The Holocene occurrence of the European catfish (*Silurus glanis*) in Belgium: the archaeozoological evidence

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ABSTRACT. An overview is given of the skeletal remains of the European catfish *Silurus glanis* found thus far in Belgian archaeological sites. These finds demonstrate that the species is autochthonous and allow documenting its occurrence and disappearance during the Holocene in the Scheldt and Meuse basins. Possible causes for the local extinction of this catfish are discussed.

KEY WORDS : archaeozoology, extinction, overfishing, Meuse, Scheldt

INTRODUCTION

Well-dated skeletal remains of fish species found during archaeological excavations can help to reconstruct the composition of ancient fish faunas and thus allow establishing the distribution of certain species before the start of human disturbance, such as overfishing or habitat degradation. In this paper, the contribution of archaeozoological finds to the evaluation of the status of the European catfish *Silurus glanis* Linnaeus, 1758 in Belgian waters is documented. Because of its large size and the robustness of its skeleton, *Silurus glanis* is a relatively good prospect for representation in the archaeological and palaeontological record. Its remains have a fair chance of being preserved and can rather easily be retrieved during excavation, whereas smaller fish species have a tendency to be overlooked when no sediment sieving is practiced. The European fossil record of this catfish is poor with few pre-Holocene finds, which are usually only identified at genus level. Miocene records of *Silurus* exist for Ukraine (BELYAEVA, 1948) and Turkey (PIVETEAU, 1978) and Pliocene finds have been reported from Russia, near the Sea of Azov (BAIGUSHEVA, 1971) and from southern France (DEPÉRET, 1885). Middle Pleistocene records of *Silurus* exist for three different sites in Turkmenistan (DUBROVO & NIGAROV, 1990). Holocene finds of *Silurus glanis*, from archaeological sites, are more numerous and have been used in neighbouring countries to reconstruct the zoogeography of the species during the last 10,000 years. This is the case for the Netherlands (BRINKHUIZEN, 1979; HEINRICH, 1994; 2007), northern Germany and southern Scandinavia (HEINRICH, 1994; 2007). However, the available evidence for Belgium has thus far never been compiled. In what follows, all known finds of *Silurus glanis* from Belgian prehistoric and historic archaeological sites is presented and discussed from a palaeozoogeographical point of view.

In the older Belgian fishery literature (e.g., DE SELYS-LONGCHAMPS, 1842; LAMEERE, 1895 or MAES, 1898), the European catfish is not mentioned at all, whereas on one occasion (RAVERET-WATTEL, 1900) it is even stated explicitly that the species is unknown in Belgium. In more recent fishery surveys, the status of the species is considered to be doubtful or is not clearly evaluated (BRUYLANTS et al., 1989; VANDELANNOOTTE et al., 1998). Confusion also arises from more popular accounts. The 'silures' mentioned from the Demer river, a tributary of the Scheldt, in the Belgian fishery bulletin Pêche et Pisciculture (ANONYMOUS, 1926) was considered to be evidence for the occurrence of the species in that river (DE CHARLEROY & BEYENS, 1998). However, this record no doubt refers to the brown bullhead *Ameiurus nebulosus* (Lesueur, 1819) (VRIELYNCK et al., 2003), a north-American silurid that became acclimated to Belgian rivers and pools since 1901 (ROUSSEAU, 1915). The postglacial distribution of *Silurus glanis* includes Central and Eastern Europe, northern Anatolia and goes as far east as the Aral Sea and the Ural mountains (DE NIE, 1996). Towards the west, the natural distribution stops at the Elbe, but there are populations in the northern part of The Netherlands and in southern Sweden that are believed to represent relic populations (HEINRICH, 2007).

Recently, a number of specimens of the European catfish have been recorded from Belgian waters. A first *Silurus glanis* was captured in 1984 in the Meuse basin near Lanaye, but nowadays it is abundant in the entire river and it lives also in the Sambre river and some canals (PHILIPPART, 2007). The species has recently also been reported from the Scheldt and some of its tributaries (the Rupel, the Grote Nete and the Kleine Nete) (BREINE et al., 2007). All these recent records, however, should be considered to represent exotic specimens (cf. VRIELYNCK et al., 2003). Similarly, Dutch records since 1972 in the area of the IJsselmeer and in the Rhine and Waal basins are regarded as escaped or stocked specimens derived from breeding experiments with animals imported from the Donau (NIJSSEN & DE GROOT, 1987). The catfish's occurrence in the Dutch part of the Meuse basin since 1985 is explained in a similar way, and chronologically coincides well with the aforementioned observations made in the Belgian part of the Meuse. Records of *Silurus glanis* west of the Elbe, in the Weser and Ems basins, are also believed to represent escaped or stocked fish (HEINRICH, 1994; 2007).

MATERIALS AND METHODS

The skeletal remains mentioned in the following survey were found during archaeological excavations and were dated through the characteristics of the context in which they were found, i.e. stratigraphical position and association with datable archaeological finds (lithics, ceramics, or coins, depending on the period). It was also always checked to ensure the finds did not represent residual or intrusive material (i.e. older or younger than the context in which they were found). Unless specified otherwise, the bones have been identified or re-analyzed by the first author. Identification was carried out by comparison with modern reference skeletons housed at the Royal Belgian Institute of National Sciences (RBINS, Brussels). On well-preserved remains a reconstruction of body size was carried out through comparison with skeletal elements of modern fish of known length. The size reconstructions are given in centimetres standard length (SL: the distance from the snout of the animal to the base of its tail).

RESULTS

The various catfish finds known to date in Belgium are presented in a more or less chronological order, for sites located along the Meuse and the Scheldt basins separately. Because of the geographic proximity to the Belgian territory, finds from Maastricht are also included. The localities mentioned in the text are indicated on Fig. 1. A chronological, cultural and biostratigraphical framework for the archaeozoological evidence is summarised in Fig. 2.

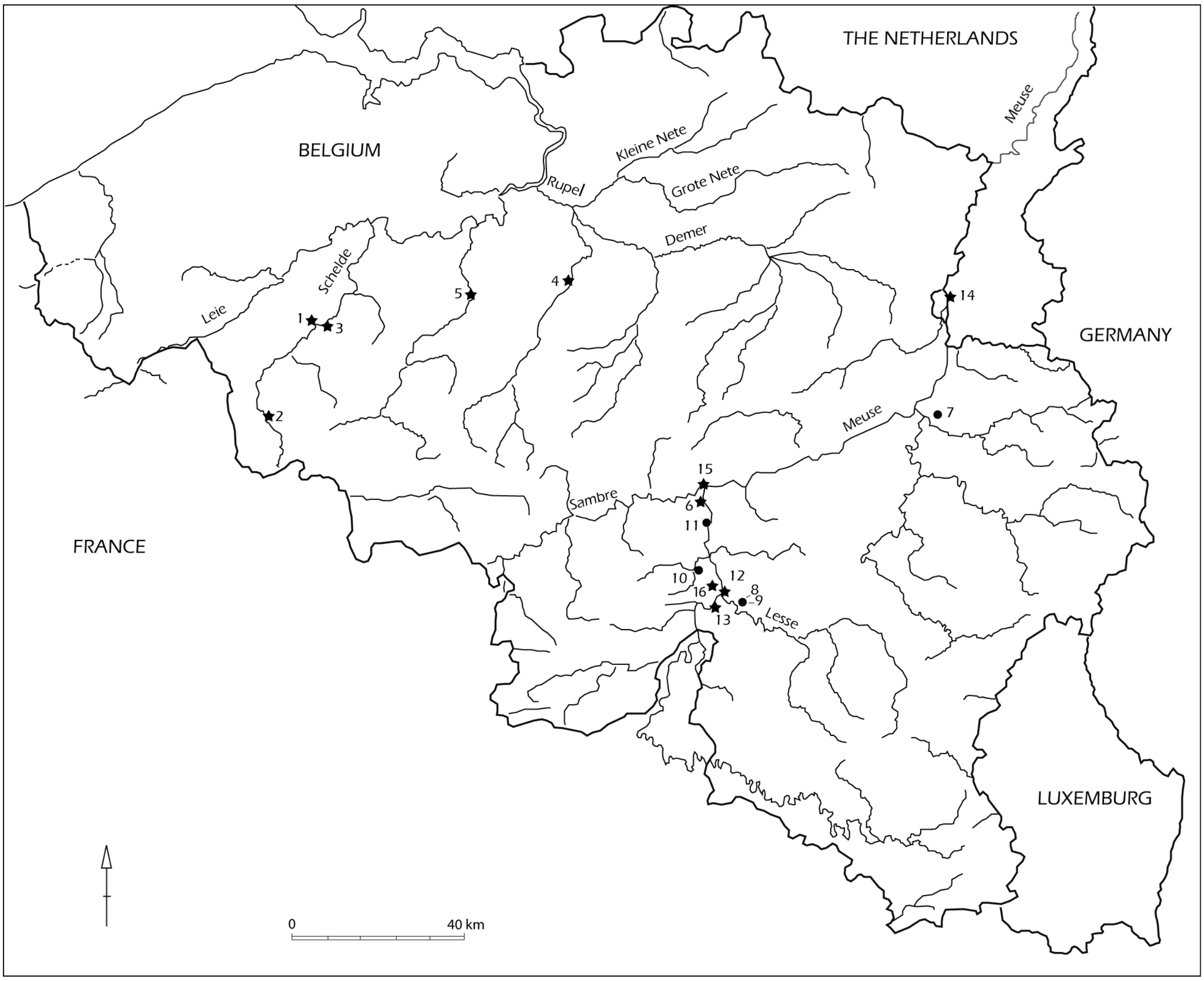

Fig. 1. – Map with the location of Belgian archaeological sites mentioned in the text. Those that yielded *Silurus glanis* are indicated with an asterisk. 1: Oudenaarde-Donk; 2: Tournai; 3: Ename; 4: Grimbergen; 5: Aalst; 6: Néviau; 7: Walou; 8: Trou de Chaleux; 9: Trou du Frontal; 10: Trou du Sureau; 11: Bois Laiterie; 12: Trou de Pont-à-Lesse; 13: Abri du Pape; 14: Maastricht; 15: Namur; 16: Montaigle.

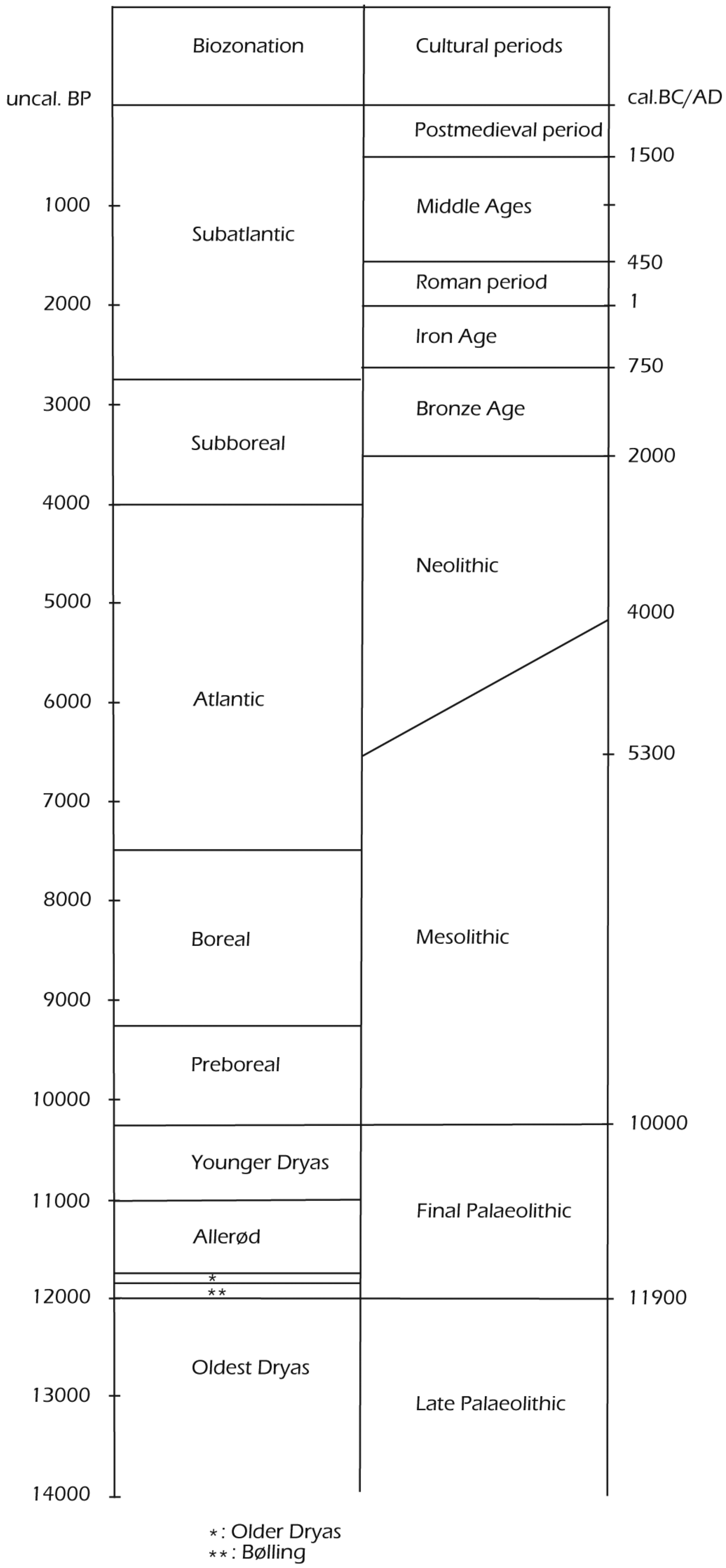

Fig. 2. – Schematic overview of the biozonation (after VERBRUGGEN et al., 1996) and succession of cultural periods (after SLECHTEN, 2004) for Belgium during the Holocene (Preboreal to Subatlantic) and Late Glacial Period.

Scheldt basin

Oudenaarde-Donk: 7 vertebrae and 6 pectoral spines of individuals between 150 and 200cm SL were found during rescue excavations of a waterlogged site near the Scheldt. Identifications were carried out by the first author in 1985 and were briefly mentioned in VAN DER PLAETSEN et al. (1986) and PARENT et al. (1987). The site yielded evidence for occupation by mesolithic hunter-gatherers and subsequently by neolithic people belonging to the Michelsberg culture. The catfish remains were found in unspecified Michelberg contexts that were radiocarbon dated between 5240±70 BP (IRPA-743) and 4990±70 BP (IRPA-667). These dates were calibrated to calendar ages using the Calib. Rev 5.0.1 program STUIVER & REIMER (1986-2005), in conjunction with STUIVER & REIMER (1993). The 2-σ ranges are 4261-3943cal BC for the oldest date and to 3945-3656cal BC for the youngest.

Tournai-Cloître: one pectoral spine of an individual measuring about 140cm SL was found in a destruction layer dated to the 9th (?)-10th centuries AD (BRULET et al. 2004: 158). Excavations carried out thus far in the town of Tournai dealt with sites ranging in time between the 2nd and the 13th century AD. Faunal remains, including fish, occur in many sites, but only one *Silurus glanis* bone was found thus far.

Ename-castrum: a context dating around 1000 AD yielded a single bone of catfish, i.e. a cleithrum of an individual that measured 140-150cm SL. There is no later evidence for the species in the extensive faunal collections that were excavated from other loci at Ename yielding bone dating between the 12th and the 17th century AD (ERVYNCK & VAN NEER, 1992; COOREMANS et al., 1993; ERVYNCK et al., 1994).

Grimbergen-Senecaberg: in a layer dated to the 12th century AD ten large fish bones were found that have been identified by D. Nolf as *Silurus glanis* (GAUTIER & RUBBERECHTS, 1978). The material was not available for re-analysis and an identification of the skeletal elements or a size reconstruction could therefore not be carried out.

Aalst-Oude Vismarkt: a preopercular of a fish measuring 130-140cm SL was found in a context dating to the first quarter of the 14th century AD. For the sake of completeness, it should be mentioned that the pottery, on which the dating was based, also includes a small quantity (3 sherds on a total of about 1000) of residual material dating to the end of the 12th-first half of the 13th century AD (DE GROOTE, 2007, pers. comm.).

Meuse basin

Néviau: a precaudal vertebra has been reported from this rock shelter on the left bank of the Meuse, 5km south of Namur (GILTAY, 1931). The photographs of the specimen in the publication allow us to confirm the identification and show that also the estimated total length of 1.50 meters is correct. The bone reportedly derives from a context that also comprised remains of *Equus* sp., *Cervus elaphus* and lithic material typical for an Upper Magdalenian (Late and Final Palaeolithic) occupation.

Trou de Pont-à-Lesse: the faunal remains from this site, excavated in 1866 by E. Dupont, are stored at the RBINS. The fish bones were recently analyzed for the first time, by the first author. Trou de Pont-à-Lesse yielded 8 skeletal remains of *Silurus glanis*, derived from layers dating to the Neolithic (DUPONT, 1905). The material includes a vomer, an ectopterygoid, a pectoral spine (Fig. 3), and a branchial fragment, all from fish measuring 150-170cm SL. Four additional bones that were poorly preserved, did not allow a size reconstruction: a vertebral centrum, a dentary, a soft fin ray and an unspecified skull roof fragment. No other fish bones are available from this site, probably because no sieving was practiced during excavation.

Abri du Pape: this cave site, located along the Meuse river at about 5km south of Dinant, yielded 10 vertebrae and a fragment of the Weberian apparatus, found in strata 20 and 21, layers with cultural material dating to the Early Mesolithic (VAN NEER, 1999). Three elements were of relatively small individuals (60-70cm SL) and one bone belonged to a fish of 100-120cm SL. Stratum 21 was radiocarbon dated to 8817±85 (GX-19366) (STRAUSS, 1999) which corresponds to a calibrated age of 8225-7653 BC (2-σ range). Another AMS date shows that stratum 20 is about a millennium younger: 7843±85 (GX-19365) or 7030-6928 (12.6%), 6924-6875 (6.6%) or 6864-6503 (80.8%) cal BC.

Maastricht, sites Pandhof, Mabro and Derlon: these three urban contexts yielded five *Silurus glanis* finds of which four are dated between the end of the 4th c. and the 5th c. AD (PIGIÈRE, 2008). The material from the site Pandhof includes a pectoral spine (undated) and a parasphenoid (400-450 AD), both from a fish measuring 90-

Fig. 3. – Left pectoral spine of *Silurus glanis* found in a Neolithic level of Trou de Pont-à-Lesse. The scale bar is 1cm.

100cm SL, as well as a precaudal vertebra, dated to 375-400 AD, of a catfish of 110-120cm SL. The site of Mabro yielded a precaudal vertebra of a fish measuring 130-140cm SL dating to 375-425 AD, and at the Derlon site a fragment of a caudal vertebra (425-475 AD) was found that did not allow size reconstruction.

Namur-Hospice Saint-Gilles: faunal remains from this site cover the Early Roman to post-medieval period, but only in a few Late Roman contexts (late 3rd to early 5th centuries AD) were bones of *Silurus glanis* found (De Cupere & Van Neer, 1993). These include two dentaries of fish that measured 120-130cm SL and two pectoral spines of specimens that were 100-110 and 110-120cm SL long.

Montaigle: below the ruins of this late 13th-16th century castle site, a Late Roman level (AD 270 to 5th c.) was found corresponding to the occupation of a small military garrison (Mignot, 1994). The site is located at the confluence of the Molignée and Flavion rivers, about 25km south of Namur. The Roman context yielded a pectoral spine of a catfish that measured about 120cm SL.

Namur-Grognon: a series of cess-pits, dating between the 12th and 17th century AD, with abundant faunal remains, were excavated at this site (Van Neer & Lentacker, 1996). In a late 15th–early 16th century AD filling, a vertebral centrum was found of a catfish measuring about 120cm SL.

Two additional catfish finds from cave sites in the Meuse basin have been reported in the literature (Casier, 1957), i.e. from Ramioul rock shelter (Province of Liège) and from Roger cave at Samson (Province of Namur). The Ramioul spine, which is depicted, was claimed to belong to a siluroid, but because of differences with a modern specimen, Casier (1957: 346) believed that the find could represent a second, still unknown, species of catfish. In reality, this bone is a right half of the dorsal spine of a large cyprinid (see Fig. 4). The feathered appearance of the posterior part of the bone is typical of barbel, *Barbus barbus* (Linnaeus, 1758). The specimen from Roger cave has not been depicted but is said to differ from the Ramioul spine in the curvature of the processes. Taking into account the first erroneous identification, this find may also represent barbel.

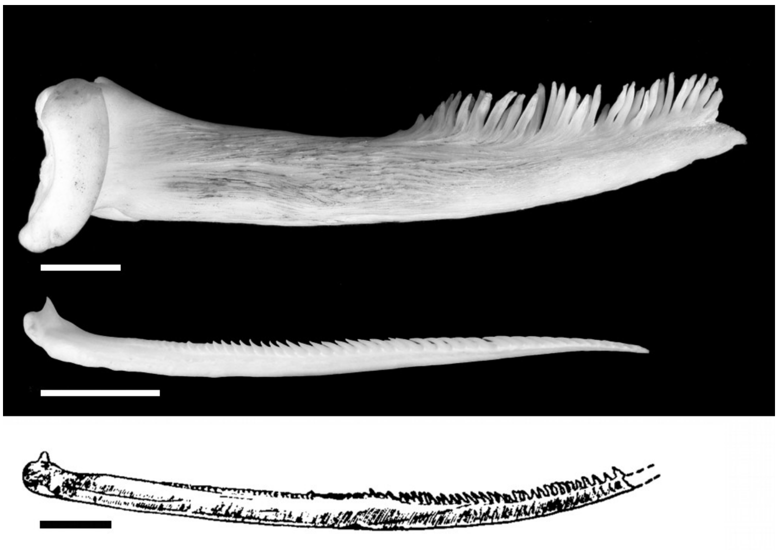

Fig. 4. – Spine depicted by Casier (1957) compared to a modern *Silurus glanis* pectoral spine (top) and a *Barbus barbus* dorsal spine (middle). Scale bars are 1cm.

DISCUSSION

For the area considered, only 12 localities with specimens of *Silurus glanis* are known thus far, possibly indicating that the species was never very abundant in the Scheldt and Meuse basins. It is unlikely that this low incidence can only be linked to sampling methods used during excavation since the large bones of this species must be easily recovered, even when no sieving is practised. In Central and Eastern Europe, where *Silurus glanis* still occurs naturally today, the species may have been more abundant in the past than in our region. Archaeological sites in those parts of Europe indeed yield numerous hand-collected remains of catfish (Székelyhidy et al., 1994). The paucity of finds in Belgium may reflect the fact that the region was a marginal part of the former distribution. Relic populations of the species may have had low population densities and may therefore have been very vulnerable (cf. Boeseman, 1975: 55).

The bone of *Silurus glanis* from Néviau (Giltay, 1931) is the only Late Pleistocene record of this species reported for the Meuse. The species was not found along this river basin in a number of other Palaeolithic cave sites of which the ichthyofauna was recently investigated. This is the case for Walou cave (Van Neer &. Wouters, 2007), where Middle and Upper Palaeolithic material was found, and for four Upper Palaeolithic cave sites, i.e. Trou de Chaleux, Trou du Frontal, Trou du Sureau (Van Neer et al., 2007) and Upper Magdalenian Bois Laiterie (Van

NEER, 1997). The specimen from Néviau was attributed to the Upper Magdalenian on the basis of associated lithic material. However, as will be argued below, in that region temperatures during most of the final phases of the Pleistocene must have been too low to allow survival of *Silurus glanis*, although significant climatic oscillations occurring at the end of the Magdalenian produced temperate periods during the so-called Bølling and Allerød interstadials (ENLOE, 2001). The fact that the layer in which the catfish bone was found also yielded remains of horse and red deer, points towards these interstadials. Especially the presence of red deer seems to confirm that climatic conditions must have been relatively mild during the period of deposition of the faunal material. However, given the fact that the recovery methods may not have been ideal in the early 20th century excavations, a younger date can perhaps not be totally excluded. It thus remains advisable to treat this record with great caution, especially since the Néviau find would not only be the only Late Pleistocene record thus far in Belgium, but also in the whole of north-western Europe (SCHLUMBERGER et al., 2001). It would certainly be worth investigating the homogeneity of the artefacts and the faunal material from Néviau, but the RBINS does not house any material from the site and it is unclear if it is available for study elsewhere.

Old finds of *Silurus glanis* that are more secure from a stratigraphical point of view, are those from Abri du Pape, in the Meuse basin, dating to the Early Mesolithic. This cultural period corresponds to the late Preboreal and Boreal biostratigraphical phases (Fig. 2), when the climate had already become much milder than during the late Pleistocene (Fig. 5). The only other prehistoric site in the Meuse basin that yielded evidence for the species is Trou de Pont-à-Lesse, which is only very roughly dated to the Neolithic. The oldest finds from the Scheldt basin are also Neolithic, and here radiocarbon dates of charcoal from the archaeological layers indicate an age between 4260-3650cal BC. A direct dating of the *Silurus* bones would, at this stage, not be informative since the radiocarbon reservoir effect of the Scheldt and Meuse basin has not yet been established. This means that the bias on radiocarbon dates from biological material out of these aquatic habitats, resulting from the intake of carbon within a different biochemical cycle compared to terrestrial organisms, cannot be corrected, simply because the former basic abundance of radiocarbon is not known for these river basins.

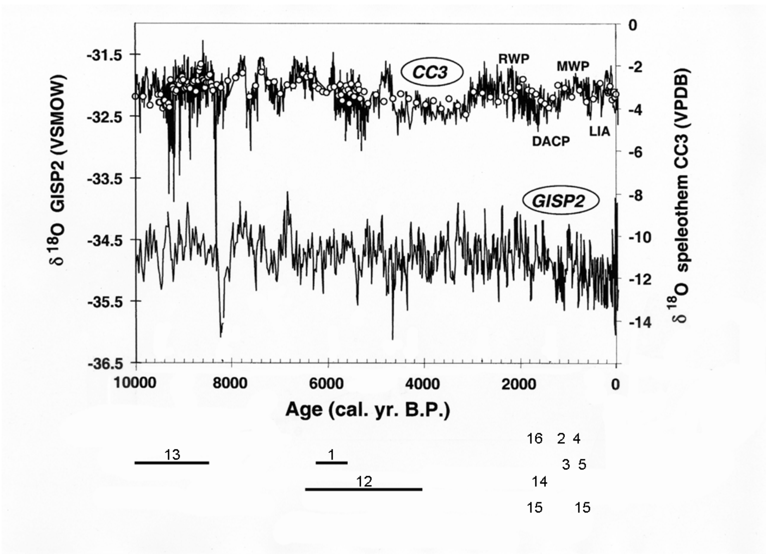

Fig. 5. – Fluctuations in the oxygen ($^{18}O/^{16}O$) isotope ratio during the Holocene reflecting climatic variations, based on a Greenland ice core drilling (GISP2) and a speleothem from south-western Ireland (CC3) (after MCDERMOTT et al., 2001). The peaks represent warmer periods, the troughs colder. Indicated are the Roman Warm Period (RWP), the Dark Ages Cold Period (DACP), the Medieval Warm Period (MWP), the Little Ice Age (LIA) and the chronological time span of the sites with catfish remains (number codes, see Fig. 1). The site of Néviau has been omitted from this graph because of its weak chronological context.

Following the prehistoric occurrence of *Silurus glanis*, there is a large hiatus until the first new appearance in the Scheldt basin in the High Medieval period (9th-10th c. AD), and in the Meuse basin in the Late Roman period (3rd-5th c. AD). However, this low prevalence could be an artefact of the archaeozoological record, which is very incomplete, in fact almost non-existent, for the Bronze Age and Iron Age in Belgium (ERVYNCK, 1994), and for the Roman and Early Medieval period in the Scheldt area.

The youngest evidence for *Silurus glanis* derives from the Late Medieval period in both basins. For the Meuse, the youngest find dates to the 15th century AD, but in the Scheldt basin the species is only attested with certainty until the 12th century. Possibly the record can be extended to the first quarter of the 14th century if the bone found at Aalst (Oude Vismarkt) proves to be contemporaneous with the majority of the pottery from the context in which it was found.

There are no finds of *Silurus* from the French or Dutch part of the Scheldt basin, but for the Dutch Meuse basin several records exist besides the finds from Maastricht already mentioned. The additional Dutch finds are all located in the estuarine region of the Meuse (for the older sites also partly the common delta area of the Meuse, Rhine and Scheldt) and consist of bones dating between the Neolithic and the Iron Age. Neolithic finds are known from the sites of Hekelingen (Prummel, 1987), Vrijenburg-Barendrecht (Zeiler & Brinkhuizen, 2005) and Albrandswaard-Portland (Brinkhuizen, 2006). Younger sites are the Middle Bronze Age locality Mijnheerenland-Hofweg (van Heeringen & Lauwerier, 1996) and the Early Iron Age site Westmaas-Maaszicht (van Heeringen et al., 1998). These Dutch finds are hence chronologically intermediate between the aforementioned Belgian records for the Meuse, which include both older (Mesolithic Abri du Pape, and possibly also Upper Magdalenian Néviau) and younger finds (Roman and Late Medieval Namur).

The archaeozoological data for the Meuse and Scheldt basin clearly demonstrate that *Silurus glanis* must be considered an autochthonous species. It lived in Belgium from at least Early Mesolithic times, since about 8200-7650cal BC, until the Late Medieval period. Post-medieval, archaeozoological records do not exist and the species is not mentioned in historic sources (chronicles, fishing regulations, feudal legislation, etc.). As already mentioned in the introduction, *Silurus glanis* is also not reported in early scientific (19th c.) fishery literature. Specimens captured in Belgian waters over the last decennia are considered to have escaped from experimental tanks or ponds. All this evidence implies that the species must have become extinct in the Scheldt and Meuse basins several centuries ago.

When trying to find possible explanations for the local disappearance of *Silurus glanis*, it is useful to consider its ecology. European catfish prefer deeper parts of large rivers and lakes, but at the onset of the spawning season they gain shallow, inshore areas. Depending on the region, the reproduction takes place between the end of April and the end of July and it seems that the start of the spawning season is related to the water temperature, which should be at least 18-20°C (Mohr, 1957) or even 20-22°C (Shikhshabekov, 1978). This dependence on a warm breeding season explains why the lower temperatures during the postmedieval Little Ice Age may have had an adverse effect on the survival of the species. Of course, the available climatic reconstructions must be regarded with caution since they are based on very different types of information. Especially the late medieval and the postmedieval data differ in quality. Nevertheless, for the Low Countries, it has been postulated (Buisman, 1998; 2000) that the Little Ice Age lasted from around AD 1430 until the middle of the 19th century. The average temperatures were about 1 to 2 degrees lower than today. Historical research based on chronicles, financial accounts and tree ring studies shows that summers certainly became cooler from about AD 1530 and that the last quarter of the 16th century was the coldest period of the last 1000 years. Such temperature shifts can perhaps have been enough to cause the final demise of the European catfish in our rivers.

Anthropogenic influences provide another explanation for the decline of *Siluris glanis*, as an alternative or in combination with climatic changes. Human interference such as the construction of sluices and other water works may have changed the hydrology of river basins and could have rendered access to suitable spawning grounds difficult. The European catfish may also have been sensitive to overfishing since it is a rather slow growing species with a relatively late maturation (Berg, 1964). In late medieval times, with growing urbanization and population numbers in general, there was indeed a high demand for fish, which caused heavy pressure on the freshwater ichthyofauna, and this resulted in an increased import of marine fish and the development of carpiculture (Ervynck et al., 2004). The facts that the catfish in contrast to, for instance, sturgeon is not mentioned in late medieval texts and that the archaeozoological finds are so rare, suggest that population densities were very low. The Scheldt and Meuse catfish may have been marginal populations that were therefore very vulnerable to anthropogenic and climatic pressure.

CONCLUSIONS

The Belgian archaeozoological record shows that the European catfish *Silurus glanis* once belonged to the autochthonous fauna of the Scheldt and Meuse basins. The species apparently colonised the region in the beginning of the Holocene when climatic conditions became milder, a phenomenon that can also be followed through the archaeofaunas of the Netherlands, northern Germany, Denmark and southern Sweden (Heinrich, 1994; 2007; Lepiksaar, 2001). In late medieval times, the catfish died out over much of its westernmost distribution area, around the 12th c. AD in The Netherlands (Brinkhuizen, 1979) and at the beginning of the postmedieval period in northern Germany (Heinrich, 1989). Relic populations persist today in southern Sweden, on the island of Sjælland in east Denmark, and in the north-western part of the Netherlands. These seem to be remnants of a wider post-Pleistocene distribution. Why the species survived in these areas remains to be investigated. The records of *Silurus glanis* from the 1970's onwards outside this distribution area do not reflect a natural expansion of the species. Instead, they correspond to specimens that were imported from Central Europe for breeding experiments and that escaped or were released intentionally.

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