



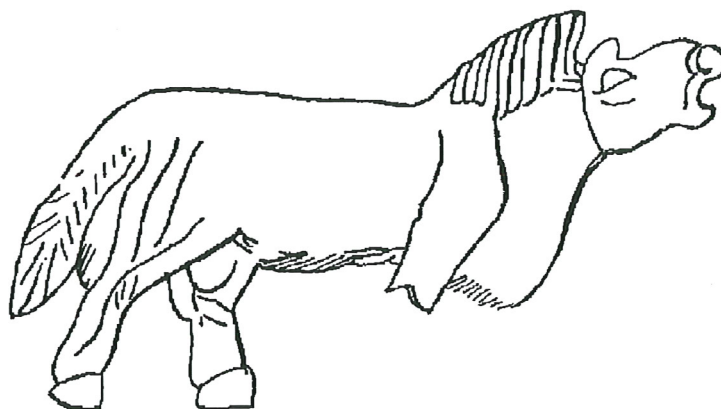
ARCHAEOZOOLOGY OF THE NEAR EAST

IV B

Proceedings of the fourth international symposium on the
archaeozoology of southwestern Asia and adjacent areas

edited by

M. Mashkour, A.M. Choyke, H. Buitenhuis and F. Poplin



ARC - Publicatie 32
Groningen, The Netherlands, 2000

Cover illustration:

Przewalski from Susa (nacre – mother of pearl)

Dated to 2500 – 2000 BC, identified by F. Poplin

copyright:

Centre for Archeological Research and Consultancy

Groningen Institute for Archaeology

Rijksuniversiteit Groningen The Netherlands

Printing: RCG -Groningen

Parts of this publication can be used if source is clearly stated.

Information: Centre for Archeological Research and Consultancy

Poststraat 6, 9712 ER Groningen, The Netherlands

ISBN 90 – 367 – 1243 - 2

NUGI 644 - 134

Contents

VOLUME B

Chiara Cavallo, Peter M.M.G. Akkermans and Hans Koens	5
Hunting with bow and arrow at Tell Sabi Abyad	
Caroline Grigson	12
The secondary products revolution? Changes in animal management from the fourth to the fifth millennium, at Arjoune, Syria	
Barbara Wilkens	29
Faunal remains from Tell Afis (Syria)	
Margarethe Uerpmann and Hans-Peter Uerpmann	40
Faunal remains of Al-Buhais 18: an Aceramic Neolithic site in the Emirate of Sharjah (SE-Arabia) - excavations 1995-1998	
Angela von den Driesch and Henriette Manhart	50
Fish bones from Al Markh, Bahrain	
Mark Beech	68
Preliminary report on the faunal remains from an 'Ubaid settlement on Dalma Island, United Arab Emirates	
Jean Desse and Nathalie Desse-Berset	79
Julfar (Ras al Khaimah, Emirats Arabes Unis), ville portuaire du golfe arabo-persique (VIII ^e -XVII ^e siècles): exploitation des mammifères et des poissons	
Chris Mosseri-Marlio	94
Sea turtle and dolphin remains from Ra's al-Hadd, Oman	
Hervé Bocherens, Daniel Billiou, Vincent Charpentier and Marjan Mashkour	104
Palaeoenvironmental and archaeological implications of bone and tooth isotopic biogeochemistry (¹³ C ¹⁵ N) in southwestern Asia	
Sándor Bökönyi † and László Bartosiewicz	116
A review of animal remains from Shahr-i Sokhta (Eastern Iran)	
Ann Forsten	153
A note on the equid from Anau, Turkestan, " <i>Equus caballus pumpellii</i> " Duerst	
Alex K. Kasparov	156
Zoomorphological statuettes from Eneolithic layers at Ilgynly-depe and Altyn depe in South Turkmeniya	
László Bartosiewicz	164
Cattle offering from the temple of Montuhotep, Sankhkara (Thebes, Egypt)	
Louis Chaix	177
A hyksos horse from Tell Heboua (Sinäi, Egypt)	
Liliane Karali	187
Evolution actuelle de l'archéozoologie en Grèce dans le Néolithique et l'Age du Bronze	
Emmanuelle Vila	197
Bone remains from sacrificial places: the temples of Athena Alea at Tegea and of Asea on Agios Elias (The Peloponnese, Greece)	
Wim Van Neer, Ruud Wildekamp, Marc Waelkens, Allan Arndt and Filip Volckaert	206
Fish as indicators of trade relationships in Roman times: the example of Sagalassos, Turkey	
Ingrid Beuls, Bea De Cupere, Paul Van Mele, Marleen Vermoere, Marc Waelkens	216
Present-day traditional ovicaprine herding as a reconstructional aid for understanding herding at Roman Sagalassos	

Contents

VOLUME A

Preface	A
Deborah Bakken	11
Hunting strategies of Late Pleistocene Zarzian populations from Palegawra Cave, Iraq and Warwasi rock shelter, Iran	
Daniella Zampetti, Lucia Caloi, S. Chilardi and M.R. Palombo	18
Le peuplement de la Sicile pendant le Pléistocène: L'homme et les faunes	
Sarah E. Whitcher, Joel C. Janetski, and Richard H. Meadow	39
Animal bones from Wadi Mataha (Petra Basin, Jordan): The initial analysis	
Liora Kolska Horwitz and Eitan Tchernov	49
Climatic change and faunal diversity in Epipalaeolithic and Early Neolithic sites from the Lower Jordan valley	
Paul Y. Sondaar and Sandra A.E. van der Geer	67
Mesolithic environment and animal exploitation on Cyprus and Sardinia/Corsica	
Pierre Ducos	74
The introduction of animals by man in Cyprus: An alternative to the Noah's Ark model	
Jean-Denis Vigne, Isabelle Carrère, Jean-François Saliège, Alain Person, Hervé Bocherens, Jean Guilaine and François Briois	83
Predomestic cattle, sheep, goat and pig during the late 9 th and the 8 th millennium cal. BC on Cyprus: Preliminary results of Shillourokambos (Parekklisha, Limassol)	
Norbert Benecke	107
Mesolithic hunters of the Crimean Mountains: The fauna from the rock shelter of Shpan'-koba	
Hitomi Hongo and Richard H. Meadow	121
Faunal remains from Prepottery Neolithic levels at Çayönü, Southeastern Turkey: a preliminary report focusing on pigs (<i>Sus</i> sp.)	
Gulcin İlgezdi	141
Zooarchaeology at Çayönü: a preliminary assessment of the red deer bones	
Banu Oksuz	154
Analysis of the cattle bones of the Prepottery Neolithic settlement of Çayönü	
Nerissa Russell and Louise Martin	163
Neolithic Çatalhöyük: preliminary zooarchaeological results from the renewed excavations	
Alice M. Choyke	170
Bronze Age bone and antler manufacturing at Arslantepe (Anatolia)	
Ofer Bar-Yosef	184
The context of animal domestication in Southwestern Asia	
Cornelia Becker	195
Bone and species distribution in late PPNB Basta (Jordan) - Rethinking the anthropogenic factor	
Justin Lev-Tov	207
Late prehistoric faunal remains from new excavations at Tel Ali (Northern Israel)	
Daniella E. Bar-Yosef Mayer	217
The economic importance of molluscs in the Levant	
Daniel Helmer	227
Les gazelles de la Shamiyya du nord et de la Djézireh, du Natoufien récent au PPNB: Implications environnementales	
Maria Saña Seguí	241
Animal resource management and the process of animal domestication at Tell Halula (Euphrates Valley-Sria) from 8800 bp to 7800 bp	

FISH AS INDICATORS OF TRADE RELATIONSHIPS IN ROMAN TIMES: THE EXAMPLE OF SAGALASSOS, TURKEY

Wim Van Neer¹, Ruud Wildekamp¹, Marc Waelkens², Allan Arndt³
and Filip Volckaert³

Abstract

The fish species found in contexts dating from the Augustan to Early Byzantine periods at the site of Sagalassos are all imported. The ichthyofauna comprises Anatolian freshwater species, marine fish as well as species imported from Egypt (and possibly the Syro-Palestinian area). The research results available thus far are summarized and a description is given of the ongoing field work and laboratory analyses carried out in order to further define the trade connections that existed in the past.

Résumé

Les espèces piscicoles du site de Sagalassos mises au jour dans des contextes datés de la période augustéenne au début de la période byzantine sont toutes introduites. L'ichthyofaune comprend des espèces anatoliennes d'eau douce, des poissons de mer, ainsi que des individus importés d'Égypte (et peut-être de l'aire syro-palestinienne). Les résultats d'analyse disponibles à ce jour sont résumés ci-dessous. De plus, une description de la fouille en cours et les analyses de laboratoire présentées ici permettront de mieux définir les réseaux commerciaux qui existaient alors.

Key Words: Fish, Trade, Anatolia, Egypt, Near East

Mots Clés: Poissons, Commerce, Anatolie, Égypte, Proche-Orient

Introduction

Former trade connections or other contacts with distant areas can be illustrated by means of animal remains belonging to species that do not occur in the vicinity of an archaeological site. Such exotic species can arrive at a site as living animals imported as a curiosity, a status symbol or as a tribute, as fresh or preserved food items, as a raw product for the production of objects, as a finished object, or as an item with a symbolic, religious or pecuniary value. In the case of food items, the time that the transport can take is dictated by the efficiency of the preservation methods to prevent spoilage. Unlike mollusc shells (see for instance Reese 1991) or raw materials such as antler or ivory, which can arrive at a site as a result of complex and indirect trade or exchange processes, remains of preserved food are therefore good indicators of former trade connections.

In this article, the use of fish remains for the documentation of short and long distance trade is illustrated for the Antique site of Sagalassos. This town, located in the Burdur district of Turkey (Fig. 1), was an important production centre for pottery from the 1st to the 7th century AD (Poblome 1996; Waelkens and the Sagalassos team 1997). Since the beginning of the excavations in 1991, faunal remains have been systematically studied (e.g. Van Neer and De Cupere 1993; De Cupere *et al.* 1993; De Cupere 1998). The study of trade and exchange patterns is approached in an interdisciplinary way and involves the interpretation of faunal data, combined with the contribution of the study of ceramics and coinage, epigraphic and historical data.

¹ Royal Museum of Central Africa, 3080 Tervuren, Belgium

² Katholieke Universiteit Leuven, Afd. Archeologie, Blijde Inkomststraat 21, 3000 Leuven, Belgium

³ Katholieke Universiteit Leuven, Zoölogisch Instituut, Naamsestraat 59, 3000 Leuven, Belgium

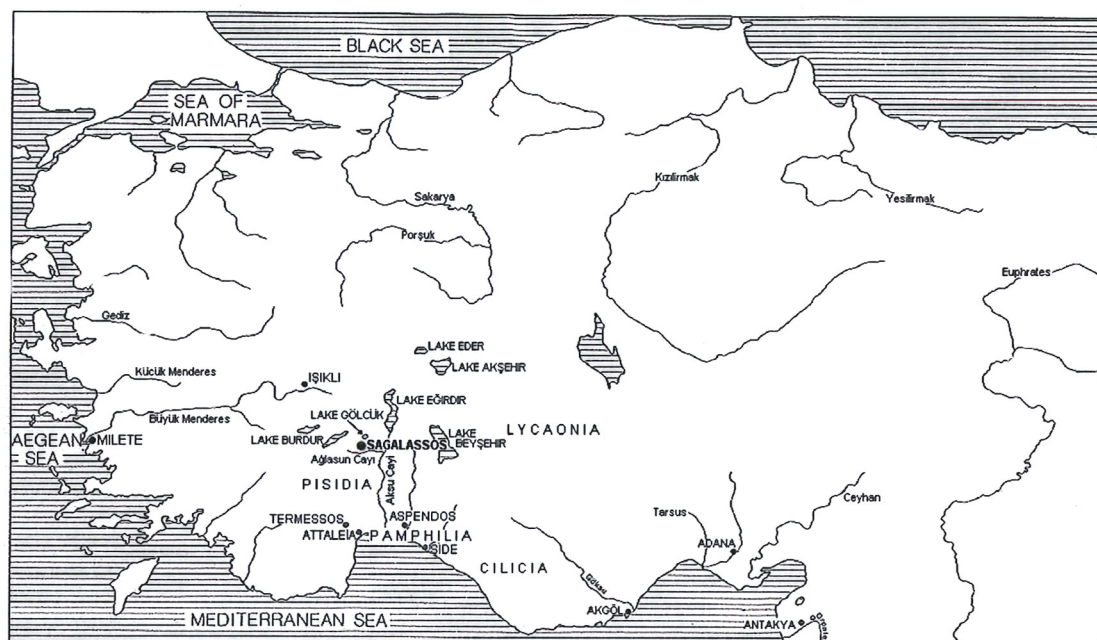


Fig. 1. The location of Sagalassos and the major rivers and lakes mentioned in the text.

Faunal and archaeological data indicating trade connections with the Mediterranean

The fish remains discovered during the 1990-1994 excavations have already been described (Van Neer *et al.* 1997) and the material from the 1995-1998 seasons is presently being analysed. The species found thus far are from levels dated between the 1st and 7th centuries AD and comprise Anatolian freshwater fish, Mediterranean species and fish designated as 'exotic freshwater species' (Table 1). Three of the seven marine taxa occur exclusively in the Mediterranean (*Epinephelus* sp, *Auxis rochei*, and *Euthynnus alletteratus*) whereas the four others (*Sardina pilchardus*, *Sarda sarda*, *Scomber japonicus*, and the unidentified sturgeon) live in both the Mediterranean and the Black Sea. It is assumed that all this fish was imported from the Mediterranean coast which is closer to the site, at approximately 110 km. Moreover, there were good roads in that direction (Mitchell 1993) and commercial contacts existed primarily with the southern part of the country (Waelkens and the Sagalassos team 1997). The coins found at Sagalassos comprise issues from major contemporary cities in Pisidia (Termessos, Kremna, Selge, and Baris) and Pamphylia (Side, Perge, Attaleia, and Aspendos). Perge was probably used as the major port for export and import by Sagalassos since most foreign city coins found at the site are from that town (Scheers 1993a, 1993b, 1995, 1997). This trade with more southerly located towns and settlements is also documented by the export of Sagalassian red slip ware (Waelkens and the Sagalassos team 1997; Poblome 1996, 1999).

Table 1. List of fish species identified thus far from Sagalassos

Anatolian freshwater fish	Marine fish
<i>Abramis brama</i>	<i>Sardina pilchardus</i>
<i>Cyprinus carpio</i>	<i>Epinephelus</i> sp.
<i>Leuciscus</i> sp.	<i>Euthynnus alletteratus</i>
<i>Vimba vimba</i>	<i>Auxis rochei</i>
<i>Silurus glanis</i>	<i>Sarda sarda</i>
<i>Esox lucius</i>	<i>Scomber japonicus</i>
Anadromous fish	Exotic freshwater fish
Acipenseridae indet.	<i>Clarias</i> sp.
	<i>Bagrus</i> sp.
	Tilapiini indet.
	<i>Lates niloticus</i>

Import of Anatolian freshwater fish

The majority of the fish remains discovered thus far at Sagalassos are from Anatolian freshwater species (Table 1). Cyprinids predominate and within this family the wild carp *Cyprinus carpio* is the best represented species. Low numbers of bream (*Abramis brama*), *Leuciscus* sp. and vimba (*Vimba vimba*) occur as well (Van Neer *et al.* 1997: Table 1). The presence of pike (*Esox lucius*) and European catfish (*Silurus glanis*) are also attested by a few fragments. Interpretation of these finds in terms of the possible fishing grounds from which they may have been derived was hampered by the poor knowledge of the modern distribution of freshwater fish in the area. In 1996, 1997 and 1998, surveys have therefore been carried out of the present-day freshwater fish fauna on and beyond the territory of Sagalassos. The reconstruction of the original ichthyofauna in the different basins was hampered by recent man-made changes to the waterbodies (damming, irrigation projects) and by the introduction of fish (mainly domestic carp and the piscivorous pikeperch *Sander lucioperca*). The fieldwork was carried out by the first two authors in collaboration with the Fisheries Faculty at Eğirdir (S.D.Ü. Eğirdir Su Ürünleri Fakültesi) and involved sampling with electric fishing equipment, seines with a mesh size of 7 millimetres, castnets, driftnets, handnets, fishtraps and rod and line. In addition to the material that was sampled by our own team, the species captured by local fishermen were also noted.

The field work in July-August 1996 concentrated on the territory of Sagalassos and on the Aksu basin (Van Neer *et al.* in press). The Ağlasun river which runs south of Sagalassos only contained the recently imported rainbow trout (*Oncorhynchus mykiss*) and is not a suitable habitat for the cyprinids, pike and European catfish encountered at the site. The Aksu river (ancient Kestros) which formed the eastern boundary of Sagalassos' territory in antiquity (Waelkens *et al.* 1997) runs south towards the Mediterranean coast with which frequent commercial contacts existed. Contrary to expectations, however, only one, non-endemic, Anatolian freshwater species (*Vimba vimba*) may have derived from the Aksu river, whereas all the others must have been imported from areas north, west or east of the site.

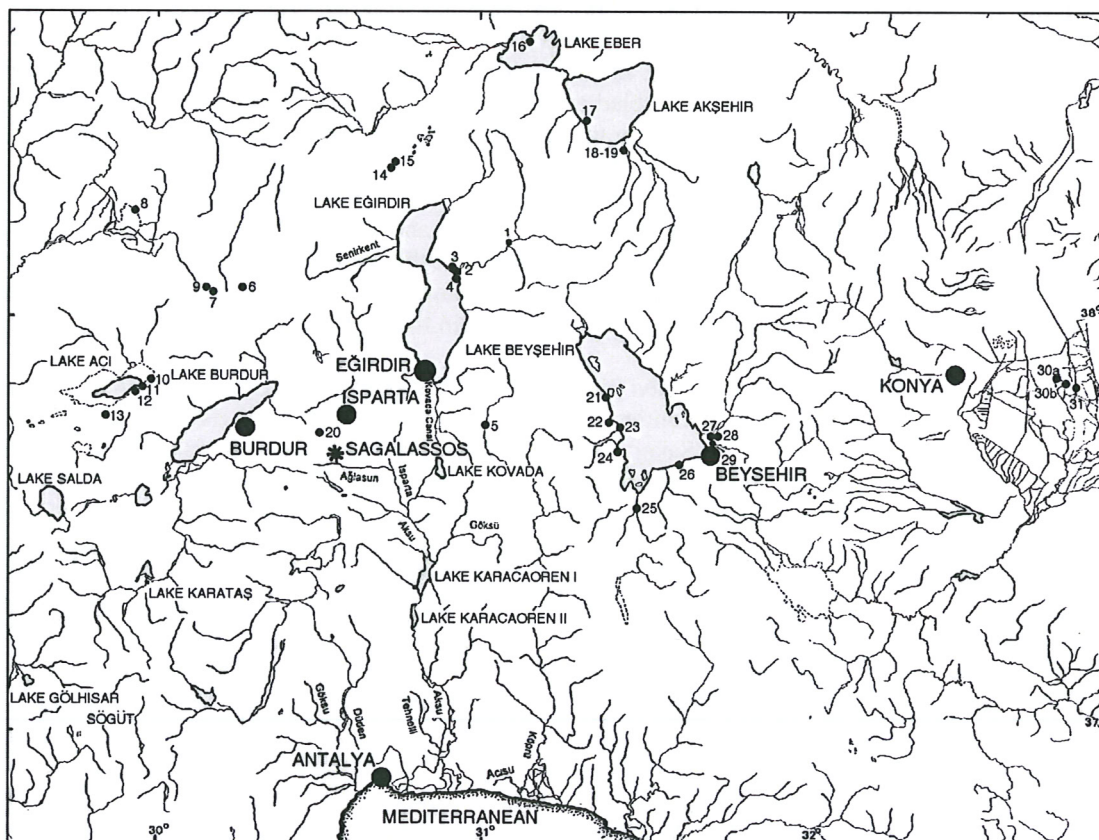


Fig. 2. Sampling stations of the 1997 freshwater fish survey

This was surprising since the major trade routes from and to Sagalassos were directed to the south, towards Perge.

The 1997 fish survey covered the Eğirdir (ancient Limnai) and Beyşehir (ancient Karalis) lakes and their tributaries (Fig. 2). In July-August 1996, the lakes yielded relatively few species, a phenomenon related to the introduction of the pikeperch (*Sander lucioperca*) about 40 years ago. Several species mentioned in the literature were not found in the lakes themselves in 1996. Interviews with local fishermen showed, however, that the rare species may still be found during the spawning season (end April-early May). The 1997 survey of the fish fauna was therefore carried out in early May and showed that small populations of all species previously recorded from Lake Eğirdir still survive in the tributaries. Similar work near Lake Beyşehir showed that all species still survive, except for *Alburnus akili* which was previously a commercially important food fish. During the 1997 survey, it was possible to collect skeletons and formaline specimens of all endemic species (except *Alburnus akili*). Such endemic fish from Lakes Eğirdir or Beyşehir have thus far not been found in the archaeozoological material from Sagalassos, but will be ideal indicators of trade connections if they show up in additional material from the site. The 1997 survey also covered Lakes Akşehir and Eber, as well as a number of basins in the Adana and Antakya region (see below).

The 1998 fieldwork concentrated on the Gediz and Büyük Menderes, but the region north of Sagalassos, especially the Sakarya (ancient Sangarios) basin, still needs to be explored in 1999. The bream (*Abramis brama*) which is rather well represented at Sagalassos has thus far not been found in the surveys and its closest occurrence relative to Sagalassos still needs to be established. The species is mentioned from the Sakarya (Geldiay and Balık 1996), but it is unclear which parts of the basin are inhabited by it.

With the information obtained thus far on the modern distribution of freshwater fishes it can be verified which are the regions from where the fish may have been exported to Sagalassos. Finding the localities most closely situated to Sagalassos in which carp must have lived during antiquity is difficult due to the fact that the domestic form has been introduced during the last two decennia in most natural and artificial lakes. The domestic form has interbred with the wild form and thus far we have found the wild carp in only one locality (number 18 on Figure 2; Karabalut river running into Lake Akşehir). Compilation of the literature, including Turkish papers, and interviews with directors of fishfarms and with local fishermen, enabled a reconstruction of the probable original distribution of wild carp to be made. The closest locality to Sagalassos is Lake Eğirdir. More distant places where they occurred must have been Lakes Akşehir, Eber and Beyşehir. The natural distribution of the species probably also included the Sakarya, the lower reaches of the Büyük Menderes (ancient Maeander) and the Küçük Menderes (ancient Kaystros; Geldiay and Balık 1996). It is unclear if the carp found in small lakes near Işıklı have been introduced or if the wild form was originally living there. The present-day occurrence of carp in Lake Gölçük at 7 km northwest of Sagalassos is believed to be a result of recent introductions as it was not mentioned in the first description of the lake's ichthyofauna (Kosswig and Sözer 1945).

During our surveys we found *Vimba vimba* in the Aksu river, Lake Eğirdir and the Gediz river (ancient Hermos). More distant localities are Eskişehir, along the Porsuk river (ancient Tembris) which is a western affluent of the Sakarya river (Ladiges 1960) and the area adjacent to the Sea of Marmara and the region just south of the Caucasus (Maitland 1978: 164).

The *Leuciscus* finds available thus far are not useful in reconstructing the place of capture since the taxon has various species with a wide distribution. *Leuciscus lepidus* lives in lake Beyşehir and further east, whereas *Leuciscus borysthenticus* was found during the surveys in lakes Karataş and Gölhisar, in the Büyük Menderes basin. It has also been reported from the northeastern part of Turkey (Geldiay and Balık 1996). *Leuciscus cephalus* finally, has been mentioned from Lake Gölhisar, and the lower reaches of the Büyük Menderes, the Gediz River and the Küçük Menderes. With the exception of Lake Gölhisar, the species' presence was confirmed from those waters during our surveys.

Silurus glanis occurs north of Sagalassos in the Sakarya River, to the west it is found in Lake Gölhisar (Kosswig 1963), and large streams such as the Büyük Menderes and the Gediz River. The species could not be obtained during our surveys, but its presence was confirmed by local fishermen.

The pike (*Esox lucius*) occurs in Lakes Akşehir and Eber which are the closest localities that could be found northeast of the site. Further north it occurs in the Sakarya basin. Pike has also been

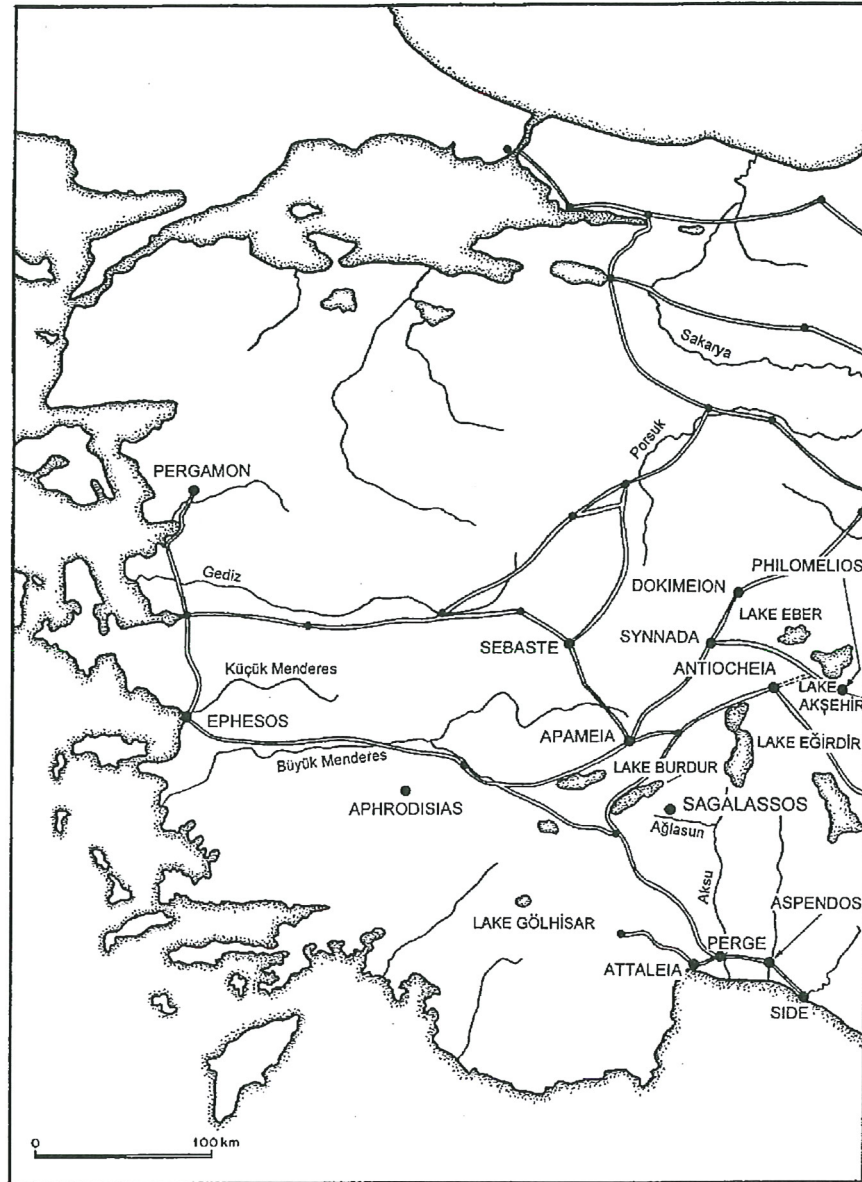


Fig. 3. Major Roman roads in western Anatolia (modified after Mitchell, 1993)

reported from the sources of the Büyük Menderes near Işıklı, from tributaries of the Seyhan River (ancient Saros) and from the northernmost part of Turkey (Kosswig 1969). The Büyük Menderes reports could be confirmed by our finds in Lake Karakuyu.

The data on the modern distribution of the freshwater fish from our survey, combined with data from the literature, hence indicate different origins for the Anatolian fish consumed at Sagalassos. There is only one species, *Vimba vimba*, which may have been derived from the Aksu River although this fish can also be found in Lake Eğirdir, the Sakarya and Gediz Basin. Lake Eğirdir is also the most closely situated waterbody where carp could be found. The importance of fishery in Lake Eğirdir during antiquity is illustrated by a late 2nd-3rd century AD sepulchral stela set up for a man who had been supervisor of the lake for twenty years. This stela represents among others a fishing scene using a boat and a trident (Pace, 1916-1920). The original distribution of the carp also included Lakes Akşehir and Eber. If transport was organised from one of those two lakes, pike may also have been imported from there. Akşehir (ancient Philomelios) could be reached over Yalvaç (Pisidian Antiocheia)

through a pass crossing the Sultan Dağ mountain range which separates both towns (Figure 3). Sagalassos may have been connected with the Büyük Menderes through the *via Sebaste* north of Burdur and hence to Apameia (Dinar), in which case this river may have yielded pike and European catfish (*Silurus glanis*). Near Apameia there was a crucial intersection of two major road systems, one running north-south from Phrygia into Pisidia, the other running east-west from the Meander Valley towards Lycaonia and Cilicia (Mitchell and Waelkens 1998: 4). The Sakarya is most likely the basin from which the bream were imported. This species is lacking in all the aforementioned rivers and lakes. *Silurus glanis* also inhabits the Sakarya, but is found in addition in Lake Gölhisar near ancient Kibyra (Kosswig 1963), and in large streams such as the Büyük Menderes and the Gediz River. Although still partly speculative, it seems that Lake Eğirdir, Lakes Akşehir and Eber, the Sakarya Basin, and the upper reaches of the Büyük Menderes are the most likely water bodies from where fish were imported to Sagalassos. Archaeological indications for commercial contacts with those areas are supported by finds of Sagalassos red slip ware which was found both to the north and to the west (Poblome 1996: 505, fig. 2). Links with the Sakarya basin are indicated by Sagalassos red slip ware found at Amorion. At the northern tip of Lake Eğirdir this type of ceramic occurs at Antiocheia. Sagalassos red slip ware was found also in the more western part of Anatolia close to the Aegean coast. This indicates that trade along roads following the major east-west running rivers (Büyük Menderes and Gediz) may have been practised. Sagalassos imported marble from central and west Anatolia, i.e. Dokimeion and Aphrodisias (Moens *et al.* 1997). Roads connected Sagalassos over Apameia (Dinar) with the Büyük Menderes, and from there with Synnada and Dokimeion from where the Sakarya river system in Galatia could be reached. It is obvious from the distances covered that, with the possible exception of fish derived from Lake Eğirdir, fish must have been transported in preserved form to prevent spoilage.

Import of exotic freshwater fish

The fish remains from the 1991-1994 excavations yielded two taxa that were designated as exotic freshwater species (Van Neer *et al.* 1997). They comprised several remains of *Clarias* sp. from Augustan to Early Byzantine contexts as well as a single find of a tilapia (tribe of the Tilapiini). The presence of the latter species has been confirmed by the finds from the 1995-1998 excavations and also additional remains of *Clarias* sp. have been recovered. Both *Clarias* and tilapia are basically Nilotic fish that also occur naturally in the Syro-Palestinian area. *Tilapia zillii* occurs as far north as the Litani basin in Lebanon and also lives in the Jordan basin and the coastal rivers of Palestine. *Oreochromis aureus* and *Sarotherodon galilaeus* also occur in the latter two regions, whereas *Oreochromis niloticus* only lives in the Yarkon river (Trewavas 1983; Krupp 1987). In the Near East, the genus *Clarias* is represented by *Clarias gariepinus*, the natural distribution of which is traditionally described as extending as far as the Orontes and Ceyhan (ancient Pyramos) basin in Turkey (Kosswig 1969; Skelton and Teugels, 1992). The available archaeological and epigraphic data point to connections of Sagalassos with both regions and therefore do not contribute to the establishment of the precise origin of the fish specimens found at Sagalassos. Coins from the imperial mints of Alexandria and Antiocheia are well represented at the site (Scheers 1993a ; 1995). Red slip ware lamps and oinophoroi from Sagalassos have been found as far as Pharas in Sudan, Alexandria in Egypt, and Kapharnaon in Galilaea (Poblome 1996, 1999; Waelkens and the Sagalassos team 1997; Poblome *et al.* in press). Epigraphic studies have shown that the Sagalassian aristocracy served the Roman army and provincial administration of Syria, Palestina and Egypt almost exclusively during the Imperial period (Devijver 1993; Devijver and Waelkens 1997).

In an attempt to elucidate the origin of the *Clarias* remains, an analysis of the ancient DNA of the bones has been initiated in 1997 by the two last authors. The procedures involved first tissue sampling of modern *Clarias gariepinus* from throughout its natural range across Asia Minor and Africa. Mitochondrial DNA (mtDNA) was isolated and a specific fragment was amplified by the polymerase chain reaction (PCR) for restriction fragment length polymorphism (RFLP) analysis. Minimum spanning tree (Rohlf 1990) and median network (Bandelt *et al.* 1995) methods were used to construct phylogeographic representations. Both methods consistently grouped North African samples with those of Asia Minor, to the exclusion of other regions of Africa. Most population samples were

characterized by a single predominant mtDNA haplotype. Specimens from four locations along the Mediterranean coast of Turkey (Akgöl, Tarsus, Terlikir Köyü, and Asi Nehri) were identical to the most common Egyptian haplotype. Based on these results, DNA sequence of the mitochondrial control region (850 base pairs) was obtained from all observed haplotypes, as well specimens from all four Turkish sites. Alignment of sequences indicated several variable regions containing point mutations that distinguish Turkish, Syrian, Israeli, Egyptian, and west African haplotypes from each other. Therefore, if DNA can be recovered and amplified from the subfossil material, it should be possible to distinguish the origin of this material. Given the highly degraded nature of ancient DNA, several primer sets were designed to amplify very small fragments (between 100 and 150 nucleotides) containing these informative regions. Attempts at extraction and amplification of DNA from ancient material have started, beginning with the more numerous samples from Apamea, Syria. Abundant, local *Clarias gariepinus* material dated to the 6th-7th centuries is available from that site which is located along the Orontes river (Van Neer 1984). Once the protocol has been optimized, the material from Sagalassos will be analysed using the same procedures.

The freshwater surveys yielded additional data on the distribution of *Clarias gariepinus* which blurr the simple picture of import from either the Nile or the Syro-Palestinian area. According to the literature, the distribution of *Clarias gariepinus* in Turkey was restricted to the Asi Nehri (Orontes) and the Ceyhan River, but the fieldwork demonstrated that the species also occurs further west. Its presence was attested in the Seyhan river, the Tarsus river and near Akgöl, which is part of the Göksu Basin (Fig. 1). In the 1980's the species had already been reported from the Tehnelli river (Balık, 1988) which is a branch of the Aksu River and our surveys showed it also to be present in the downstream part of the Aksu River near Gülluluk. Moreover, a new find in 1998 shows that *Clarias gariepinus* is presently also living in the Acısu River (Fig. 2). The presence of this catfish so far west from its 'normal distribution' was initially considered as a possible result of human introduction (Balık 1988 and pers. comm. 1998), although no documents seem to exist that such operations were undertaken by the Ministry of Agriculture or the DSI (Devlet Su İşleri; Turkish Water Management Organisation). The latter agency, responsible for irrigation and drainage projects, regularly stocks ponds and lakes with carp. In the areas where the *Clarias* were found in the Acısu and lower Aksu, local informants stressed that they had known the species since their childhood, long before fish introductions were practised, whereas leading Turkish ichthyologists consider these catfish to be recent introductions. The new finds between the Seyhan and the Aksu river might indicate that the catfish species was able to colonise several intermediate coastal streams by "hopping" from one basin to the other. As the westernmost localities are situated close to the southward trade routes of Sagalassos, it is vital that this question is solved. A possible way to investigate this problem would be an additional genetic analysis of the present populations in the different river basins. Microsatellite analysis may document roughly how long these populations have been living in the Aksu, Tehnelli and Acısu Rivers. If the populations have been recently introduced, their genetic make-up will not differ significantly from the source populations in the east. A drawback is, however, that modern tissue samples for such a study should comprise at least 30-50 individuals for each basin. In the eastern part of Turkey, *Clarias gariepinus* is a commercially important species making it relatively easy to obtain tissue samples for DNA analysis. This is not the case further west where this catfish is not regularly captured and where, in addition, no professional fishermen are working in freshwater areas. Tissue samples from these localities have been taken already but are still too small in number to start microsatellite analysis. Further efforts will be made to increase sample size. In addition, more fieldwork should be carried out in order to verify the presence of *Clarias gariepinus* in the numerous rivers emptying into the Mediterranean between the Tarsus and Acısu Rivers. Finds of catfish in these intermediate basins may give further support to the hypothesis of natural colonisation.

Since the moment that the DNA analyses have been set up for *Clarias*, two additional exotic taxa have been found in the ichthyofauna from the 1995-1998 excavations. These new taxa give clear indications for their provenance. Bones from the Nile perch (*Lates niloticus*) and a bagrid catfish (*Bagrus* sp.) were found and indicate import from Egypt. It is still unclear, however, if the *Clarias* and tilapia have also been imported from there. An import from the Syro-Palestinian area cannot yet be excluded and, in the case of *Clarias*, the possibility cannot be ruled out for the moment that it was obtained from the Aksu or one of the neighbouring rivers.

Conclusions

The analysis of the fish remains from Sagalassos indicates a multiple geographic origin. Among the marine fish, species occur that live exclusively in the Mediterranean and which reflect the commercial relationships that existed with Pamphylian towns, especially the port of Perge. The Nilotic species *Lates niloticus* (Nile perch) and *Bagrus* sp. indicate long distance trade between Egypt and the Anatolian coast from where the fish were likely brought to Sagalassos along the same route as the Mediterranean species. The geographic origins of the *Clarias* and tilapia still need to be further investigated. Both taxa may come from Egypt, like the Nile perch and *Bagrus*, but it is not excluded either that they were brought in from the Syro-Palestinian area with which contacts are documented through archaeological and epigraphic data. For *Clarias*, it may be possible to decide on a Nilotic or Near-Eastern origin in the future if the analysis of mtDNA proves to be successful. Another matter that still requires further investigation is whether the *Clarias* populations recently discovered at about 100 km south of Sagalassos are recent introductions or if they represent populations that naturally colonised the Aksu and nearby basins. The Anatolian freshwater fish, finally, indicate that the Aksu basin was not a major source for the exploitation of fish. So far, there is no indication either for fish that may have come from the local river in the valley just south of the town. The freshwater fish at Sagalassos is mainly derived from lakes and rivers located north and west of the site.

Acknowledgements

This text presents research results of the Belgian Programme on Interuniversity Poles of Attraction initiated by the Belgian State, Prime Minister's Office, Science Policy Programming. The text also presents the results of the Concerted Action of the Flemish Government (GOA 97/2) and the Fund for Scientific Research-Flanders (Belgium). Scientific responsibility is assumed by its authors.

References

- Balık, S., 1988. Türkiye'nin Akdeniz Bölgesi içsu balıkları üzerinde sistematik ve zoocoğrafik araştırmalar, *Doğa Tu Zooloji D.* 12(2): 156-179.
- Bandelt, H.-J., P., Forster, B.C., Sykes, and M.B., Richards, 1995. Mitochondrial portraits of human populations using median networks. *Genetics* 141: 743-753.
- De Cupere, B., 1998. *Archeozoölogische studie van Romeins-vroeg-Byzantijns materiaal van Sagalassos (Zuidwest-Turkije)*. Doctoral Thesis. Katholieke Universiteit Leuven
- De Cupere, B., W. Van Neer and A. Lentacker, 1993. Some aspects of the bone-working industry in roman Sagalassos. In: M. Waelkens and J. Poblome (eds.), *Sagalassos II: Report on the third excavation campaign of 1992 (Acta Archaeologica Lovaniensia Monographiae 6)*, eds, Leuven, University Press: 269-278.
- Devijver, H., 1993. The inscriptions of the Neon-Library of Roman Sagalassos. In: M. Waelkens and J. Poblome (eds.), *Sagalassos II. Report on the third excavation campaign of 1992. (Acta Archaeologica Lovaniensia Monographiae 6)*. Leuven, Leuven University Press: 107-123.
- Devijver, H. and M. Waelkens, 1997. Roman inscriptions from the fifth campaign at Sagalassos. In: M. Waelkens and J. Poblome (eds.), *Sagalassos IV. Report on the survey and excavation campaigns of 1994 and 1995. (Acta Archaeologica Lovaniensia Monographiae 9)*. Leuven, Leuven University Press: 293-314
- Geldiay, R. and S. Balık, 1996. *Türkiye tatlısu balıkları (Ege Üniversitesi Basımevi)*, Izmir, Bornova.
- Kosswig, C., 1963. Bemerkungen zur Geschichte und zur Ökologie der Ichthyofauna Kleinasiens, besonders seines abflußlosen Zentralbeckens. *Zoologischer Anzeiger* 172: 1-15.
- Kosswig, C., 1969. New contributions to the zoogeography of fresh water fish of Asia Minor, based on collections made between 1964-1967. *Israel Journal of Zoology* 18: 249-254.
- Kosswig, C. and F. Sözer, 1945. Nouveaux Cyprinodontidae de l'Anatolie centrale, *Revue de la faculté des sciences de l'Université d'Istanbul* 10(2): 77-83.
- Krupp, F., 1987. Freshwater ichthyogeography of the Levant. *Beiträge zum Tübinger Atlas des Vor-*

- deren *Orients* A. *Naturwissenschaften* 28: 229-237.
- Ladiges, W., 1960. Süßwasserfische der Türkei. 1. Teil Cyprinidae. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut* 58: 105-150.
- Maitland, P.S. 1978. *Elseviers gids van de zoetwatervissen*. Amsterdam, Elsevier.
- Mitchell, S., 1993. *Anatolia. Land, men, and goods in Asia Minor. Vol. I. The Celts in Anatolia and the impact of Roman Rule*, Oxford, Clarendon Press
- Mitchell, S. and M. Waelkens, 1998. *Pisidian Antioch. The site and monuments*. London, Duckworth.
- Moens, L., P. De Paepe, and M. Waelkens, 1997. An archaeometric study of the provenance of white marble sculptures from an Augustan Heroon and a middle Antonine nymphaeum at Sagalassos (southwest Turkey). In: M.Waelkens and J. Poblome (eds.), *Sagalassos IV. Report on the survey and excavation campaigns of 1994 and 1995. (Acta Archaeologica Lovaniensia Monographiae 9)*. Leuven, Leuven University Press: 367-384.
- Pace, B., 1916-1920. I paesi del lago di Egherdir. *Annuario della R. Scuola di Archaeologia di Atene e delle missioni Italiane in Oriente* 3: 47-53.
- Poblome, J., 1996. The ecology of Sagalassos (southwest Turkey) red slip ware. In: M. Lodewijckx (ed.), *Archaeological and historical aspects of West-European societies. (Acta Archaeologica Lovaniensia Monographiae 8)*. Leuven, Leuven University Press: 499-511
- Poblome, J., 1999. *Sagalassos red slip ware. Typology and chronology*. Studies in Eastern Mediterranean Archaeology II. Turnhout, Brepols Publisher.
- Reese, D.S., 1991. The trade of Indo-Pacific shells into the Mediterranean basin and Europe. *Oxford Journal of Archaeology* 10: 159-196.
- Rohlf, F.J., 1990. *NTSYS. Numerical taxonomy and multivariate analysis system, version 1.60*. Setauket, New York, Exeter Publishing.
- Scheers, S., 1993a. Catalogue of the coins found during the years 1990 and 1991. In: M. Waelkens (ed.), *Sagalassos I. First general report on the survey (1986-1989) and excavations (1990-1991). (Acta Archaeologica Lovaniensia Monographiae 5)*. Leuven, Leuven University Press: 197-205.
- Scheers, S., 1993b. Catalogue of the coins found in 1992. In: M. Waelkens and J. Poblome (eds.), *Sagalassos II. Report on the third excavation campaign of 1992. (Acta Archaeologica Lovaniensia Monographiae 6)*. Leuven, Leuven University Press: 249-260.
- Scheers, S., 1995. Catalogue of the coins found in 1993. In: M. Waelkens and J. Poblome (eds.), *Sagalassos III. Report on the fourth excavation campaign of 1993. Acta Archaeologica Lovaniensia Monographiae 7*. Leuven University Press: 307-317.
- Scheers, S., 1997. Coins found in 1994 and 1995. In: M. Waelkens and J. Poblome (eds.), *Sagalassos IV. Report on the survey and excavation campaigns of 1994 and 1995. (Acta Archaeologica Lovaniensia Monographiae 9)*. Leuven, Leuven University Press: 315-350.
- Skelton, P. and G. Teugels, 1992. Neotype description for the African catfish *Clarias gariepinus* (Burchell, 1822; Pisces: Siluroidei: Clariidae). *Ichthyological Bulletin of the J.L.B. Smith Institute of Ichthyology* 56: 1-8.
- Trewavas, E., 1983. *Tilapiine fishes of the genera Sarotherodon, Oreochromis and Danakilia*. London, British Museum (Natural History).
- Van Neer, W., 1984. Les restes de poissons de quelques maisons d'Apamée. In: J. Balty (ed.), *Fouilles d'Apamée de Syrie, Miscellanea* 13: 291-303.
- Van Neer, W. and B., De Cupere, 1993. First archaeozoological results from the Hellenistic-Roman site of Sagalassos. In: M. Waelkens (ed.), *Sagalassos I. First general report on the survey 1986-1989) and excavations 1990-1991). (Acta Archaeologica Lovaniensia Monographiae 5)*. Leuven, Leuven University Press: 225-238.
- Van Neer, W., De Cupere, B. and Waelkens, M. 1997. Remains of local and imported fish at the ancient site of Sagalassos (Burdur Prov., Turkey). In: M. Waelkens and J. Poblome (eds.), *Sagalassos IV. Report on the survey and excavation campaigns of 1994 and 1995. (Acta Archaeologica Lovaniensia Monographiae 9)*. Leuven, Leuven University Press: 571-586.
- Van Neer, W., R.H. Wildekamp, F. Küçük, M. Ünlüsayın, M. Waelkens, and E. Paulissen, (in press). Results of the 1996 survey of fish fauna of the Aksu river and some lakes in Southwestern Anatolia and the implications for the fish trade at Sagalassos. In: M.Waelkens and L. Loots (eds), *Sagalassos V. Report on the survey and excavation campaign of 1996. (Acta Archaeologica Monographiae 10)*, Leuven, Leuven University Press.

- Waelkens, M., E. Paulissen, H. Van Haverbeke, I. Öztürk, B. De Cupere, H.A. Ekinici, P.M. Vermeersch, J. Poblome, and R. Degeest, 1997. The 1994 and 1995 surveys on the territory of Sagalassos. In: M. Waelkens and J. Poblome (eds.), *Sagalassos IV. Report on the survey and excavation campaigns of 1994 and 1995. (Acta Archaeologica Lovaniensia Monographiae 9)*. Leuven, Leuven University Press: 11-102.
- Waelkens, M. and the Sagalassos team, 1997. Interdisciplinarity in classical archaeology. A case study: the Sagalassos Archaeological Research Project (southwest Turkey). In: M. Waelkens and J. Poblome (eds.), *Sagalassos IV. Report on the survey and excavation campaigns of 1994 and 1995. (Acta Archaeologica Lovaniensia Monographiae 9)*. Leuven, Leuven University Press: 225-252.