel in one assemblage from Bølling Sø demonstrates that this species must have (re-)colonised Northern Europe quite early in the Holocene.

Given that pike are present at nearly every site considered and that they are often the dominant fish in the assemblage (although with reservations due to varying recovery methodology), the question as to 'why' is of some importance for understanding the groups exploiting them. Seasonality and fishing technology provide possible answers. During the spring (March to May), pike move into shallow waters to spawn and are easily taken by spearing. Bone points suitable for this activity are numerous at many Maglemosian sites, whereas fishhooks and evidence for nets or other means of fishing, while known, are not common. For mobile bands of hunter-gatherers, spearing fish with tools that might also be employed for different game at other times was a means to take advantage of plentiful aquatic resources at certain times, especially spring, when other sources of food were scarce – without the large resource investment in the stationary fishing structures that become prevalent later in the Mesolithic (although see HANSSON et al. 2016 for early evidence of such structures in Sweden). It might also be the case that fluctuating sea levels repeatedly restructuring inland water systems made it difficult for groups to acquire the knowledge of local conditions necessary to develop fisheries that more fully exploited the whole range of species available.

The other species fished by Early Mesolithic people, especially cyprinids, do demonstrate that the fisheries were more complex than simply spearing pike during the spawn, but overall the picture is of relatively limited exploitation of aquatic resources. Environmental changes, decreased mobility and increasing populations are some of the possible explanations for the greatly increased emphasis on (especially marine) aquatic resources that characterise the subsequent periods of the Mesolithic. Of course, the role of cultural choices in this transformation must also be considered. Above all, in order to understand the lives of the people who inhabited southern Scandinavia and adjacent regions in the early Holocene before the advent of farming, we must remember to occasionally step off the land and into the water.

Acknowledgements

We express our gratitude to the organisers of the 'Working at the sharp end at Hohen Viecheln: from bone and antler to Early Mesolithic life in Northern Europe' conference for the invitation to present there. We also wish to thank Daniel Groß and Harald Lübke in particular for their patience regarding the preparation of this manuscript, and the two anonymous reviewers whose comments greatly improved the final version.

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