

Scaly Heads and tales: Detecting commercialization in early fisheries

SOPHIA PERDIKARIS

NABO, Bioarchaeology Laboratory, Dept. of Anthropology
Hunter College, CUNY, 695 Park Avenue, NYC 10021, USA

(Received 11 October 1995; accepted 28 December 1995)

ABSTRACT: Given the example of the widespread failure of North Atlantic fisheries in the 1990's, one might easily conclude that intensive large scale commercial cod fishing is a profoundly bad idea. How did communities all across the North Atlantic first become dependent upon large scale, interregional, «world-system» scale exploitation of fish stocks that ultimately have proved unable to withstand human demand and technology? Where and how did the transformation of subsistence fishing for local consumption take place? What zoological and archaeological indicators signal the beginning of commercialization in a locality? How can we compare developmental sequences in different areas? These questions may be even more complex than previously thought. This paper attempts to take a closer look at these issues and raise questions for future study in the varied North Atlantic areas in an effort to better understand the processes of commercialization and to come up with tangible signatures of commercialization against which data can be compared.

KEY WORDS: COMMERCIALIZATION, FISHERIES, NORTHERN NORWAY, PROTOCOLS, CUT-MARKS, RATIOS, FISHSIZE

RESUMEN: A la vista del colapso general de las pesquerías del Atlántico Norte en la década de los años noventa, se podría concluir que la pesca comercial intensiva a gran escala constituye una pésima iniciativa. ¿Cómo llegaron a tal grado de dependencia de un tal sistema interregional a gran escala las comunidades humanas, sistema que, a la postre ha sido incapaz de responder a nuestra demanda y tecnología? ¿Dónde y cómo tuvo lugar la transformación de la pesca de subsistencia? ¿Qué indicadores zoológicos y arqueológicos marcan los comienzos de la comercialización en un determinado lugar? ¿Cómo podemos comparar distintas secuencias de desarrollo en diferentes zonas? Estas y otras preguntas podrían ser mucho más complejas de lo que hasta ahora pensábamos. Nuestro trabajo pretende abordarlas en detalle así como formular nuevas preguntas que canalizen futuras investigaciones en las diferentes áreas del Atlántico Norte en un intento por comprender mejor los procesos de comercialización de la pesca y diseñar pruebas de contraste que permitan la eventual contrastación de nuestros datos.

PALABRAS CLAVE: COMERCIALIZACIÓN, PESQUERÍAS, NORUEGA SEPTENTRIONAL, PROTOCOLOS, MARCAS DE CORTE, PROPORCIONES, TALLAS DE PESCADO

THE NORTH NORWEGIAN EVIDENCE

Several generations of systematic collection of animal bones from sites of all periods in Northern Norway, and long-term research by scholars such as Pirjo Lahtiperä at the Zoological Museum in Bergen provide a series of potential test cases that allow us to address (if not answer) some of the basic questions surrounding commercialization. Some of these questions are conceptual. These

conceptual issues include the still uncertain definition of commercialization, the precise nature of local transitions from a subsistence to market economy in specific areas, the interaction of new trading possibilities with the political and social agendas of local elites, and the complex interactions of human intent and a changing natural environment. Other urgent research questions are practical and methodological. What are the key zooarchaeological signatures of a commercial

transition? How can we build a case for a commercial fishery rather than a subsistence one for a given site? How can we expand from such site-specific arguments to generate a set of techniques, indicators, and signatures that may be more universal in application?

Many scholars working with North Atlantic faunal collections have based arguments for commercialization in their particular area on sheer numbers of fish (Amorosi, 1991), cutmarks (Barrett, 1994), fish size and ratios (Bigelow, 1984; Amorosi, McGovern & Perdikaris, 1994). Particular approaches have led to convincing arguments for specific cases, but do yet provide a set of recipes we can all use?

WHAT IS «COMMERCIALIZATION»?

Before any methodological questions are addressed, it is interesting to explore how commercialization has been defined. Commercialization of fish or any other natural product is the end result of a process that gives human value and significance to a selected portion of an ecosystem. The transformation of marine resources into human «natural capital» that can be mobilized by local and distant elites to finance other projects and agendas parallels earlier transformations of wild herds into flocks and then into marketable wool, milk, and mutton. The conversion of what Cronon (1993) has termed the «first nature» of pre-industrial local subsistence into the «second nature» of a commercial capital asset involves linked changes in production, marketing, transport, diet and food ways, and most particularly in the political organization of space and time. Unlike the oceans of grain and mountains of hog bellies that passed through Cronon's Natural Metropolis of 19th century Chicago, the medieval conversion of the first nature of fish in the sea to the second nature of stockfish in the bishop's storehouse did not draw upon the Neolithic agricultural first nature, but upon an older northern maritime hunting and fishing tradition.

In North Norway, we have evidence for such a maritime hunting/fishing tradition extending back to the Older Stone Age. In the Northern Isles of Britain we have nearly as much time depth. In the Faroes, Iceland, and Greenland we have what were essentially first settlements in the Viking Age, with little or no in-place continuity with prehistoric

uses of land and sea. Given these different prehistories of the first nature of subsistence fishing, can we be sure that the transformations that produced the second nature of commercial fishing in the high Middle Ages were really all the same? Or should we expect this process to be manifested in many different ways and to be more region specific than universal and uniform?

The transformation from first to second nature is linked to the economic, political and historical development of both producers and consumers, and probably to long and short term changes in local and regional climate and current circulation as well. We are thus looking at an extremely complex interplay of humans and nature, and we might begin by being wary of simple, single-cause explanations or easy answers of any sort. This paper proposes no answers at all, hard or easy, but instead attempts to raise some issues that may lead to better questions.

Commercialization, when it refers to the stockfish production in the medieval North Atlantic, is essentially the generation of surplus fish. The profits and organization of this large scale fishing are controlled by the governing institutions of the state and church. Fish is used as a commodity that generates a cash profit from markets abroad. In order for us to approach this issue and try to establish whether we are looking at a site that is involved in commercial production there are a number of parameters and conditions that need to be met. Ultimately no one measure by itself can «produce» a commercial site. It would have to be a combination of factors and approaches. In the following sections I will address these issues separately and discuss their merit and potential.

NUMBERS OF FISH

The cod fishery and the production of stockfish in particular, has been the economic backbone of the Norwegian fishing industry for the last 1000 years. The Barent Sea north of Norway and Russia is the most important breeding ground for the cod population.

Some of the ancient roots of Norwegian trade and travel are attested to in king Alfred of Wessex's translation of Orosius in the early AD 890's. This source relates to the trading voyages of Ottar who was a North Norwegian chieftain from

Kvaløy. Ottar like many other northern chieftains considered the Swedish Norrland, Kola and the entire northern coast as their trading area. When did stockfish become a trading item to be taken along on these voyages? When did it cross the line from subsistence to market?

The production of stockfish by the 12th century became *the* key element in Norwegian interaction with Europe. But how did this start? The transition to a commercial economy is normally described as a «natural development» resulting from the intense internal restructuring of the secular and ecclesiastical domains in Norway at about A.D. 1050 (Urbanczyk, 1992). Distant urban markets, religious restructuring of the European diet and a chronic cash shortage in the newly reorganized Norwegian monarchy are often identified as the prime movers in the equation. Exploitation of northern cod stocks and northern Norwegians by large-scale market forces to the south thus can be made to explain both the situation in the 12th century and in the early 20th, and the transition becomes somet-

hing that just happened to a passively marginal population.

Or did commercialization in northern Norway give a new form to an old mode of trade? During the Iron Age, as observed in the faunal collection from Bleik in Andøya (Figure 1), the local people were certainly involved in an active intense fishery. The difference between the two eras, i.e., Iron Age and Middle Ages, lies in the focus and scope of the activity as well as the nature of the controlling elements. Norwegian cod in the form of stockfish can therefore stand in for the yams of the Polynesians—a resource that could be intensified, stored, and which could provide the basic fuel for chiefly ambition. In the Iron Age the pressures for generation of surplus were of a local nature. Surplus fish can feed the population under the chieftains control during the «bad» years and can be used as storable provisions during the long Viking voyages. Fish can also be added to the list of skins, furs and oil to be traded in foreign lands. Cod was probably used to form alliances with chieftains of nearby regions.

North Norwegian Archaeofauna Major Taxa

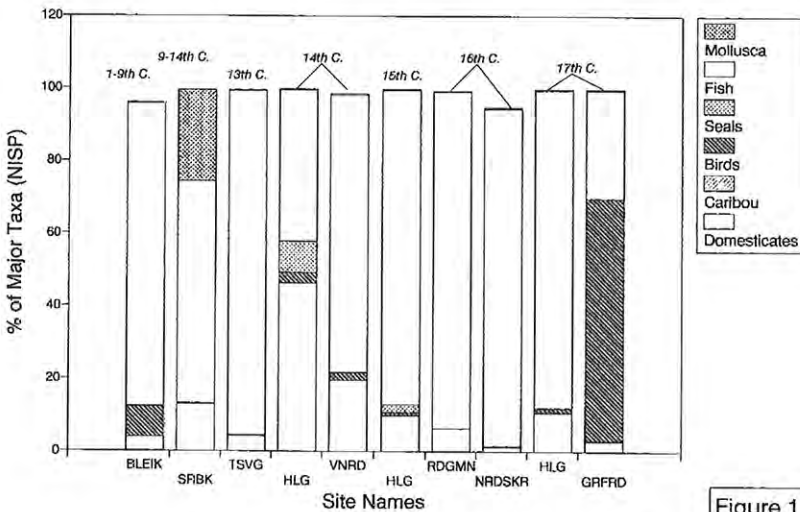


Figure 1

FIGURE 1

A Comparison of the major taxa of the 2nd century site of Bleik in Andøya with the 13th, 14th, 15th, 16th and 17th century sites of the Helgøy region (Torsvåg, Helgøy, Vanareid, Rodgammen, Nordskar, Grunfjord) and the inland farm mound of Sauerbekken (9th-10th century).

The profits and benefits from such ventures would directly benefit the chieftain and the people under his control. During the commercialization era, local power was not autonomous any more; the king and church were now the ultimate power foci. Taxation and tithes were now to be collected by the state for the state. Profits obtained from intense fishing became a domain of the new centralized government. The fledgling state had already created large debts to the church and it was in desperate need of new revenues that would generate profit. «Lofot-fish even before the middle of the 11th century had reached a volume which became economically interesting for regular tax policy of the kingdom» (Bjørø, 1986 b: 42).

Capital gain moved from the hands of local lords to the hands of the state. The forming of alliances and trading was now done on an international level going beyond alliances and generation of surplus to feed the population in a bad year. It was now geared to bring monetary profit to a state with growing needs and huge debt to the church. During the medieval period there was also a shift in settlement pattern and power distribution. The chieftain's farms faded and new centers developed. These centers were the seats for the local secular and church representatives. There was therefore a shift of focus from the chiefly farm to the church yard, and zooarchaeology is a key resource that brings out this manipulation of stockfish which marks the transition from a subsistence to a staple goods economy.

By late medieval times, the Lofoten fisheries provided a significant portion of the fish catch of Western Europe. By 1500, the once-independent fisher-farmers of the Lofoten and Vesterålen were caught up in debt-driven intensive winter fisheries and tied to economic fluctuations in markets thousands of miles away. This local transformation of marine exploitation from subsistence to market production was thus to have profound implications for the development of modern commercial fishing both in Norway and in the whole North Atlantic.

As Bjørø (1986) discusses, the reason that «the monarch's good graces» extended to this far-flung place in Lofoten must be put in a broader historical context. «The fast development of north European long-distance trade, initiated already at the turn of the 11th century must have stimulated the growth of dried fish production in Lofoten with Vågan as a natural center of this industry because fishing waters south of Lofoten have never played

an important role in connection with export» (Bjørø, 1986 b: 43).

When comparing the Iron Age site of Andøya, Bleik, that I have already mentioned, with the medieval sites of the Helgøy region and Vågan we see that the patterning is consistent (Figures 1, 2). The sites of Helgøy and Vågan are farm mounds and Bleik is a midden. The bone element count for these sites varies from 30,000 to 75,000 bones. Only bones identified to species have been used for these comparisons. As is evident from the data, fish, in particular cod, comprise the majority of most of the sites' archaeofauna followed by halibut, ling and coalfish.



FIGURE 2
Map of Norway showing the archaeological sites mentioned in the text.

It is interesting to note that the historical and zooarchaeological data for the medieval sites correlate nicely. There is a peak of fish bones associated with the beginning of the Lofoten fisheries during the 13th and early 14th century, a time of trouble due to the preying of Russian raiders on Lofoten boats bearing trading goods bound for southern markets and the loss of labor due to the Black Death. Eventually the numbers rise during the 15th and 16th century and continue strong into the 1800's.

It is apparent therefore that when talking about commercialization in Norway, the numbers of fish alone are not the answer. If we look at the archaeo-

fauna of the Iron Age site of Bleik and compare it with the other medieval sites I mentioned, the patterning is identical. This patterning, however, means two different things depending on the period. Sheer numbers of fish does not equal commercialization and there is no magical threshold percentage to separate subsistence from commercial production. We cannot ignore the more general historical development of the area but must instead incorporate it, since the zooarchaeological data alone can give a skewed image of what really went on.

CUTMARKS, RATIOS AND FISH SIZE

A. Cutmarks

Can we find a signature for commercialization in cutmarks, fish size or ratios between head and tail elements? An informal cutmark experiment was conducted by the author this summer, where the cutmarks produced on codfish bone by a) a local fisherman, b) a decapitating machine on the fishing boat and c) the author, were analyzed. Five specimens were collected for each category. The average live length of fish was 60 - 65 cm.

After examination, two distinct groups of cutmarks were observed. The first was a *clear-cut* type that went through the vertebra (Figure 3); the second was a *cut and snap* type on the centrum faces (Figure 4). Both types of marks were produced by the fisherman and the machine while all the specimens I personally butchered showed only clear cuts that split the cervical (pre-thoracic) vertebra in half. This demonstrates that knives may potentially produce both types of cutmarks and that neither is indicative of industrial processing. This of course is only a limited study and further actualistic research is necessary for a fuller understanding of cutmark variability. Cutmarks can probably indicate processing of cod for stockfish, but not all stockfish is geared for the commercial market. Cod heads are not traditionally used in food preparation and are therefore removed from the body in a similar fashion to stockfish. When we consider the medieval commercial production of stockfish, the cutmark patterning might not be the answer. The same person who is the commercial fisherman is also the fisher-farmer who prepares the day's catch for his household. The patterning does not change. The only other possibility for difference in the cutmarks produced is if there is a

different knife blade. The iron blade of medieval knives did get dull soon and needed sharpening more often. A different set of cutmarks may not indicate commercialization patterning but rather an accidental occurrence.

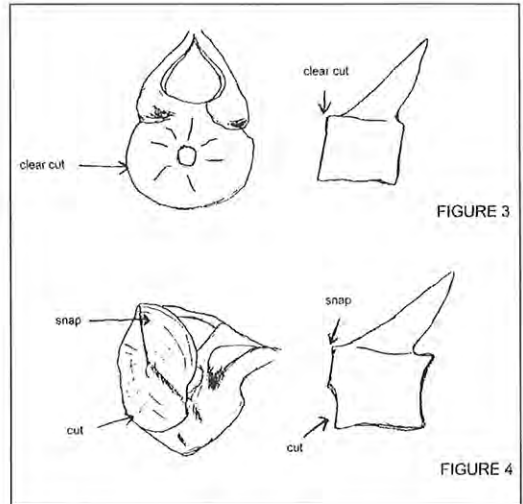


FIGURE 3

A drawing of a gadid vertebrae showing the «clear cut» type of cutmark.

FIGURE 4

A drawing of a gadid vertebrae showing the «snap & cut» type of cutmark.

B. Ratios

What about head and tail (in this context referring to the vertebral column) ratios? In this case I think two separate arguments can be built: one for the area of production and one for the area of consumption. When it comes to northern Norway, the preparation of cod for stockfish in medieval times was done near the farm or rorbu (fisherman's huts), close to the shoreline. The discarded material, i.e., head bones and entrails, does not all end up in the midden. Fish heads have been used for animal fodder and field fertilizer throughout the medieval period. The volume of refuse produced in the fishing season through the preparation of stockfish is usually so large that even though a lot of material leaves the area through human or animal agents (seagulls, foxes, etc.) there is a certain over-representation of head bones versus tail bones for example in the Icelandic material as seen in these tables (Table 1, 2, 3).

Fish Relative Percentages Based on NISP counts						
	H7	H9	H14	Mean	SD	CV
SPECIES						
Cod	91.58	100	91.82	94.47	4.79	5.07
Saithe/Pollack	2.48	0	1.79	1.42	1.28	89.93
Ling	3.96	0	3.32	2.43	2.13	87.60
Haddock	1.98	0	3.07	1.68	1.56	92.46
Whiting	0	0	0	0.00	0.00	ERR
Fish Cranial to Body Proportions Based on NISP Counts						
% Total Cranial	94.12	85.16	90.95	90.08	4.54	5.04
% Total Vertebral	5.88	14.72	9.05	9.88	4.48	45.31
Observed						
Ident. Cran.: Vert.	1.06	3.17	0.83	1.69	1.29	76.47
«Natural»						
Ident. Cran.: Vert.	3.1	3.1	3.1			
Observed- «Natural»	-2.04	0.07	-2.27	-1.41		
<i>Table borrowed from Russel, Amorosi & McGovern, 1986</i>						

TABLE 1
Fish Relative Percentages from the Upper Layers of Storaborg, Iceland.

Storaborg Middle Layers				
Fish Relative Percentages				
Based on NISP Counts				
	H 9/14	Mean	SD	CV
SPECIES				
Cod	90.63			
Saithe/Pollack	2.08			
Ling	5.21			
Haddock	0			
Whiting	2.08			
Fish Cranial to Body Proportions				
Based on NISP Counts				
% Total Cranial	88.19			
% Total Vertebral	11.81			
Observed				
Ident. Cran.: Vert.	2.29			
«Natural»				
Ident. Cran.: Vert.	3.1			
Observed- «Natural»	-0.81			
<i>Table borrowed from Russel, Amorosi & McGovern, 1986</i>				

TABLE 2
Fish Relative Percentages from the Middle Layers of Storaborg, Iceland.

Storaborg Middle Layers						
Fish Relative Percentages						
Based on NISP Counts						
	H17	H18	H19	Mean	SD	CV
SPECIES						
Cod	94.17	92.94	91.34	92.82	1.42	1.53
Saithe/Pollack	3.33	5.08	4.72	4.38	0.92	21.12
Ling	0	0.85	0.79	0.55	0.47	86.78
Haddock	2.5	1.13	3.15	2.26	1.03	45.63
Whiting	0	0	0	0.00	0.00	ERR
Fish Cranial to Body Proportions						
Based on NISP Counts						
% Total Cranial	93.3	71.6	84.79	83.23	10.93	13.14
% Total Vertebral	6.7	28.4	15.21	16.77	10.93	65.20
Observed						
Ident. Cran.: Vert.	1.88	7.16	4.09	4.38	2.65	60.59
«Natural»						
Ident. Cran.: Vert.	3.1	3.1	3.1			
Observed- «Natural»	-1.22	4.06	0.99	1.28	2.65	207.70
<i>Table borrowed from Russel, Amorosi & McGovern, 1986</i>						

TABLE 3
Fish Relative Percentages from the Lower Layers of Storaborg, Iceland.

The anomalous ratio between the cranial and post-cranial skeletal elements of the different species of fish in the Storaborg archaeofauna is an interesting one. Tables 1, 2, and 3 have been borrowed from «An Archaeofauna from Storaborg, Southern Iceland: An Interim Report» (Russell, Amorosi & McGovern, 1986). In these tables data on the skeletal ratios is presented in addition to the relative percentage of the different fish species. The sixth and seventh rows present the proportions of all cranial fragments to all vertebral fragments, and point to the over-abundance of cranial fragments (ca. 71%-94% of the total number of fish bones for each context). Of the cranial bones, only those identifiable to species level have been used in order to avoid the «noise» produced by small broken fragments. These are restricted to the denser and less fragile mouth parts and the otoliths.

These cranial fragments are likely most comparable in terms of recoverability and density to the gadid vertebral centrum. Of the vertebrae, only the larger elements of the gadid vertebral sequence have been used (11 cranial parts to 34 vertebral parts). This produces a ratio of 1:3.1 (Tables 1, 2, 3: row 9) (Russell, Amorosi & McGovern, 1986). Indeed, if we expect that where fish skeletons enter archaeological contexts in roughly equal ratios of head to body, and where preservation and recovery factors do not selectively discriminate against cranial or post cranial elements, the mean is -0.31, indicating an overall disproportionate predominance of head parts in most excavation contexts.

The over-representation of cranial elements alone does not necessarily represent commercialization. Stockfish is part of the local diet. The Norwegian and Icelandic fisher-farmers produce

stockfish both for individual consumption and for the market. Can we really tell which is which? A slightly different approach towards heads and tails is to compare the percentages generated from the cranial and post-cranial elements from cod to the percentages generated by the other significant (in terms of numbers) species. The way the two compare can potentially give us a better idea of whether we are looking at a taphonomic phenomenon or a commercial signature.

The argument can be a bit more straightforward when it comes to areas of consumption. Complete absence of head bones and presence of articulated portions of the vertebral column can be indicators that point to commercialization. Care must be taken to separate the presence of local fishing from the imported material and that is a site-specific scenario.

C. Fish size

There are some selected patterns, observed by many workers in a growing number of North Atlantic archaeofaunas, that point to a distinct difference between reconstructed lengths of cod and those observed in most modern stocks in the same area. The North Norwegian fish bone assemblage

from Storvågan indicates cod slightly smaller than those from medieval Icelandic sites in both the dentary and premaxillary reconstructions (Figure 5). Even though analyses are ongoing, some clear zooarchaeological trends are already apparent in the Storvågan collections (Figures 6, 7). The great variability in cod size in the early and late phases could reflect the influence of several ecological technological and consumption variables. The analysis is too preliminary to distinguish the particular variable accounting for the diverse cod size present at Storvågan at different times. The most important trend discernible at this time is that the relative mean lengths of cod whose bones were deposited at Storvågan over its long occupation largely ranged from 65 to 900 mm. The upper end of this size range compares well with the larger fish caught in Iceland (Amorosi, 1989) and Shetland (Bigelow, 1984) during the various pre-modern periods.

Other workers (Colley, 1983, 1990; Bigelow, 1984; Jones, 1991; Barrett, 1993) describe similar archaeological samples with mean reconstructed cod length around 90-100 cm from the Shetland Islands, Orkney, and Caithness. These distributions appear to extend back beyond the Norse period into the Pictish Iron Age in Orkney and Caith-

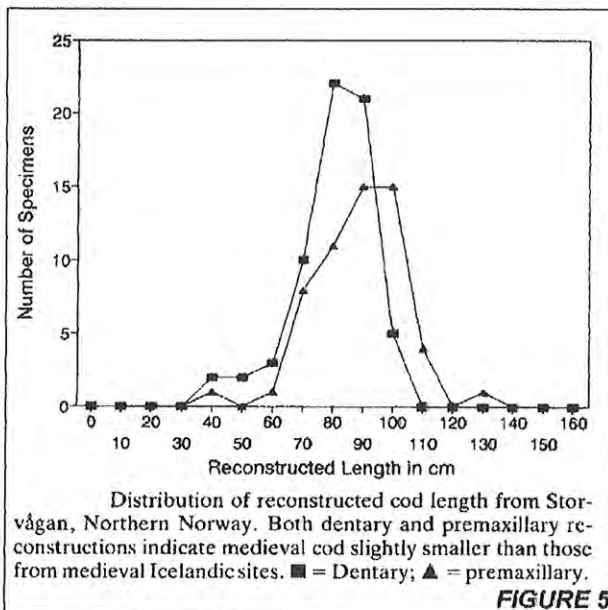


FIGURE 5
A distribution of reconstructed cod length from Vågan (Storvågan), Northern Norway.

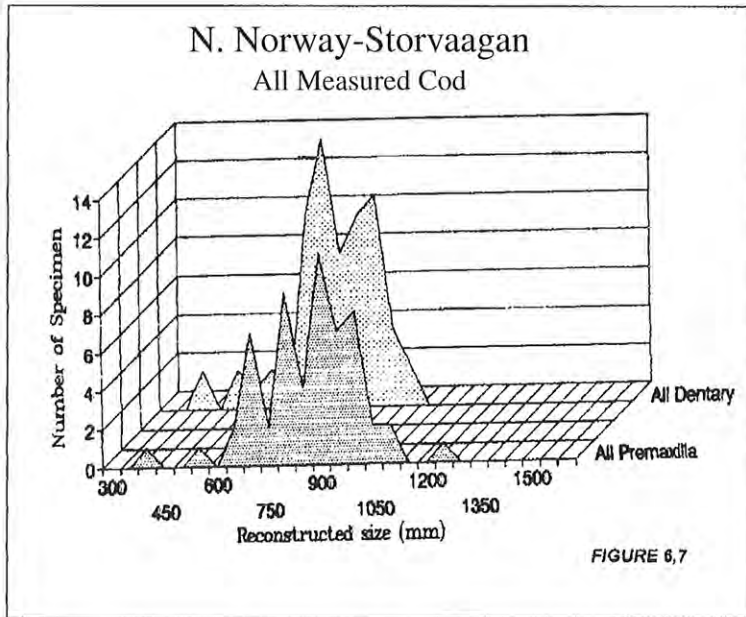


FIGURE 6, 7

A graph combining two figures showing the measurements on the gadid dentary and premaxillary elements from the site of Storvågan.

ness (Colley, 1983, 1990; Jones, 1991). While sample sizes and conditions of preservation vary, it is apparent from this published data that a wide range of other researchers have also noted that large (presumably old) cod are widespread in the archaeological record. The existence of this distribution is not controversial, and appears to constitute a constant archaeological pattern that is neither local nor subtle. Application of varied osteometric techniques has indicated a fairly consistent patterning in reconstructed cod lengths (cf. Amorosi, McGovern & Perdikaris, 1994). Does larger size fish reflect a commercial catch or is it an artifact of environmental variables and fishing techniques? Ultimately a regional approach will result in a better contextualization of meaning for the patterning observed.

SITE AND DATA TYPES

Complete excavation of middens in different functional areas is at present being undertaken by the author in the area of Langenes in the Øksnes

Commune of Northern Norway (Figure 8). This work will concentrate not only on the bone material but on analyzing the entire midden composition. This will be done in order to identify and record the specific signatures of what middens from a seasonal *rorbu* (fisherman's hut) environment look like, versus the midden of a farm occupied year-round. While the 1995 test pits did produce quantities of fish, mammal, and bird bone, these are not sufficient to reasonably discuss commercialization at Langenes. This is not entirely because of sample size; it is important to excavate a fairly extensive part of the midden and not rely on a small column sample.

In the recent *Freswick Monograph* (Morris, Batey *et al.*, 1995), James Rackham builds a convincing case for the value of a combined vertical and horizontal excavating strategy. As Rackham points out, fish processing and mammal butchery and consumption may not take place in the same areas, and even on an architecturally simple «fishing farm» the horizontal dimension is archaeologically critical. As many have noted (e.g. Barker, 1983) column samples are necessarily narrow diachronic windows into change through time in a limited portion of a site.

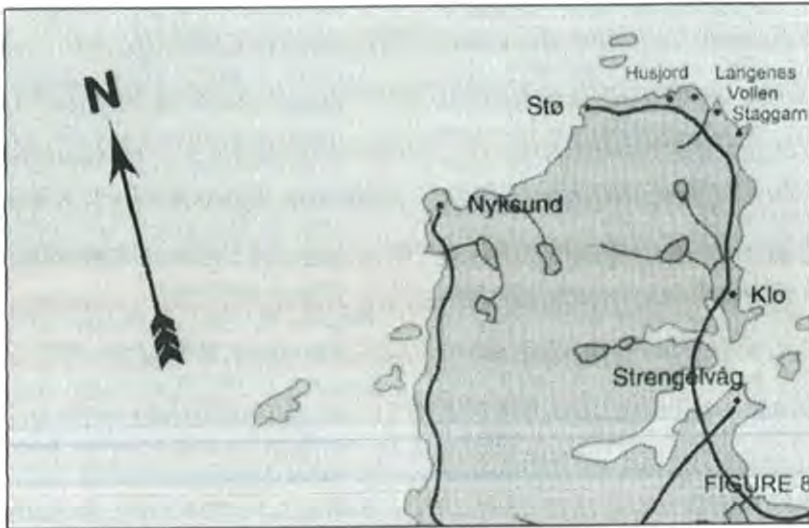


FIGURE 8

Map showing the project area of Langenes, Vesterålen, Northern Norway.

The critical issues of site organization and development of specialized processing areas are not likely to be addressed by narrow «telephone booth» excavations (Flannery, 1976).

The task is a difficult one especially since in this region there are two seasons of activity in the seasonal occupation areas, one during the winter fishing from January to April and another one during the summer when the ice has melted in the Russian peninsula and traders come down from Russia to buy fish. In order to account for that, the proposed overall research strategy takes a regional longitudinal perspective, following Bertelsen (1991), Crumley *et al.* (1991) and Bigelow (1991): a multidisciplinary investigation focused on long-term changes within a definable region rather than an emphasis on a single site or a narrowly restricted time period. Artifacts, site location, animal and fish bones, pollen, macroflora and soils from the Langenes area will all be integrated with the existing data from the other regions of Helgøy and Vågan (Storvågan) that I have already mentioned above. In this way I hope to eliminate «noise» factors characteristic of small scale column sample excavations and to investigate the changing impacts of humans on local resources and the effects and consequences of the development of large scale fisheries at a regional level.

CONCLUSIONS

In North Norway, archaeofauna dating to the 2nd century BC is dominated by gadid remains, and the relative percentages and other indicators look strikingly similar to collections dating to the 15th-16th century AD.

Single sites could easily be selected to «prove» commercialization in the early Iron Age. While early Iron Age Norwegians may have been fishing to provision complex local chieftainships with piscine staple goods, we may doubt that they were engaged in the same scale of fishing as their descendants supplying the Hansa. Equifinality is a major problem in archaeology and in zooarchaeology. We need a far more careful and systematic investigation of the phenomenon of commercial fishing what it is and what its archaeological and zooarchaeological residues can look like.

If we are to address these complex issues more effectively we need to:

1. Adopt a regional, rather than site-focused, perspective. One site is interesting but we need enough sites to form patterns. Patterns that appear on several sites, and several classes of sites are less likely to be taphonomic noise, and provide the basis for a regional interpretation of what was most certainly an inter-regional process.

2. Develop some general protocols for data collection and assessment. Large open area excavations and small column samples may both produce thousands of bones, but they are not archaeologically equivalent. We need to determine what sorts of questions are best suited to different types of collections -not all collections will allow investigation of all possible issues.

3. Integrate the zooarchaeological data into the historical and artifactual evidence for large scale interregional exchange. By using historical and artifactual data we can propose types of sites (cf. locations, Binford, 1980) which can be specifically linked to the commercial fishery. Bone data is invaluable, but it is only one category of evidence that bears on our common problem. Zooarchaeology cannot do this alone.

Medieval commercialization signatures at this stage still remain a headache in need of a proper cure. The cure will not come from pat answers and recipes. It will come through an in-depth understanding of regional development and the incorporation of archaeological, historical and environmental data.

ACKNOWLEDGEMENTS

Special thanks to Pirjo Lahtiperä for sharing her expertise and making many helpful suggestions. Thanks to Dr. Reidar Bertelsen, Dr. Inger Marie Holm-Olsen and Dr. Roger Jorgesen for allowing access to this material. Thanks to Dr. Tom McGovern without whose insightful comments this work would not have been possible. Thanks to Dr. Christian Keller for helping with the specimen photographs. I am grateful to Dr. Rolf Lie for permitting me to use the collections in store at the Bergen Zoological Museum. Thanks are also due to Dr. A. Morales for organizing this meeting, Tromsø University, the Øksnes Kommune fishermen and Hunter College.

REFERENCES

- AMOROSI, T. 1989: Contributions to the zooarchaeology of Iceland: some preliminary notes. In: Durrenberger, P. & P. Palsson (eds.): *The Anthropology of Iceland*: 203-227. University of Iowa Press, Iowa City.
- AMOROSI, T. 1991: Icelandic archaeofauna: a preliminary review. In: Bigelow, G. F. (ed.): *The Norse of the North Atlantic*. *Acta Archaeologica* (Copenhagen), 61(1990): 272-284.
- AMOROSI, T.; MCGOVERN, T. H. & PERDIKARIS, S. 1994: Bioarchaeology and Cod Fisheries, a new source of Evidence. ICES Conference Proceedings, Copenhagen.
- BARKER, W. 1983: *Techniques of Archaeological Excavation*. Aldine Press, NY.
- BARRETT, J. 1993: Bone weight, meat yield estimates and cod (*Gadus morhua*): a preliminary study of the weight method. *International Journal of Osteoarchaeology* 3: 1-18.
- BARRETT, J. 1994: Paper presented at the 1994 I.C.A.Z. Conference, Konstanz, Germany.
- BERTELSEN, R. 1991: A north-east perspective. In: Bigelow, G. F. (ed.): *Norse of the north Atlantic*. *Acta Archaeologica* (Copenhagen) 61(1990): 29-35.
- BIGELOW, G. 1984: Subsistence in late Norse Shetland: an investigation into a northern island economy of the middle ages. University of Cambridge, UK Ph.D. thesis.
- BIGELOW, G. (ed.) 1991: *The Norse of the North Atlantic*. *Acta Archaeologica* vol. 61, Copenhagen.
- BINFORD, L. 1980: «Willow smoke and dogs' tails»: hunter-gatherer settlement systems and archaeological site formation». *American Antiquity* 45(1): 4-20.
- BJØRGO, N. 1986: Kontakten mellom Bergen og Nord-Norge I melomalderen, In: Øye, I. (ed.): *Kjøpstad og rikssentrum*, Bergen 41-53.
- COLLEY, S. M. 1983: The role of fish bone studies in economic archaeology, with special reference to the Orkney Isles. University of Southampton, UK. Ph.D. thesis.
- COLLEY, S. M. 1990: The analysis and interpretation of archaeological fish remains. In: Shiffer, M.B. (ed.): *Archaeological, Method and Theory*: 207-253. University of Arizona Press, Tucson.
- CRONON, WM. 1991: *Nature's Metropolis: Chicago & the Great West, 1848-1893*. W.W. Norton & Co., Inc. Press. NY.
- CRUMLEY, C. & MARQUARDT, WM. (eds.) 1991: *Burgundian Landscapes*. Aldine Press. NY.

- FLANNERY, K. (ed.) 1976: *The Mesoamerican Village*. Academic Press, NY.
- JONES, A. K. G. 1991: The fish remains from excavations at Freswick Links, Caithness, 1980-1982. University of York, UK. Ph.D. thesis.
- MORRIS C. & BATEY, C. (ed.) 1995: *Freswick Links Caithness*. University of Glasgow Press. NABO monograph 1, Glasgow (in press).
- RUSSELL, D.; AMOROSI, T. & MCGOVERN, T. H. 1986: An Archaeofauna from Storaborg, Southern Iceland: An Interim Report. Draft II. Report on file with Hunter College, Dept. of Anthropology.
- URBAŃCZYK, P. 1992: *Medieval Arctic Norway*. Zakład Poligraficzny Press, Warszawa, Poland.