ARCHAEOZOOLOGICAL RESEARCH IN MEDIEVAL IBERIA: FISHING AND FISH TRADE ON ALMOHAD SITES

by

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Abstract: Archaeozoological analyses of three iberian moorish sites (Calatrava La Vieja, Mértola and Saltés) are combined with traditional historical techniques in order to explore the nature of fishing in the muslim world of medieval Iberia. The results from this cooperative study evidence concordances and discordances between faunal and documentary data, but, above all, stress the importance which animal remains themselves might bear on the analysis of palaeoeconomic questions over which history often remains mute.

Keywords: Fish. Archaeozoology. 12th Century/13th Century.

I. INTRODUCTION

Historians should start regarding animal remains from archaeological sites as empirical tools of prime relevance, for not only these provide them with raw data but also constitute an ideal and independent testing ground for theoretical research (Delort, 1984). Failure to realize this inferential potential will often result in partial and also in biased historical analysis.

In the case of analyses on the economics of fishing, for example, it is not only fishing techniques and strategies (seldomly referred to in written sources) that the analyst might infere from the bones, but, specially, the nature of the fish assemblage itself. For it is with a thorough knowledge of the species' biological habits that one can answer a series of questions of historical interest (e.g. biotopes cropped, inshore/offshore fishery, existence and nature of potential

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trade routes, etc...) over which written sources often remain mute or have little to say (Delort, Op. cit.; Audoin-Rouzeau, 1990).

These benefits are by no means unidirectional. The interpretation of faunal information is, in many cases, difficult due to absence of context and complementary data (Klein & Cruz-Uribe, 1984; Hesse & Wapnish, 1985; Morales, 1993). For this reason, when working on historical assemblages, the help of the historian is to the archaeozoologist as decissive as to the historian might be the story the bones have to tell. This is truly interdisciplinary work.

In this paper we present data both historical and archaeozoological on the existence of a fish trade in almohad Iberia. It is our hope that this first demonstration of such a phenomenon on the peninsula will promote a more systematic analysis of such questions in the future.

II. THE ALMOHADS IN IBERIA: A GENERAL SURVEY

The internal difficulties suffered by the almoravid Al-Andalus from the start of the 12th century (including an ever increasing pressure from the christian Kingdoms) caused a situation of social unrest which resulted in 1144 in the Algarve's rebellion, where the cities of Mértola, Silves, Beja and Evora played a decissive role. The result of this event was the second generation of Taifa Kingdoms (Al-Andalus became fragmented in some 12 of these) which eventually melted into the Almohad empire (Le Tourneau, 1969).

The almohads (i.e., "the monoteists") themselves had progressively replaced the almoravids in the Magreb during the first half of the 12th century. In the summer of 1146, the first almohad troops arrived on the peninsula in the hope of taking over the almoravids. After the occupation of the cities of Tarifa and Algeciras, they headed towards the Algarve, where the rebellion against the almoravids had broken out, and where they were immediately accepted as rulers. By 1172 the andalus' political unity had been reestablished under almohad control and Seville became the capital city. The decissive battles of Alcaçer do Sal (1191), Calatrava (1195) and Alarcos (1195) allowed the almohads to gain control once again over the whole Guadiana's bassin as well as the lower middle course of the Tagus river. The battle of Navas de Tolosa in 1212, however, gave the christians control over the head of the Guadalquivir valley and marked the decline of the Almohad empire which, nevertheless, managed control of Al-Andalus up until 1228 (Vigueras, 1988).

Despite its brevity, almohad times were full of events, both social and economic, and constitute one of the most remarkable periods of the Iberian Middle Ages.

III. MATERIAL AND METHODS

Being this analysis a combination of two widely different fields of research, we will have to divide this section into a series of units of homogeneous content.

IIIa. The sites

The three sites discussed here represent important moorish cities, each one with a different character, which flourished under almohad rule (Figure 1). The fact that these settlements seem to be linked by a commercial route through the Guadiana river, connecting the coastline with the hinterland of the almohad empire, gives further interest to a combined comparative analysis.

IIIa.1. Saltés

The island of Saltés (Shaltish) is located in the estuary of the Odiel river, close to the city of Huelva and the estuary of the Tinto river, in a salty marshland (marisma) and very near to the atlantic coast (Figure 1A).

Several muslim authors, in their geographical works, described Saltés as the mediña and capital, until 1501, of a small Taifa Kingdom with a harbour which was a thriving centre of trade and industry which reached its zenith during the 12th-13th centuries (Al-Idrisi, 1968). On top of activities such as metal-working, intensive agriculture and stockbreeding, Saltés, according to Ibn Sa id, became an important fishing town and the main provider of fish to the city of Seville. This author further states that the fishes were salted. Some evidence of pickling is found at Saltés for, during the 1988 campaign, two brine baths were excavated close to the estuary. Though dated back to roman times, it is possible that these structures could have remained functional well into medieval times (Bazzana & Cressier, 1989; Lentacker, in press).

It is, at present, assumed that this moorish town was probably abandoned right after the christians took over the area and, by the end of the 14th century, the place was already described as rural (Bazzana & Cressier, Op. cit.).

Animal remains have been collected in the course of two excavation campaigns. During 1988, bones were only collected by hand whereas in 1990 sieving was carried out using 5 and 2 mm meshes. During this last campaign, moreover, sieving was carried out on sediments filling specific structures such as storage and waste pits, wells and drainage channels (Lentacker, Op. cit.). Since, on the opinion of the excavators, all these materials were homogeneous,

they have been treated as a unit (Table 1).

In some muslim geographical treaties we have read that "...this river [Guadiana] continues to flow to the fortress of Mértola and proceeds further down to meet the sea... not far from the island of Saltés..." (Levi Provençal, 1938). Such statement provides a hint about the connection which probably existed between Saltés and our next site.

IIIa.2. Mértola

With a supposedly fantastic origin - Mértola seems to have been founded by the phoenicians from Tyrus which fled from Macedonia at the time of Alexander the Great and named this city Myrtillis (i.e.,new Tyrus) - we have at this settlement evidence of an important urban centre during roman times (Figure 1B). The moors rebuilt the city and turned it into a strategic fortress over the Guadiana river. At the time of the first Taifa Kingdoms, Mértola was part of the Kura of Beja and in 1044 the city was conquered by the governor of Silves, at the service of the King of Seville, under the rule of Banu Muzayn. In 1239, under christian control, the city was offered to the Military Order of Santiago under whose administration it stayed until 1316 (Huici, 1956-7; Arié, 1984).

Due to the role played by the Algarve in the almohad conquest of Al--Andalus, one can easily imagine Mértola's importance during the 12th century, at which time it was the administrative center of a Kura[1].

Though fishing and salt production were long-known industrial activities along the coast of the Algarve, we do not have at present direct references about either local fishing or fish trade in Mértola during this period, though several indirect are known[2,3].

The fish remains presented in this paper all come from the 1990-91 excavation campaigns and include three different samples: a) one from a dump pit (Q-17c) and b) two (Q16B N1-C (cont.1030) and Q17AA N1-C) from a general refuse

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[1] Mértola is so closely linked to the almohads that the records even made reference of the visit which the main almohad leader payed to the holy poet Ibn Imarn Al Martuli previous to the start of the holy war which culminated in Alarcos (1195). Obviously, these sources attribute the victory over the christians to the intercessin of this holy man (Levi Provençal translating Ar-Rawd Al--Mistar, 1938).

[2] Fishing in the rivers of the area has been mentioned by several historical sources without further specifications (Levi Provençal, 1938; Pellat, 1961). Written sources also state that, from the 13th century onwards fishing hamlets -povoa- became established to the north of the Tagus river.

[3] Coins from Myrtillis have been found with engravings of dolphins and sturgeons on them. During the 18th century there are mentions of conger, eels, lampreys, grey mullets, shads and basses as "coming to the fishermen's nets" thus implying local fishing of these species (Borges Coelho, 1993) something which, for some of them, seems most doubtful.

area (Figure 2).

All samples have been sieved with 5 mm meshes and all seem to date back into the 12th century. It is the opinion of the excavators that they represent a homogeneous material (S. Macias, verb. comm.).

IIIa.3. Calatrava la Vieja

Founded by the moors during the eight century as a fortress along the Guadiana river, Calatrava la Vieja was probably the most important city, both strategically and economically speaking, of the whole la Mancha region (Ruibal, 1984).

Occupied in 1147, during the first Taifa, by the castilian King Alfonso VIII, the city fell into the hands of the almohads in 1195 after the decissive battles of Calatrava and Alarcos but was definitively occupied by the troops of the King of Aragón on the summer of 1212.

Though Calatrava originally had an economy based on stockbreeding, mainly of sheep and horses, hunting and the mining activities around Sierra Morena contributed to its overall wealth as well. Later, due to its strategic location on the routes linking Toledo with the caliphate's capital city of Cordoba, Calatrava became an important centre of commerce between the christians -mainly providers of raw materials- and the muslims, providers of manufactured goods. This commerce turned the place into an atrractive tax-collecting post for both christian and moorish rulers alike.

Among the goods arriving in Calatrava, written records mention weapons, luxury products, cattle, salt, salted meat and furs from both beavers and sable martens, though this last species never existed on the Iberian peninsula and probably indicates a mis-translation (or, perhaps, a mis-identification) of equivalent mustelids, such as the beech marten (*Martes foina*) or the pine marten (*M. martes*), to be found still in Spain. In this context one should not be surprised to find evidence of a fish trade. The documents do not specify whether the commerce with the southern coast actually took place through the Guadiana river or not.

Despite its comparatively brief almohad occupation, the excavations carried out in 1984 under the direction of J. Zozaya & E. Retuerce on one of the towers of the northern sector of the defensive wall, detected an apparently homogeneous filling of the whole structure which was, archaeologically speaking, 96% almohad (Retuerce & Lozano, 1986). Both the nature of the archaeological artifacts (whole or broken pottery and glassware which could be made to fit) and the mammals and birds retrieved (whole skeletons in anatomical connection) indicate

the existence of a dumpyard which was formed during a very short time interval and whose elements testify to a rapid episode of violence and destruction of, at least, a portion of the city (Morales *et al.*, 1989; Morales, 1993; Morales *et al.*, in press; Aguilar 1990; Retuerce & Lozano, Op. cit.). The archaeologists believe this moment to be either coincident with or shortly after the definitive christian occupation of Calatrava which, after a siege where aragonian troops managed to cross the dessicated marshes[4] storming two of the towers of the defensive wall, took place on the start of the summer of 1212 (M. Retuerce, verb. comm.).

In Calatrava, the whole deposit was sieved through 5-3 mm meshes.

IIIb. Methods

IIIb.1. Historical methods: the problem of written sources

As so many scholars have repeatedly stressed, the study of the almohad economy and society is very sparse and most of the work remains to be done (Viguera, 1988). There are a couple of reasons for this state of affairs:

a) Islamic records, though in general are extremely detailed with chronicles, literary aspects, doctrinal writings and, above all, legislative matters, tend to be comparatively poor when it comes to socio-economic matters (Viguera, Op. cit.). Economic information is to be found, for example, in writings so different as geographical treatises and cooking books, but the information provided, besides dispersed, is always indirect and normally sparse (Huici, 1966; Arié 1974/75; Díaz 1978/79; García 1978, 1980).

b) Islamic documents, in particular those dating back to almohad times, remain by and large untranslated into european languages.

Hisba (market management) treaties of almohad Seville (Ibn Haldun) and Málaga (Al Saqati) are among the few sources which allow us the glimpse over andalusi feeding habits by reviewing the laws regulating the activities of different guilds, though usually say little about fishing and fish commerce (Levi Provençal & García Gómez, 1948). Geographic treatises, such as those of Ar-Rawad Al Mitar and Idrisi, on the other hand, provide occassional information (mostly laconic) on the fisheries and fishing activities of Al-Andalus, though, more often than not, only tend to confirm previous (i.e., roman) documentary sources.

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[4] The marshland of the Guadiana, lying to the north of Calatrava but south of the river, was, inicidentally, one of the reasons why the defensive wall was not so well developed here and also why rulers often found it difficult to overcome the reputation of unhealthyness which the city had and which was due to malaria (Ruibal, 1984).

It is in this way, that we learn about the fishing carried out in Bezmiliana, Sidonia, Málaga and Huelva and we see that there are repeated references to mediterranean fisheries though very little indeed is said about atlantic ones. Data included in the Córdoba calendar refer to the main species taken: sturgeon and shads (which swimmed rivers upstream during the month of march to spawn), pilchards (fished in august according to these sources) and grey mullets. These documents also specify that tunas (which were caught with the local almadraba gear) were a most valuable resource in the city of Sidonia swimming, during the month of may, from the Atlantic into the Mediterranean. Throughout the Costa del Sol -Almuñecar, Salobreña (prov. Granada) and Fuengirola plus Marbella (prov. Málaga)- fishing concentrated on both pilchards and anchovies, etc.

However, documentary sources do not seem to go any further. The sources repeatedly refer to fishes in general and to the act of fishing with nets. "Big" fish and "small" fish, fish that "sells well"[5], etc.., are continuously mentioned but very seldomly are species specified (on top of the already mentioned ones sometimes we come accross "sturgeon" and "red mullets" (genus *Mullus*) but little else). Not a word has been found on the ways of processing fishes in this period although several references stress that in coastal cities "fishes were consumed mainly fresh" (Brill, 1987). In addition to salted fishes being shipped inland (see previous references on Saltés), one must also have to assume that fishes could have been consumed fresh in certain cities further away from the shore. In Seville, for example, we know about the existence of guilds of both fish mongers and "fish friers", activities which, most probably, were carried out on fresh animals.

More precise references about fishes and fish consumption have been found from later periods in the Al-Andalus area (Arié, 1974/75; García 1978, 1980; Malpica, 1984) but this 14th century data is of little use in our case.

It is for this reason that we feel there should be a regular cooperation of historians in the analysis of these questions with researchers from fields, such as archaeozoology, were data can be obtained in a radically different way in order to provide a more holistic approach to the subject of fishing and fish trade in Medieval times.

IIIb.2. Archaeozoological methods

Archaeozoology, as so many other biological disciplines, relies mainly on

[5] There are several references to a fish type, referred to as «Fahl» for which we have been unable to find any translation!

the comparative method. This method, in our case, is carried out in two sequential stages:

a) First of all, remains are identified with the aid of a reliable comparative collection and

b) Afterwards, the information these identified remains provide, either quantitative (e.g., number of remains, sizes, number of individuals, etc...) or qualitative (e.g., age, sex, cutmarks, etc...) is interpreted with the inferential basis provided by what is known at present about the biology of the taxa, the way they become integrated into biocenosis, the way they are cropped and processed by humans, etc... (Brandt, 1984; Whitehead *et al.*, 1984, 1986a,b; Wheeler & Jones, 1989).

Ultimately, archaeozoological information is contextualized through a confrontation with other sources of data (archaeological or, as in this case, historical) which provide a larger framework to evaluate and, eventually, put forward hypotheses concerning patterns observed in the strictly biological data. This is not to say that the archaeozoologist sets about explaining his/her data with no idea of what to expect. In our case, for example, we have seen that historical sources, though faintly, are evidencing a series of consistencies concerning fishes from almohad times. These data provide, nevertheless, only a background which in no case should constitute a biasing agent for the archaeozoological results (Morales, 1988).

The identification of the fish remains has been carried out using the comparative collections of A.M. at the Laboratorio de Arqueozoología in the Universidad Autónoma de Madrid (Calatrava, Mértola and Saltés) and the Koninklijk Museum voor Midden-Afrika (Saltés). Other methodologies such as those referring to size and minimum numbers of individuals estimation can be found in Roselló (1989).

The estimation of the Shannon-Wiener diversity index (H') has been calcultated with the DIVERSIDAD program developed by M.A. Cereijo at the Laboratorio de Arqueozoología.

IV. RESULTS

Though the samples of fish are not abundant in the analyzed taxocenosis we have managed to retrieve more than seven hundred remains from the three almohad sites of which close to six hundred have been taxonomically identified (Table 1). The total numbers of fish remains, moreover, are rather similar, with the richest collection coming from Saltés and the poorest from Calatrava (Tables

1 and 4). In Mértola, quite a large amount of taxonomically unidentified fish remains are scales (NR=80, 32 from Q16B and 48 from Q17C), probably from grey mullets or cyprinids (Roselló, in press) and the remaining categories are ribs, vertebrae and radial elements (pterygophores, s.l.). In contrast, the unidentified remains from Calatrava all come from flat (i.e., cranial) bones which are assumed to belong to cyprinids due to the degree of ossification which they exhibit (Roselló & Morales, 1991).

Both at Mértola and Calatrava the samples seem to be homogeneous in terms of taxonomic diversity despite low sample sizes (Table 1). This is normal in the case of the spanish site since all the deposits belong to a similar chronostratigraphical unit, but more striking in Mértola where samples come from two different places. In Saltés the most striking differences occur between campaigns and are obviously caused by different retrieval methods. Thus, during the 1988 excavations the bones which were collected by hand, amount to 10 remains (mostly large vertebrae) from four different species whereas in the sieved samples of the 1990 campaign, a minimum of 22 taxa (15-17 species) have been identified (Tables 1 and 4). No differences in fish diversity seem to have been detected among the analyzed structures (i.e., drainage channels, storage and waste pits, etc...) (Lentacker, in press). For this reason, the whole ichthyocenosis is treated as a single unit.

A final word concerning overall patterns has to do with taxonomic diversity and taphonomic loss. More than 30 specific or generic taxa have been detected in a sample of roughly 600 bones. This datum, combined with the estimation of MNI (minimum numbers of individuals) (Roselló & Morales, 1991; Lentacker in press; Roselló, in press) allow us to state that:

1) Taxonomic diversity, even in small samples such as those from Mértola, is incredibly high and indirectly indicates the importance of fishes as a resource to these muslim communities, both inland and coastal.

2) Taphonomic loss, as far as we are able to infere, must have been equally enormous, and in no single case has it been estimated below 90% (most figures run well into 99%!) (Roselló & Morales, 1991).

This feature also indicates that fish are, more than any other faunal sector, the most underestimated animal resource in the three sites under consideration.

In order to make more specific comments we need to look at the taxa themselves in some detail.

V. DISCUSSION

Though the hypothesis advanced at this stage must be taken as tentative due to restricted size and provisional nature of the archaeozoological results (work on fish remains from Calatrava and Mértola is still under progress) (Roselló, in prep.), some of the data at hand allow us to certify a series of consistencies in the samples:

1) Each site exhibits a different spectrum of ichthic diversity with Saltés being clearly dominated by a marine family (i.e., the Sparidae or "sea breams"), Calatrava by a freshwater family (Cyprinidae) and Mértola by the amphidromous grey mullets (i.e., Mugilidae) (Figure 2, Table 2). One can not help linking this fact with the location of each site on the Iberian peninsula and its functionality, for it seems very clear that Saltés must have been a production and export center for fishes, whereas Mértola and Calatrava functioned both as import centers as well as local fishing centers. In this way, one can explain the bimodal fish diversity at Calatrava (42.5% of the remains are from imported fishes, (Tables 1 and 2), and also the reason for the cyprinid's abundance. In the case of Mértola, there is a relative equilibrium between saltwater fishes (26% of the identified remains) and freshwater fishes (16%) (Tables 1 and 2) and the only obscure point would be on how to classify the grey mullets on a cultural basis (i.e., allochtonous or autochtonous?). In view of the distance of the sea, some 100 km, and the biology of present-day Mugilidae (Whitehead *et al.*, 1986a), we think we can safely conclude that these fishes could have been the products of local fishing and not of fish trade[6]. One way or the other it should be clear that whereas the ichthyocenosis at Saltés is culturally homogeneous (i.e., local), those from Mértola and Calatrava are heterogeneous.

2) On strict archaeozoological grounds, therefore, the evidence of a fish trade is unrefutable. The volume and nature of such a trade, however, is still vague. The first parameter can be inferred by the large amount which imported fishes in Calatrava contribute to the ichthyocenosis (Tables 1, 2 & 3) as well as by the taphonomic loss which the fish samples indicate (both at inland and coastal sites), but it is very difficult to calibrate or to compare with other sectors of the production economy (stockbreeding, etc...). One has to assume that long-distance trade implied ways of processing the fishes but the faunal evidence, like most of the documentary and archaeological one, is scarce. True, historical records testify to the salting of fishes at Saltés and the discovery of

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[6] This «decission» not only agrees with the very few references to fishing in Mértola (Borges Coelho, 1993) but also the fact that mullets are normally consumed fresh, something which would be unfeasible in the case these animals had been brought to the site from the sea. At Mértola, moreover, grey mullets are still regularly fished (Morales, pers. obsv.).

the roman brine baths agree with written sources. However, all we can say about the marine fishes retrieved inland is that they seem to have been transported as whole specimens, for all types of bones from their skeletons have been identified (i.e., cranial (including braincases), vertebrae and girdles) (Roselló & Morales, 1990, 1991). On ethnological grounds, we know that pilchards "herring style" (i.e., dried, salted and smoked) has been the method prior to modern canning techniques.

3) More conclusive evidence has been found on the fishery of Saltés. Evidence from an inshore fishery comes from the remains of sparids. The finding of *Pagellus* and *Diplodus* remains in sufficient numbers to enable a reconstruction of body lengths (i.e., standard lengths, SL) (Whitehead *et al.*, 1984) has been particulary useful for this purpose. Most *Pagellus* bones belong to small animals (10-20 cm), smaller than normal mean lengths for both pandora and the axillary sea-bream (i.e., 20-25 cm) and much smaller still than the present day maximum SL values of either pandora (60 cm) and the axillary sea-bream (36 cm) (Whitehead *et al.*, 1986a) (Figure 3A). These small fishes, therefore, indicate the presence of young specimens which live very close to the shore and which could have been easily fished (e.g. with trail nets on the beach) (Brandt, 1984). Adults, living in deeper waters, were probably more difficult to catch. In *Diplodus annularis*, on the other hand, both juveniles and adults live in the littoral zone and their normal size range (12-15 cm) is comparable to most fishes found at Saltés (Figure 3B; Whitehead *et al.*, 1986a). Further evidence for an inshore fishery comes from specimens of meagre (*Argyrosomus regius*) which, like the shad and grey mullets, entered coastal lagoons and estuaries to spawn. These species, and the sole (*Solea sp.*), fond of sandy or silty bottoms, could also indicate regular fishing having taken place within the estuary itself.

Evidence for an offshore fishery at Saltés comes from the presence of shoaling fishes, such as mackerels (*Scomber* sp.), pilchards (*Sardina pilchardus*) and, above all, bluefin tuna (*Thunnus thynnus*). Pilchards are too small to be catched with anything but nets and tunas crossing these waters are animals on their gametic migration -a time when they do not feed and travel in deep water- thus nets seem the only appropiate gear to fish them.

4) At Mértola and Calatrava we believe we have found evidence of the fish trade having taken place with the atlantic sector of the southern iberian shorelines. Thus, the abundance in Calatrava of sardinella (*Sardinella aurita*) remains, a species most frequently encountered in that area, supports the idea (Whitehead *et al.*, 1984). However, the clearest indication is the retrieval in Mértola of the red pandora (*Pagellus bellottii*) (Table 1; Roselló, in press). This species is not aknowledged as part of the iberian fauna, due to the fact that at present, it only reaches as far north as Morocco (Whitehead *et al.*, 1986a).

Whereas we believe such a status assignal to be the product of a biased (i.e., incomplete) survey, the fact remains that the only fishmarkets of Spain where we have been able to detect the species (i.e., Isla Cristina, Huelva and Puerto de Santa Maria, all pers. obsv.) are located in the atlantic coast of Andalusia. Confirmation of this find with similar ones in the future (at present only one operculum has been found, cf. Roselló, in press) would greatly help in defining the nature of the trade route along the Guadiana river.

5) A further point of interest in Calatrava, particulary since written records are so scarce on this subject, concerns fish frauds. We believe that the presence of sardinella at this site indicates such a practice having taken place. Though both pilchards and sardinellas are easy to diagnose on strict osteological grounds (Figure 4), whole animals are extremely similar, even when fresh (Whitehead *et al.*, 1986a). Sardinella, furthermore, has a very poor meat quality which contrasts with the tasty flesh of the pilchard[7]. If, as we think was the case, clupeids were dried, smoked and salted prior to shipping, it would be extremely easy for someone to smuggle sardinellas in boxes of pilchards (both species show similar (i.e., 15-20 cm) size ranges; Roselló & Morales, 1991). This fraudulent activity, moreover, would have been easier to succeed with customers unacquainted with the fishes as opposed to the local coastal populations familiar with the different fish types. Though the archaeozoological evidence is very clear, we need other sources of information in order to substantiate it. We know, for example, that pilchards are one of the few species that written records consistently mention[8], whereas sardinellas are not mentioned ever in muslim (i.e., not just almohad) records. We assume that, then as now, people were not very fond of the taste of sardinella and undoubtedly were able to distinguish it from that of the pilchard, etc. But the more we try to refine the evidence the softer it becomes. As in the case of geographical connections, the question of fish frauds has been stated and only further evidence will help refine or disprove it.

6) From the ecological classifications of the assemblages shown in Table 2 and one can conclude that: (a) neritic (i.e. littoral) species make up for the largest fraction of the marine taxa at both Saltés and Mértola and (b) benthonic species are either absent from the samples or represented in very low numbers. This data, thus, indirectly indicate a major primacy of nets over other types of fishing gear and, as a corollary of this, the existence of regular or periodical surpluses of fishes which come as a consequence of fishing with nets, demanding different ways to handle them (i.e., export, processing, etc...).

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[7] Most sardinella is at present processed as fish flour.

[8] Pilchards are the only species retrieved in all three sites and make up for a substantial amount of the fish remains at both Saltés (±10%) and Calatrava (17.5%) (Table 1).

7) Though processing techniques can not be inferred from the fishes themsleves, it seems likely that exported fishes were mainly of the fatty-meat type (i.e., pilchards, sardinella, horse mackerels, mackerels and tunas) as these seem to be the most frequent types inland (in particular Calatrava) whereas the low-fat fishes (sparids) probably were consumed fresh, as their abundance in Saltés indicates. Nevertheless, even these small fishes could have been processed from time to time.

8) Finally, one can not forget the diversity gradients evidenced in the taxocenosis of Saltés, Mértola and Calatrava (Table 4). The falling values in diversity indexes not only indicate the presence of a poorer fish fauna as one moves further inland but, since this fauna is built up to a large extent by taxa imported from the coast, they also testify to some kind of cultural filter governing the dispersion of exported products. In this way, the further inland we are, the lower the number of taxa "able" to reach the site from the coast will be. This, obviously, is also indicating that there were different types of processing techniques, some being more long-lived than others.

VI. CONCLUSIONS

It is extremely interesting to see how a simple faunal analysis can provide the historian with so many hints about apparently unsuspected cultural patterns.

Perhaps the one single most important contribution for our research has been the documentation, for the first time in Iberian history, of a marine fish trade connecting coastal with inland sites.

Results from this combined historical and archaeozoological approach further evidence four categories of data (see also Morales, in press):

A) Concordant information. Within this section we have been able to detect a correlation between fish taxa regularily mentioned in documents and regularily retrieved in the subfossil samples. The most obvious case is that of the pilchard, already mentioned in the previous section, but the same would apply to other groups such as shads and grey mullets. The archaeozoological confirmation of the fish trade would also fall within this category.

B) Discordant information. This applies both to species not mentioned in the written records but found in the archaeological sediments (the most obvious case is that of sparids) as well as species mentioned in the documents but absent from the samples. In this second category one can include the bluefin tuna and the anchovies (*Engraulis encrasicholus*). The case of the tuna (only two vertebrae found at Saltés) is one where we may have some hints on the reasons for the discordance. Thus, we know that the processing of such large

fishes leaves most of the bones behind, in the place where the animals have been butchered (pers. obsv.). In such instances, the exported product is mostly flesh thus being difficult to find evidence of the species in the places where it was consumed (Roselló 1991/92; Morales, in press).

C) Historical sources as the sole providers of information. In some cases, faunal evidence has not been able to substantiate documentary data. This has been the case, for example, with the ways of processing fishes (or even wether some of them were processed at all). Documents and archaeological finds (i.e., brine baths) point to the salting of the animals but the bones themselves leave no trace of having been salted or consumed fresh. It is in these cases where faunal evidence will tend to remain mute and most of the effort to solve the questions will have to come from the traditional historical methods[9].

D) Faunal data as sole providers of the information. Fortunately for the archaeozoological group of authors of this paper, the largest category of events has been that one where zoological results have been able to elaborate on the problem of almohad fishing and fish trade beyond what was stated in the documents. Thus, in the case of Saltés, both an inshore and an outshore fishery have been documented. The trade route of inland sites along the Guadiana now has faunal data indicating contacts with the atlantic sector of the andalusian coasts. These large-scale results, together with the small-scale results (i.e., potential existence of a fraudulent commerce of false pilchards) also recorded, have greatly contributed to increase the scope of traditional historical research and to demonstrate the benefit of archaeozoological analysis in medieval studies of economic nature.

We believe that an analysis such as ours should be encouraging for other scholars to proceed further, for, no matter how deep and wide our knowledge of any particular discipline or phenomenon is, interdisciplinary research will always be superior to work oriented along a single methodological pathway. It will be only through this cooperation that we will be able to refine or, eventually, refute in the future some of the results that have been presented here.

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[9] The main question of wether the Guadiana river, which during some years might be completely dry in some places was, in fact, the single or, even, the main commercial route to Mértola and Calatrava, is one over which faunal data will have probably little to say.

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TABLE 1

Preliminary species list of the fishes excavated at Saltés, Mértola and Calatrava. Number in brackets on the last line refer to total number of taxonomically identified remains.

	SALTÉS			MÉRTOLA				CALAT.	TOTAL
	1988	1990	T	Q18B	Q17A	Q17C	T		
Chondrichthyes	-	1	1	-	-	-	-	-	1
Mustelus mustelus	4	24	28	-	-	-	-	-	28
Raja sp.?	-	7	7	-	-	-	-	-	7
Acipenser sturio	-	-	-	-	1	-	1	-	1
Sardina pilchardus	-	34	34	1	-	1	2	33	69
Sardina sp./*Sardinella* sp.	-	-	-	-	-	-	-	4	4
Sardinella aurita	-	-	-	-	-	-	-	39	39
Alosa alosa	-	4	4	-	1	-	1	-	5
Chondrostoma polylepis	-	-	-	-	-	-	-	1	1
Leuciscus cephalus	-	-	-	-	-	-	-	11	11
Barbus comiza	-	-	-	-	-	-	-	28	28
Barbus microcephalus	-	-	-	-	-	-	-	5	5
Barbus sp.	-	-	-	4	-	1	5	64	69
SPARIDAE	1	117	118	-	-	1	1	-	119
Pagellus acarne	-	24	24	-	-	3	3	-	27
Pagellus erythrinus	2	17	19	-	-	-	-	-	19
Pagellus bellottii	-	-	-	-	-	1	1	-	1
Pagellus sp.	-	25	25	-	-	-	-	-	25
Pagellus sp./*Pagrus* sp.	-	43	43	-	-	-	-	-	43
Pagrus pagrus	-	2	2	-	-	-	-	-	2
Pagrus auriga	2	1	3	-	-	-	-	-	3
Pagrus sp.	-	6	6	-	-	-	-	-	6
Sparus aurata	-	1	1	-	-	-	-	-	1
Diplodus annularis	-	18	18	-	-	-	-	-	18
Diplodus sargus	-	-	-	-	-	1	1	-	1
Diplodus sp.	-	11	11	-	-	-	-	-	11
Serranus sp.	-	1	1	-	-	-	-	-	1
Argyrosomus regius	1	3	4	-	-	-	-	-	4
Trachurus trachurus	-	-	-	-	-	-	-	4	4
MUGILIDAE	-	-	-	-	3	6	9	-	9
Chelon labrosus	-	1	1	-	-	-	-	-	1
Liza aurata	-	-	-	1	-	5	6	-	6
Mugil cephalus	-	-	-	-	-	1	1	-	1
Thunnus thynnus	-	2	2	-	-	-	-	-	2
Scomber scombrus	-	2	2	-	-	-	-	-	2
Scomber colias	-	2	2	-	-	-	-	-	2
Scomber sp.	-	9	9	-	-	-	-	-	9
Solea aff. vulgaris	-	2	2	-	-	-	-	-	2
unspecified remains				34	-	59	93	48	128
TOTAL	(10)	(357)	(367)	40(6)	(5)	79(20)	124(31)	237(189)	728(587)

TABLE 2

Relative abundance of ecological groups (according to number of remains, NR and their percentages) within the ichthyocenosis of the almohad sites.

ECOLOGY	SALTÉS	MÉRTOLA	CALATRAVA
FRESHWATER	-	5 (16%)	109 (57.5%)
AMPHIDROMOUS	5 (1.5%)	18 (58%)	-
SALTWATER	362 (98.5%)	8 (26%)	80 (42.5%)

TABLE 3
Biotope preferences of the marine fishes retrieved in the almohad sites (data partially after Whitehead *et al.* 1984, 1986a, 1986b) expressed as NR and corresponding percentages. See text for further comments.

ECOLOGY	SALTÉS	MÉRTOLA	CALATRAVA
NERITIC	309 (84.5%)	25 (96%)	76 (95%)
BENTHONIC	42 (11.5%)	1 (4%)	-
PELAGIC	15 (4.0%)	-	4 (5%)

TABLE 4
Selected diversity parameters from ichthyocenosis of the almohad sites.

PARAMETER	SALTÉS	MÉRTOLA	CALATRAVA
NUMBER OF TAXA	22	11	7
NUMBER OF SPECIES	15	9	7
H' 2'37	2'03	1'66	

APPENDIX 1: NOMENCLATURAL EQUIVALENCES OF THE TAXA MENTIONED IN THIS PAPER.

SCIENTIFIC NAME	ENGLISH NAME	SPANISH NAME	PORTUGUESE NAME
Chondrichthyes	cartilaginous fish	pez cartilaginoso	peixes
Mustelus mustelus	smooth-hound	musola	caçâo-liso
Raja sp.	skate/ray	raya	raia
Acipenser sturio	sturgeon	esturión	solho/esturjâo
Sardina pilchardus	pilchard	sardina	sardinha
Sardinella aurita	sardinella	alacha	sardinela-lombuda
Alosa alosa	Allis shad	sábalo/saboga	sável
Chondrostoma polylepis	Iberian nose	boga de rio	boga-de-boca-direito
Leuciscus cephalus	chub	cacho	escola
Barbus comiza	Iberian barbel	comiza	barbo-cumba
Barbus microcephalus	———	barbo del Guadiana	barbo de cabeça pequena
Barbus sp.	barb	barbo	barbo
Pagellus acarne	axillary seabream	aligote	besugo
Pagellus erythrinus	common pandora	breca	bica
Pagellus bellottii	red pandora	breca colorado	bica-buço
Pagrus pagrus	common seabream	pargo	pargo-legítimo
Pagrus auriga	redbanded seabream	hurta	pargo-sêmola
Sparus aurata	gilthead	dorada	dourada
Diplodus annularis	annular seabream	raspallón	sargo-alcorraz
Diplodus sargus	white seabream	sargo	sargo-legítimo-do-Mediterrâneo
Serranus sp.	comber	cabrilla/mecillo	serrano
Argyrosomus regius	meagre	corvina	corvina-legítima
Mugilidae	grey mullets	mujoles	tainhas
Chelon labrosus	thick-lipped grey mullet	lisa	tainha-liça
Liza aurata	golden grey mullet	galupe	tainha-garrento
Mugil cephalus	flathead grey mullet	pardete	tainha-olhalvo
Thunnus thynnus	bluefin tuna	atún rojo	atum-rabilho
Scomber scombrus	mackerel	caballa	sarda
Scomber colias	chub mackerel	estornino	cavala
Trachurus trachurus	horse mackerel	chicharro	carapau
Solea aff. vulgaris	sole	lenguado	soleídeo

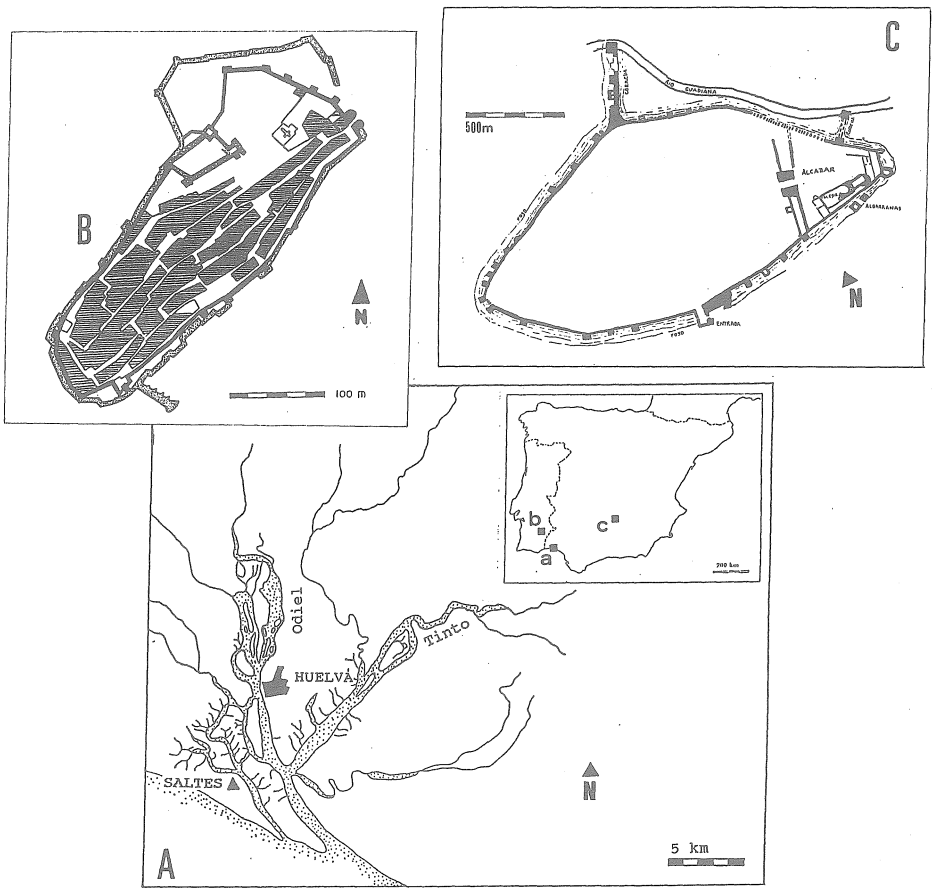


Fig. 1 — Geographical location of Saltés (A), Mértola (B) and Calatrava La Vieja (C).

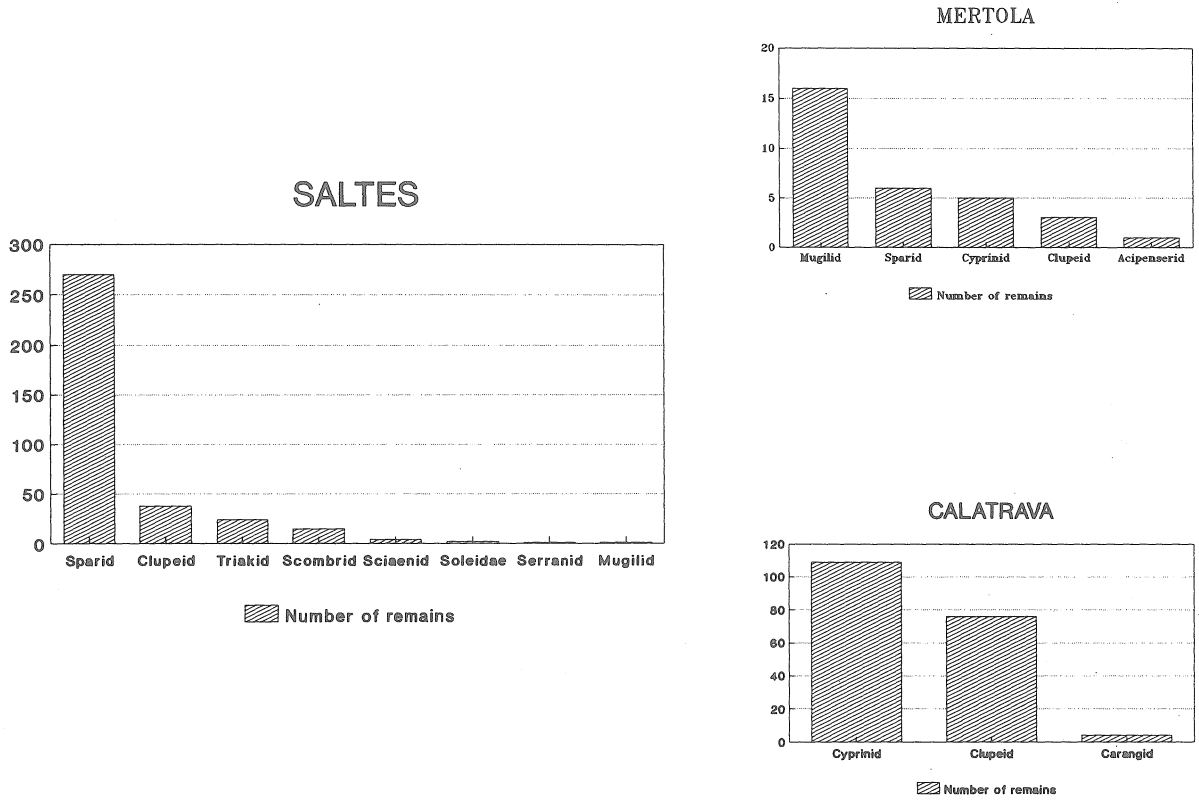
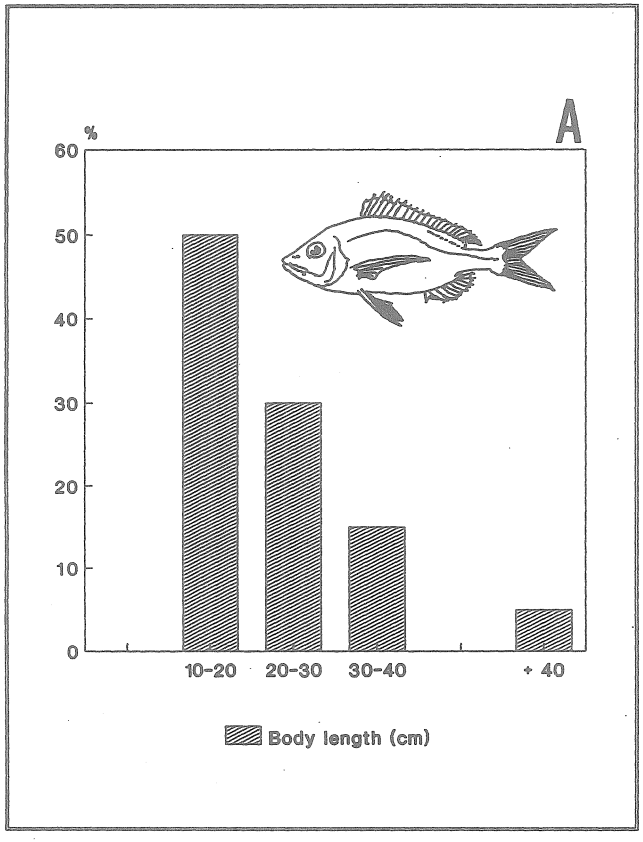


Fig. 2 — The ichthyocenosis found at Saltés, Mértola and Calatrava La Vieja organized as NR according to families.



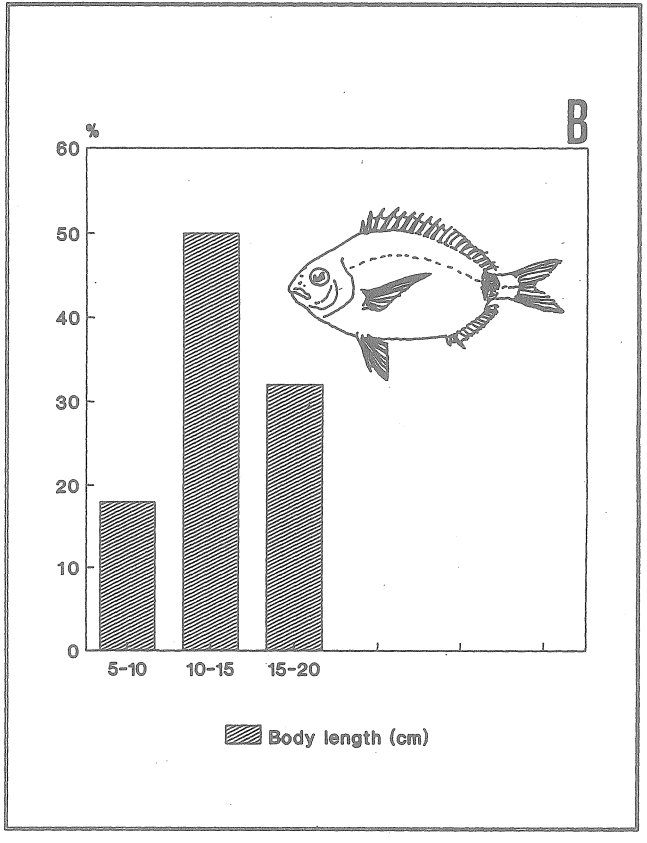


Fig. 3 — Reconstruction of the body length (SL in cm) of *Pagellus sp.* (A) and *Diplodus sp.* (B) found at Saltés, with indication of the number of skeletal elements (taken from Lentacker, in press).

Est. III

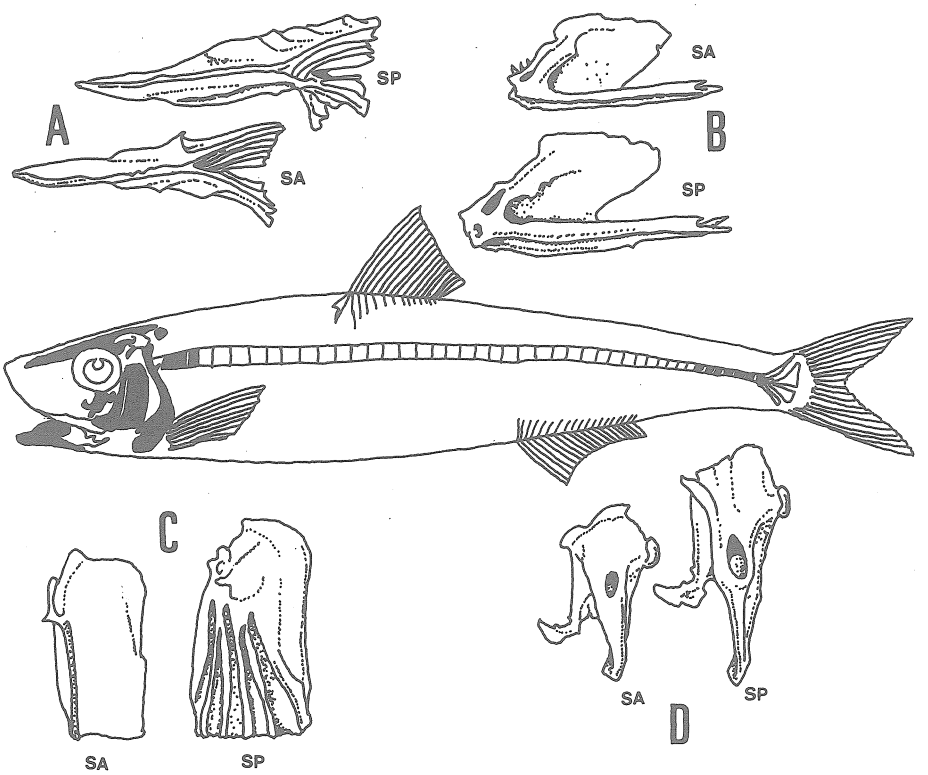


Fig. 4 — Osteological differences between pilchards (*Sardina pilchardus*, SP) and round sardinella (*Sardinella aurita*, SA) in a series of bones (A: frontale; B: dentale; C: operculare; D: hyomandibulare) and clupeid bones (shown in black) from Calatrava La Vieja evidencing the existence of complete individuals at the site. (Taken from Roselló & Morales, 1991).