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The Archaeofauna of the late Medieval, Islamic Harbour Town of Saltés (Huelva, Spain)

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ABSTRACT: A preliminary assessment of the food economy in the late medieval Moorish town of Saltes, on the southwestern coast of Spain has been carried out. The study of animal remains indicates that the meat supply to the town was provided by small livestock, cattle, rabbit and domestic fowl. The exploitation of marine resources, however, should have been at least equally important for the food economy. Fishing and the gathering of molluscs mainly took place close to the coast but fishing in the open sea provided an additional yield. Probably, an important part of the catch in the open sea was processed and shipped towards inland consumer sites. Comparison with other medieval Islamic sites from the Iberian Peninsula points to cultural factors as influencing the composition of the daily diet.

KEYWORDS: ISLAMIC SPAIN, ATLANTIC COAST, LATE MEDIEVAL PERIOD, CONSUMPTION PATTERNS, MARINE RESOURCES

RESUMEN: El trabajo lleva a cabo una valoración preliminar acerca de la economía alimentaria en la ciudad musulmana bajo medieval de Saltés en la costa española sudoccidental. El análisis de los restos animales indica que el aporte cárnico a la ciudad estaba preferentemente constituído por ovicaprinos, vacuno, conejos y pollos. Creemos, no obstante, que la explotación de los recursos marinos debió haber sido tan importante para la dieta como los animales terrestres. La pesca y el marisqueo parecen haber sido actividades costeras en su mayor parte si bien existen claras evidencias de una pesquería pelágica. Posiblemente una gran parte de estas capturas eran procesadas y posteriormente comercializadas hacia asentamientos del interior. Las comparaciones con otros yacimientos medievales islámicos de la Península Ibérica indican la existencia de factores culturales como determinantes de la dieta global.

PALABRES CLAVE: ESPAÑA MUSULMANA, COSTA ATLÁNTICA, BAJA EDAD MEDIA, PATRONES DE CONSUMO, RECURSOS MARINOS

SALTÉS: AN INTRODUCTION

The deserted site of Saltés is located on a island with the same name in the estuary of the rivers Odiel and Tinto, close to the town of Huelva, on the southwestern coast of Spain (Figure 1). The island is surrounded by brackish water and consists of three zones of higher elevation, separated by marshland. The occupation of the site dates back to prehistoric times but recent excavations focused on the medieval development of a Moorish harbour town in the northern part of the island. The recent archaeological fieldwork, directed by Mr. A. Bazzana, took place between 1988 and 1997, and showed that the medieval site was characterised by the very intensive urbanisation typical for Moorish towns. Historical sources confirm that the site was conquered by the Christians around

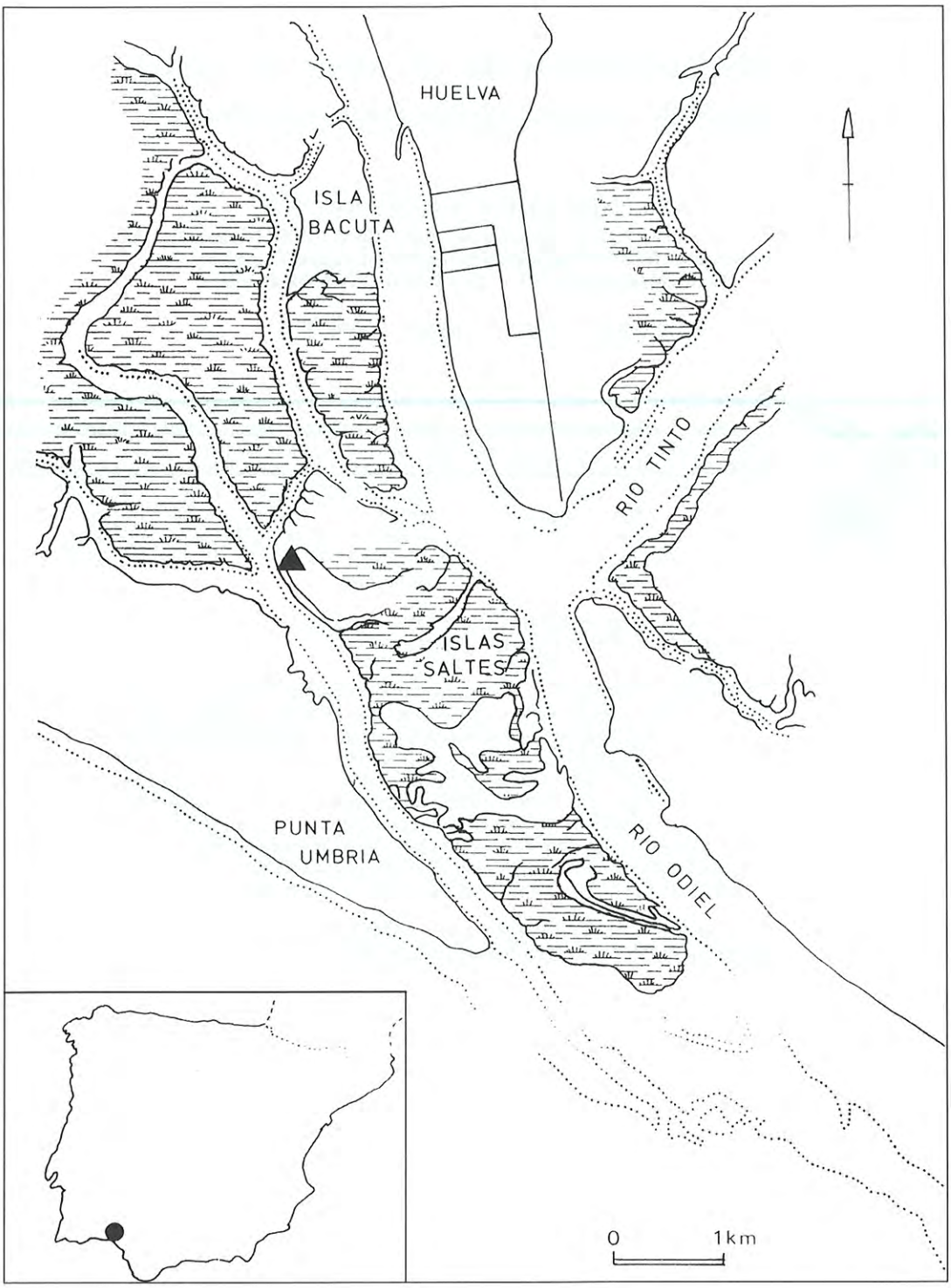

FIGURE 1
Location of the site in the estuary of the rivers Odiel and Tinto.

the middle of the 13th century but was never reoccupied (Bazzana & Cressier, 1989; Bazzana & Bedia García, 1993; Bazzana *et al.*, 1994).

Environmental archaeology, and especially the analysis of organic remains found during excavations, has still not become a full, integrated part of all excavations around the Mediterranean basin (Morales, 1996). One of the reasons is that "classical" archaeology focuses more on the reconstruction of the chronological history of sites than, e.g., on the socio-economic aspects of the daily life that took place in these dwelling places. Another reason is the fact that many excavators are still unacquainted with the possibilities and methodology of environmental research within archaeology. The Saltés excavations illustrate the possibilities of archaeozoology, i.e. the analysis of animal remains, for the reconstruction of the food economy of a medieval urban site from the Almohad period of Muslim Spain. The study collection is limited and biased in many regards, but still delivered essential information. Its publication can be justified by the scarcity of archaeozoological reports from medieval Islamic sites, in particular those from southern Europe, by the historical importance of the site, and by the fact that historical research of the economy of the Almohad period is still not very developed (Viguera, 1988).

A preliminary survey of the fish remains from the 1988 and 1990 campaigns has already been presented at the occasion of the 6th meeting of the ICAZ Fish Remains Working Group (Lentacker, 1994). The same assemblage has subsequently been incorporated in an analysis of fishing and fish trade on Almohad sites on the Iberian peninsula (Morales *et al.*, 1994). The present report deals with all animal remains found during the various excavation campaigns. Amongst this collection, a small number of human remains was found. A chapter will be devoted to their description at the end of the archaeozoological report.

MATERIAL AND METHODS

The present study is based on a collection of animal remains excavated during the campaigns of 1988, 1990 and 1995. Due to differences in sampling and recovery methodology applied from year to year, the archaeozoological collections from these campaigns are considerably heterogeneous. In 1988, no environmental archaeologist took part in the excavation, which partly explains why, during that campaign, animal remains were ocassionally (hand) collected, resulting in a selective and limited sample. In total, 18 contexts yielded animal remains. At that time, this material was stored for future analysis.

The field-work of the 1990 campaign was assisted by the senior author, who introduced the use of sieves, with meshes of 5 and 2 mm, in the excavations. Since no real refuse pits were found during the campaign, all sieved samples had to be collected from drainage channels, latrines, wells and grain storage pits. Other contexts were investigated by handcollecting, be it in a less biased way compared to the previous campaign. In total, 17 stratigraphic units yielded animal remains, although, unfortunately, the density of finds was generally low. As a result, the collection from this campaign is again limited in number but characterised by a high frequency of smaller finds. During the 1990 campaign, most of this material was identified at the site, together with the finds from 1988. For the identification of the mollusc remains, the key of Pérez Quintero (1989) was used. The fish remains were identified using the comparative collections of the Laboratorio de Arqueozoología of the Universidad Autónoma de Madrid, and of the Royal Museum for Central Africa (Tervuren, Belgium). Length estimations of the specimens were made by visual comparison to reference skeletons from these collections.

During the 1995 campaign, both authors visited the site for a short period. That year, sampling was exclusively restricted to a series of stratigraphical layers which contained multiple accumulations of shells (see below). Since no time was devoted to the sampling of other archaeological contexts, the 1995 collection of animal remains is again characterised by a high frequency of large (handcollected) finds. The overall finds number, derived from 46 different contexts, is low. After the field campaign, the collection was shipped to Belgium and analysed using the reference collection of the Royal Museum for Central Africa.

During the field campaign of 1997, no environmental archaeologists were present on the site. Although it was reported that, a.o., a pit was excavated, that contained a large number of oyster shells (Bazzana, pers. comm.), no animal remains from that campaign have been available for study.

In general, the larger animal remains from Saltés are heavily fragmented, hampering the identification of an important part of the bone collec-

tion. For the same reason, given that find numbers are low, a biometrical analysis of the vertebrate remains was not attempted. Although the finds were recovered from different contexts, they are not treated separately within the present report. A comparison of the identification lists per context, which are not published here but remain available from the authors, clearly shows that no meaningful differences in species composition can be detected between the archaeozoological record of individual stratigraphical units. Possible taphonomical and chronological differences between sampling units have therefore also been ignored. Following the information of the excavators, the animal remains, derived from destruction layers and urban refuse contexts, are generally dated to the second half of the 12th and first half of the 13th century, which corresponds to the last occupation phase of the site.

INVENTORY

Molluscs

A few terrestrial gastropods were recovered from a single context during the 1988 campaign and again during the 1995 campaign. Due to sieving, a considerable number was recovered from 5 contexts in 1990 (Table 1). No attempt has been made to identify these remains, all of small size.

The medieval urban refuse contexts from Saltés yielded 15 mollusc taxa that occur in marine or estuarine biotopes. Surprisingly, the sieving campaign of 1990 did not result in a markedly higher number of finds or species within this zoological category. In fact, new contexts excavated in 1990 proved to be poor in marine mollusc remains, compared to the units sampled in 1988 (Table 1). In general, the excavators only collected a set of specimens from each context, that was considered representative for the species composition. Therefore, only presence/absence data and no fragment counts or frequencies are given for this animal group. The abundance of a taxon can only be evaluated by counting the number of contexts where it was collected from (Table 1). This calculation coincides well with a subjective estimation of the species' frequencies, made by the senior author in 1990, by inspecting the remains *in situ*, during several site visits (see 'frequency' in Table 1).

The taxa identified are listed in Table 1. The nomenclature applied follows Poppe & Goto (1991, 1993), which also served as the information

	1988	**1990**	**1995**	**total**	**frequency**
Total number of contexts	18	17	46	81	
Acanthocardia sp.	0	1	0	1	RR
Bolinus brandaris	9	1	3	13	F
Cerastoderma edule	1	2	0	3	R
Cerithium vulgatum	1	1	1	3	R
Chamelea gallina	0	2	0	2	RR
Charonia lampas lampas	1	0	1	2	R
Cymbium olla	3	0	0	3	R
Dentalium sp.	2	0	0	2	R
Glycymeris glycymeris	12	6	5	23	FF
Mytilus edulis	0	1	0	1	RR
Ostrea edulis	13	2	2	17	FF
Pecten maximus	7	2	4	13	F
Sepia officinalis	0	1	1	2	RR
Solen / Ensis sp.	1	3	3	7	R
Tapes decussatus	4	2	2	8	R
Terrestrial gastropods	1	5	1	7	

TABLE 1

Survey of the molluscs found at Saltés. The number of contexts where the species was recovered from, and a subjective estimation of the frequency of the marine species, made during the 1990 campaign are indicated.

source for the ecological characteristics of the species. Most of the species found occur on soft substrates close to the coast:

- *Acanthocardia* sp. on mud bottoms from the intertidal zone to the continental shelf,
- *Bolinus brandaris* on sand and mud bottoms 1 to 200 m deep,
- *Cerastoderma edule* in sand, mud and gravel bottoms from the intertidal zone to a few meters deep,
- *Cerithium vulgatum* in shallow water on sandy and muddy bottoms,
- *Chamelea gallina* on mud and sand bottoms from 5 to 20 m deep,
- *Charonia lampas lampas* on different substrates from the extreme low tide level to 700 m deep,
- *Cymbium olla* in shallow water on sand bottoms,
- *Dentalium* sp. on mud and sandy bottoms between 1 to 50 m deep,
- *Mytilus edulis* on substrates from the intertidal to 40 m deep,
- *Ostrea edulis* on different types of sediments from shallow water down to 90 m deep,
- *Pecten maximus* on sand and gravel bottoms but also on mud, from the extreme low tide level to 250 m deep,
- *Solen/Ensis* sp. in shallow sandy areas,
- *Tapes decussatus* in sand or muddy gravel bottoms, in quiet waters below mid-tide level to a few meters deep.

One bivalve, *Glycymeris glycymeris*, occurs offshore, on sand, mud and gravel bottoms down to 75 m deep. The cuttlefish, *Sepia officinalis*, is the only cephalopod species, represented by fragments of its internal shell. Cuttlefish live in waters above the continental shelf.

Fish

As usual, sieving had a considerable impact on the diversity and amount of fish bones collected. During the excavations of 1988, 10 fish remains from 4 different species were found; these remains are mostly large vertebrae. The 1995 campaign yielded only two fish bones. However, in 1990, sieving produced 1054 remains, amongst which 19 different species could be recognised. Of course, a large part of the collection, i.e. 690 specimens or two thirds of the total, remained unidentified. A list of the fish species found is given in Table 2. Compared to the preliminary list published earlier (Lentacker, 1994), two species have been added, the identifications of two species (*Alosa* sp. and *Solea* sp.) have been described more carefully, and the nomenclature has been updated according to Whitehead *et al.* (1984, 1986a, b). The relevant ecological and economical data for the fishes have been taken from the latter works and from von Brandt (1984).

The Saltés fish assemblage is dominated by marine and estuarine species. That remains of freshwater fishes were absent from the site is not surprising; sea water penetrates far upstream in the Odiel and Tinto rivers, which gives the immediate environment of the site a brackish character. The most important fish present were the seabreams or sparids (Sparidae). Within this family, few remains belonged to the genus *Pagrus*, represented by two species, the common seabream (*Pagrus pagrus*) and the redbanded seabream (*Pagrus auriga*). A single bone came from a gilthead (*Sparus aurata*) but specimens of the genera *Pagellus* and *Diplodus* were the most frequently found within the sparids. The collection contained sufficient numbers from the latter two genera to allow a reconstruction of body length distribution within the populations (Figure 2). Within the *Pagellus*-group the bones of the common pandora (*P. erythrinus*) and the axillary sea-bream (*P. acarne*) were recognised. *Pagellus erythrinus* can attain a total length of 60 cm while the maximum for *P. acarne* is 36 cm. Usually, however, both species attain a length of 20-25 cm. The majority of the Saltés finds represent fishes from only 10 to 20 cm (Figure 2). Hence, most of the sea-breams that were caught at Saltés are rather small and represent young individuals. The young of these fishes live closer to the coast than the adults. Within the genus *Diplodus* only one species was found, i.e. the annular seabream (*Diplodus annularis*). Both juveniles and adults of this species live in the littoral zone. The adults reach to 12-15 cm long, which is a size comparable to that of most of the specimens found at Saltés (Figure 2).

Other in-shore species represented within the fish assemblage are the comber (*Serranus* sp.), the sole (*Solea* sp.) and the meagre (*Argyrosomus regius*). Meagre usually attains 50 cm but some of the specimens from Saltés were even longer than 85 cm. It is known that, from April to August, these large adult fishes enter the coastal lagoons and estuaries to spawn. The cartilaginous fish that

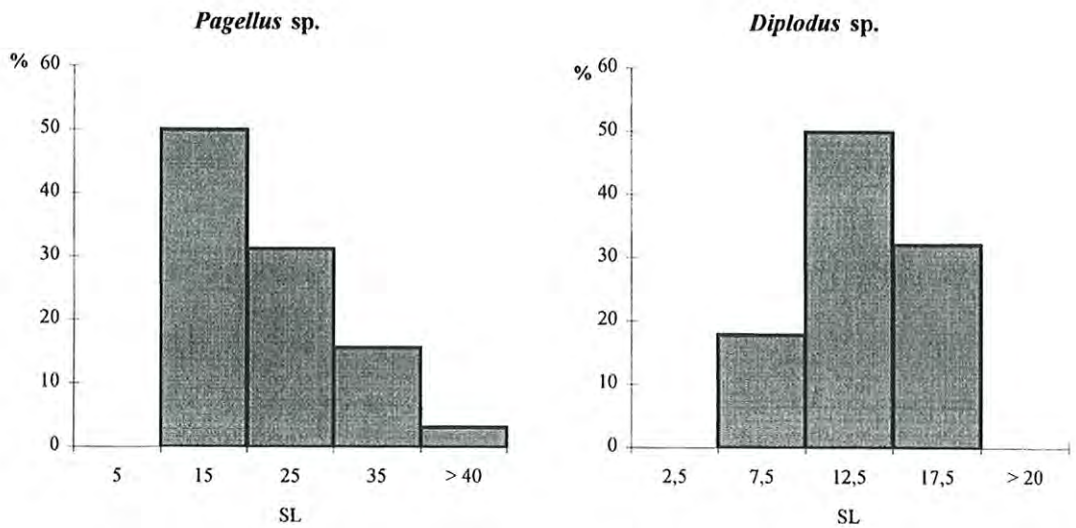

FIGURE 2
Frequency distributions of the estimated body lengths (SL) of fishes within the genus *Pagellus* (n = 64) and the genus *Diplodus* (n = 28).

left remains at Saltés, i.e. the sand tiger shark (*Eugomphodus taurus*), the tope shark (*Galeorhinus galeus*), the smooth-hound (*Mustelus mustelus*) and the ray (*Raja* sp.), also live not far from the coast.

Other fishes found in small quantities in the collection of Saltés are the thicklip grey mullet (*Chelon labrosus*) and the allis or twaite shad (*Alosa* sp.). Both these species enter estuaries and occur close to the coast, together with the species already described. However, some fish represented within the Saltés excavations are to be found off-shore, especially the shoaling fish that live in open waters, such as the mackerels *Scomber japonicus* and *Scomber scombrus*, and the Atlantic blue tuna (*Thunnus thynnus*). The shoaling pilchards (*Sardina pilchardus*), also found at Saltés, live closer to the coast. Within the off-shore group, only the pilchards were found in meaningful numbers.

Birds

Bird remains are scarce within the archaeozoological record of the Saltés excavations (Table 3). One species, the domestic chicken (*Gallus gallus* f. *domestica*) dominates all samples. A few bone fragments prove the presence of both hens and roosters. Generally, the finds are too fragmented and too few to allow for a biometrical analysis. It is possible that chicken was not the only domestic bird species at Saltés but the scarce remains of geese (Anseriformes sp.) do not allow a species identification, let alone subspecific differences as would be the case for the domestic goose (*Anser anser* f. domestica). The same is true for the mallard (*Anas platyrhynchos*) remains. Remaining bird bones certainly come from wild species and prove the presence of red grouse (*Alectoris rufa*), herring gull (*Larus argentatus*), a dove (*Columba* sp.) and a passerine bird (Passeriformes sp.). Except for the geese, that are winter residents, all birds can be found in the area around the site throughout the year.

Mammals

Amongst the mammal remains (Table 3), those of sheep (*Ovis ammon* f. *aries*) and goat (*Capra aegagrus* f. *hircus*) are the most numerous (Figure 3). These two domestic species have been inventoried together, because often their remains can not be discriminated from one another (Boessneck *et al.*, 1964). Only during the analysis of the 1995 material (that could be studied in the lab) special attention was paid to the discrimination of sheep and goat. Within a set of 31 identifiable bones, 29 came from sheep, 2 from goat. This suggests that sheep was far more frequent in the archaeological contexts investigated. Only 6 bones from sheep could be used for a reconstruction of the withers height, yielding results ranging from 53 to 70 cm.

	1988	1990	1995
Sand tiger shark (*Eugomphodus taurus*)	–	1	–
Tope shark (*Galeorhinus galeus*)	–	6	–
Smooth-hound (*Mustelus mustelus*)	4	24	–
Ray (*Raja* sp.?)	–	7	–
Cartilaginous fish (Chondrichthyes)	–	1	–
Axillary seabream (*Pagellus acarne*)	–	24	–
Common pandora (*Pagellus erythrinus*)	2	17	–
Pagellus sp.	–	25	–
Common seabream (*Pagrus pagrus*)	–	2	–
Redbanded seabream (*Pagrus auriga*)	2	1	–
Pagrus sp.	–	6	–
Pagellus sp./*Pagrus* sp.	–	43	–
Gilthead (*Sparus aurata*)	–	1	–
Annular seabream (*Diplodus annularis*)	–	18	–
Diplodus sp.	–	11	–
Sparidae sp.	1	117	–
Meagre (*Argyrosomus regius*)	1	3	1
Sole (*Solea* sp.)	–	2	–
Comber (*Serranus* sp.)	–	1	–
Bluefin tuna (*Thunnus thynnus*)	–	2	1
Chub mackerel (*Scomber japonicus*)	–	2	–
Mackerel (*Scomber scombrus*)	–	2	–
Scomber sp.	–	9	–
Pilchard (*Sardina pilchardus*)	–	34	–
Allis or twaite shad (*Alosa* sp.)	–	4	–
Thick-lipped grey mullet (*Chelon labrosus*)	–	1	–
Total identified fish remains	10	364	2
Unidentified fish remains	0	690	0
Total	10	1.054	2

TABLE 2

Fish remains collected during the excavation campaigns at Saltés.

Estimations of the age at death were difficult to asess for the Saltés sheep and goats, due to the limited number of more or less complete tooth rows in the collection and the heavy fragmentation of the long bones. Nevertheless, an assemblage of 110 sheep and goat remains (from the 1988 and 1990 campaigns) evidenced the presence of 42 specimens (38%) from subadult animals, that had not yet reached the age of 3 to 3.5 years. Amongst those, first, second and third year animals could be found. An important part of the small livestock was thus slaughtered when young. No intra-skeletal selection is evident; all bones seem to be present, except for the smallest ones that have been missed by handcollecting. One context contained the incomplete skeleton of an adult sheep. The bones from this buried carcass have only been counted as one find within the inventory.

Cattle (*Bos primigenius* f. *taurus*) bones were found in lower numbers compared to the sheep and goat remains (Figure 3). It has to be taken into account that handcollecting of animal material normally produces collections that are biased towards the larger finds, such as cattle or horse bones. The low frequency of cattle bones at Saltés is therefore certainly significant. Since no complete adult cattle long bones have been found, withers heights could not be calculated. The frequency of subadult animals (younger than 4 years) could again only be roughly evaluated. In a sample

	1988	1990	1995	Total
Aves				
Geese (Anseriformes sp.)	2	0	0	2
Mallard (*Anas platyrhynchos*)	1	0	1	2
Red grouse (*Alectoris rufa*)	1	6	6	13
Herring gull (*Larus argentatus*)	0	1	0	1
Dove (*Columba* sp.)	1	0	0	1
Passerine bird (Passeriformes sp.)	0	1	0	1
Domestic fowl (*Gallus gallus* f. domestica)	24	6	26	56
Unidentified bird remains	10	17	17	44
Mammalia				
Shrew (Soricidae sp.)	0	1	0	1
Black rat (*Rattus rattus*)	0	11	0	11
Unidentified rodent (Rodentia sp.)	0	0	1	1
Rabbit (*Oryctolagus cuniculus*)	77	54	80	211
Hare (*Lepus capensis*)	3	1	0	4
Roe deer (*Capreolus capreolus*)	4	0	0	4
Red deer (*Cervus elaphus*)	12	0	5	17
Horse (*Equus ferus* f. caballus)	11	0	7	18
Cattle (*Bos primigenius* f. taurus)	45	3	43	91
Sheep (*Ovis ammon* f. aries) / Goat (*Capra aegagrus* f. hircus)	209	28	145	382
Dog (*Canis lupus* f. familiaris)	4	0	0	4
Cat (*Felis silvestris* f. catus)	7	5	16	28
Small vertebrae	3	21	3	27
Medium sized vertebrae	73	0	30	103
Large vertebrae	16	3	3	22
Ribs	158	2	106	266
Unidentified mammal remains	370	184	159	713
Total bird remains	39	31	50	120
Total mammal remains	992	313	598	1.903

TABLE 3

Bird and mammal remains excavated at Saltés.

of 49 finds, only 10 (20%) came from subadult specimens. All parts of the skeleton were present.

Domestic mammals that were found in lower numbers than sheep and cattle, are horse (*Equus ferus* f. *caballus*), dog (*Canis lupus* f. *familiaris*) and cat (*Felis silvestris* f. *catus*). All horse bones seem to derive from adult animals; some were fragmented and showed cutting or chopping traces. The bones from cats and dogs almost certainly come from complete skeletons, although these have been only partially recovered. Amongst the cat remains, a high frequency of bones are from young animals, both juveniles and subadults.

Small wild living mammals are represented at the site by a shrew species (Soricidae sp.), the black rat (*Rattus rattus*) and an unidentified rodent (Rodentia indet.). Without doubt, the black rat lived close to or even in the houses of Saltés, as a commensal animal. This could also be true for the small insectivore and the unidentified rodent. Larger species, that came from the natural surroundings in the region, are the hare (*Lepus capensis*), roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*).

A special mention should be made for the remains of rabbit (*Oryctolagus cuniculus*), that were very numerous in the collections from all sea-

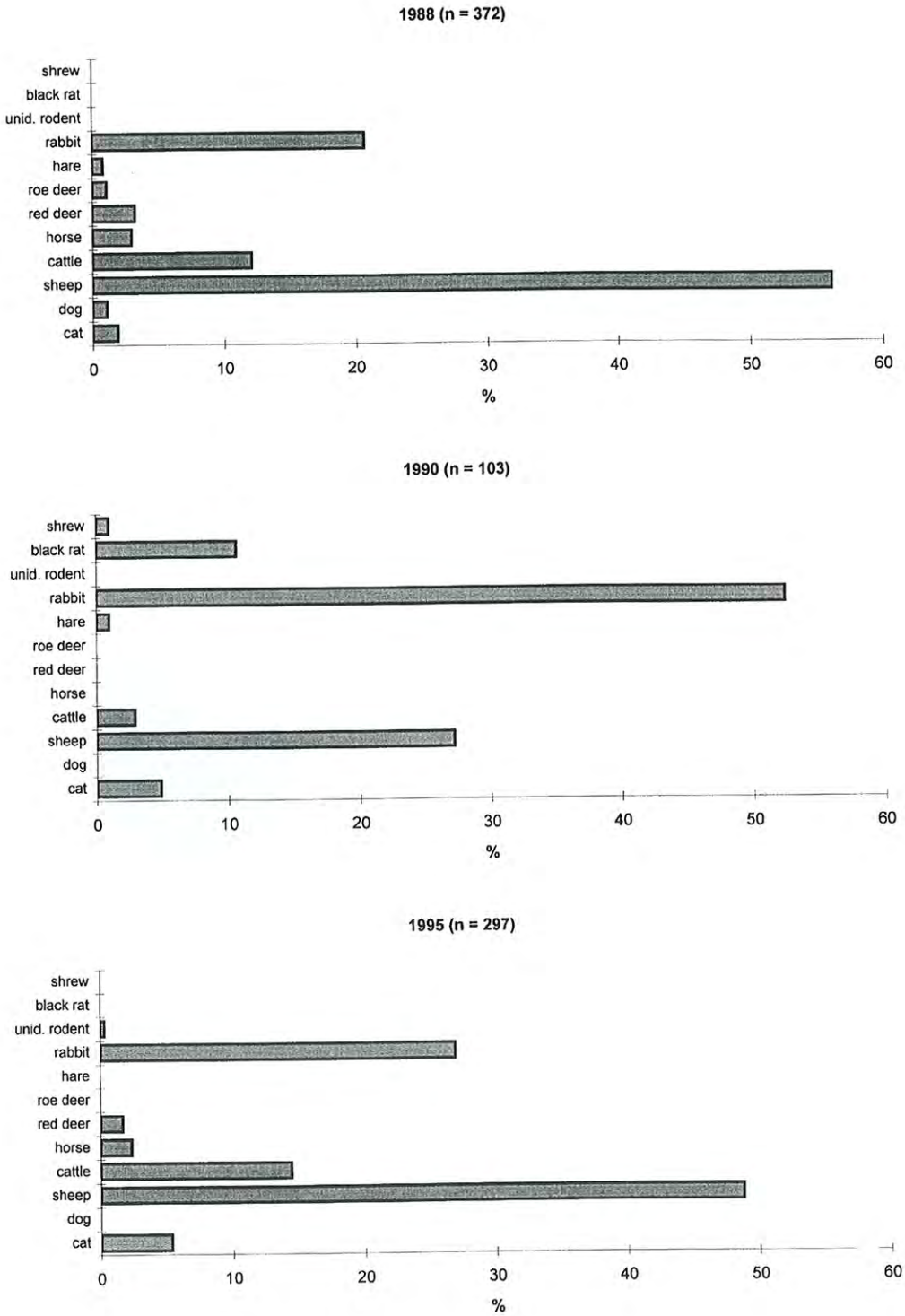

FIGURE 3

Frequency of species within the mammal remains from the different excavation campaigns.

sons (Figure 3). During the 1990 campaign, when most care was taken during collecting, the rabbit was the most common mammal found in the archaeozoological assemblage. Better sampling and recovery was without doubt responsible for a higher frequency of small bones, including those of rabbits. This is also proven by the higher frequency of very small bones amongst the rabbit remains. Rabbit phalanges, e.g., have only been found in 1990. It can be assumed that all types of bones were present at the site but whether the rabbit remains were sometimes found as part of complete skeletons is not documented in the excavation records. Measurements on the bones (not listed in the present report) have been compared to those reported by von den Driesch & Boessneck (1970), and show no significant differences between the Saltés population and other wild rabbits from the Iberian Peninsula. Hence the finds provide no arguments for the existence, within the medieval site, of a domesticated rabbit population characterised by the presence of selectively bred, large individuals. In historical documents from late medieval Andalucia the rabbit is also classified amongst the hunted fauna (García, 1996: 226).

Relative importance of the animal groups

When a global view is given of the animal remains found during each campaign (Figure 4), it becomes apparent that the 1990 campaign, during which sieving was applied, yielded a strikingly different faunal spectrum compared to the handcollected assemblages from 1988 and 1995. On the

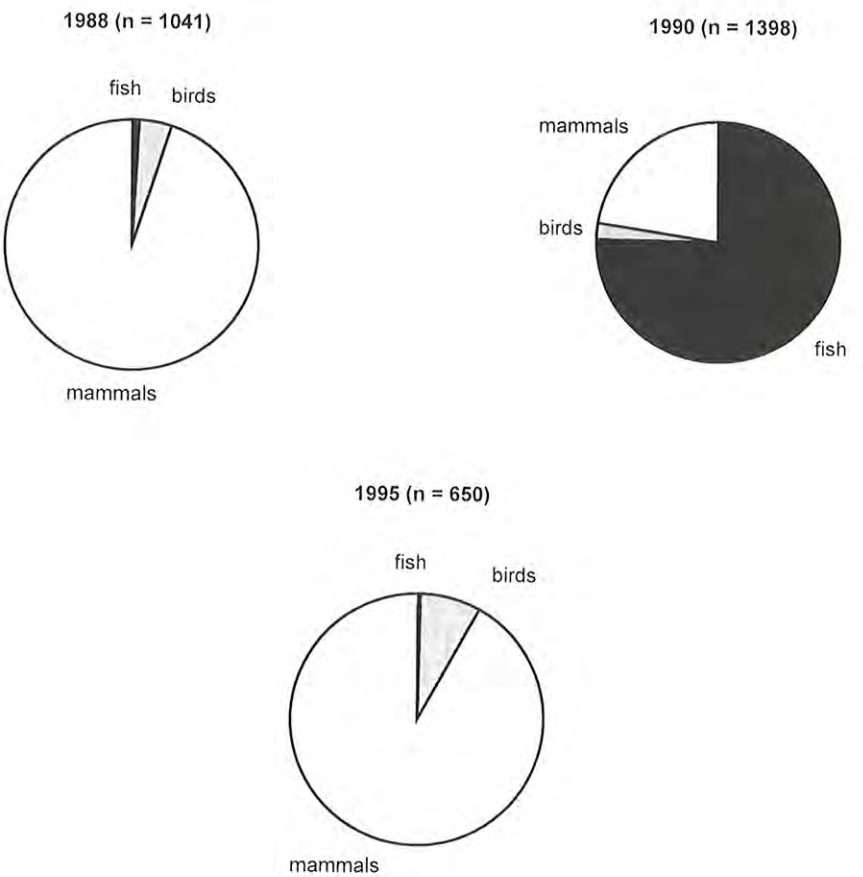

FIGURE 4
Frequency of fish, bird and mammal remains in the different assemblages.

one hand, the importance of fish on the meat-procuring economy would have been completely missed without the 1990 campaign. On the other hand, the frequency of the bird remains only slightly increased because of sieving, suggesting that this group of remains was not severely overlooked by handcollecting. Comparable methodological observations have been documented in the case of other medieval sites (Ervynck, 1993) and must lead to the conclusion that bird bones are indeed rather rare on Saltés, as on many other medieval sites. Since only the presence or absence of the mollusc taxa was recorded per context, no evaluation of their abundance per campaign could be made.

TAPHONOMICAL ASPECTS

With a few exceptions, the shells of marine molluscs found at Saltés are to be regarded as human consumption refuse. The collection mainly consists of uneroded specimens of large, consumable species. Only the "razor blade" shells of the *Solen* and/or *Ensis* specimens were mostly broken but, considering their brittle nature, this can be seen as a normal condition. Two species, *Cerithium vulgatum* and *Dentalium* sp., are small and could therefore represent intrusive finds, not used for human consumption. They could have been brought to the site accidentally, with a load of fish or with other molluscs. This scenario, however, can not be proved and is only based on the assumption that shellfish that yield a limited meat weight are often considered not to be consumable. The only shells that are without doubt intrusive are some of the *Glycymeris glycymeris* that show clear traces of erosion, i.e. a rounded, abraded shell, often with a perforation at the umbo. These shells clearly were not brought to the site as parts of live animals; they more probably were once part of a beach deposit, eroded by the tides, that was used within town, e.g., for levelling or consolidating. Finally, the small shells of terrestrial gastropods are also considered to be intrusive.

All fish and bird remains found must come from animals that have been used for consumption. The only exception could be the herring gull, a bird that is commonly considered to be less suited as a food item in Europe. Within the consumption refuse category are also included the bones of hare, roe deer and red deer that were hunted for their meat, and those of cattle, sheep and goat that were the domestic meat providers. The only exception is the find of an incomplete sheep skeleton. The taphonomic status of most other mammal remains does not pose many problems. The black rat, an unidentified rodent and an insectivore species are without doubt contemporaneous intrusives. Cats and dogs were most probably also not eaten at medieval Saltés; their bones must represent what is left from carcasses that were buried within town. Whether the horse bones come from buried, complete animals or are consumption leftovers, is more difficult to decide. When the first scenario holds, these skeletons must have been disturbed in later times, because complete horses have certainly not been found during the excavations. It is unfortunate that, due to the limited finds of horse bones, an evaluation of the fragmentation and the presence of chopping or cutting traces is difficult. However, some of the bones are indeed broken up and do display the traces mentioned. Therefore, it can not be excluded that part of the horse remains is the result of human consumption.

Part of the rabbit bones found certainly represent kitchen or table refuse. However, since the rabbit is a burrowing animal that still occurs in large numbers in the region of Saltés, it has to be taken into account that, after the site was deserted, animals may have disturbed the medieval deposits. When these rabbits occasionally died within their burrows, their remains could become part of an archaeological context. The only way to distinguish bones that are consumption refuse from those that are part of buried intrusive animals is the recognition of complete skeletons while excavating. However, intrusive skeletons can also be disturbed by later burrowing animals, which further complicates a taphonomic reconstruction. Rabbit bones at Saltés show no differences in colour compared to the other bones excavated at the site. Complete skeletons have also not been recorded by the excavators, although this can be linked to the excavation techniques applied. It will thus be assumed that rabbit bones in the collections mainly represent medieval consumption refuse, although it must not be forgotten that part of the collection has possibly nothing to do with the medieval site.

THE FOOD ECONOMY OF MEDIEVAL SALTÉS

Animal husbandry

Generally, the area around medieval Saltés is described by the contemporary writer al-Himyari

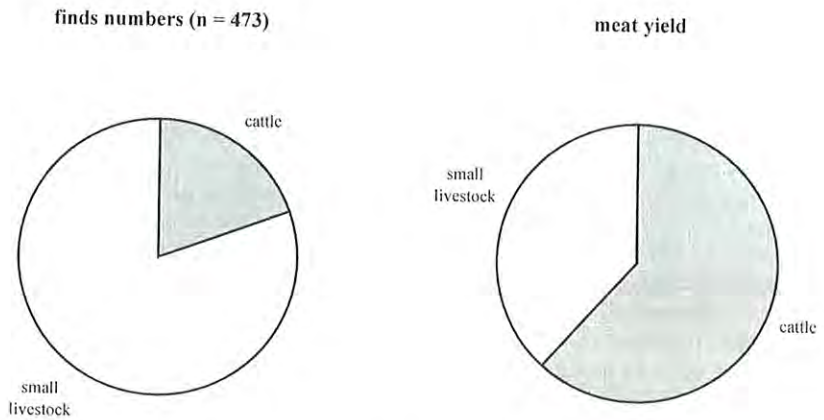

FIGURE 5
Frequency of small livestock versus cattle (all assemblages combined), on the basis of the finds numbers and of the calculated meat yield (see text).

as having good pastures, that were always green and had sufficient fresh water sources (Bazzana & Cressier, 1989: 35). The site thus had ample opportunities to rear livestock. The inventory showed that, in terms of meat consumption, sheep was the most highly priced animal at Saltés; cattle was slaughtered in considerably smaller numbers (Figure 5). Of course, it must be taken into account that each cattle bone stands for a much larger meat weight than each sheep element. If we estimate the meat yield of a medieval sheep at 15 kg and that of medieval cattle at 100 kg (Nobis, 1965), and assume that, for each species, the number of individuals stands in the same relation to the number of bones found, the meat weight of cattle and sheep can be evaluated against each other by simply multiplying the number of bones with the meat yield per individual (Figure 5). Such a calculation shows that, in terms of food intake, cattle was more important than small livestock but this does not say anything about what meat was most in culinary demand. Written sources indicate that the meat of young sheep was most appreciated within the cuisine of Muslim Spain (García, 1996). Find numbers of the Saltés collection are in accordance with this. Moreover, sheep remains also evidenced a high frequency of bones from subadult animals. The frequency of subadult individuals was much lower within the (slaughtered) cattle population.

There still remains a possibility that the low frequency of cattle bones in the excavated contexts is the result of taphonomical processes. Maybe larger bones amongst the kitchen refuse were more easily cleaned away? Or perhaps only few bones of cattle, that were slaughtered outside the main habitation area, were brought to the site, attached to the meat? These arguments can not be ruled out but it needs to be stressed that no intra-skeletal selection was visible within the set of cattle remains. Moreover, a dominance of small livestock has been recorded from many other Iberian Muslim sites, such as Calatrava la Vieja (Morales *et al.*, 1988), Mesas do Castelinho (Portugal: Cardoso, 1993a, b), Silves (Portugal: Antunes, 1991) and Mértola (Portugal: Antunes, 1996; Morales, 1993b).

The absence of pigs (and wild boar) from the consumption refuse must of course be linked with the Muslim taboo on this animal. Muslim sites in Spain sometimes contain some pig remains, perhaps due to the presence of a small nucleus of Christian people within the settlement. Examples are Calatrava la Vieja (Morales *et al.*, 1988), Mértola (Antunes, 1996) and Mesas do Castelinho (Cardoso, 1993b). At Saltés, however, not a single bone was found. This complete absence is striking since the medieval writer al-Himyari mentions the presence of an important number of Christians at Saltés (Bazzana & Cressier, 1989: 35). Perhaps these people had no access to pork or were living in a different part of town, outside the excavation area? An example of another Iberian Muslim site with a complete absence of pig or wild boar bones is Silves (Antunes, 1991).

The presence of horse bones must also be discussed within the context of religiously framed food patterns. The problem, however, is that it

remains uncertain what the taphonomic status of the horse remains was. Was horse occasionally eaten at the site, or do the bones represent parts of buried carcasses? It is not probable that dead horses were buried within the dense habitation zone but perhaps parts of dead animals were fed to the dogs? Written sources certainly do not suggest that horse meat was highly esteemed within the medieval Muslim cuisine (García, 1996). Some horse bones were also found amongst consumption refuse at Islamic Calatrava la Vieja (Morales *et al.*, 1988), Mesas do Castelinho (Cardoso, 1993b) and Mértola (Antunes, 1996; Morales, 1993b), although Morales (1993b: 265) considers them not to be consumption refuse.

As has been discussed, there are no biometric grounds for the presumed presence of domestic rabbits at Saltés. Such possibility, however, can not be excluded. The same is true for the remains of anseriform birds and of mallard. Perhaps chicken was the only domestic bird at the site but, certainly, they must have been common. Domestic animals that were not kept in town to be consumed, are dogs and cats. The latter were presumably useful for the destruction of small commensals, such as the black rat. Dogs served as guards or company.

Hunting

The wild mammals that could be hunted in the area around Saltés include roe deer, red deer, hare and rabbit, when one assumes that not all specimens from the latter species were domesticated. The hunting of wild fowl brought red partridge, dove, and possibly also a small passerine, geese and mallards to the site. Geese were hunted only during winter. With the exception of rabbit, wild animals were only responsible for a minor part of the meat supply. Important find numbers of rabbits are typical of other Islamic sites from the Iberian Peninsula. Examples are Calatrava la Vieja (Morales *et al.*, 1988), Mértola (Antunes, 1996; Morales, 1993b) and Mesas do Castelinho (Cardoso, 1993a). In no case did the study of these sites testify to the presence of domestic rabbits.

Fishing

The importance of fishing with nets at Saltés is reflected by the multiple finds of net weights (Bazzana & Cressier, 1989: 47), and cylindrical terra cottas (Bazzana & Bedia García, 1993: figs. 27 & 28). The species spectrum of the fish and the cuttlefish consumed at Saltés, and the size distribution within the genus *Pagellus*, indicate that coastal fishering was the prevalent way to exploit marine resources. The most important fish caught were the sparids, a pattern that is comparable to most other sites in the area (Morales, 1983; Roselló & Morales, 1987, 1990). Sparids are easily caught, e.g. with trail-nets on the beach. Next to the sparids, cartilaginous fish seem to have been an important yield from the coastal fishery. Rays and sharks were certainly not rejected as food items. Fishing with nets was also practiced at the open sea. In that way, mackerels, pilchards and blue tuna arrived to the site. The faunal spectrum of fish from medieval Saltés is almost identical to that from the nearby protohistoric site of Cabezo de San Pedro (Lepiksaar, 1973).

Compared to the sparids fished close to the coast, the importance of the open sea fishes seems to have been limited. However, it is possible that the tunas were butchered and that most of their bones were removed from the flesh before they were brought into town (Morales, 1993a). This taphonomical pattern would underestimate the importance of that fish sector in the food supply of the site. Another agent responsible for the underestimation of the fish catch in the open sea, involved processing and subsequent transport inland. Fishing with nets could result in a catch which was too large for immediate local consumption. Drying, smoking or pickling could certainly help preserve this surplus.

Some evidence of fish processing was found at Saltés. During previous excavations (Bazzana & Cressier, 1989: 27) two pickle or brine baths were excavated at the edge of the site, near the estuary. Their construction was dated to the Roman period but they could possibly also have been in operation during medieval times. Unfortunately, the archaeologists emptied the brine baths at Saltés to take measurements but did not take any samples of the material filling them. A physico-chemical dating of the contents was therefore impossible. Traditionally, the heydays of the fish salting industry along the southern Spanish coast are thought to be restricted to the Roman period (Ponsich, 1988). Lack of samples from the baths also hampered the possible identification of the species processed. Generally, fish processing produced two types of food items: salted fish (*salsamenta*) and fish sauce (*garum*, *muria* or *allec*) (Morales, 1993a: 136-137). The open sea fishes, i.e. mackerels and pil-

chards, were well suited to be processed into these products. The role of tuna in the process is critically reviewed by Morales (1993a).

Historical sources from Almohad times tell little about the economics of fish selling and trading (Morales *et al.*, 1994). Later texts, however, describe that within the kingdom of Granada, tuna was one of the most highly priced (thus expensive) fishes. Sole also ranked high as a food product. Sparids were much cheaper, perhaps because they were easily caught, in large numbers, perhaps because their meat is full of spines. Cartilaginous fish did not command high prices either, but this could be to the generally low culinary value of their meat (Malpica, 1984).

Gathering of molluscs

The species inventory (Table 1) showed that the consumption of molluscs was not restricted to a few species. Most of the marine shells are from large specimens. Just like the fishing activities, the gathering of benthic molluscs took place mainly close to the coast. Soft substrates were explored in search of shellfish that lived in the sediment, such as, e.g., cockles (*Cerastoderma edule*) or "razor blade" shells (*Solen/Ensis* sp.). Other species were collected on the substrate, especially those occurring in banks, such as oysters (*Ostrea edulis*) and mussels (*Mytilus edulis*). The only molluscs from deeper water are the non-intrusive specimens of *Glycymeris glycymeris*, that were probably side catches of the offshore fishery.

Meat or fish?

The archaeozoological data gathered at Saltés do not allow one to estimate the contribution of the various animal items to the diet of the town's inhabitants. Such an evaluation is always difficult, due to differences in preservation and recovery chances of the animal remains. The fact that not all remains were sampled in a non-selective way during the excavations obviously hampers any straightforward interpretation. Nevertheless, the finds do suggest that marine resources were very important for the settlement. Consumption refuse from fish can be found everywhere and, even though large molluscs are not abundant in all archaeological contexts, this can be due to specific disposal patterns of large refuse items.

Written sources on the cuisine from Andalucia indicate that fish was not highly regarded as a food item for the upper classes. This is reflected by the fact that, in Muslim cookery books, little attention is paid to fish (García, 1996). Other authors, such as Arié, state that '*les Andalous furent de tous temps amateurs de poisson de mer*' (Arié, 1974-75: 304). Generally, the texts indicate that fish was especially popular amongst the people living along the coast and close to rivers. Fish, that was elsewhere seen as an occasional item in the diet, provided an essential part of the food supply for the coastal and riverine Islamic populations (García, 1996).

The economic relation between Saltés and inland sites

It remains to be investigated to what extent the settlement at Saltés must be interpreted as a self-sufficient production unit within medieval Muslim Spain or whether import and export were important aspects of the food economy. Although medieval written sources describe the presence of good pastures around Saltés, it is probable that livestock consumed in town was not all reared in the immediate surroundings of the city and was often imported from other regions. That small livestock was reared in a transhumant system is well documented for medieval Spain (Moreno, 1997) and makes it probable that the city benefited from animal husbandry that took place further inland.

It has been shown that Saltés produced food products that could be of potential trading interest. The commercial function of the town is mentioned by contemporary written sources, such as the geographical works by al-Idrisi and al-Himyari (Bazzana & Cressier, 1989: 33-34). Another contemporary writer, Ibn Said, specifically described Saltés as an important fishing center, where fish was salted before being exported to Sevilla (Bazzana & Cressier, 1989: 34). The author gives no indication about which species were processed and also does not specify in what way was the fish salted. It is possible that the Roman brine baths described earlier have to be linked with this export, but this can not be proven. Most probably, in the case of fish that was of the fatty-meat type, i.e. pilchard, mackerels and tuna, an elaborate processing took place (Morales *et al.*, 1994). From historical sources it is known that at Sevilla fresh fish was also eaten. Coastal towns as Saltés could therefore have been responsible also for the supply of fresh products, that could mainly have consisted of sparids (Morales *et al.*, 1994).

element	remains recovered	greatest length
upper skull	fragments of one specimen	
lower jaw	fragments of one specimen	
vertebrae	1	
ribs	23	
scapula	2 (1 L, 1 R)	
clavicula	3 (2 L, 1 R)	42.6 / 43.2 / 44.1
humerus	3 (2 L, 1 R)	62.1 / 62.4 / 63.0
ulna	2 (1 L, 1 R)	57.6 / 57.7
radius	3 (2 L, 1 R)	50.0 / 50.2 / 50.7
femur	2 (1 L, 1 R)	71.9 / 72.2
tibia	4 (2 L, 2 R)	61.2 / 61.4 / 62.2 / 62.7
fibula	2 (1 L, 1 R)	59.6 / 60.1

TABLE 4

Human remains found in a medieval refuse context at Saltés (L: left, R: right), and measurements of the greatest length of the long bones (in mm).

Archaeozoological evidence for fish trade in Almohad Spain comes from inland sites such as 12th to 13th century Mértola (Portugal), where (a few) bones from pilchards and sparids were found (Antunes, 1996; Roselló, 1993). In an early 13th century archaeological context at Calatrava la Vieja (La Mancha, Spain), pilchards, sardinellas (*Sardinella aurita*) and horse mackerel (*Trachurus trachurus*) were found as imported seafish (Mo-rales *et al.*, 1994). The faunal spectrum of the imported fish indicates a trade with the Atlantic sector of the southern Iberian coast (west of Gibraltar), rather than with the Mediterranean (Morales *et al.*, 1994).

A possible trade of marine molluscs inland can not be proved on account of the written sources but animal remains from inland Muslim sites testify to it. At 9th to 10th century Mesas do Castelinho (Almodovar, Portugal) *Patella* sp., *Glycymeris glycymeris*, *Cerastoderma edule* and *Mytilus* sp. were apparently consumed (Cardoso, 1993a). At Muslim Mértola (Portugal) *Nassarius reticulatus*, *Acanthocardia tuberculata*, *Ostrea edulis*, *Pecten* sp., *Tapes decussatus* and *Cerastoderma edule* were found (Moreno, 1993), and, at another location within the same site a second author reports *Ostrea edulis*, *Mytilus galloprovincialis*, *Pecten maximus*, *Tapes decussatus* and *Cerastoderma edule* (Antunes, 1996).

HUMAN REMAINS

At one location, during the 1988 campaign, a set of small human bones was found. These remains were encountered in a refuse context, together with numerous animal remains, and were therefore not recognised as inhumations. Most probably these bones are contemporaneous with the animal remains. An inventory of the assemblage is given in Table 4, showing that all skeletal elements are present, except small ones such as phalanges, carpals, etc. In several instances left and right bones can be paired, leading to the conclusion that the remains of two individuals were excavated. When the length of the long bones is compared to reference growth curves (Johnston, 1962), one can see that both inhumations are from newborn children. Most probably, two stillborn baby's (twins?) were simply buried in the vicinity of their parents' house. It is known that in the medieval Islamic world very young children were sometimes not buried with the same regards that adults were (Simpson, 1995). The habit of burying stillborn children in the house has been also attested in the Bahia oasis (Egypt) (Fakhry, 1950).

CONCLUSION

The study of the animal remains indicates that the meat supply at Saltés predominantly came from small livestock, cattle, rabbit and domestic fowl. The exploitation of marine resources, however, must have been at least equally important for the food economy of the town. Fishing and the gathering of molluscs took mainly place close to the coast but open sea fishing provided an additional yield. Probably, an important part of the

pelagic catch was processed and traded inland.

The organic material collected at Saltés demonstrates that the site has a high potential for the study of consumption patterns within a medieval Islamic community. Only when future excavations incorporate an extensive sampling program for animal and botanical remains, can this potential be fully exploited. In that way, aspects that were not touched in the present study, such as socio-economic differences between living units, diachronic comparison within the medieval period or patterns of garbage disposal, could also be analysed. The site also offers a unique possibility to study the consumption behaviour of a protohistoric settlement lying below the medieval city.

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