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FISH REMAINS FROM THE UPPER MAGDALENIAN IN THE GROTTE DU BOIS LAITERIE

W. Van Neer

Introduction

A survey of the literature shows that fish remains have only seldom been reported from Paleolithic sites in Belgium. The Caverne Marie-Jeanne yielded some fish bones from Middle Paleolithic levels that were tentatively identified as 'percomorph' (Gautier and de Heinzelin, 1980), whereas six remains of 'freshwater fish' were found in a layer with a mixture of Aurignacian and Neolithic material from the Grotte de la Princesse at Marche-les-Dames (Gautier, 1981). Finally, a vertebra of the European catfish (*Silurus glanis*) has been reported from a Magdalenian level in a cave at Néviau, about 5 km south of Namur (Giltay, 1931). Because of the foregoing, the fish bone sample from Grotte du Bois Laiterie, although small in size, may help to understand better Paleolithic fishing in Belgium.

The Grotte du Bois Laiterie is situated on the north-facing side of the Burnot gorge at about 50 metres above the Burnot valley floor. Human inhabitants of the site had access not only to the Burnot affluent, but also to the Meuse located about 500 metres farther east. The former hydrological situation probably differed from present-day conditions, but the general geological setting was more or less similar. Temperatures were lower than today and this must have influenced the behaviour of the fish. As to the samples, fish remains were collected mostly in layer YSS, the main Magdalenian deposit. A few finds originate from LBS, the partially disturbed layer overlying YSS near the mouth of the cave, while the original test trenches (TT) dug into YSS yielded only one fish bone. More information on the site, its context and samples can be gleaned from the other contributions to this volume.

Material

The remains were identified with the aid of the comparative collections housed in the Royal Museum of Central Africa, Tervuren. Specimens were first brought to skeletal element and to species and then the corresponding fish length was estimated by direct comparison to modern specimens of known length. The estimates are given by classes of 10 cm length (Fig.1). Tab.1 summarizes the finds per level.

Salmo trutta fario (brown trout)

LBS: 2 precaudal and 2 caudal vertebrae;

YSS: 1 keratohyal, 1 quadrate, 1 articular, 14 precaudal vertebrae, 15 caudal vertebrae, 1 precaudal or caudal vertebra, 4 scales; total 37 specimens.

The morphological distinction of bones from the brown trout *Salmo trutta* and the Atlantic salmon *Salmo salar* is very subtle and in many cases impossible (Le Gall, 1984; Desse and Desse, 1976). Le Gall (*ibid.*) mentions small differences on the outer morphology of precaudal and caudal vertebrae, whereas Desse and Desse (*ibid.*) demonstrate a great deal of intraspecific variation and overlap between both species when frontal radiographs of vertebral centra are used. Lepiksaar and Heinrich (1977) report that the width-length ratio of the keratohyal is a good distinguishing character, as they found an index of 25.2 to 32.1% in salmon and of 17.2 to 22.2% in brown trout. For the comparative material at Tervuren, we computed an index of 35.7% for salmon and indices of 22.3 and 24.3% for two brown trout specimens. The keratohyal specimen found at Bois Laiterie Cave is slender as in the brown trout, with an index of 23.5%.

The reconstructed sizes (Fig. 1) of the well preserved brown trout remains are between 30 and 50 cm SL (= standard length, *i.e.*, length from the tip of the snout to the base of the tail). Most of the vertebrae show growth bands which theoretically can be used for analyses such as ageing, calculation of the growth rate and establishment of the season of death (Casteel, 1976). However, a large number of the BL vertebral centra are poorly preserved, the margins especially being weathered. Reading of the growth zones and establishing the amount of marginal growth is hampered in many cases. Nevertheless, it is clear that most of the salmonids were caught in their fourth or fifth year (4+ and 5+ in ichthyological jargon). The archaeological relevance of this is minimal, but the ages obtained confirm the identification of the salmonid vertebrae as brown trout. Atlantic salmon of such ages are much larger. All the vertebral centra of which the margins seemed intact had a relatively wide outer growth zone. This indicates that the fish died at a moment when their last rapid growth season was over. The potential of this observation for seasonality will be discussed below.

Thymallus thymallus (grayling)

YSS: 1 frontal, 1 articular, 1 precaudal vertebra.

The very distinct morphology of the two cranial bones allows an unequivocal identification as grayling, whereas the damaged precaudal vertebra can be labelled only through the small anatomical details described by Le Gall (1984). All grayling bones belong to individuals of 30-40 cm SL.

Lota lota (burbot)

TT: 1 caudal vertebra;
LBS: 2 precaudal vertebrae;

YSS: 1 otolith, 1 premaxilla, 2 quadrates, 2 cleithra, 13 precaudal vertebrae, 1 caudal vertebra; total 20 specimens.

The distribution of the reconstructed fish lengths (Fig. 1) demonstrates that most of the burbot specimens measure between 40 and 60 cm SL. An attempt was made to use the incremental growth structures of the vertebral centra for the determination of the individual ages and the season of death, but several difficulties were encountered. Compared with the salmonids, the seasonal bands in burbot vertebrae are less clear. Moreover, the vertebral centra are more heavily weathered and the margins are most frequently affected. The specimens permitting a reasonably good reading indicate that the majority of the burbots were captured when 4 or 5 years old.

	TT	LBS	YSS
Salmo trutta fario (brown trout)	-	4	37
Thymallus thymallus (grayling)	-	-	3
Lota lota (burbot)	1	2	20
total identified	1	6	60
unidentified	-	1	6

Tab. 1 - Fish remains found in the different archaeological levels.
The numbers represent number of specimens

Taphonomy and Magdalenian Fishing

The mammalian fauna (Gautier, this volume) demonstrates that the cave has been visited by man and that several carnivores also temporarily inhabited the place during the considered period. The identified carnivore remains derive mainly from foxes, with only small numbers of badger, polecat, weasel, stoat, wolf, hyena and bear. Although some of those carnivores may contribute significantly to the deposition of bones, it is believed that the fish remains are mainly derived from fish that were brought to the cave by man. The large size of the fish (mainly between 30 and 60 cm SL) excludes the smaller mustelids (weasel, stoat and polecat) as possible taphonomic agents. The distance of the Burnot and Meuse to the cave, together with the difficult access to the site, seem to exclude the other carnivores also, as major accumulators of the fish bones. Fish do not belong to the usual food of badgers but these animals occasionally eat them as carrion. Salmon stranded as a result of disease along a river in the neighbourhood of a large badger set have been found in scavenged condition in the undergrowth back from the river bank. On two occasions, skeletal remains of salmon have been observed in a set at about 200 metres from the river, but there exists only one eye-witness account of a badger actively capturing fish from shallow water (Neal, 1986). Fish is usually not mentioned as a food item in foxes (Lloyd and Hewson, 1986; Broekhuizen *et al.*, 1992); however, since they are opportunistic feeders it is likely that they sometimes catch spawning fish in shallow water (Maitland and Campbell, 1992, p.126). Hyena and wolf also eat fish occasionally (Ewer, 1973), whereas bears are known to prey actively on migrating or spawning salmonids. Generally, all the aforementioned carnivores feed rarely on fish and the few existing observations on their ichthyophagous behaviour show that the catch is consumed in or near the water. The same is true for the otter, the only real fish eating carnivore in our region, but of which no remains have been found in the cave. Otters can be responsible for the accumulation of fish remains on archaeological sites as a result of the prolonged deposit of spraints. These droppings contain, however, mainly remains of small fish (Wise *et al.*, 1981) and are deposited along the shore.

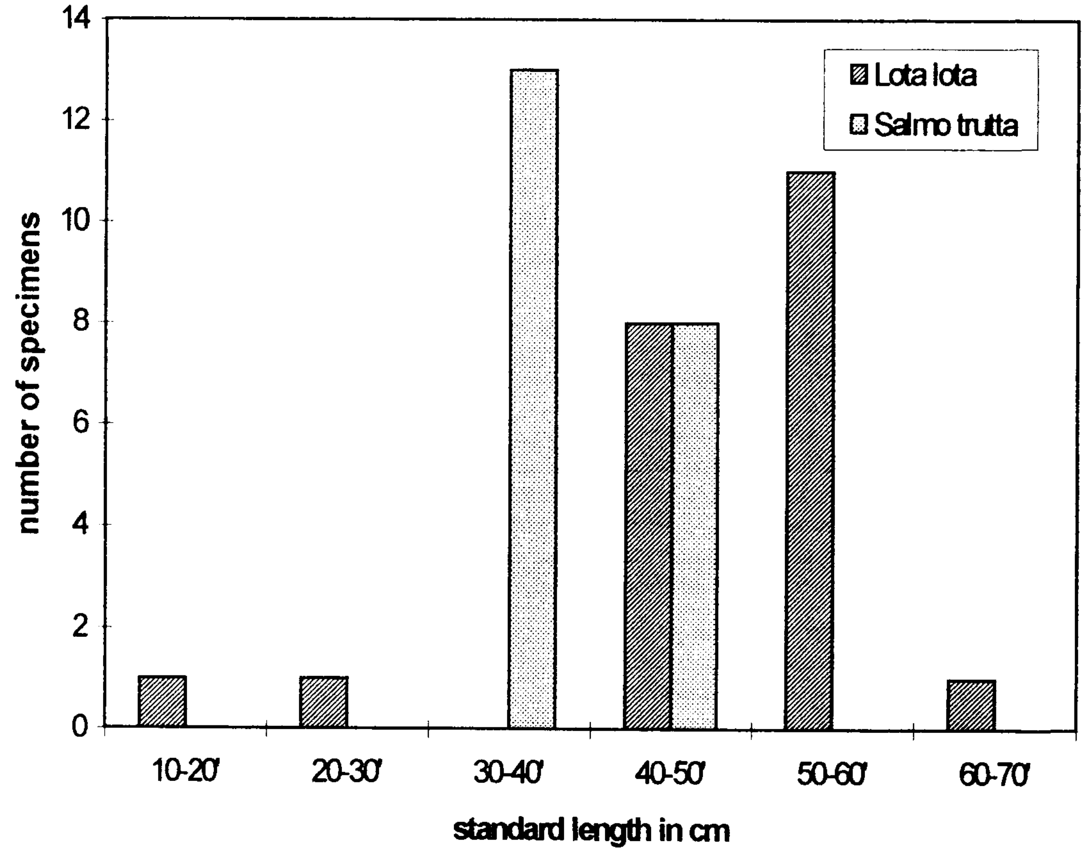

Fig.1 - Distribution of the reconstructed lengths of brown trout and burbot found in the Bois Laiterie Cave, all samples combined.

The intraskeletal distribution of the BL fish remains shows that there is a heavy preponderance of vertebrae, especially in the salmonids. Such patterns have been interpreted as an indication of decapitation of fish near the place of capture, possibly followed by conservation of fish bodies for later consumption (*e.g.*, Cleyet-Merle, 1990, p.95). Experiments have demonstrated, that differential preservation is a much more likely explanation for the underrepresentation of head bones (Butler, 1993; Butler and Chatters, 1994; Lubinksi, 1996).

The brown trout occurs in cool, oxygen-rich waters with gravelly bottoms, and shows a preference for irregularities in the bottom and the river bank. The members of this species are strictly confined to their territory, which they leave only for reproduction. Young fish prefer shallow waters, whereas the larger ones occur in deeper parts. This explains also why the larger specimens are not found in the trout zone *sensu* Huet (1954), but rather in the grayling or barbel zone (Seifert and Kölbing, 1989). The Meuse near the Bois Laiterie Cave belongs to the barbel zone. The growth rate of the brown trout near the site must have been high compared to that in small, fast streaming waters where food is scarce and where fish use up a lot of energy struggling against the strong currents. The reconstructed fish lengths and the number of growth rings observed on the BL material indicate indeed that we are dealing with a fast growing population.

The age at maturity of fishes depends on the feeding behaviour and growth rate which in turn depends on the habitat (Maitland and Campbell, 1992). Usually, the first spawning of brown trout occurs in the second or third year. Today, spawning takes place mainly from mid-October to mid-December. Earlier dates have been recorded, however, and spawning may be extended into late January or early February depending on the temperature (Maitland and Campbell *ibid.*). The average temperatures in Late Magdalenian times being lower than those of the present-day, it is likely that spawning occurred rather late. The best spawning grounds are usually not situated in the main river but in small tributaries with fast running water over gravelly bottoms. The Burnot tributary is likely to have been such a suitable spawning place, visited seasonally by trout from the Meuse. Reproduction of the brown trout usually occurs in 15-30 cm deep water. Mortality by predation is high at the spawning places but also at other shallow parts of the river where the migrating trout pass. Adult trout can also strand in small streams. In such places they are an easy prey to many predators, including several bird species, mammals such as otter and foxes (Maitland and Campbell *ibid.*,p.126). Prehistoric man may also have taken the opportunity to capture migrating or spawning fish.

Grayling prefers spawning grounds similar to those used by brown trout but their season of reproduction sets on later in spring when river temperatures start rising (Maitland and Campbell, 1992, p.161).

As to the burbot, its presence among the BL fish remains cannot be explained in terms of high vulnerability related to spawning behaviour. The species is a typical bottom dweller reproducing in running but usually deep water. The Meuse would seem a more suitable environment for reproduction of burbot than the Burnot. However, the species is vulnerable to predation during the spawning season of trout and grayling, as a result of its feeding behaviour. Burbot is reputed to search actively for the spawning grounds of salmonids where it predates on the eggs and fry (Seifert and Kölbing, 1989). The damage can be such that some of the fishery literature recommends to eradicate burbot in the nursery reaches of salmonid waters (Maitland and Campbell, 1992, p.264). In conclusion, it seems likely that both brown trout and grayling were captured by man in shallow parts of the Burnot river during the spawning period probably in late winter and early spring. Burbots visiting the salmonid spawning grounds for feeding could also be easily captured in the shallow waters.

The foregoing scenario is based on the behavior of the fish species and on the assumption that the Late Magdalenians were opportunistic fishers. An analysis of the growth increments on the fish vertebrae from Bois Laiterie Cave might support this hypothesis. The seasonal variations in temperature and food availabity result in a different growth rate of fishes within the year. The alternation of zones of rapid and slow growth on the vertebrae allows the reading of the age of the fishes, whereas the amount of the latest incremental growth permits the establishment of the season of death and hence the season of capture. Increment studies base seasonal inferences on the width of the last, external growth zone. The vertebrae from BL are mainly derived from 4 or 5 years old specimens. Complete growth zones formed during the fourth and fifth year are already relatively narrow and estimating the season of death from such specimens cannot be done with high precision. Also, the BL sample is too limited and the material too fragmentary to allow a detailed analysis of the growth increments as Monks and Johnston (1993) have proposed. The outer growth zones, apparently intact, that could be observed, give the impression of being already fully developed with respect to the growth zone of the preceding year. This suggests that the fish were captured towards the end of their fast growth season. A major methodological problem, however, is that, from the marginal part of outer growth zones of vertebrae (or other bone structures), it is difficult to distinguish animals having just ended their rapid growth season from individuals captured during the slow growth season (winter) and from those captured at the very beginning of the new rapid growth season (early spring). As a result of this there can be a tendency to overestimate the number of fish captured during the rapid growth season (Van Neer, 1993). The width of the observed outer growth zones in the BL vertebrae are compatible with the hypothesis that fish were captured in late winter and early spring but they provide no unequivocal proof.

As already mentioned in the introduction, only a few Paleolithic sites in Wallonia have yielded fish remains thus far, which excludes comparisons of the BL material with other faunas. The assemblage from the cave is small and comprises mainly brown trout, followed by burbot and grayling. Worth mentioning, with respect to the predominance of brown trout in the BL assemblage, is the find of a Magdalenian *bâton de commandement* at Goyet, about 5 km southeast of Namur. This artefact, made of reindeer antler, bears a very realistic carving of brown trout (Twiesselmann, 1951). Salmonids, both Atlantic salmon and brown trout, predominate among the numerous Upper Paleolithic representations of fish found in France (Cleyet-Merle, 1990). The importance of seasonal salmonid fishing is also illustrated by the preponderance of their remains in French sites. Ichthyofaunas studied in France and Germany demonstrate that besides the three species found in the Bois Laiterie cave, other fish were also regularly captured during the Late Magdalenian (Torke, 1981; Le Gall, 1992). A survey of some 30 Early, Middle and Late Magdalenian sites gives the impression that fishing became an important economic activity only in Late Magdalenian times. The changing climatic conditions resulted in the gradual disappearance of reindeer which was the favorite game animal of the Magdalenians. This and the fact that the site catchment became more forested may have seriously affected the mode of exploitation of the environment. Possibly this led to a more diversified and more intense fishing activity (Le Gall, 1992).

No precise reconstruction can be given of the fishing methods used near the Bois Laiterie Cave, but given the shallow, inshore waters in which the fish occurred, the methods did not have to be very elaborate. Grasping by hand as well as the use of any type of striking or wounding gear *sensu* von Brandt (1984) would have been successful. A wide variety of fishing gear made of wood (clubs, spears) or plant fiber (baskets, etc.) could be used but no such instruments are preserved in the Magdalenian archaeological record. It is not absolutely certain whether the harpoons made of bone or reindeer antler, regularly found in Magdalenian sites, were used for fishing and the same is true for the very elaborate «leister» elements (Cleyet-Merle, 1990). Fish gorges made of bone have been found at Late Magdalenian sites in France and possibly small bipointed stone tools made suitable gorges as well. Among the BL artifacts, none can be associated specifically with fishing, although harpoons have been found at Goyet and Coleoptère.

Conclusions

The fish assemblage found in the Bois Laiterie cave comprises, in decreasing order of importance, brown trout, burbot and grayling. This small assemblage is considered to be of anthropic origin. Fishing was probably a seasonal activity practised at the end of the winter, the beginning of spring, or during both periods. The occupants of the cave then had easy access to spawning brown trout and grayling and to burbot feeding on the eggs and fry of the first species in the Burnot river.

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