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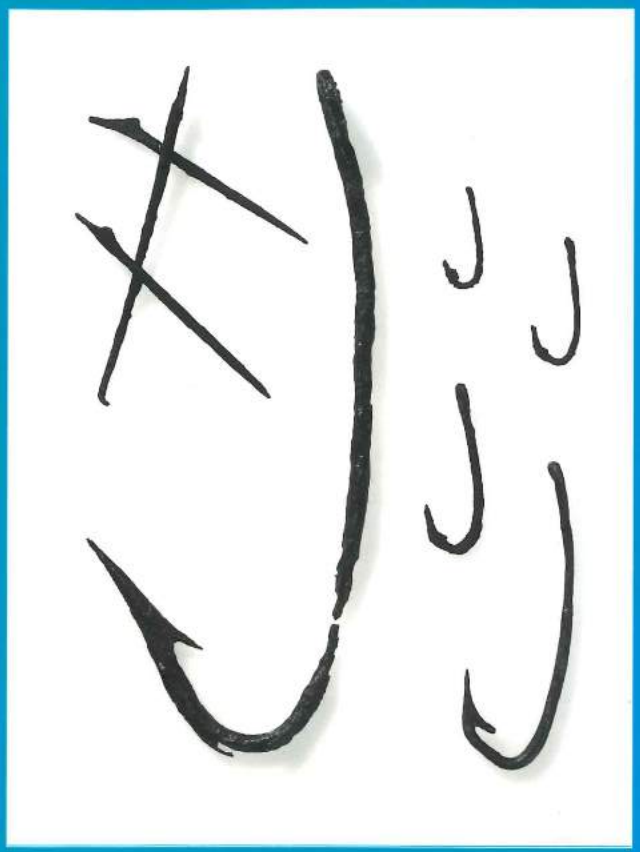

MEDIEVAL FISHING TACKLE FROM BERGEN AND BORGUND

FAGBOKFORLAGET

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give a scholarly presentation of the archaeological finds from the excavations at Bryggen and other medieval and early modern sites in Bergen.

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MEDIEVAL FISHING TACKLE FROM BERGEN AND BORGUND

Editor:
Ingvild Øye

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FOREWORD

Although fishing has long traditions as the backbone of coastal economy in Norway, the archaeological remains have so far been only sparsely studied. In this volume of the Main Series of the Bryggen Papers we present results of two studies of artefacts associated with fishing, one from excavations in the medieval town of Bergen and the other from the smaller medieval urban community Borgund in Sunnmøre further north. Both studies throw light on essential questions concerning the marine food supply in early urban communities, from the earliest phases throughout the medieval period. The studies of fishing equipment and the techniques, character and extent of fishing also throw new light on the character of these urban societies as such. The significance of fishing is demonstrated by the extensive range and variety of the finds.

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The editorial board responsible for the publication of the series consists of Senior Executive Officer Ann Christensson, Directorate for Cultural Heritage, District Office West, Bergen, Professor Else Mundal, Centre of Medieval Studies, University of Bergen, Professor Ingvild Øye, Department of Archaeology, University of Bergen, and Director Anne Ågotnes, Bryggens Museum.

Bergen, January 2004

Ingvild Øye
Chief Editor

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Ole Mikal Olsen:

MEDIEVAL FISHING TACKLE FROM BERGEN

Ole Mikal Olsen

1 INTRODUCTION

This paper discusses the fishing tackle found at several archaeological excavations of medieval Bergen. The majority of the material is present in the period from the early twelfth century until first half of the sixteenth century. Fishing as a subsistence strategy in Norway can, however, be dated back to early Stone Age.

Both fishing and fishing equipment from prehistory and the medieval period in Bergen and Norway in general have so far been only sparsely documented and analysed. This may seem strange, since the rich supply of fish has been a primary prerequisite for an existence along the Norwegian coast. Here we find one of the richest resources of fish in the world. Through several thousand years, fish has been a main food resource for the coastal settlements and an important supplement to agricultural products. Gradually fishing grew in importance, into commercial fisheries and large-scale exports. This development is clearly visible in the medieval period when fish turned into an important economical and commercial factor, and no longer just a source for self-supply.

Fishermen took up no space in the town since their work was performed in the fjords and sea outside Bergen. Consequently, they are not mentioned in the Urban Code issued by King Magnus Håkonsson in 1276. They are nevertheless present indirectly through the regulation, which claimed that salmon, other fresh fish and oyster should be sold from boat or pier.

The main aim is to investigate what kind of fishing tackle and fish-catching methods the medieval fishermen of Bergen used. Another aim is to present the character and importance of this fishery through the medieval period. The fishing equipment from Bergen may also represent an archaeological contribution to the discussion of the relation between town and countryside during the medieval period. Furthermore, it may add some new aspects in defining the character of a medieval town. Finally, the fishing equipment may contribute to the description of the medieval town's socio-economic division and the character of its residents. The aim is to shed new light on aspects of medieval fisheries since the research material is large and located in a town. The results may also have relevance for medieval fishing in general.

Fish was an important food resource during the Middle Ages due to the severe food restrictions imposed by the Church through the numerous days of fasting. The days of fasting could last from one third to as much as half of the days of the year (Christoffersen and Porsmose 1996: 168). The longest period of fast lasted 40 days (Sundays not included) before Easter. During the fast meat was forbidden food, but fish was allowed. In areas where fish was easily available it was, of course, used frequently outside the fast too. In these areas fish may very well have been among the most important food resources. The people in the Middle Ages have been great consumers of fish, probably using a larger variety of species than today.

The archaeological material, which this analysis is based upon, is limited to the fishing tackle found during the archaeological excavations at Bryggen (1955–1979) and several minor excavations within the area of the medieval town of Bergen. The great variety and number this material represents, creates a unique opportunity to present the medieval fishermen's technology for Bergen, and hopefully for the medieval period in general.

Of the total 555 artefacts, 488 (c 88%) are found in datable contexts. The material from the excavations at Bryggen constitute 401 artefacts (72%), 389 of which are datable. Fig 1 shows

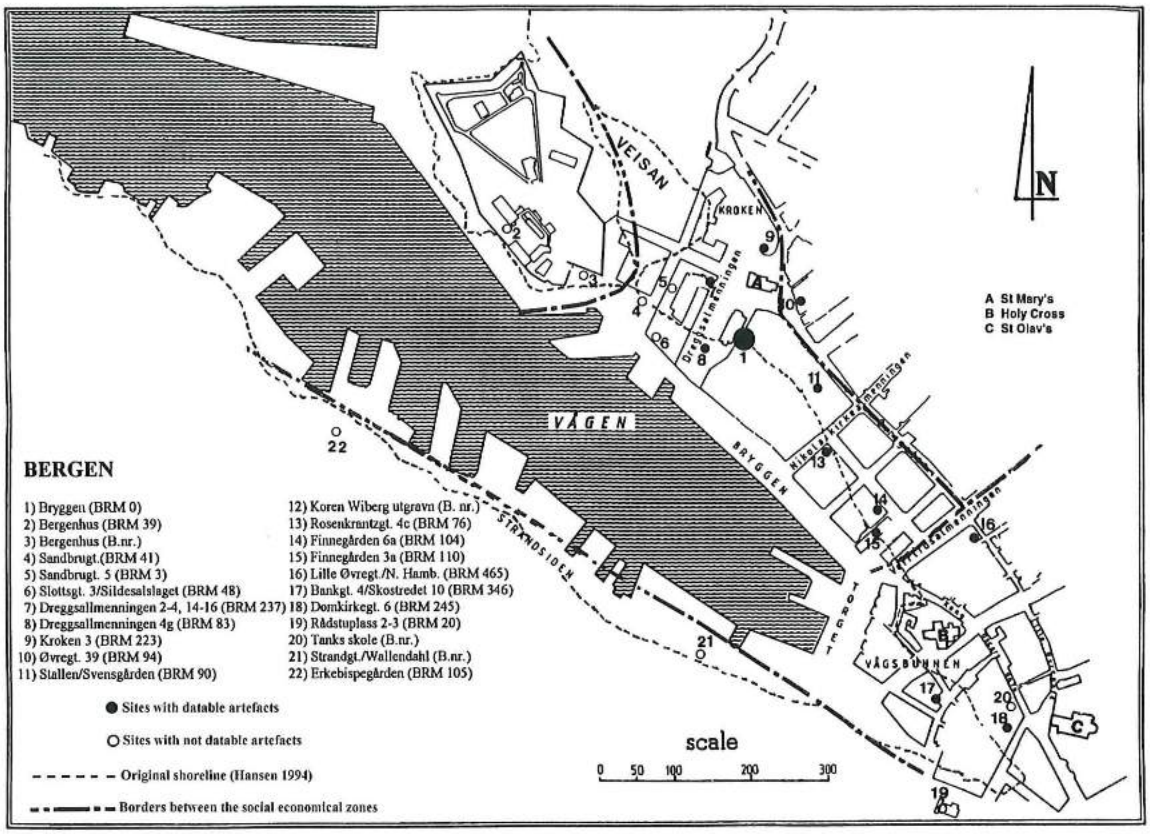


Fig 1 The localisation of excavations in Bergen where fishing tackle has been found. The map is based on Andrzej Golembnik's map drawn for NIKU (The Norwegian Institute for Cultural Research)

the area of Bergen where excavations containing fishing equipment have been located.

The material consists of artefacts made of wood, bone, horn (antler?), stone and metal, in which a majority can be linked to various hand line fishing techniques and fishing nets. In addition, there are examples of artefacts used for spearing fish and fish traps. Some of the artefacts may also have been used for making fishing equipment. Weights, which may have been used as net weights, will also be considered. There are, however, certain problems in identifying these artefacts, and they are therefore not included among the objects with more certain identification.

Most of the artefacts are found in good dateable contexts. Consequently, it is possible to illuminate a development throughout the period.

Approaches

The fishing equipment represents a variety of fishing techniques. What sort of techniques has been used through the medieval period? How was the fishing equipment used, and where was it used? These are the main problems which will be discussed in this paper.

Throughout the medieval period the urban community of Bergen probably depended on food supply from the hinterland. The town's relations to its hinterlands were, however, not static and probably went through some major changes during these 500 years. The archaeologist Axel Christophersen has given a sketch of Trondheim's development from its earliest foundation to the more fully developed town in the late medieval period. In the earliest phase, characterised as a *rural phase*, the exchange of goods and produc-

tion of crafts were based on a simple exchange of food and presige goods, and depended upon a high degree of self-sufficiency. Gradually, in the *transitional phase*, new relations of power and social groups evolved to new forms of exploitation and changes in the conditions of production. This development encouraged the development of a separate urban economy, where production and commerce were based partially on an exploitation of the resources of the countryside, partially on imports. Finally, in the *phase of urban establishment* the town was totally dependent on trade and interchange (Christophersen 1997: 15). This model may also be relevant when analysing the fishing tackle from Bergen. By using this model of urban development, the fishing equipment may contribute in shedding light on changing relations between Bergen and its countryside in a dynamic perspective. In the ongoing discussion of whether an "urban identity or mentality" existed as early as in the Middle Ages, the fishing tackle may, perhaps, add some new aspects and insights.

The medieval town of Bergen may in its earliest phase have been the resort of a population that carried out a variety of activities, including production of food and other goods. Trade grew in importance during the twelfth and thirteenth centuries. At the beginning of the fourteenth century foreign merchants were a common element in the Bryggen tenements during the winter. Here, on the eastern side of the Vågen bay they rented lodgings as "winter-sitters". The Germans outnumbered the other nationalities (Helle 1982: 276). Gradually, the Bryggen area experienced a more permanent change in population. By the establishment of the German *Kontor* c 1360 a new ethnic group came to dominate the area permanently, and the area became the German merchant's scene. When a population group consisting partly of producers, probably with strong connections to the countryside around Bergen, gets totally replaced by a group of foreign merchants and consumers, one should expect that it would be reflected in the finds material and in the frequency of fishing equipment found in the Bryggen area. Can the establishment of German merchants in this area from the middle of the fourteenth century be traced through this material? The distribution of fishing tackle through the medieval period might shed light on the question.

In which parts and areas of the town did the fishermen produce, maintain and store their equipment? Identification of such activity areas could help defining the town's structure and the social economical spatial division of Bergen, as it is described in the Urban Code of 1276. This law mentions a number of different crafts and occupations, and points out the areas and sites where these should be performed. It is, however, uncertain whether fishing can be identified as a professional occupation or if such activities only served as a subsidiary source of income. According to the historians Arnved Nedkvitne and Per Norseng, fishing as a profession in medieval Oslo was of less importance since import of fish covered most of the fish consumption in the town (Nedkvitne and Norseng 1991: p 156). The importance of the town fisheries in Bergen through the medieval period will be a central issue in this analysis.

Danish research has shown that a person living in a medieval town had to use about 70 per cent of his income to achieve enough foodstuffs to maintain a reasonable level of nutrition (Jacobsen 1994: p 227). In Bergen, as in other Norwegian towns, primary activities such as agriculture, horticulture and animal husbandry were not uncommon (Øye 1998). Could also the fishing tackle be interpreted as part of a subsistence strategy based on primary activities in a town context, an issue which leads to the question: How "urban" was Bergen really in the Middle Ages?

State of research

Very little archaeological research has been carried out on fishing equipment, both in Norway and abroad. The earliest study on the Norwegian material was done by Olaf Nordgaard (1908). Although he was not trained as an archaeologist he visited all the archaeological museums in Norway, Oslo, Stavanger, Bergen, Trondheim and Tromsø, in order to identify and interpret fishing equipment. His work is important as a reference. Nordgaard started his studies before the great technological changes in the fishing

industry took place, and the fisheries in Norway were still on a low technological level, with equipment unchanged for centuries. Nordgaard was thus able to study fishing tackle, some of prehistoric type, in actual use. By help of the living tradition of fisheries he was able to interpret the use of prehistoric fishing tackle. His interpretations of function will be discussed in this paper, and his work will be used comparatively to evaluate whether the Bergen material represents a local tradition, or is representative for a more common Norwegian coastal culture.

Not until the middle of the twentieth century was fishing equipment investigated by an archaeologist. Together with other tools from the Viking period (800–1050 AD), fishing tackle was briefly discussed by Jan Petersen in his analysis of tools and equipment, *Vikingetidens redskaper* (Petersen 1951). Petersen's identification of fishing gear is, however, mainly based on Nordgaard's work, and medieval fishing equipment is consequently not discussed. Still, Petersen's work will be important in a discussion of the technological changes from the Iron Age to the Middle Ages.

Fishing equipment found in an urban context has been touched upon in Øivind Lunde's doctoral thesis on medieval Trondheim (1977). Since his main topic is the urban building topography the fishing equipment has not been given any thorough examination. Lunde does, however, discuss criteria for separating line sinkers from warp weights; these are criteria, which partly will be used in this paper. Lunde also shows how the spatial distribution of the equipment can be used to identify areas of fishing-related activities in Trondheim – an approach which is relevant for Bergen as well.

Lunde's thesis is based on archaeological excavations before 1970. Later excavations have revealed more fishing tackle, although without any "in depth" research on the subject. Sæbjørg W. Nordeide observes from the extensive excavation on Folkebibliotekstomta in Trondheim that the fishing equipment found, seems to follow the same distribution pattern as the finds in general. She suggests that this pattern reflects the demographic development, and that the town fisheries were basically for townspeople's own consumption and not dependent on a market (Christophersen and Nordeide 1994).

A study of fishing tackle from Trøndelag has recently been performed in a master thesis in archaeology at the University of Trondheim (NTNU) (Elvestad 1998). Elvestad's material from North- and South Trøndelag will be used comparatively. The aims and methods do, however, differ from my own study.

In Oslo Erik Schia claims that the town fisheries primarily were for the townspeople's own private consumption, but also some market sale may have taken place (Schia 1991: p 187). Schia's interpretations of the fisheries are, however, mainly based on fish bones without regarding the fishing tackle. Neither have Nedkvitne and Norseng (1991) studied the material remains with their historical approach to the topic.

The most thorough archaeological discussion of fishing equipment in an urban context so far is presented in the archaeological report on Søndre Bydel in Tønsberg (Olsen 1992). In his report Terje Olsen identifies and interprets various fishing equipment, thus making it possible to compare fishing tackle from coastal areas in Eastern Norway with the Western Norwegian tradition. Olsen's interpretations of function will be considered in the corresponding discussion of this paper. Based on a rich amount of fish remains Olsen discusses the types of fish, which seem to have been consumed in Tønsberg.

During the excavations at Bryggen in Bergen fish remains were not systematically collected or documented. Thus it is not possible to perform a comparable quantitative analysis of this area. Anne Karin Hufthammer's qualitative analysis of fish bones from a limited area will, however, be discussed when considering the types of fish that were caught by the Bergen fishermen (Hufthammer 1987).

A variety of fishing equipment was found during the excavations at Borgund, Sunnmøre (cf Sørheim this volume). The material has been examined by Helge Sørheim and serves as an important comparative material from the northern part of Western Norway (Sørheim 1997).

Two master theses in archaeology from the 1990s discuss fishing equipment from both the Iron Age and the medieval period (Helberg 1993; Johannessen 1998). Bjørn Hebba Helberg discusses the development of the fisheries of North-

ern Norway with special focus on the period 1000–1400 AD. His classification and interpretation of function will also be discussed in this paper. According to Helberg, Northern Norway experienced a change in the fishing technology from 1000 to 1200 AD. Live Johannessen based her analysis on material found on three small, remote islands on the western coast of Hordaland: Risøy and Sandøy in the municipality of Sund, and Hjartøy in the municipality of Øygarden. These islands can be seen as a part of the countryside of Bergen in the medieval period. In her analysis Johannessen tries to identify possible technological changes, and she also discusses the methods of catching different types of fish. Her material will also be compared with the Bergen material.

Fishing tackle found at the deserted medieval farm Høybøen, situated at Vindenes in the municipality of Fjell west of Bergen, is analysed by Kjersti Randers (1981). Both the material and area are highly relevant for my own study.

Lastly, in her master thesis in archaeology, Birgit Tansøy discusses the fishing equipment found in the Viking town of Kaupang, in the county of Vestfold (Tansøy 2001). This material will be used comparatively in order to evaluate whether the equipment from Bergen may have its roots in the Iron Age.

Other relevant research outside Norway is even more sparse. Studies from Great Britain form an exception, and archaeologists have studied both fishing technology and fishery-related subjects. These studies have resulted in the conference paper *Medieval Fish, Fisheries and Fishponds in England.* J.M. Steane and M. Foreman here point out a problem common to most countries; although it is well known that fish was a natural resource fully exploited in the medieval period, the fisheries and the catching methods are poorly documented. The archaeological information does not supplement the lack of written sources satisfactorily. There are several reasons for this: Much of the equipment was made from organic material, and has not survived except in waterlogged deposits. Foreman and Steane thus emphasise that only in Norway, Poland and Russia has the full range of medieval fishing tackle been found (Foreman and Steane 1988). In their paper, Foreman and Steane present fishing equipment from England and some other countries. This information is valuable both for the identification process and the comparative analysis of my own study.

In addition to the archaeological approach to fishing equipment, several historians have studied medieval fisheries. Arnved Nedkvitne (1988) discusses the fisheries and fishing equipment in Western and Northern Norway from the period 1500–1730 AD, focusing on the coastal economy. In both these areas a special *crofter-fisherman economy* developed, an economy probably unique on a global scale. Hardly anywhere else were the marine resources as rich and so close to the farms, enabling the farmers to fish both for their private consumption and for sale. Only a small boat and cheap fishing equipment was required (Nedkvitne 1988: 73). An interesting question to be addressed is whether elements of this economy can be traced in medieval Bergen. Did people moving to Bergen from the countryside continue to practise their rural way of living?

Odd Vollan, another historian who has studied the history of Norwegian fisheries, claims that both archaeological material and folk traditions prove that the same main principles in fishing were used before, during and after the medieval period (*KLNM* IV:326). He classifies the material according to fishing methods. This approach to classification will also be used in this study.

In the first chapter of the town history of Bergen the historian Knut Helle (1982) briefly mentions some of the fishing equipment found during the extensive Bryggen excavations. He points out that the townspeople not only made a living from urban activities as trade and crafts, but to a certain extent also gathered, caught and produced food in an urban context (Helle 1982: p 443). I will delve deeper into this problem later on.

This brief and introductory survey of studies related to fishing equipment from the Iron Age and the Middle Ages, does not claim to be exhaustive. The aim has been to point out and emphasise studies relevant for my own research. Several minor articles will also be referred to and discussed in the succeeding analysis.

2 METHODOLOGICAL APPROACHES

The methods in this study should be adapted according to the problems posed, and the perspectives chosen. Different levels of approach towards the artefacts are therefore required, from a close up view to a wider spatial macro perspective. Consequently, it is necessary to clarify some important premises concerning identification, dating and representativity.

Identification

Medieval fishing tackle represents a heterogeneous group of artefacts where the variation in objects still is only partly clarified when it comes to function. A number of fishing-related artefacts is still not identified, representing a methodological problem. The identification process in this study is based on five main principles: (1) the artefact's find context, (2) comparative archaeological material, (3) ethnological material whose identity has already been established (Øye 1988: 21), (4) a morphological or shape evaluation has also been applied. The latter principle is based on a subjective evaluation of the various shapes of artefacts in order to ascertain whether these have been constructed intentionally for fishing or fishing-related activities. (5) The quality of the morphological principle again depends on a fifth principle – the researcher's experience and knowledge. Personally, I have gained practical knowledge from my early adolescence onwards, and through oral information. I grew up in a fishing society, on an island situated on the west coast of Hordaland county, not far from Bergen. Here, my ancestors have been living as fishermen for centuries.

Still, the five principles of identification give no guarantee that all the archaeologically recorded fishing equipment will be identified. In the medieval period the fishermen may have used fishing tackle unknown to fishermen in later periods. Unknown shapes and fragmented material may therefore have been overlooked. Wood, for instance, has traditionally been used for fish traps and fish pots, hand frames, etc. As many of the wooden artefacts from Bergen are very fractured, unfamiliar shapes may be difficult to identify.

An uncritical application of former archaeologists's identification of what they may have thought have been fishing equipment gives no guarantee. The use of such material may easily lead to arguing in a circle. Identified material should therefore be scrutinised, and also be compared to ethnological material. Although written sources and ethno-archaeological studies may help us interpret archaeological finds, great care must be taken when these are being used on archaeological material (Jones and Wheeler 1989: 175). Ian Hodder stresses that using analogies from anthropological studies to interpret archaeological findings can only be justified if a number of similarities in the cultures compared is present. "... the use of analogy does not lead to the final solution, a definite interpretation. Assumptions, logic and conclusions may be wrong." (Hodder 1982: 211).

As for the material dealt with in this paper, a series of similarities between ethnological and archaeological material may be identified, justifying the use of analogy. The relevant ethnological material has been used along the coast of the North Sea and the Norwegian ocean, basically the Norwegian coast, in the period 1700–1900. The fishing technology seems to have changed very little from the medieval period until the twentieth century in this area (Fig 2). A strong *continuity* in the material culture of the fisheries seems to have been the rule. The traditions linked to fishing seem to share the same continuity as the boat-building traditions of Norway, which was a craft strongly interrelated with fishing. The use of retrospective studies is, therefore, highly relevant. In addition of being an aid in the identification process, the ethnological material will serve as an important source material in the interpretation of function.

Dating

With the exception of a few secular and ecclesiastical buildings in stone, the medieval building pattern of Bergen was completely dominated by wooden houses. Several extensive fires ravaged the town through the centuries. Due to

the densely built areas the fire spread easily. The most extensive fires were important events referred to in contemporary written sources. Several of the fire layers found during excavations in Bergen have been linked to these historically documented fires (Helle 1998).

During the extensive Bryggen excavations an absolute dating based on a direct connection with historical and archaeological documented fires was the common method of dating. Based on these two source categories, together with archaeologically datable objects, like runic inscriptions, that could support the absolute dating of the fire layers, the excavation director Asbjørn E. Herteig established a chronology based on fire layers for the whole excavated Bryggen area. The interval between two fire layers was defined as one period (Fig 3). There were, however, some difficulties in relating a fire layer that must have occurred before 1248, but that was not mentioned in written sources. Herteig suggested three alternatives: (1) The fire occurred before the earliest historically documented fire in 1170/71. (2) The fire struck between 1170/71 and 1198 (VI). (3) The fire took place between 1198–1248 (fire layers VI and V) (Herteig 1985: 27). Herteig chose the first alternative as the most likely alternative. This has later also turned

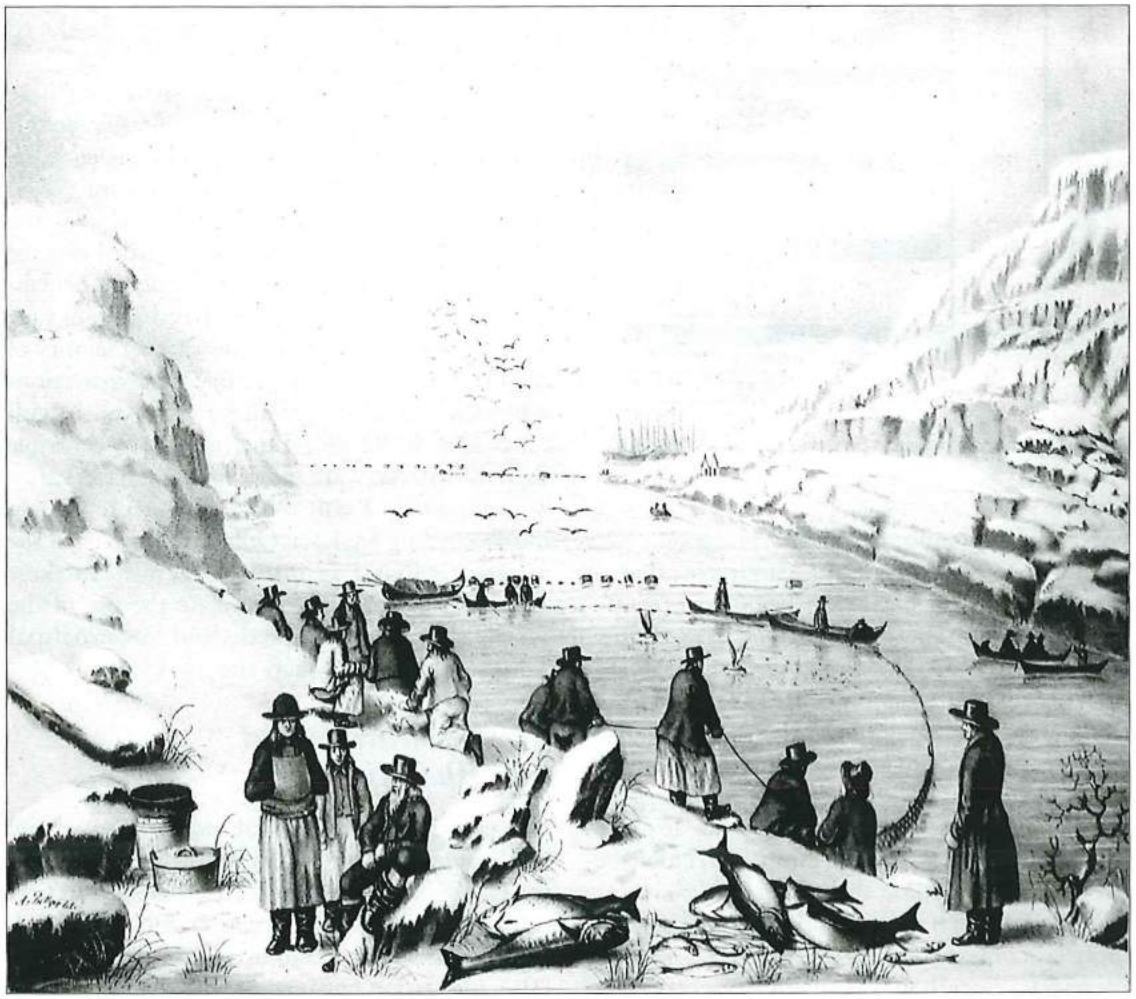


Fig 2 Example of ethnological material. Herring fisheries outside Bergen, c 1840 (print by Losting)

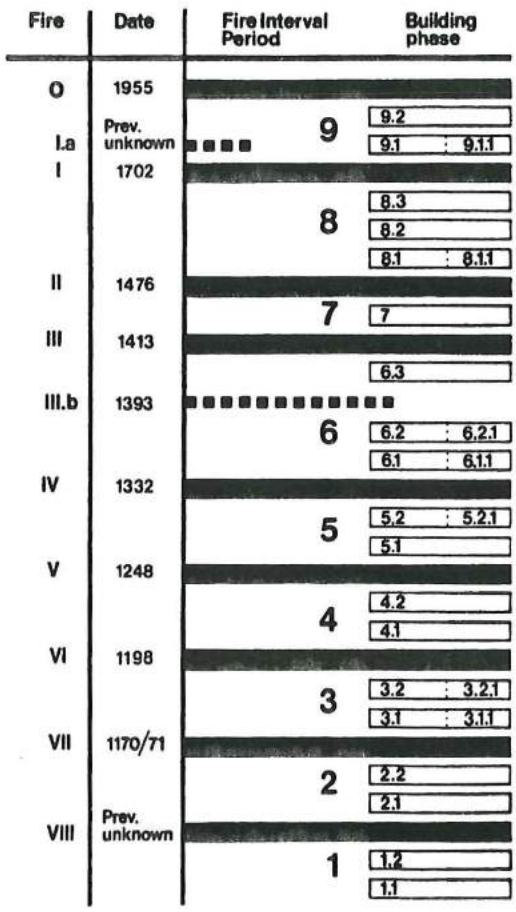


Fig 3 Chronology of fire layers, alternative I (Herteig 1990: 12)

out to be the most likely interpretation. New dendrochronological dating indicates that it struck around 1120 (Hansen 1998).

From 1980 onwards The Bergen excavation office, from 1994 reorganised as Norwegian Institute for Cultural Heritage Research (NIKU's-regional office, Western Norway), has applied another methodological approach for dating, although fire layers also serve as an important source. The locality's stratigraphical sequence is first established through the interrelation between layers. Based on these layers the phases are identified and dated through: (1) *dating artefacts* (pottery, coins, combs, shoes, glass). (2) *scientific methods* (radiocarbon, thermoluminescence, dendrochronology), and (3) *written sources.* When possible, a combination of these three methods is applied. The sites in Bergen excavated after 1980 have primarily been dated based on the archaeological material. The scientific and historical methods are used secondarily. Contrary to the Bryggen *periods,* NIKU use the term *phases.* The separation between the phases is not necessarily a fire, but quite often it is. The phases are classified as *phase of construction*, *phase of use* and *phase of deconstruction.* This makes it easier to evaluate context of the artefacts than in the Bryggen excavations. At the excavations after 1980 a historical unknown and also debated fire c 1230 has been taken into consideration (cf Dunlop and Hansen, 1998). Both the Bryggen excavations and excavations after 1980 use the fire layers as important dividers between phases. When referring to the post-1980 excavations the chronology developed will be applied in this paper.

Although different methods of dating have been applied at the excavations relevant for this study there are no major problems in correlating them. Most of the fishing equipment (72%) is found at the Bryggen site. Therefore, the chronology established at this site will form the basis of interpretation of the frequency of fishing equipment during the medieval period. One should, however, bear in mind that a majority of the fishing tackle from the Bryggen excavations was found in fill-layers and areas levelled with fill masses (c 97 %). This implies in principle that the artefacts are older than the layers they were found in. I will return to this problem in the succeeding analysis. Only a minor part of the material is found *in situ* in buildings. In these cases it will be possible to relate the use of the artefacts to a period or phase, and to a structural context, a building, quay, etc.

Source criticism and representativity

All archaeological material, which is analysed and interpreted, represents only a selection of the material first deposited. The theoretical consequences of this situation will affect archaeological interpretation in two major ways: (1) A correlation between the material which has survived and the non-material culture may be unreliable since important elements in the mate-

rial culture may not have survived, or have not been found by the archaeologists. (2) We may lack the elements in the artefacts that make us capable of interpreting their original function, or of categorising them (Dark 1995: 47). A conscious attitude toward these problems may help us acknowledge the limitations in our data, and the great care with which interpretations based on material of fragmented quality should be executed (*ibid*). According to Stig Welinder, the archaeological criticism of sources is based on a consciousness on how this selection of information works out, and how it affects interpretations and descriptions. This selection is ruled by the living, prehistoric society itself, later destructive mechanical and chemical forces, and lastly the individual archaeologist (Welinder 1986:13). Due to the problems connected to selection and the focus of this paper, a total reconstruction of the situation around the fisheries in medieval Bergen is far beyond reach. The aim is to hypothetically reconstruct certain elements, and to indicate tendencies in a development.

Several cultural and natural processes have affected the selection of fishing equipment found in Bergen.

Cultural processes

Here I define cultural processes as human behaviour and actions in past and present, which have influenced the amount and type of fishing tackle rediscovered. It is, of course, impossible to present the totality of relevant cultural processes involved. I will only elucidate a few important factors that have affected the selection of the material.

Methods of excavation

During the Bryggen excavations the site was not dug from top to bottom all over. Some parts of the site were removed by machine, without closer examination, down to fire level V (1248), while the rest of the site was dug stratigraphically from top to bottom (Fig 4).

This excavation practice has clearly affected both the spatial representativity as well as the frequency of finds through the periods. These are problems I will return to in chapter 6.

At Bryggen the finds context is mainly described as to how it is related to fires (over- and underrelations), constructions and other layers, within 8 x 8 meter grids. The artefacts were not plotted in a system of coordinates within these grids. This situation limits the level of accuracy in the spatial analysis. The solution I have chosen is to keep the spatial analysis on a macro level, interpreting the artefacts in a wide spatial context including the whole medieval town area. This is also more suitable for my approach and the problems posed.

Waste disposal in Bergen during the medieval period

As previously mentioned, a majority of the fishing equipment was found in fill-layers. The methods of disposing waste material in the Bryggen area changed during the Middle Ages. Until about 1400, rubbish and waste seem to have been thrown close to where people lived and worked. After 1400, waste material was dealt with in more organised forms, and transported away from the area (Økland 1998). As a consequence of this practise, artefacts found before 1400 give stronger and more valid evidence of direct usage on the spot, and are representative when it comes to interpretation of the spatial distribution and the frequency of findings in time. Consequently, there is more uncertainty linked to the archaeological material dated to after 1400. But even before 1400 fill masses were deposited in the area, which was partly covered by the Bryggen excavations. During the entire medieval period large amounts of material were dumped into the harbour. As a consequence, the Bryggen area expanded out in the harbour basin (Herteig 1985: pp 69). Such a practise will necessarily also affect the spatial distribution of artefacts. These problems will be further discussed in chapter 5.

The loss of fishing tackle

Fishing equipment are artefacts easily lost when in use. Fishing nets may be destroyed if a storm occurs, or they can be stolen. Line sinkers and

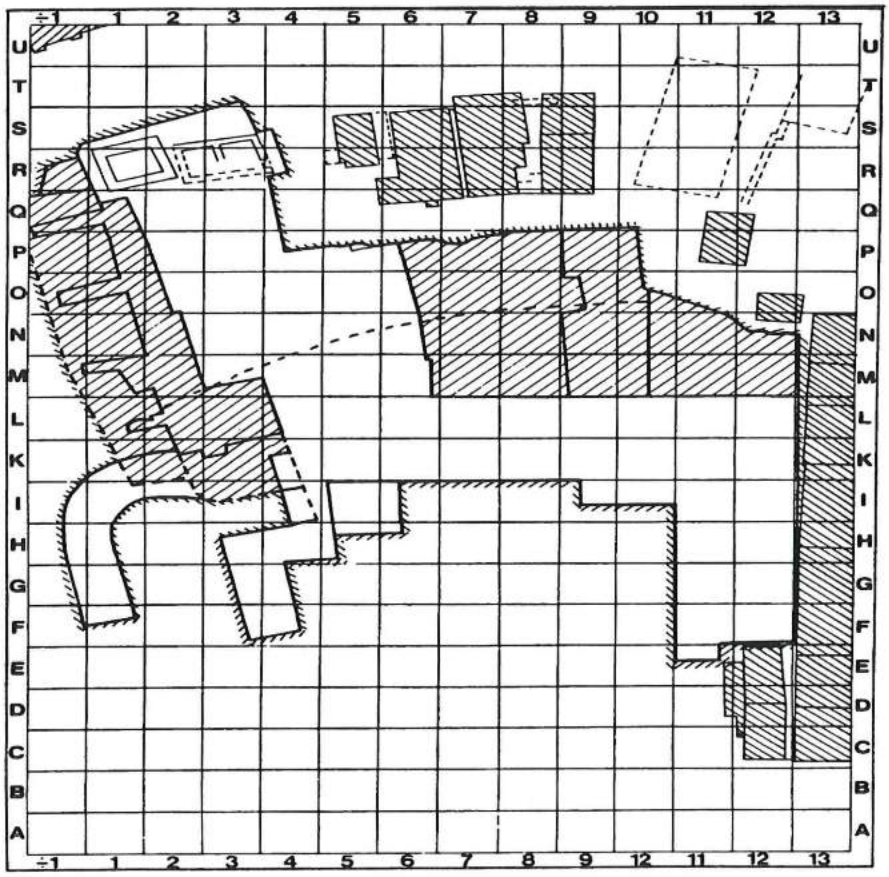


Fig 4 The map shows the extensive Bryggen excavations divided into 8 x 8 meter grids. The ground where the upper layers were dug by machine down to fire layer V is hatched. The rest of the area was dug stratigraphically from upper layer down to fire VII (Øye 1988)

fishing hooks can get stuck on the bottom or be lost during fishing. Consequently, a far greater number of fishing tackle must have been in use during the medieval period than suggested by the recovered archaeological material – a problem, which will be further discussed in chapter 6.

The fishing equipment found archaeologically does not necessarily represent the ideal or preferred equipment (Helberg 1993: 88). The fisherman must have struggled to achieve the best functional shape of his equipment, based on the tradition he was a part of and his technological skills. The most suitable gear would necessarily be most frequently used. Consequently, it was a greater risk of loosing or damaging such equipment (Sørheim 1997: 19). What is recorded on land are leftovers, equipment no longer found usable, or tackle which also could have a function on land (weights used as warp weights, or vice versa).

Natural processes

The fishing equipment dealt with in this paper has been exposed to chemical and mechanical forces in varying degree. Generally, the preservation conditions for organic material are good in waterlogged cultural layers where the oxygen level is low. This preservation situation was present at the extensive Bryggen excavations. The preservation conditions were particularly favourable for the artefacts lying deep in the waterlogged fill masses, but even higher up the conditions were fairly good. On the other hand the situation was far worse for organic material deposited on dry land. In periods 1 and 2 (before 1170/71) most of the settlement on the eastern side of Vågen (cf Fig 1) was located on dry land on the shore (Herteig 1985: 69). This situation may cause problems regarding representativity for the two earliest periods at Bryggen. The preservation conditions for metal are far better in dry environments, while hydrochloric acid may develop in fill masses soaked by salt-water and the decomposition of iron starts.

3 FISHING TACKLE – ANALYSIS OF THE ARTEFACTS

The purpose of this analysis is to identify the fishing equipment and classify the different categories in order to evaluate the variety and complexity, which will form the basis for a further investigation into the artefacts. By means of a systematic evaluation of forms and function a tool for interpretation of function and technological changes in time can be established.

Classification

Traditionally, fishing equipment has been regarded as artefacts with small variations in shape. The reason may be that effective fishing methods were developed at an early period and thereafter continued with very little typological change for hundreds if not thousands of years (Foreman and Steane 1988: 88). The consequence of this attitude has been a general lack of interest in studying this material.

One of the aims of this study is to elucidate questions regarding how function and shape are interconnected. A classification of the material will be an important tool of research in this process. In the classification the material will be organised in groups. The purpose is to: (1) organise data into manageable units, (2) describe types, and identify the individual attributes of the artefacts in order to group them by common attributes into relative few types, and (3) identify relationship between types. Most classification of objects tends to be on the basis of form – *formal classification* – or function – *functional classification* – (Dark 1995: pp 78).

Depending on the level of the analysis, both formal and functional classification has been applied in this study. On the highest level I have used Vollan's system of classifying fishing equipment, where he separates the equipment into four main categories: (1) *fishing with hooks,* (2) *fishing with nets,* (3) *fish traps,* and (4) *fishing by piercing* (*KLNM IV*: 326).

On the next level a functional classification within these four categories is done in order to separate the different functional groups. For example: under fishing with hooks there are hooks, fishing lines, sinkers and line runners.

On the lowest level I have used formal classification for each of the functional groups. The shape of the object within each of these functional groups provides the basis of a further division into types. Such a formal classification has enabled me to compare shapes and types from other medieval contexts both at home and abroad. It will also help to clarify the changes in shapes and types in time, and finally serve as a tool for the interpretation of function.

Fishing with hooks

Fishing with hooks is a generic term for a group of objects used in line fishing. Fishing with hooks requires a hook, a line and a line-sinker, and at the opposite end the line is connected to a rod, hand frame, etc. Although fishing with hooks most often is done vertically in the sea, one may also use the troll line technique. A troll line consists of one or several hooks, line sinker and is towed after the boat, forcing the hook to move upwards in the sea. The line runner was fastened to the gunwale and protected both the line and gunwale when fishing. The line runner must have been an important part of the medieval fishing equipment since the line was made of organic material and therefore far more exposed to wear and tear than the modern synthetic line. In addition to these objects, bobbins will be included.

The fishhook

The basic shape of fishhooks (ON *ongull*, m) seems to have changed very little over a period of thousands of years. A definition of a fishhook, which may capture the span in time, could be: an object that is bent or carved to a bend. One end is pointed while the opposite end has a grip for attaching a line.

Medieval fishhooks were made of metal, bronze or, more common, iron. The transition from hooks made from bone and wood to hooks made of metal resulted in a freer shape. The iron hooks were often made bigger than bronze

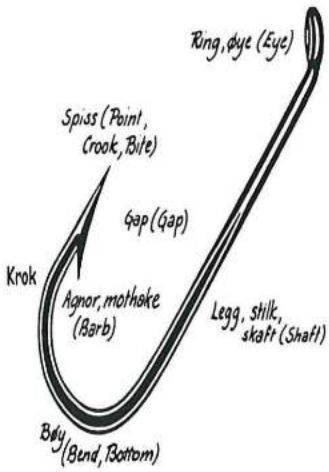


Fig 5 The parts of a fishhook (Hurum 1976: 9)

hooks, but had to be treated with copper plating or tinning if they were to resist corrosion. They had to be neither too soft to avoid straightening out by pulling nor too hard to prevent breaking under strain (Foreman and Steane 1988: 90).

The hook consists of five parts (Hurum 1977) (Fig 5): *the point* (1), which can stand straight up or be bent outwards. The latter has an *open* shape, while if the point is bent inwards it has a *closed* shape (Fig 6).

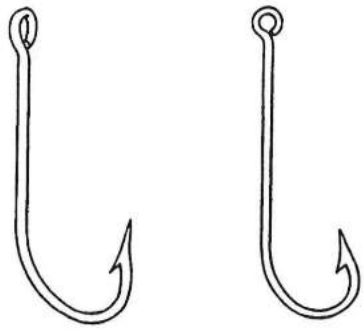


Fig 6 Fishhooks with open and closed shape

The barb (2), may be placed immediately under the point or possibly at the rear. Further the hook is rounded at the bend (3) and straightens out again at the shank (4). The shank may be straight, curved or angled (Fig 7) while the point may be straight or twisted[1] (Fig 8). The shank ends up in the part attached to the line. It is

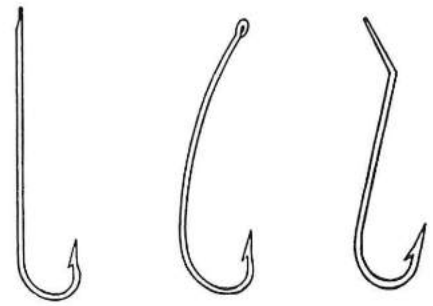


Fig 7 Fishhooks with straight, curved and angled shank

Fig 8 Curved, straight and reversed fishhook

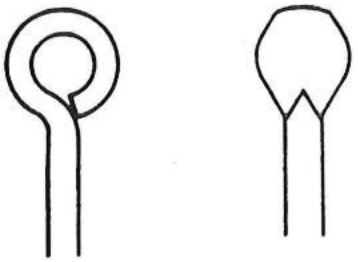


Fig 9 Eye and plate hold, two common ways of preparing the hook in order to fasten it to the line

common to roll the shank up in an eye or flatten it to a plate (5) (Fig 9).

The purpose of the hook is to ensure that the fish is unable to spit it out with the bait after biting or swallowing it. It penetrates into its mouth when the bait is taken or the line is pulled, so that the fish is caught. A good hook needs to have a needle-sharp point for effective penetration, correct shape for holding the catch, perfect hardening to avoid breaking, and high rust resistance (von Brandt 1984: p 73).

[1] A twisted fishhook may be curved or reversed. On a curved fishhook the twist is to the left when held with the bend up and the point towards the right. A reversed fishhook has a twist to the right.

In addition to the information the shape of the different parts of the fishhook may give, the proportion is important. *Primary* elements of proportion, as the length and thickness of the shank, will therefore be evaluated together with *secondary* or *actual* elements of proportion, which is one primary element in relation to another, as the distance between the point and the shank (the gap).

Fig 10. Medieval fishhooks from Bergen (nos 245/2412, 40299, 245/661, 65575)

Fishhooks from Bergen

Altogether 46 objects have been identified as fishhooks. Some were found during the Bryggen excavations, the rest at four smaller excavations in Bergen. When listed, the excavations will be mentioned according to their location along a north-south axis in the town. The Bryggen excavations are always mentioned first since they represent the largest site. This principle of listing will be followed throughout the study.

Most of the fishhooks are damaged or fractured, but 12 are almost intact. The fishhooks vary in size and shape (Fig 10). Some are finished while others are semi-products. All 46 are made of iron, although fishhooks made from bronze were also used in Norway in the Middle Ages (Hurum 1976: 30).

Classification

In his study of medieval fisheries in Northern Norway, the archaeologist Bjørn Hebba Helberg developed a formal classification for fishhooks found in an archaeological context. Helberg stressed the following criteria based on a strictly functional approach (Helberg 1993: 102):

- curved or straight shank
- closed or open hook
- twisted point or not
- the way the fishhook is prepared to be fastened to a line, eye or plate.

TYPE	A	B	C	D	E	UNCERTAIN TYPE
NUMBER	5	2	7	1	1	13

Fig 11 Fishhook types from Bergen

These criteria may also be applied for a non-functional classification of fishhooks. A fishhook shape may also reflect local traditions or variations and development through time. I will use Helberg's criteria as they cover the most important elements of shape that a fishhook consists of. Using the same criteria will also simplify a comparison with the Northern Norwegian material. The following types of fishhooks have been identified in the Bergen material[2] (Fig 11):

Type A: Fishhooks with straight shank, open hook, straight point and eye hold (as Helberg's type IA).

Type B: Fishhooks with straight shank, closed hook, straight point and eye hold.

Type C: Fishhooks with curved shank, open hook, straight point and eye hold (as Helberg's type IVA).

Type D: Fishhooks with curved shank, open hook, straight point and plate hold (as Helberg's type IVB).

Type E: Fishhooks with curved shank, open hook, straight point and angled plate hold towards the hook side.

Since many of the fishhooks lack one or several elements of shape, only 16 hooks have been identified according to the type description (Fig 11).

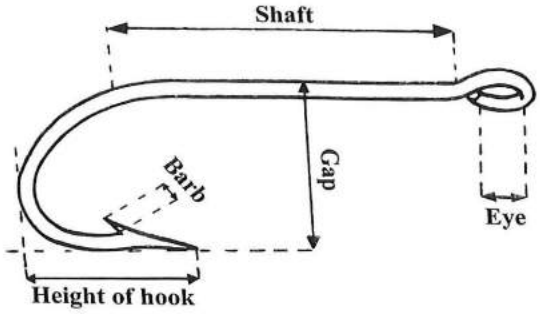


Fig 12 System for measuring the fishhooks

summary of fish catching methods worldwide, stresses the importance of the proportion of the gap as a way of distinguishing between fish (von Brandt 1984: 73). When troll fishing after pelagic species, such as salmon, saithe and pollack, the size of the gap is particularly important. The hook is towed after the boat forcing the hook to move almost horizontally in the sea. The fish will attack the hook from behind as if it was chasing another fish and the gap discriminates even more (Olsen 1984: 172). Also when fishing vertically in the sea one may provoke similar attacks by sending the hook quickly down or pulling quickly upwards.

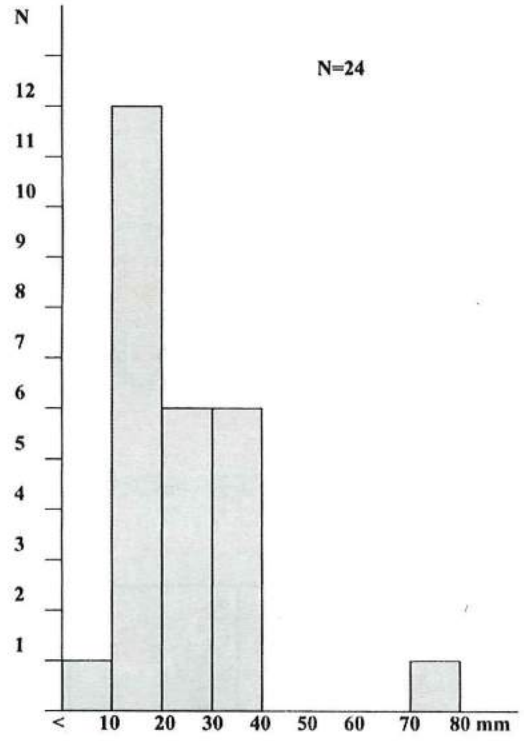


Fig 13 The distribution of gap sizes on fishhooks from Bergen

The gap

The gap, or the distance between point and shank, is an important element of proportion that may indicate what kind of fishing the hook has been used for (Fig 12). Andres von Brandt, who has given an important and extensive

The gap thus works in a selective way. A wide gap will first and foremost catch larger fish, while smaller fish will have difficulties biting over. Wide gap hooks can more easily penetrate through layers of smaller fish down to the larger underneath. A fishhook with a narrow gap is

[2] Only fishhooks with enough shape elements preserved to be identified as a type is discussed.

Width in mm	A	B	C	D	E	Number
<10		1				1
10.01-20	4	1	4			9
20.01-30			1		1	2
30.01-40	1		1	1		3
40.01-50						
50.01-60						
60.01-70						
70.01-80			1			1
Total	5	2	7	1	1	16

Table 1 Distribution of gap sizes according to types

adapted to smaller fish, although there are lots of examples that narrow gap hooks have caught fish of considerable size. Consequently, the gap size should not be interpreted too rigidly as far as function is concerned.

A gap size between 10–20 mm seems to dominate in the Bergen material (Fig 13). This gap size is also the most common in the more extensive material from Northern Norway. In Bergen types A and C represent most fishhooks within this gap size (Table 1). It is, of course, difficult to compare the two geographical finds groups since the number are so unequal, but the material from Northern Norway clearly indicates that this was the most favoured gap size in this part of the country. A gap size of 10–20 mm gives a flexible fishhook, capable of catching both larger and smaller fish, and it is likely that this size also was common in Western Norway in the medieval period.

Hook height

The hook height is measured from the point end, down to where the bend starts (Fig 12). When moving the fishhook gently in the sea the fish may attack it horizontally. When using this technique the height of the hook part will discriminate between fish sizes and types. Fig 14 shows that hook heights between 10–20 mm dominate the material. A low hook-height is best suited for fish with a hard mouth, like haddock (Hurum 1976: 81).

Comparative material

The extensive material from Northern Norway makes a good basis for comparison. There are few fishhooks found elsewhere, with the exception of Borgund, and a few in Tønsberg. We have seen that three of Helberg's fishhook types were found in the Bergen material, types A, C, and D. There were totally 14 hooks of these types in the North Norwegian material. Types A and C are also known from the Viking period and Early Modern period in Northern Norway. Since three of the types from Northern Norway also were found in the more sparse material from Bergen, one should expect that most of the types from Northern Norway would be present in medieval Bergen. In the Bergen material a clear disproportion in quantity exists between fishhooks

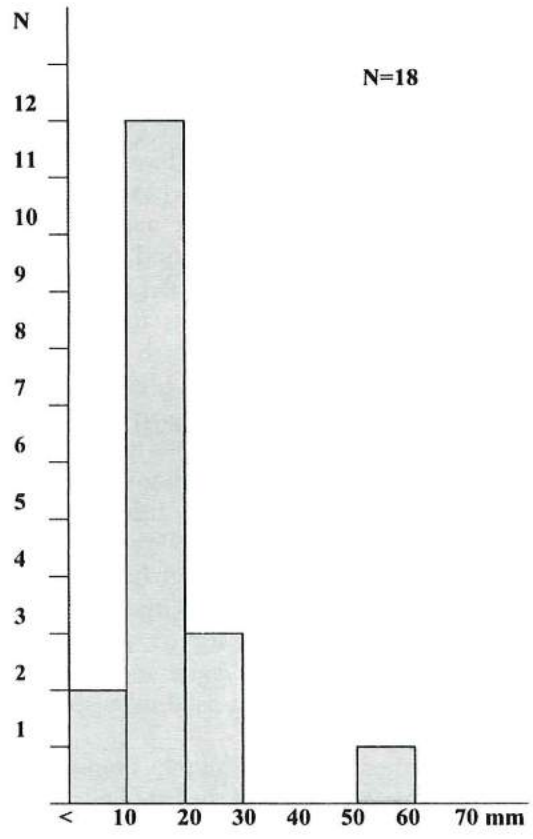


Fig 14 Distribution of fishhook heights in mm

and line sinkers found, probably due to the poor preservation conditions for metal. The rich variety and quantity in line sinkers may, however, imply that a greater range of fishhook types has actually been in use than the types identified. Still, it is not possible to draw conclusions from negative findings. The culture of fishing equipment may also have been richer and more varied in Northern Norway. In Borgund, Sørheim has identified 19 fishhooks (Sørheim 1997b: 20), of the same types as types A, C and E from Bergen (cf Sørheim, this volume). Type A has also been identified in Kaupang dated to the Viking period (Tansøy 2001: 49).

Based on the material from Bergen and Borgund, there is a slight tendency towards the use of fishhooks with curved shank and eye hold in Western Norway, while hooks with straight shank and plate hold have been favoured in Northern Norway. Whether these variations are due to regional traditions or have functional causes is uncertain.

Summing up the fishhook material

All in all, five types of fishhooks have been identified in the Bergen material, and three of these types were also present in the material from Northern Norway. The types found at Borgund material equalled types from Bergen. Unfortunately, the Bergen material is too small to recognise tendencies, but it is worth mentioning that only one fishhook of type D, which totally dominates in the North-Norwegian material, is found in Bergen. Apparently the fishermen in Western Norway preferred fishhooks with eye hold, while in Northern Norway fishhooks with plate hold dominate. In Bergen 94% of the fishhooks have eye hold while in Northern Norway only 6%. The fishhooks from Borgund were all made with an eye hold. A curved shank seems to have been favoured in Bergen and Borgund, while straight shanks were used extensively in Northern Norway.

Small to medium size fishhooks dominate in the Bergen material: 91% of the fishhooks have a gap of 10–40 mm, 83% had a height of the hook of 10–30 mm and 55% had a shank length from 20–40 mm. This average size gives a versatile fishhook, usable for a wide range of fishing techniques and species.

Line sinkers and possible line sinkers

A *line sinker* is made of stone or metal, for weighing down the line, bait and fishhook while fishing. When the term *sinker* is used without a prefix it is unclear whether the object has functioned as a net- or line sinker, or both.

Karin Gjøl Hagen characterises a "typical line sinker" as having two holes or more, and/or a groove for attaching the line. These criteria separate the line sinkers from net weights and warp weights (Hagen 1994: 206). This definition does not, however, completely cover the variety of line sinkers identified in the Bergen material. I have applied several elements of shape during the identification process and reached the following definition: *A line sinker is an artefact in stone or metal with one or several holes and/or groove (-s) for attaching the fishing line. In addition, the line sinker has a shape adapted to movements in the sea.* This definition enables me to separate line sinkers from net weights, since net weights are not supposed to make any movement in the sea. Their shape is consequently of secondary importance to their weight (Lunde 1977: 130; Hagen 1994: 206). I will return to a more detailed discussion on the problem of separating net weights from warp weights in the chapter discussing fishing with nets.

I have not used weight as a criterion in identifying line sinkers since the weight will vary considerably, reflecting both different fishing techniques, depth where the fishing has been carried out, and the force of the current. Nevertheless, weight will serve as an important criterion when function is discussed.

Medieval line sinkers from Bergen

All in all, 106 artefacts have been identified as line sinkers. Some of these may also have been used as net weights. They were found at 16 sites in Bergen. The condition of the line sinkers

Material	Number with exception of blanks	Blanks	Complete sinkers
Stone	91	958	
Metal	5		4
Number	96		962

Table 2 Distribution of line sinkers regarding material and state

varies from intact to fragmentary (Table 2). In addition to the majority, which are ready-made, there are also semi-products. Only 5 are made of metal, the rest are made of stone.

Although the line sinkers vary considerably in shape it has been possible to establish criteria for a classification and typology. In most cases the line sinkers will be classified by their basic shape. A further division into types is primarily based on the shaping of the line hold (hole and/or groove). In these few cases where the line hold shows little or no variation, which is the case for the semi-circle shaped sinkers, the shape of the base will form the basis for the division into types. The boat-shaped line sinkers display shapes of both similarity and difference, and in this case the basic shape will be used to divide them into types.

Fig 16 Oval line sinkers from Bryggen (nos 807614, 53578, 80711, 77227)

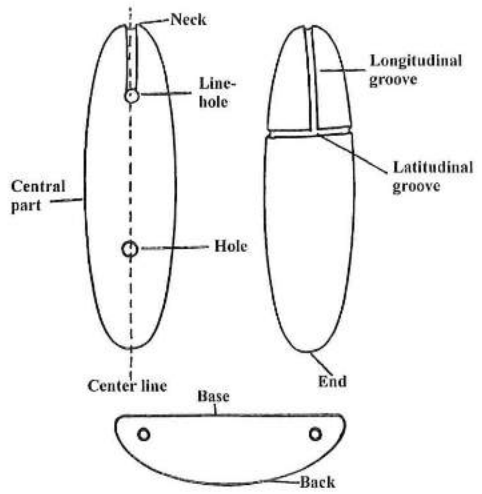


Fig 15 The parts of line sinkers

The line sinkers may be divided into the following basic shapes: oval, semi-circular, crescent, ball-shaped, boat-shaped, V-shaped, and conical, rectangular and trapezoid shapes.

A line sinker may further be divided into several elements (Fig 15). The end where the line hold is placed will be denoted *the neck*, gradually sloping into the *central part* that slopes into *the end*. If a line sinker is placed in an upright position, grooves running horizontally will be denoted *latitudinal grooves*, while the vertical running grooves will be referred to as *longitudinal grooves*. While still in an upright position with the widest part facing, an imagined line running from neck to end through the middle is referred to as the *centre line*. A line sinker may be *symmetrical* or *asymmetrical* in relation to the centre line. Some line sinkers are boat-shaped. In these cases "the keel-part" is denoted as *the back*, while the opposite side is called *the base*. If holes are drilled in the neck these will be called line-holes, while holes drilled elsewhere will just be denoted as *holes*.

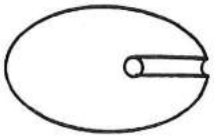
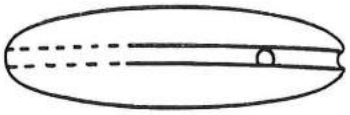
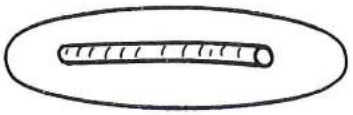
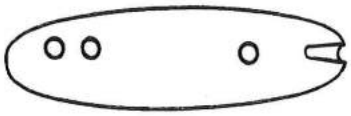
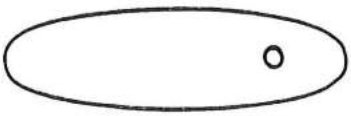
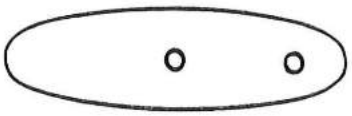
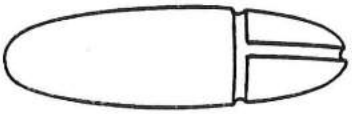
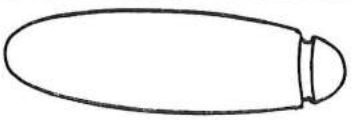
	*Type A*: oval line sinker with a longitudinal groove over the neck ending in a line hole (cf. Helberg type IV).
	*Type A1*: round-oval line sinker with a longitudinal groove over the neck ending in a line hole.
	*Type B*: oval line sinker with a longitudinal groove passing over the neck and further over the line hole towards the end.
	*Type C*: oval line sinker with a longitudinal groove starting at the line hole and extending towards the end.
	*Type D*: oval line sinker with a short longitudinal groove passing over the neck, and a line hole. Two holes towards the end.
	*Type E*: oval line sinker with a line hole in the neck.
	*Type F*: oval line sinker with a line hole in the neck, and a hole in the central part.
	*Type G*: oval line sinker with a latitudinal groove around the neck, and a longitudinal groove passing over the neck and ending in the latitudinal groove.
	*Type H*: oval line sinker with short latitudinal and longitudinal groove at the neck.
	*Type I*: oval line sinker with latitudinal groove at the very end of the neck.

Fig 17 Types of oval line sinkers

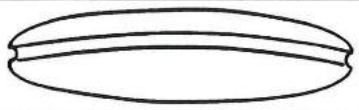
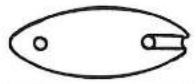
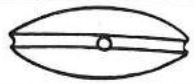
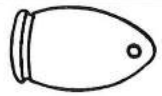
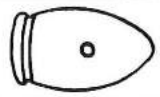
	*Type J*: oval line sinker with a longitudinal groove all around the sinker.
	*Type J1*: narrow oval line sinker with a longitudinal groove all around the sinker. The sinker has a narrow oval cross section.
	*Type K*: blunt-oval line sinker with a line hole at the neck and one at the end.
	*Type L*: pointed-oval line sinker with a longitudinal groove over the neck which end in a line hole. A hole at the end.
	*Type M*: pointed-oval line sinker with a longitudinal groove all around the sinker. A hole at the central part.
	*Type N*: round-oval line sinker with a pointed neck and almost flat end. A line hole at the neck and a latitudinal groove around the end.
	*Type O*: round-oval line sinker with a pointed neck and almost flat end. A hole at the central part and a latitudinal groove around the end.

Fig 17 Types of oval line sinkers

Oval line sinkers

The largest group of line sinkers is symmetrical oval sinkers, with a total number of 57. The oval line sinkers vary in weight from 36g to over 2000g; all made of stone (Fig 16).

Based on the shaping of the line hold, 15 main types and two subtypes are identified (Fig 17). Type A is oval with groove and line-hole, while subtype A1 is defined by a more round-oval variety in relation to the more common narrow oval A-type. The shaping of the line-hold is identical. Type J has a longitudinal groove and a rounded cross section. Subtype J1 also has a longitudinal groove, although it is more narrow oval with an oval cross section.

The oval line sinkers are found as complete sinkers, fractured sinkers, reused fractured sinkers, semi-products and fractured semi-products. Table 3 shows the number and state of the oval line sinkers according to type. Type A is in majority (31%). According to Nordgaard, types A and G were strictly located to Northern Norway, where they were used in the commercial cod fisheries (Nordgaard 1908: p 93). The Bergen material, however, demonstrates that this was not the case.

The weight

The weight of the oval line sinkers contains important information about where and how deep it was fished. Not only the intact line sinkers, but also the fractured ones have been evaluated as far as weight is concerned. By comparing the shapes of fractured line sinkers with intact ones I have estimated how large a part of the total line sinker these fractured objects represent. It has then been possible to estimate the weight of the fractured line sinker within a reasonable margin of error. The relation between weight and shape will be examined in more detail towards the end of this chapter. Weight will also be further discussed in chapter 4.

Type	Number	Complete	Reused
A	14		71
A1		1 1	
B	1		
C		2 2	
D		1 1	
E		2 1	
F		1 1	
G		2 2	
H		2 1	
I	1		
J		8 6	
J1		2 2	
K		4 2	
L		1 1	
M		1 1	
N	1		
O	1		
?			62
Blanks		6 3	
Total	**57**	**31**	**2**

Table 3 Number and state of oval line sinkers

Fig 20 Sickle-shaped sinkers from Bergen (nos 23523, 2371/10075)

Semicircle-shaped sinkers

This is a group of 13 sinkers, all made of stone (Fig 18). In average, the sinkers are twice as long as their width. The sinkers have been separated into two types, based on whether the base is straight or concave (Fig 19). The shaping of the

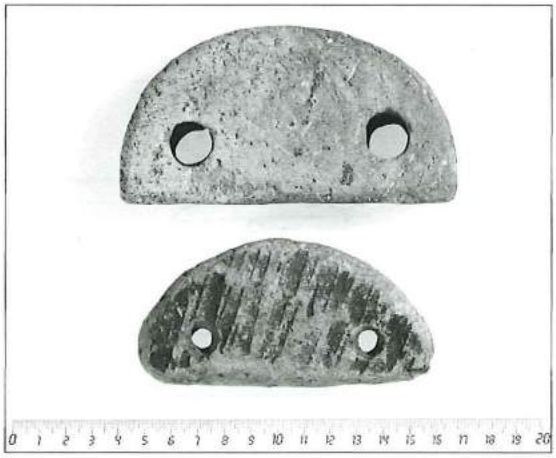


Fig 18 Semicircle-shaped sinkers from Bryggen (nos 8246, 69593)

Type	Number	Complete
A	10	6
A1	1	
B		22
Total	**13**	**8**

Table 4 Semicircle-shaped sinkers

line hold is not a criterion since these sinkers are too homogeneous in shape. In those cases where a type of semicircle-shaped sinkers show variation in line hold they will be defined as a subtype. Since it has been argued that these sinkers may have been used as line sinkers (troll fishing), net weights, or both (Helberg 1993: 179; Sørheim 1997: 111), I prefer to use the more functional neutral term *sinker* for this group instead of *line sinker*. The semicircular shaped sinkers are found both intact and fractured (Table 4). As the table shows, type A is in majority.

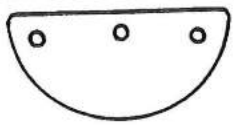
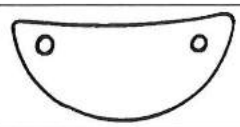
	*Type A*: Semicircle-shaped sinker with straight base and line hole at each end.
	*Type A1*: Semicircle-shaped sinker with straight base and line hole at each end and in the middle.
	*Type B*: Semicirle-shaped sinker with slightly concave base and line hole at each end.

Fig 19 Types of semicircle-shaped sinkers

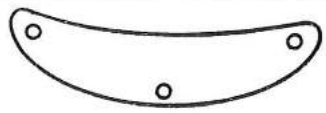
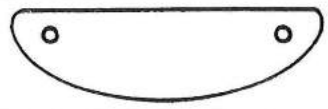
	*Type A*: sickle-shaped line sinker with concave base and two horizontal line holes, one in each end.
	*Type A1*: sickle-shaped line sinker with concave base and two horizontal line holes, one in each end. A longitudinal groove passes over one of the ends and stops at the line hole.
	*Type A2*: sickle-shaped line sinker with concave base and three horizontal line holes, one at each end and one in the central part of the back.
	*Type A3*: sickle-shaped line sinker with concave base and two line holes, one horizontal in one end and one vertical in the other end.
	*Type A4*: sickle-shaped line sinker with concave base and two vertical line holes, one in each end.
	*Type B*: sickle-shaped line sinker with straight base and two horizontal line holes, one in each end.
	*Type B1*: sickle-shaped line sinker with straight base, two horizontal line holes, one in each end, with short latitudinal grooves on each side of the line holes.

Fig 21 Types of sickle-shaped line sinkers

Type	Number	Complete
A	5	5
A1	1	1
A2	1	1
A3	2	2
A4	1	1
B	2	2
B1	1	1
?	2	
Total	15	13

Table 5 Distribution of types of sickle-shaped line sinkers with regard to condition

Sickle-shaped line sinkers

These are narrow, oblong sinkers with a convex back and a straight or concave base (Fig 20). Compared with the semicircle-shaped sinkers these are narrower. In average the length is four times longer than their width. Altogether 15 line sinkers of this kind have been found in Bergen; 13 were made of stone and two of lead. The shaping of the base is the criterion for separating these line sinkers into two types. The shaping of the line hold displays minor variations but constitutes nevertheless the basis for a further division into subtypes (Fig 22).

The sickle-shaped line sinkers are found both intact and fractured. Table 5 shows that type A is in majority, while the rest is relative evenly distributed both in number and types. Only two of the line sinkers were so fractured that it was impossible to identify them as types.

Leather-loop for attaching the line

One of the sickle-shaped line sinkers of type A (no 23523) still has a leather-loop attached to one of the line holes (Fig 20). The line must have been attached to this leather-loop instead of directly to the line sinker, probably in order to reduce the wear and tear of the line. Whether this was a common practice in the medieval period is unclear. Since the leather has not been preserved it has shrunk, and the loop is now 7 mm wide and 2,2 mm thick.

Type	Number	Complete
A1	1	
B4	1	
Total	5	2

Table 6 Ball-shaped sinkers

Ball-shaped sinkers

This is a small group of sinkers differing from the rest of the oval line sinkers by the fact that the main shape (the ball) is not manmade. These are almost round pebbles, only slightly oval and probably found on the beach. The sea, sand and other stones have created a rounded polished surface, well suited for a sinker. The only factor that discriminates these stones from a pure nature product is the grooves carved into the pebbles for attaching the line. The direction of the groove is the basis for the two types identified. Type A has a latitudinal groove and type B has a longitudinal groove (Fig 22).

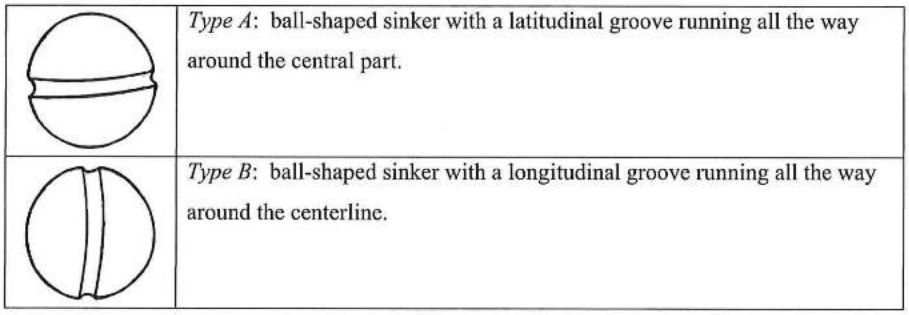


Fig 22 Types of ball-shaped sinkers

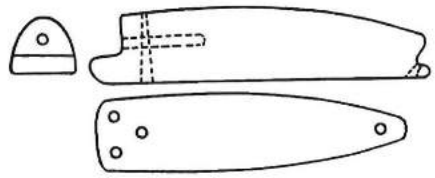
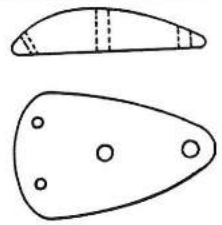
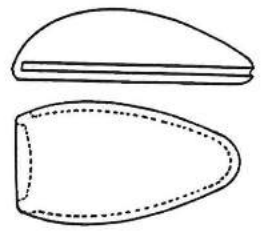
	*Type A*: narrow boat-shaped line sinker with convex back and flat base. At the straight end there are three vertical holes, one of them conical, and in addition one horizontal hole. At the pointed end no 55771 has a vertical line hole drilled through a "tongue", while no 80788 has a horizontal line hole.
	*Type B*: boat-shaped line sinker which is short and wide, with convex back and flat base. At the blunt/straight end there are two angled, vertical holes. At the central part there is a vertical hole, and at the pointed end there is a vertical line hole.
	*Type C*: boat-shaped line sinker with marked convex back and flat base. At the straight end there is a deep groove which stopping before the edge. Another groove starts at the other side of the edge and runs all the way around the base, until it stops straight before the opposite edge.

Fig 23 Types of boat-shaped line sinkers

As for the semi circle-shaped sinkers, these may have been used as line sinkers, net weights, or both (Nordgaard 1908: 77; Helberg 1993: 177). I will return to this question in chapter 4. Due to the uncertain function of these objects, they are denoted as "sinkers" instead of line sinkers. As Table 6 shows, type B is in majority.

Boat-shaped line sinkers

This is a small group of four line sinkers. They have convex back in both length and width, while the base is flat in both directions. They have one pointed end and one relative straight end, giving a shape that is similar to the hull of a boat. Based on the difference in the basic shape three types have been identified (Fig 23).

V-shaped line sinkers

This group consists of two artefacts, one made of steatite, the other of lead, both found during the Bryggen excavations (cf Fig 49). V-shaped line sinkers have two "legs" which meet at a pointed end (Fig 24). The steatite line sinker lacks a major part of one of the legs. The surface of this line sinker is bevelled with eight facets in cross section, indicating that it is a semi-finished sinker that broke during making.[3] The weight

[3] The first step in shaping a line sinker in steatite is to bevel it into a basic shape. A finished line sinker is ground smooth, with all edges well rounded.

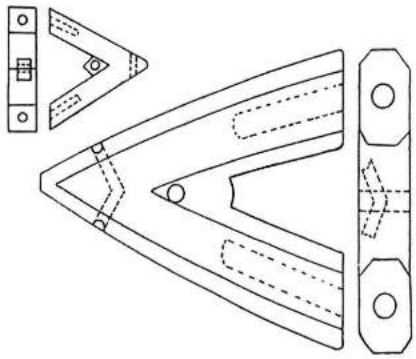


Fig 24 The construction principle for V-shaped line sinkers. The largest artefact is the steatite line sinker, while the smallest is the line sinker made of lead

when whole was probably around 400g. The V-shaped line lead sinker is square in cross-section and weighs 44g (a small fragment is missing from the leg).

Conical line sinkers

Two conical line sinkers, both in steatite, were found in Bergen during the Bryggen excavations. They have one pointed and one straight end with an oval cross section. One of the line sinkers has a hole drilled at the straight end, with a small step incised at the side of the hole, while the other has a deep groove at one of the sides (Fig 25).

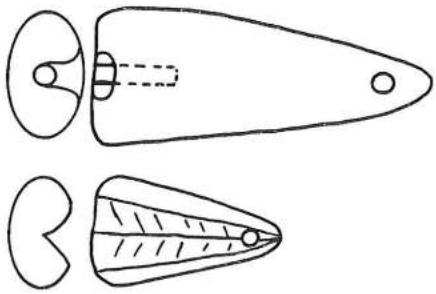


Fig 25 Conical line sinkers

Rectangular line sinkers

The rectangular steatite line sinker was found at Dreggsallmenningen. It is rather flat, almost rectangular with well-rounded edges. The cross section is like a bent oval. The line sinker gradually thickens from the end where the line hole is to the opposite end. At the thickest end a hole has been drilled, which is angled in such a way that it penetrates one of the sides. At the opposite end a boat has been carved with a runic symbol inside (Fig 26).

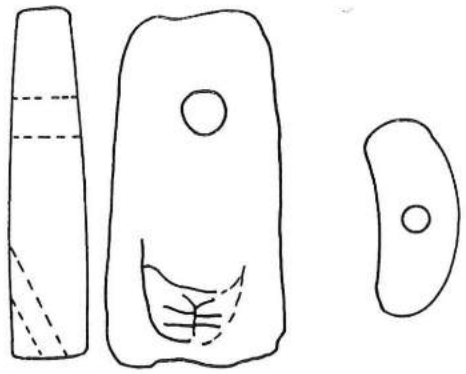


Fig 26 Rectangular line sinker

Trapezoid-shaped line sinker

Three trapezoid-shaped line sinkers, made of steatite and lead, have been found in Bergen. The steatite line sinker has a rectangular cross section while the two lead sinkers have a more quadratic cross section. All three are shaped like a pointed trapezium (Fig 27). Line sinkers of this type are small and light, well suited for fishing in shallow waters like rivers and lakes. I will return to this discussion in chapter 4.

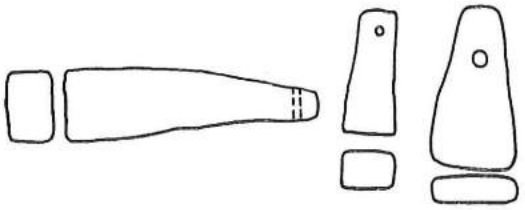


Fig 27 Trapezoid-shaped line sinkers

Other possible line sinkers

In this subchapter I will discuss a group of sinkers that may have been used when fishing with line. No attempt of classification or identifying types is, however, done due to their irregular/casual shape. The sinkers are only presented by

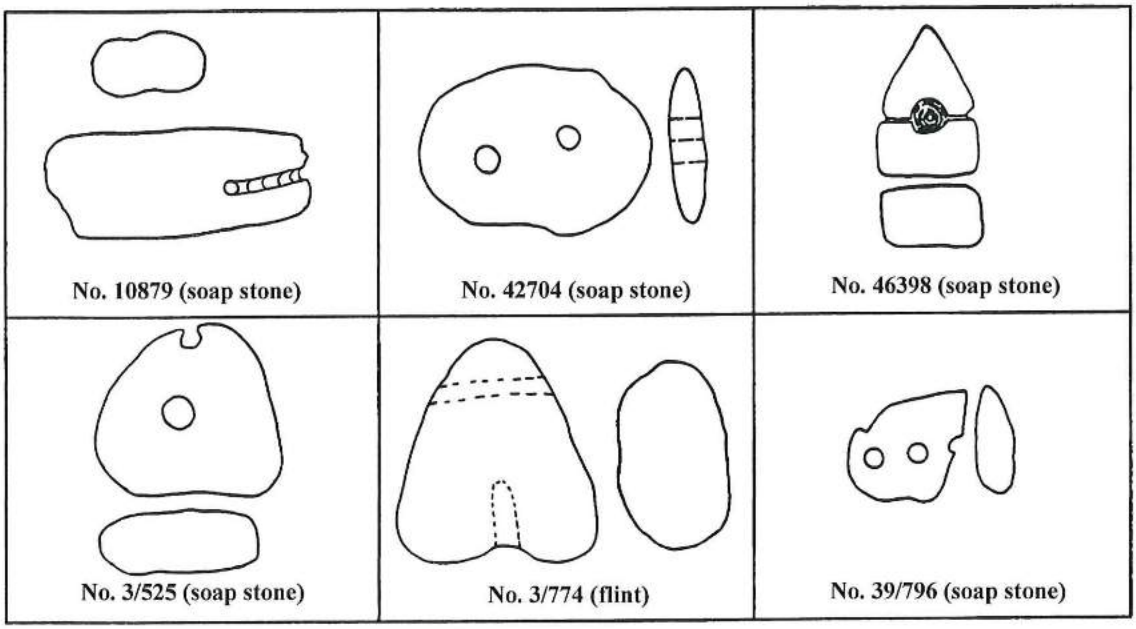


Fig 28 Other possible line sinkers

principle sketches (Fig 28). Since there is a lot of uncertainty linked to their function they are not included in the total number of fishing tackle from Bergen.

Material, manufacture, weight and decoration

Material and manufacture

Stone has been the primary material when making line sinkers. Including semi-products, 95% are made of stone and 5% of metal. 80% of the line sinkers in stone are made of steatite, while all the metal line sinkers are made of lead. Granite, slate, marble and volcanic rocks are other identified types of minerals.

Steatite has been used in Norway since prehistory. It has several important qualities. It is easy to shape, carve, cut, drill, grind and polish. It resists heat well and does not weather easily. In Norway, steatite was the most favoured mineral for all kinds of décor and mountings that demanded a high degree of precision in the medieval period (Ekroll 1997: 63).

The Middle Ages are known as the period in Europe when the building of monumental stone buildings, secular and ecclesiastical, accelerated. In Norway, steatite was particularly favoured in stone buildings in Western Norway and the Trøndelag region. The construction of these buildings must have created a surplus of steatite waste, from small pieces to blocks. Steatite must therefore have been easily accessible in Bergen already from the first half of the twelfth century.[4] Due to a series of major building works, the supply of steatite to Bergen must have been relatively constant up until the second half of the fourteenth century. After this period the construction of monumental stone buildings in Norway came to an almost complete stop (*ibid*). However, a continuous process of repairing the numerous stone buildings in Bergen took place after this period as well, requiring a stable flow of steatite into the town.[5] The tearing down of

[4] It was transported in to Bergen from steatite quarries north and south of the town, in Nordhordland, Os or Hardanger.
[5] Around 1330 there were about 20 stone churches in Bergen (Lidén 1985: 85).

existing buildings also provided a source of steatite leftovers. Consequently, finding steatite for line sinkers and net weights in Bergen should have been fairly easy during the whole medieval period.

The shaping of the line sinkers shows a conscious attitude among the fishermen as to how they wanted the sinkers to move in the sea. The shape of the line sinkers is clearly based on hydrodynamic principles. Besides the accessibility of the material, the easy shaping of steatite made it the most preferred raw material for line sinkers and sinkers. Traces of the shaping process is still clearly visible on several line sinkers: To make an oval line one started with an oblong block that was chiselled until it had received a quadratic cross section. Further, the longitudinal edges were bevelled by chiselling gradually deeper towards each end, leaving a basic oval shape. Further bevelling improved the shape. The line sinker was eventually finished by pecking, grinding, or both. A completely smooth surface was not necessary. There are several examples of line sinkers with a relatively coarse surface with use wear marks. The drilling of holes seems to have been accomplished at an early stage, probably to reduce the risk of cracking the sinker while drilling. There are three examples of sherds from steatite pots that have been reused as line sinkers; two semicircular and one sickle-shaped.

The shaping of the line hole is clearly a result of the mineral used. Among the oval line sinkers in steatite 83% have line holes, while only 13% have grooves. The same tendency is present among the sickle-shaped line sinkers in steatite, where 92% are equipped with line holes. A line hole seems to have been preferred if the mineral made it possible. Whether the use of groove or line hole can be explained functionally will be discussed in chapter 4.

Of all groups, the semicircular shaped sinkers seem to have received the least attention as far as shaping concerns (except the ball-shaped sinkers). The semicircular sinkers all have a rough shape, even where steatite has been used as raw material.

As discussed in the subchapter dealing with the ball-shaped line sinkers, this group consisted of pebbles with a groove. The hardness of the pebbles makes them wear and tear resistant, and therefore well suited as anchor stones of nets in weather exposed areas. Pebbles are from nature already equipped with a polished, hydrodynamic shape that requires only small adjustments to become functional. Pebbles must also have been easily accessible; it may therefore seem strange that they do not appear more frequently in the finds material.

Only five line sinkers made of metal (lead) have been found in Bergen, in addition to a mould for a V-shaped line sinker. Line sinkers of lead are also known from the Viking period, where several were found in particularly richly equipped burials (Petersen 1951: p 273). But stone was the most favoured raw material for line sinkers in the Viking period as well. There are probably several reasons why lead was so rarely used. As one of the V-shaped line sinkers shows, making complex shapes in steatite was possible. Accordingly, lead had no advantage as far as shape is concerned. Lead must have been less available, and as a consequence, a more expensive raw material to obtain. The risk of loosing a line sinker is always present while fishing. Economically it was therefore wise to use a less expensive material. Lead sinkers from Bergen may also have been recast into other artefacts after a while.

In his doctoral thesis *Boat finds from Bryggen*, Arne Emil Christensen discusses some wooden objects, interpreted as cast moulds for line sinkers (Christensen 1985: 159, 169). The V-shaped lead sinker fitted exactly into one of the moulds. Based on the mould the legs must have been 0,5–1cm longer than today.

Weight and shape

The weight and shape of the line sinkers have been correlated in order to evaluate whether the weight is distributed independently of shape, or if weight groups can be identified within certain shapes. Table 7 demonstrates how the different groups of line sinkers are distributed regarding weight. Oval line sinkers type A–J (from now on denoted Norw. *jarstein*) are separated as a group of its own and they clearly differ from the rest of the oval line sinkers in weight. Earlier in this paper they have been connected to the group

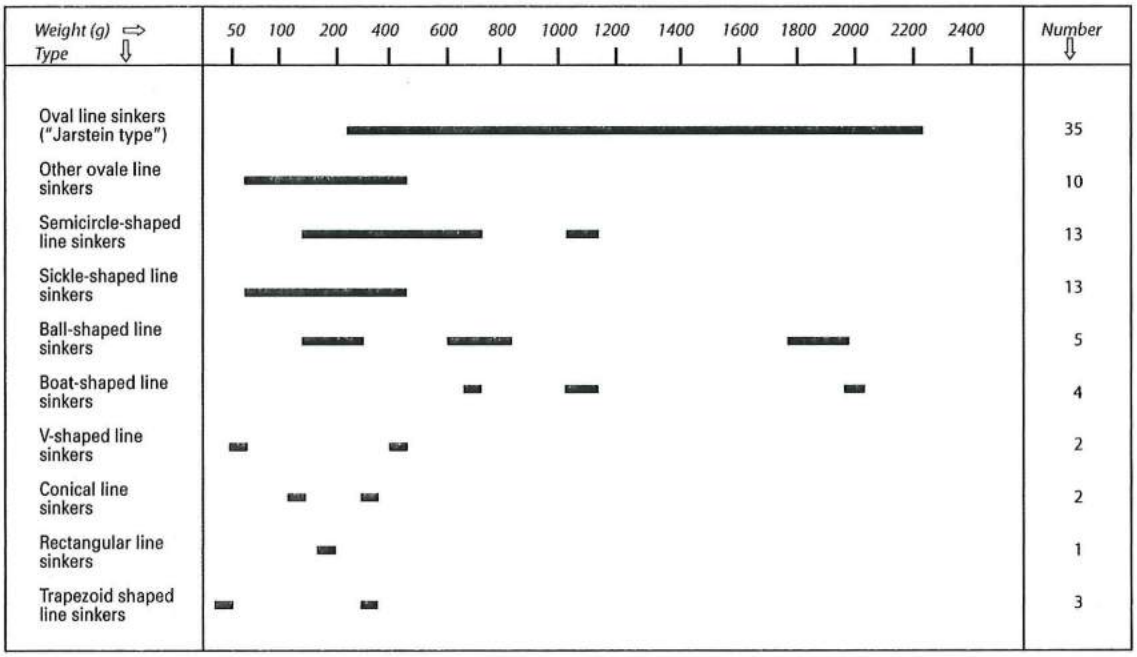


Table 7 The relation between the shapes of line sinkers and weight. The table shows the distribution of the different groups. Among the oval shaped line sinkers types A–J «jarstein» sinkers are seen as a separate group

oval line sinkers, based on the main shape. Table 7 shows that most of the line sinkers/sinkers are distributed in the weight area 50–600g. *Jarstein* sinkers (oval types A–J), ball-shaped sinkers and boat-shaped sinkers differ as they are particularly represented in the higher weight classes, up to over 2200g. There is no clear answer to the problem of whether weight is distributed independently of shape, or if it is connected to certain shapes. In the lowest weight classes the weight is distributed independently of shape, while in the higher weight classes the weight is more dependent on shape. It is, however, important to bear in mind that there are major sources of error in these interpretations since most of the groups are represented with only a few objects.

Decoration

Of 96 line sinkers only 6 % have been decorated, all in steatite; one oval, one pointed oval, two sickle-shaped, one rectangular and one more unidentified shape. Four of the sinkers are decorated with runes or rune-like symbols (Fig 26). The two sinkers without runes are decorated with parallel latitudinal lines around the line hole and incised dots respectively. In general, line sinkers are not decorated.

Comparative material

By comparing the line sinkers from Bergen with corresponding material found elsewhere, we may perhaps trace tendencies and find answers to whether the Bergen material belongs to a larger fishery-technological tradition, or whether it is a result of a local development and production. In order to evaluate the development in a broader context it is also necessary to include line sinkers from pre-medieval periods.

Oval line sinkers

On the islands Risøy and Sandøy in the municipality of Sund, and Hjartøy in the municipality of Øygarden, in the county of Hordaland on the western coast of Norway, a number of building constructions related to fishing in the Iron Age and early medieval period have been detected.

During excavations on Risøy, oval line sinkers of type J and probably type I were found.[6] The line sinkers were located inside the foundations of a building dated to the late Iron Age (800–1050 AD) (Johannessen 1998: 14).

The same types as the oval line sinkers A and G from Bergen have previously been connected to Northern Norway (Nordgaard 1908: pp 90). Nordgaard describes this type as "deep-sea sinkers" (Norw."dypagnstene"). Povl Simonsen describes a group of line sinkers from Northern Norway as: ...long, roller shaped or quadratic shaped sinkers in steatite with one or several grooves, but most often with a drilled hole at the upper end. These line sinkers have in Northern Norway often been called "jarstein" (Simonsen 1983: 13).[7] Based on this description of "jarstein," oval line sinkers from Bergen types A–J should fit into this regional term. A total of 35 line sinkers of the «jarstein» type (semi-products not included) have been identified in the Bergen material, while the total number from Northern Norway is 16 from the period 400–1700 AD. Line sinkers of «jarstein» type have also been located in medieval Trondheim, and Borgund in Sunnmøre. Line sinkers of type A and G from Bergen are also found in Northern Norway where they are dated to the late Iron Age and the medieval period (Helberg 1993: p 116). From Trondheim types A and J appear in a medieval context (Lunde 1977: p 127), while types A, G and J are found at Borgund (Sørheim 1997: p 112; cf Sørheim this volume). It is not clear whether these are present in both the last part of the Late Iron Age and the medieval period. Type J is also found in the Viking town of Kaupang (Tansøy 2001: 52). Oval line sinkers of types A, G, J and M are also found in a Viking Age context at Jarlshof, Shetland (Hamilton 1956: 118, 166, plate XXXIV).

Oval line sinkers of type A have approximately the same weight distribution as similar types from Northern Norway. When evaluating all the line sinkers of «jarstein» type from Bergen, these have a weight distribution from 210g to beyond 2200g, while «jarsteins» further north have a similar weight distribution from 300 to 2100g. Consequently, Nordgaard's statement about line sinkers of «jarstein» type belonging to a separate Northern Norwegian tradition must be rejected. This type of line sinker has been in use along larger parts of the Norwegian coast. Types A, G, I and J may have their origin in the late Iron Age, maybe early Iron Age (pre 800 AD) for types I and J.

Oval line sinkers of type J are also found in a medieval context during excavations at *Uppistovubeitinum* in Leirvík, in the Faeroes. The site was probably in use from 1100 to 1400 AD. Since the criteria for classifying the line sinkers from Bergen were slightly different from the ones used in the Faeroes, both types A and B from the Faeroes may be identical to type J from Bergen (oval line sinker with longitudinal groove running all around the sinker). Sinkers of this type were also found at the Viking Age site Fuglafjörður in the Faeroes (Arge 1997: 31). Type J seems to have been less common in other areas of Norway. Several objects of type J from Bergen were made of dark, probably volcanic minerals, indicating that the raw material or the finished sinker in fact originates from Iceland. Type J may, therefore, belong to a Northwest Atlantic tradition. Bergen was frequently visited by merchant ships from both the Faeroes and Iceland during the Middle Ages.

West of Bergen on the island of Sotra, at the deserted medieval farm Høybøen, three oval pointed line sinkers of type M (cf Fig 17) were found in an archaeological context related to the buildings. The heaviest of these sinkers weighed 265g (Randers 1981: pp103), while the heaviest from Bergen were of similar weight, 245g. The same type is also located in a medieval context in Trondheim (Lunde 1977: 128). Nordgaard believes that this type of sinker had its origin in the Viking period (Nordgaard 1908: 88). This is also supported by the material from Northern Norway where the same type of sinkers is dated

[6] The line sinkers are named *type B2* and *D* by Live Johannessen (Johannessen 1998:30).

[7] Simonsen claims that the word "jarstein" comes from the old norse word *kljár* m. which meant steatite (ibid.). This has been rejected by the linguist Kåre Elstad. In Old Norse this sinker was called *vaðsteinn* m. which means line stone or sinker stone. Elstad claims that it is reasonable to assume that *jarstein* replaced *vaðsteinn* when iron sinkers became common (Helberg 1993:179).

to 900–1100 AD (Helberg 1993: 142). The pointed oval line sinkers from Bergen, therefore, seem to belong to a more extensive coastal tradition rooted in the Iron Age.

Semicircle-shaped sinkers

Semicircle-shaped sinkers occur at several sites with an Iron Age or medieval context. On the islands of Risøy, Sandøy and Hjartøy 14 sinkers of type A were found within building foundations dated to early and late Iron Age. As in Bergen, there are several examples of sherds from steatite pots reused as sinkers. The sinkers are relatively light, weighing between 100 and 150g (Johannessen 1998: pp 14), while the sinkers from Bergen display a wider weight distribution (cf Table 7). Three sinkers of type A were found on Høybøen, but only one was intact, weighing 145g (Randers 1981: 103). Type A has also been found at Borgund in a late Iron Age/medieval context (Sørheim 1997: pp 111, cf this volume). Semicircle-shaped sinkers are also present in Northern Norway where they are found in Viking Age or medieval context (Elvestad 1998: p 72). Semicircle-shaped sinkers were used in Western Norway during the Iron Age and medieval period. Whether these sinkers were used elsewhere along the coast as well is still uncertain.

Sickle-shaped line sinkers

Sickle-shaped line sinkers of types A and B have also been found in late Iron Age/medieval contexts at Borgund, representing an average weight of 160g (Sørheim 1997: pp 111, cf this volume). Type B has been used in Northern Norway from 400 to 1300 AD, with an average weight of less than 100g, although there were examples of sinkers weighing about 350g. In comparison, the line sinkers from Bergen weigh 195g in average. One 365g sickle-shaped line sinker from Bergen increased the average weight considerably. Without this sinker the average weight would have been 168g, quite close to the average at Borgund. Sickle-shaped line sinkers may therefore also belong to a larger Western and Northern Norwegian fishery tradition, and may have their origin in the early Iron Age.

Ball-shaped sinkers

The ball-shaped sinker type A (cf Fig 22) is the most common sinker in the North Norwegian material. The type was used throughout the medieval period, but its use can be traced back at least to the Merovingian period (570–800 AD) in this area (Helberg 1993: pp 142). Type B is found in a Viking age context at Jarlshof, Shetland (Hamilton 1956: 118, plate XXXIV). Pebbles are also used as a raw material in Northern Norway. Helberg interprets these sinkers as either "juksasnøre" (fishing vertically in the sea with hooks), net weights or anchor stones for lines (*ibid:* 177). Consequently, ball-shaped sinkers seem to have been in use in Norway for a very long period. Poul Simonsen claims that as early as from 4000 BC–500 AD "juksafiske" with ball-shaped sinkers was the most common way of fishing. The use of such sinkers in the late Neolithic is supported by Nordgaard (Nordgaard 1908: pp 63). Ball-shaped sinkers found in graves and building remains demonstrate that they were common along most of the Norwegian coast in the Viking period (Petersen 1951: pp 266).

Ball-shaped sinkers of type B were also found at the site Uppistovubeitinum, in the Faeroes, representing the most common sinkers found in the Faeroes (Arge 1997: 31). These sinkers may represent the longest continuous use of fishing equipment in Norway. Thus, the ball-shaped sinkers found in an urban context in Bergen represent a tradition lasting several thousand years.

Boat-shaped line sinkers

At the farm Møgster in the municipality of Etne, Sunnhordland, and at the farm Skåle in the municipality of Kvinnherad, boat-shaped line sinkers of type B have been found, none in a datable context (Nordgaard 1908: p 96). Nordgaard describes them as boat-shaped line sinkers used for troll fishing. The boat-shaped line sinkers of type B may have been in use in the Viking period. Two boat-shaped line sinkers were found at the farm Osnes in the county of Rogaland, dated to around 900 AD (Petersen 1951: p 272). Type A from Bergen is not found elsewhere. Its relative complex construction may have led to a more limited availability and use. Type B repre-

sents a more simple construction, with a wider distribution both in time and space. Type C in the Bergen material is unknown elsewhere.

V-shaped line sinkers

Four V-shaped line sinkers are found in Trondheim, three steatite and one lead. They probably belong to the Viking period, but may be younger (Lunde, *op.cit.* p 127). The steatite sinkers from Trondheim show great resemblance with the Bergen sinker, this also applies to the one described by Nordgaard (Nordgaard, *op.cit.* 97). The same principle of construction seems to lie behind the sinkers from Bergen and Trondheim.

V-shaped lead sinkers may also have been used in the Tønsberg area in the medieval period. Two wooden moulds for V-shaped line sinkers were found during the excavations in "Søndre bydel," and dated to c 1200–1250, and 1250–1350 AD respectively (Olsen 1992: 191). The sinkers that were cast in these moulds were apparently of the same size and shape as the Bergen sinkers. V-shaped lead line sinkers were also used in the Viking period (Nordgaard, *op.cit.* p 98; Petersen, *op.cit.* 275). These were, however, larger than the medieval lead sinkers, measuring 120–150mm from the pointed end to leg end, while the Bergen sinker measures c 50mm. Accordingly, they must have been considerably heavier. V-shaped sinkers may have been used along larger parts of the Norwegian coast, at least from Vestfold in the southeastern part of the country to Trondheim.

Conical line sinkers

No conical line sinkers of stone have been recorded in medieval context elsewhere in Norway. Sinkers with the closest resemblance are those made in lead, of basically the same shape and size, from the Viking period. Nordgaard describes two conical sinkers found in a burial context (Nordgaard *op.cit.* 93). One of these has a similar longitudinal hole as no. 74750 from Bergen, and may indicate a similar function.

Conclusion

The fact that not all the researchers who have dealt with this type of fishing equipment, have been equally thorough and precise in describing the artefacts has complicated the comparison. Neither Nordgaard nor Petersen mention the distribution of weight, nor refer to the raw material systematically. This makes it difficult to evaluate whether the sinkers have changed weight, or if systematic changes in the use of raw material have taken place from the late Iron Age to the medieval period. It has first and foremost been possible to compare the variations in shape.

The line sinkers and possible line sinkers from Bergen display a great variety in shapes, thus making it possible to classify the material in groups and types. Most of the shapes were, however, also present in late Iron Age contexts. Contrary to former opinion, the oval sinkers of «jarstein» type belong to a larger fishery-technological tradition, probably rooted in the late Iron Age. It has also been demonstrated that some of the groups, as the ball-shaped sinkers, were probably used unchanged through several thousand years. It is also interesting to observe that several of the groups and types from Bergen have not been found elsewhere, neither in an Iron Age nor in a medieval context. Regional variations may be the cause, but since a major comparative and datable material only existed in two other areas, Borgund and Northern Norway, the impression of local variation or innovation may change when reports from other areas hopefully appear. All in all, it is not possible to detect a significant technological development in the use of line sinkers from the Iron Age to the Middle Ages based on the available material.

Line runners

Line runners (*vaðbein* from Old Norse *vað*r m., = fishing line, and also called ON *vaðhorn* n.) have up until the present been an important piece of equipment during line fishing. The line runner was fastened to the inside or on top of the gunwale, and the line was pulled over the line runner. The smooth gliding surface of the line runner reduced the wear and tear of the line, and consequently made it easier to pull in

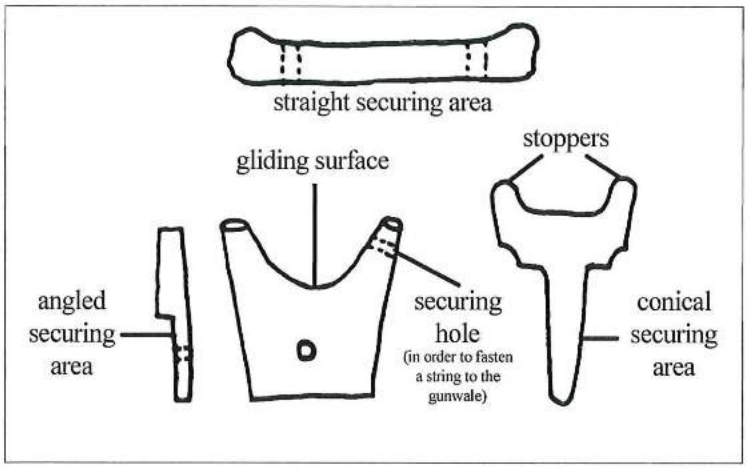


Fig 29 The various elements of the line runner

Fig 30 Line runners from Bryggen (from the left, starting at the top: nos 7322, 46160, 4133, 9633, 11976, 4676, 41553, 41198, 21334)

the line. The criterion for defining an object as a line runner is the use of hard, wear resistant material such as bone, horn, or hardwood, suitable for withstanding the strain caused by fishing. Softwood was only acceptable when used in combination with a wear resistant *gliding surface.* The gliding surface of the line runners has *stoppers* raised at each end to prevent the line from slipping over (Fig 29).

The line runner also needs a *securing area*, shaped in a manner that the line runner may be attached rigidly to the top of, or inside the gunwale. The securing area may be *straight, stepped* or *conical.* Several line runners have an extra drilled *hole.* The purpose of the hole is to tie a line through it, and secure it to the boat, preventing the line runner from slipping overboard while fishing (pers. inf. Arne Emil Christensen).

At the lowest part of a red deer antler there is a natural outgrowth shaped as a *whorl.* This whorl has been used as the gliding surface for three of the line runner types.

Line runners from Bergen

Altogether 43 artefacts have been identified as line runners, possible line runners, finished and semi-products in the Bergen material. They are made of bone from mammals (land), whalebone, antler (red deer and reindeer) and hardwoods, in addition to the combination mammal bone and pine. The line runners are generally in good condition (Fig 30).

The identification of types is based on shape. The shape gives information on how the line runner functioned, how it was made, as well as an opportunity to compare with line runners found in other medieval and prehistoric contexts. Six main types and five subtypes have been identified based on the shaping of the securing area and gliding surface (Fig 31).

Table 8 shows that types II and IV are in majority, representing more than half of all the line runners. Type I is the third most common

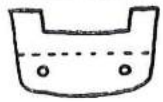
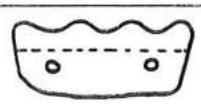
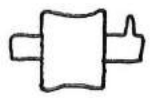
	*Type I*: bone from land mammal with straight gliding surface and securing area. Drilled hole at each end for attaching on top of the gunwale.
	*Type II*: made from a fork shaped piece of antler where the points work as stoppers for the gliding surface. Stepped securing area.
	*Type IIA*: made from the lowest part of a red deer antler. The whorl works as a stopper at one end of the gliding surface, while a wooden dowel has the same function at the other end. Stepped securing area.
	*Type IIB*: similar to IIA with the exception that the wooden dowel stopper is replaced by a raised edge.
	*Type III*: line runner of antler where the whorl is used as gliding surface. Stepped securing area.
	*Type IV*: line runner with incised gliding surface and stepped securing area.
	*Type IVA*: similar to IV with the exception that one of the stoppers is incised, creating an extra gliding surface.
	*Type IVB*: similar to IV and IVA, but with three gliding surfaces. The stoppers are lower and more rounded.
	*Type V*: similar to type IV, but the stepped securing area is replaced by a conical tap.
	*Type VA*: similar to IV but the gliding surface is a changeable mammal bone.
	*TypeVI*: may be the part of a line runner with a roll. The part consists of a wheel and shaft. The surface of the wheel is incised creating two raised edges which may act as stoppers.

Fig 31 Types of line runners from Bergen

type. As for several of the types it is the lack of an intentional shaping of the raw material that actually constitutes the shape (cf type I, II, IIA and IIB). Type I is just a straight bone with a hole drilled at each end. The same ability to exploit a natural made shape counts for type II with its subtypes. 60% of the line runners are made from antler, particularly red deer. Types IIA, IIB

Type	Horn	Bone		Wood	Bone and wood in combination	Possible line sinker with rotating gliding surface	Number
		Land mammals	Whale				
I		6					6
II	10						10
II	A						2 2
II	B						1 1
III							4 4
IV		71	1	4			13
IV	A						1 1
sIV	B						1 1
V				3			3
V					A1		1
VI						1	1
Total	26	7	1	7	1	1	43

Table 8 Distribution of line runners regarding number and raw material

and III are all made from red deer antler. The extensive use of antler may have two reasons: Firstly, antlers have a hard surface with an almost "prefabricated" line runner shape, requiring little effort to turn it into a functional line runner. Secondly, the combmakers in Bergen used antlers in their production, so that antler was readily available. 76% of the line runners are shaped with a stepped securing area. The step increases the securing area and gives the line runner support from both the top and side of the gunwale, the result being a well-seated line runner that does not give in during fishing. Line runners with straight and stepped securing areas were attached to the gunwale with wooden dowels. Several of these dowels were still seated in the line runner. Line runners with a conical tap have probably been incised into a conical hole on top of the gunwale or a conical mar at the inside.

Line runners with a rotating roll

In her doctoral thesis *Textile equipment and its working environment, Bryggen in Bergen c 1150-1500,* Ingvild Øye describes possible pulley blocks used on looms with horizontal warp (Øye 1988: p 74). Line runner type VI, which is described as a possible part of a line runner with a rotating roll, shows a significant resemblance with the pulley-wheel and shaft described in Øye's thesis. The wheel and shaft of type VI are, however, considerably heavier made. The pulley block described by Øye has a stepped securing area and shows some resemblance with type II line runners, although it is too light to have functioned as a line runner. Type VI may, however, represent a possible transition from line runners with an immovable gliding surface to line runners with a roll, based on a modified shape of the pulley-block (Fig 32). The shaft is 20 mm in diameter, and like the wheel it is made of hardwood.

Possible line runners with a roll, dated to the period 1248–1332, must have been replaced later by line runners of the North Norwegian type. Such line runners had a rotating roll, mounted in a strong wooden construction. The roll was made of bone or hardwood and the shaft had bushings made of bone-plates. In Northern Norway, line runners of this larger type have been used from the eleventh century (Helberg 1993: pp 180). It is uncertain when this type first came to Bergen and Western Norway, but the contact between Bergen and Northern Norway was very close during the whole medieval period. In 1883 the Norwegian Fishery Museum received

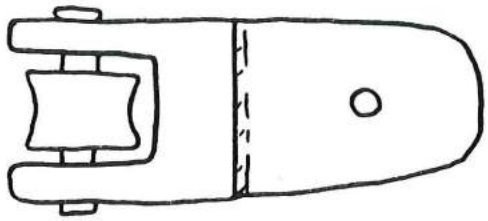


Fig 32 Suggested reconstruction of line runner with a roll, as type VI

a well-used line runner of North Norwegian type, used at Sotra west of Bergen. Line runners with a rotating roll must have been widely used in Western Norway, at least from the nineteenth century, maybe earlier. The line runner of North Norwegian type dominates in ethnological material from Western Norway.

Although the interpretation of the shaft and roll (type VI) is uncertain, the heavy line sinkers of «jarstein» type from Bergen imply that line runners with a rotating roll were used in this area during the Middle Ages. There is a clear connection between the introduction of heavy line sinkers of «jarstein» type, and line runners with a rotating roll of North Norwegian type (Helberg 1993: 180-182). Line runners with a rotating roll were probably necessary when fishing with heavy line sinkers in deep waters. The friction of the line when a line runner with an immovable gliding surface would be high, causing the fishing line to be worn down very quickly (*ibid*). We have seen that the weight distribution for «jarstein» type line sinkers, from Bergen and Northern Norway, concur. The fishermen from the Bergen area must have had the same need for line runners with rotating roll as fishermen from Northern Norway, although this line runner type is not positively identified in medieval contexts in Bergen.

Traces of wear and tear caused by fishing line

Sixteen of the line runners have incised traces on the gliding surface as a result of wear and tear when the fishing line was pulled over the surface repeatedly. The marks give a clue to the line dimensions that were used. This information can be used for interpreting function, such as fishing locations and what kind of fishing took place. The diameter of the fishing line varies from 1,6 to 4,5 mm, with an average of 2,9 mm. What kind of fishing that required line runners will be discussed in chapter 4.

Decoration

Four of the line runners have some kind of decoration. Two artefacts of type II have a raised edge running around the outer edge of the line runners. One line runner of type IV is decorated with a cross made by small concentric circles, and one type V has an incised cross. To crossmark doors of boathouses, boats and the fishing gear, is known as a custom among the fishermen all along the Norwegian coast. The cross protected against evil powers, bless the work and enhance the luck of fishing (Hodne 1997: 52).

Comparative material

Line runners are also known from the Viking period. In the "blacksmith-grave" from Ytre Elgsnes, in the county of Troms, a line runner of type II was found, dated to the first half of the ninth century (Simonsen 1953: 117). This type of line runner is the only one Bergen and Northern Norway has in common. Beside type II, and the previously mentioned possible line runner with a rotating roll, only one other type is identified in Northern Norway; a "saddle-shaped" line runner that is mounted on the gunwale, as a saddle is mounted on a horse. This type is unknown in Bergen and the rest of Western Norway. All in all, there seems to be far less variation in shape among the line runners found in archaeological contexts in Northern Norway than in Bergen, although the preservation conditions for bone and antler is generally good in Northern Norway, with large areas of calcareous soil along the coast.

Only one line runner of type IV, made of bone, has been found at Borgund. It has not been dated more precisely from the period early eleventh to the thirteenth century, when Borgund functioned as a central place (Sørheim 1997: 107). A quite similar line runner to type IV is found in a medieval or post-medieval context in Trøndelag (Elvestad 1998: 90). A line runner made of antler with a stepped securing plate, is

also found in a Viking Age context at Jarlshof, Shetland (Hamilton 1956: 122).

Summing up line runners

The line runners from Bergen represent a fairly wide variation of shapes. The variety is probably due to the raw material used rather than to functionality. There were different ways of attaching the line runner to the gunwale, where the stepped was the most favoured, creating the best bond between gunwale and line runner. The absence of line runners with a rotating roll of the North Norwegian type in the Bergen material, may be explained by the development and use of another type of line runner in the Bergen area. Line runners of the North Norwegian type first became common in Western Norway after the Reformation. This far, the identification of a medieval locally developed line runner with rotating roll, is no more than an uncertain hypothesis. Nevertheless, the heavy line sinkers of «jarstein» type found in Bergen indirectly indicate that line runners with a rotating roll were probably used in this area during the Middle Ages. The variety of line runners used by the medieval fishermen from the area were probably adapted to Bergen and reflects a varied fishing. This will be further discussed in chapter 4.

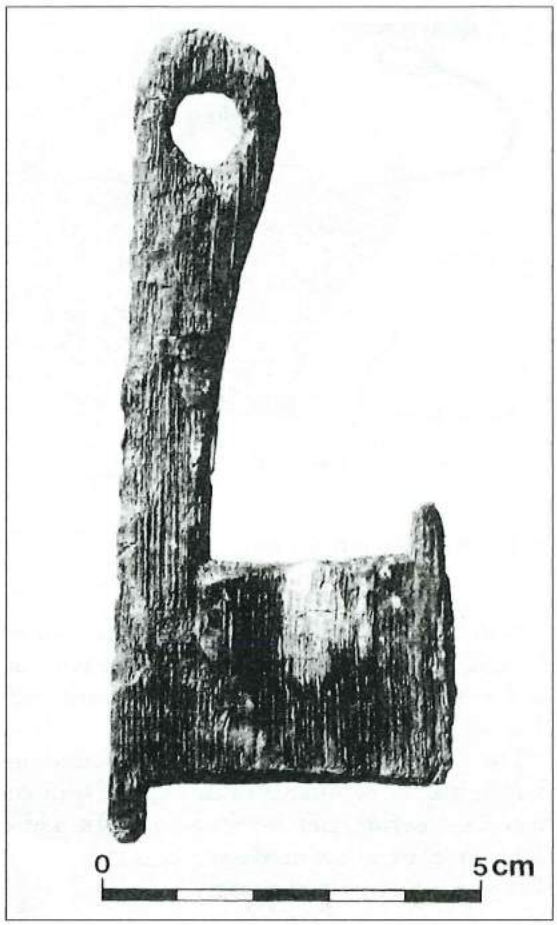


Fig 33 Bobbin found at Bryggen, no 1065

Bobbins

One bobbin was found during the excavations at Bryggen. Bobbins were used in making a quadruple plait.[8] Among fishermen in Western Norway this quadruple plait was often called *forsyn*, in Britain the snood, and it was used as a hook-carrying branch line. In the last centuries the plait was made of flax or hemp, while lime-bast was probably common in the medieval period. The length of the plaits could be from one to three fathoms when used in fishing. Making quadruple plaits is well known over a wide geographical area, and was also known in the Middle Ages (Hald 1950: 286). The bobbin from Bergen is 99 mm long and made of an unidentified hardwood (Øye 1988: 57) (Fig 33).

Fishing using nets

This group includes both fishing nets where the fish is caught in the mesh, and seine where the fish is trapped inside a wall of meshes. At the top and bottom a net is edged with a thicker line called *cork line* (top) and lead line (bottom), in Norwegian called *tenel* (ON *þinull* m.). This line strengthens the edge and creates a sturdy hold for attaching floats and net weights. A thicker

[8] To make the quadruple plait used in line fishing, two men with one pair of bobbins each had to work together. Ethnological studies show that this was primarily a job for men since the plait needed to be very stiff. Three to four fathoms could be made if working a whole evening. Since the quadruple plait was stiff in sea, the hook attached to one of the plait-ends did not get entangled with the line during fishing. Among fishermen the work of making quadruple plait normally took place in the living room during the winter. It is still possible to find the two nails in the roof beam of old houses where the quadruple plait was fastened (Martinussen 1998: p 26).

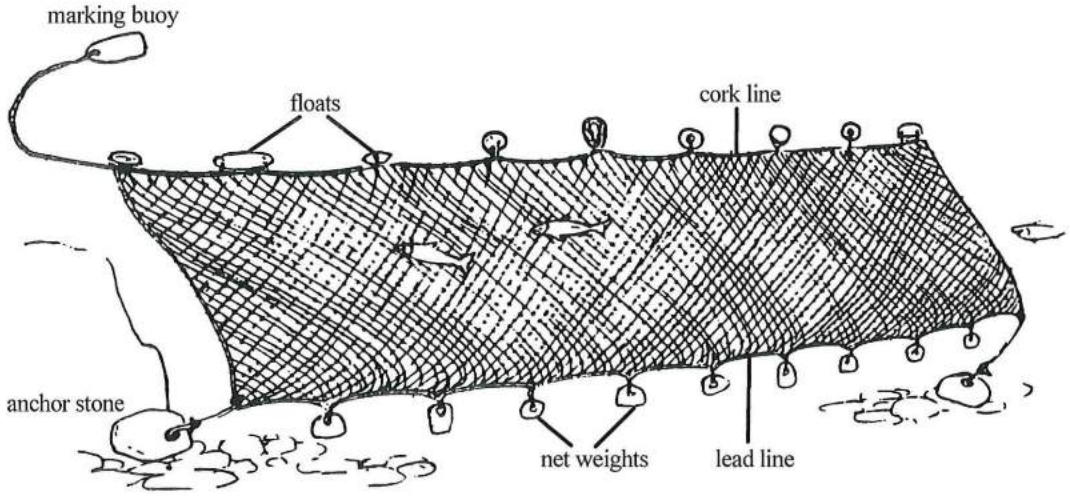


Fig 34 The different parts of a net

rope to the surface runs from the cork line where a marking buoy is attached. At the bottom an anchor stone is normally attached at each end (Fig 34).

The following group of artefacts found in Bergen may be connected to this way of fishing: *floats*, *net weights* and *marking buoys*. In addition, there are a few artefacts that may be connected to net fishing: *fragments of mesh from lime-bast* and *net needles*.

Floats

The criterion for identifying an object from a low technological society as a float (Norw. *flå*, ON *flá*, f) is that it should be made in a natural material that floats, either wood, bark or cork. It needs to have a hole or groove to be securely attached to the cork line. In order to get the net coils easily into the boat, the float should be reasonably small, and should have a well-rounded shape that prevents it from getting entangled in the meshes. The float's buoyancy keeps the net vertical in the sea.

In the classification of the Bergen material I will not separate floats used on regular fishing nets from floats used on seine nets. In chapter 4, I discuss the use of different types of floats more thoroughly.

Fig 35 Floats from Bergen (from top left nos 54873, 20429, 29949, 22622, 78607, 25583, 53581)

Floats from Bergen

Altogether 330 objects of wood, bark and cork have been identified as floats and possible floats. Nine main types of floats are identified based on shape: two oval, one pointed oval, two drop-shaped, two round dishes, one ball-shaped and one rectangular (Fig 36).

Raw material and manufacture

Table 9 shows that wood dominates as raw material: altogether 82% is made of wood, 17% of bark, and 1% of cork. Juniper is the most favoured type of wood, but sallow is also used. Juniper is particularly well suited as raw material for floats, since it is highly resistant against rot (Høeg 1981: 25). At the middle of the eighteenth

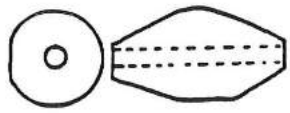
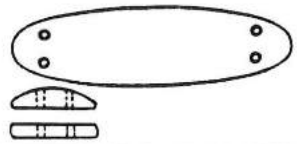
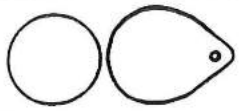
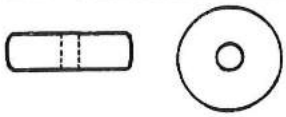
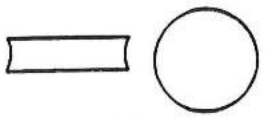
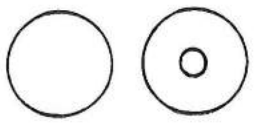
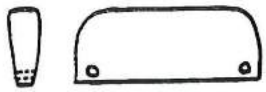
	*Type I*: oval floats with round or round-facetted cross section. Usually with a small, flat base. A wide hole is drilled from end to end.
	*Type II*: oblong, oval floats with either flat cross section or a cross section with flat base and convex back. Usually with two holes at each end.
	*Type III*: pointed oval floats with a round cross section. A latitudinal groove around the middle.
	*Type IV*: drop-shaped floats with a round cross section. A hole at the pointed end.
	*Type V*: drop-shaped floats with a flat cross section. A hole at the pointed end.
	*Type VI*: disc-shaped floats with hole through the centre.
	*Type VII*: disc-shaped floats with groove around the periphery.
	*Type VIII*: ball-shaped floats with hole through the centre.
	*Type IX*: rectangular floats with two rounded corners, holes at the opposite corners and a narrow trapezoid cross section.

Fig 36 Types of floats

Material	Total (except blanks)	Blanks
Wood	258	14
Pine bark	56	
Cork	2	
Total	316	14

Table 9 Distribution of floats according to raw material

century the fishermen in Hordaland still used floats of juniper, sallow and pine bark. Pine-bark had the highest buoyancy, while juniper was most resistant against soaking. In 1785 cork started to become more common. Juniper, sallow and pine-bark would all have been easily accessible in the countryside of Bergen.

The floats from Bergen were made in two techniques, hand carving or woodturning. At least 79% of the floats are hand carved, while the rest may be turned, such as types III and VIII. This may indicate that the main production of floats was not necessarily connected to the professional wood workers in Bergen, who had access to a lathe. Although type I is hand carved it has a very standardised shape, this may imply a professional production, but not necessarily. Within the group of wood, there are a great variety of types (Table 10). This variation is determined by function rather than material, used on different types of nets. I will discuss this in more detail in chapter 4.

Type	Wood	Pine bark	Cork	Number
I	147			147
II		9		3 12
III				3 3
IV				48 48
V				4 4
VI		3249	2	83
VII				17 17
VIII				13 13
IX				3 3
Total	272	56	2	330

Table 10 Distribution of types of floats according to raw material

Comparative material

Do the floats from Bergen belong to a local tradition, or are they also found in a wider geographical setting? As the floats found in archaeological contexts are made of organic material they have only survived in waterlogged deposits, and, consequently, rarely turn up in archaeological reports. The lack of published documentation on medieval/prehistoric fishing equipment complicates and restricts the comparative analysis. Material from Borgund, Trondheim, Tønsberg and Wolin, Poland will be brought into the discussion.

At Borgund nine floats of types I, V, VII and IX were found, belonging to the early eleventh to the fourteenth century (Sørheim 1997: 113, cf this volume). At "Frimurerlogens tomt" in Trondheim, types I, III, IV, VIII and IX were found, but have not been dated (Lunde 1977). In Tønsberg, "Søndre bydel", 23 floats were found during excavations; types II, III, IV, and V were found in phases 2–4 (late 1100/early 1200 until the last half of 1200 AD (Olsen 1992: 187-192). In Wolin, Poland, types II and VI (in wood and bark) were found in medieval contexts (Rulewicz and Zajdel-Szczyrska 1970). This spatial distribution indicates that the float types found in Bergen were also used within a wider national and North European setting.

Summing up: floats

A total of nine types of floats have been identified in the Bergen material, of which three types differ in quantity from the rest. In terms of quantity type I is the largest with 46% of the total, while type VI represents 25% of all floats, and type IV 15%. Juniper was the most favoured raw material, probably due to its resistance to rot and soaking. The floats from Borgund indicate that some of the types were also used in the late Iron Age. Most of the types from Bergen have also been identified in other medieval urban contexts, like Tønsberg, Borgund and Trondheim. Therefore, the floats from Bergen seem to belong to a wider Norwegian coastal tradition. Two float types from Wolin, Poland identical to types from Bergen indicate an even wider geographical representation and tradition.

Type	A	B	C	D	X	Total
Total	39	55	45	73	48	260
Whole weights	26	47	38	65	24	200

Table 11 Weights from the minor excavations in Bergen: distribution according to shape and condition

Possible net weights

Net weights and floats stretch the net while working in opposite directions. The criteria for identifying an artefact as a *possible* net weight are that it must be relatively heavy, made in a raw material that sinks, such as stone, burnt clay or metal, and it needs a hole or groove in order to tie it to the lead line. The shape is subordinate compared to the line sinkers, since net weights are not supposed to move in the sea. By using the term *weight* I intentionally choose a neutral word, since the object may have been used as a warp weight, net weight or both.

Net weights found in archaeological contexts may easily be confused with the warp weights used on the upright or warp weighted loom. Several archaeologists have discussed the problem of identification (Bertelsen 1973; Øye 1988; Rui 1991; Gjøl Hagen 1994). However, no certain criteria have so far been established to distinguish net weights from warp weights. Both Helberg and Sørheim, for instance, have chosen to disregard the problem (Helberg 1993; Sørheim 1997).

In her study on textile equipment from Bryggen, Øye has identified warp weights that may also have been used as net weights (Øye 1988: 70). In the following I will present the weights found at the other archaeological sites in Bergen, without being able to decide whether they have been used on land or at sea. In addition, I will briefly refer to the weights from Bryggen. The problems of identification of their function will be discussed in more detail in chapter 4, and a possible method of identifying net weights will be presented.

Possible net weights from the minor excavations in Bergen

Altogether 260 stone weights have been found at minor sites in Bergen. Øye's typology of the Bryggen weights – including 792 artefacts – will also be applied on these weights with a division into types based on shape. I have used her typology because basically the same types appear in the larger material (Fig 37). As the whole weight

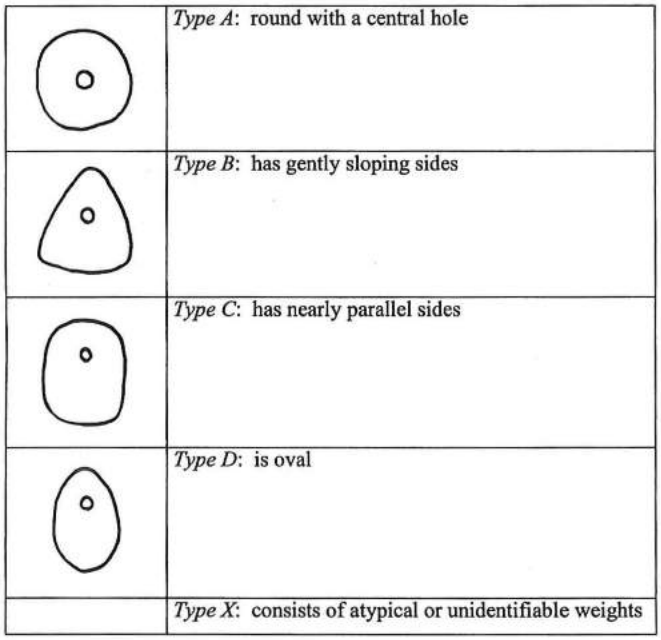


Fig 37 Types of weights from the minor excavations in Bergen

material from Bergen will be studied as one unit, I also find it useful to apply the same typology. The four main types according to shape will not be further divided into subtypes. A fifth group consists of atypical artefacts.

Of the weights from the minor excavations in Bergen, 94% were made from steatite, while 98% of the weights from the Bryggen excavations were from this mineral. In Trondheim, as much as 99% of the weights were made from steatite. The weights from Oslo show a different distribution, with 52% of the weights made from burnt/dried clay and 48% from steatite. In the other Nordic countries clay is also the most common material (Rui 1991: p 127). The absence of fired clay in net weights in Bergen should be explained culturally, since the waterlogged layers in Bergen generally preserved fired clay well, which the vast amounts of pottery sherds found clearly indicates.

As Table 11 shows, type D constitutes the largest group (28%) while there are minor differences in quantity between type A (15%), type B (21%) and type C (17%).

Weight

Weight is an important functional quality to consider when trying to identify weights used on nets. I will discuss the distribution pattern of weights in chapter 4.

Table 12 shows a wide distribution in weight among the whole weights, from 100g to over 2200g. Type A is the lightest, with 77% of the weights between 100g and 400g. Types B, C and D have a wider distribution in weight and seem to cluster in a higher weight group, 79% of the weights vary from 300 to 900g. The tendency that in average type A represents lighter weights is also observed among the weights from the Bryggen excavations. Øye has suggested that weights of type A may have been used both as warp weights and net weights (Øye 1988: 69). Types B and C from the Bryggen excavations show a tendency in weight distribution similar to types B, C and D in my own material. Since a large number of floats have been found at this site, one should expect that some of the weights here actually have been used as net weights.

Type ⇒ weight in g.⇓	A	B	C	D	X	Total	%
under 100					1	1	0,5
100.01-200	6	1	1	2		10	5
200.01-300	6	2	1	7	4	20	10
300.01-400	8	5	1	10	4	28	14
400.01-500	3	6	7	13	3	32	16
500.01-600	3	4	4	6	5	22	11
600.01-700		11	8	8	4	31	15,5
700.01-800		5	5	7		17	8,5
800.01-900		6	4	9	1	20	10
900.01-1000		1	1	2		4	2
1000.01-1100		2	4			6	3
1100.01-1200		2	2	1		5	2,5
1200.01-1300		2				2	1
over 2200					2	2	1
Total	26	47	38	65	24	200	100

Table 12 Distribution of types of whole weights by weight. Each hatch represents one weight

Comparative material

Few weights have been found in archaeological contexts related to fishing. They are normally found close to or in buildings without fishing gear, and are interpreted as warp weights.

The deserted farm Høybøen is located in an area with rich fishery resources. In addition to the line sinkers previously mentioned, weights of type B were found at the farm site. They were found inside a room that also contained line sinkers and textile equipment. One of the weight concentrations lay around 200–400g, while the other was distributed between 500 and 700g. It is possible to interpret the weights as warp weights (Øye 1988: 67), but the lightest cluster may also have served as net weights.

Kjersti Randers interprets one of the finds, a dish-shaped steatite weight with a hole in the middle, as a possible net weight (Randers 1981: plate 14). The weight shows some resemblance with type A weights, but is flatter and with a smaller centre hole. It is quite similar to the anchor stones in burnt clay that are still in use on the local net type, called *trollgarn*.

Nordgaard describes and interprets some undated objects in burnt clay as net weights. His interpretation is based on similarities with net weights used on *trollgarn* and cod nets at the beginning of the twentieth century (Nordgaard 1908: 100). These net weights are shaped as hollow cylinders. Some of the shortest resemble type A weights. Weights of burnt clay are, however, not found in Bergen.

Fig 38 Possible marking buoys from Bryggen (nos 86279, 13559)

Several limestone net weights have been found in the river Thames, Oxfordshire and of a shape similar to types B and D from Bergen. They lack, however, a firm dating (Steane and Foreman 1988: 98).

Several Norwegian museums possess old types of nets. The weights used on these nets would have been an important material for comparison. Unfortunately, the net weights were removed before the nets were brought into the museums in order to reduce the weight, and thus reduced the possiblity to use them as comparative material.

Summing up weights from the minor excavations in Bergen

Basically the same four types of weights that dominated the Bryggen excavations were also present in the material found in the minor excavations in Bergen. Beyond comparison, steatite was the most common raw material. A majority of the weights clustered between 200 and 900g, which is the same tendency as for the weights from the Bryggen excavations. It has not been possible to link any of the weight types to fishing nets, maybe with the exception of weights from the rural context at Høybøen. English river finds have demonstrated that several of the identified types from Bergen must have been used on fishing nets.

Marking buoys for nets

Buoys are used to mark the position of the nets when these are set far from land. From one of the upper corners of the net a rope runs all the way to the surface, and a buoy is attached to the end (cf Fig 34). The disadvantage of floating buoys is that they may be pressed under water if there are strong currents, and they cannot prevent the net from drifting. The nets are therefore far better secured when they are tied to land. When weath-

er conditions were bad, however, nets would not be set until the weather improved.

Three objects from Bergen can be interpreted as possible buoys, two made of hardwood (Fig 38) and one of cork. The hardwood buoys measure respectively 256 and 238mm in length and 96 and 66mm in width. They have one pointed end with a hole, and one straight end. The cork buoy has a rectangular shape, 160mm long, 94mm wide and 20mm thick, with a hole in the centre.

Fig 39 The binding technique of the net fragments found at Bryggen. Illustration from Schjølberg 1988

Possible fragments of nets

Three fragments of nets made from lime bast were found during the Bryggen excavations (Schjølberg 1988: 119-121). The meshes are bound in the same technique (Fig 39) as have been documented in Hedeby (von Brandt 1970: 69-73). The diameter of the three ropes measured 20mm, 9mm and 6,5mm respectively. The three fragments are coarsely made. While ropes made of wooden fibres are not suited for agricultural work as they tend to get brittle when dry they are much stronger when used wet at sea. Lime bast ropes are also very resistant against rot. The most important use must therefore have been in fishing.

Netting needles

Two needles used for net making were found at Bryggen, one finished (Fig 40) and one unfinished. The needles are long and narrow with a thin flat shaft, which is cut through by an elongated U-shaped perforation, leaving a central tongue. One end of the needle is pointed, the other is fork-shaped. The type is known all over Europe and also in Asia and may be traced back to prehistoric times. The Bryggen examples are made of birch wood and their length varies from 18 to 18.5cm, their width from 2.3 to 2.5cm (Øye 1988: 101).

Fish traps

When fish traps are used the fish enters a catching chamber from which escape is difficult or impossible. The fish enters the trap voluntarily, maybe searching for shelter, or lured by some bait, or frightened and guided by fishermen.

Fish traps from Bergen

Three relatively intact fish traps were found *in situ* on the sea-bottom during the Bryggen excavations, in front of the quays near the tenement of Bugården (Herteig 1969: 65) (Fig 41).

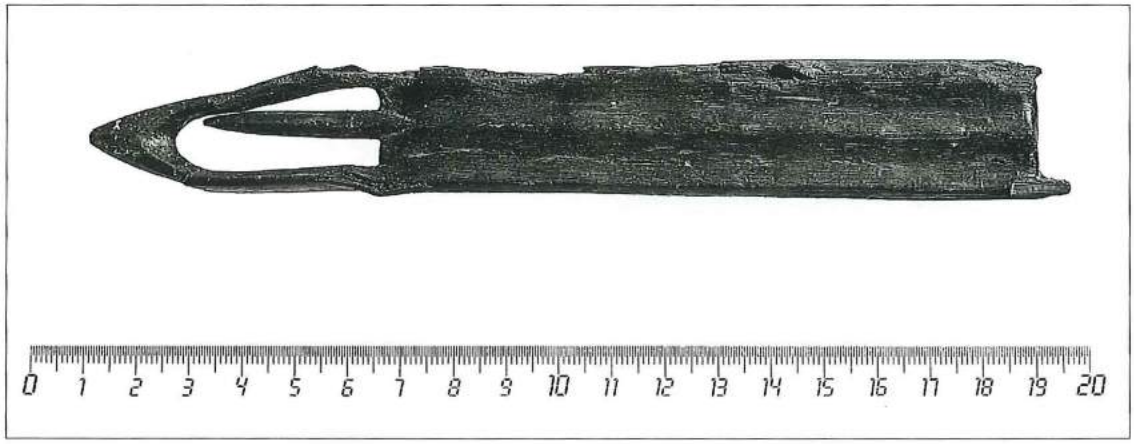


Fig 40 Netting needle from Bryggen (no. 1351)

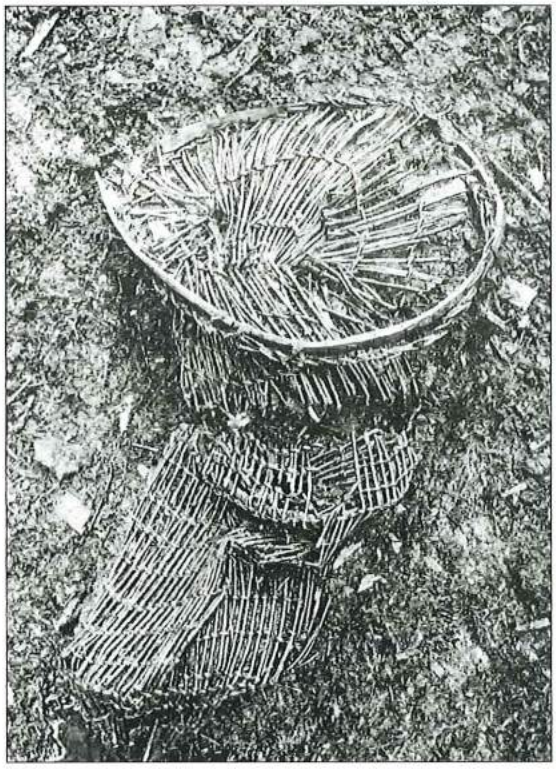


Fig 41 Fish trap found ***in situ****, in front of the quays at Bugården (no. 11096)*

Remains of different species of fish were found in all three. One of the traps was still attached to an anchor stone with a bast rope. The fish traps had probably been placed on the bottom in the harbour when they were covered by waste. This happened around the year 1200 (*ibid:* 65). Fragments of a possible fourth trap were also found, bound in basically the same way as the three intact fish traps, only slightly tighter.

Since the fish traps were not preserved after being excavated, they are now fractured and brittle, which has complicated an exact reconstruction. The description of the fish traps is therefore mainly based on Herteig's observations and descriptions in the finds catalogue.

The fish traps were shaped as narrow cones, 80–90cm, with an opening c 40cm in diameter, and made of wicker. The longitudinal twigs were tied together with thinner wither running latitudinal around 1–3 longitudinal twigs at a time (Fig 42). At the opening the longitudinal twigs were tied to a plaited ring of wicker. The end, where the longitudinal twigs ended in a point, was tied together with a line of bast. By opening this end the fish traps could be emptied. Three wicker rings kept the fish trap open, and at the opening a split and barked hazel twig was attached to the plaited wicker ring. At the middle of the trap a whole hazel twig was attached. Finally, there was a "throat ring", where a funnel-shaped valve made of wicker was mounted, functioning as a non-return device.

This kind of fish trap may have been used for catching different fish species, depending on the depth where it was placed. The extensive disposal of waste into the harbour basin of Bergen must have gathered lots of fish, such as shellfish, and explains the location of the fish traps. Mackerel found in the traps must have been the bait, as it is a shoal-fish that cannot be caught in traps. Fish traps in Norway have also been used for catching salmon in the rivers (Molaug 1956: 122).

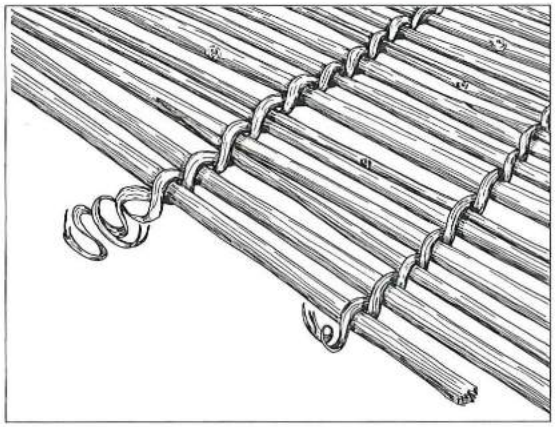


Fig 42 The binding technique of the fish traps (drawing by Elin Jensen)

Fishing by piercing

To pierce fish – Norw. *lystra;* ON *ljóstr*, m., *ljósta*, v. to beat or pierce – is in its basic form the most primitive of all fishing techniques. Piercing fish is known from prehistory and is used all over the world (von Brandt 1984: pp 43).

The fishing spear is a long wooden shaft with a spearhead consisting of one or more points, usually barbed. The length of a pushed spear is

limited in greater depths of water by the buoyancy of the wooden shaft. Moreover, a long spear of some several metres is difficult to handle in a small boat. In this case other devices are needed to bring up the prey from the bottom. This can be done with the help of fish plummets. The fish plummet (Norw. *pigglodd* or ON *lóð*) is a piece of equipment operated according to the principle of the spearing, but a rope replaces the shaft. The spearhead is replaced by a weight in metal or stone, with one or several barbed points, which can be dropped down in water in order to pierce flat fish and other creatures lying on the bottom (*ibid:* 47).

Possible fishing spearhead and fish plummet

Two iron objects may be interpreted as equipment used for piercing fish: a fractured fishing spearhead, and a 165mm long and double barbed point used on a spearhead/plummet (Fig 43). The fractured, fork-shaped object is most likely a fishing spearhead, since it is dated to the period 1413–1476. Forks for cooking and eating were first used in Norway in the sixteenth century. At Bryggen the earliest fork used for cooking/eating were found below fire layer I (1702) (Ågotnes 1994: 151). The barbed point may have been used together with a conical weight with a hole at the end, such as the one described in Fig 25, but the weight would need to be heavier. The barbed point may also have been used as an arrowpoint.

Summing up the analysis of the artefacts

The aim of this analysis has been to identify, describe and classify the artefacts of Bergen that may be connected to fishery activities in the medieval town. The artefacts have been classified according to four main principles of fishing: fishing with hooks, fishing with nets, fish traps, and fishing by piercing. My analysis has demonstrated that all four principles were most likely used. The fishing tackle from Bergen displays a rich variety of shapes, which have been the basis for a division into a number of types and subtypes. The rich variety can partly be explained functionally, reflecting different fishing techniques. The fishing equipment contains several types that may go back to the Iron Age or earlier, and one type seems to be unchanged from the Neolithic. Several of the types also seem to have been used in larger geographical areas along the Norwegian coast, while others have not been found elsewhere so far.

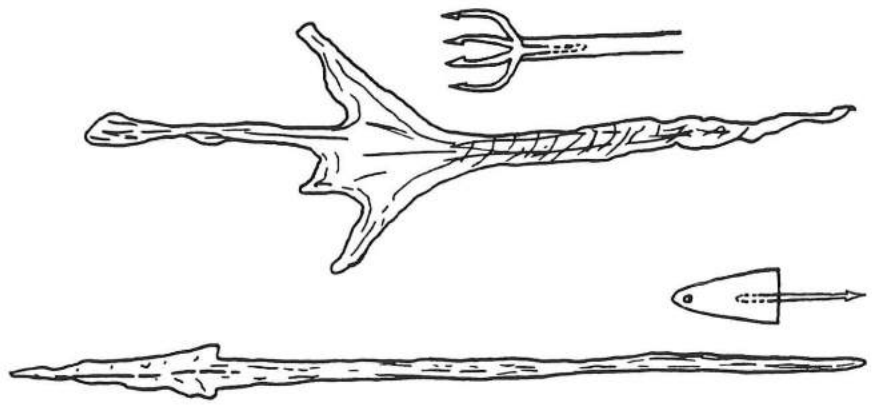


Fig 43 Barbed point in iron, and fractured fishing spearhead in iron. Possible reconstruction of the equipment

4 HOW WAS THE FISHING TACKLE USED? AN ANALYSIS OF FUNCTION

Most of the artefacts discussed in the previous chapter seem to represent a variety of fishing techniques. The main issue in this chapter will be to discuss and interpret their function – to illuminate what kind of fishery was carried out in Bergen during the medieval period. Ethnological material will be used extensively as an analogy to explain the medieval material. My aim is to discuss how the identified fishing tackle was used; what the equipment may have looked like when it was used, and what kind of fish the various tackle was meant to catch. The medieval fishery is divided into fishing with hooks, fishing with nets and fishing by piercing. As for the fish traps, I refer to the previous presentation.

Fishing with hooks

A number of the artefacts are connected to the technique of fishing with hooks – hooks, line sinkers and line runners. According to the oceanographer Thor Iversen, the traditional way of fishing with hooks may be divided into two subgroups: fishing with *hand line* (active tackle) and fishing with *long line*[9] (passive tackle) (Iversen 1937: 32). Since the long line is not identified in the Bergen material, I will focus on fishing with hand line.

Fishing with hand line

When fishing with hand line it is common to fish vertically, straight up and down in the sea. This technique is called *juksafiske* in Northern Norway and *harping* in the area around Bergen. This technique is well suited for catching deep-sea fish. Alternatively, one may force the hook and bait to move more horizontally in the sea by pulling the fishing gear after a boat in motion, in order to catch fish moving about in the upper levels of the sea. This technique is called Norw. *dorging*, or *troll fishing* in English. These techniques require different types of equipment, especially the line sinkers, but to some extent also the hooks. To decide which types of line sinkers and hooks that can be connected to these two techniques, functional elements of the line sinkers will be analysed. Hooks and line runners will also be discussed. Finally, I will try to link these functional groups together in a "set of tools", as line sinker, hook and line runner interacted during fishing.

How were the line sinkers used?

Vertical fishing requires a line sinker shaped so it does not run sideways when sent into the sea. A line sinker running sideways will also complicate the hauling of the catch. The best line sinker for vertical fishing is symmetrical along the centreline (cf Fig 15). The symmetrical line

Fig 44 Johan Tufteland showing an oval line sinker, type A or E (local dialect drutastein) from Gåsnes, Stolmen at Austevoll. This particular line sinker is dated to c 1780 (Fagerbakke, Solbakken and Tufteland 1986: 12)

[9] The long line can involve hundreds or today even thousands of hooks, each fixed to the main line by short lines called branch lines (or snoods, leaders, dropper line, droplines, or droppers, gangion, or gangin) (Steane and Foreman 1988: 90). Due to lack of archaeological material it is uncertain when the long line came into use in Western Norway. The cod-line must have been in use in Western Norway at least from the late sixteenth century, since it had its breakthrough as far north as Finnmark in this period (Nedkvitne 1988: 438).

sinkers are oval, ball-shaped, V-shaped, conical, rectangular and trapezoid, all of them suited for vertical fishing. As for the V-shaped and conical types there may also have been other uses. Line sinkers that may have been used in troll fishing, are: semicircle-shaped, sickle-shaped and boat-shaped types.

Oval line sinkers

Oval line sinkers, types A–J, are very similar to the line sinkers from Northern Norway called "jarstein". According to Helberg, the «jarstein»-sinkers were mainly used for fishing cod and other species in deep waters in Northern Norway (Helberg 1993: 178). As previously mentioned, Nordgaard connected the «jarstein»-sinkers to the commercial cod fisheries (Nordgaard 1908: 92).

It would, however, be wrong to identify the «jarstein»-sinkers from Bergen exclusively with cod fishing. The cod fishery has never been of any great importance in Hordaland. No extensive shoal of mature cod makes its way to this coast, in opposition to Borgund and particularly Vestfjorden in the north. But when the mature herring shoals regularly entered the coast of Hordaland cod would follow, grazing on the herring roe, as in the Fedje area (Nedkvitne 1988: pp 434).

The cod traditionally caught in Hordaland, originates in small local breeds. This fishery, nonetheless, has been important as a supplement for the fishermen and crofter-fishermen in the district. Analysis of fish bones from the tenement site Engelgården at Bryggen has shown that 60% of the bones were from cod. This species dominates throughout the high Middle Ages (Hufthammer 1987: 70). The size of the cod bones indicates that it was generally small fish, not the large skrei (*ibid:* 70).[10] This small cod probably belongs to a local breed around Bergen. Due to its size, it is highly unlikely that it is imported from Borgund or Northern Norway. The fishery after small cod normally takes place during the autumn and winter when the cod moves up into shallow waters. It is normally caught in fish traps and nets.

Ethnological research on the traditional coastal life in Northern Norway has shed light on various aspects of this way of living. Within fishery it is documented that the small fishery after local breeds generally took place near shore, down to 14 fathoms. At these depths line sinkers of «jarstein» type were used, weighing 250–600g (Gjessing 1945: p 238). Five of the «jarstein» types in the Bergen material have a weight concentration within this area. With the exception of type N, this also includes the rest of the oval line sinkers (cf Table 7). All the oval line sinkers within this weight area could be well suited for this local fishery in shallow waters, not only after cod, but even more important the fishery after young saithe.

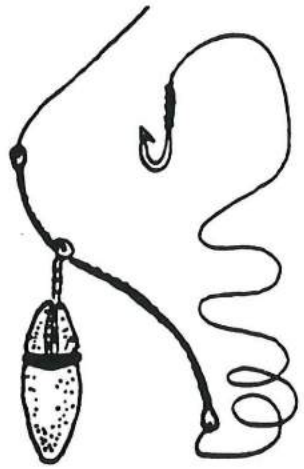


Fig 45 «Jarstein» used in juksa-fishing, Northern Norway (Helberg 1993: 182)

Ethnological material has documented that line sinkers of "jarstein" type were in use as late as the early twentieth century in Austevoll, Hordaland, south of Bergen. Types A or E were used when fishing "crab-cod" (Fig 44).

The saithe fishery has been very important in Hordaland, since large quantities of saithe spawn along this coast. Thus saithe fishing has long traditions in Hordaland. As for the larger saithe the best season was generally in the spring, although good catches could be done the year around.

[10] According to Fritzner this small cod was called ON *kroppungr* in the medieval period. The word occurs in a diploma from 1328, Nidaros (Grøn 1927: 120).

Fig 46 Line sinker from Iceland (Hjort 1905: plate I, Fig 5)

Fig 47 Oval line sinker from Shetland, nineteenth century (Nordgaard 1908: 90)

There are very good fishing places for saithe, located in the open sea, west of the municipalities Sund, Fjell and Øygarden, not so far from Bergen to the north-west. Local fishermen used to fish for saithe as deep as 120–130 fathoms with hand lines (pers.mess. Oddvin Olsen). The line sinkers used were normally of lead, weighing 1500g, with a thick iron thread moulded into the lead (Fig 54). The local name of this line sinker was *fiskastein*. The line was tied to the lead sinker, and the snood with hook and bait was tied to the iron thread. In more shallow waters lighter versions of the *fiskastein* were used. This type of line sinker was used up until the middle of the twentieth century.

Based on these facts I will argue that fishermen from Bergen may have used the line sinkers of "jarstein" type found in Bergen. The fishery could have taken place close to shore in the open sea west of Bergen, or in the fjords. As Table 7 shows, the «jarstein» types are distributed up to over 2200g, indicating fishing in deep waters. Together with saithe, the ling was the second most common fish species among the fish bones from the Engelgården-site at Bryggen (Hufthammer 1987: 70). Ling is a codfish and together with torsk it can be found in the fjords at depths of 100–400m (c 50–200 fathoms). Bones from torsk were also found at Engelgården. Both these species may be caught on hand line, but they are normally caught on the longline nowadays. In Northern Norway, when fishing on c 45 fathoms of depth, they traditionally used «jarstein» sinkers weighing c 750–1000g, and c 1000–1250g from 60 fathoms. As previously mentioned, sinkers weighing 1500g were used when fishing on depths around 120 fathoms west of Bergen. The line sinkers of «jarstein» type weighing from 800 to 2200g might then also have been used in the fjords in the Middle Ages, when fishing for ling and torsk. An alternative explanation of the use of heavy line sinkers could be that they were used where there were particularly strong undercurrents. A heavy line sinker would be needed in order to prevent the hand line from drifting away.

The oval line sinkers were divided into types based on the main shape and line hold. The shaping of the line hold, together with holes and grooves elsewhere on the line sinker may partly be explained functionally if we study ethnological material. The «jarstein» type in Fig 44 shows one possible way which the line and the snood may have been attached to the «jarstein». A long stick (Norw. *spøte*) made of juniper or baleen was bent like a bow, with a line between the ends, and attached to the neck. The snood with hook was fastened to the longest end, and the fishing line to the shortest. The purpose of the stick was to keep the hook clear of the line, and to reduce the tug of the fish. A similar principle is described in Fig 45.

An alternative way of keeping the hooks clear of the fishing line and reduce the tugging was to insert a stick through the sinker. Snood and hooks could then be fastened to each end of the stick, while the fishing line was attached to the neck (Fig 46). Ethnological material from Shetland describes a third way of attaching line and

snood (Fig 47). The Sunnmøre Museum collections contain a «jarstein» sinker, similar to the one from Shetland, used for fishing halibut until c 1930 (Sørheim 1998: 23).

Three different principles of arranging line sinkers have been demonstrated. Could any of these principles be applied on the oval line sinkers from Bergen? The first principle discussed requires only a line hole at the neck, but a line hole in combination with groove, a single groove running all around the sinker or a longitudinal and latitudinal groove at the neck would also work. Holes further down on the sinker would not be necessary. Oval line sinkers of types A–C, E, G–J1 could therefore have been applied according to the first principle (cf Fig 17). The second principle, with a stick through the sinker, will need a hole drilled below the line hold. Types D, F, and L could have functioned with this arrangement. The last principle requires a longitudinal and latitudinal groove as types G and H. Variations over these principles probably also existed.

The oval line sinker, type K, might have had the fishing line attached to one of the holes and the snood and hook to the opposite hole (Nordgaard 1908: p 77). Types N and O might probably also have functioned similarly.

Several of the oval line sinkers of «jarstein» type have crush marks at the bottom end. These marks occur when the sinker hits the hard seabed. One special technique of fishing caused the soft steatite sinkers to repeatedly hit the seabed. In Norwegian it is called *pilking:* the sinker is sent straight down until it hits the seabed. Then the line is pulled up a few fathoms and the line is jerked several times. The sinker is then sent to the seabed again, denoted as *steinskyt* in local dialects west of Bergen, and pulled up again a few fathoms. This is done in order to control the distance from to the bottom. Then the whole process of jerking, "steinskyt", pulling up again etc. is repeated several times. When fishing like this a sinker of steatite will be exposed to considerable wear and tear at the bottom end when fishing over hard seabed. Particularly cod and haddock is caught with this method.

Ball-shaped sinkers

It has not been possible to find any ethnological evidence that the ball-shaped sinkers have been used as line sinkers. It is primarily the shape that might lead to such a conclusion. According to Helberg, these sinkers may have been used at "juksa"-fishing, but without giving evidence for his interpretation. If the ball-shaped sinkers from Bergen really functioned as line sinkers, they must have been used at various depths.

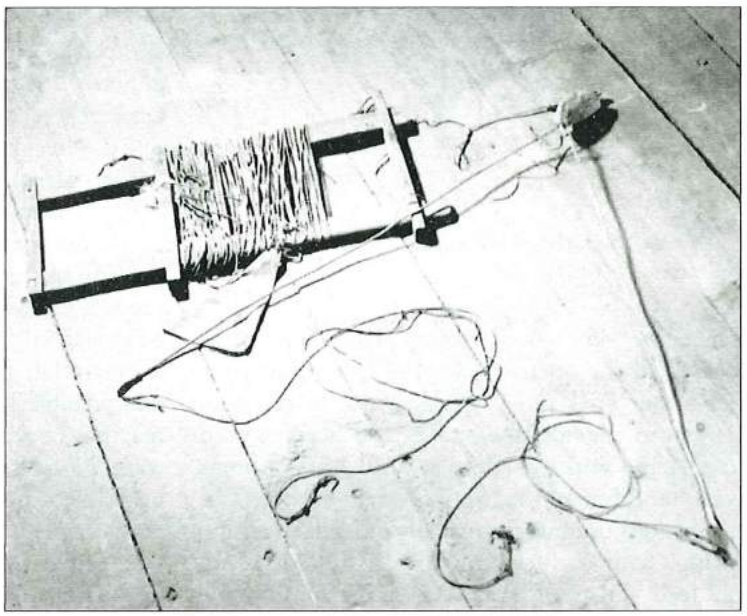


Fig 48 Line sinkers with spreading sticks, Andabeløy nineteenth century (Dannevig and v.d. Eynden 1986)

As Table 7 shows, the weight was concentrated around three clusters: 100–200g, 600–800g and 1800–2000g. They might therefore have been used as line sinkers at c 10 fathoms, c 40 fathoms and c 150 fathoms and deeper.

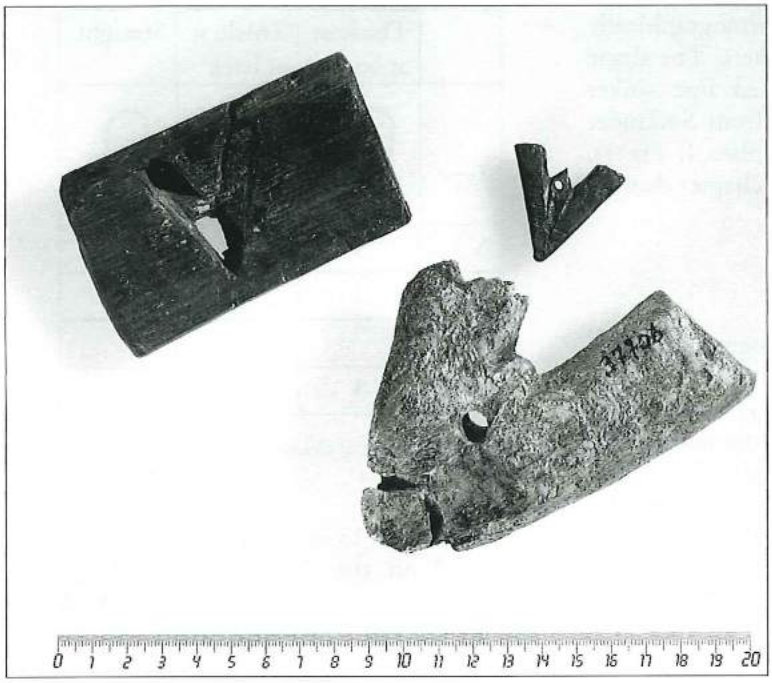


Fig 49 V-shaped line sinkers in soapstone (no. 37706) and lead (no. 18948), wooden mould for V-shaped sinkers in lead (no. 26924)

V-shaped line sinkers

The V-shaped legs of these sinkers made it possible to fish with two hooks, without the risk of getting the hooks entangled in each other or in the line. This was done by inserting long sticks at the end holes of each leg. Line sinkers with spreading sticks were used in the southern part of the country in the nineteenth century, and normally in vertical fishing after a variety of species (Dannevig and v.d. Eynden 1986: 47) (Fig 48).

The V-shaped line sinkers have earlier been interpreted as troll sinkers (Nordgaard 1908: p 97), but I have found no ethnological evidence to support this interpretation. The weight of the V-shaped soapstone line sinker from Bergen is c 400g, implying a fishing depth at c 15 fathoms. The weight also indicates that it has not been used as a troll sinker, since such sinkers probably were considerably lighter. I will return to this issue when the sickle-shaped line sinkers are discussed. The V-shaped lead line sinker and weighed only c 50g, and accordingly must have been used in shallow waters. Judging by the weight it might have functioned as a troll sinker (Fig 49).

Conical line sinkers

The two conical line sinkers may have functioned as line sinkers, although there are some functional elements added to the shape that might imply an alternative use. The line sinker with a hole drilled at the straight end will be discussed in the subchapter "Fishing by piercing", while the function of the sinker with the deep groove on one of the sides is uncertain.

Rectangular line sinker

This line sinker has probably been used in vertical fishing. An angled hole is drilled at the opposite end of the line hold, and a stick might have been inserted through this hole (Fig 50). The stick would then have the same function as sticks used on «jarstein» sinkers. A

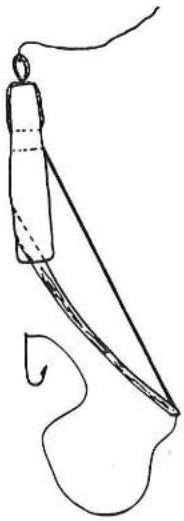


Fig 50 Suggested reconstruction of rectangular line sinker

similar system is documented ethnographically concerning boat-shaped line sinkers. The shape of the rectangular, reconstructed line sinker is very similar to a line sinker from Sørlandet called "revsnøre" (Hjort 1905: plate I, Fig 1). This will be discussed in the subchapter dealing with boat-shaped line sinkers.

Trapezoid line sinkers

I have not found any ethnological material documenting the use of these line sinkers, but the shape indicates vertical fishing. The heaviest sinker of 292g might have been used at 15–20 fathoms, while the others of 9g and 33g would have been used in shallow waters, maybe a river or lake, where lighter equipment is more commonly used.

Semicircle-shaped sinkers

Based on the main shape, the semicircle-shaped sinker might have been used as troll sinkers, net weights or both (Helberg 1993: 179; Sørheim 1997: 111). Nordgaard claims that when the base is thicker than the back, such sinkers have been used for trolling. When the back is thicker than the base, and there is usewear on top of the base, they have most likely been used as net weights (Nordgaard 1908: p 83). If we correlate the distribution of thickness and the weight, we might get closer to an answer of function. Traditionally, the troll sinkers from Northern Norway generally weighed less than 100g (Helberg 1993: 179), while possible troll sinkers from Borgund weighed c 160g in average (Sørheim 1997: 112). When fishing in the coastal area of Hordaland nowadays, light troll sinkers seem to be the most common. Table 13 shows how the thickness is distributed on the three types of semicircle-shaped sinkers, while Table 14 shows the distribution of thickness regarding weight. According to Table 13, there is a slight majority of sinkers where the back is thicker than the base, but due to the low number of objects it is not possible to detect any tendency. As Table 14 shows, there are five sinkers where the base is thicker than the back.

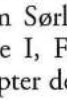
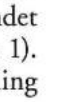
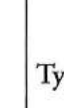
	Thickest at base	Thickest at back	Straight
Type			
A	4	5	1
A1	1		
B		2	
Total	5	7	1

Table 13 Distribution of thickness, semicircle-shaped sinkers, according to types

According to Nordgaard, these types might have been used as troll sinkers. The four heaviest weigh 370g in average, which is very heavy for troll sinkers, compared to the troll sinkers described by Helberg and Sørheim. Thus, it is not possible to accept Nordgaard's criteria for identifying troll sinkers as far as material is concerned. Generally, the weight of the semicircle-shaped sinkers from Bergen is so high that it is doubtful whether they have been used as troll sinkers at all. The straight base of these sinkers would, however, fit neatly to the lead line of fishing nets.

Weight (g.)	100-200	200,01-300	300,01-400	400,01-500	500,01-600	600,01-700	1000-1100	Total
Thickest at base	1		3	1				5
Thickest at back	1			2	1	2	1	7
Straight		1						1
Total	2	1	3	3	1	2	1	13

Table 14 Distribution of thickness, semicircle-shaped sinkers, according to weight

The lightest of these sinkers, 100–500g, would be well suited as net weights, while the heavier ones might have functioned as anchor stones or net weights. I will return to this issue in the discussion on fishing with nets.

A last argument for interpreting these sinkers as net weights is the seven semicircle-shaped sinkers, of type A, found together close to a cliff wall in the island of Risøy (pers. mess. Live Johannessen). The sinkers were discovered during the excavation of the fishing station at Risøy, used in the Iron Age and early Middle Ages. Such a concentration of semicircle-shaped sinkers in a clear fishing context must clearly be interpreted as the remains of a fishing net. It is difficult to understand why troll sinkers should have been gathered like this otherwise.

Sickle-shaped line sinkers

A troll sinker is towed after a boat and needs a shape which enables it to run through the water without rotating. Such a rotation would cause an unwanted twist on the line. The sickle-shaped line sinkers, with a hole at each end and a deep marked back, create a centre of gravity low in the middle of the sinker. When towed, the speed forces the sinker in position with the back down, creating a steady run through the water without rotation (Nordgaard 1908: 83). Saithe, mackerel, salmon and sea trout may be caught when trolling (Halmø 1962: 250). In addition, there are strong traditions of trolling after pollack in the coastal areas west of Bergen.

Nowadays, the sinker is attached about the middle of the fishing line. This could very well have been the way it was done in the Middle Ages, too. Several fathoms further down, below the sinker, the snood and hook with bait would have been attached. Based on the shaping of the line hold the sickle-shaped line sinkers were divided in two main types and five subtypes (cf Fig 21). It has not been possible to give any functional explanation for these variations, with the exception of subtype A2, where the extra hole could have been used for fastening an extra line with snood and hook.

As Table 7 shows (p 37), the sickle-shaped line sinkers have a relatively low weight distribution, from 50 to 400g, with an average weight of c 126g. This weight distribution supports the functional interpretation of these line sinkers as sinkers used for trolling.

Since only two out of 15 were damaged (Table 5), this might also support this interpretation. The troll fishing goes on in the upper sea, and as the sinkers normally have no contact with the seabed, they avoid the wear and tear of the line sinkers used vertically in the sea.

Boat-shaped line sinkers

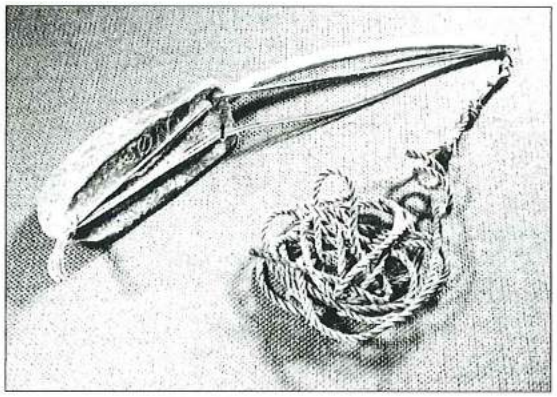


Fig 51 Boat-shaped lead line sinker, eighteenth century, Southern part of Norway (Dannevig and v.d. Eynden 1986: 104)

Three types of boat-shaped line sinkers were identified in the Bergen material. The shape of type A (cf Fig 23) may be explained by an analogy from an eighteenth century line sinker from the southern part of Norway. In the book *Skagerrak – fiskerens historie* (Dannevig and v.d. Eynden 1986) a boat-shaped line sinker made from lead is depicted, apparently with the same kind of holes drilled (Fig 51). Fig 23 shows that type A has one horizontal hole and three vertical holes drilled at the straight end. One of the vertical holes is also conical. It is reasonable to believe that a similar stick was inserted in the horizontal hole on the medieval sinker. In order to avoid breakage, lines ran from the point of the stick through the vertical holes at the end and further up to the line hold where they were fastened, forming a loop where the fishing line was attached. A plug was inserted into the coni-

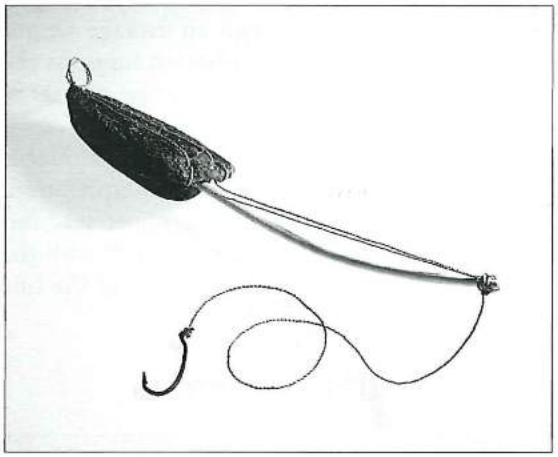


Fig 52 Boat-shaped line sinker from Bergen (no. 55771), reconstructed with hook (no. 41974)

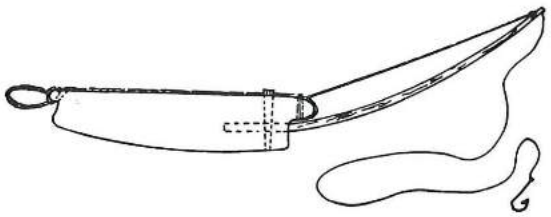


Fig 53 Suggested reconstruction of boat-shaped line sinker type A

cal hole to ensure that the stick did not loosen (Figs 52, 53).

Such line sinkers were described by Hjort as "revsnøre" (Fig 54). Based on the depicted line sinkers in Fig 51 I suggest the following reconstruction of the boat-shaped line sinker, type A from Bergen (Fig 52, 53).

The sinker depicted in Fig 51 is described by the authors as a troll sinker. It is unlikely that the boat-shaped sinker from Bergen has been used for trolling since it is rather heavy. The intact sinker weighed 1157g, while the blank must have weighed more than 1019g. I suggest that type A has been used in a similar way as the line sinker from the west coast of Hordaland. Fishermen from the county used this line sinker type until the middle of the twentieth century. The most common use was for fishing saithe. There are several elements similar to the line sinkers shown in Fig 54, which makes a further connection to the medieval type A plausible. The weight of the

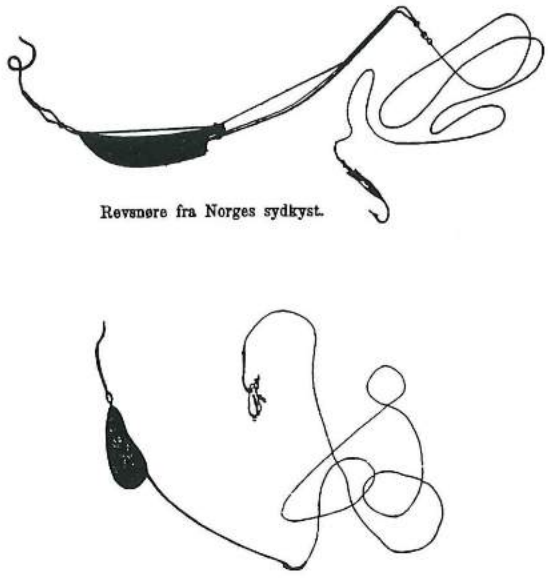


Fig 54 Line sinker ("revsnøre") from Sørlandet, and line sinker from the west coast of Hordaland (Hjort 1905: plate I figs 1 and 2)

type A sinker implies fishing on depths from 60 fathoms (cf Gjessing 1945: 238). This line sinker might have been used at the open sea, in the fjords, or in shallow waters with strong currents.

Boat-shaped line sinkers similar to type B from Bergen (cf Fig 23) have been interpreted by

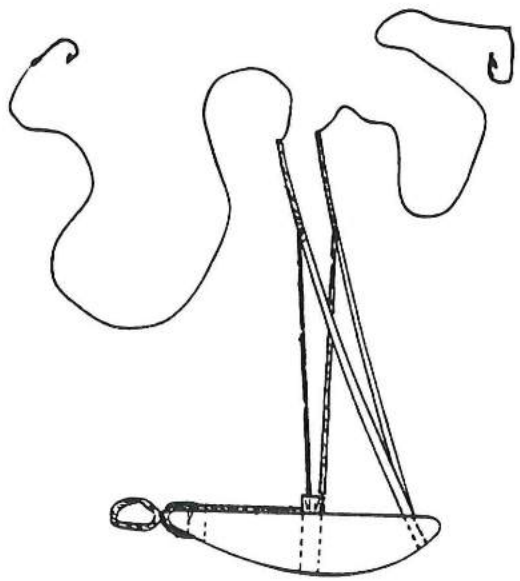


Fig 55 Suggested reconstruction of boat-shaped line sinker, type B

Nordgaard as troll sinkers (Nordgaard 1908: 96). He describes a line sinker from Møgster, Hordaland, where the angled holes at the straight end have been used for inserting two sticks. Based on his interpretation I suggest a reconstruction as shown in Fig 55.

The type B line sinker from Bergen weighs 623g which is heavy for a troll sinker, but the wide boat shape would probably have lifted the sinker high up in the sea when towed.

It has not been possible to find any explanation to the shape of the boat-shaped, type C. The type is neither described in archaeological nor ethnological literature. The weight is 2053g, but it is uncertain whether this is a finished sinker or an unfinished one. If finished it may have been used on depths down to 150 fathoms.

Conclusion:

functional analysis of line sinkers

The functional analysis of the line sinkers has shown that the variety in shape and weight probably represents different fishing techniques, different depths of fishing, different areas of fishing, and that a variety of species were caught. Both vertical fishing and trolling technique have been used when fishing at the open sea and in the fjords. The vertical fishing may have been performed on depths down to 150 fathoms. The light line sinkers indicate fishing in rivers and lakes. The medieval fisherman has been fishing with hand line after saithe, cod, ling, torsk, mackerel, haddock and pollack, and probably a number of other species.

How were the hooks used?

I will now try to correlate the hooks found in Bergen with different fish species and techniques. Among the line sinkers we have noticed a conscious attitude towards the shaping of the equipment. The same attitude has probably been present when shaping the fishing hooks.

Fishing for large saithe, ling and torsk

What kind of fishhooks may have been used when fishing after the large saithe, the ling and torsk at the open sea and in the fjords? As previously discussed, these species may have been fished at depths down to 150 fathoms, with "jarstein" and boat-shaped line sinkers. This type of fishery would require fishhooks with a solid thread, relative large hook height and gap. In addition, a long shank when fishing for ling and torsk would be an advantage. A minimum diameter of 3–4mm of the shank would probably be sufficient, if the hook was properly hardened. In the material from Bergen there are six fishhooks which meet these criteria; three hooks of type C and one of type E, the other two are not identified as types. In addition, there are six hooks with a diameter of 4–7mm of the shank, types A, C and D. This thread thickness could also have been used for such a fishery. A hook height and gap of 30–40mm would be appropriate. The criteria listed are based on the dimensions of modern hooks used for similar purpose. Table 1 shows that types A, C and D have the required gap, and have the 30–40mm hook height as well. A long shank is required when fishing for ling and torsk. Due to their sharp teeth, these fish species could easily tear off the snood if the shank is too short. It is also easier to work with a long-shanked hook when a powerful fish is taken off the hook (Hurum 1976: 81). An appropriate length would be from 60mm. Types A, C and D all have such lengths. Although the fishhook material is small, with only 29 finished hooks, and the rest blanks, we have seen that types A, C and D meet the criteria for the described fishery in the open sea and in the fjords. These three fishhooks have an open hook shape and a straight relation between shank and hook.

Fishing for halibut

In the Bergen material one fishing hook differs clearly from the rest. The hook of type C has a shank, that is 6mm thick and 135mm long. The gap is 64mm and the height of the hook is 65mm. These dimensions imply that the hook has been used for fishing halibut, which is a fish that can reach a considerable size. One of the most sought-after delicacies in the medieval period was made from halibut, *rav* and *rekling* (Kjersgaard 1978: p 65). The fat is concentrated

along the fins, which were cut off together with the rich fat meat close to the fins, and became the product called ON *raf*. The *rekling* was the meat from the back and the belly cut in long strips and wind dried (Grøn 1926: 125). The "rekling" was used particularly during the fast and the halibut was called ON *heilagr fiskr*, holy fish (Kjersgaard 1978: 66). Occasionally, halibut is caught in the fjords around Bergen, but there has generally never been any extensive fishing for halibut in this area. As previously mentioned, oval line sinkers of «jarstein» type G were used for fishing halibut in Sunnmøre until c 1930. Other "jarstein" types might also have been used in the medieval period.

Fishing after smaller fish inshore

All the other fishhooks, with smaller dimensions than those mentioned previously, would be suitable when fishing inshore after smaller fish. A majority of the hooks have a hook-height and gap of 10–20mm (Figs 13, 14). These dimensions make a versatile fishhook, capable of catching a variety of fish species and sizes with different techniques. These fishhooks contrast the larger ones, which seem to have a more specialised "deep sea and large fish" function. The hooks with 10-20mm gap and height dimensions are also in clear majority in the extensive fishhook material from Northern Norway. These smaller fishhooks may probably be associated with the lighter line sinkers, up to 600g. Most of the line sinkers have their weight within this area (cf Table 7). There seems to be a connection between the dominating weight distribution and the dominating fishhook dimensions.

Although the fishhook material from medieval Bergen is rather small, it probably represents different kinds of fishing. There are fishhooks especially designed for catching large fish at the open sea and in the deep fjords, and there are smaller fishhooks made for fishing in shallower waters (both saltwater and freshwater) after a variety of fish species and sizes.

For what kind of fishing were the line runners used?

The line runner's function was primarily to reduce the wear and tear of the fishing line and ease the hauling in of catch. In the Bergen material it was possible to identify a number of variations in shape, divided into 11 types. I will now discuss whether these different types represent different fisheries, by analysing the shaping of the gliding surface and the securing area (cf Fig 29).

The line sinkers from Bergen were either used for vertical fishing or troll fishing. Line runners were not needed when troll fishing. The traditional local fishery in the coastal areas in Hordaland normally took place from small wooden rowing boats equipped with sail. The most common sizes were the *færing* with two pairs of oars and the *seksæring* with three pairs of oars. The "færing" was used for fishing inshore, but could also go approximately one nautical mile out into the open sea, while the "seksæring" was primarily the offshore boat, going approximately two nautical miles out into the open sea, where they fished with hand lines and long lines (Asphaug 1992: p 22). Several boat parts, representing boats of these sizes, have been found in medieval layers at Bryggen (Christensen 1985: 220).

Traditionally, when a person was troll fishing alone in a "færing" he sat on the front thwart and rowed slowly. The fisherman used either one or two troll lines simultaneously. After the line had been sent out in the sea to the required depth, the fisherman tied a loop on each of the lines and hooked this to a finger on his right and left hand. From the fingers the lines went out in the sea, running over the outside of the rear rowlocks (*keip*). Traditionally, the rowlocks were made of oak and functioned as line runners in this situation.

Traditionally, when fishing vertically in the sea, the fisherman is sitting on the thwart with the line runner attached to the gunwale at a c 90° angle to the fishing line, which runs from the fingers. This angle will be visible as traces of wear on the gliding surface. An examination of the line runners from Bergen showed a c 90° direction of the wear grooves for the line runners with preserved use wear, thus indicating that

the line runners were primarily used for vertical fishing.

All the line runner types would probably work well together with the lighter line sinkers. What kind of line runners could have been used together with the heavy line sinkers? As previously discussed, the line runners of North Norwegian type with a rotating roll are missing in the Bergen material. These were the line runners linked to the heavy line sinkers of "jarstein" type. Whether this type of line runner did not exist in Western Norway in the Middle Ages or whether it was used but has not been found in the archaeological record, is uncertain. As an alternative to the line runner with a rotating roll, I have previously discussed the find of a wooden shaft with a rotating roll, which might have been a part of a line runner (Fig 31, type VI). The reconstruction in Fig 32 would have had a rigid construction. The step would secure it properly to the gunwale with support both from the top and side, and probably create the required stability when fishing in deep sea with heavy line sinkers. The construction is, however, not very solid. An alternative interpretation should, therefore, rather be pulley block on horizontal loom, as already suggested.

Which of the line runners with an immovable gliding surface may have been used together with the heavy line sinkers in deep sea? This fishery would require a line runner rigidly mounted on the gunwale. 76% of the line runners had a stepped securing surface creating a strong bond to the gunwale. The widest and deepest traces of wear from fishing line are found on these line runners (up until 4,5mm). A fishing line with a diameter of 4–4,5mm would probably be thick enough to be used together with the heavy "jarstein" sinkers. Type II line runners with stepped securing area has a lighter construction than types IIA–IVB. Type II would probably be unsuitable for such "heavy" fishery. Traces after thicker fishing lines have not been found on this type.

Some of the line runners of types IIA–IVB, with stepped securing area and traces of wear from thick fishing lines, may have been used during the deep-sea fisheries. The suggested line runner (type VI), or the line runners of North Norwegian type, would have been more functional, since the rotating roll would reduce the wear and tear of the fishing line and ease the hauling in of the catch considerably.

The line runners from Bergen with an immovable gliding surface were particularly suited for vertical fishing with lighter sinkers.

Equipment for fishing with hand line

In the following I will divide the different objects used when fishing with hooks into two main areas of use: deep-sea fishery and fishing in shallow waters.

Deep- sea fishery

The line sinkers that have been described so far were used on different depths; from a few fathoms to more than 150 fathoms. In the deep-sea fishery, oval line sinkers of types A–J from 600g and heavier would be suitable. In addition, the heavier ball-shaped line sinkers, and boat-shaped line sinkers type A would work. The fishhooks used in this heavy fishery would need to be solid, with a thread thickness of 3–4mm, a hook-height and gap of 30–40mm and a shank length of 60mm and longer. Hooks of types A, C, and D are particularly represented within these dimensions. Line runners of types IIA–IVB and VI would probably have functioned.

Of the total 83 line sinkers (the semicircle-shaped are no longer included), 46% are suited for deep-sea fishing. The line runners of types IIA–IVB and VI represent 56% of the total line runners, indicating that deep-sea fishing probably was common in the Middle Ages in the area outside Bergen.

Fishing in shallow waters

For fishing in shallow waters all line sinkers with a weight up until c 600g would work; oval line sinkers of types A–A1, E, J–O, all the types of sickle-shaped line sinkers, ball-shaped line sinkers of type A, boat-shaped line sinkers of type B, V-shaped line sinkers, conical, rectangular and trapezoid. The lightest line sinkers may have

worked both in fresh and shallow salt water, especially the trapezoid sinkers weighing only 9 and 33g, combined with fishhooks with dimensions smaller than those described for the hooks used in deep-sea fishing. All the line runners would function in shallow waters for this kind of fishing. As for the sickle-shaped line sinkers no line runner would be needed.

However, line sinkers weighing more than 600g would be required in shallow waters with strong currents. Line sinkers and possible line sinkers for fishing in shallow waters (fresh and salt) represent 54% of the total number in this group. All the line runners would work.

To conclude then: It seems that it was just as common for the medieval fishermen from Bergen to fish in deep sea as in shallow waters.

Fishing with net

As for the fishing with net, different types of floats, possible net weights, marking buoys and fragments of a net have been identified.

On which net types may the floats have been used?

The linking of the identified floats to different types of fishing nets is primarily based on Nordgaard's analysis of fishing nets from the eighteenth and nineteenth centuries. Several of the floats from this material are identical to the floats in the Bergen material.

Floats for herring nets

According to Nordgaard, floats like type I (wood) and type VI (wood and pine bark) were particularly common on herring nets (cf Fig 36). The herring net was a rectangular net set vertically in the sea. The mesh size normally allowed only the head of the herring to penetrate, and the herring would be hooked up by the gill cleft. According to Hans Strøm in *Søndmørs Beskrivelse* (1762), the herring net was the smallest of all the nets. When the fishermen from Øygarden in the nineteenth century went for fishing herring, each man owned and was responsible for three herring nets, which he brought with him. The fishermen joined together, tied their individual nets (Norw. *bolk*) to their partner's net and got a long chain of nets, which they used during the herring season (Asphaug 1992: 41).

On a herring net from Agdenes, dated to 1782, 7–8cm long floats of type I were used, while a herring net dated to 1810, in the Fishery museum in Trondheim, used floats of type VI with pine bark (Nordgaard 1908: 102). The same type, size and raw material as this ethnological material are identified in the medieval material from Bergen. The similarity indicates that the floats of medieval types I and VI could have functioned as herring net floats.

The *Helsingør tingbok* from 1569 contains an illustration showing a herring net with floats and net weights (Vollan 1971: 46). The depicted floats are oblong, and might be of a similar type as type II in the Bergen material (Fig 56).

The herring that seeks out the Norwegian coast in the spawning season belongs to the Atlanto-Scandinavian breed. This breed has been of the greatest importance in the Norwegian herring fisheries throughout the centuries. The herring enters the coast in the early winter and spawns during February–April. The quantity of herring has always varied (Vollan 1971: 9). Vollan divides the medieval herring fisheries in Norway into three main areas: (1) furthest south, the herring fishery at *Viken*, that is the area from Båhuslen to the Oslofjord, (2) the herring fishery in Western Norway, and (3) the herring fishery in Northern Norway (Vollan 1971: 13). The medieval herring fishery in Western Norway was primarily a non-

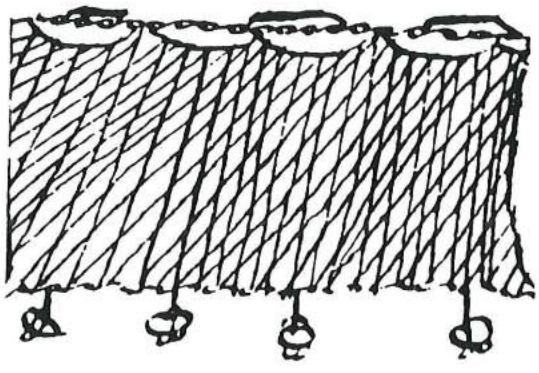


Fig 56 Herring net from Helsingør tingbok, 1569. (Vollan 1971)

commercial fishery basically for private needs, and partly local needs (Nedkvitne 1988: 471).

Herring was also common everyday food for the people in medieval Bergen, according to the representation of herring bones found at the Engelgården site (Hufthammer 1987: 70). At the royal castle at Bergenhus in Bergen fresh herring was served at the end of January in 1517, and in ten weeks 740 barrels of herring were consumed. At the same place 28 barrels of fresh herring was bought in 1522 (Sulebust 1997: 175).

Floats for flounder-nets

According to Nordgaard, floats of type IX have been used on flounder-nets. Traditionally, fishing for flounder has not been of any great importance in the areas around Bergen.

Conclusion floats

Floats of the same types as types I, II, VI and IX in the Bergen material were used on herring- and flounder nets in the eighteenth and nineteenth centuries. These fish species are very difficult to catch with fishhooks. If the medieval floats were used for the same species as in the post-medieval period, the quantity distribution indicates the great importance of herring fishery in Western Norway in the Middle Ages. Floats of types I, II and VI (herring nets) alone represent 74% of the total number of floats, while floats of type IX (flounder nets) represent less than 1%. Some of the other float types would probably work on a herring net, too.

Identification of net weights

Contrary to line sinkers, net weights do not need a hydrodynamic shape. What is required is a hole or groove to attach the weight to the lead line, a rounded shape in order to prevent the weight from getting caught in the meshes, a certain size to prevent the weight from threading itself through the meshes, and finally a certain weight. The weight will vary, depending on the type of net being used. As a basic rule the net weights should not be heavier than what is needed to create a gentle downward stretch in the net. It is first and foremost the anchor stones that secure the nets to the bottom.[11] Nowadays, when fishing in exposed areas, lead line number 4 on bottom nets is used (Skumsvoll 1977: 52). This gives a weight of 12 kg per 100m on the lead line. In less exposed areas lead line number 3 (7 kg per 100m) would be more suitable. Locally, the commonly used bottom net troll garn has an average length of 15 fathoms (28m). If this net should use lead line number 4, the line would not weigh more than three kilos. The modern type of net is normally made of nylon or other synthetic material that does not soak water. The medieval fishing nets were made of organic material that got soaked. When soaked, these nets had an extra weight which helped weighing the net down. This extra weight was probably taken into consideration when the medieval fishermen calculated the required weight on the lead line. When dry a fishing net made of organic fibres would have some buoyancy. Soaking the net in water before use could probably reduce this effect. To some extent adding more net weights or heavier anchor stones could also compensate the buoyancy.

There were several advantages when using light net weights: it was easier to pull the net in and there was less wear and tear when setting and pulling in the net. Light net weights also needed less space and also made the boat lighter, making it easier to row or sail.

Taking these factors into consideration, it would be possible to identify net weights. Weights weighing from 100–500g would probably be suitable as net weights. This weight area would create a functional distance between the net weights and an acceptable weight of the fishing net as a whole. An identification of weights is nevertheless dependent of the archaeological context they were found in. Found in dwelling house contexts they could just as well be interpreted as warp weights, although it was also common to bring the nets home for mending. Tradition-

[11] Local fishermen inform that net weights made of stone or iron rings were preferred to the modern lead line (a plaited hollow line filled with a continuous "necklace" of tiny lead weights). Net weights of stone or iron, tied to the net with a certain distance between each weight, would create a row of "bags" (local dialect *kalvar*) in the fishing net that improved the catching of fish (pers. mess. Atle Langøy).

ally, the fishing nets were kept in the boathouse, with a short distance from boat to storing. The boathouses also had a good draught, which was important as the organic fibres of the nets needed to dry up to prevent rotting.

Identification of net weights

Although a number of weights have been found in the building remains at Bryggen, none of these could be identified as certain net weights. I have already suggested that clusters of light weights may indicate the remains of fishing nets, particularly if these were found in a fishery context (in or near boathouses, near the sea, etc.) During her study of possible warp weights at Bryggen, Ingvild Øye identified several clusters of weights (Øye 1988: 65). None of these clusters displayed the weight distribution I have suggested for identifying net weights. The same situation applies to the minor excavations in Bergen. I have, therefore, not been able to identify weights which have positively been used on fishing nets, with the exception of the semicircle-shaped sinkers. The lighter weights, found together with the heavier, may at least temporarily have been used on fishing nets. Otherwise, it seems strange that 330 floats have been identified, and no net weights. As the floats were made of organic material one would assume that more net weights than floats would have been preserved.

Correlating the finds frequency of weights and floats may be useful for determining whether weights within a period could have been used together with contemporary floats (Table 15). As shown in the table, there is a certain concurrence in the frequency of finds, from period 2 until the end of period 4 (c 1120–1248). This could indicate that some of the weights in these periods may have been used as net weights. While the highest number of floats within a period was found in period 4 (1198–1248), the highest number of weights occurred in period 5 (1248–1332). A pronounced reduction in quantity is clearly visible for both artefact groups in periods 7 and 8. It is tempting to conclude that *several* of the weights found, particularly in the earliest periods (2–4), must have been used as net weights. This does not exclude that they may also have been used as warp weights in the same period.

Marking buoys for fishing nets

Based on the size and shape of the three possible marking buoys it is very likely that these were made to mark the spot where the fishing net was set. The shape gives no clue as to what kind of nets they might have been used on.

Period	Dating	N 25 50 75 100 125 150 175	N Weights	Floats
8	1702-1476		12	2
7	1476-1413		24	2
6	1413-1332		87	43
5	1332-1248		176	61
4	1248-1198		142	83
3	1198-1170		147	70
2	Before 1170		54	23
		Total:	642	284

Table 15 The finds frequency between weights and floats found at the Bryggen excavations

Possible net for catching whale

One of the net fragments of lime bast was made of 20mm rope. This might be the remains of a strong net used when whaling in narrow bays. In the late medieval period (and probably earlier) nets and ropes made of lime bast were used to close off narrow bays after whales had been chased in. The net and rope could be 50m long. The net was made of rope thick as a finger, and the mesh size was 30cm (Stoltz 1957: 148). The net might consist of several parts where each man owned one part. The individual parts were then joined together at the spot, as the system used in Øygarden in the nineteenth century. This was a way for fishermen to finance a whole net by cooperation. An alternative method was to rent nets. One of the partners in a larger investment in Tælavåg, in the present municipality of Sund in Hordaland, was the governor of Bergenhus castle, Vincens Lunge. In 1520, he received a part of the whale catch, and a barrel of butter for each whale as payment for renting out net and rope to the whalers (*ibid*).

Summary

Based on ethnological material, 73% of the floats may be connected to the herring fishery. One type of floats may also have been used on flounder nets. The floats would also have functioned when fishing for other fish species, but this cannot be confirmed in the ethnological material. Fragments of a lime bast net may be connected to whaling.

Fishing by piercing

In chapter 3, two ways of piercing fish was suggested: piercing with fishing spear and plummet. How was this fishery carried out?

Fishing with spear

In Norway, fishing with spear seems first and foremost to have taken place when catching salmon in the rivers. Normally, this fishery was carried out after dark. In the light from a torch or a light basket the salmon backs were visible on the shallow banks of the river (Molaug 1956: 101). In the Middle Ages, salmon may have swimmed up several of the rivers in the outskirts of Bergen: North of the town ran *Gunildarå* (Munkebotnvassdraget or Stormølleelven) and *Mulelven*, while the *Alrekstadelven* ran straight south of the town. Salmon might have been speared here when going up to spawn.

Fishing with plummet

The plummet was common when fishing small halibut and flounder. The plummet was attached to a line and lowered down into the sea. Under the weight one or several barbed points was mounted. The visibility in the sea limited the use of the plummet. The fish was easily seen when it was lying on a sandy seabed. Normally, there were two in the boat; one person manoeuvring and the other lying over the gunwale staring at the seabed for fish. When a fish was spotted the boat was held in position. The plummet was then lowered down in the sea until it was right above the fish, and then sent rapidly down penetrating the fish. The barb prevented the fish from escaping and the catch was hauled in (Asphaug 1992: 52). In addition to the barbed point (cf Fig 43), the conical sinker with a hole at the end (cf Fig 25) could have functioned as a plummet for smaller fish. Beside the opening of this hole a groove has been made, probably to force in a wedge, which would secure the barbed point.

Summing up: the functional analysis

By using ethnological material comparatively it has been possible to propose a functional interpretation on a number of the medieval fishing equipment found in Bergen. Fishing with hand line could have taken place at the open sea and in the fjords, down to 150 fathoms. Varied fishing in shallower waters was also carried out, primarily in salt water but probably also in fresh water. The medieval fisherman used a variety of techniques when fishing with hand line: troll fishing, fishing up in the sea vertically (*harping* or *juksafiske*) and fishing straight over the sea bed (*pilking*). Herring was probably the most important fish species caught in nets, but other species, such as flounder, were also caught. The particularly thick net found might be the remains of a net used when hunting whale. The medieval fisherman also used fish traps, he speared fish and pierced flounder and halibut on sandy seabeds with a plummet.

5 THE DISTRIBUTION OF MEDIEVAL FISHING TACKLE IN BERGEN IN TIME AND SPACE

Where is the fishing tackle in Bergen located? Were there areas in the town related more strongly to fishing activities than others? And, how is fishing tackle distributed throughout the different medieval periods? These questions will be illuminated in this chapter. A discussion on the spatial distribution will be approached from a macro perspective, with the medieval town as a unit. The main aim is to identify *zones* in Bergen linked to fishery related activities. Due to the find circumstances it is difficult to link the fishing tackle directly to building remains. The term *fishery related activities* includes all activities that can be linked to fishing, directly or indirectly, including the storing, the production and maintenance of fishing equipment. These zones may not necessarily be identical with the dwelling area of the fishermen.

The Urban Code of Bergen contains rules regulating the fish trade. Salmon, other fresh fish, and oyster were to be sold from boat or jetty down at the bay of Vågen, and should not be taken up in the booths (*Bl VII*, 23). In principle, the whole seafront should then be viewed as a zone where trading with fresh fish could take place. If possible, jetty constructions will, therefore, be linked to fishing equipment. Most of the fresh fish trade probably took place near the jetties.

What areas in Bergen can be connected with medieval fishing activities?

I will now examine whether there existed certain areas in the town where fishing-related activities were carried out, and what kind of fishing tackle was found in the different areas. Can changes be observed through the periods?

The areas in Bergen where fishing equipment was found close to the sea will be described as possible *fishing-related zones*. These zones will be placed within already identified socio-economic areas in medieval Bergen. When connecting the fishing tackle to the different areas in the town, one might get a more compound picture of the changing socio-economic character of Bergen throughout the medieval period.

Bergen in the high Middle Ages (1150-1350) consisted of five main areas: *Holmen*, the residential areas at *Bryggen*, *Øvrestretet*, *Vågsbunnen* and *Strandsiden* (Helle 1982: pp 228). These socio-economic zones structured the town, and each zone seems to have had its main function (Øye 1999: pp 548). In order to locate the finds of fishing equipment within larger social and economical contexts, this spatial division into zones will be used as an analytical tool. Hopefully, this material will throw some new light on activities within the different areas of the medieval town.

Holmen

In the medieval period Holmen was the name of the area where Bergenhus castle is situated today. As a royal and ecclesiastic centre in the Middle Ages, it made a marked distinction to the rest of the town. Only four objects of fishing equipment have been recorded in this area: one trapezoid line sinker, one pointed oval line sinker (type M), one fragment of a «jarstein» blank (type B) and one float (type VI), none of which were datable.

Being the resort for the secular and clerical aristocracy and their households the population at Holmen would basically have been consumers of food, not producers. In such an environment one would not expect to find fishing equipment. Since the fishing equipment cannot be dated, its connection with *medieval* Holmen is uncertain. Generally, there have been few archaeological excavations in the Holmen area, and the sites have not been excavated stratigraphically.

Bryggen

The Bryggen area occupied the eastern shore of the harbour bay of Vågen, demarcated to the northwest by the Holmen area, and to the

southeast by Autaalmenningen (Vetrlidsallmenningen) (Helle 1982: 228). Within this area, there were at least 31 medieval tenements, known from written sources (*ibid:* 246). Several archaeological excavations have been carried out in this area, with the Bryggen excavations as the most extensive. The comprehensive archaeological material confirms the impression of a busy commercial area. The whole medieval town east of Vågen seems to have been shaped from the needs of trade and shipping (Øye 1999: pp. 548). In addition of being a commercial centre, it was also a habitation area where people lived in the tenements throughout the whole medieval period (Helle 1982: 218).

Within the Bryggen area there are altogether eight sites containing datable fishing tackle. These sites will have the strongest focus in the further discussion. Furthermore, there are four sites containing fishing equipment without datable contexts. These artefacts can only be used as indicators of fishery related activities at some point of time. This material will only be presented in the appendix, together with the rest of the analysed material. The same procedure will basically be followed for the rest of the sites without datable material. In my further analysis, 471 objects related to fishing will serve as sources, of which 447 (95%) are datable. I regard this material as representative since most of the types previously described are present in this selection.

Fishing tackle on Bryggen (BRM 0) (The northern Bryggen area)

As discussed in chapter 2, the spatial distribution of fishing equipment at Bryggen is not quite representative for all the periods, since it was not dug from top to bottom all over the site. Some parts of the area were removed by machine down to fire level V (1248), while the rest of the area was excavated from top to bottom. Methodically, I could have chosen to analyse only the parts of the material with a complete time scale, but I choose to include the whole area in my analysis. Later I will discuss, and if necessary state reservations, regarding representativity.

Being the most extensive archaeological site in Bergen, the Bryggen excavations comprise 72% of the material discussed in this paper, including 389 dated and 12 not datable objects. The material represents 85% of the total material from the whole Bryggen area. Only eight artefacts (2%) have been found in fire layers within building remains. These are interpreted as *in situ* findings in fire layers (0–5cm from the identified fire layer). The buildings where the artefacts were found might directly represent an environment linked to fishery. The distribution of these few objects alone will not, however, give a representative picture of the localisation of the environment linked to fishery activities at Bryggen.

Instead of focusing on building constructions alone, I prefer to concentrate on where the artefacts were distributed in filler layers or waste layers at Bryggen in the different periods. None the less, *in situ* findings will be mentioned separately. One could argue that the alteration of the fillers within the periods makes such a method uncertain. New research of the waste disposal practices at Bryggen implies a modification of this view. The premise, which is the foundation for an identification of a fishery related zone at Bryggen, is that the artefacts found in the early periods at Bryggen may actually have had a delimited distribution in space. According to Bård Gram Økland's study (1998) there was a marked drop in the accumulation of waste in the Gullskoen and Bugården areas in periods 7 (1413–1476) and 8 (1476–1702). The reduction indicates that waste was removed from the area and dumped elsewhere. Prior to these periods, however, waste basically seems to have been dumped in the vicinity of where it was used and produced.

This might indicate that the waste within the tenements at Bryggen, at least for periods 2–6 (from c 1120 to 1413), may be linked to the areas closest to the waste. Consequently, the fishing tackle may be linked to an environment even if they are not found *in situ* in buildings. A possible source of error occurs due to the fact that some re-deposition of waste went on even in the earlier periods, for instance the depositions into the Vågen harbour. The following maps describe the spatial distribution of the fishing tackle and

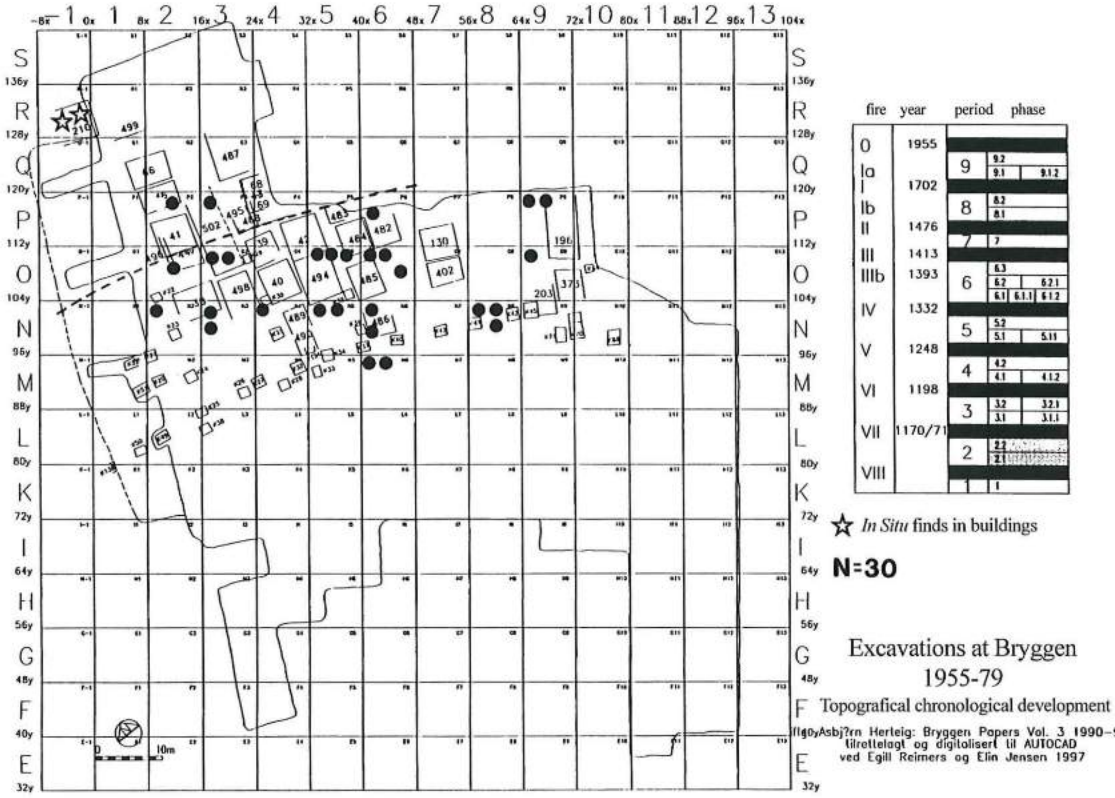


Fig 57 Distribution map, Bryggen (BRM 0), period 2 (c 1120–1170/71). The dashed line indicates the northern extension of the fishing-related zone

fishing-related objects found at Bryggen through seven periods, starting in period 2. There are no finds from the earliest period, period 1, but as previously mentioned, there is a certain lag in time, since the objects finally ended up in fill masses as waste or more likely lost objects.

Period 2 (c 1120–1170/71)

From period 2, which according to the established chronology at Bryggen and new dendrochronological dating starts c 1120 and ends with the fire in 1170/71, 30 artefacts are identified as fishing tackle, representing 8% of the dated fishing tackle from the Bryggen excavations. Of these 23 artefacts relate to fishing with net, and the rest to fishing with hooks. Within the group fishing with hooks, *line sinkers of "jarstein" type*: of types A, C, and J, *sickle-shaped line sinker* of type B1, and *line runners* of types II, III and IVA are represented. In the group fishing with nets we find *floats*: types I, II, IV and VII.

Two line sinkers of «jarstein» type (types A and C) were found *in situ* in building 210 (grid R-1) (Fig 57). This building was furthest away from the harbour of all the identified buildings and constructions, located north of the St' Lawrence church (Herteig 1991: 89), a distance of 50–60 meters from the outermost caissons. Handlines with sinkers were not particularly heavy and could easily have been taken home for repair or storing. This might explain the finding of "jarstein" sinkers in a building outside the nearest fishery zone. Whether the building has been used as a dwelling is uncertain, as no fireplace was found inside. The rest of the fishing equipment from period 2 was found in fill masses.

In periods the waste may have been disposed close to where the people lived and worked. If this is the case, the overall distribution of fish-

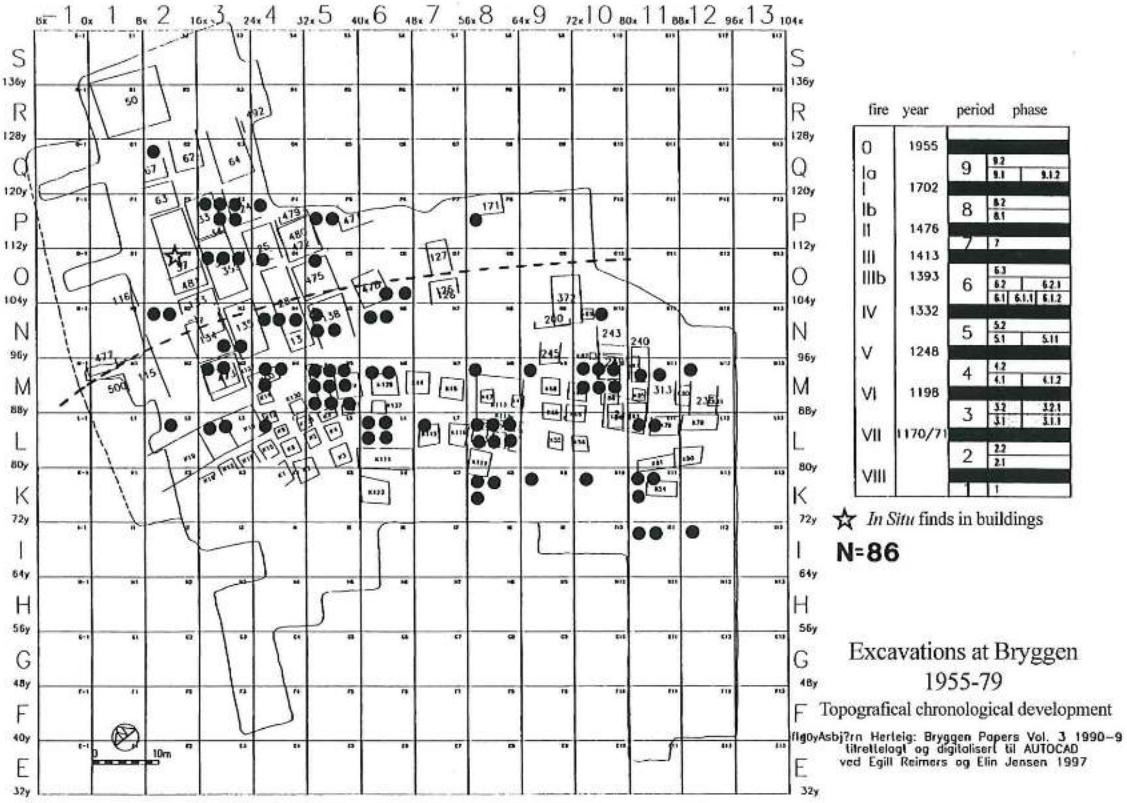


Fig 58 Distribution map, Bryggen (BRM 0), period 3, c 1170/71–1198. The dashed line indicates the northern extension of the fishing-related zone

ing tackle indicates that 90% of the objects were located within a zone of approximately 30 metres in width, measured from the outermost caissons and inwards in a northerly direction (Fig 57). This area can therefore be characterised as a possible *fishing-related zone*. Within this area we find caissons; i e stone-filled timber constructions which functioned as foundations for buildings, quays, jetties etc. Buildings also were located within this zone.

Period 3 (1170/71–1198)

The distribution map (Fig 58) demonstrates that the amount of fishing tackle increased considerably: It comprises 86 objects, or 21% of the dated fishing tackle, from Bryggen. Within the group fishing with hooks, there are *line sinkers of "jarstein" type* of types C, E, J, a *boat-shaped line sinker* of type A, a *sickle-shaped line sinker* of type A, and *line runners* of types II, III, IV, V and VA. Within the group fishing with nets there are *floats* of types I, II, IV, V, VI, VII, VIII and IX, *semicircular sinkers* of type B, and a *marking buoy* and a possible *net for catching whale.*

This period is short, only 28 years, providing 31 finds for each decade. A single type I float was found *in situ* in building 37 (grids P2 and O2), belonging to the Gullskoen tenement. There were no indications of dwelling functions. *In situ* finds of possible warp weights and a spindle-whorl indicate that textile production was carried out and probably also fishing-related activities.

About 65% of the fishing equipment was found in the fishing-related zone. In this period the zone mainly consisted of caissons, linking it to the harbour and the sea, with a clear fishing-related identity. The zone had now extended further out in the Vågen harbour, compared to the previous period. Most of the fishing tackle was found in fill-layers. In addition to the concentration of fishing equipment, there are quite a few

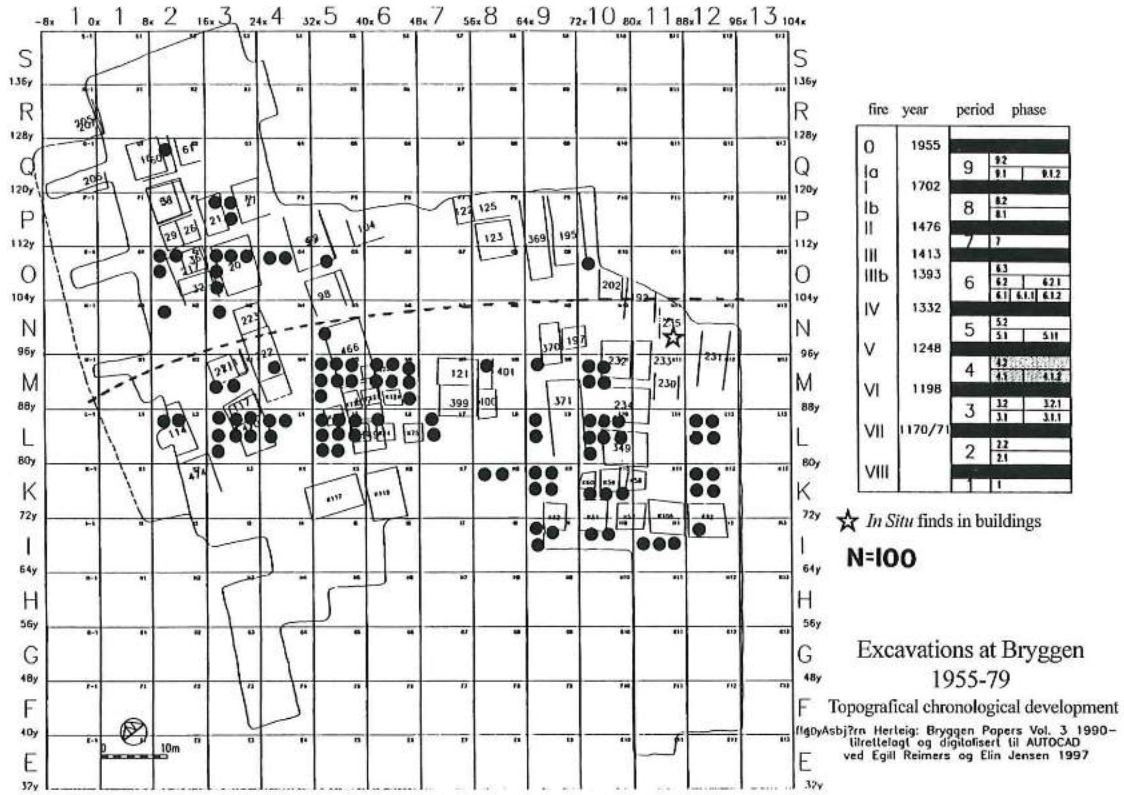


Fig 59 Distribution map, Bryggen (BRM 0), period 4, 1198–1248. The dashed line indicates the northern extension of the fishing-related zone

fishing-related artefacts in an area which is partly located within the fishing-related zone and partly outside. The area is limited by the excavated grids P3 at north, L3 at west, O6 at east and L6 at south. The northern part of this area consisted mainly of building constructions. More than half of the fishing tackle (55%) from Bryggen was found within this area. This concentration of objects in period 3, modifies the pattern of a fishing-related zone strictly restricted to the area closest to the harbour. Buildings further away from the harbour may also have been used for storing fishing tackle, although only building no. 37 can possibly be linked to such a function.

The majority of the fishing equipment is, however, found in general fill-layers and in other waste, indicating that fishing tackle was transported to the building area and cannot necessarily be associated to the actual building, and may have been used some other place. This situation also counts for the rest of the periods. Økland's study does, however, suggest a short distance between the place of use, production and waste.

Period 4 (1198–1248)

The number of fishing tackle increases in period 4. More than one fourth, 25% (N=99), of the dated fishing equipment found at Bryggen belongs to this period. Nonetheless, period 4 displays a reduction in fishing tackle compared to the previous period when the length of the period is considered. The number of objects per decade is now reduced to 25.

The group fishing with hooks contain fishhooks of types C and D, line sinkers of «jarstein» type of type B and an uncertain type, V-shaped line sinker in lead, and line runners of types II, III, IV. In the group fishing with nets there are

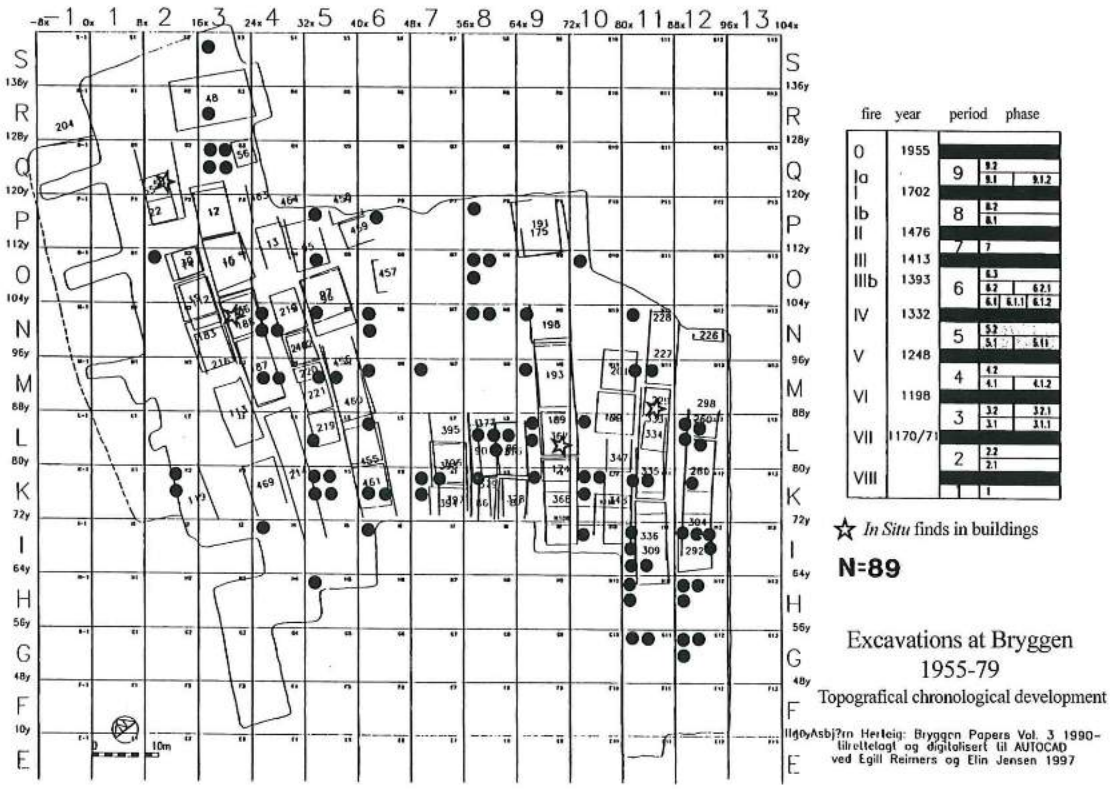


Fig 60 Distribution map, Bryggen (BRM 0), period 5, 1248–1332

floats of types I, II, III, IV, VI, VII and a tie on label. Three of the fish traps were also from this period.

One float was found *in situ* in building 235 in the Bugården tenement (grid N11). Only a few constructional elements remained of the building and its function is unknown (Herteig 1989: 50). The distribution map demonstrates a marked concentration of fishing tackle down towards the Vågen harbour (Fig 59). 80% of the fishing equipment is located within the fishing-related zone, which has now moved further south into the Vågen harbour compared to the previous period. The zone now consisted mainly of caissons and buildings. Within this zone two concentrations of fishing tackle have been recorded. The first was located in the front of the Gullskoen tenement, and the second in front of the Engelgården tenement. Both concentrations consisted mainly of floats, in addition to a few objects used for fishing with hand line. A small concentration of floats was also found in front of the Bugården tenement. In grid I 11, three fish traps were found *in situ*, all containing fishbones. In the area of the Søstergården tenement, fishing equipment was completely absent. As for the previous periods, most of the fishing tackle was found in fill-layers.

Period 5 (1248–1332)

Period 5 contains 22% (N=89) of the dated fishing equipment from he Bryggen excavations. Lasting 84 years it represents one of the longer archaeological periods. About 11 objects per decade is a marked reduction in quantity compared to the previous periods.

In the group fishing with hooks there are *fishing hooks* of type D, a *line sinker of «jarstein» type* of type J, a *pointed-oval line sinker* of type N,

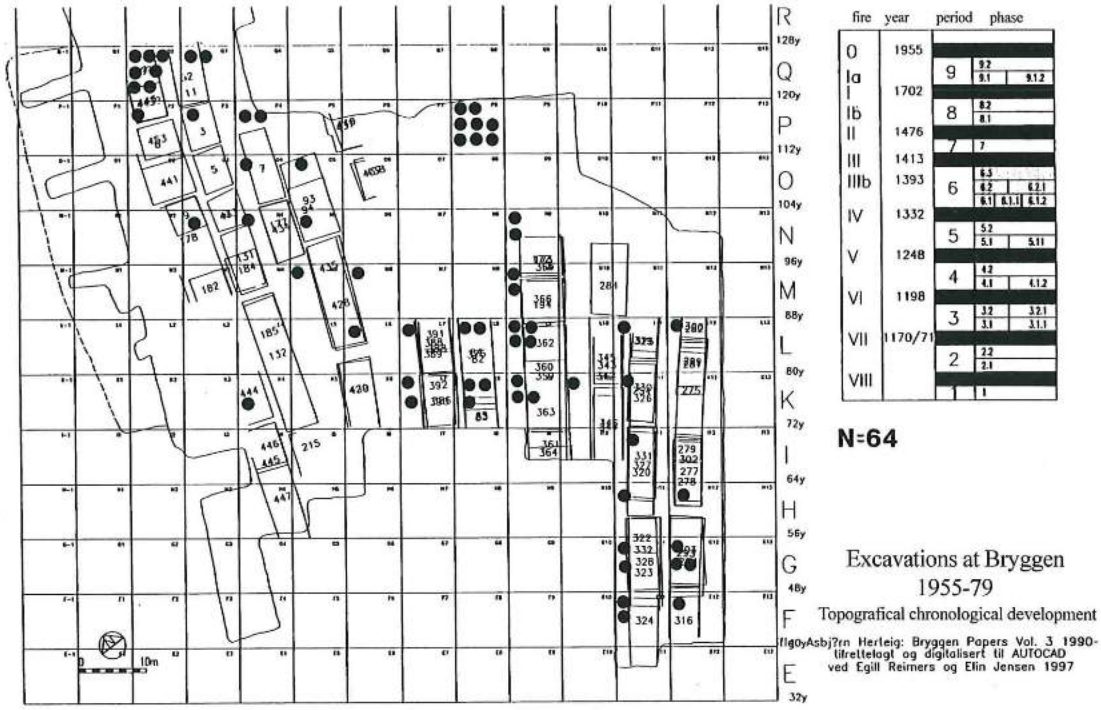


Fig 61 Distribution map, Bryggen (BRM 0), period 6, 1332–1413

a *ball-shaped sinker* of type B, *sickle-shaped line sinker* of types A, A2, B, a *boat-shaped line sinker* of type A, and *line runners* of types I, II, IIA, IV, IVB, V VI. In the group fishing with net there are *floats* of types I, II, III, IV, V, VI, VII, VIII, IX, *semicircular sinkers* of types A, A1, B and a *netting-needle.* In the group piercing fish a *conical sinker* with a hole at the end might have functioned as a plummet. A fish trap was also found.

Although there is a reduction in quantity of fishing equipment found per decade, period 5 represents the most varied selection of fishing equipment of all periods, with all four groups of fishing techniques present.

Four objects were found *in situ* in identified buildings: buildings 54, 186, 333 and 367 (Fig 60). One semicircular-shaped sinker of type A was found in building 54 in the Gullskoen tenement, where the remains of floorboards and a possible destroyed fireplace have been identified, indicating its function as a dwelling (Herteig 1991: 46). In building 186 in the Gullskoen tenement, a float of type IX was found *in situ*, and another float of type I was found *in situ* in building 333, belonging to the Bugården tenement. There were no structures in the building, measuring c 16,5m, that might indicate a dwelling function. One fishing hook of type D was also found *in situ* in building 367 in the Engelgården tenement. This building measured 6,7 x 5,9 square meters.

The main impression of the spatial distribution of fishing equipment in period 5 is that the fishing tackle appears more sporadically than in the previous periods. A fishing-related zone is no longer clear, due to the repeatedly filling out in the harbour, and the zone disappears beyond the excavated area. This may also help to explain the dispersed distribution and the reduced number of fishing equipment.

As far as the Gullskoen tenement is concerned, it is not possible to identify the front of this building complex in this period. The profile through the Bugården south tenement shows nonetheless caissons in front of a building (Herteig 1990: plate 1). The relation between these two areas in-

dicates that the whole Gullskoen tenement now would be lying outside a possible fishing-related zone, while the Bugården tenement might still be lying within. There are no marked concentrations of fishing tackle to be found in Bugården. Only a few fishing tools were found in the more inward lying area in the fishing-related zone, but no major concentrations.

Period 6 (1332–1413)

Period 6 lasts for 81 years and shows an even stronger reduction in fishing equipment than the previous periods. 16% of such objects (N=64) relates to period 6) and when the length of the period is taken into consideration – 8 objects per decade (Fig 61).

In the group fishing with hooks there are a *fishing hook* of type C, a *line sinker of "jarstein" type* of type A, *blanks of "jarstein" sinkers* of uncertain type, an *oval line sinker* of type K, a *sickle-shaped line sinker* of type A4, and a *mould for V-shaped line sinker in lead.* In the group fishing with net there are *floats* of types I, II, III, IV, VI, VII and VIII, a *marking buoy,* and a *semicircular sinker* of type A. In the group spearing fish there is a barbed point that may belong to a *plummet.*

No piece of fishing tackle was found *in situ* in buildings from this period. As for the Bugården tenement phase 6.2, the caissons at the front are found between grids G and F, while the caissons at the front in phase 6.3 disappear outside the excavated area (Herteig 1990: plate 1). There are no marked concentrations of fishing tackle in the Bugården tenement, but two concentrations north/northeast of the tenement were found. In grids Q2 and Q3, a concentration of seven floats, type I, and three semicircular sinkers of types A and A1 were found. In grid P8, 8 floats of type I were discovered. The significance of these concentrations is uncertain, but both concentrations were located relatively far away from the quay front. This might perhaps indicate that buildings further back were also used for storing fishing equipment.

Period 7 (1413–1476)

In the fifteenth century there was an even stronger drop in the number of fishing tackle in the archaeological record. Only 3% (N=10) of the total number of fishing tackle from the Bryggen excavations was found in this 63 year long period, giving less than two objects per decade.

In the group fishing with hooks there is a *fishhook* of type E, *a "jarstein" blank* of uncertain type, an *oval line sinker* of type K, a *line sickle-shaped sinker* of type A, a *conical sinker with V-shaped groove,* a *V-shaped line sinker in steatite,* and a *bobbin.* In the group fishing with net there are *floats* of type VI. In the group spearing fish a *fish spear* was also found.

The fishing-related zone was now moved further south and out in the Vågen harbour and is no longer detectable. No objects were found *in situ* in buildings.

Period 8 (1476–1702)

Period 8, which lasts 226 years, has only 1% (N=5) of the dated fishing equipment from the Bryggen excavations. The number of fishing tackle confirms the strong tendency of a drop in the frequency of finds in the later periods, this is particularly significant from period 7. Consequently, a fishing-related zone has no longer relevance.

In the group fishing with hooks there are one *fishing hook* of uncertain type and a *line sinker of "jarstein" type*: type A. In the group fishing with net there are *floats*: types I and IV, and a *netting needle.*

In period 9 (1702-1955) only a ball-shaped sinker of type A has been found.

Fishing tackle at Dreggsallmenningen, BRM 83 (the northern Bryggen area)

The 288m² site (Hansen 1994: 52) lies as a narrow south-western extension of the western corner of the Bryggen site (BRM 0) (Long and Marstrander 1980). I have identified 19 fishing-related artefacts from this site (3% of the total number of fishing equipment from Bergen), of which fifteen can be dated:

Period 1198–1248:

fishing with hooks:

line runner, type I,

fishing with net:

float, types II and VI.

Period 1248–1332:

fishing with hooks:

"jarstein" type line sinker,

uncertain type,

line runner, type IV,

fishing with net:

float, types I and VI.

Period 1332–1413:

fishing with net:

float, type VI.

Period 1413–1476:

fishing with net:

float, type VI.

The site is located close to the Vågen harbour, and caissons and jetties dominate most of the building phases (Long and Marstrander 1980: pp 22). The fishing-related zone identified at the Bryggen site could be extended to Dreggsallmenningen, although the number of fishing tackle is relatively low. 93% of the fishing equipment has been found within the same periods as most of the fishing tackle from Bryggen; period 4 (1198–1248) to period 6 (1332–1413). No fishing tackle was found *in situ* in buildings. All fishing equipment with an identifiable spatial distribution (93%) was found in caissons.

Fishing tackle at Dreggsallmenningen 14–16, BRM 237 (the northern Bryggen area).

The site has been excavated in two steps, in 1986 c 550m² was dug and in 1991 c 80m² (Golembnik 1990; 1994).

A total of 11 fishing-related artefacts were identified at Dreggsallmenningen 14–16, representing 2% of the identified fishing tackle from Bergen. Nine were datable:

First half of the 12th century:

fishing with hooks:

sickle-shaped line sinker, type A3.

The end of the 12th century:

fishing with hooks:

fishhook, type D.

1200–1248:

fishing with hooks:

pointed oval line sinker (blank),

trapezoid line sinker (steatite).

1248–1332:

fishing with hooks:

trapezoid line sinker (lead).

1332–1413:

fishing with hooks:

fishhook, uncertain type.

Second half of the 14th century or first half of the 15th century:

fishing with hooks:

line sinker «jarstein» type (blank).

After 1536/37 (post-medieval):

fishing with hooks:

fishhook, type A and an uncertain type.

The excavation revealed one of the earliest dated fishing equipment from the medieval period in Bergen: A sickle-shaped line sinker type A3, dated to the first half of the twelfth century. The fishing equipment is otherwise spread throughout the medieval period without any marked accumulation.

No objects were found *in situ* in buildings, but the sickle-shaped line sinker was discovered in the earliest construction at the site (no. 158), a burnt timber construction (Golembnik 1994: 8). Four other artefacts were found in primary-and secondary relation to building foundations. No functional or structural elements such as jetties or caissons could link these constructions directly to a fishing-related zone although the distance to the sea was short. Whether the Veisan area (Fig 1) was deep enough for smaller boats in the twelfth century is uncertain.

Fishing tackle at Kroken 3, BRM 223 (the northern Bryggen area)

The site measured only 10–20m² (Dunlop 1985). A fishhook dated to c 1400–1590/1600 has been found. No building constructions were identified in this phase. Kroken 3 was an open site and may have been used for disposal of waste. From c 1400 until the end of the sixteenth century, this area was unpopulated (Dunlop 1985: 59). The fishhook may therefore have been dumped here together with other waste. The topographic location confirms the impression of a land-oriented area. About 1190 Kroken was situated c 130 metres from the quay front at Vågen.[12]

The excavated sites in the Bryggen area described until now are all located in the northwestern part of the Bryggen area. Southeast of this area there are two sites in the middle Bryggen area: Stallen/Svensgården (BRM 90) and Rosenkrantzgate 4 (BRM 76). Fishing tackle from this central part of the medieval town can give information as to whether fishing-related activities were carried out here during the medieval period.

Fishing tackle at Stallen/ Svensgården, BRM 90 (the middle Bryggen area)

The site covered 75m² (Christensson *et al* 1982). One float (type VI) and a semicircular sinker (type VI) have been identified. The float was dated to phase 7 (1225/30–1248), the sinker to phase 5, the start of the fourteenth century – 1393/1413. None of the objects were found *in situ*. In the last decades of the twelfth century the area must have been close to the quay front at the Vågen harbour (*ibid:* 46), and may have belonged to the fishing-related zone. The low number of fishing equipment found, may be explained by the size of the site and the mortar production in the high Middle Ages.

Fishing tackle at Rosenkrantzgate 4, BRM 76 (the middle Bryggen area)

Rosenkrantzgate 4 was excavated in 1978–79 and in 1981. The total excavated area covered 450m² (Hansen 1994: 51).

Altogether 27 fishing-related artefacts were found at the site, which is 5% of the total found in Bergen, and 6% of the fishing tackle found at the Bryggen area both dated and undated:

c 1190:

Fishing with hooks:

pointed oval- or sickle-shaped line sinker (blank).

Fishing with net:

float types I and VI.

1198–1248:

Fishing with hooks:

line runner, type II, *ball-shaped sinker*, type B.

Fishing with net:

float, types VI, IV and V, *semicircular sinker*, type A.

1248–1413:

Fishing with hooks:

oval line sinker, "jarstein", types A,

[12] The distance measured is based on Gitte Hansen's marking of the 0-contour line in her cartography description of the residential topography c 1190 (Hansen 1994).

H and I, "jarstein" blank.

Fishing with net:

float, types I and VI, *marking buoy*.

1413–1476:

Fishing with net:

float, type VI, *semicircular sinker*, type A.

The temporal distribution of fishing equipment resembles the Bryggen excavations, concentrated to the late twelfth until the second half of the fifteenth century. Basically, the same type of fishing equipment is found at both sites. Line runner type II and floats of types I and II have been identified and dated from the end of the twelfth century towards the middle of the thirteenth century at both sites. These types turn up earlier in the northern Bryggen area. In the period 1248–1413, "jarstein"line sinkers of type A are identified in both areas, while only the middle area is represented with types H and I. Float type I is known from the northern Bryggen area in the same period. In the period 1413–1476, float type VI is identified in both areas. As the two sites differ in size, it is difficult to ascertain whether the middle Bryggen area had a less varied composition of fishing tackle than the northern Bryggen area.

Two of the artefacts were found *in situ* in buildings. In phase 3 (1198–1248), a float type VI was found *in situ* in building no. 13, erected on caissons. Wall-beams were still intact in the northwestern corner, and a latrine was found to the south. A line sinker of "jarstein" type H, dated to late 1300–1476 was found *in situ* in building no. 36. The discovery of a possible baking oven (Ekroll 1981: 12) indicates that the house was used for baking bread. Consequently, linking the "jarstein" sinker to the building is difficult. The site is located close to Vågen harbour, and caissons have been identified in several phases. The fishing tackle and the sea-oriented location, are arguments for extending the fishing-related zone to the middle Bryggen area.

In the southern part of the Bryggen area, close to the Autaallmenningen, demarcating the southern end of the Bryggen area, two sites with identified fishing equipment have been excavated, Finnegården 6a (BRM 104) and Finnegården 3a (BRM 110).

Fishing tackle at Finnegården 6a, BRM 104 (southern Bryggen area)

The site covered 40m² (Dunlop 1982). Six fishing-related artefacts have been identified at Finnegården 6a:

c 1150:

Fishing with hooks:

line runner, type IV.

Before 1170/71:

Fishing with hooks:

line runner, type IV.

c 1198:

Fishing with net:

float, type IV.

1248–1350:

Fishing with net:

float, type VI.

1520/30–1550/60:

Fishing with net:

float, type VI.

No fishing tackle was found *in situ* in buildings. The site covered the original seashore, a quay front and a triangular caisson represented the oldest phase. The line runner found in this phase lies in a clear fishing-related zone. No other fishing equipment is linked to the constructions. In general, this site may be connected to a fishing-related zone throughout the whole medieval period. The low number of fishing equipment found may be due to the limited area excavated.

Fishing tackle at Finnegården 3a, BRM 110 (southern Bryggen area)

The site covered 90m² (Golembnik 1994). Four fishing-related artefacts have been found at the site:

1170/71–1st quarter of the 13th century:

Fishing with hooks:

line runner, type IV.

After 1st quarter of the 13th century to 1248:

Fishing with hooks:

line runner, type IV.

c 1248–1393/1413:

Fishing with hooks:

oval line sinker, type K, *line runner*, type IV.

No fishing tackle was found *in situ* in buildings. In phase II, dated to the end of the twelfth century, constructional elements belonging to the remains of a quay-front were identified (Golembnik 1982: 18). During phase III, dated to the first half of the thirteenth century, the quay went into disuse, perhaps because the harbour area became too shallow due to the dumping of fill masses into the sea basin (*ibid:* 21). The area excavated was actually lying at the medieval shore. With the fishing equipment found, and the closeness to neighbouring site, Finnegårdsgaten 6a, it can be argued that this area also belonged to a fishing-related zone.

The line runners of type IV found at the site are not known from the middle Bryggen area, but are represented in the northern Bryggen area just as early. Oval line sinkers of type K are also known in the middle Bryggen area, although not in datable contexts.

Summing up: spatial distribution at the Bryggen area

Seven of the eight sites excavated in the Bryggen area, with datable material, were situated close to the seashore. Kroken 3 differs from the rest of the area both topographically and with its temporal representation with one artefact from post-reformation period. Dreggsallmenningen 2–4 and 14–16 also had a slightly longer distance to the sea than the other sites. Around 1190 the rest of the sites were located approximately 0–15m from the seashore (0 contour line).[13] This sea-oriented location is physically represented by constructions of quay fronts, or caissons, in addition to the fishing equipment.

The Bryggen excavations demonstrate that there might have been an approximately 30m wide harbour- or fishing-related zone, measured from the outermost caissons (that may be interpreted as the quay front) and inwards. Within this zone most of the fishing equipment found is dated to periods 2–4. The zone is also the easiest to identify archaeologically within these periods. In period 5, the zone seems to expand into the old harbour basin, and disappears into the unexcavated area. It is both reasonable and well documented ethnologically that activities linked to fishing, such as the making, repairing and storing of fishing tackle, mainly took place in a zone close to the sea. The archaeological material from Bryggen indicates a general functional division between the more land-oriented area to its rear, and the area that faced the harbour.

The fishing tackle found outside the fishing-related zone was more dispersed, with the exception of a few concentrations. The material from this rear part of the area indicates some kind of storage of fishing equipment. Since the excavations at Bryggen mainly covered the filled-up harbour basin, warehouses are found over the whole area (Herteig 1969: 193). This might help explain why the more voluminous fishing equipment, such as fishing nets, could be found spread all over the site. Fishing tackle may also have been stored in buildings behind the tentative

[13] Measurment as for Kroken 3.

fishing-related zone, since the distance down to the harbour was not too far. Still, the overall spatial distribution of fishing tackle indicates that the fishing-related zone dominated as a storage area, as well as a commercial area.

None of the periods represent a complete collection of tackle and types found. The largest variation in fishing equipment stems from periods 3–6, but there were minor variations from period to period.

Due to relatively small quantities of fishing equipment found at the other minor sites, an identification of the fishing-related zone is more complicated in these areas.

Was the identified fishing equipment lost or thrown away? In general, objects that are damaged and not repairable must have been thrown away. Only a smaller quantity of the fishing material found in the Bryggen area was, however, so damaged that it could not be used. Reuse of fishing equipment seems to have been the rule. For instance, when the securing plates on the line runners had broken, new holes were drilled in the remaining part of the plate. When the stoppers broke off they were replaced by wooden dowels. Heavy line sinkers of "jarstein" type were reused as line sinkers for shallower waters when they broke. Only a few of the many floats found were damaged. Based on these observations I interpret most of the fishing tackle as lost.

Øvrestretet

Øvrestretet (= the Upper Street) stretches out at northeast, on the upper side of the Bryggen area. In the Middle Ages it functioned as a market street, with booths of the various craftsmen and retailers. Several churches and churchyards also dominated this area (Helle 1982: 246). Based on these activities and its topographical position, Øvrestretet should be considered as a land-orientated area. Øvregaten 39 is the only systematically excavated site at Øvregaten (the medieval Øvrestretet) (Myrvoll 1985: 70).

Fishing tackle at Øvregaten 39, BRM 94

Very few archaeological investigations have been carried out in this area; most of them are small and poorly dated. Øvregaten 39 covers an area of 70m² and is the largest site (Dunlop 1982; Hansen 1994). Only one piece of datable fishing tackle has been found: a pointed line sinker, type L, dated to 1332–1500. It was found close to a foundation in a possible settlement layer. Line sinkers of type L are only found at this site.

Due to this lack of systematical investigation of Øvrestretet, very little archaeological material can contribute in an analysis of the area. Its geographical position and documented function in written sources does not support the interpretation of the area as a fishing-related zone. Nevertheless, fishing equipment may have been produced here, such as floats and fishhooks. According to written sources, craftsmen making various objects in wood and metal had their work here. Particularly floats of type A had a standardised shape, which might indicate mass production. Fishing equipment made of stone and bone was far less standardised, and may perhaps have been made by individual fishermen. Unfortunately, there is no material to shed light on these questions.

Vågsbunnen

Vågsbunnen started at Autaallmeningen and followed the bottom of the Vågen harbour to the church of All Saints (Helle 1982: 250), at the isthmus between Vågen and Alrekstadvågen (*ibid:* 145). According to written sources, the dominating craftsmen at Vågsbunnen were shoemakers. Three sites with datable fishing tackle have been identified in this area: Lille Øvregaten (BRM 465), Skostredet 10 (BRM 346) and Domkirkegaten 6 (BRM 245). Two sites in the area contained fishing tackle that could not be dated: Rådstuplass 23 (BRM 20) and Tanks skole.

Lille Øvregaten, BRM 465

The excavation at Lille Øvregaten was carried out at the corner where Lille Øvregaten and Nedre Hamburgersmauet meet, and covered an area of 33m² (Hansen 1995). One boat-shaped line sinker type B was found at the site, dated to

the end of the fourteenth or the beginning of the fifteenth century. Only one sinker of this type is identified in Bergen. Lille Øvregaten should be considered as a land-orientated area.

Skostredet 10, BRM 346

The site covered an area of 160m² (Hansen 1994: 65; Golembnik 1992 *in prep.*). Four artefacts were identified:

1200/1300: fishing with hook: line runner type I

The end of the 14th century–first quarter of the 15th century: fishing with hook: oval line sinker of "jarstein" type, type A

The first quarter of the 15th century–second half of the 15th century: fishing with hook: oval line sinker of «jarstein» type, type J

The first half of the 16th century: fishing with net: float, type I.

All these fishing tackle types are known from the northern Bryggen area, while the middle area lacks line runners, type I and «jarstein», type J. None of these types are found in the southern Bryggen area.

The fishing equipment at Skostredet represents less than 1% of the total amount of fishing material found in Bergen. None was found *in situ* in buildings, and could therefore not be linked directly to single constructions at the site. A gradual filling out of the area took place through the periods mentioned, and the fishing equipment may therefore have been deposited here as a result of such activity. Nonetheless, one cannot exclude the possibility that the fishing tackle belonged to a fishing-related environment. The site is situated close to the sea at the shallow Vågsbunnen. The oldest fishing-related artefact was dated to phase VIa (1200/1300). A foundation structure of 50m² from this phase had its southwestern orientated towards the sea, with its opposite end on dry land (Golembnik 1994b: 46). This sea orientation could be confirmed throughout all the phases that contained fishing tackle.

Domkirkegaten 6, BRM 245

The site covered an area of 300m² (Hansen 1994: 58; Komber *et al.* 1994).

At Domkirkegaten 6, there were 25 assemblages containing a total of 41 artefacts, probably fishing tackle, representing 7% of the total number of fishing equipment found in Bergen. Altogether 36 of these artefacts could be dated.

Phase 9, 1160/70–early 1200:
Fishing with net:
float, type I.

Phase 8, 1230/40–1280:
Fishing with hook:
sickle-shaped line sinker, uncertain type.
Fishing with net:
float, type I

Phase 7, 1280–1350:
Fishing with hook:
fishhook types A, B, C, uncertain types, unbent blanks.
Fishing with net:
float, type IV.

Phase 6, 1300–500:
Fishing with hook:
fishhook, uncertain type.

Phase 5, 1570/80–1623:
Fishing with hook:
fishhook, type C, uncertain type, unbent blanks
Fishing with net:
float, types IV and VI.

Phase 4, 1623–1640:
fishing with net:
float, type VI.

Fishhooks type B are not known elsewhere in Bergen, which is also the case for the unbent unfinished products. Otherwise, we find the same types of fishing equipment as in the Bryggen area. None of the objects lay *in situ* in buildings. No other sites in Bergen contained as many fishhooks as Domkirkegaten 6; a total of 29 dated

fishhooks (finished and blanks). The blanks indicate that some kind of fishhook production might have taken place in the Vågsbunnen area around 1300, and in the post-reformation period. Other types of metal production have probably also taken place. A variety of metal objects, and 700kg of slag was found at the site (Komber *et al* 1994: 132). In the period of metal production Vågsbunnen may have been a wet, swampy area. This made the area less vulnerable to fire, and therefore more suitable for activities involving fire.

The production of fishhooks may probably be linked to Vågsbunnen, as most of the layers at Domkirkegaten 6 were secondary dumped masses of waste it is rather uncertain whether the main production actually took place at this site. The objects found at Domkirkegaten 6 may only contribute in describing the general development of activities in the whole Vågsbunnen area. With its sea-orientated location close to the shoreline, with jetties and quay constructions, the area may have been well suited for some kind of fishing-related activity. In phase 10, 1130/40–1160/70, when the earliest traces of human activity can be observed, a jetty raised on posts was constructed at the eastern part of the site (*ibid:* 214). When the first fishing tackle could be identified, in phase 9, a quay founded on solid caissons replaced this jetty.

The closeness to Vågen may have structured the area throughout the whole medieval period. According to written sources the quay front reached no further in than west of the crossroad between Bankgaten–Skostredet.

Summing up: the Vågsbunnen area

At Vågsbunnen three sites contained fishing equipment that could be dated. A total of 46 fishing-related artefacts (both dated and undated) have been found. In addition to these sites, two undated artefacts of fishing tackle were found. At Rådstuplass 2–3, (BRM 20) an oval line sinker of «jarstein» type A has been identified; the same type was also found at Tanks school. The fishing equipment at Vågsbunnen represents 9% of the total number of fishing tackle in Bergen. Domkirkegaten 6 had 85% of all the material of this kind at Vågsbunnen. With the exception of the boat-shaped line sinker, type B, fishhook type B and fishhook blanks, the fishing equipment from the Vågsbunnen area does not differ from the material found in the Bryggen area. The waterlogged fill masses at Vågsbunnen created a preservation environment relatively equal to that of Bryggen, and the conditions for preserving metal were poor in both areas. Despite this, fishhook blanks and a substantial amount of iron slag were found at Vågsbunnen, being a good indication that Vågsbunnen actually served as an area for fishhook production in the Middle Ages. Parts of Vågsbunnen were clearly sea orientated, although the harbour area was shallower than in the Bryggen area. More than half of the fishing tackle at Vågsbunnen can be dated to the period c 1280–1350.

Strandsiden

The Strandsiden started at the Church of All Saints in the high Middle Ages, and stretched in a northwesterly direction from the western side of Vågen. Along this area there were at least 20 medieval tenements, but probably as a more dispersed settlement (Helle 1982: 254-258). Few systematical archaeological excavations have been carried out at Strandsiden, and only two fishing-related artefacts have been found in this area.

During the excavation at Wallendahl & Søns property in Strandgaten, an undated oval line sinker of «jarstein» type G (B number) was found. The ruins of the Archbishop's tenement, BRM 105, have been excavated in several steps (Kristoffersen 1984), but only one object related to fishing has been found, a fractured, undated oval line sinker of «jarstein» type, probably type A.

Summing up: The spatial distribution of fishing tackle in Bergen

The discussion of the spatial distribution of fishing equipment has shown that nearly all the material is found at sites with a clear sea-orientated

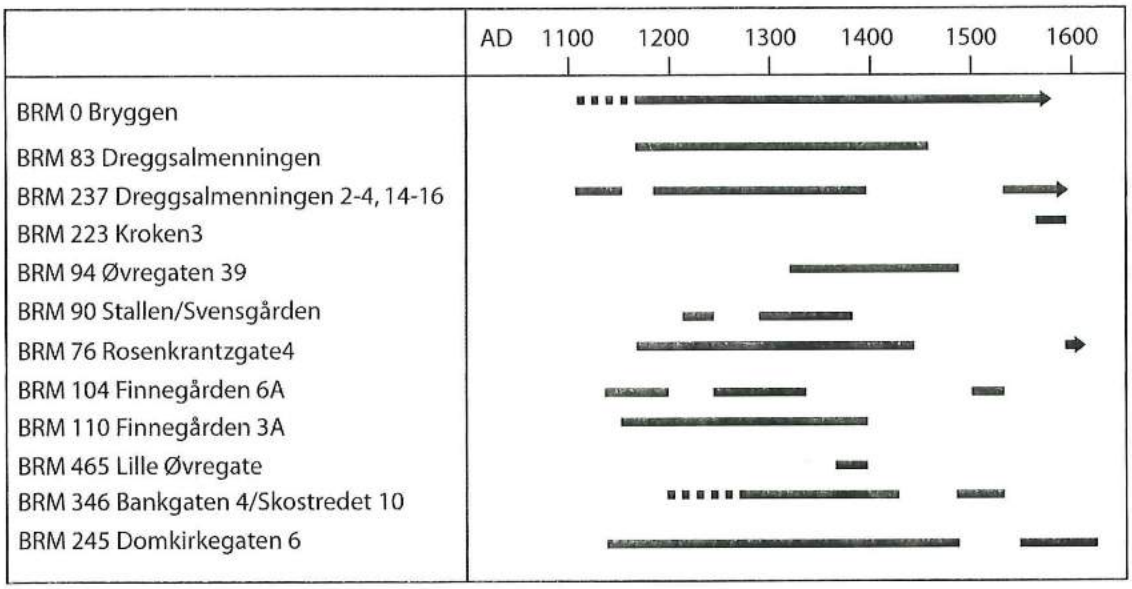


Table 16 The distribution of fishing tackle in time, dated sites.

location. At most of the more land-orientated sites in medieval Bergen, no fishing tackle has been identified. Accordingly, I have argued for the existence of a harbour or fishing-related zone on the eastern side of the Vågen harbour. In this zone most of the land-based activities were associated with the fisheries in the town. At the extensive Bryggen site this fishing-related zone may have comprised an approximately 30m wide belt, measured from the quay front to the rear part. Nevertheless, this distance should not be taken as a definite border, but rather as a tentative zone. As for the rest of the sites analysed, it has not been possible to identify a corresponding inward extension of the fishing-related zone.

The fishing material in Bergen appears from the beginning of the twelfth century (Table 16) and is represented until the post-reformation period. From about 1200 until c 1400 most of the sites were represented with fishing equipment. This may indicate that the area from the north-western part of Bryggen all the way in to Vågsbunnen was an area for fishing-related activities, as well as commercial and other harbour related functions – a situation that lasted for at least 200 years. As the number of artefacts varies from one site to another, a further comparison at a micro level is not possible.

The richest diversity in shapes and types is documented in the northern Bryggen area, due to the Bryggen excavations. The amount of fishing equipment found here makes it likely that the site contains a representative selection of the fishing tackle that was used in medieval Bergen. Due to the relative small amount of fishing material found in the rest of the Bryggen area, it has not been possible to identify any clear differences between the fishing tackle in the middle and southern area. The Vågsbunnen area differs from the rest of the sites by its relatively large collection of fishhooks, indicating some kind of fishhook production.

6 CHANGES IN THE USE OF FISHING TACKLE

In this chapter I focus on the possible causes for changes in the frequency of artefacts related to fishing. I will try to describe the types of fishery that were practised in medieval Bergen, and detect possible changes in this fishery in the course of this period. Was one fishing technique more important than another? As an analytical tool, the fishing tackle will be classified in three main areas according to use: fishing in more shallow waters, deep-sea fishing and fishing with nets.

Representativity

When discussing the frequency of artefacts in time I will use the material from the extensive Bryggen excavations only. This is the only site containing a material large enough to capture tendencies in the development of the fisheries throughout the medieval period. As previously mentioned, the removal by machine down to fire level V created certain problems as far as representativity is concerned. This process of excavation has resulted in a certain overrepresentation of objects from the earliest periods, up until period 4 (1198–1248), in certain areas of the site. Methodologically, this overrepresentation could have been avoided by analysing only the artefacts from the area dug from top to bottom. However, I have chosen to consider the whole site, as it will not significantly change the tendency in the frequency of finds, with the possible exception of period 2 (c 1120–1170/71), as altogether 80% of the fishing equipment from this period was located outside the area dug from top to bottom. If using only the top to bottom dug area, most of the material from the earliest period would have been left out.

The original number of fishing equipment in actual use, must have been far higher than the number found in Bergen. Due to the often extreme conditions fishing equipment is exposed to, there is a constant risk of loosing it. The fishing nets set out in the sea might be stolen, or lost if bad weather set in. Both fishing nets and line fishing tackle could be lost if they got stuck to the seabed or if the catch were too heavy. Lines and ropes made of organic material were more exposed to wear and tear than the synthetic material of today, but even today the loss of fishing equipment is an everyday routine. Therefore, we must assume that the number of fishing tackle linked to the fishing-related environment at Bryggen must have been far higher than the number actually found.

Another important problem is that the types of artefacts found in Bergen are not necessarily identical to those preferred by the medieval fisherman here. The most favoured fishing equipment would necessarily be that which was most frequently used, with consequently a greater risk of loosing it (Sørheim 1997: 19).

A final problem of representativity relates to the evaluation of what kind of fishing equipment was most common. One does not know how many fishing nets the floats identified actually represent. A 20-fathom long fishing net from the nineteenth century needed approximately 30 floats (Moltu 1932: 76). It will therefore be very misleading if each single float is given the same value as for instance a sickle shaped line sinker. One float might only represent 5% of a single fishing tackle, while the sickle-shaped line sinker alone represents 100%. This is a source of error that should be taken into consideration.

Table 17 demonstrates that there is a marked change in the frequency of artefacts at Bryggen from period 2 (c 1120–1170/71) until period 3 (1170/71–1198). The number of fishing equipment increases by 14%. A specific explanation is difficult to give. It might probably partly be explained by the general increase in activities and population that Bergen experienced in the late twelfth century.

Knut Helle points out that the town, from its first stages, was dependent on regular supplies, particularly food, and that the districts around Bergen were able to supply the permanent town population with important products (Helle 1985: 10). To what degree Bergen was capable of supplying itself with fish, is uncertain. The town probably experienced a continuous influx of people from the nearest districts. These people

Period	Dating	5 10 15 20 25 30 %	Number	%
8	1702-1476		5	1
7	1476-1413		10	3
6	1413-1332		64	17
5	1332-1248		89	23
4	1248-1198		100	25
3	1198-1170		86	22
2	Før 1170		30	8
Total number of dated fishing tackle at Bryggen		Total:	384	100

Table 17 The distribution in percent of dated fishing tackle found per period at Bryggen, BRM 0. One object from period 9 (Early Modern period) is not included

Period	Dating	Number of finds per decade 5 10 15 20 25 30	N. per decade	Total finds per period
7	1476-1413		2	10
6	1413-1332		8	65
5	1332-1248		11	88
4	1248-1198		25	99
3	1198-1170		31	86
			Total:	348

Table 18 The distribution of fishing tackle found at the Bryggen excavations, BRM 0, per decade

brought with them different types of knowledge, all accumulated in Bergen. As far as fishing is concerned, Bergen became the place of residence for people with special knowledge of how to fish, and where the best fishing places in the districts around Bergen were found. These people also knew the seasonal changes and where to fish for the different species. Such a supply of knowledge moving to Bergen *may* have enabled the town, to a larger extent than previously thought, to be partly self supplied with fresh fish.

According to Table 17, period 3 (1170/71–1198) had 22% of the artefacts. As this period is the shortest, only 28 years, it is actually the period with the highest finds frequency per decade (31), all periods included (Table 18). Period 4 has the second highest frequency with 25 fishing-related objects per decade. In period 5 the number of objects are reduced to 11 per decade. This might indicate that the fishing activities at Bryggen were most intensive in the period c 1170 until approximately 1248. This might seem odd as the rest of the archaeological material and written sources indicate that the population and the activity is at its highest from the middle of the thirteenth century (Helle 1982: 487, 492).

Could the reduction in the town fishery be explained by the fact that Bergen was going through an economical restructuring? As Bergen and the commercial activities expanded, fishing as a subsistence strategy may have become less important. There might have been a gradual change in mentality with a more urban population and a weakening competence in this field.

With a continuous increasing population, the town fishery could become less capable of supplying the demand. Instead, the trading relations towards the districts may have become stronger, and fishermen living in the districts close to Bergen would supply most of the fresh fish. The fishery from Bergen may have changed from a fishing for sale and private consumption, towards a fishing strictly for private or self-support.

According to Tables 17 and 18 there is a further drop – absolutely and relatively – in the number of fishing equipment at Bryggen. In period 6 (1332–1413) there are 8 artefacts connected to fishing per decade. This is reduced to 2 finds per decade in period 7 (1413–1476). What might be the cause of this marked change? It is within this period of time that the whole Bryggen area, from Holmen in the northwest to Autaallmenningen in the southeast, becomes the residential area for foreign merchants, particularly Germans. Before their establishment, which gradually started in the thirteenth century, Norwegians "occupied" the area, with the exception of a smaller amount of foreign "winter sitters".

After the middle of the fourteenth century the number of Norwegian dwellers was strongly reduced. The Norwegians, more or less completely, ceased to live in the Bryggen area from the early fifteenth century, as a consequence of the establishment of The Hansa Kontor (Helle 1982: 723). A completely new residential structure developed. Women and children disappeared from the area, and with the establishment of The German Kontor the Bryggen area became a pure male society. Such a development may be confirmed archaeologically in the frequency of the textile equipment from the extensive Bryggen excavations (Øye 1988). This temporal frequency coincides approximately with the frequency of fishing equipment. The temporal frequency of jewellery and dress equipment, however, diverges from this pattern (Molaug 1998), which indicates that the representation is not accidental. The area probably changed its socio-economic character, from being the resort of a producer-orientated group of people, to a more consumer-orientated group dealing with large scale trading. The German merchants also represented a new ethnic group with other traditions and lifestyles. To be a fisherman required special knowledge in how to use boats, fishing tackle, how to read the weather, seasonal changes, and locate the best fishing places (knowing the *méd*[14]) etc. To understand the significance of such knowledge is important in order to understand why the fishing equipment disappeared from the area when the Germans entered the scene. Whether the fishermen moved elsewhere in the town due to the establishment of the German Kontor can only be investigated through further excavations along Vågen and Strandsiden.

At the same time as the German merchants established their commercial activities, another event is identified along the Bryggen area which might help explain the drop in quantity of fishing tackle in period 7. Økland's investigation of the practice of waste deposit at the extensive Bryggen site, shows that the accumulation of waste ended more or less completely in this period (Økland 1998). The new renovation practice implied that waste was systematically carried away from the area. The archaeological consequences would necessarily be a reduction in number of artefacts found. An equivalent marked drop in the archaeological material in period 7 is documented in the shoe material from the Gullskoen area at Bryggen.

The observed and documented changes in the fishing tackle material may be due to several combined factors. An increasing influx of people from the districts to Bergen could have changed the economic character of the town fishery. There was also a gradual mental change among the urban population. A new foreign ethnic group settled down, and ended up by completely dominating the Bryggen area. And finally, the practice of waste disposal changed.

[14] Norw. *méd* (ON *mið*) means the middle, or the point where two lines of sight cross each other. When a fisherman lies on the "méd" he is straight over the fishing ground. This is found by using to fixed points along each line of sight. This could e.g. be two headlands lying at the same line at one of the line of sights, while along the other line of sight a gap in an island should be on line with a skerry. "Méd" was very important knowledge delivered from the elder to the younger, from father to son while fishing.

What kind of fishing was carried out in Bergen through the medieval period, and were there any major technological changes?

The functional analysis has shown that the [illegible] from Bergen can be separated into three [illegible] of fishing: (1) fishing with nets, (2) shallow waters (trolling and with line sinkers lighter than 600g) and (3) deep-sea fishing with oval line sinkers of «jarstein» type and boat-shaped line sinkers weighing more than 600g. In addition, techniques such as fishing by spearing and fish traps were also used. Was this fishery run throughout the whole medieval period? What changes can be detected?

In order to evaluate these changes I will look closer at the group of fishing tackle that was most common, the floats. As for the other ways of fishing, the material is not large enough to discern changes, it can only give information as to whether these were represented throughout the whole medieval period or not.

The frequency of floats follows the same graph as the total collection of fishing equipment (Tables 17 and 18). As discussed in the analysis of function (chapter 4), most of the net fishing may have been concentrated to the herring fishery. It is interesting to notice that the main concentration of floats stems from periods 3 and 4 (1170/71–1248), if floats are counted per decade. I have already interpreted the general frequency of artefacts as the result of an intensification of the fishery due to the increasing influx of people to Bergen. In addition, I will try to correlate the floats to possible herring periods.

One of the characteristics of herring is that it varies greatly in number from one season to another. The great herring periods were important events. Consequently, they were spoken about and recorded. In Bohuslen, to day in Sweden, major herring fisheries have taken place from the Iron Age and onwards. In this area the herring could be away for 50–70 years. When it returned the herring period could last for 30–60 years (Molander 1924: 1). Based on Icelandic sagas a number of herring periods have been identified in the time span between 1000 and 1300 (Stibéus 1997: 529). Of particularly interest to this study is a recorded herring period dated to 1195–1250 (*ibid*). According to oceanographer Odd Nakken, it is not yet determined whether the Norwegian spring spawning herring (which is the herring caught in Western Norway) went all the way to Bohuslen, or whether the herring at Bohuslen belonged to a North Sea breed of its own (Nakken 1997: 35). Among oceanographers both views are claimed. If the herring from Bohuslen belonged to the Norwegian spring spawning breed, the herring period recorded in Bohuslen may also have been present in Western Norway in the same period. In the archaeological material from the Bryggen excavations, periods 3 and 4 (1170/71–1248) would cover this herring period. Thus, one might argue for correlating the floats from Bryggen to a general increase in the herring fisheries, due to a massive influx of herring to Western Norway in the period c 1195–1250. There might also have been a herring period between 1307–1362 (Stibéus *op. cit.* 529), although this period is not reflected in the material from Bryggen.

Due to the relatively low number of fishing tackle it has not been possible to identify any tendency of development in the fishery in shallow and deep-sea waters. Fishing tackle used in shallow waters was present from period 2 to 7 (before 1120/71–1476). The distribution per decade shows that period 3 (1170/71–1198) contained most fishing equipment. The fishing tackle used at deep sea was present from period 2 to 8 (before 1120/71–1702) without any clear tendency in distribution. Fish traps have been identified in periods 4 and 5 (1198–1332), but have probably been used throughout the whole medieval period. Vågen was well suited for fish traps due to the deposition of organic waste into the basin, which must have attracted fish. Fishing with plummet has been identified in periods 5 (1248-1332) and 6 (1332–1413), and fish spear in period 7 (1413–1476). Fishing by spearing was probably also carried out throughout the whole medieval period.

It has not been possible to identify any tendencies or patterns in the variation of fishing tackle, and types of fishing tackle that turned up through the periods. This counts for both the whole Bryggen area and Vågsbunnen area. Con-

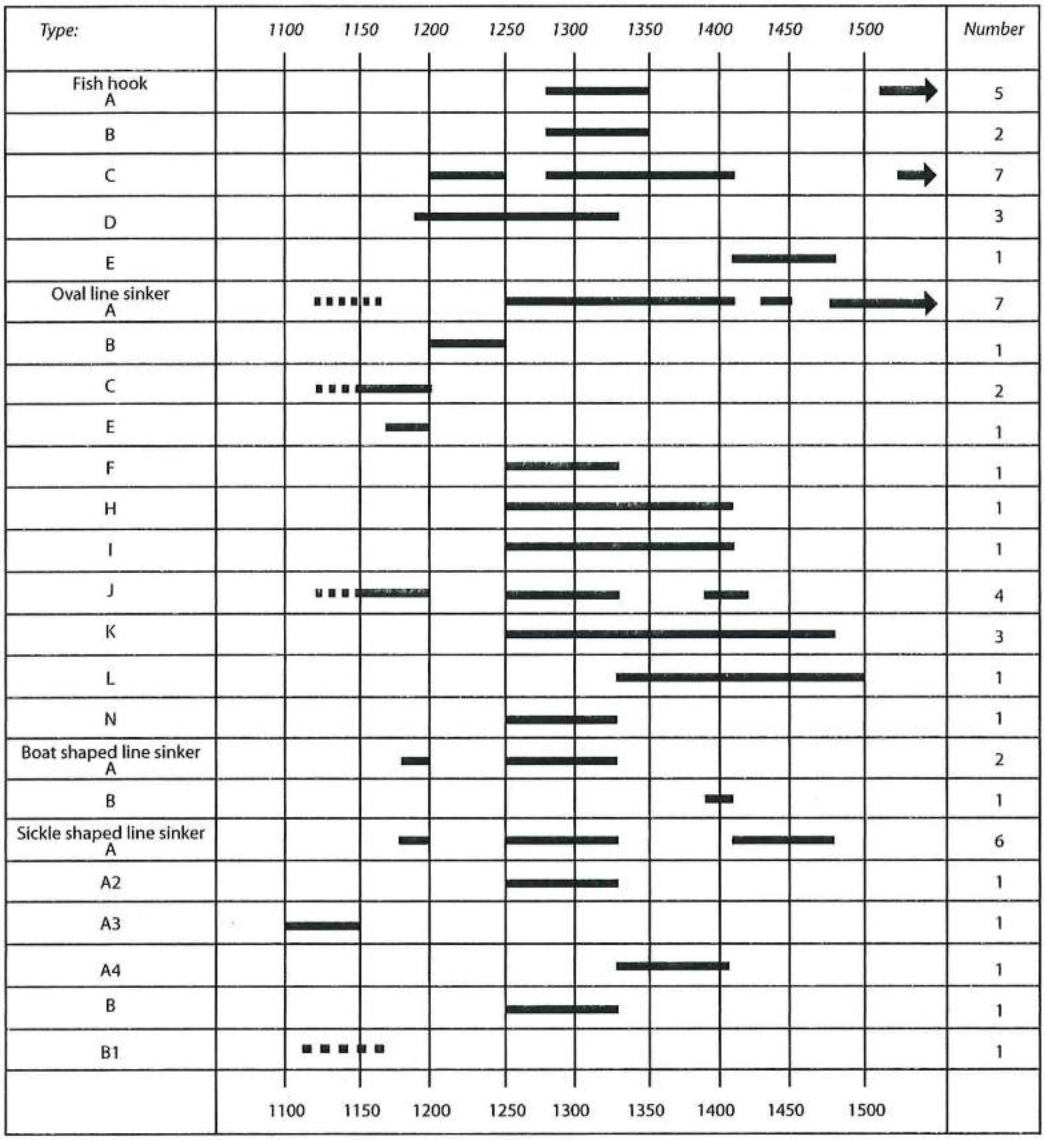


Table 19 The distribution in time of various types of fishing tackle from Bergen, associated with fishing with hooks in the Middle Ages

sequently, no clear fishery technological changes have been identified during the Middle Ages in Bergen.

According to Table 19, the largest variation within the group fishing with hooks seems to be present from the middle of the thirteenth century and onwards. The span in variety gradually decreases when approaching the middle of the fourteenth century. Table 20 shows that most of the line sinker types and line runner types appear from the first half of the thirteenth century until the middle of the fourteenth century. Table 21 shows a slightly different tendency for the group fishing with nets. The largest variation occurs in this group from c 1170 and continues until 1400, when a marked reduction in variety occurs.

This analysis has shown that the changes in the frequency of fishing-related artefacts throughout the Middle Ages may be due to a combination of factors – a changing relationship between town and district, possibly also a change in mentality and degree of urbanisation,

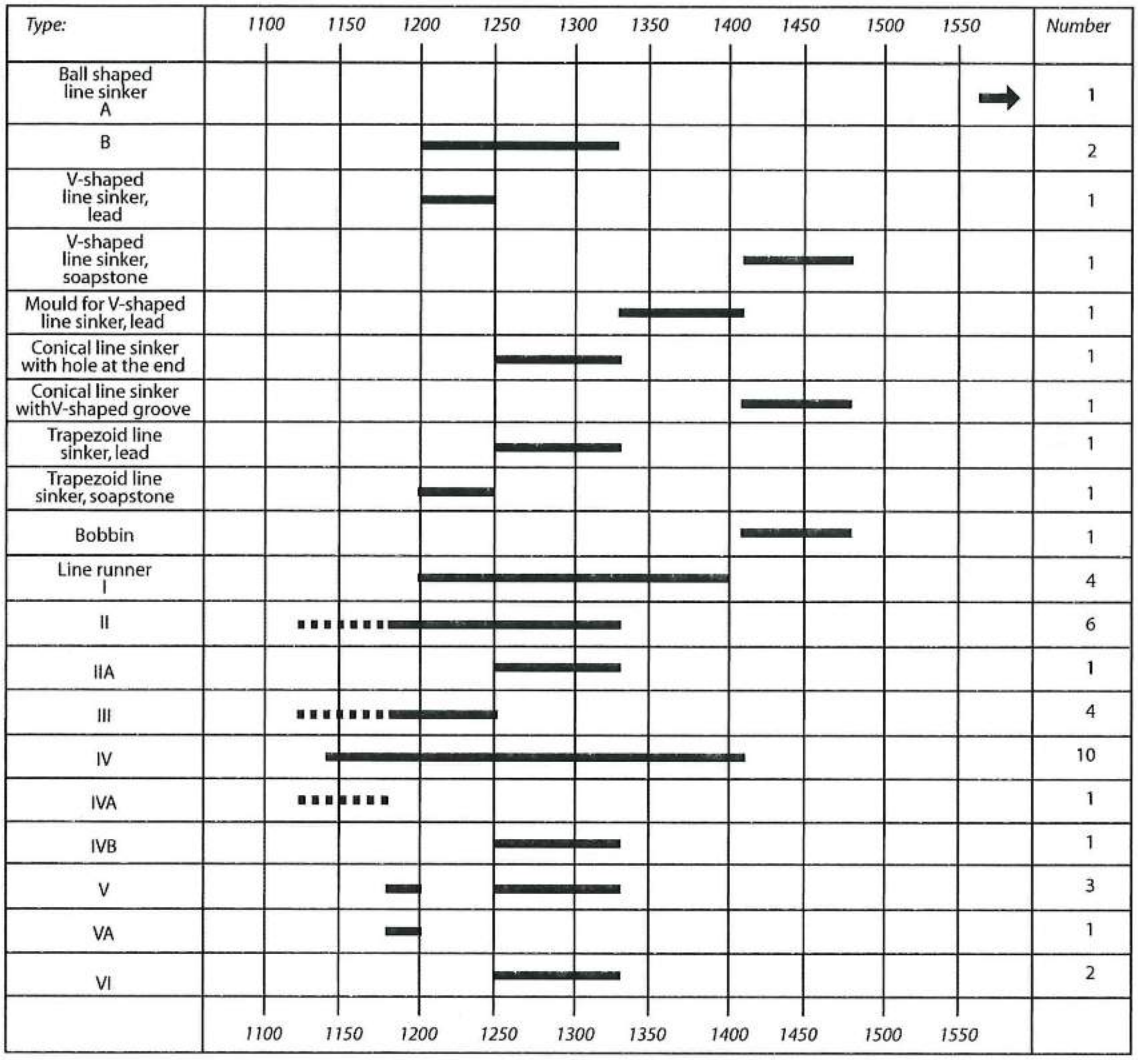


Table 20 The distribution in time of various types of fishing tackle from Bergen, associated with fishing with hooks in the medieval period. The conical sinker with a hole at the end might have functioned as a plummet

the emergence of a new distinct and dominating ethnic group, a change in the practice of waste disposal, and finally a significant herring fishery. Any marked technological changes have not been observed.

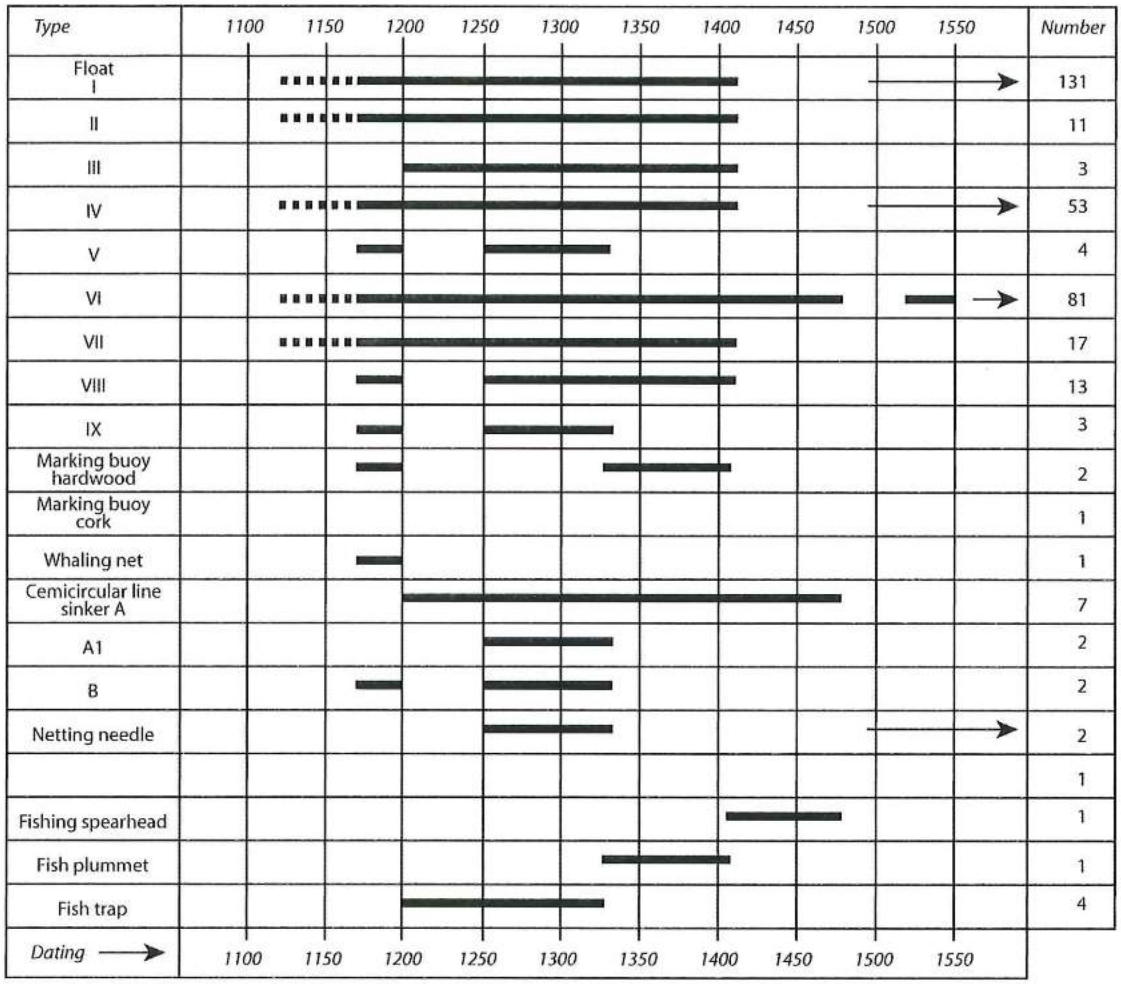


Table 21 The distribution in time of various types of fishing tackle from Bergen, associated with fishing with nets, fishing by spearing and fish traps in the Middle Ages

7 CONCLUSIONS

Initially, I suggested several approaches to problems related to fishing equipment. I have tried to suggest some possible answers to these problems. I have identified four main ways of fishing in the Middle Ages: fishing with hooks, fishing with nets, fish traps and fishing by piercing. Fishing with hooks and nets was probably most common as these techniques could be identified almost throughout the entire medieval period.

Within the group fishing with hooks, line sinkers weighing up to 600g, together with fishhooks of smaller dimensions were used for fishing in shallow waters. In this shallow water fishery both trolling line and vertical fishing seems to have been common techniques. The fishing in shallow waters took place both in salt and fresh water, in the vicinity of Bergen. Further away from Bergen, heavier equipment it was also used for fishing. The deep-sea fishery in particular may have taken place at the open sea west of Bergen, and then at depths down to 150–200 fathoms. Some deep-sea fishery has probably also taken place in the deep fjords around Bergen.

Herring was the most important fish species caught in net. The accumulation of floats in periods 3 and 4 (1170/71–1248) may be explained by rich herring fisheries in the area, due to the occurrence of a large herring period.

The medieval fishermen's attitude toward their fishing tackle seems to have been dualistic. On the one hand we find a conservative tradition, which resulted in fishing tackle with a shape more or less unchanged throughout the whole period, and with its roots in the Iron Age. The most striking example is the ball-shaped line sinkers, which first turned up in the late Neolithic period. On the other hand, we may note how an innovative attitude expresses itself through a rich variety of types of fishing equipment. It has not been possible, however, to identify any significant technological changes during the Middle Ages.

It has been demonstrated how the fishing tackle from Bergen actually was part of a larger Norwegian coastal tradition, and partly a North Atlantic tradition. However, some of the fishing tackle found in Bergen is still not identified elsewhere. Only further investigations in coastal areas may reveal whether these have a strictly local distribution.

Based on the frequency of finds in the extensive Bryggen excavations we noted that the fishery in Bergen was at its most intensive in the period 1170/71–1248. This local fishery seems gradually to have lost its importance during the Middle Ages. These changes may be viewed in the light of the relationship between Bergen and its countryside. If we apply Axel Christophersen's model for Trondheim to Bergen, the period 1170/71–1248 may be viewed as an introductory transitional phase, from a more rural town to a more urban scene – from a town where self-supply played an important part, and where the relations to the countryside were not so established, towards a development of a town with a more urban character, a town completely dependent on the products from the countryside or imports. In this town a majority of the citizens may have experienced a gradual changing mentality, and the development of an urban identity alienating them from primary industries. Despite this development a minor group in Bergen continued with fishing activities throughout the whole medieval period. The purpose of this fishery was most likely for self-supply, and in minor degree for sale.

The marked reduction in fishing equipment documented in the fourteenth century may be viewed in light of socio-economic changes in the Bryggen area with the German merchants establishing themselves here. Due to this development the Bergen fishermen moved away from the area.

The spatial distribution of the fishing tackle found in Bergen has shown that a great majority was found close to the harbour and in sea-orientated contexts. Jetties, quay constructions or caissons could often be observed in the vicinity of the fishing equipment. As for the extensive Bryggen site I have argued for the existence of an approximately 30 meter wide fishing-related zone, measured from the sea front to the rear. It was probably in this zone that most of the land

based fishing activities took place, although fishing tackle found in a more land-orientated area outside this zone indicates that the whole Bryggen area to a certain extent was involved in the fishing and harbour related activities, through storing, repairing or production of fishing equipment. Nevertheless, the 30 meter wide zone seems to have been the most important one.

The fishing tackle from Bergen shows that the distinction between town and countryside in the early Middle Ages was not as distinct as we may assume today. Throughout the whole medieval period a group of people with resort in Bergen carried out activities no different from the people living in the neighbouring countryside. They walked the short road down to the Vågen harbour where their double-ended wooden boats of the four- and six-oared type lay moored. The noise and smell from the town quickly evaporated as they slowly rowed out the fjord. Soon they were only surrounded by the cry of the seagulls, and the fresh salt smell from the sea.

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Ole Mikal Olsen

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APPENDIX - LIST OF FINDS

The list of finds contains all objects which I have related to fishing activities. These are all found during excavations in Bergen. A few of the objects are uncertain but most are secure. The list is sorted into four groups related to the groups of fishing techniques identified. It gives an overall view of the finds and the excavations involved. The list of finds contains the following information:

Find-number
Identification of object
Type
Dating
Number

List of finds, fishing with hooks

Number	Object	Type	Dating	N
BRM 0 00531	Bobbin		1413-1476	1
BRM 0 00780	Oval line sinker "jarstein"	A	?	1
BRM 0 01133	Line runner	IIA	1332-1413	1
BRM 0 01304	Oval line sinker "jarstein"	A	1332-1413	1
BRM 0 03897	Ball shaped sinker	B	1248-1332	1
BRM 0 04133	Line runner	II	1248-1332	1
BRM 0 04504	Ball shaped sinker	A	1702-1955	1
BRM 0 04676	Line runner	IV	1170-1198	1
BRM 0 04986	Oval line sinker "jarstein"	A	1476-1702	1
BRM 0 06473	Sickle shaped sinker	A4	1332-1413	1
BRM 0 06640	Line runner	IV	1332-1413	1
BRM 0 07322	Line runner	IVB	1248-1332	1
BRM 0 09633	Line runner	IV	1248-1332	1
BRM 0 10879	Oval line sinker "jarstein"	A	1332-1413	1
BRM 0 11976	Line runner	I	1248-1332	1
BRM 0 13038	Sickle shaped line sinker	A	1248-1332	1
BRM 0 13307	Oval line sinker "jarstein"	?	1413-1476	1
BRM 0 14207	Line runner	I	1332-1413	1
BRM 0 14424	Oval line sinker "jarstein"	?	1332-1413	1
BRM 0 14520	Oval line sinker "jarstein"	Blank	1332-1413	1
BRM 0 15758	Line runner	I	1332-1413	1
BRM 0 15902	Fish hook	D	1248-1332	1
BRM 0 16316	Oval line sinker	K	1332-1413	1
BRM 0 17015	Line runner	V	1248-1332	1
BRM 0 17787	Sickle shaped line sinker	B	1248-1332	1
BRM 0 17946	Line runner	V	1248-1332	1
BRM 0 18948	V-shaped line sinker		1198-1248	1
BRM 0 19293	Oval line sinker "jarstein"	B	1198-1248	1
BRM 0 20231	Line runner	II	1198-1248	1
BRM 0 20487	Line runner	II	1248-1332	1
BRM 0 21334	Line runner	III	1198-1248	1
BRM 0 23523	Sickle shaped line sinker	A	1248-1332	1
BRM 0 25268	Line runner	II	1170-1198	1
BRM 0 25921	Line runner	V	1170-1198	1
BRM 0 26220	Line runner	II	1170-1198	1
BRM 0 26924	Mould for V-shaped sinkers		1332-1413	1
BRM 0 26979	Line runner	I	1248-1332	1
BRM 0 27971	Line runner	IV	?	1
BRM 0 33221	Oval line sinker "jarstein"	A	1476-1702	1
BRM 0 36719	Sickle shaped line sinker	A	1413-1476	1
BRM 0 36898	Line runner	II	1332-1413	1

BRM 0 37706	V-shaped line sinker		1413-1476	1
BRM 0 39923	Line runner	IIA	1248-1332	1
BRM 0 40299	Fish hook	C	1198-1248	1
BRM 0 40413	Line runner	IIB	1332-1413	1
BRM 0 40414	Oval line sinker "jarstein"	J	?	1
BRM 0 40914	Oval line sinker "jarstein"	A	1248-1332	1
BRM 0 41198	Line runner	IV	1198-1248	1
BRM 0 41380	Oval line sinker	N	1248-1332	1
BRM 0 41553	Line runner	III	1198-1248	1
BRM 0 41974	Fish hook	D	1198-1248	1
BRM 0 43886	Oval line sinker "jarstein"	J	Before 1170	1
BRM 0 44259	Line runner	VA	1170-1198	1
BRM 0 45086	Line runner	IV	1170-1198	1
BRM 0 45392	Oval line sinker "jarstein"	E	1170-1198	1
BRM 0 45463	Line runner	III	Before 1170	1
BRM 0 46160	Line runner	IVA	Before 1170	1
BRM 0 47761	Conical sinker		1476-1413	1
BRM 0 53578	Oval line sinker "jarstein"	J	1170-1198	1
BRM 0 55719	Sickle shaped line sinker	A	1170-1198	1
BRM 0 55771	Boat shaped line sinker	A	1170-1198	1
BRM 0 55876	Line runner	III	1170-1198	1
BRM 0 56920	Fish hook	?	1476-1702	1
BRM 0 59157	Oval line sinker "jarstein"	?	1332-1413	1
BRM 0 61917	Oval line sinker "jarstein"	?	1198-1248	1
BRM 0 62034	Line runner	II	1198-1248	1
BRM 0 64811	Line runner	II	Before 1170	1
BRM 0 65575	Fish hook	E	1413-1476	1
BRM 0 69932	Oval line sinker	K	1413-1476	1
BRM 0 71531	Sickle shaped line sinker	A2	1248-1332	1
BRM 0 72956	Sickle shaped line sinker	A	1170-1198	1
BRM 0 75555	Oval line sinker "jarstein"	J	1248-1332	1
BRM 0 77227	Oval line sinker "jarstein"	F	1248-1332	1
BRM 0 80711	Oval line sinker "jarstein"	C	1170-1198	1
BRM 0 80788	Boat shaped line sinker	A	1248-1332	1
BRM 0 81512	Line runner	VI	1248-1332	1
BRM 0 82255	Fish hook	C, ?	1332-1413	2
BRM 0 83651	Fish hook	C	1332-1413	1
BRM 0 84637	Sickle shaped line sinker	B1	Before 1170	1
BRM 0 87614	Oval line sinker "jarstein"	A, C	Before 1170	2
BRM 3 00319	Oval line sinker "jarstein"	?	?	1
BRM 3 00699	Ball shaped sinker	B	?	1
BRM 3 00715	Oval line sinker "jarstein"	G	?	1
BRM 3 00890	Line runner	?	?	1
BRM 20 00497	Oval line sinker "jarstein"	A	?	1
BRM 39 00002	Oval line sinker "jarstein"	B	?	1
BRM 41 00091	Oval line sinker "jarstein"	J	?	1
BRM 48 (-)	Boat shaped line sinker	C	?	1
BRM 76 05366	Oval line sinker "jarstein"	A	1413-1454	1
BRM 76 06187	Oval line sinker "jarstein"	I	1248-1413	1
BRM 76 06966	Oval line sinker "jarstein"	?	1248-1413	1
BRM 76 07368	Oval line sinker "jarstein"	A1	?	1
BRM 76 07369	Oval line sinker "jarstein"	A	?	1
BRM 76 10293	Line runner	II	1198-1248	1
BRM 76 10969	Sickle shaped line sinker?	?	?	1
BRM 76 11079	Oval line sinker	J1	?	1
BRM 76 11224	Ball shaped sinker	B	1198-1248	1
BRM 76 14446	Oval line sinker "jarstein"	J	?	1
BRM 76 15936	Oval line sinker	K	18th or 20th Century	1
BRM 76 18871	Oval line sinker "jarstein"	H	End of 14th Century - 1476	1
BRM 83 00028	Rectangular line sinker		?	1

BRM 83 04316	Oval line sinker "jarstein"	?	1248-1332	1
BRM 83 05528	Line runner	IV	1248-1332	1
BRM 83 05697	Line runner	I	1198-1248	1
BRM 94 00477	Oval line sinker	L	1332-1500	1
BRM 104 02088	Line runner	IV	Before 1170	1
BRM 104 02407	Line runner	IV	Ca 1150	1
BRM 105 00835	Oval line sinker "jarstein"	A	?	1
BRM 110 01297	Oval line sinker	K	1248-1393/1413	1
BRM 110 01888	Line runner	IV	1248-1398/1413	1
BRM 110 04991	Line runner	IV	After 1st quarter of 13th Century – 1248	1
BRM 110 06069	Line runner	IV	1170 – 1. quarter of 13th Century	1
BRM 223 01820	Fish hook	?	1400-1590/1600	1
BRM 237 00119	Oval line sinker "jarstein"	?	2nd half of 14th Century/1st half of 15th Century	1
BRM 237 01134	Fish hook	D	End of 12th Century	1
BRM 237 01638	Fish hook	A	After 1537	1
BRM 237 01864	Fish hook	?	After 1537	1
BRM 237 01947	Fish hook	?	1332-1413	1
BRM 237 02527	Trapezium shaped line sinker		1200-1248	1
BRM 237 03404	Oval line sinker (fragment, half of BRM 237 11179)	?	1200-1248	1
BRM 237 04058	Trapezium shaped line sinker		1248-1332	1
BRM 237 10075	Sickle shaped line sinker	A3	1st half of 12th Century	1
BRM 237 11179	Oval line sinker (fragment, half of BRM 237 03404)	?	1200-1248	1
BRM 237 12381	Ball shaped sinker	B	?	1
BRM 237 13384	Oval line sinker "jarstein"	H	?	1
BRM 245 00661	Fish hook	2A, 1B, 2C, 1?	1280-1350	6
BRM 245 00662	Fish hook	B	1280-1350	1
BRM 245 01217	Sickle shaped line sinker	?	1230/40-1280	1
BRM 245 01372	Fish hook (unfinished)	?	1570/80-1623	3
BRM 245 01432	Fish hook	?	1300-1500	1
BRM 245 01811	Fish hook	?	1570/80-1623	1
BRM 245 02363	Fish hook (unfinished)	?	1280-1350	1
BRM 245 02396	Fish hook	C	1570/80-1623	1
BRM 245 02412	Fish hook (unfinished)	?	1280-1350	7
BRM 245 02772	Fish hook	?	1280-1350	1
BRM 245 02782	Fish hook	?	1570/80-1623	1
BRM 245 02799	Fish hook	C	1280-1350	1
BRM 245 02808	Fish hook	A	1280-1350	1
BRM 245 02811	Fish hook (unfinished)	?	1280-1350	1
BRM 245 02834	Fish hook (unfinished)	?	1280-1350	1
BRM 245 02873	Fish hook (unfinished)	?	?	4
BRM 245 02910	Fish hook	?	1280-1350	1
BRM 245 02926	Fish hook	A	1280-1350	1
BRM 245 05037	Oval line sinker "jarstein"	A	?	1
BRM 346 02623	Oval line sinker "jarstein"	J	1st quarter – 2nd half of 15th Century	1
BRM 346 04821	Oval line sinker "jarstein"	A	End of 14th Century – 1st quarter of 15th Century	1
BRM 346 05503	Line runner	I	13th/14th Century	1
BRM 465 01329	Boat shaped line sinker	B	End of 14th Century – beginning of 15th Century	1
Bryggen B 6252	Oval line sinker	E	?	1
Bryggen B 6252	Sickle shaped line sinker	A1	?	1
Wallendahl B 6553	Oval line sinker "jarstein"	G	?	1
Bergenhus B 6586	Oval line sinker	M	?	1
Bergenhus B 6586	Trapezium shaped sinker		?	1
Bryggen B 6601	Sickle shaped line sinker	A3	?	1
Bryggen B 7097	Line runner	II, IV	?	2
Bryggen B 7097	Sickle shaped line sinker	B	?	1

Bryggen B 7097	Oval line sinker	O	?	1
Bryggen B 8643	Oval line sinker "jarstein"	D	?	1
Tanks skole B 8790	Oval line sinker "jarstein"	A	?	1

List of finds, fishing using nets

Number	Object	Type	Dating	N
BRM 0 01351	Netting needle		1476-1702	1
BRM 0 01725	Float	VI	1332-1413	1
BRM 0 01838	Float	VII	1332-1413	1
BRM 0 01911	Float	VII	1332-1413	1
BRM 0 02095	Float	IV	1248-1332	3
BRM 0 02828	Float	IV	1248-1332	3
BRM 0 02895	Float	II	1248-1332	2
BRM 0 02974	Float	I	1248-1332	3
BRM 0 03198	Float	IV	1332-1413	1
BRM 0 03343	Netting needle		1248-1332	1
BRM 0 03442	Float	VI	1332-1413	1
BRM 0 03507	Float	I	1198-1248	1
BRM 0 04046	Float	I	1248-1332	1
BRM 0 04288	Float	I	1198-1248	1
BRM 0 04397	Float	I	1198-1248	1
BRM 0 04432	Float	I	1198-1248	2
BRM 0 04447	Float	I	1198-1248	1
BRM 0 06675	Float	I	1248-1332	1
BRM 0 06909	Float	IV	1332-1413	1
BRM 0 07755	Float	VI	1248-1332	1
BRM 0 08246	Semicircle shaped sinker	A	1332-1413	1
BRM 0 08255	Float	I	1248-1332	1
BRM 0 09256	Float	VII	1248-1332	1
BRM 0 10178	Float	VIII	1170-1198	3
BRM 0 10284	Whaling net?		1170-1198	1
BRM 0 10361	Float	I	1170-1198	1
BRM 0 10886	Float	VI	1248-1332	1
BRM 0 12169	Float	II	1332-1413	1
BRM 0 12261	Float	VI	1413-1476	1
BRM 0 13559	Marking buoy		1332-1413	1
BRM 0 13731	Float	VI	1413-1476	1
BRM 0 14921	Float	VIII	1332-1413	1
BRM 0 15057	Float	VI	1248-1332	1
BRM 0 15064	Float	IV	1332-1413	1
BRM 0 15158	Float	VI	1332-1413	1
BRM 0 15205	Float	VI	1332-1413	1
BRM 0 15490	Float	VI	1332-1413	1
BRM 0 16095	Float	III	1332-1413	1
BRM 0 16464	Float	I	1198-1248	1
BRM 0 17026	Float	III	1248-1332	1
BRM 0 17114	Float	V	1248-1332	1
BRM 0 17505	Float	I	1248-1332	1
BRM 0 17608	Float	I	1198-1248	1
BRM 0 17667	Float	I	1198-1248	1
BRM 0 17697	Float	VI	1198-1248	3
BRM 0 18172	Float	IV	1332-1413	1
BRM 0 18276	Float	VI	1198-1248	2
BRM 0 18391	Float	VII	1198-1248	1
BRM 0 18416	Float	VII	1198-1248	1
BRM 0 18555	Float	I	1198-1248	1
BRM 0 18931	Float	I	1198-1248	1
BRM 0 19595	Float	I	1198-1248	1
BRM 0 19970	Float	I	1198-1248	1
BRM 0 20417	Float	VI	1332-1413	1

BRM 0 20429	Float	I	1198-1248	1
BRM 0 21082	Float	I	1198-1248	1
BRM 0 21140	Float	III	1198-1248	1
BRM 0 21442	Float	I	1198-1248	1
BRM 0 21638	Float	VI	1198-1248	1
BRM 0 21849	Float	IV	1198-1248	1
BRM 0 22622	Float	II	1170-1198	1
BRM 0 23307	Float	I	1248-1332	1
BRM 0 23312	Float	VI	1248-1332	1
BRM 0 23567	Float	I	1248-1332	1
BRM 0 24640	Float	VI	1170-1198	1
BRM 0 24641	Float	VI	1170-1198	1
BRM 0 24920	Float	I	1198-1248	1
BRM 0 25583	Float	VI	1332-1413	1
BRM 0 25908	Float	IV	1198-1248	1
BRM 0 26534	Float	I	1332-1413	1
BRM 0 27733	Float	VI	1248-1332	1
BRM 0 28211	Float	I	1332-1413	1
BRM 0 28325	Float	I	1248-1332	1
BRM 0 28559	Float	VIII	1248-1332	1
BRM 0 28680	Float	I	1248-1332	1
BRM 0 29426	Float	VI	1248-1332	1
BRM 0 29470	Float	I	1248-1332	1
BRM 0 29569	Float	I	1198-1248	1
BRM 0 29949	Float	VIII	1248-1332	1
BRM 0 30558	Float	VI	1248-1332	1
BRM 0 30823	Float	IV	1248-1332	2
BRM 0 31272	Float	VI	1198-1248	1
BRM 0 31318	Float	VI	1170-1198	1
BRM 0 31326	Float	I	1198-1248	1
BRM 0 31399	Float	VI	1198-1248	1
BRM 0 31935	Float	I	1170-1198	1
BRM 0 31989	Float	VI	1198-1248	4
BRM 0 32160	Float	I	1198-1248	1
BRM 0 32862	Float	I	1198-1248	1
BRM 0 33757	Float	I	1170-1198	1
BRM 0 33978	Float	VIII	1332-1413	1
BRM 0 34453	Float	VI	1179-1198	1
BRM 0 34705	Float	I	1476-1702	1
BRM 0 35187	Float	I	1170-1198	1
BRM 0 35282	Float	IV	1170-1198	1
BRM 0 35893	Float	I	?	1
BRM 0 36023	Float	I	?	1
BRM 0 36092	Float	I	1248-1332	1
BRM 0 36591	Float	VI	1332-1413	1
BRM 0 37229	Float	VIII	?	1
BRM 0 37543	Float	I	1248-1332	1
BRM 0 37608	Float	I	1248-1332	1
BRM 0 38361	Float	VI	1332-1413	1
BRM 0 39321	Float	I	1248-1332	1
BRM 0 39732	Float	I	?	1
BRM 0 39879	Float	VII	1248-1332	1
BRM 0 40932	Float	IV	1248-1332	1
BRM 0 41027	Float	VI	1332-1413	1
BRM 0 41051	Float	IV	1198-1248	1
BRM 0 41079	Float	IV	1198-1248	1
BRM 0 41153	Float	VI	1198-1248	1
BRM 0 41154	Float	I	1198-1248	1
BRM 0 41157	Float	I	1198-1248	1
BRM 0 41384	Float	I	1198-1248	1

BRM 0 41425	Float	VI	1248-1332	1
BRM 0 41448	Float	I	1198-1248	1
BRM 0 41487	Float	VI	1198-1248	1
BRM 0 41512	Float	VI	1198-1248	1
BRM 0 41592	Float	VI	1198-1248	2
BRM 0 41593	Float	I	1198-1248	1
BRM 0 41727	Float	IV	1170-1198	1
BRM 0 41747	Float	VI	1170-1198	1
BRM 0 41788	Float	IV	1170-1198	1
BRM 0 41917	Float	I	1170-1198	1
BRM 0 41931	Float	I	1170-1198	1
BRM 0 42098	Float	I	1170-1198	1
BRM 0 42118	Float	VI	1248-1332	1
BRM 0 42195	Float	I	1248-1332	1
BRM 0 42398	Float	IV	Before 1170	2
BRM 0 42637	Float	VII	1170-1198	1
BRM 0 42863	Float	IV	1170-1198	1
BRM 0 43053	Float	VII	1170-1198	1
BRM 0 43114	Float	VII	1170-1198	1
BRM 0 43457	Float	I	Before 1170	1
BRM 0 43503	Float	I	1170-1198	1
BRM 0 43753	Float	IV	Before 1170	1
BRM 0 44041	Float	I	1170-1198	1
BRM 0 44074	Float	VII	1170-1198	1
BRM 0 44710	Float	VII	1170-1198	1
BRM 0 44831	Float	IV	1170-1198	1
BRM 0 45046	Float	VI	Before 1170	1
BRM 0 45088	Float	IV	1170-1198	1
BRM 0 45415	Float	IV	1170-1198	1
BRM 0 45495	Float	IV	Before 1170	1
BRM 0 45624	Float	VI	Before 1170	1
BRM 0 45644	Float	IV	Before 1170	1
BRM 0 46106	Semicircular sinker	B	1170-1198	1
BRM 0 46706	Float	VI	Before 1170	1
BRM 0 46767	Float	VII	Before 1170	1
BRM 0 48557	Float	VIII	1332-1413	1
BRM 0 48783	Float	VI	1332-1413	1
BRM 0 51214	Float	IX	1248-1332	1
BRM 0 51586	Float	VII	1248-1332	1
BRM 0 51957	Float	VI	1198-1248	1
BRM 0 52106	Float	I	1248-1332	1
BRM 0 52223	Float	I	1248-1332	1
BRM 0 52280	Float	VI	1248-1332	1
BRM 0 52401	Float	I	1170-1198	1
BRM 0 52814	Float	I	1198-1248	1
BRM 0 52986	Float	VIII	1170-1198	1
BRM 0 53032	Float	IV	1170-1198	1
BRM 0 53229	Float	I	1170-1198	1
BRM 0 53278	Float	IV	1170-1198	1
BRM 0 53355	Float	IV	1198-1248	1
BRM 0 53423	Float	IV	1198-1248	1
BRM 0 53581	Float	IV	1170-1198	1
BRM 0 54504	Float	IV	Before 1170	1
BRM 0 54542	Float	I	1170-1198	1
BRM 0 54635	Float	II	1198-1248	1
BRM 0 54714	Float	IV	Before 1170	1
BRM 0 54738	Float	I	1198-1248	1
BRM 0 54873	Float	IX	1198-1248	1
BRM 0 55087	Float	VII	Before 1170	1
BRM 0 55140	Float	VI	1170-1198	1

BRM 0 59012	Float	IV	1332-1413	1
BRM 0 60824	Float	I	1332-1413	1
BRM 0 61301	Float	I	1198-1248	1
BRM 0 61507	Float	I	1198-1248	1
BRM 0 61570	Float	I	1198-1248	1
BRM 0 61885	Float	I	1198-1248	1
BRM 0 61948	Float	II	1198-1248	1
BRM 0 62069	Float	I	1170-1198	1
BRM 0 62257	Float	I	1198-1248	1
BRM 0 62457	Float	I	1170-1198	1
BRM 0 62510	Float	I	1248-1332	1
BRM 0 62606	Float	I	1170-1198	1
BRM 0 62796	Float	I	1198-1248	1
BRM 0 63258	Float	VIII	1170-1198	1
BRM 0 63430	Float	I	1170-1198	1
BRM 0 63459	Float	IV	1170-1198	1
BRM 0 63463	Float	IV	1198-1248	1
BRM 0 63467	Float	IV	1170-1198	1
BRM 0 63687	Float	II	1170-1198	1
BRM 0 63812	Float	I	1170-1198	1
BRM 0 64003	Float	V	1170-1198	1
BRM 0 64273	Semicircular sinker	B	1248-1332	1
BRM 0 64475	Float	VI	Before 1170	1
BRM 0 64747	Float	IV	Before 1170	1
BRM 0 65013	Float	I	1198-1248	1
BRM 0 65019	Float	I	Before 1170	1
BRM 0 69593	Semicircular sinker	A	1248-1332	1
BRM 0 70773	Semicircular sinker	A	1332-1413	1
BRM 0 71528	Float	I	1248-1332	1
BRM 0 71531	Float	IV	1332-1413	1
BRM 0 71534	Semicircular sinker	A1	1248-1332	2
BRM 0 71768	Float	I	1332-1413	1
BRM 0 71769	Float	I	1332-1413	1
BRM 0 73360	Float	II	Before 1170	1
BRM 0 74686	Float	I	1332-1413	3
BRM 0 74690	Float	I	1332-1413	1
BRM 0 74962	Float	I	1332-1413	1
BRM 0 75436	Float	I	1248-1332	1
BRM 0 75447	Float	I	1198-1248	1
BRM 0 76441	Float	I	?	1
BRM 0 77232	Float	II	1248-1332	1
BRM 0 77440	Float	VI	1198-1248	1
BRM 0 77671	Float	VI	1198-1248	1
BRM 0 77722	Float	VIII	1170-1198	1
BRM 0 77723	Float	I	1198-1248	1
BRM 0 77724	Float	I	1198-1248	1
BRM 0 77785	Float	IV	1198-1248	1
BRM 0 77786	Float	II	1198-1248	1
BRM 0 77791	Float	VII	1198-1248	1
BRM 0 77852	Float	IV	1170-1198	1
BRM 0 78007	Float	VI	1170-1198	1
BRM 0 78090	Float	IX	1170-1198	1
BRM 0 78106	Float	II	1170-1198	1
BRM 0 78185	Float	I	1198-1248	2
BRM 0 78220	Float	VI	1170-1198	1
BRM 0 78431	Float	I	1170-1198	1
BRM 0 78457	Float	VI	?	1
BRM 0 78607	Float	V	1248-1332	1
BRM 0 78611	Float	VIII	1248-1332	1
BRM 0 78651	Float	VII	Before 1170	1

BRM 0 78668	Float	IV	Before 1170	1
BRM 0 78694	Float	VI	Before 1170	1
BRM 0 78865	Float	I	1248-1332	2
BRM 0 79022	Float	I	1198-1248	1
BRM 0 79025	Float	VII	1170-1198	1
BRM 0 79360	Float	I	1332-1413	8
BRM 0 79563	Float	I	1332-1413	1
BRM 0 79643	Float	I	1248-1332	1
BRM 0 80140	Float	IV	1198-1248	1
BRM 0 80395	Float	I	1248-1332	1
BRM 0 80945	Float	I	?	3
BRM 0 81387	Float	VI	1170-1198	1
BRM 0 81434	Float	I	1170-1198	1
BRM 0 82152	Float	I	Before 1170	1
BRM 0 82450	Float	IV	1248-1332	1
BRM 0 83258	Float	I	1332-1413	1
BRM 0 83923	Float	I	1248-1332	1
BRM 0 84361	Float	VI	1198-1248	1
BRM 0 84821	Float	I	1170-1198	1
BRM 0 84925	Float	I	1170-1198	1
BRM 0 85385	Float	VI	Before 1170	1
BRM 0 85473	Float	I	Before 1170	1
BRM 0 86279	Marking buoy		1170-1198	1
BRM 0 87031	Float	I	1248-1332	1
BRM 0 87186	Float	I	1248-1332	1
BRM 0 87857	Float	I	1198-1248	1
BRM 0 88636	Float	VI	1198-1248	1
BRM 0 88663	Float	VI	1170-1198	1
BRM 0 88735	Float	I	1198-1248	1
BRM 0 88737	Float	I	1198-1248	1
BRM 0 88858	Float	IX	1170-1198	1
BRM 0 88898	Float	VIII	1170-1198	1
BRM 0 88984	Float	I	1170-1198	2
BRM 0 89125	Float	I	1198-1248	1
BRM 0 89372	Float	I	1198-1248	1
BRM 0 89373	Float	IV	1170-1198	1
BRM 0 89852	Float	I	1170-1198	1
BRM 0 89853	Float	I	1170-1198	1
BRM 0 89854	Float	I	1170-1198	2
BRM 0 89975	Semicircular sinker	A	1248-1332	1
BRM 3 00010	Float	VI	?	1
BRM 3 00316	Float	I	?	1
BRM 3 00363	Float	VI	?	1
BRM 3 00521	Float	I	?	1
BRM 3 00547	Float	I	?	1
BRM 3 00553	Float	I	?	2
BRM 3 00683	Float	II	?	1
BRM 3 00737	Float	VI	?	1
BRM 3 00883	Float	I	?	1
BRM 3 00962	Float	VI	?	1
BRM 3 00978	Float	I	?	1
BRM 39 00635	Float	VI	?	1
BRM 48 00180	Float	VI	?	1
BRM 76 03170	Semicircular sinker	A	1413-1454	1
BRM 76 05507	Float	VI	1413-1454	1
BRM 76 07146	Float	VI	1248-1413	1
BRM 76 07545	Marking buoy(?) in cork		1248-1413	1
BRM 76 07963	Float	VI	1198-1248	1
BRM 76 08368	Float	VI	?	1
BRM 76 08460	Float	I	1248-1413	1

BRM 76 09961	Semicircular sinker	A	1198-1248	1
BRM 76 10296	Float	V	1198-1248	1
BRM 76 10458	Float	IV	1198-1248	1
BRM 76 11504	Semicircular sinker	A	1198-1248	1
BRM 76 12370	Float	VI	1198-1248	1
BRM 76 12840	Float	VI	Ca 1190	1
BRM 76 15425	Float	I	Ca 1190	1
BRM 76 19945	Float	VI	1248-1413	1
BRM 83 00260	Float	I	?	1
BRM 83 02407	Float	VI	1248-1332	1
BRM 83 02725	Float	VI	1332-1413	1
BRM 83 03274	Float	VI	1248-1332	1
BRM 83 03366	Float	VI	?	1
BRM 83 03440	Float	VI	1413-1476	1
BRM 83 03614	Float	I	?	1
BRM 83 03663	Float	VI	1248-1332	1
BRM 83 04041	Float	VI	1248-1332	1
BRM 83 04048	Float	VI	?	1
BRM 83 04419	Float	VI	1248-1332	1
BRM 83 04603	Float	VI	1248-1332	1
BRM 83 05068	Float	I	1248-1332	1
BRM 83 05161	Float	VI	1198-1248	1
BRM 83 05496	Float	II	1198-1248	1
BRM 83 05529	Float	I	1198-1248	1
BRM 94 00001	Semicircular sinker	A	?	1
BRM 104 00316	Float	VI	1520/30-1550/60	1
BRM 104 00371	Float	VI	1520/30-1550-60	1
BRM 104 01204	Float	VI	1248-1350	1
BRM 104 01711	Float	IV	Ca 1198	1
BRM 245 00365	Float	I	1230/40-1280	1
BRM 245 00887	Float	IV	1570/80-1623	1
BRM 245 01004	Float	VI	1623-1640	1
BRM 245 01253	Float	VI	1570/80-1623	1
BRM 245 01798	Float	IV	1280-1350	1
BRM 245 03454	Float	I	1160/70-1230/40	1
BRM 346 01300	Float	I	1st half of 16th Century	1

List of finds, fishing by piercing

Number	Object	Type	Dating	N
BRM 0 06500	Barbed point (for plummet?)		1332-1413	1
BRM 0 34046	Fishing spear		1413-1476	1
BRM 0 74750	Conical sinker (plummet?)		1248-1332	1

List of finds, fish traps

Number	Object	Type	Dating	N
BRM 0 11096	Fish trap		1198-1248	3
BRM 0 12607	Fish trap		1248-1332	1

BORGUND AND THE BORGUNDFJORD FISHERIES

Helge Sørheim

The cod fisheries in the Borgundfjord near Ålesund on the northwestern coast of Norway are well known in recent history. The archaeological excavations from 1954 to 1975 of the small medieval town of Borgund, approximately 4 km east of the modern town Ålesund, uncovered artefacts, fishing equipment and fish bones reflecting marine activities. The geographical location, remains of jetties, quays, buildings for storage, etc. in Borgund all indicate that the place to a large extent based its existence on maritime communications and exploitation of marine resources.

The present study is based on archaeological artefacts that may have been connected to fishing and other forms of exploitation of marine resources. Structural remains, such as quays, buildings and other constructions indicating sea-related activities are also taken into consideration together with written sources and ethnological material from later periods in order to evaluate the finds within a larger context.

Based on the archaeological material the aim is to throw light upon the origin and early development of the commercial fisheries and trade of fish products in the Borgund area. One of the questions that will be discussed is whether the fisheries were limited to the shallow, protected Borgundfjord, or whether deep-sea fishing in the Atlantic started in the early Middle Ages. I will also consider whether the sea-oriented settlement of Borgund can throw light on fishing and trade and the role as a centre of those activities. This could hopefully provide a new insight into the importance of the fisheries and the trade of fish products for the emergence and growth of Borgund as a central place and urban community.

The oldest settlement in the Sunnmøre region, from the point when ice withdrew 10–12,000 years ago, showed a preference for the outer coast. Fishing and hunting sea mammals, and later farming as well, have been the economic backbone in the region for thousands of years. For almost a thousand years, commercial fisheries and trade of catches and fish products have shaped the economy and settlement pattern in Sunnmøre. Fish must have been an important resource in the Middle Ages, not least because of the Catholic fast, which constituted a third or a half of the year. During the fast, meat was prohibited, whereas fish was accepted (cf Olsen this volume).

Deep fjords intersect Sunnmøre, so most settlements are related to the sea, and the marine resources could easily be exploited. At the same time, the sea was an essential means of communication, both locally and on a larger geographical scale. It is thus with good reason that the region is named "Møre" – the sea country – while Norway was called *Norvegr*, the road to the North, i.e. the waters along the coast.

Traditionally, farmers and crofters in Sunnmøre have taken part in fishing, either in the fjords for their own consumption, or in the seasonal fisheries along the coast and out towards the fishing bank Storegga, 100km from land, where the continental shelf drops away into great depths of the Atlantic Ocean.

The prehistoric and historic settlement pattern indicates a densely populated coast and more sparse settlement further inland (Solberg 1976: 11). The favourable agricultural conditions on the outer coast of Sunnmøre, together with the sea and marine resources, were important factors for the location of settlement. The technological level, knowledge of sea and marine resources were the deciding factors in the development of the settlement pattern in the region.

The twelfth century was an important phase for the development of trade in the Middle Ages. At this time the expansion of North European long-distance trade started, which some historians have denoted "the commercial revolution"

of the Middle Ages (Lopez 1971). Large-scale trade increased strongly and new types of goods appeared. Goods such as grain, timber, textiles and fish products increasingly dominated the traditional trade in luxury goods. The peasant-tradesmen and proprietor-tradesmen were gradually replaced by professional urban merchants (Nedkvitne 1983: 16).

Fish and fish products were the first important large-scale export products. The commercial production of stockfish from c 1100, provided an export product for a larger European market. Dried fish, the so-called stockfish, dominated Norwegian foreign trade until the seventeenth century (Dyrvik 1979). The medieval herring production, however, did not exceed the needs of the local farmers. The supply of salt was, as in later times, a bottleneck in the production of herring. Quality herring was in fact imported. In 1553, German merchants sold herring at Bryggen in Bergen according to custom (Nedkvitne 1988: 471-2).

Today, the county of Møre and Romsdal exports more fish than Northern Norway as a whole. In 1996, 35 % of the total export volume came from the region, representing 7,1 billion NOK, in addition to a considerable quantity transported by road to Eastern Norway and shipped from Oslo. It is the start of this commercial activity that will be discussed in this paper.

Different kinds of fisheries

Here I distinguish between fish for one's own consumption and professional fisheries, where the catch was intended for sale. The sociologist Ernest Mandel defines a commodity as "a product that has not been manufactured with the intention of direct consumption, but is intended for trade at the market. Any commodity must have a trade value as well as a practical value" (Mandel 1963: 11). He also points out "when manufacturing started and became general, it radically changed the working methods and organisation of society" (*ibid*: 3).

Thus a commodity only has a trade value insofar as it is manufactured in a community based on trade or a society where trade is commonly practised. A precondition for trade is that there is a division of labour, that resources are shared differently and that people produce different commodities. In the latter part of the Iron Age, the division of labour was developed considerably. Whereas trade in the Viking Age concentrated on small quantities of luxury goods, there was a shift towards large quantities of necessities, as people increasingly found work outside the primary production of food in a traditional rural society. The emergence of towns, the establishment of a Church organisation and a unified monarchy resulted in specialisation with separate groups of artisans and merchants, a clergy, professional administrators, as well as ordinary workers. The new groups created a demand for foodstuffs, which in turn created new possibilities for trading, among others fish products that was widely available along the Norwegian coast. The obligatory fast also created an increased demand for fish. This increasing demand for fish formed the basis of the commercial fisheries. The new specialisation did not, however, replace farming, and was rather a supplement to the farming run by the crofter-fishermen. As men went fishing for longer periods of time, the wives became responsible for the farms to a larger extent (cf Bertelsen 1998). The gendered division of labour should, therefore, also be taken into consideration.

The area of research

Borgund has a central location as a point of intersection between the fjords and the coast and also in relation to the richest fishing grounds in Western Norway, the Borgundfjord, a spawning ground for pelagic cod. The fisheries in the Borgundfjord from January to April are known as one of the major fisheries in southern Norway as far back as written sources go (Fig 1).

Borgund may have emerged as a central place as early as the transition between the Viking Age and Middle Ages both as a local market place and/or as a fishing station in the Borgundfjord for farmers or crofters who fished for their own consumption. Borgund is mentioned in Snorre's Heimskringla in the Saga of Olaf the Saint, in connection with events that allegedly should

Fig 1 Overview of the Borgundfjord seen from east. The fjord opens up at the sound Breisundet to the left rear. The medieval settlement of Borgund is located on the forested peninsula on the northern side of the fjord. The flat island of the manor Giske is seen in the horizon to the right rear (Photo: H. Sørheim)

have taken place around 1027–28. The place name Hundsvær is also mentioned in this context, and must be identical to the fishing village situated on some small islands west of Borgund. Molvær is another place with the suffix "vær", denoting a small fishing station or settlement.

Borgund is known from medieval literary sources as the most important commercial and administrative centre in Sunnmøre at that time. In the early Middle Ages it is denoted as a market place or town-like settlement, *kaupstaðr* (Nilsen 1976: 6, 174-178). It also emerged as an early Christian centre. The presence of three, possibly four churches shows that Borgund was also the largest religious centre between Bergen and Trondheim.

Already in the latter part of the fourteenth century the written sources indicate that Borgund was detoriating as a commercial centre. Commercial activities are, however, still mentioned in the early fifteenth century, but a taxpayer's list from 1520 does not mention a single taxpayer there at that time. Artefacts indicate activities from the early eleventh until the sixteenth century, and the place seems to have been flourishing from the twelfth to the first part of the fourteenth century (Herteig 1957; Sørheim 1990).

The written sources on medieval Borgund and the fisheries in the Borgundfjord are sparse. More extensive sources appear from the seventeenth century, of which Hans Strøm's account of Borgund and the fisheries in Sunnmøre from 1762–67 is the most valuable, published in the two volumes of *Physisk og Oekonomisk Beskrivelse over Fogderiet Søndmør, beliggende i Bergens Stift i Norge.*

This study is, however, mainly based on material excavated during 20 seasons from the early 1950s onwards. The methods of excavation and recording, together with the poor conditions of preservation, are not ideal from the point of

Fig 2 Overview of the medieval settlement area of Borgund. The excavated settlement area is located on the open fields in front of St. Peter's church – the present parish church at Borgund – with the eastern excavation site and the present Medieval Museum. To the left rear, behind the quay the remains of a boathouse of prehistoric type has been located. To the left, the remains of large landing stages for boats can be seen. In front to the left: the sound Klokkersundet runs into the bay Katavågen, with remains of long rows of parallel lying warehouses in both areas. Here, in the hill up to St. Peter's a Christian grave yard from the early eleventh century has been located, and St. Matthew and/or a Christ church to its left. The remains of St. Margaret was located on the outer promontory against Klokkersundet (Photo: R. Engvik, Sunnmørsposten)

view of a modern stratigraphical-topographical analysis. This kind of analysis has been carried out only to a limited degree (Lossius 1977), and is not applicable on the material in this study. Thus, the entire period of settlement and activity from the early eleventh century to c 1500 has been treated more or less as one.

The archaeological excavations and surveys have established evidence of an urban settlement spread over an area of c 45,000 square metres, of which approximately 5,000 square metres have been excavated (Figs 2 and 3). The medieval settlement area is situated on flat plains east of the present parish church at Borgund, rebuilt on the medieval St. Peter's church. The settlement area is oriented towards the sea and faces the Borgundfjord to the south, where remains of large landing stages for boats can still be observed. To the east, the shallow, protected sound Klokkersundet runs into the bay Katavågen (of ON *kati*, m. boat) and defined the northern boundary of the settlement area. Katavågen, which has a shallow and narrow outlet to the sound Nørvasundet in the north, is directly linked to the fjord system and the northbound sailing route. At high tide it would have been possible to row or pull small boats across. Other harbours in the county also have names with the prefix *kat*(i) (Buset 1959), including Katneset (meaning the boat promontory) in Veøy in Romsdal, another medieval small-scale urban community.

The archaeological finds of two buckles in Urnes style and a coin minted by Ethelred (1004–1009) support the early dating from liter-

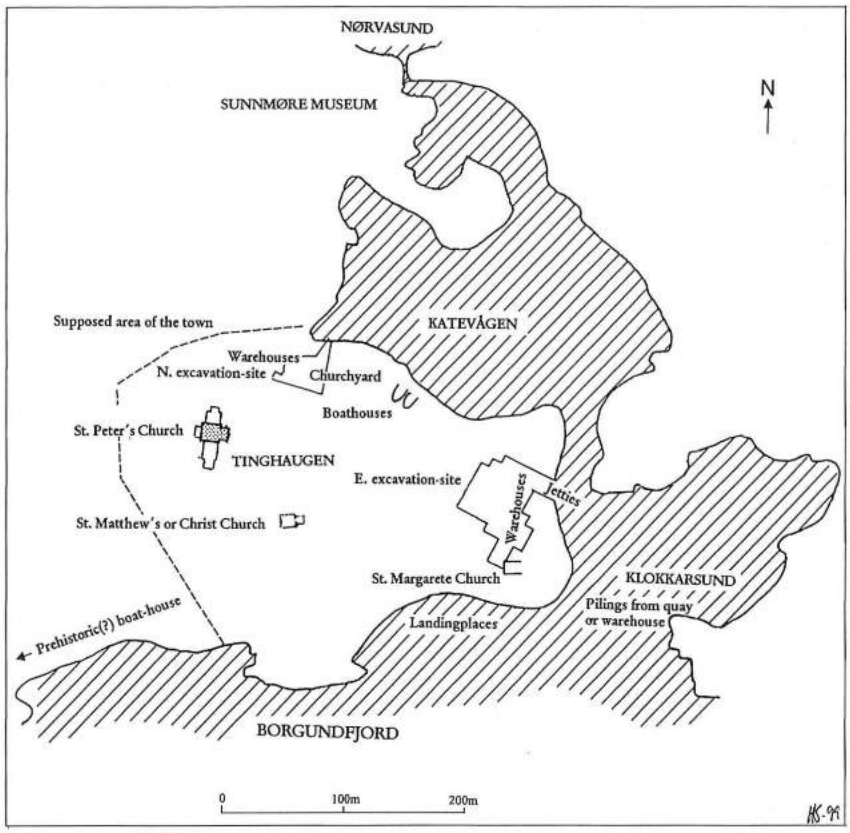

Fig 3 Map of the medieval settlement area in Borgund

ary sources. A cluster of buildings, with among others an assembly hall (Norw. *årestue*), has been dated to the second half of the eleventh century and no later than 1100 (Herteig 1957: 464), a date that also has been confirmed through 14C dating (pers. comm. Arne J. Larsen, University of Bergen). Buildings and ditches uncovered beneath the building must be even older.

Based on the maritime technology of the time and the central location at the junction between the inner fjord-districts and outer coast areas close to the northbound sailing route, Borgund had an ideal location for a local and regional meeting place. The harbour facilities were favourable for boats and small ships, such as *færinger* (boats with four or two pair of oars) and *åttringer* (boats with eight to ten or four to five pairs of oars), which were used from prehistoric times and in the fisheries until the twentieth century. The land here was also suitable for settlement, and last but not least it was close to the fjord and rich marine resources. Today, the harbour is shallow, as Klokkersundet must have been filled in at a later stage.

In a bay near the former church pier in Borgund, further west in the Borgundfjord, the site of a large boathouse is still visible. In the 1760s, Strøm linked the site to a medieval shipyard and shipbuilding, mentioned in literary sources (Strøm 1766: 70-719). As the site has not been excavated, this cannot be confirmed. According to the saga, a longship for twenty oars was under construction when the small town was ravaged during the civil wars in Norway in the second part of the twelfth century (Herteig 1957: 447).

Rows of postholes that have been found in the direction of Klokkersundet, have been interpreted as remains of long rows of parallel lying warehouses stretching from the beach where wooden piers have been located (Fig 4). The longest buildings measured more than 30m in length, and the area covered by excavated remains of warehouses was approximately 600 square metres, indicating a large storage capacity. Similar building remains have also been found further north in Katavågen. Since large areas have not been excavated, there could possibly be even more of them. An alternative, albeit perhaps less likely, interpretation is that some of the postholes could belong to structures for drying fish. Furthermore, two pits in the ground towards Katavågen have been interpreted as remains of boathouses.

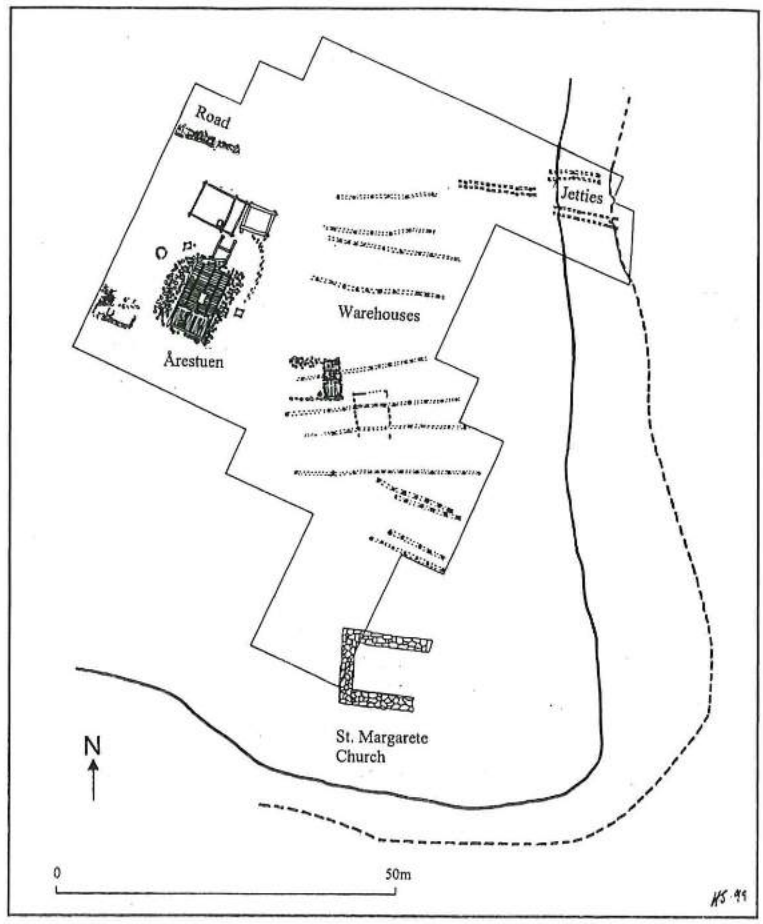

Fig 4 The eastern site with traces of warehouses and piers

On the beach at Klokkersundet, 16 postholes are arranged four by four in a quadratic formation and may be connected with the remains of a bridge. In 1766, remains of a wooden bridge, which had crossed the sound "in the old times", were still visible (Strøm 1766: 72). A possible medieval bridge across the sound would, however, have blocked the entrance to the inner harbour area. It is therefore more likely that the postholes should be interpreted as remains of the foundation of a warehouse or a pier.

Behind the harbour area with the remains of boathouses, piers and warehouses, traces of residential and commercial buildings were found. The best-documented cluster of buildings, with the mentioned assembly hall, is partly preserved and today exhibited in the site museum, the Medieval Museum of Borgundkaupangen.

Three stone churches, perhaps four, judging by the recorded names, demonstrate Borgund's importance as a medieval church centre. These were dedicated to St. Margaret, St. Peter, St. Matthew, and/or a Christ church. The marble church of St. Margaret towered the headland. The cross section in the present parish church is what is left of the medieval St. Peter's church. It is situated at the top of the hill at the border of the medieval settlement area, behind the so-called Tinghaugen – a mound where local things allegedly were held. The remains of the St. Matthew's or Christ church, another marble church, are located near this site.

These stone churches were probably built in the twelfth century (Kloster 1977: 11-12). However, they are preceded by a cemetery containing 3–400 graves that can be dated to the early eleventh century, based on the mentioned Ethelred coin from 1004–9 (Sørheim 1995: 12). Although no traces of earlier wooden churches have been found, it may be assumed that there were at least one or several churches here in the early missionary period, in conjunction with the cemetery. Thus Borgund was in all likelihood an early Christian centre, which was also the case at Veøy further north, in Romsdal (Solli 1996: 158).

The churches also demonstrate considerable economic strength and a certain population size. Capital was needed in order to build the churches in stone, and they were probably raised through donations, tithe and rent of the land owned by the Church in the area. The Church eventually became a considerable economic power. In the

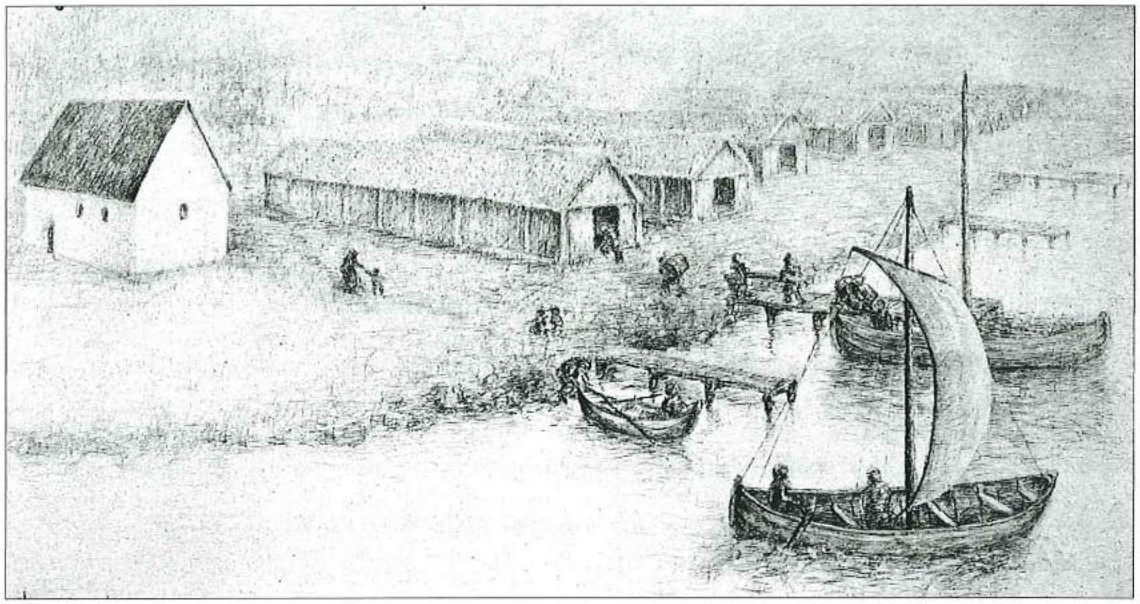

Fig 5 Reconstruction of the harbour area against Klokkersundet: St. Margaret, warehouses and piers (Drawing: T. Walderhaug)

post-medieval period, in 1648, about 25 % of the land in the region was owned by the Church (Kvamme 1994: 272).

The Church also took active part in commercial activities in the Middle Ages, and both bishops and monasteries owned merchant ships, which crossed the North Sea in the beginning of the fourteenth century (Nedkvitne 1983: 233-235). There is no written information about such involvement in Borgund. We must, however, assume that considerable amounts of goods, including fish products, in forms of tithe and land rent came through the ecclesiastical and commercial centre of Borgund (Fig 5). The Church may also have taken part in and organised the fisheries. The Church should therefore be regarded as a substantial factor for the origin and growth of Borgund.

The aristocratic Giske lineage may also have played an important role in the economic history of Borgund in the Middle Ages. The manor of Giske was located on the small island Giske, just outside Borgund and prominent chieftains from Giske appear in the written sources for the first time in connection with the battle of Stiklestad in 1030. The Giske estate became one of the largest in medieval Norway, owning land all over Sunnmøre. It also had its own tenement in Bergen. Some of the medieval noblemen from Giske are directly connected with Borgund, like Petter of Giske. As the harbour facilities at the island of Giske were poor, Borgund may have served as Giske's port and harbour in the manor's trading activities, and the majority of its trade may have been channelled through Borgund. The rich fish resources in the Borgundfjord should also be considered in connection with Giske's power and economic strength.

Methodological considerations

Although fishing and catching mammals have long traditions as the backbone of the coastal economy, this part of history has, rather paradoxically, been sparsely documented. There are several reasons for this. Many of the tools were made of organic material that, with a few exceptions, have not survived the ravages of time. Another problem is that efficient fishing methods were developed at an early stage, resulting in few typological changes; thus, the artefacts are difficult to date. Norwegian folk museums, based on nationalistic and romantic farming traditions, have until recently shown little interest in fishing and coastal culture. Consequently, the pre-industrial fishing equipment that would have helped to explain the

archaeological material has therefore only been preserved and documented to a small degree.

One of the first tasks when working on an archaeological material such as fishing equipment is to interpret and explain the activities the artefacts reflect. We can resort to synchronous analogies based on contemporary material, or retrospective methods.

Although retrospective methods are frequently used in both historical and archaeological research, they should be used with caution. Certain criteria must be met in order to develop sustainable theories through analogies (cf Binford 1972: 369; Sørheim 1981: 174-175). One of these criteria is that a historical relationship exists between the archaeological material and the recent, documented material. In a study of for example crafts and craftsmen, the possibilities of retrospective studies vary according to the sources and the extent of development within the particular craft. This also applies to fishing and fishermen.

Fishing is a traditional occupation, and the opposition to innovations can be illustrated by the scepticism and resistance to new and more efficient fishing methods. There was for instance great resistance to the introduction of long lines in the Borgund fisheries in the seventeenth century (Myklebust 1971: 18-21).

As fishing was traditional, at least until the major innovations in the twentieth century, the use of analogies can be justified. I find a retrospective analysis acceptable when objects found within a similar geographical and physical setting belong to a common historical development (Sørheim 1981: 174).

Few researchers have, however, recorded and examined fishing tackle that is suitable for comparative studies of medieval fishing equipment. In my own study, O. Nordgaard's study, *Træk av fiskeriets utvikling i Norge* (1908) has been of great help. His book was written when fishing equipment was still in use that can to some extent be compared to medieval equipment.

An important comparative material from Northern Norway has been analysed by Bjørn Ebba Helberg (1995). A large material from the excavations in Bergen is published by Ole Mikal Olsen in this volume, and I refer to his survey of the history of research on the subject.

The Borgundfjord and The Fisheries in Sunnmøre

The main spawning ground for the pelagic cod is Lofoten. The fisheries here date to the early twelfth century at the latest (Bertelsen 1994: 120), and Vågan was the most important marketplace for stockfish from Northern Norway from the 1170s onwards (Nedkvitne 1983: 189).

Part of the shoal spawned as far south as Møre (Eliassen 1983: 4), and the 12 km long Borgundfjord is a well known spawning ground with a depth varying between 50 and 125m (Fig 6). Here an extensive cod-fishery takes place from February until April. Sunnmøre is one of the southernmost areas with climatic conditions for producing stockfish of reasonable quality.

The deep rift Breisunddjupet in the continental shelf in seabed between Godøy and Hareidlandet is 222 fathoms (c 400m) at the deepest. The rift has been assumed to go on to the great depths in the Norwegian Sea, but this is not the case. It closes in the west and further out at

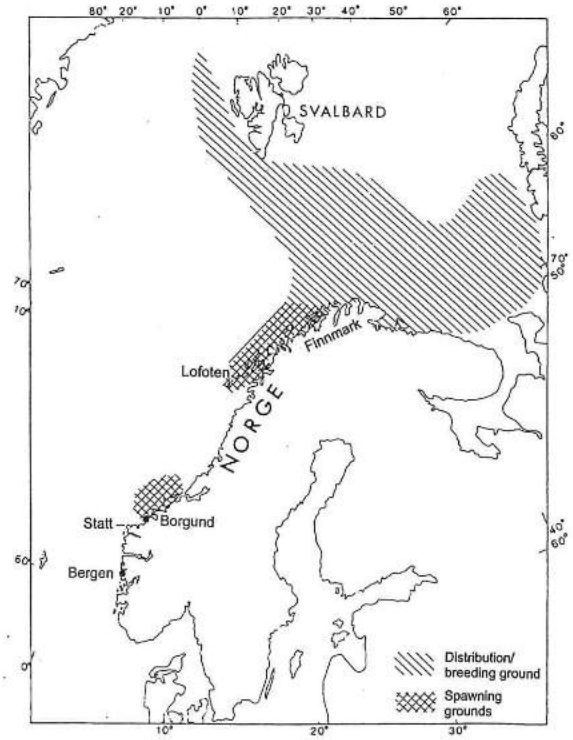

Fig 6 The extent of the fields and spawning grounds for the Norse-Arctic pelagic cod (Based on Eliassen 1983: 4)

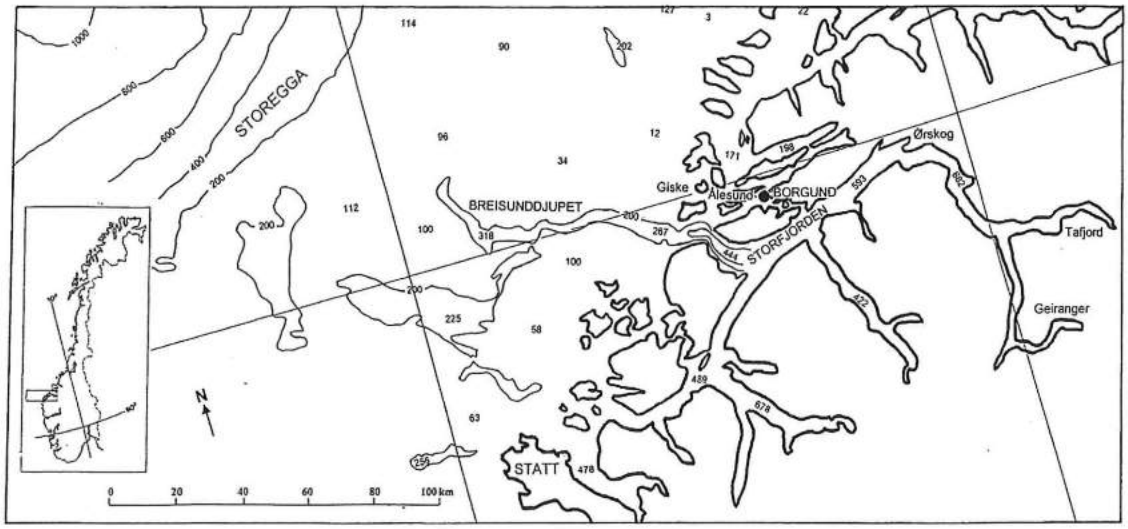

Fig 7 Sunnmøre with its many islands and deep fjords, and the continental shelf outside

Storegga there are shallow waters about 100m deep (Fig 7).

The Borgundfjord, continuing west to Hessafjord, adjoins the deep sound Breisundet, which forms the mouth of Storfjord (Fig 8). According to the fishermen, the cod comes in through the northern side of Breisunddjupet. The underwater slope towards Breisunddjupet is a much used fishing ground, and also described by Strøm in the 1760s (Strøm 1766: 52-53).

If the fish shoal follows Breisunddjupet it would naturally continue into the fjords Sulafjord and Storfjord. As the fjords are deep and the currents are strong, they are not well suited for fishing. Further inland, in the bay Ørskogvika, the cod fishery is more sporadical.

The main fisheries take place in the Borgundfjord because of the favourable depths in the fjord. With depths around 100m the waters are suitable for fishing with nets and lines (cf Myklebust 1971).

The Borgundfjord fisheries are described by Strøm in his account of Sunnmøre from 1762–66. At that time the cod net was commonly used (Strøm 1762: 476). According to Strøm, the fisheries were extensive and 499 *fioringfar* (big fishing boats) and 2994 fishermen took part in the Borgundfjord fisheries in 1756 (*op. cit.* 470-472). Visiting fishermen from the large fishing grounds in southwestern Sunnmøre or further away were, however, not included in this survey. The large number of fishermen in the cod fisheries in Sunnmøre thus outnumbered the 3000 men that took part in the Lofoten fisheries in the 1660s (Dyrvik 1979: 34). The cod fisheries in Sunnmøre were, however, more unstable than in Lofoten. In a journal from 1807, when the Lofoten fisheries were at a peak, Leopold von Buch noted that the fisheries in Sunnmøre were poor. He also mentioned that the fisheries at times were almost at the level of the Lofoten fisheries (Solhaug 1976: 207-8).

At the end of the seventeenth century, the fishermen in the Borgundfjord area had the most advanced equipment along the coast for fishing cod (Fig 9). According to written sources, cod nets and long lines were first used during the rich cod fisheries in the protected waters, primarily in the Borgundfjord and to some extent further south. Documents from the early seventeenth century concerning the use and theft of long lines for cod, demonstrate that this equipment was used in the late 1600s (Nedkvitne 1988: 438-40).

The question is whether the commercial cod fisheries in the Borgundfjord can be traced back to the early Middle Ages. Was the equipment of the same type and quality as at the end of the

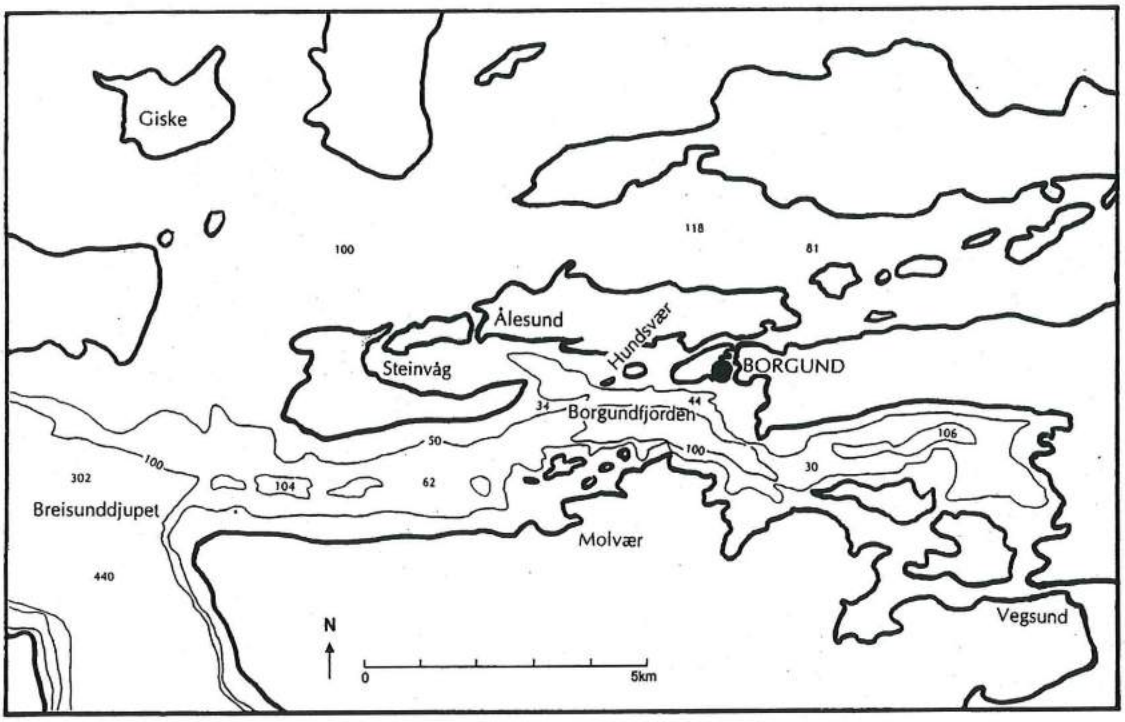

Fig 8 The Borgundfjord

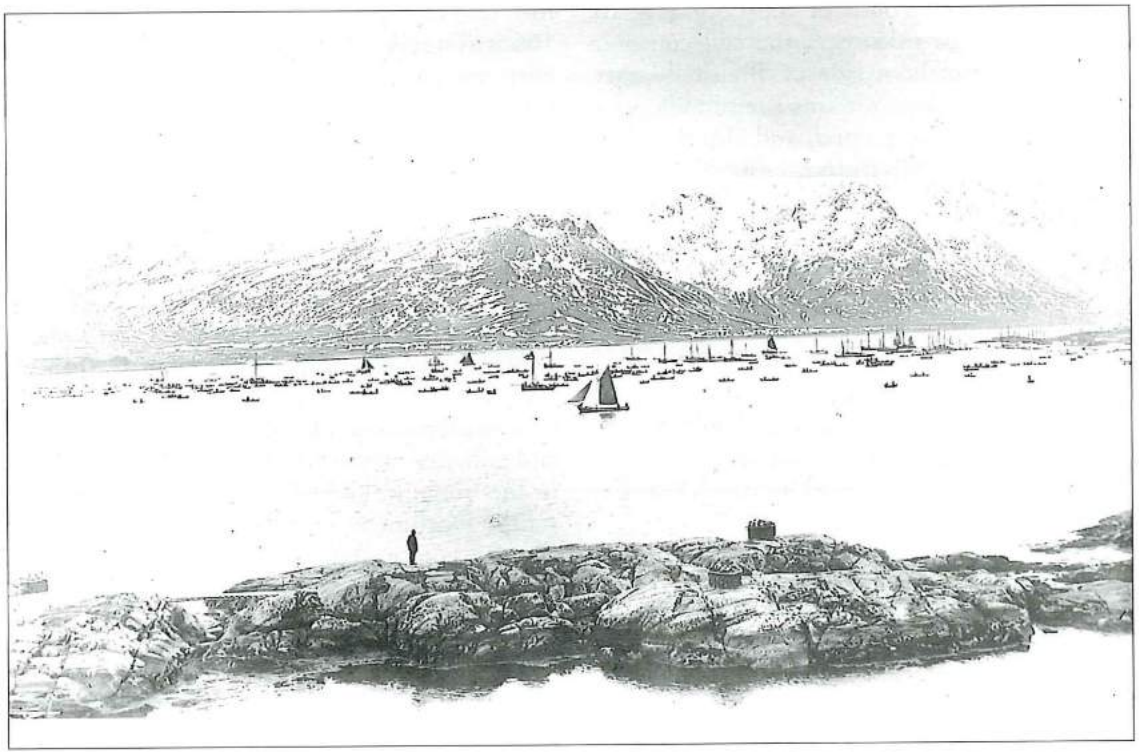

Fig 9 Cod fishing in the Borgundfjord c 1900 (Photo: Aalesunds Museum)

1600s? Were the fisheries limited to the shallow and protected Borgundfjord, or did the fishermen go further out to sea, to Storegga and the excellent fishing banks where the continental shelf drops into the Atlantic Ocean? Can the artefacts from the excavations at Borgund throw light on these questions?

Fishing Tackle From Borgund

Possible fishing methods to be traced in the Borgund material is primarily hand lines (Norw. *djupagnsnøre* or *juksa*) and troll lines (Norw. dorgesnøre). The two types of line consist of a line, sinker, snood and hook. The cod line was adopted from around 1600, according to written sources (Myklebust 1971: 20). Nets are known from the Middle Ages. The cod net is of particular interest as it is popularly believed, albeit mistakenly, that the inventor of the cod net, Claus Nielsen, lived in the Borgundfjord area and that it was introduced here in 1685 (Strøm 1762: 448-9). Whether cod nets were in use in the Middle Ages is rather doubtful. Assumedly nets and closing nets were used primarily for catching herring (Vollan 1960: 203-4).

Equipment for line fishing

Hooks

A hook is a more or less curved artefact made of a relatively hard material, sharp at one end and a line can be attached to the other end. The hook has two main tasks: to catch the fish with ease and secondly to hold on to the fish until it is on land or dragged into the boat.

Although the shaping of the hook has varied greatly through time according to the limitations set by the material – wood, shell, stone or metal – the main design has remained the same. However, there are variations adapted to different species, their behaviour, size, and fishing methods.

Helberg (1995: 102) emphasises the behaviour of the fish when establishing criteria for a typology. Some species approach their prey out of curiosity or irritation, some jump as they are about to bite, others suck or swallow their prey. Based on this, Helberg has drawn up the following criteria:

- Curved or straight shank
- Open bend of the hook or inwards curved hook
- Twisted hook-end in relation to the shank or straight end
- Barbed end or straight end
- Attachment for the line, eye or sheet

The shape of the shank affects the way the hook behaves in the water. Hooks with slightly curved shanks may catch some species more successfully than hooks with straight shanks. Hooks with curved shanks twist easily into a favourable position and are suitable for passive fishing, e g using a line. Hooks curved inwards catch fish more successfully because they penetrate the mouth of the fish with ease. Twisted hook-ends may also catch fish more successfully than hooks with straight ends. The latter are common, but many fishermen today, especially the Icelandic, prefer hooks with twisted ends when fishing with bait. These hooks are also easier to bait (Hurum 1976: 79-83).

Elements such as the length of the shank, the mouth of the hook and the length of the barb are not used as classificatory criteria. However, such elements can supply information on the size and species that were caught.

A total of 19 complete or fragmentary iron hooks have been found in Borgund (Fig 10), (cf Table 1), of which one (1/3387) is uncertain as a fishhook. All the other hooks have crosswise eyes for attaching the line or the snood. With the exception of two hooks, they all have curved shanks. All the hooks have an open bend and most of them are barbed. There are no twisted hooks.

The majority of the hooks from Borgund are classified as Helberg's type IV A (Helberg 1995: 111) or Olsen's type C (cf Olsen this volume). This is a rarely known type in the material from Northern Norway, only two hooks are found. Hooks with straight shanks and a sheet for attaching the line dominate in the north Norwegian material with a total of 253 hooks. Helberg describes this type, denoted IC, and also known as type J, as an all-purpose hook for all kinds of fishing, where the size of the hook was decisive. According to Helberg, hooks with the longest

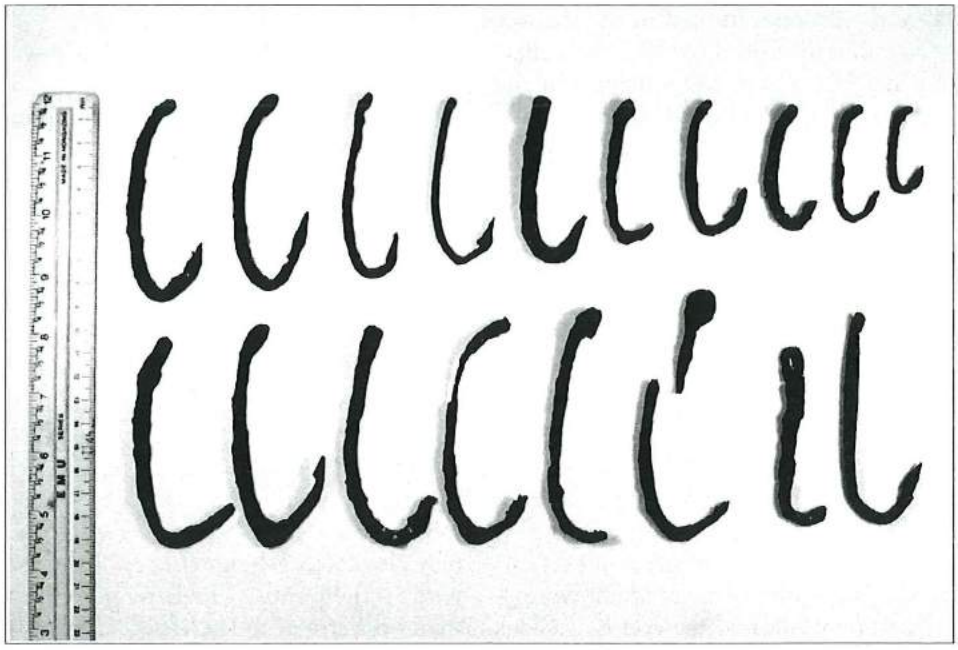

Fig 10 Fishhooks. No. 1/2710 with a straight leg, the others with curved legs. (Photo: H. Sørheim)

shanks may have been used for fishing flat fish and halibut, which have sharp teeth and are able to bite off the snood if the shank is too short (Helberg 1995: 173). Helberg's type IC hooks have been commonly used in Norway until the end of the 1970s (Dybdahl 1992: 29). In Borgund, the hook with curved shank, eye and open bend seems to have been the all-purpose hook.

The hooks from Borgund appear to be slightly bigger on average than the hooks from Northern Norway. Helberg's type IC hook measures an average of 6,8cm, whereas in Borgund, the average length of the hooks is 7,9cm. The hooks from Borgund are higher and wider than the hooks from Northern Norway and also from Bergen (cf Olsen this volume).

In conclusion, the medieval fishermen from Western Norway appear to have preferred hooks with eyes and curved shanks, whilst hooks with straight shanks and sheets for attaching the line were common in Northern Norway. The hooks are generally larger in Borgund as well. Whether this is due to regional variation or tradition, or there is a functional explanation, cannot be determined. The smaller size of the hooks in Bergen may be explained by the fact that they were used mainly for fishing more stationary species in the Bergen area (cf Olsen this volume). The fisheries here were more domestic compared to the fisheries in Sunnmøre and Northern Norway.

Weights

The weights are the largest group of fishing-related artefacts from Borgund. It is not always easy to determine whether a stone was used as a weight in fishing or had other purposes. Stone weights were used on warp-weighted looms in order to tighten the warp, but may also have been used for fishing as net weights or line sinkers. I will here use the same criteria as Ole Mikal Olsen when trying to identify the different categories of weights.

The purpose of a line sinker is to bring the line and hook down to the desired depth and at appropriate speed. A heavy streamlined line sinker will make the hook sink rapidly to the chosen depth in order to prevent unwanted fish in shallow waters from swallowing the bait. The shape

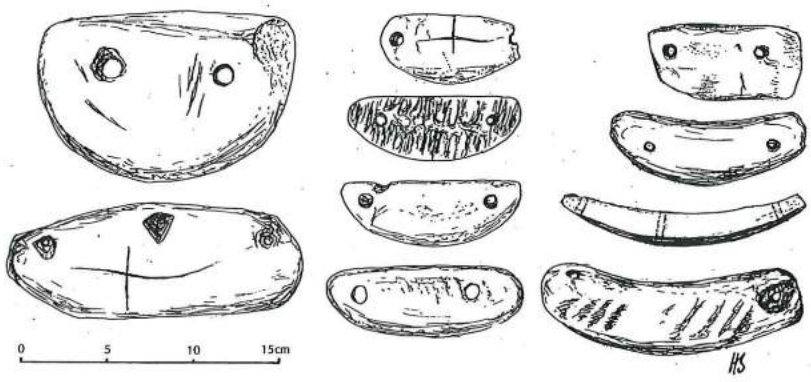

Fig 11 Sinkers for troll lines

decides whether the line moves properly in the water. A closer analysis of weight and form can give an idea of the ability to bring the hook down to the desired depth as well as the ability to cut through the waters and currents effectively.

A striking common denominator for all the weights from Borgund, is that they are made of soapstone. Only five fishing weights are made of other minerals. There were no metal or clay weights.

The archaeological material indicates that broken soapstone pots were frequently used as weights. Siri Myrvoll Lossius suggests that the majority of the soapstone vessels came from quarries in Hardanger, south of Bergen, but soapstone is also found in Sunnmøre and may have been quarried locally. Soapstone is easy to work and is particularly suitable for the production of weights. Sherds from broken pots were handy for making weights. Although it is not always possible to determine whether the weights were made of pot sherds, it must be assumed that the sherds were used as much as possible. Soapstone was also used as a building material, especially for artistic details in the window- and door openings in the three stone churches, and unused material was ideal for making small objects such as fishing weights and warp weights. The more or less exclusive use of soapstone bears witness to the abundance of this material.

Sinkers for trolling

When trolling, the line is dragged through the water behind the boat and consequently, it is important to prevent the line from twisting. This is achieved by using an asymmetrical sinker. The suspension holes, one at each end, are placed in such a way as to obtain balance when the line is dragged through the water. Sinkers for trolling (Norw. *dorgesøkker* of ON *dorg* f.=fishing line dragged through the water) are frequently boat-shaped, with a straight back and a curved, hanging "abdomen". The line is attached at each end near the back. These sinkers could also have been used as net weights. Nordgaard assumes that some sinkers can be defined as net weights based on the latitudinal grooves around the suspension holes (Nordgaard 1908: 84), but similar grooves have not been found on the sinkers from Borgund.

There is a total of 19 sinkers that may have been used for trolling (Fig 11). In addition, there are 8 pot sherds with two or more holes along the edges. Although they may have been used as sinkers, they are more likely to be the result of repairs and I will therefore leave them out of the discussion.

Twelve of the sinkers have an almost straight or slightly convex back, denoted as type A (cf Table 3). Seven sinkers have a concave back, shaped like a banana, and denoted as type B (cf Table 4). The shape causes the line to move slightly up and down in the water, but whether this was intentional, is uncertain. Only two type B sinkers seem to have been given the shape intentionally, while five sinkers were made of fragments of soapstone vessels, where the shape of the vessel determined the shape.

The weight of type A sinkers varies from 90 to 637g, with an average of 235g. Two sinkers stand out by being heavier than the rest, weighing 518 and 637g. Excluding these two sinkers, the average weight of the remainder is 167g. The smallest type B sinker weights 45g, while the largest one weighs 454g. The average is 152g. According to Nordgaard, these sinkers appear to be found

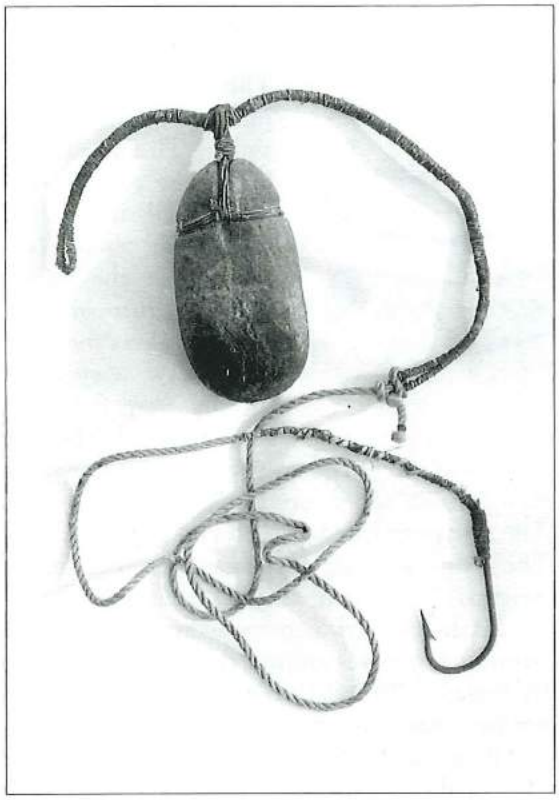

Fig 12 Deep bait line used for fishing halibut until the 1930s. Uksnøy, Haram, Møre and Romsdal (Photo: H. Sørheim)

only locally in Western Norway (Nordgaard 1908: 95).

On the whole, the troll sinkers from Sunnmøre are heavier than the sinkers from Northern Norway; the latter generally weigh less than 100g, although some sinkers weigh about 350g. These may, however, have been used as net weights (Helberg 1995: 179).

Deep bait line

The hand line is commonly known as deep bait line (Norw. *djupsagnsnøre*, ON *djúpshöfn* f. =fishing line, deep bait line). In Northern Norway it is called *juksa* (Aasen 1918: 108). The shape and weight of the sinker is adapted to the desired depth of fishing as well as the currents. An important factor in terms of the sinker's ability to sink rapidly, is that unwanted fish in shallower waters may swallow the bait before the hook reaches the desired depth. There is not the same need to prevent the line from twisting, so the sinkers are symmetrical. These sinkers can also be used as net weights.

The simplest type of sinker is a stone with a latitudinal or longitudinal groove for the line. Only one sinker of this kind has been found in Borgund, weighing 740g (1/2858). An oval, flat stone with a latitudinal groove around the edge was heavier, weighing 909g (1/58/384). In terms of shape and raw material, these sinkers stand out from the rest.

Three long sinkers or fragments of sinkers have grooves stretching from the edge to a hole in the middle, similar to Nordgaard's Fig 50 "deep bait sinkers from Northern Norway" (Nordgaard 1908: 92) and Helberg's type IV (Helberg 1995: 117) (Fig 13). In Northern Norway, this type is known as *jarnstein* or *jarstein* (ironstone) (Nordgaard 1908: 90). They were probably used exclusively for the hand line (Norw. *juksa*) for cod and other deep-sea fish. The sinkers from Northern Norway are large and heavy, weighing 1200–2103g for Helberg's type III, which are long sinkers with latitudinal grooves but no holes, and 300–1500g for Helberg's type IV, which has a longitudinal groove (Helberg 1995: 178). The only complete sinker from Borgund that is comparable to type IV weights 432g and is small compared to the sinkers in the north. It is, therefore, unlikely that it was used for fishing in deep waters.

Only one example of the northern jarstein of Helberg's type III *(ibid*: 117) has been found in Borgund: a long sinker with a deep encircling groove and a longitudinal groove. Weighing 1299g, this is one of the heaviest sinker from Borgund (cf Table 6). Nordgaard compares this type to a sinker from Shetland, where the line is attached over the head and the snood is tied around the stone, in order to prevent the snood and hook from intertwining with the line.

At a later stage an iron wire was used in order to avoid this problem. A slightly curved wire was attached to the sinker with a leather cord and a lead weight was welded directly on to the wire. Strøm depicts a line sinker of metal where the wire seems to have been replaced by a thick plait-

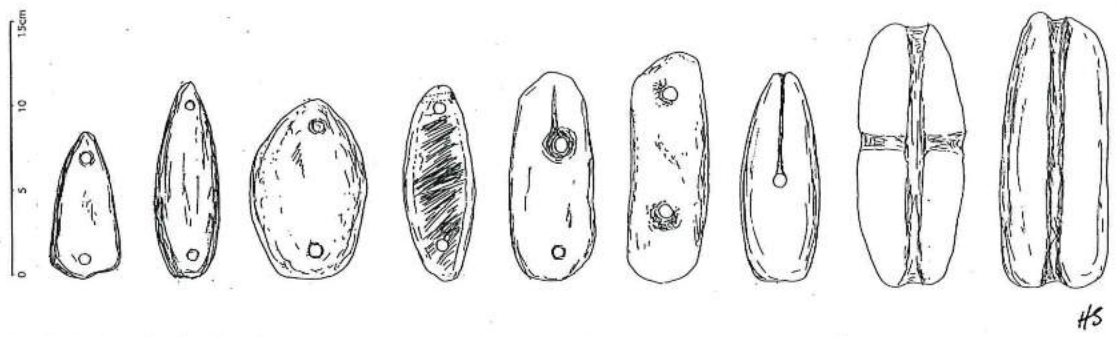

Fig 13 Sinkers for deep bait lines

ed rope (Strøm 1762: Fig 9). This is the earliest recorded example of this type that I know of.

A comparable heavy wired sinker where baleen is used as wire, is found from Uksnøy, Haram in Sunnmøre (SM 12285). This is an oblong stone of the northern jarstein type (Helberg's type III), and was used until 1931 for fishing halibut (Fig 12).

The largest group of sinkers that have been used as deep bait sinkers, are long and straight stones with a symmetrical axis and holes in the ends. They are similar to the troll sinker, but are less stable in terms of preventing the line from twisting. Nordgaard argues that the line was attached to one of the holes, while the snood was attached to the other, thus providing the simplest type of line. They may, however, also have been used as net weights.

The 15 complete examples from Borgund (Table 2) vary in weight from 105 to 1380g. The latter, as well as two sinkers weighing 828g and 966g respectively, differ from the rest in weight. Disregarding the three heavy sinkers, the average weight of the remaining complete sinkers is 222g, considerably less than the northern jarstein.

With a few exceptions the weight of the deep bait sinkers is so small that they were probably not used for fishing deep-sea fish. It is likely, therefore, that the sinkers were mainly used for fishing in the shallow Borgundfjord.

Line runners

The only line runner found in Borgund is fork-shaped and fastened to the gunwale by a wooden peg (Fig 14). It was made of bone and was used when pulling in the line in order to protect both line and gunwale. There are no traces of the rolling line runner, which has a rotating cylinder for pulling the line across. Helberg found that this line runner was adopted at the same time as the heavy jarstein from the eleventh to the thirteenth century and it is one of the technological changes in the Middle Ages.

Fig 14 Line runner made of bone

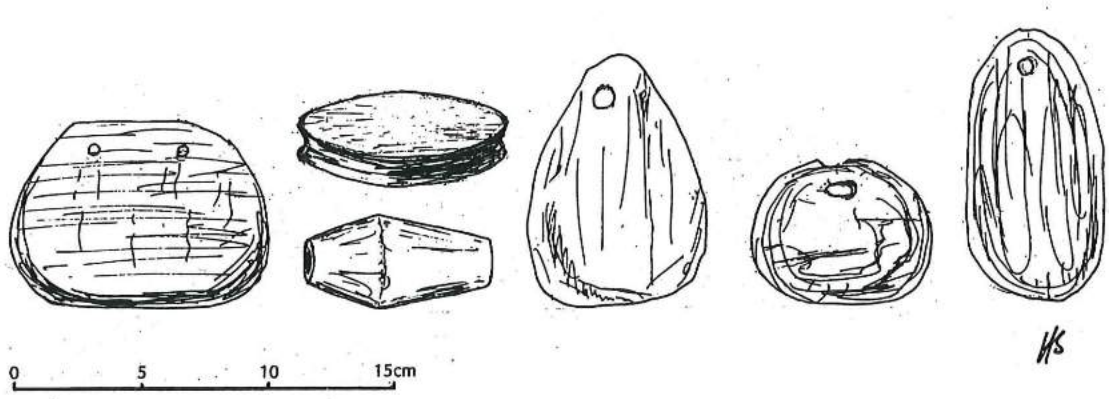

Fig 15 Floats made of wood and pine bark

Equipment for fishing with nets

Nets and closing nets are mainly used for fishing salmon and herring (Vollan 1960: 327).

Floats

In total eight floats of four types have been found at Borgund (Fig 15):

A) wooden, pear-shaped with a hole in the end (3)
B) wooden, round discs with a groove around the edge (3)
C) wooden, bag-shaped with a triangular section and two holes on the edge (1)
D) pine bark, long and flat with a hole at the end (1), or round with a hole near the edge (1)

Net weights?

According to Nordgaard's classification, only one of the weights from Borgund – a barrel-shaped weight (1/57/418) with a longitudinal whole, weighing 233g, can be classified with certainty as a net weight. A marble ball (1/57/418) may also have been part of the fishing tackle. The heavy weight, 3,55kg, indicates that it was an anchor stone for a long line or net, a socalled *ilestein*.

As Ole Mikal Olsen has pointed out (cf Olsen this volume), it can be rather difficult to distinguish between warp weights and net weights if the weights are not found in a clear finds context, but as the excavated area is close to the sea it is likely that nets and other equipment were stored, thrown away or lost here. The archaeological material from Borgund comprises 129 weights of soapstone that may either have been used as warp weights and/or net weights. Most of them are flat and pear-shaped, but the shape ranges from round to more cylindrical weights (Fig 16). The finishing also varies, ranging from fragments of vessels with a hole to neatly polished weights.

As none of the weights from Borgund have been found in a clear context as far as function is concerned, I will look closer into the weight. As Olsen already has shown, a weight class of 100–500g should be a reasonable weight for medieval net sinkers. Without going into a discussion of the individual weights, the average weight of the stone weights from Borgund is considerably less than that of the weights from e g Oslo, which is 813g (Rui 1991: 119), and probably mostly used as warp weights. I find it likely that the weights from Borgund could also have been used as net weights when available, in the same way as any suitable stones that could easily be attached to nets were used.

Needles and knotting peg

Two wooden needles may have been used for netting or repairs, while a flat wooden peg with one convex side has been interpreted as an equipment for knotting the mesh (Norw. *re* or *kjølve*) (Herteig 1957: 447) (Fig 17). If this interpreta-

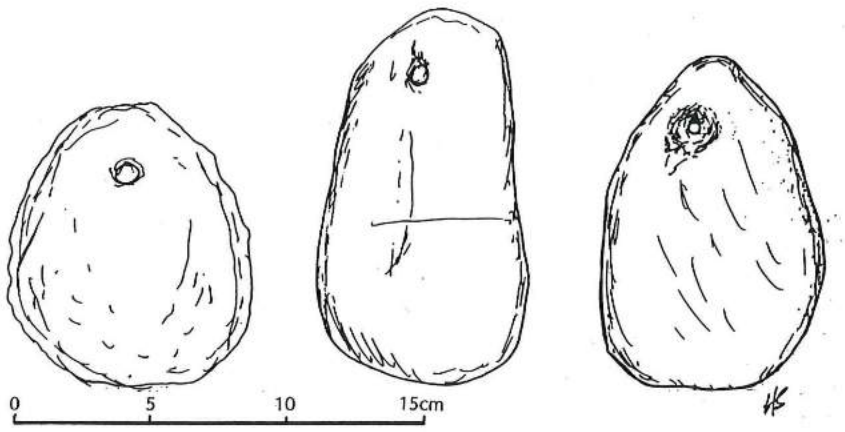

Fig 16 Weights of soapstone from Borgund – warp weights or net sinkers?

The number of finds that indicate the use of nets for fishing in Borgund is, however, altogether sparse: 8 floats, 2 needles, 1 positive net sinker and 1 possible peg. An extensive use of nets for fishing cannot be derived on this basis. There is no indication that nets were used for fishing cod as early as the Middle Ages.

tion is correct it would give a mesh of 2,5 cm measured from knot to knot, the same as in a modern herring net.

The director of the Borgund excavations, Asbjørn E Herteig has earlier claimed that fishing with nets must have been a widely used technique in Borgund (Herteig 1957: 421).

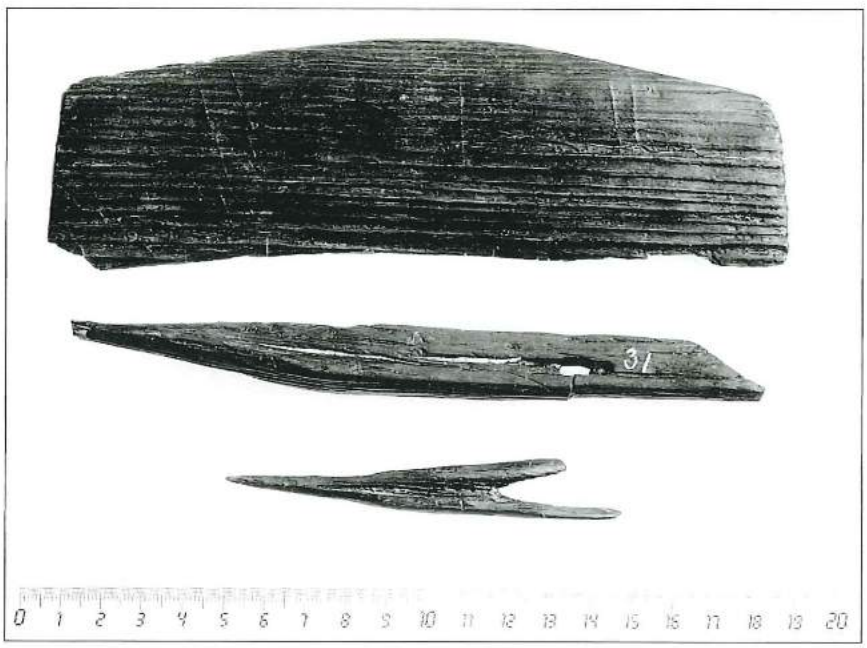

Fig 17 Top: Wooden peg (Norw, "re" or "kjølve") for knotting the mesh in nets. Below: Netting needles (Photo: S. Skare, Bergen Museum)

Harpoons

A harpoon or fish spear measuring 9,4cm was found in Borgund. It has two barbs and a ferrule (Fig 18). Nordgaard has also identified similar objects as harpoons (Nordgaard 1908: 108). Its fairly modest size indicates that it was used for harpooning fish or possibly to catch seal.

Fish bones

The osteological material collected between 1954 and 1962, a total of 24,593 fishbones, has been identified by Kaare Sunde at the Zoological Museum in Bergen (Sunde 1972). As the soil was not sieved, only larger and visible bones were collected. Bones from small fish, such as herring,

are therefore completely lacking. Three species dominate: cod (16%), saithe (32%) and ling (51%). The large quantity of ling is striking. Ling is caught particularly at depths between 100 and 400m at Storegga, but there is also plenty of ling in the deep mouths of the fjords. However, the depth requires long lines with heavy sinkers, which have only to a small extent been found in Borgund. The low percentage of cod could possibly be explained by the fact that cod as dried stockfish was a commodity for export and was not consumed in any great quantity at Borgund. However, as stockfish was also made of ling, it is difficult to explain the difference in quantity between the two. A dominance of bones from fish heads would have indicated production of stockfish (Perdikaris 1998; 1999). If this had not been the case, it would have meant that the production of stockfish took place along the fjord, while the fish was stored and traded in Borgund. As the bone material from Borgund has not been collected systematically and analysed more thoroughly, this question cannot be illuminated any further.

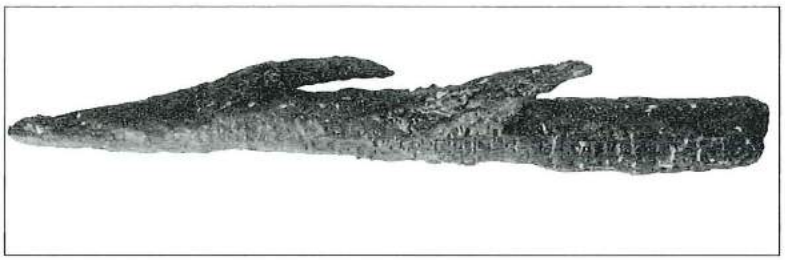

Fig 18 Harpoon or fish spear of iron found in Borgund, length 9,4cm (Photo: H. Sørheim)

CONCLUSIONS

The fishing tackle found in Borgund, and the location and orientation towards the sea, indicate that the place to a large extent was based on marine activities and maritime communications. The main reason for Borgund's development to more than a local centre and fishing village, should be sought in the trade in stockfish. The remains of warehouses from the thirteenth and fourteenth centuries indicate that Borgund was an important staple place storing large quantities of goods at that time. The rich and powerful Giske chieftains and noblemen seem to have taken part in the trade and probably organised the fisheries as well. The three twelfth century stone churches also reflect the economic strength of the Borgund area at an early stage. The church may also have played an important role in the production and trade of stockfish.

The stockfish was brought to Bergen for further export, as was the case with fish from Northern Norway. In 1177, King Sverre met the "Vågan fleet" en route to Trondheim. This confirms that the fishermen in the north brought their goods to Vågan, and the goods were taken from Vågan to Trondheim and Bergen by boat. A similar organisation could have existed in Borgund in the twelfth and thirteenth centuries. It is, therefore, relevant to relate the origin and development of Borgund to the development of Bergen as a commercial centre, and to the rapid demographic expansion in Northern Europe and the general growth of trade in the early Middle Ages. It should also be taken into account that Borgund was located closer to the market than Lofoten. The extent of the medieval stockfish export from Borgund is, however, unknown. In the 1700s there were as many fishermen in the Borgundfjord area as there were in Lofoten a hundred years earlier, and suggests the potential of the fisheries in the area.

The troll lines found in Borgund were probably used first and foremost for fishing saithe and cod, intended for domestic consumption. The deep bait line was, however, probably used for the winter and spring fisheries. Based on the fishing-related finds from Borgund, it has been claimed that the net was an important equipment in the Middle Ages (Herteig 1957: 447; Vollan 1960: 203). To my mind, this is taking the evidence too far. The finds of eight floats, two needles, a few net sinkers and a possible peg, cannot substantiate the use of cod nets.

The light deep bait sinkers bear witness to fishing in shallow waters, most likely in Borgundfjord, which excludes the possibility that fishermen from Borgund fished in deeper waters, for instance the Storegga. In shallow waters, at depths of 50–125m, the shape of the sinkers might be less important, and the possibility that stones shaped like the classical warp weights could have been used as sinkers as well should not be overlooked. It is even likely that weights weighing less than 500g, were used as net sinkers when available.

Because of the large quantities of bones from ling, several historians have suggested that ling was fished at Storegga (Sulebust 1981: 273; Nedkvitne 1983: 365). Based on the archaeological material and historical documents, I find it more likely that it was caught in the deep fjords in the area, where there was plenty of ling. Ling could be caught all year round and is a more stable resource than cod, which comes to spawn during the few short winter months. This may perhaps explain the difference in quantity between bones of ling and cod. Cod may also to a larger extent have been produced as stockfish for export. Due to the unsatisfactory collection of the bone material, it is difficult to decide whether stockfish was produced in Borgund itself.

In Northern Norway, the introduction of heavy deep sea sinkers (*juksa*) and line runners with moving rolls to pull the line over are dated to around 1000–1200 AD. Helberg links these technological changes to the commercial fisheries, the trade in stockfish and professionalisation of fishing (Helberg 1995: 192, 218). Since line runners also have been found in Bergen, they should be expected to have been used in a wider area. However, corresponding equipment has not been found in Borgund.

The lack of heavy sinkers of the jarstein type in the fishing tackle from Borgund could be explained by the fact that fisheries in the Borgund-

fjord took place in shallow waters. However, as the growth of commercial fisheries in Norway coincided with the emergence and development of Borgund as an urban centre, I find it likely that this happened as a result of the development of the commercial fisheries.

It is reasonable to believe that medieval fishermen and crofter-fishermen travelled from the district to take part in the Borgundfjord fisheries in the same way as is known from the seventeenth and eighteenth centuries. They would have required seasonal lodgings. The fishing villages Hundsvær and Molvær may have had such a function. Similarly, it can be assumed that Borgund was crowded with fishermen during the season.

The distance between the farms and fishing grounds was probably shorter in Sunnmøre than in the north. The fishing season was also shorter, compared to Lofoten. The social organisation of the fisheries in Sunnmøre differed from that in Northern Norway with less fishing stations. The many farms on the islands along the coast could provide lodgings for visiting fishermen so there was not the same need for fishing stations as in the north.

Borgund declined as a central place and was deserted by the late Middle Ages. The decline started as early as the fourteenth century. The Black Death in 1349–50 and the following epidemics must have been catastrophic for the place and the activities there. 67% of all the farms in the district were deserted in the late Middle Ages. The Church as a proprietor was also affected and as a result the economy of the ecclesiastical centre of Borgund suffered.

The fluctuations in the fisheries are also a factor that should be considered. In later periods, we know that the fish was absent for shorter or longer periods. Such fluctuations may also have taken place in the Middle Ages. There are several and rather complicated reasons for the fluctuations, such as climatic changes and changes in currents. Cod is extremely sensitive to changes in temperature. Although it cannot be ascertained, a colder period could have influenced the fish and the fisheries in the Borgundfjord in the late Middle Ages, and could thus have contributed to the decline of Borgund.

According to written sources, trade was reorganised in the late Middle Ages. A decree from the 1290s prohibiting foreigners to sail further north than Bergen, was lifted in the mid fourteenth century. As the foreign merchants, particularly the Hansa merchants at Bryggen in Bergen, were able to give credit, the fishermen began to take stockfish directly to Bergen, instead of delivering it to Borgund. A document issued by king Olav Håkonsson in 1384 reacted upon the new situation, and instructed people to maintain old traditions: people from Finnmark and Hålogland should sail with their goods to Vågan, people from Namdal, Nordmøre and Trøndelag to Trondheim, people from Romsdal to Veøy, and people from Sunnmøre to Borgund, "as they had always done". This instruction seems to have failed and Borgund eventually became redundant as a staple. The reason may have been that the Black Death broke up old trade patterns, as claimed by Johan Schreiner and Alf Kiil. Arnved Nedkvitne, on the other hand, argues that the reorganisation can be explained by the higher prices and competition for fish as a result (Nedkvitne 1983: 282). The shallow harbour can also have become a problem for bigger cargo vessels in the late Middle Ages.

Borgund was deserted around 1500, but the Borgundfjord fisheries continued. Borgund's role as a staple for stockfish en route to Bergen was gone. However, local trade and craft activities were carried on around the Borgundfjord until the development of the new town of Ålesund in the nineteenth century.

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Hooks

No.	Length	Height	Width	Weight	Material	Hook	Shank	Barbs
1/57/49	9.5	3.9	3.1	16.1	Iron	Open	Curved	Yes
1/57/122	5.3	2.0	2.7	3.5	Iron	Open	Curved	Yes
1/57/442	8.4	2.1	2.5	17.5	Iron	Open	Curved	?
1/58/254	9.0	1.8	4.1	12.3	Iron	Open	Curved	?(broken off)
1/59/576	9.3	1.9	4.0	14.9	Iron	Open	Curved	Yes
1/59/626	6.9	1.9	2.8	9.8	Iron	Open	Curved	No
1/59/709	9.1	0.6	2.5	10.3	Iron	Open	Curved	?(broken off)
1/59/711	8.8	2.5	5.5	7.1	Iron	Open	Straight?	No
1/59/910	5>				Iron			?(broken off)
1/59/1363	8.5	2.5	3.4	3.4	Iron	Open	Curved	Yes (?)
1/60/1596	7.8	1.9	2.5	1.9	Iron	Open	Curved	Yes
1/60/1472	3.7	1.2	1.5	0.7	Iron	Open	Curved	Yes
1/1999	7.6	3.0	2.4	5.4	Iron	Open	Curved	Yes
1/62/2638	6.1	1.9	2.1	3.5	Iron	Open	Curved	?(broken off)
1/62/2710	9.0	2.1	3.4	12.5	Iron	Open	Straight	Yes
1/62/2734	7.1	2.0	2.6	3.6	Iron	Open	Curved	Yes
1/63/2829/1	9.5	2.4	3.7	9.3	Iron	Open	Curved	Yes
1/63/2829/2	10.9	1.9	3.9	12.0	Iron	Open	Curved	?(broken off)
1/63/3310	8.3	3.3	3.3	9.6	Iron	Open	Curved	Yes
1/63/3043	5.2	1.5	2.1	3.6	Iron	Open	Curved	?(broken off)
1/64/3387	7.5	0.9	2.1	5.6	Iron	Open	Straight	Broken off?
Average	**7.9**	**2.1**	**2.9**	**8.1**				

Table 1. Hooks

Sinkers

No.	Length	Width		Weight	Material	From vessel?	Note
No number 10	11.5	6.7	2.3	314	Soapstone	Yes	
No number 21	10.1	3.7	2.4	148	soapstone	yes	The holes diverge 45°
1/57/168	14.1	4.4	1.7	178	soapstone		
1/57/423	10.2	3.6	2.7	133	Stone		Broken at one hole, replaced by new hole
1/58/83/1	12.1	5.0	2.7	225	soapstone		Big and small hole
1/58/277/1	9.5	3.8	2.6	160	soapstone		Broken at one hole
1/1654	12.0	4.2	2.1	180	soapstone	yes	Extra hole at one end at an angle to the other holes
1/2288	15.4	6.5	2.4	425	Soapstone	yes	
1/2592	20.1	8.3	6.0	1380	Soapstone		Grooves from hole
1/2662/2	>8.2	4.1	1.9	>74	Soapstone		Broken. One half preserved
1/2877	14.9	8.9	5.5	966	Stone		Naturally shaped stone
1/4398	10.7	7.2	3.6	336	Soapstone		Oval
1/4427	8.6	4.2	1.8	105	Soapstone		Broken at one end
1/4748/1	11.6	4.0	2.3	163	Soapstone	Yes	
1/5860	21.1	8.00	3.7	828	Soapstone		
1/6117	13.4	4.8	3.1	293	Soapstone	Yes	
Average	**13.0**	**5.8**	**3.1**	**389**			
Average				**222**	(The three heaviest sinkers excluded)		

Table 2. Long, straight, with symmetrical holes along the median line at each end

No.	Length	Width	Thick ness	Weight	Material	From vessel?	Note
1/54/148/1	9.3	4.7	2.7	177	Soapstone		
1/54/148/2	11.7	3.9	3.0	186	Soapstone		
1/54/150	11.6	3.9	2.5	170	Soapstone		
1/57/458	16.8	6.8	3.2	518	Soapstone		Unfinished hole in the middle. Cross-shaped engraving
1/58/394	14.8	9.3	2.7	637	Soapstone		
1/262/3	8.6	5.5		105	Soapstone		
1/4461/1	9.8	4.6	2.0	178	Soapstone	Yes	
1/6116	8.6	4.0	2.7	120	Soapstone		Cross-shaped engraving
1/6118	12.4	4.6	3.6	276	Soapstone		
1/6120	10.3	3.9	1.8	90	Soapstone		
1/6147	10.6	4.0	2.2	159	Soapstone	Yes	
1/6148	6.5	4.4	2.8	213	Soapstone		
Average	**10.9**	**5.0**	**2.4**	**235**			
Average				**167**	(The two heaviest sinkers excluded)		

Table 3. Troll sinkers type A: long and straight or slightly convex back and "abdomen". Holes at each end near the back, weight asymmetrical along the median line.

No.	Length	Width	Thick-ness	Weight	Material	From vessel?	Note
1/54/214/1	11.4	4.4	1.9	164	Soapstone		
1/56/181	15.1	4.0	4.3	454	Soapstone		
1/2731	10.3	2.8	2.6	124	Soapstone	Yes	
1/2909	9.1	2.2	1.7	67	Soapstone	Yes	Four parallel lines crosswise on each side
1/3024	8.1	1.9	1.7	45	Soapstone	Yes	
1/3088	11.1	2.2	1.9	80	Soapstone	Yes	
1/4913	14.1	2.8	1.9	135	Soapstone	Yes	
Average	**11.3**	**2.9**	**2.3**	**152**			

Table 4. Troll sinker type B: long, concave back and convex "abdomen" ("banana –shaped"). Holes at each end near the back. Weight asymmetrical along the median line. (The shape of sinkers made of broken vessels is determined by the shape of the vessels.)

No.	Length	Width	Thick-ness	Weight	Material	From vessel?	Note
1/57/172	9.2	4.2	3.7	196	Soapstone		
1/58/342	16.0	6.0	4.8	831	Soapstone		
Average	12.6	5.1	4.3	513.5			

Table 5. Long sinker with longitudinal encircling groove.

No.	Length	Width	Thick ness	Weight	Material	From vessel?	Note
1/57/549	16.0	6.6	6.1	1299	Sandstone		Slight depression for knot in one end

Table 6. Long sinker with longitudinal and latitudinal groove (As Heiberg 1995 type III, "jarstein").

No.	Length	Width	Thick-ness	Weight	Material	From vessel?	Note
1/2858	9.0	7.7	6.5	740	Stone		

Table 7. Globular sinker with latitudinal groove

No.	Length	Width	Thick-ness	Weight	Material	From vessel?	Note
1/56/234	>4.9	3.9	2.1	>25	Soapstone		Fragment
1/57/460	>12.5	4.7	4.3	>	Soapstone		Fragment

Table 8. Long sinker, one hole and line groove over the neck.

No.	Length	Width	Thick ness	Weight	Material	From vessel?	Note
1/54/28/4	10.1	5.5	2.7	172.0	Soapstone	Yes	
1/54/32/1	8.2	6.1	1.9	144.0	Soapstone	Yes	
1/56/124/1	6.9	5.7	2.0	98.0	Soapstone	Yes	
1/2671	10.6	12.1	2.9	553.0	Soapstone	Yes	Broken at hole, replaced by new hole
1/2725	6.4	5.6	1.9	103.0	Soapstone	Yes	Broken at hole
1/2912	10.3	7.2	3.7	307.0	Soapstone	Yes	Rim shard with handle broken off. One large and one small hole, one hole near edge
1/3026	14.7	8.2	2.2	371.0	Soapstone	Yes	Three holes engraved cross
1/3234	13.3	8.7	2.3	42.1	Soapstone	yes	One large and one small hole

Table 9. Fragments of vessels with two holes, asymmetrical axis. Uncertain whether they are sinkers.

FAGBOKFORLAGET

The Bryggen Papers present results based on the archaeological material from the excavations at Bryggen and other medieval and early sites in the town of Bergen. Starting out as an episcopal seat and regional royal administrative and residential centre, Bergen developed in the twelfth and thirteenth centuries into the first truly international trading centre of Scandinavia and one of the most important ports of northern Europe, at the same time becoming the first capital of the Norwegian kingdom. The Hanseatic League established one of its four main trading stations or *Kontore* in Bergen around 1360, lasting into the latter part of the eighteenth century.

This volume of the Main Series of the Bryggen Papers presents results of two studies of artefacts associated with fishing from excavations in medieval Bergen and the smaller medieval urban community Borgund in Sunnmøre further north. Both studies throw light on essential questions concerning the marine food supply in early urban communities, from the earliest phases throughout the medieval period. The studies of fishing equipment, and the techniques, character and extent of the fishing also throw new light on the character of the urban societies as such. The significance of fishing is demonstrated be the extensive range and variety of the finds.

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