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Palaeo-oceanographic development and human adaptive strategies in the Pleistocene–Holocene transition: A study from the Norwegian coast

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Abstract

The human colonization of Norway occurred in the Pleistocene–Holocene transition – one of the most abrupt and severe climatic shifts in human history. For 1500 years (9500–8000 BC), the whole coast was occupied by mobile, marine-oriented hunter-gatherers. This paper explores dynamic relations between human adaptation and marine environmental variations in this period. An updated record of archaeological sites and palaeo-oceanographic data suggests a correlation between marine productivity and site distribution and density. The data further demonstrate spatial and temporal differences in the environment. A cooling pulse at 9300–9200 BC (the Preboreal Oscillation) with widespread ecological consequences must have been noticeable to humans occupying Norwegian landscapes. A more gradual shift occurred around 8800 BC when the arctic climate gave way to warmer conditions: The Norwegian Atlantic current stabilized, all fjord systems became ice-free, and animal diversity increased. In the northernmost region, the impact of Atlantic water was less severe, and Polar conditions with more sea ice seem to have lingered throughout the period. Variations in the site pattern may be related to these fluctuations in the resource situation. Variations in the lithic industry, on the other hand, seem to be connected to technological choices or local traditions, rather than environmental dissimilarities. The archaeological record indicates that the lifestyle, which developed under arctic conditions, was maintained through a flexible mobility pattern and a versatile tool technology, but the Norwegian coast also provided a good base to uphold such a lifestyle.

Keywords

archaeological site patterns, Early Holocene, environmental changes, marine productivity, Norway, paleo-oceanography

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Introduction

The Pleistocene–Holocene transition marks one of the most abrupt and severe climatic shifts in human history. In Scandinavia, the terrestrial ice sheet melted away, sea levels fluctuated, vegetation appeared, and arctic animals were partly replaced by a more temperate fauna. The human colonization of Norway (Figure 1) also occurred during this transition phase, and for 1500 years, the whole coast was occupied by mobile, marine-oriented hunter-gatherers. The archaeological record from the Early Mesolithic Period (Table 1) give the impression of a well-established lifestyle that was maintained throughout severe climatic changes.

The post-glacial natural history of Norway is well incorporated in the archaeological discourse (e.g. Anundsen, 1996; Bang-Andersen, 1996, 2003, 2012; Fuglestvedt, 2009; Indrelid, 1975). However, the discussion about human adaptations in changing environments largely revolves around terrestrial data: fluctuations in ice cover, air temperature, and vegetation. With an Early Mesolithic location pattern that is clearly oriented toward the coast and marine resources, the paleo-oceanographic development may be even more relevant to bring into discussion: How did the climatic changes affect the *marine* environment and resource situation? How does the archaeological record relate to *this* trajectory? The Scandinavian Peninsula is one of the few regions in the world where Preboreal coastlines are situated above the present sea level (Fischer, 1996; Kindgren, 1996) and where the dynamic relation between the very first marine foragers and their fluctuating oceanic surroundings can be illuminated (Bjerck, 2009). This paper explores these topics, by including archaeological and paleo-oceanographic data, and thus shed light on a part of the human–environment discussion that is less known in the European context.

Several archaeologists have taken a marine environmental approach in understanding the Norwegian Mesolithic. Of particular interest are the following studies from different parts of the country, which are based on topographical observations and physical oceanography. Nygaard (1987) points to the highly productive aquatic environment found on the *west coast* today, suggesting that a mixing of polar and subpolar water masses would create

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Table 1. Chronological terms and calibrations used in this paper, after Bjerck et al. (2008: 82). All dates in the text are provided in calibrated years BC. Dates that are presented as ^{14}C years in the original publication are calibrated by the author using the online program Oxcal version 4.2, calibration curve IntCal 13 (Bronk Ramsey, 2009).

Geological phase	Vegetational/climatic phase	Archaeological phase	Age BC	^{14}C years
Mid-Holocene	Atlantic	Late Mesolithic	6500–4000	7700–5200
	Boreal	Middle Mesolithic	8000–6500	9000–7700
Early Holocene	Preboreal	Early Mesolithic	9500–8000	10,000–9000

extra favorable conditions for plankton productivity in the Preboreal period. Bergsvik (1991, 1995, 2001) has studied Mesolithic settlement patterns on the west coast in relation to tidal currents. Here, the production of zooplankton is at its highest, something that attracts marine predators from all trophic levels. These locations should also be sought out by marine foragers. Bjerck (Bjerck, 2007, 2008, 2009; Bjerck and Breivik, 2012; Bjerck and Zangrando, 2013 and Bjerck et al., 2008) has drawn attention to what he terms *fjord–skerry coastal landscapes*. In these seascapes, which are prominent along the Norwegian coast, mixing of water with different salinities, temperatures, and nutrient levels provides a desirable and stable environment for a diverse marine fauna. He points to several features that enhance the productivity in *central Norway* and relates them to the high density of sites in this region. Svendsen (2007) also emphasizes the sum of several beneficial factors on the coast of central Norway in his study of Early Mesolithic location patterns. Moreover, and referring to modern characterizations, he regards the archipelago as a more productive ecozone than the fjords also in Preboreal times. In his interpretation of the Målsnes I site in *northern Norway*, Blankholm (2008) describes a productive environment with freshwater runoff from the river systems meeting the tidal currents of the salty fjords – ideal for fish, marine mammals, and sea fowl.

These studies, which propose that there is a connection between specific features, marine productivity and archaeological site location, give rise to the question:

1. *Is there a relation between marine productivity and the spatial distribution of Early Mesolithic sites in Norway?*

Paleo-oceanographic data, resulting from increased aquatic research in recent years, give us the opportunity to study productive habitats and dynamics in the Early Holocene marine conditions more closely. The following review will not only reveal spatial differences in the marine resource base but will also demonstrate that the environment changes quite severely over time. This evokes a second question:

2. *Does the archaeological record reflect temporal variations recognized in the Early Holocene marine environment?*

The environmental bases for this paper are mainly published analyses of sediment cores from the Nordic Seas. The cores are relatively scattered and few in number, and the available data are most suited to give an over-regional review of the conditions. The distribution and location of Early Mesolithic sites in Norway make out the archaeological basis for the paper. Currently, the most detailed distribution maps exist on a local or regional scale – primarily in unpublished theses (e.g. Barlindhaug, 1996; Bjerck, 1983, 1995; Dugstad, 2007; Granados, 2011; Lindblom, 1984; Svendsen, 2007; Waraas, 2001; Westli, 2009). To improve the empirical situation, an updated compilation of Early Mesolithic sites is presented in this study. The discussion will furthermore be informed by additional archaeological material.

Figure 1. Map with names of places mentioned in the text.

The Early Mesolithic sites of Norway

As a result of poor preservation conditions, the Early Mesolithic sites of Norway are identified by stone artifacts and the traces of temporary dwellings only. The temporary dwellings are recognized by tentrings, cleared areas, or simply aggregations of lithic scatters. The artifact assemblage includes several typological indicators: flake adzes, core adzes, single-edged and tanged arrow points, microliths, microburins, and unifacial platform cores with acute striking angle. Other projectile and core types, along with edge burins and large irregular blades, are also common (e.g. Bjerck, 1986; Indrelid, 1975; Lindblom, 1984; Nærøy, 1999; Olsen, 1994; Woodman, 1993). The technocomplex has its roots in the south Scandinavian and northern European Hensbacka and Ahrensburgian traditions (Fischer, 1996; Fuglestvedt, 1999, 2009; Kindgren, 1996; Kutschera, 1999; Schmitt, 1994, 1999; Waraas, 2001).

Only a few radiocarbon datings are retrieved from Early Mesolithic contexts in Norway (Bang-Andersen, 2012; Bjerck, 1995; Blankholm, 2008; Kleppe, 2014). However, the isostatic rebound recorded along the coast offers us an alternative dating method: A long tradition of research has left us with comprehensive knowledge about the nature of land uplift and sea-level fluctuations in the Late Pleistocene–Early Holocene period (e.g. Hafsten, 1983;

Figure 2. The islands of Vega and Søla in Nordland county: Typical surroundings in which Early Mesolithic sites are located. Photo: Hein B. Bjerck, NTNU University Museum.

Møller, 1986; Svendsen and Mangerud, 1987). The assumption that the coastal sites were situated close to the contemporary water margin hence gives a good idea of the earliest possible age.

Previous studies highlight that most of the sites are recovered in the coastal zone, frequently on islands, and are positioned close to good natural harbors (Figure 2; Bang-Andersen, 1996; Bergsvik, 1995; Bjerck, 1990, 1995; Odner, 1964; Svendsen, 2007; Westli, 2009). In a recent analysis that includes 57 Early Mesolithic sites from different parts of the country, Nyland (2012) concludes that 89.5% of the sites are situated on islands, 3.5% in fjord areas, and 7% on mountain plateaus. The distribution of sites in north Norway expresses a somewhat different pattern: The sites are commonly situated by fjords or channels – most often on isthmuses and sometimes on headlands and islets (Barlindhaug, 1996). An orientation toward marine resources is proposed for all regions.

A search through literature and databases, supplemented with information provided by colleagues (see acknowledgements), has resulted in the updated distribution map presented in Figure 3.

The map displays 778 sites, with 527 that are dated to the Early Mesolithic by a combination of typology and sea-level curves or radiocarbon dates. The number includes both stray finds, test-pitted sites, and excavated sites that hold one or more of the typological indicators presented above. The last 251 sites lack typological markers, but are sea level–dated and contain raw materials, and in many cases technological traits, associated with the Early Mesolithic period (Table 2).

In line with previous research, two trends are visible from the distribution map:

1. The sites are not evenly distributed topographically: Early Mesolithic sites are mainly situated in the coastal zone: 747 sites (*c.* 96%) are coastal, while only 30 sites (*c.* 4%) are situated in the mountain zone.
2. The sites are not evenly distributed geographically: A particularly high concentration of sites is found in central Norway (267/319). Concentrations are also found in the southwest coast (142/163 sites), in southeast (39/128 sites), and in northernmost Norway (63/147 sites). Some areas lack traces of Early Mesolithic settlements.

In order to discuss how the distribution pattern relates to the Early Holocene marine environment, we need to evaluate the validity of these topographical and geographical trends: Which sources of errors are associated with the distribution map?

Validity of the distribution map

Topographical distribution: coast versus inland. Mappings of Early Mesolithic sites in Norway started in the early 20th century, when Anders Nummedal – a geologist with an interest in archaeology – investigated post-glacial, elevated shorelines visible as beach gravel on dry land. On numerous occasions, he found flint artifacts close to these geological deposits that would prove to be traces of shore-bound Early Mesolithic sites (Breivik and Ellingsen, 2014). In the wake of Nummedal's first discoveries, search for early sites was exclusively performed along elevated Preboreal shorelines. The dominance of sites in the coastal zone known at this time was thus a result of the survey methods. During the last 50 years, however, large archaeological mapping projects in mountain and forest zones have been conducted. In south and central Norway, over 1000 Stone Age sites from the inland have been mapped and surveyed, yet few can be dated to the Early Mesolithic (Foosnæs and Stenvik, 2010; Indrelid, 2009). Likewise, the majority of the sites detected in connection with development of hydroelectric power plants in northern Norway were from younger periods (Foosnæs and Stenvik, 2010; Amundsen, 2010). Finally, recent surveys with trenching and test pitting over vast areas generally support the view that the archipelagic zone and marine resources were indeed attractive to the first settlers (e.g. Bang-Andersen, 1996, 2012; Bergsvik, 1995, 2001; Bjerck, 1995, 2007, 2008, 2009; Blankholm, 2008; Lindblom, 1984; Odner, 1964; Pettersen, 1999; Svendsen, 2007). The new distribution map (Figure 3) is therefore likely a representative illustration of the topographical distribution pattern of Early Mesolithic sites.

Geographical distribution: site absence and site concentrations. In a discussion of sea-level fluctuations and glacio-isostatic uplift, Nummedal (1933) advocated that Early Mesolithic sites on the coast of west and south Norway must have been damaged by the later Tapes transgression. This would be the reason for the evident absence of sites in this part of the country. Sites that later were discovered on the southwest coast spoke for a more complex development with regional differences. With updated

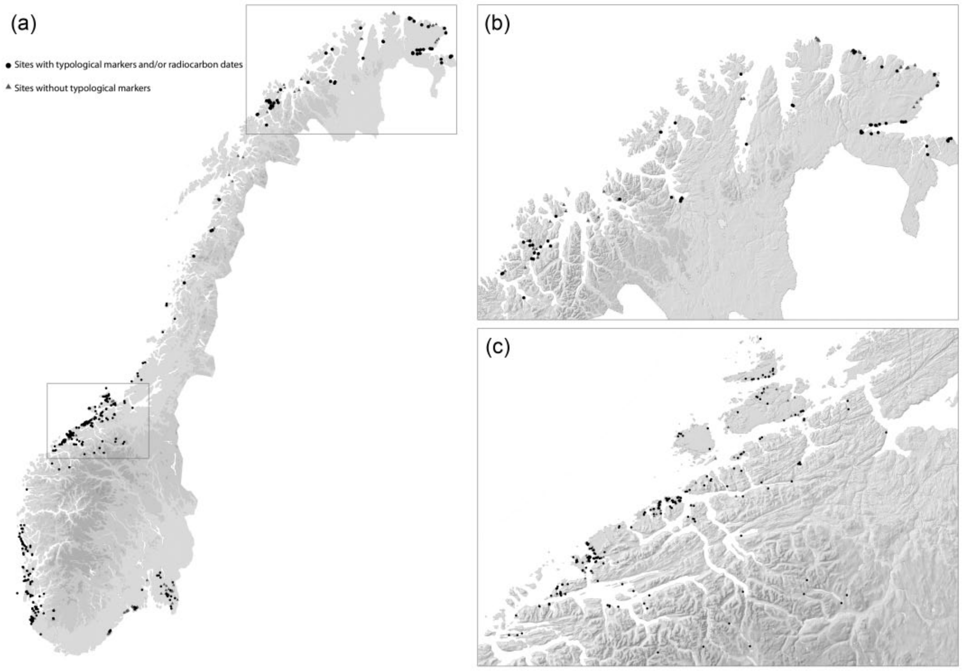

Figure 3. (a) The distribution of Early Mesolithic sites in Norway, with the present shore line. Sites which are dated by a combination of typological markers, sea-level curves and/or radiocarbon datings are indicated by black dots. Sites which lack typological markers, but are sea-level dated and contain raw materials and/or technological traits associated with the Early Mesolithic period are indicated by gray triangles. (b) Section showing the distribution of Early Mesolithic sites in northernmost Norway. (c) Section showing the distribution of Early Mesolithic sites in central Norway.

Table 2. Number of Early Mesolithic sites in Norway, sorted by counties. The left column presents sites that are dated by a combination of sea-level curves, typological markers, and/or radiocarbon dates. The middle column presents additional sites that are dated by sea-level curves, but lack typological markers. The right column sums up the total number of sites.

County	Sites with typological markers and/or radiocarbon datings	Sites without typological markers	Total	Comments to the sites and artifacts
Østfold	20	28	48	Southeast Norway: Large surveys in the recent decade have resulted in many new sites. A considerable amount of the new sites only contain flint flakes and must be regarded as uncertain, although they are situated on elevations that can be sea level–dated to the Early Mesolithic phase. Few sites are excavated.
Akershus	3		3	
Vestfold	11	46	57	
Telemark	1	2	3	
Aust-Agder	4	13	17	
Rogaland	69	14	83	Southwest Norway: A few larger survey projects in the recent decade have resulted in new sites. Some of these sites lack typological markers but contain artifacts with technological attributes associated with the Early Mesolithic period.
Hordaland	73	7	80	
Sogn og Fjordane	1		1	
Møre og Romsdal	221	40	261	Central Norway: Many of the sites are the result of targeted investigations in the early 20th century. A few large survey projects in the recent decade have resulted in new sites. Some of these sites are without typological markers, but most contain artifacts with technological attributes associated with the Early Mesolithic period. Assemblages from Nordmøre and Romsdal, Trøndelag, and southern Nordland are examined by the author.
Sør-Trøndelag	46	12	58	
Nord-Trøndelag	3		3	
Nordland	12	5	17	
Troms	17	23	40	Northernmost Norway: Several of the sites were discovered and collected in the early 20th century. Most of the sites from Finnmark are recovered and mapped by Hans Peter Blankholm (in preparation) and included here with his kind permission. Most of the sites without typological markers contain artifacts with technological attributes and raw materials associated with the Early Mesolithic period.
Finnmark	46	61	107	
Total	527	251	778	

information on archaeological sites and sea-level fluctuations, Bjerck (1983, 1986, 1995) more specifically ascribed the lack of sites in Sogn and Fjordane and adjacent areas to the Tapes transgression. Studies have also shown that transgressions have greatly affected Preboreal shorelines in southern and northernmost Norway (Hafsten, 1983; Møller, 1986), resulting in eroded or superimposed sites from this period.

Another potential contributor to the regional differences is archaeological survey intensity. Bjerck (1983) particularly stresses the significance of Nummedal's thorough mappings of central Norway. However, Nummedal also conducted surveys in northernmost and southeast Norway and investigated parts of the west coast. Moreover, systematic surveys in more recent decades have revealed Preboreal sites in Hordaland (Bergsvik, 1991), Nordland (Bjerck, 1990; Hauglid, 1993), Troms (Sandmo, 1986), and Finnmark (Blankholm, in preparation; Kleppe, 2010). Yet, none of the regions can demonstrate the same site density as central Norway.

Finally, Pettersen emphasizes the excessive land upheaval in Nord-Trøndelag, Nordland, and around the Oslofjord, which has resulted in Preboreal shorelines situated well above the cultivated areas. Only a few attempts have been made to locate the high-lying sites in these regions (Pettersen, 1999). During the last decade, however, archaeological mappings and excavations in connection with large industrial projects have resulted in improved knowledge about Early Mesolithic sites in southeast Norway, in particular (e.g. Jaksland, 2012a, 2012b).

The new distribution map (Figure 3) demonstrates the geographical differences discussed above: The 'empty' stretches along the coast are likely because of the transgression scenarios referred to above (Bjerck, 1995). The absence of sites on the exposed parts of the north coast may also be a consequence of the transgression. When it comes to site density, differences in archaeological survey frequency may have biased the distribution pattern somewhat. Nevertheless, the high concentrations of sites, particularly in central Norway, testify to greater activity in some regions during the Early Holocene.

Development and productivity in the Early Holocene marine environment

Marine productivity basically depends on the presence of phytoplankton and picoplankton (Huston and Wolverton, 2009). Phytoplankton attracts both fish and sea mammals, and its distribution can be used as a guideline to environments and habitats marine foragers would have sought. As plankton requires sunlight, carbon dioxide, and nutrients to grow, its productivity varies according to the influence of current systems, presence of ice, and differences in light, nutrients, and sea temperatures. These factors will be regarded in order to characterize spatial and temporal trends in the Early Holocene marine environment.

Temperatures and ice

The Preboreal period can be described as a rapid transition phase from a cold to a warm climate. Air temperatures increased by up to 5°C throughout the period, and ended in mean summer temperatures of about 10–14°C and winter temperatures of about −8 to −4°C (Birks et al., 2005b). The temperature rise caused the terrestrial ice sheet, which covered most of the land in the Late-glacial period, to diminish rapidly. Large parts of north, central, and southwest Norway were ice-free already at the start of the Holocene (Andersen, 2000), and by about 8800 BC, the ice had retreated from the fjords (Faulkner and Hunt, 2009; Forwick and Vorren, 2002; Gyllencreutz, 2005; Mangerud et al., 2013; Rise et al., 2006).

In the beginning of Preboreal, there was an abrupt transition from cool sea surface temperatures (SSTs) to temperatures similar or warmer than today. Analyses from the Vøring plateau and southward show summer SSTs at around 10–13°C and cool but ice-free conditions with winter SSTs of about 5–8°C (Birks et al., 2005b). In northernmost Norway, Early Holocene summer SSTs were *c.* 9–11°C. Analyses from a core off the coast of Finnmark indicate that the ice cover in the southwest Barents Sea extended further south than today. Seasonal freezing is suggested, mainly ascribed to diminished ocean heat transport due to a reduced strength of the westerly wind forcing and subsequently reduced ocean mixing (Risebrobakken et al., 2010). Similar refreezing scenarios are likely for the fjord systems in the Early Preboreal – particularly in the glaciated fjords – as low saline water from glacial input zones enhances stratification, which in turn enhances sea ice formation (Statham et al., 2008).

Estimates based on marine diatoms suggest that the SSTs in the Norwegian Sea decreased by 1°C during the Preboreal Oscillation (PBO), a cold event occurring *c.* 300 years after the onset of the Holocene (Björck et al., 1997). A high-resolution record from the Vøring plateau suggests that there were in fact two cooling pulses at 9300 and 9200 BC; the former was the most severe with a drop of 2°C (Berner et al., 2010). The event is recognized on land in large parts of Europe – mainly by decreasing pine and birch pollen and increasing values of herbs, grasses, and shrubs. In Sweden, decreased carbon values imply a lower biological production in lakes, perhaps as a result of longer seasons of ice cover, and in southwest Norway, glacial readvances are connected to the PBO (Björck et al., 1997).

Current systems

Ocean currents distribute nutrients and oxygen and are important for circulating water with different qualities. In Norwegian waters, the northernmost extension of the Gulf Stream – the Norwegian Atlantic current – is the most important contributor, as it transports warm and saline water masses along the coast. The current has had varying influence on the Nordic Seas. After a period of decreased influence in the Late-glacial period, it became well established along the coast during the Early Holocene – probably within 1000 years after the end of Younger Dryas (YD) (Birks et al., 2005b). On the Vøring plateau, the impact of the Atlantic current is demonstrated by a gradual increase in diatom fluxes in 9500–8800 BC, indicating higher surface ocean productivity (Berner et al., 2010). In north Norway, freshwater influx prior to 9000 BC and strong stratification of the water column throughout Early Holocene testify to a weaker inflow of Atlantic water (Risebrobakken et al., 2010).

Of great significance are also tidal currents that mix and transport coastal water to fjords and sounds. Simulations from the northwest European shelf estimate larger tidal amplitudes in the Late Pleistocene and Early Holocene time span – also for the western seaboard of Norway (Uehara et al., 2006). The tides would have been important for bringing warm, salty water masses to inner coast areas as the Atlantic current became more influential toward the Mid-Preboreal.

Archipelago and fjord

According to Koç et al. (1993), stronger inflow of Polar water and greater seasonality (warmer summers and colder winters) in the Early Holocene resulted in active mixing and highly productive surface water conditions in the Nordic Seas. The large amounts of meltwater that would drain from the receding ice could have had a similar effect on Norwegian coastal waters: Glacial runoff stimulates plankton growth in adjacent coastal waters as the nutrient content of high-latitude, previously ice-covered soils is typically high (Huston and Wolverton, 2009; Statham et al., 2008). During the meltdown of the Scandinavian ice sheet, nutritious sediments would have been transported to the coast via the fjords. In southeast Norway, freshwater influx from the draining Baltic Ice Lake and Yoldia Sea would have distributed additional nutrients into the saltier water masses in the Early Preboreal (Gyllencreutz, 2005). However, the high concentrations of silt- and clay-sized particles from glacial runoff can cause light attenuation close to the outlets (Statham et al., 2008). This, in addition to glaciated and seasonally frozen fjord bottoms and the weak influence of the Norwegian Atlantic current in the Early Preboreal, should have resulted in a mixing of different water masses closer to the fjord mouth and archipelagic zone than today.

Lou Schmitt (in press) has recently pointed to the beneficial marine biological conditions created by expanded phytoplankton populations around islands. The idea is based on a biophysical model that investigates the development of phytoplankton blooms along vortex streets in island wakes (Hasegawa et al., 2009). The model shows that upwelled and vertically mixed nitrate-rich water masses entrain into the ambient flow, creating a connected band of high productivity in the lee of the island. From this, Schmitt (in press) suggests that the great influx of melting water from the Vänern basin in Sweden, and the Norwegian fjords, would have enhanced the phytoplankton production in the skerry zone.

Kelp forests and coral reefs: highly productive ecosystems

Kelp forests are found along shallow, rocky coasts in cold-water habitats. The diversity of marine organisms associated with the kelp forests makes it one of the most diverse and productive ecosystems of the world (Lorentsen et al., 2010; Steneck et al., 2002). The Norwegian continental shelf provides good growing conditions for kelps today. *Laminaria hyperborea*, the dominant species, grows in the northeast Atlantic with optimal conditions on the coast of central Norway (63–65°N; Sjøtun et al., 1995). They grow on rocky substratum in shallow (<30 m) and wave-exposed areas with good light conditions (Bekkby et al., 2009). A study performed on several *Laminaria* species showed that they generally had optimal growth in the 10–15°C range (Bolton and Lüning, 1982). Remembering that the SST established at 10–13°C during the Preboreal period, the coast of Norway would have been good for kelps, given sufficient nutrients and sunlight.

Other highly productive underwater environments are coral reefs. Cold-water corals in the northeast Atlantic typically dwell at 350–1200 m depth and thrive at 5.5–12°C in nutrient-enriched and current-dominated settings. The Norwegian shelf comprises some of the most prolific and widespread coral populations today. Here, the reefs grow exclusively within the Atlantic current on the shelf up to 72°N and in fjords with inflow from this current (López Correa et al., 2012). A map of the current distribution of *Lophelia* coral reefs, compiled by Fosså et al. (2002: 3; Figure 1), interestingly shows concentrations in southwest and central Norway similar to the Early Mesolithic site map presented in Figure 3. Recent studies have dated living coral reefs (*Lophelia pertusa*) in Stjernsundet to 8900–7400 BC as the minimum age. The formation of the coral ecosystem hence took place rapidly, within *c.* 750 years after the YD termination, and *c.* 370 years after the PBO (López Correa et al., 2012), and most likely corresponds to the stabilization of the Norwegian Atlantic current system referred to above.

Marine fauna

As osteological remains are rare from Preboreal contexts in Norway, the fauna has to be reconstructed on the basis of climatic data. A few collections from older, Late-glacial layers in caves and some stray finds show an arctic fauna, similar to what we find on Svalbard or Greenland today (Hufthammer, 2001). Cold-tolerant pioneer animals were still a part of the earliest post-glacial fauna: skeletal remains of a bearded seal (*Erignathus barbatus*) from Malvik in the Trondheimsfjord in central Norway are recently dated to Early Preboreal (Jørgen Rosvold, NTNU University Museum, 2013, personal communication). Additionally, we can assume that ringed seal (*Phoca hispida*), harp seal (*Phoca groenlandica*), walrus (*Odobenus rosmarus*), and polar bear (*Ursus maritimus*) were present (Hufthammer, 2001). Faunal remains suggest that most of these species were frequent in the Kattegat–Skagerrak area until terminal Pleistocene (Aaris-Sørensen, 2009).

Ice-obligate species – polar bears, walruses, bearded seals, and ringed seals (Moore and Huntington, 2008) – would have been pushed northward during the Early Holocene as the temperatures increased, but areas with seasonal sea ice (see above) may still have provided good winter/spring habitats. At the same time, gray seal (*Halichoerus grypus*) probably immigrated. Faunal records from Denmark and Sweden document the presence of this species already from the beginning of Early Holocene. Harbor seal seems to have migrated into northern Europe at a later stage (Aaris-Sørensen, 2009; Sommer and Benecke, 2003).

Faunal remains retrieved from various Ice Age contexts show a diverse coastal avian fauna: fulmar (*Fulmarus glacialis*), eiders (*Somateria* spp.), puffin (*Fratercula arctica*), guillemots (*Uria* sp. and *Cepphus grylle*), razorbill (*Alca torda*), little auk (*Alle alle*), gulls (*Larus canus* and *Pagophila eburnea*), geese (*Branta/Anser*), scoters (*Melanitta* spp.), and kittiwake (*Rissa tridactyla*; Hufthammer, 2006; Valen et al., 1996). These are species that most probably inhabited the coast in the Preboreal period.

Several fish species would also be present. Cold-tolerant species able to handle low salinity would be the first to arrive. Analyses from an inlet on the west coast of Canada show that few fish were present during the initial meltdown of the terrestrial ice sheet when the ocean received large quantities of glacial outwash. A pronounced spike of plankton occurs just before fish associated with low saline water appear. A greater diversity and abundance appear when the conditions are warmer and drier (Tunnicliffe et al., 2001). A similar scenario can be pictured for Norway. Cod (*Gadidae*), polar cod (*Boreogadus saida*), bull-heads (*Cottidae*), and cusk (*Brosme brosme*) are examples of species associated with arctic conditions (Hufthammer, 2001). Alpine charr (*Salvelinus* sp.), capelin (*Mallotus villosus*), herring (*Clupea morhua*), whiting (*Merlangius merlangus*), and ling (*Molva molva*) are known from Late-glacial contexts on the Swedish west coast (Jonsson, 1995). A greater diversity of fish species is expected from the Mid-Preboreal when the Atlantic current establishes.

The increased seasonality recorded in the early phase implies that an arctic fauna may have been present during winter months and a more temperate fauna could have migrated during the summer months.

Spatial trends: marine productivity and archaeological site distribution patterns

The review suggests that the outer coast was the most productive zone in the Preboreal time. In the early phase, the combination of reduced westerly wind forcing, a weaker Norwegian Atlantic current, and runoff from melting glaciers via the fjords could have resulted in a mixing of different water masses where the fjords meet the archipelago. Great meltwater discharge would create phytoplankton blooms in the wake of islands, and nutritious sediments transported from former ice-covered land would have created an even more productive environment than we find along the coast today. The Norwegian Atlantic current that established around the Mid-Preboreal brought new nutritious water along the coast and created livable conditions for new species. In this fruitful archipelagic zone, we find most of the Early Mesolithic sites.

A close relation between productive marine habitats and site location pattern is demonstrated in central Norway where the sites are typically oriented toward the zone where the primary production would be high: on the exposed islands, facing the ocean rather than the mainland (Figure 3c). Many sites are also located around the channels that connect the open ocean with the fjord mouths where the tidal amplitudes would create vertical mixing of different water masses. Cold-water corals and kelp populations, which have good growing conditions in the region today, could have established already in Early Holocene. These ecosystems would have provided extra beneficial conditions for marine organisms on certain places. The paleo-oceanographic data seem to support that the high density of sites in this region is connected to a particularly productive marine environment, created by the combination of several beneficial factors. A similar environmental characterization is valid for southwest coast – another region with a high concentration of Early Mesolithic sites.

In northernmost Norway, we find a different situation. Here, the Norwegian Atlantic current had less influence, and arctic conditions with severe seasonal freezing prevailed in the Preboreal phase. Mammals dependent on sea ice would have lingered longer than further south. It may also be relevant to discuss whether polynyas – areas of open water surrounded by ice – could have been present. Recurring polynyas (those that occur at the same time and place each year) are particularly important because migrating or overwintering birds and mammals depend on their existence when the sea is largely ice-covered (Stirling, 1997). These circumstances would have resulted in a different and more restricted distribution of nutrients, plankton, and marine species that feed on them. A large part of the sites in north Norway are situated around fjord heads and sheltered sounds – locations that were less appreciated farther south (Figure 3b). The data thus suggest that the somewhat different approaches to the landscape may have been closely related to the different resource situations.

Resource availability in different seascapes

Marine mammals have been lifted forward as a significant prey for early marine foragers in many parts of the world (e.g. Bjerck, 1995; Erlandson et al., 2007; Grønnow et al., 2011; Orquera and Piana, 2009a; Schmitt et al., 2006; Yesner, 2004). In northern Norway, the arctic mammals (walrus, harp seal, ringed seal, and bearded seal) would appear frequently. Even today, harp seals and ringed seals enter the large fjords in this region: Harp seals often feed in or near the pack ice, but migrate into the Varangerfjord during spring. Ringed seals are found in largest numbers during winter and early spring and prefer the shore-fast ice of the inner fjord (Hodgetts, 1999: 108–110). The species would distribute farther south in the Early Preboreal. The presence of ringed seal in the Baltic Sea, at least from the end of YD until today (Schmölcke, 2013), speaks of suitable conditions in this region, and it is likely that the species lingered in the Oslofjord throughout the first half of Preboreal. The physical evidence of a bearded seal in the Trondheimsfjord likewise shows that arctic species were at this latitude in the same period. Winter/spring hunting of these ice-obligate artic marine mammals was likely performed in connection to frozen water, and it is plausible to think of the many fjord sites in north Norway as camps related to this activity. Also recurring polynyas could have provided predictable hunting grounds in frozen seascapes: Polynyas are known as fowling sites in the Baltic Sea (Nuñez and Gustavsson, 1995) and as important walrus-hunting grounds for Thule Inuits in northeast Greenland (Grønnow et al., 2011).

Gray seals, on the other hand, commonly breed along rocky coasts and offshore islands (Hodgetts, 1999: 111; Schmölcke, 2008). The present Norwegian population form large, stationary groups in September–December and April–May in relation to breeding and molting (Hodgetts, 1999: 111). After the breeding season, they disperse and migrate widely, often in pelagic waters (Schmölcke, 2008). The highly productive archipelago along the western seaboard would provide desirable habitats throughout most of the year, but hunting may have been most efficient and predictable during spring and autumn/winter. In these seasons, gray seals could be hunted on and around land in great numbers. These operations would require sea-going vessels – at least for transport of hunters and prey.

Birds must have been another resource of importance. While seals provided meat, blubber, skin, and sinew, birds provided down, feathers and hollow bones, as well as eggs, and were highly valued among coastal hunter-gatherers (e.g. Moss and Erlandson, 2013; Tivoli and Zangrando, 2011). Osteological data picture a wide range of water fowl already during the Late-glacial phase, and more species would follow as the temperature rose. The greatest diversity would appear during summer time when migratory birds found their way to the Scandinavian archipelago. The outer coast would thus be quite desirable for marine foragers throughout most of the year.

The presented data suggest that there are correlations between the distribution of Early Mesolithic sites and productive marine habitats, and the spatial variations in settlement density and location patterns speak for a consciousness toward different environments and resource situations. This gives rise to the second question: Does the archaeological record also reflect temporal variations recognized in the Early Holocene marine environment? As the distribution map is not sufficient to shed light on this, the question will be explored bringing in additional archaeological data.

Temporal trends: human adaptive strategies in a shifting environment

The palaeo-oceanographic review draws a picture of a marine environment that underwent large changes during the Early Holocene time span. From being greatly influenced by ice and meltwater in the earliest phase, a gradual but comprehensive shift seems to occur midway through the Preboreal phase (*c.* 8800 BC), when the arctic climate gave way to warmer conditions. For a period of time, central Norway, and maybe also regions farther south, may have been occupied with arctic species during wintertime and a more temperate fauna during the summer months. As all fjord systems turned ice-free, cold-tolerant animals would be pushed northward and other marine species would settle in permanently. The Norwegian Atlantic current stabilized along the coast, and the oceanic circulation regime became more like the present. Terrestrial data suggest presence of tree stands, in a landscape dominated by low vegetation, in most regions at the same time (Birks et al., 2005a), with a subsequent growing number of animal species. The palaeo-environmental data thus speak for an increasingly productive environment, with a greater faunal diversity from the Mid-Preboreal. The Late Preboreal phase would have been characterized by increased stability in the marine conditions – consequently with more constant habitats for fish and sea mammals and hence a more predictable resource situation for human predators.

In addition to the gradual shift outlined above, a more abrupt event occurred at 9300–9200 BC. The PBO had widespread ecological consequences that must have been noticeable to humans occupying Norwegian landscapes: air and sea temperatures decreased, vegetation diminished, and terrestrial ice sheet readvanced. It may also have caused longer lasting seasonal ice covers in sheltered waters and fjords. The changes would have affected the dispersal and composition of animals, as their habitats were rapidly changing.

Human response to a changing environment is a widely investigated topic in archaeological research. Due to absence of datable material, this subject is less treated in Norwegian Early Mesolithic studies, but case studies from northern Europe show correlations between food abundance and hunter-gatherer population sizes (Tallavaara and Seppä, 2011), between climatic events and technological changes (Riede, 2009a), and between environmental changes and distribution of settlements (Crombé et al., 2011). If the PBO cold event had a sudden and severe effect on the economic basis of the marine foragers of Norway, we should look for a decline in site density and maybe even a subsequent change or loss in technology after 9300–9200 BC. Changes in hunting strategies and site location patterns might have occurred as the ice retreated and animal species found new suitable habitats during the second half of the Preboreal.

Material from central Norway, which holds almost half of the presented sites, is appropriate to test these hypotheses. As radiocarbon dates from Preboreal contexts are rare, we have to rely on shore displacement curves in order to study temporal trends. There are great differences in the rebound effect within the region, and the oldest Early Mesolithic sites are today situated from 20 m a.s.l. in the southwest archipelago to *c.* 160 m a.s.l. in the inner fjord areas. The sea-level 'drop' of up to 60 m during the Preboreal period gives us good age control as long as we know the elevation of the site. However, as the sites may have been positioned in various distances to the contemporaneous water margin, the method only provides us with the oldest possible date (Helskog, 1978; Lindblom, 1984; Årskog, 2009). Consequently, sea-level-dated sites are only adequate to illuminate general trends over time.

In all, 86 of the examined assemblages with typological markers from central Norway have sufficient mapping information to be dated by sea-level curves.

Site density and location patterns

Figure 4 illustrates changes in site density through the Preboreal period. The final stages of the period are hampered by non-cultural factors as the relatively low elevations on which the youngest sites are found may be affected by the Tapes transgression. Moreover, the transition to a Middle Mesolithic tool industry may have left us with fewer sites with typological markers toward the end of the Early Mesolithic. The strong declining trend must therefore be considered with caution. That being said, the curve does not demonstrate the predicted tendency: An argument for a decrease in site number in relation to the PBO cannot be sustained. From this we can suggest that the cold event did not have a dramatic effect on the marine food abundance, and that the environmental conditions were sufficient to uphold the human population through this period.

A tendency toward a less exposed location pattern oriented toward inland in the Late Preboreal phase has been advocated on the basis of regional studies from south Norway (Nyland, 2012; Waraas, 2001). The 86 sea-level–dated sites from central Norway show a similar trend (Figure 5): A higher percentage of sites with a retracted location, in fjord basins or sheltered sounds connected to the mainland, are found in the second half of the period. It has been argued that changes in settlement patterns – both location and duration – during the Middle and Late Mesolithic phases express alterations in the subsistence strategy that partly can be connected to environmental changes (e.g. Bergsvik, 1995; Bjerck, 1990; Indrelid, 1978; Lindblom, 1984; Nygaard, 1990; Olsen, 1992). Considering the results from the environmental review, it is plausible that this cultural development has its roots in the gradual stabilization of the marine environment, along with the terrestrial changes, that seems to occur in the Late Preboreal. Implementation of new species and new habitats may have started already toward the end of this period.

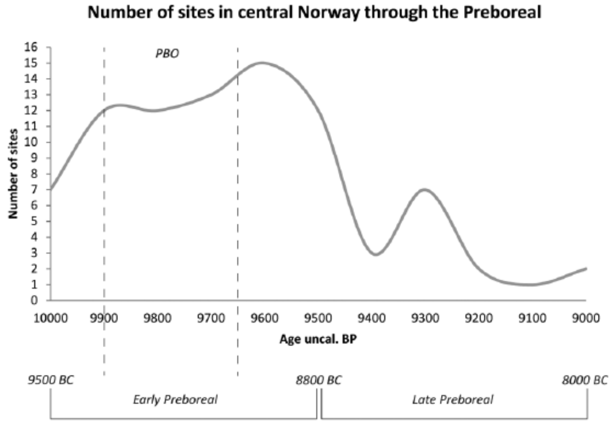

Figure 4. Changes in site density through the Early Mesolithic period, based on 86 sea-level-dated sites from central Norway.

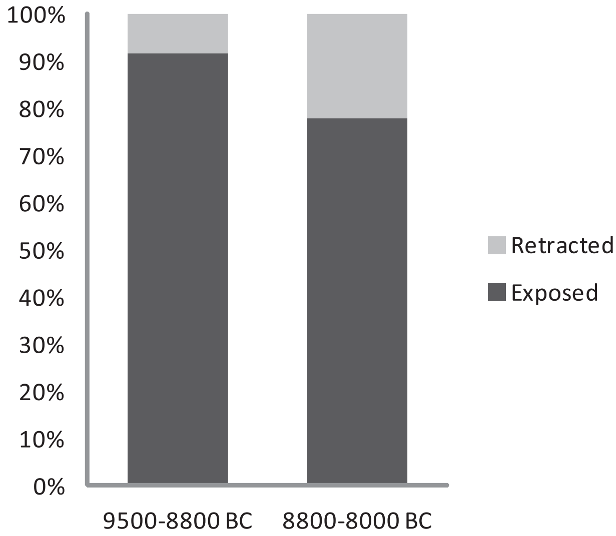

Figure 5. The percentage of sites with retracted and exposed location in the first and second half of the Early Mesolithic period, based on 86 sea-level-dated sites from central Norway (9500-8800 BC: N = 59; 8800-8000 BC: N = 27).

Technology

The Early Mesolithic technocomplex is distinguished by the use of direct striking technique and includes several specific artifacts that seem to appear on most sites (see above). As such, a technological continuity is already established for the period. However, a small change has been detected in the Mid-Preboreal (Bjerck and Ringstad, 1985; Fuglestvedt, 1999; Kutschera, 1999; Waraas, 2001). Based on Early Mesolithic sites from southwest Norway, Kutschera (1999) finds that while tanged points are common in the earliest phase, there are sites with few tanged points or none in the latest phase. Instead, lancet microliths become more common. It is not suggested how these artifacts relate to the use of resources, and currently, we know little about the function of these tools: Microliths have been used as projectiles (Aaris-Sørensen and Petersen, 1986; Larsson and Sjöström, 2011) as well as for cutting tools (Finlayson and Mithen, 1996). The points, which in size and shape equal the small tanged Ahrensburg points, are, on the other hand, certainly connected to the use of bows and arrows (Riede, 2009b, 2010). A decreasing number of tanged points could thus testify to a changeover in hunting strategies. Either way, if the technological shift in Mid-Preboreal is related to the parallel changes in the resource situation, we could expect a similar development in central Norway.

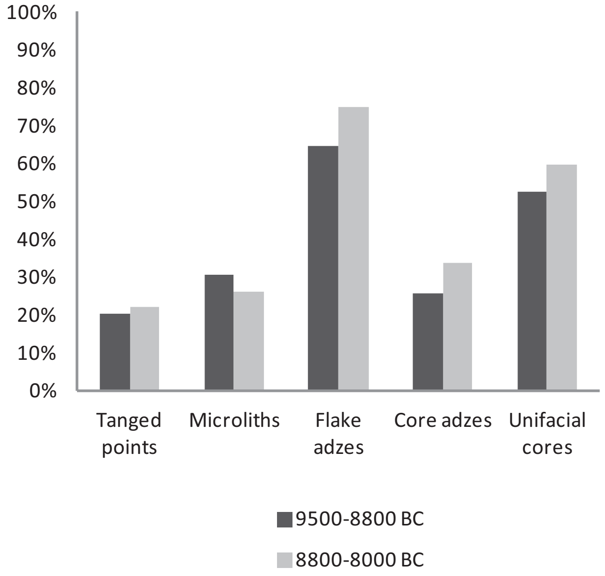

Figure 6. The percentage of sites with tanged points, microliths, flake adzes, core adzes, and unifacial cores in the first and second half of the Early Mesolithic period. The calculations are based on 86 sea-level-dated sites from central Norway (9500-8800 BC: N = 59; 8800-8000 BC: N = 27).

Among the 86 sea-level–dated sites from central Norway, tanged points seem to be just as common in the late phase as in the early phase (Figure 6). Microliths show a slight declining trend, but are more common than tanged points throughout the period. The technological shift identified in the southwest Norwegian material is thus not evident in the present material from central Norway, nor is it recognized in excavated material from Slettnes and Melkøya in Finnmark (Ramstad, 2009). This may imply that it is a regional trend, perhaps connected to cultural choices rather than to environmental changes. It should also be noted here that a similar technological development is documented in Bohuslän in west Sweden (Kindgren, 1996), reflecting close relations between south Norwegian and Scandinavian groups throughout the Preboreal.

Taking other artifact categories into consideration, we see that flake adzes, core adzes, and unifacial cores tend to increase in frequency from the first to the second half of the period. This gives the impression of a well-functioning lifestyle that could be maintained despite changing environments. This was also the conclusion of a study based on environmental and archaeological data from north Norway (Blankholm, 2009; Hald and Blankholm, 2009).

Conclusion: the coast as a fruitful ecozone

The paleo-oceanographic review of the Early Holocene marine environment in Norway demonstrates interesting spatial and temporal trends:

1. The outer coast was the most fruitful ecozone; vertical mixing of different water qualities would occur in the transition zone between fjords and archipelago; phytoplankton blooms would occur in the wake of islands.
2. In northernmost Norway, arctic conditions with severe seasonal ice cover and a cold-tolerant fauna lingered throughout the Preboreal; the rest of the country experienced gradually warmer oceanic conditions with a subsequent immigration of a more temperate fauna.
3. A cold event, referred to as the PBO, influenced the climate at 9300–9200 BC by decreased temperatures, glacial readvance, and longer seasonal ice cover.
4. In the Mid-Preboreal, around 8800 BC, an environmental shift occurred. From being greatly influenced by ice and meltwater in the earliest phase, the oceanic conditions now became more likely present as the Norwegian Atlantic current stabilized along the coast and glaciers withdrew from the fjords.

The archaeological site distribution corresponds with the paleo-oceanographic data on many levels:

1. Concentrations of sites are found in ecozones and regions with good marine productivity.
2. Regions with different paleo-oceanographic characterizations display different location preferences.
3. The settlement pattern seems to change over time as the resource situation stabilizes.

The analysis thus implies that variations in the marine environment and resource situation have influenced the early marine foragers' approach to the Norwegian seascapes. The tool kit, on the other hand, seems to be less influenced by the environmental changes. The technological shift detected in southwest Norway (less tanged points and more lancet microliths) is not recognized in central Norway – a region with a similar paleo-environmental development – and cannot be related directly to a change in the resource situation. The fact that the same range of tools is found also on mountain sites supports this line of reasoning. Human adaptive strategies in Early Holocene are thus archaeologically visible through varying location patterns rather than changed tool technologies.

Several ecological and cultural factors must have been significant in order to sustain a lifestyle in a cold, fluctuating environment. First, the productive Norwegian coast provided a good base to uphold a hunter-gatherer lifestyle. Traditionally, coastal environments and marine resources have caught less attention than terrestrial societies in hunter-gatherer studies. Within the framework of ecological and optimal foraging theories, marine resources are low in the scales of preferred foods (Bailey and Parkington, 1988), and their initial exploitation has frequently been discussed in light of demographic stress or environmental changes (e.g. Binford, 2001; Glassow et al., 1988; Johnson, 2014; Osborn, 1977). During the last decade, however, there has been an increased focus on marine resources as attractive, and the role of coastlines in human migration is emphasized (e.g. Bailey, 2004; Bjerck, 2007, 2008, 2009; Dixon, 2001; Erlandson, 2001, 2010; Erlandson et al., 2007; Orquera and Piana, 2009b; Schmitt et al., 2006, 2009). High-latitude oceans are pointed out as one of the richest niches on the globe (Huston and Wolverton, 2009). The present study likewise depicts the Norwegian coast as a bountiful environment that could supply foragers with food and necessary materials around the year.

Another advantage is that marine resources can withstand higher cropping rates than many terrestrial mammals because of high annual net recruitment rates (Yesner, 1980). An economy based on marine resources would thus be better suited to withstand environmental fluctuations and hunting pressure. A focus on the coastal 'megapatch' (see Beaton, 1991) may thus have been the key to a successful adaptation to the Norwegian landscape.

However, an efficient exploitation of the marine resources required both proper knowledge and technological investment. The rocky and skerried seascape was very different from the continental plains from which the colonists originally had their roots. Only with a knowledge base customized toward a marine environment, the colonists would have been equipped to meet the conditions (Kelly, 2003). The Swedish west coast has been lifted forward as a potential region for the development of such knowledge. The marine resources along this productive coastal stretch may have been gradually incorporated in the subsistence base of continental hunter-gatherer groups at the close of the Late-glacial period (Kindgren, 1996; Schmitt, 1995). Bjerck (1995, 2007, 2008, 2009) argues that this area, located in the transition zone between the European plain and the Scandinavian archipelago, was essential in the development of an advanced marine technology, seaworthy boats in particular, which allowed for an efficient colonization and exploitation of the Norwegian coast. Although the marine foragers were now moving into pristine land, they found themselves in a familiar landscape with the same resources available. The present study underlines that the initial occupation of Norway was carried out by conscious movements toward certain habitats grounded in knowledge about marine productivity and animal behavior.

Finally, the lifestyle was maintained through a flexible mobility pattern. Mobility is one of the main behavioral strategies by which human hunter-gatherers adapt to the temporal and spatial distribution of resource in their environment (Binford, 1980; Kelly, 1995; Perrault and Bantingham, 2011). To deal with fluctuating environments and move according to changing resource situations must have been a well-incorporated part of the cultural tradition, based on many generations of experience. Within this social system, the climatic shifts that developed over time may even have been less significant than the year-to-year, or even seasonal, changes.

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References

Aaris-Sørensen K (2009) Diversity and dynamics of the mammalian fauna in Denmark throughout the last glacial–interglacial cycle, 115–0 kyr BP. *Fossils and Strata* 57: 1–60.

Aaris-Sørensen K and Petersen EB (1986) The Prejlerup aurochs – An archaeozoological discovery from boreal Denmark. In: Königsson LK (ed.) *Nordic Late Quaternary Biology and Ecology* (Striae, vol. 24). Uppsala: Societas Upsaliensis pro Geologia Quaternaria, pp. 111–117.

Amundsen HR (2010) *Faglig program for vassdrag. Historisk oversikt og kunnskapsstatus for vassdragsundersøkelser i Finnmark, Troms og Nordland*. Report. Oslo: NIKU. Available at: http://www.riksantikvaren.no/filestore/06-01985-34ManusFagligprogramvassdragnordNIKU2010.pdf353496.PDF.

Andersen BG (2000) *Istider i Norge*. Oslo: Universitetsforlaget.

Anundsen K (1996) The physical conditions for earliest settlement during the last deglaciation in Norway. *Acta Archaeologica Lundensia*, Series in 8(24): 207–217.

Årskog HB (2009) *Steinalderlokaliteter i tid og rom. en undersøkelse basert på Ormen Lange-registreringene på Nordvestlandet*. MA Thesis, University of Oslo.

Bailey G and Parkington J (1988) The archaeology of prehistoric coastlines: An introduction. In: Bailey G and Parkington J (eds) *The Archaeology of Prehistoric Coastlines*. Cambridge: Cambridge University Press, pp. 1–10.

Bailey GN (2004) World prehistory from the margins: The role of coastlines in human evolution. *Journal of Interdisciplinary Studies in History and Archaeology* 1(1): 39–50.

Bang-Andersen S (1996) The colonization of Southwest Norway. An ecological approach. *Acta Archaeologica Lundensia*, Series in 8(24): 219–234.

Bang-Andersen S (2003) Southwest Norway at the Pleistocene/Holocene transition: Landscape development, colonization, site types, settlement patterns. *Norwegian Archaeological Review* 36(1): 5–25.

Bang-Andersen S (2012) Colonizing contrasting landscapes. The pioneer coast settlement and inland utilization in southern Norway 10,000–9500 years before present. *Oxford Journal of Archaeology* 31(2): 103–120.

Barlindhaug S (1996) *Hvor skal vi bygge og hvor skal vi bo? En analyse av lokaliseringsfaktorer i tidlig steinalder i Troms*. MA Thesis, University of Tromsø.

Beaton JM (1991) Colonizing continents: Some problems from Australia and the Americas. In: Dillehay TD and Meltzer DJ (eds) *The First Americans: Search and Research*. Boca Raton, FL: CRC Press, pp. 209–230.

Bekkby T, Rinde E, Erikstad L et al. (2009) Spatial predictive distribution modelling of the kelp species *Laminaria hyperborea. ICES Journal of Marine Science* 66: 2106–2115.

Bergsvik KA (1991) *Ervervs- og bosetningsmønstre på kysten av Nordhordland i steinalder, belyst ved funn fra Fosnstraumen*. MA Thesis, University of Bergen.

Bergsvik KA (1995) Bosetningsmønstre på kysten av Nordhordland i steinalder. En geografisk analyse. *Arkeologiske skrifter* 8: 111–130.

Bergsvik KA (2001) Sedentary and mobile hunter-fishers in Stone Age western Norway. *Arctic Anthropology* 38(1): 2–26.

Berner KS, Koç N and Godtliebsen F (2010) High frequency climate variability of the Norwegian Atlantic Current during the early Holocene period and a possible connection to the Gleissberg cycle. *The Holocene* 20(2): 245–255.

Binford LR (1980) Willow smoke and dogs' tails: Hunter–gatherer settlement systems and archaeological site formation. *American Antiquity* 45: 4–20.

Binford LR (2001) *Constructing Frames of Reference. An Analytical Method for Archaeological Theory Building Using Ethnographic and Environmental Data Sets*. Oakland, CA: University of California Press.

Birks HH, Larsen E and Birks HJB (2005a) Did tree-Betula, Pinus and Picea survive the last glaciation along the west coast of Norway? A review of the evidence, in light of Kullman (2002). *Journal of Biogeography* 32: 1461–1471.

Birks HH, Kristensen DK, Dokken TM et al. (2005b) Exploratory comparisons of quantitative temperature estimates over the last deglaciation in Norway and the Norwegian Sea. *Geophysical Monograph Series* 158: 341–355.

Bjerck HB (1983) *Kronologisk og geografisk fordeling av mesolitiske element i Vest- og Midt-Norge*. Cand. Mag. Thesis, University of Bergen.

Bjerck HB (1986) The Fosna–Nøstvet Problem. A consideration of archaeological units and chronozones in the South Norwegian Mesolithic period. *Norwegian Archaeological Review* 2: 103–121.

Bjerck HB (1990) Mesolithic site types and settlement patterns at Vega, Northern Norway. *Acta Archaeologica* 60: 1–32.

Bjerck HB (1995) The North Sea Continent and the pioneer settlement of Norway. In: Fischer A (ed.) *Man and Sea in the Mesolithic*. Oxford: Oxbow Books, pp. 131–143.

Bjerck HB (2007) Mesolithic coastal settlements and shell middens in Norway. In: Milner N, Craig OE and Bailey GN (eds) *Shell Middens in Atlantic Europe*. Oxford: Oxbow Books, pp. 5–30.

Bjerck HB (2008) Norwegian Mesolithic Trends: A review. In: Bailey G and Spikins P (eds) *Mesolithic Europe*. Cambridge: Cambridge University Press, pp. 60–106.

Bjerck HB (2009) Colonizing seascapes: Comparative perspectives on the development of maritime relations in Scandinavia and Patagonia. *Arctic Anthropology* 46(1–2): 118–131.

Bjerck HB and Breivik HM (2012) Off shore pioneers: Scandinavian and Patagonian lifestyles compared in the Marine Ventures project. *Antiquity* 86. Available at: http://antiquity.ac.uk/projgall/bjerck333/ (accessed 9 July 2013).

Bjerck HB and Ringstad B (1985) *De kulturhistoriske undersøkelsene på Tjernagel, Sveio*. Report, Arkeologiske rapporter 9. Bergen: Historisk Museum, Universitetet i Bergen.

Bjerck HB and Zangrando AF (2013) Marine ventures: Comparative perspectives on the dynamics of early human approaches to the seascapes of Tierra del Fuego and Norway. *Journal of Island and Coastal Archaeology* 8(1): 79–90.

Bjerck HB, Åstveit LI, Gundersen J et al. (2008) *NTNU Vitenskapsmuseets arkeologiske undersøkelser Ormen Lange Nyhamna*. Trondheim: Tapir Academic Press.

Björck S, Rundgren M, Ingólfsson Ó et al. (1997) The Preboreal oscillation around the Nordic Seas: Terrestrial and lacustrine responses. *Journal of Quaternary Science* 12(6): 455–465.

Blankholm HP (2008) *Målsnes 1. An Early Post-Glacial Coastal Site in Northern Norway*. Oxford: Oxbow Books.

Blankholm HP (2009) Pionertiden i det nordlige Fennoskandia. Motivasjon, innflytting, tilpasning. *Oral presentation on the conference: Pionerer i nytt landskap*, NTNU University Museum, Trondheim, 19–20 March.

Blankholm HP (in preparation) Fifty-nine sites in six days: Macro-level predictive modelling of early Stone Age pioneer settlement locations in Varanger, Norway.

Bolton JJ and Lüning K (1982) Optimal growth and maximal survival temperatures of Atlantic Laminaria species (Phaeophyta) in culture. *Marine Biology* 66: 89–94.

Breivik HM and Ellingsen EG (2014) 'A discovery of quite exceptional proportions': Controversies in the wake of Anders Nummedal's discoveries from Norway's first inhabitants. *Bulletin of the History of Archaeology* 24(9): 1–13.

Bronk Ramsey C (2009) Bayesian analysis of radiocarbon dates. *Radiocarbon* 51(1): 337–360.

Crombé P, Sergant J, Robinson E et al. (2011) Hunter-gatherer responses to environmental change during the Pleistocene–Holocene transition in the southern North Sea basin: Final Palaeolithic–Final Mesolithic land use in northwest Belgium. *Journal of Anthropological Archaeology* 30: 454–471.

Dixon EJ (2001) Human colonization of the Americas: Timing, technology and process. Beringian Paleoenvironments: Festschrift in honor of David M. Hopkins. *Quaternary Science Reviews* 20(1–3): 277–299.

Dugstad SA (2007) *Hushold og teknologi. En studie av tidlig preboreale lokaliteter i Rogaland*. MA Thesis, University of Bergen.

Erlandson JM (2001) The archaeology of aquatic adaptations: Paradigms for a new millennium. *Journal of Archaeological Research* 9(4): 287–350.

Erlandson JM (2010) Food for thought: The role of coastlines and aquatic resources in human evolution. In: Cunnane SC and Stewart KM (eds) *Human Brain Evolution: The Influence of Freshwater and Marine Food Resources*. Hoboken, NJ: John Wiley & Sons, Inc., pp. 125–136.

Erlandson JM, Graham MH, Bourque BJ et al. (2007) The Kelp Highway hypothesis: Marine ecology, the coastal migration theory, and the peopling of the Americas. *Journal of Island and Coastal Archaeology* 2: 161–174.

Faulkner TL and Hunt CO (2009) Holocene deposits from Neptune's Cave, Nordland, Norway: Environmental interpretation and relation to the deglacial and emergence history of the Velfjord–Tosenfjord area. *Boreas* 38: 691–704.

Finlayson B and Mithen S (1996) The microwear and morphology of microliths from Gleann Mor. In: Knecht H (ed.) *Projectile Technology*. New York: Plenum Press, pp. 107–130.

Fischer A (1996) At the border of human habitat. The Late Palaeolithic and Early Mesolithic in Scandinavia. In: Larsson L (ed.) *The Earliest Settlement of Scandinavia* (Acta Archaeologica Lundensia, Series in 8, no. 24). Stockholm: Almquist & Wiksell International, pp. 157–176.

Foosnæs K and Stenvik LS (2010) *Vassdragsundersøkelser i Midt-Norge. Historisk oversikt over arkeologiske registreringer og undersøkelser i vassdrag som har blitt utbygd eller vurdert for utbygging av vasskraft*. Trondheim: NTNU. Available at: http://www.riksantikvaren.no/filestore/06-01985-36Historiskoversikt-1354297.pdf

Forwick M and Vorren TO (2002) Deglaciation history and postglacial mass movements in Balsfjord, northern Norway. *Polar Research* 21(2): 259–266.

Fosså JH, Mortensen PB and Furevik DM (2002) The deep-water coral *Lophelia pertusa* in Norwegian waters: Distribution and fishery impacts. *Hydrobiologia* 471: 1–12.

Fuglestvedt I (1999) The Early Mesolithic site at Stunner, Southeast Norway: A discussion of Late Upper Palaeolithic/Early Mesolithic chronology and cultural relations in Scandinavia. In: Boaz J (ed.) *The Mesolithic of Central Scandinavia* (Universitetets oldsaksamlings skrifter, Ny rekke 22). Oslo: Universitetets oldsaksamlings, pp. 189–202.

Fuglestvedt I (2009) *Phenomenology and the Pioneer Settlement on the Western Scandinavian Peninsula*. Lindome: Bricoleur Press.

Glassow MA, Wilcoxon LR and Erlandson J (1988) Cultural and environmental change during the Early Period of Santa Barbara Channel prehistory. In: Bailey G and Parkington J (eds) *The Archaeology of Prehistoric Coastlines*. Cambridge: Cambridge University Press, pp. 64–77.

Granados TJ (2011) *Skiveøkser frå Vest-Noreg: Ein analyse av teknikk, klassifikasjon og distribusjon*. MA Thesis, University of Bergen.

Grønnow B, Gulløv HC, Jakobsen BH et al. (2011) At the edge: High Arctic walrus hunters during the 'Little Ice Age'. *Antiquity* 85: 960–977.

Gyllencreutz R (2005) Late Glacial and Holocene paleoceanography in the Skagerrak from high-resolution grain size records. *Palaeogeography, Palaeoclimatology, Palaeoecology* 222(3–4): 344–369.

Hafsten U (1983) Shore-level changes in South Norway during the last 13,000 years traced by biostratigraphical methods and radiocarbon datings. *Norsk geografisk tidsskrift* 37: 63–79.

Hald M and Blankholm HP (2009) Kunsten å overleve klimaendringer (feature article). *Nordlys*, 18 September 2009, p. 5.

Hasegawa D, Lewis MR and Gangopadhyay A (2009) How islands cause phytoplankton to bloom in their wakes. *Geophysical Research Letters* 36(20): L20605.

Hauglid M (1993) *Mellom Fosna og Komsa. En preboreal «avslagsredskapskultur» i Salten, Nordland*. Cand. Mag. Thesis, University of Tromsø.

Helskog K (1978) Late Holocene sea-level changes seen from prehistoric settlements. *Norsk Geologisk Tidsskrift* 32: 111–119.

Hodgetts LM (1999) *Animal bones and human society in the late younger stone age of arctic Norway* (Durham E-Theses Online). Doctoral Thesis, Durham University. Available at: http://etheses.dur.ac.uk/4491/.

Hufthammer AK (2001) The Weichselian (*c*. 115,000–10,000 B.P.) vertebrate fauna of Norway. *Bollettino Della Societa Paleontologica Italiana* 40(2): 201–208.

Hufthammer AK (2006) The vertebrate fauna of eastern Norway – From the Ice Age to the Middle Ages. *Kulturhistorisk Museum Skrifter* 4: 191–202.

Huston MA and Wolverton S (2009) The global distribution of net primary production: Resolving the paradox. *Ecological Monographs* 79(3): 343–377.

Indrelid S (1975) Problems in relation to the Early Mesolithic settlement of Southern Norway. *Norwegian Archaeological Review* 8(1): 1–18.

Indrelid S (1978) Mesolithic economy and settlement patterns in Norway. In: Mellars PA (ed.) *The Early Postglacial Settlement of Northern Europe*. London: Duckworth, pp. 147–176.

Indrelid S (2009) *Arkeologiske undersøkelser i vassdrag: faglig program for Sør-Norge*. Oslo: Riksantikvaren.

Jaksland L (ed.) (2012a) *E18 Brunlanesprosjektet Bind II. Undersøkte lokaliteter fra tidligmesolitikum* (Varia 80). Oslo: 07 Gruppen AS.

Jaksland L (ed.) (2012b) *E18 Brunlanesprosjektet Bind III. Undersøkte lokaliteter fra tidligmesolitikum og senere* (Varia 81). Oslo: 07 Gruppen AS.

Johnson AL (2014) Exploring adaptive variation among hunter-gatherers with Binford's frames of reference. *Journal of Archaeological Research* 22(1): 1–42.

Jonsson L (1995) Vertebrate fauna during the Mesolithic on the Swedish west coast. In: Fischer A (ed.) *Man and Sea in the Mesolithic*. Oxford: Oxbow Books, pp. 147–160.

Kelly RL (1995) *The Foraging Spectrum: Diversity in Hunter–Gatherer Lifeways*. Washington, DC: Smithsonian Institution Press.

Kelly RL (2003) Colonization of new land by hunter-gatherers. Expectations and implications based on ethnographic data. In: Rockman M and Steele J (eds) *Colonization of Unfamiliar Landscapes: The Archaeology of Adaptation*. London: Routledge, pp. 44–58.

Kindgren H (1996) Reindeer or seals? Some Late Palaeolithic sites in central Bohuslän. In: Larsson L (ed.) *The Earliest Settlement of Scandinavia* (Acta Archaeologica Lundensia, Series in 8, no. 24). Stockholm: Almquist & Wiksell International, pp. 191–205.

Kleppe JI (2010) Klubbvik 1. Tidlig bosetning og klima i Varangerfjorden i lys av nye undersøkelser nær Mortensnes, Nesseby kommune. *Varanger årbok* 2010: 71–78.

Kleppe JI (2014) Desolate landscapes or shifting landscapes? Late glacial/early post-glacial settlements of northernmost Norway in the light of new data from eastern Finnmark. In: Riede F and Tallavaara M (eds) *Lateglacial and Postglacial Pioneers in Northern Europe* (BAR International Series 2599). Oxford: Archaeopress, pp. 121–146.

Koç N, Jansen E and Haflidason H (1993) Paleoceanographic reconstructions of surface ocean conditions in the Greenland, Iceland and Norwegian seas through the last 14 kyr based on diatoms. *Quaternary Science Reviews* 12(2): 115–140.

Kutschera M (1999) Vestnorsk tidligmesolitikum i et nordvesteuropeisk perspektiv. In: Fuglestvedt I, Gansum T and Opedal A (eds) *Et hus med mange rom. Vennebok til Bjørn Myhre på 60-årsdagen. Ams-Rapport, Bind A*. Stavanger: Arkeologisk museum, Universitetet i Stavanger, pp. 43–52.

Larsson L and Sjöström A (2011) Early Mesolithic flint-tipped arrows from Sweden. *Antiquity* 85(330), Project gallery, December 2011. Available at: http://antiquity.ac.uk/projgall/larsson330/ (accessed 9 July 2013).

Lindblom I (1984) *Former for økologisk tilpasning i Mesolitikum*. Østfold: Universitetets Oldsaksamling Årbok (1982/1983), pp. 43–86.

López Correa M, Montagna P, Joseph N et al. (2012) Preboreal onset of cold-water coral growth beyond the Arctic Circle revealed by coupled radiocarbon and U-series dating and neodymium isotopes. *Quaternary Science Reviews* 34: 24–43.

Lorentsen S-H, Sjøtun K and Grémillet D (2010) Multi-trophic consequences of kelp harvest. *Biological Conservation* 143(9): 2054–2062.

Mangerud J, Goehring BM, Lohne ØS et al. (2013) Collapse of marine-based outlet glaciers from the Scandinavian Ice Sheet. *Quaternary Science Reviews* 67: 8–16.

Møller JJ (1986) Holocene transgression maximum about 6000 years BP at Ramså, Vesterålen, North Norway. *Norsk Geografisk Tidsskrift* [Norwegian Journal of Geography] 40(2): 77–84.

Moore SE and Huntington HP (2008) Arctic marine mammals and climate change: Impacts and resilience. *Ecological Applications* 18(2): S157–S165.

Moss ML and Erlandson JM (2013) Waterfowl and lunate crescents in Western North America: The archaeology of the Pacific flyway. *Journal of World Prehistory* 26(3): 173–211.

Nærøy AJ (1999) The Norwegian Stone Age in south Scandinavian and northwest European context. *AmS Rapport* 12B: 463–488.

Nummedal AJ (1933) Kan det finnes flintplasser på kyststrekningen mellom Kristiansand og Ålesund? *Naturen* 1933: 227–244.

Nuñez M and Gustavsson K (1995) Prehistoric man and ice conditions in the Åland archipelago 7000–1500 years ago. In: Robertsson AM, Hicks S, Åkerlund A et al. (eds) *Landscapes and Life: Studies in Honour of Urve Miller*. Strasbourg: Conseil de l'Europe, pp. 233–244.

Nygaard SE (1987) Socio-economic developments along the southwestern coast of Norway between 10,000 and 4,000 BC. In: Rowly-Conwy P, Zvelebil M and Blankholm HP (eds) *Mesolithic Northwest Europe: Recent Trends*. Sheffield: University of Sheffield, pp. 147–154.

Nygaard SE (1990) Mesolithic Western Norway. In: Vermeersch PM and Van Peer P (eds) *Contributions to the Mesolithic in Europe*. Leuven: Leuven University Press, pp. 227–237.

Nyland AJ (2012) Lokaliseringsanalyse av tidligmesolittiske pionerboplasser. In: Glørstad H and Kvalø F (eds) *HAVVIND – Paleogeografi og arkeologi – Archaeological Report*. Oslo: Norwegian Maritime Museum, Museum of Cultural History, pp. 70–96.

Odner K (1964) Erhverv og bosetning i Komsakulturen. *Viking* 28: 117–128.

Olsen AB (1992) *Kotedalen – en boplass gjennom 5000 år, bind 1. Fangstbosetning og tidlig jordbruk i Vestnorsk steinalder: Nye funn og nye perspektiver*. Bergen: University of Bergen.

Olsen B (1994) *Bosetning og samfunn i Finnmarks forhistorie*. Oslo: Universitetsforlaget.

Orquera LA and Piana EL (2009a) Sea nomads of the Beagle Channel in southernmost South America: Over six thousand years of coastal adaptation and stability. *Journal of Island and Coastal Archaeology* 4: 61–81.

Orquera LA and Piana EL (2009b) The southern top of the world. The first peopling of Patagonia and Tierra del Fuego, and the cultural endurance of the Fuegian sea-nomads. *Arctic Anthropology* 46(1–2): 103–117.

Osborn AJ (1977) Strandloopers, mermaids and other fairy tales: Ecological determinants of marine resource utilization – The

Peruvian case. In: Binford LR (ed.) *For Theory Building in Archaeology: Essays on Faunal Remains, Aquatic Resources, Spatial Analysis, and Systemic Modeling*. New York: Academic Press, pp. 157–205.

Perrault C and Bantingham PJ (2011) Mobility-driven cultural transmission along the forager–collector continuum. *Journal of Anthropological Archaeology* 30(1): 62–68.

Pettersen K (1999) The Mesolithic in Southern Trøndelag. In: Boaz J (ed.) *The Mesolithic of Central Scandinavia* (Universitetets oldsaksamlings skrifter, Ny rekke 22). Oslo: Universitetets oldsaksamlings, pp. 153–166.

Ramstad M (2009) Oppsummering: Materiell kultur og bosetning på Melkøya gjennom forhistorisk tid. In: Hesjedal A, Ramstad M and Niemi AR (eds) *Undersøkelsene på Melkøya: Melkøyaprosjektet – kulturhistoriske registreringer og utgravninger 2001 og 2002*. Tromsø: Tromsø University Museum, pp. 379–436.

Riede F (2009a) Climate and demography in early prehistory: Using calibrated 14C dates as population proxies. *Human Biology* 81(2–3): 309–337.

Riede F (2009b) The loss and re-introduction of bow-and-arrow technology: A case study from the Southern Scandinavian Late Palaeolithic. *Lithic Technology* 34: 27–45.

Riede F (2010) Hamburgian weapon delivery technology: A quantitative comparative approach. *Before Farming* 2010: Article 1.

Rise L, Bøe R, Sveian H et al. (2006) The deglaciation history of Trondheimsfjorden and Trondheimsleia, Central Norway. *Norsk Geologisk Tidsskrift* 86: 419–438.

Risebrobakken B, Moros M, Ivanova EV et al. (2010) Climate and oceanographic variability in the SW Barents Sea during the Holocene. *The Holocene* 20(4): 609–621.

Sandmo AK (1986) *Råstoff og redskap – mer enn teknisk hjelpemiddel: Om symbolfunksjoner som et aspekt ved materiell kultur; skisse av etableringsforløpet i en nordeuropeisk kystsone 10.000–9.000 BP*. Cand. Mag. Thesis, University of Tromsø.

Schmitt L (1994) The Hensbacka: A subsistence strategy of continental hunter-gatherers, or an adaptation at the Pleistocene–Holocene boundary? *Oxford Journal of Archaeology* 13(3): 245–263.

Schmitt L (1995) The West Swedish Hensbacka: A maritime adaptation and a seasonal expression of the North-Central European Ahrensburg? In: Fischer A (ed.) *Man and Sea in the Mesolithic*. Oxford: Oxbow Books, pp. 161–170.

Schmitt L (1999) Comparative points and relative thoughts: The relationship between the Ahrensburgian and Hensbacka assemblages. *Oxford Journal of Archaeology* 18(4): 327–337.

Schmitt L (in press) Early colonization, glacial melt water, and island mass effect in the archipelago of western Sweden: A case history. *Oxford Journal of Archaeology*.

Schmitt L, Larsson S, Burdukiewicz J et al. (2009) Chronological insights, cultural change, and resource exploitation on the west coast of Sweden during the Late Palaeolithic/Early Mesolithic transition. *Oxford Journal of Archaeology* 28(1): 1–27.

Schmitt L, Larsson S, Schrum C et al. (2006) Why they came: The colonization of the coast of Western Sweden and its environmental context at the end of the last glaciation. *Oxford Journal of Archaeology* 25(1): 1–28.

Schmölcke U (2008) Holocene environmental changes and the seal (Phocidae) fauna of the Baltic Sea: Coming, going and staying. *Mammal Review* 38(4): 231–246.

Schmölcke U (2013) A short history of seals and seal populations in northern European waters. In: Grimm O and Schmölcke U (eds) *Hunting in Northern Europe Until* AD *1500. Old Traditions and Regional Developments, Continental Sources and Continental Influences*. Neumünster: Wachholtz, pp. 91–99.

Sjøtun K, Fredriksen S, Rueness J et al. (1995) Ecological studies of the kelp Laminaria hyperborea (Gunnerus) Foslie in Norway. In: Skjoldal HR, Hopkins C, Erikstad KE et al. (eds) *Ecology of Fjords and Coastal Waters*. Amsterdam: Elsevier Science, pp. 525–536.

Sommer R and Benecke N (2003) Post-Glacial history of the European seal fauna on the basis of sub-fossil records. *Beitraege zur Archaeozoologie und Praehistorischen Anthropologie* 6: 16–28.

Statham PJ, Skidmore M and Tranter M (2008) Inputs of glacially derived dissolved and colloidal iron to the coastal ocean and implications for primary productivity. *Global Biogeochemical Cycles* 22: GB3013.

Steneck R, Graham MH, Bourque BJ et al. (2002) Kelp forest ecosystems: Biodiversity, stability, resilience and future. *Environmental Conservation* 29(4): 436–459.

Stirling I (1997) The importance of polynyas, ice edges, and leads to marine mammals and birds. *Journal of Marine Systems* 10(1–4): 9–21.

Svendsen F (2007) *Lokaliteter og landskap i tidlig mesolittisk tid. En geografisk analyse fra Nordvest-Norge*. MA Thesis, University of Trondheim.

Svendsen JI and Mangerud J (1987) Late Weichselian and Holocene sea-level history for a cross-section of Western Norway. *Journal of Quaternary Science* 2: 113–132.

Tallavaara M and Seppä H (2011) Did the mid-Holocene environmental changes cause the boom and bust of hunter-gatherer population size in eastern Fennoscandia? *The Holocene* 22(2): 215–225.

Tivoli AM and Zangrando AFJ (2011) Subsistence variations and landscape use among maritime hunter-gatherers. A zooarchaeological analysis from the Beagle Channel (Tierra del Fuego, Argentina). *Journal of Archaeological Science* 38: 1148–1156.

Tunnicliffe V, O'Connell JM and McQuoid MR (2001) A Holocene record of marine fish remains from the Northeastern Pacific. *Marine Geology* 174: 197–210.

Uehara K, Scourse JD, Horsburgh KJ et al. (2006) Tidal evolution of the northwest European shelf seas from the Last Glacial Maximum to the present. *Journal of Geophysical Research* 111: C09025.

Valen V, Mangerud J, Larsen E et al. (1996) Sedimentology and stratigraphy in the cave Hamnsundhelleren, western Norway. *Journal of Quaternary Science* 11(3): 18–201.

Waraas TA (2001) *Vestlandet i tidleg Preboreal tid. Fosna, Ahrensburg eller vestnorsk tidligmesolitikum?* MA Thesis, University of Bergen.

Westli C (2009) *Å slå seg ned: En regional analyse av tidligmesolittisk lokalisering med utgangspunkt i Østfold*. MA Thesis, University of Oslo.

Woodman P (1993) The Komsa culture. A re-examination of its position in the Stone Age of Finnmark. *Acta Archaeologica* 63: 57–76.

Yesner DR (1980) Maritime hunter-gatherers: Ecology and prehistory. *Current Anthropology* 21(6): 727–750.

Yesner DR (2004) Prehistoric maritime adaptations of the Subarctic and Subantarctic zones: The Aleutian/Fuegian connection reconsidered. *Arctic Anthropology* 41(2): 76–97.