

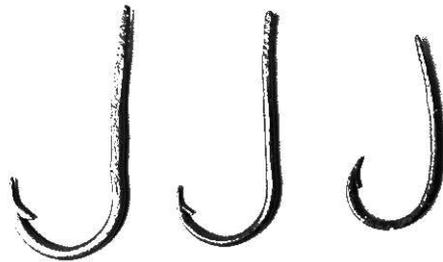
ANCIENT NETS AND FISHING GEAR

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TØNNES BEKKER-NIELSEN
and
DARÍO BERNAL CASASOLA



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7. The Origin and Development of Tuna Fishing Nets (*Almadrabas*)

ENRIQUE GARCÍA VARGAS & DAVID FLORIDO DEL CORRAL

Introduction

The closure of most Mediterranean and Atlantic coastal tuna-fishing sites, or *almadrabas*, during the last thirty years, and the transformation of some into tourist attractions, has triggered an interest in a fishing technique that has been used since ancient times (Ravazza, ed., 1999, 79-90; Ravazza, 2000, 22-24). This paper aims to contribute to the study of *almadraba* and related fishing techniques, especially concerning its origins. Our goal is not a technological reconstruction or an ethnographic description of tuna fishing (for this, see Oliver Narbona, 1982; Regueira & Regueira, 1993, 73-79; Martínez Maganto, 1992, 234-236; Ladero Quesada, 1993, 352), but to study the fishing activity in its context within different historical periods, from the perspective of both archaeology and cultural anthropology, with special attention to the following aspects:

- The physical and biological preconditions for tuna fishing.
- Fishing techniques and available sources of information.
- The historical development of ownership and management models, and the consequent “territorialization” of the coast.
- The general economic context and the commercial implications of coastal tuna fishing with *almadrabas* and related techniques.

Eco-biological requirements

Catching tuna in large coastal nets, which since the Middle Ages have been known to western Mediterranean fishermen as *almadrabas* or *madragues*, depends on two

main factors: the presence of fish shoals and access to them by means of socially complex technical resources. Given the technological conditions applicable in Antiquity, offshore fishing was an exceptional activity (Trotta, 1996, 230), only mentioned by pseudo-Aristotle, who reports that fishermen from Cádiz (*Mir.*, 136a) operated in Saharan fishing grounds (Mederos & Escribano, 1999), sailing on vessels which were known as *hippoi* because of their horse-shaped sterns (Luzón Nogué, 1988). The system did not provide large amounts of fish, but enabled the capture of a very specific kind of tuna which, again according to pseudo-Aristotle, was highly appreciated by the Carthaginians, to whom the fish was sold (García Vargas & Ferrer Albelda, 2001; 2006).

Until the European exploitation of the Grand Banks of Newfoundland in the sixteenth century (Cutting, 1955), fishing was, therefore, mainly a coastline activity. Coastal fishing used to require hard labour, and gave poor profits in return. Fishermen could only escape their miserable existence through a “spell of good luck”, filling their nets with either a large amount of fish or a smaller amount of very valuable fish (*Theocr. Id.* 21.52). Nonetheless, this spell of good luck could indeed arise in some coastal areas, thanks to the passage of huge numbers of migratory fish a couple of times a year (García Vargas & Muñoz Vicente, 2003).

One such privileged spot is the Strait of Gibraltar (Roselló & Morales, 1988; Serna *et alii*, 2004), where pelagic fish have always been available in plenty, especially tuna (*Thunnus thynnus*). Tuna enters the Mediterranean from the Atlantic in late spring. They travel in search of suitable hatching areas (gametic migration) where they can find nutrients for their offspring and where the temperature and salinity of the water favours the development of young fish (Sella, 1928; 1929; Rodríguez Roda, 1964; 1973). Although most shoals are dispersed in the waters between Algeciras and Ceuta due to anticyclonic turbulence in the sea of Alboran (Compán Vázquez, 1988, 212), they gather again in the area between Sicily and the Balearic Islands, where their main hatching areas are found.

During their outward migration, the tuna follow the currents of the sea, especially the main branch of the Atlantic current. This current enters the Strait of Gibraltar at surface level due to its lower salinity and density compared with the Mediterranean (where, as is typical of a closed sea, the evaporation rate is higher).

On their return from the hatching areas (Serna *et alii*, 2004) in the late summer (trophic migration), the shoals follow the circuits of secondary currents flowing towards the Atlantic, created by the anticyclonic dynamics of the superficial water mass, along the coast of the Maghreb. At this stage, their flesh contains less fat, due to the immaturity of the young fish and the reproductive stress recently suffered by the adults.

Two other biological characteristics of scombrids are crucial for explaining their proximity to beaches during migration (Florido & Ménanteau, 2006): their low tolerance to temperature changes and the fact that they are visual predators. The former forces them to search for warm and salty waters. The latter brings them close

to clear water coasts in search of a prey whose location varies, among other factors, with the winds, so fishermen talk about “*tuna winds*” when they are “blown” close to the coast. Finally, attacks by or the proximity of killer whales can also bring tuna very close to the coastline.

Technical aspects of *almadraba* fishing

Types of tuna fishing nets and how they operate

When fishing a shoal of tuna, either on their outgoing or return (*revés*) journey, the net must be adapted to its target. From an ecological perspective, we can distinguish between two basic types of grouping: the shoal and the school. The former is a simple association of individuals created by social attraction, whereas the latter is a group swimming in a synchronised manner. This swimming action may be polarised or not, depending on whether the group consistently moves in a given direction or changes direction in a compulsive and random manner. Both behaviour patterns are adaptative, but the former, apart from protecting the fish from predators, maintains sustained progress towards a reproductive or trophic goal. Generally, tunids progress in schools which, besides a uniform pace, involve organised distribution, with the adults leading the march, and a more or less sustained direction. The shape of the caudal fin of tuna and its oscillating (i.e., not wave-like) motion, the shape of the body and the development of the ossified scales of the chest, which help to reduce water friction, enable tuna to reach a maximum speed of 80km/h (although the average is about 45km/h). A fishing procedure intended to trap one of these large groups, comprising hundreds of fish and following the lead of fully developed individuals, must therefore try to stop the tuna before their capture.

In large static *almadrabas* of the early modern period (figure 1), which were conceived as traps comprising several chambers and fixed to the seabed, this function is performed by the *rabera*, a net curtain stretching from the beach into the sea, perpendicular to the swimming direction of the school. The *rabera* also forces the fish to swim along the walls of the net to the entrance of the succession of chambers which form the central part of a modern *almadraba*. The fish are trapped within these chambers until the fishermen decide to lift the *copo* (terminal section) of the final chamber – into which the fish, in today’s practice, are forced by boats as well as frogmen – to the surface (figure 3).

But before the use of these static devices became widespread, tuna fishing was carried out with a technique known in Spain as *vista* or *tiro* (figure 2) which had a much greater heroic or epic component. Descriptions of “lances” or *vista* or *tiro* fi-

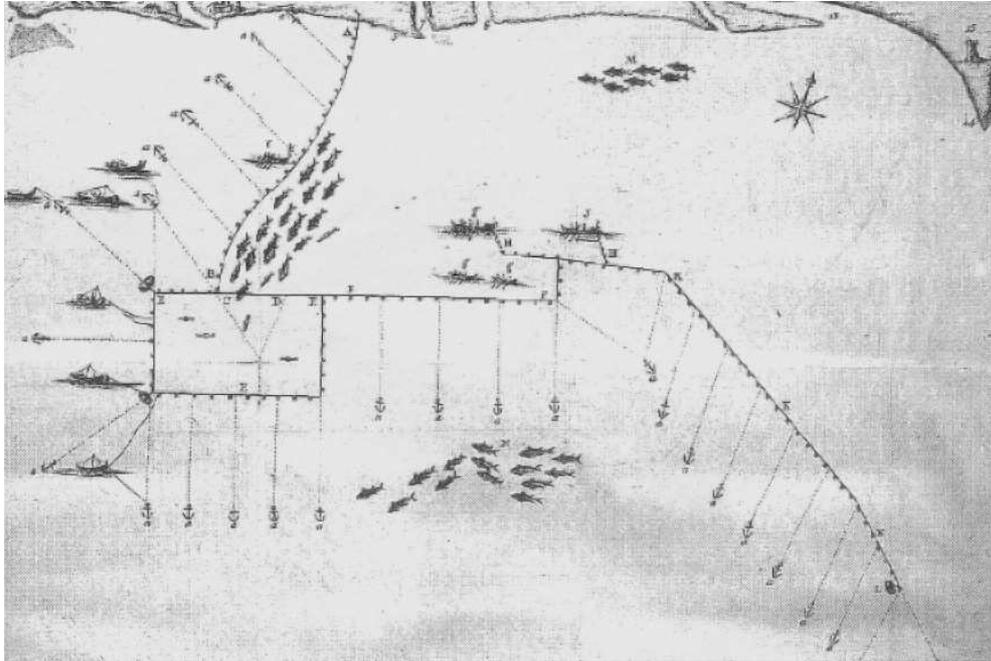


Figure 1. Modern static almadraba of buche type from El Terrón, in Ayamonte, Huelva (Sáñez Reguart, 1791-1795).

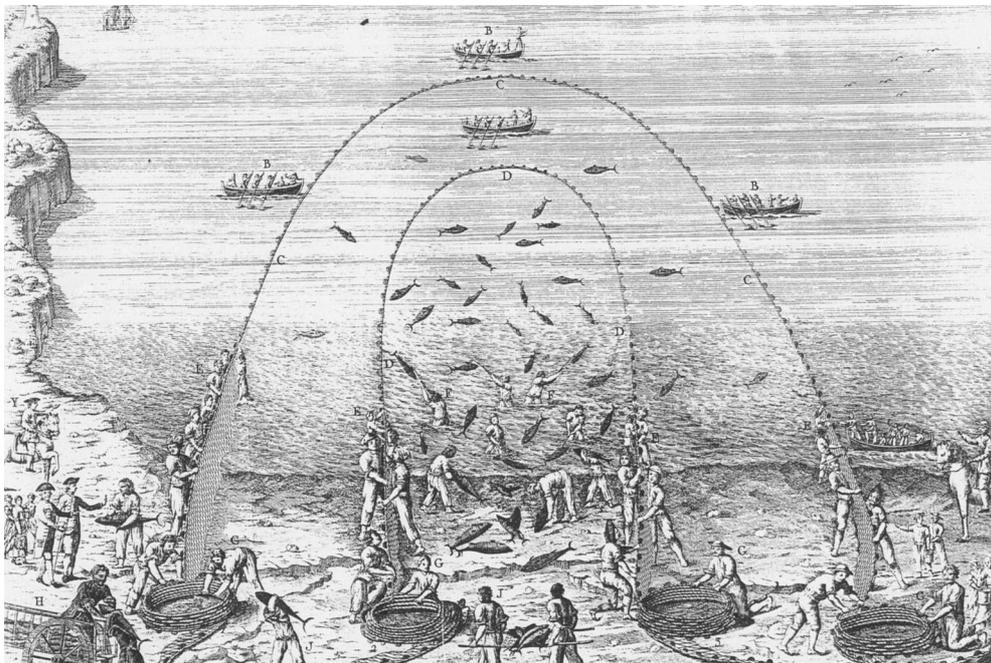


Figure 2. Old fashioned vista or tiro almadraba from Conil de la Frontera, in Cádiz (Sáñez Reguart, 1791-1795).



Figure 3. Tuna fishing in a Sicilian tonnara (Ravazza, 2000).

shing are generally based on those provided by fifteenth- to nineteenth-century historians, topographers and ethnographers (Pedro de Medina, Pérez de Messa, Agustín de Horozco, Suárez de Salazar, brother Jerónimo de la Concepción, Sáñez Reguart and father Miravent being the best known). These descriptions, besides being rather repetitive, are very simplistic. They mention two consecutive operations, which commence at the moment when the *torrero* or *atalayero* (lookout) announces the presence of tuna from a tower (figure 4) on the coast.

Recently, a more detailed description of this fishing system was published by Luisa I. Álvarez de Toledo (2007), after the reconstruction of documents and drawings from the archives of the Dukes of Medina Sidonia (*Explicación de la almadraba de tiro*, 1765), who for decades monopolized *almadraba* fishing. This description describes the vessels and tools, the guilds and categories of fishermen and a detailed sequence of the operations involved. This information is fundamentally consistent with that published in 1791 by Sáñez Reguart (1791-1795), about the organisation of the *almadraba* of Conil. Both documents provide details about the two stages of fishing using the *almadraba de vista* or *tiro* fishing systems.

In the first, several vessels (*boliches*, *calones*, *barca delantera*, *barca de segunda*) with a different number of rowers (from four to ten, depending on the type of boat), were launched to cross the path of tuna coming from the west (because the *almadraba* of Conil is *de derecho*). After sighting the tuna, the *atalayeros* would make signals to the watchmen on the boats with flags. The boats, positioned at the two ends of

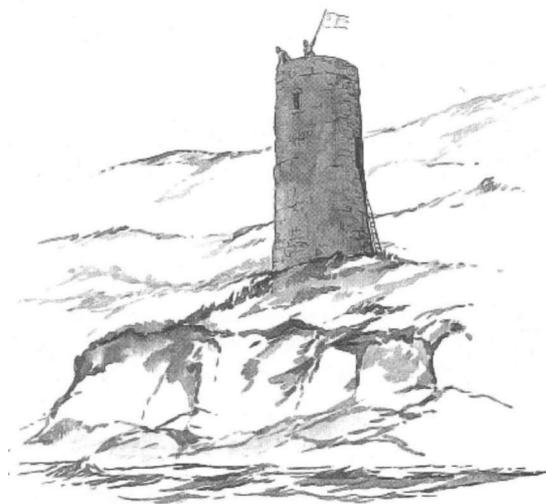


Figure 4. “El Puerco” tuna watching tower in Chiclana de la Frontera, Cádiz (Regueira & Regueira, 1993).

the fishing area, the *boliche de levante* and the *boliche de poniente*, would sail and place the nets called *sedales* (Sáñez Reguart, 1796, I, 50). The one at the east end would progress from its position towards the beach, and the one at the west end would sail along a parallel line further out to sea. The first vessel’s net or *sedal* would stop the tuna, and the second’s net would prevent it from escaping. A third boat, the *barca segunda*, would extend the *sedal de la barca*, equipped with *panda y plomo* (floats and weights) between these two nets, progressing towards the west. Once this net converged with the eastern and western *sedales*, the trap was complete, and the sailors would cease to row. However, there would still be a gap at the ends of the nets (*cabrestreras*) through which the tuna could escape. This was prevented by small boats (*calones*) with crews making noise, hitting the boat and the sea surface with their oars and throwing stones to keep the tuna away from the gaps. In the meantime, the ends of the nets would be provisionally stitched together from the boat called *calón de cabrestretera*.

This signalled the start of the second stage of the process, encircling the tuna with a thicker net and pulling it in towards the land in order to capture it on the shore. A boat called *calón de sirga* would set a rope (the *sirga*) encircling the *boliches* and through which the *cinta* – thicker net, reinforced in the eastern side (Sáñez Reguart, 1791, II, 291) – would be set. The watchmen of the boat performing this operation would be directed by the *atalayeros*, in order to follow the arch required to catch all the tuna. The *ventureros* were responsible for pulling in the *sirga*. Among them, the *cabeceras* would be located on the shoreline, inside the water, to prevent the tuna passing above the floats of the *cinta*, while the *ventureros* pulled the *sirga* in from the beach. According to most sources, the *cloqueros* or *paralelos*, who had pushed the boats out to the sea at the start of the operation, would then kill the tuna, armed with hooks.

Ancient tuna fishing in literary sources

Ancient literary descriptions of tuna fishing appear to refer to a *vista* or *tiro* system, although it is not entirely clear whether the net circles used were double, as in later sources. However, the ancient descriptions available are incomplete or metaphorical, and difficult to understand and interpret. The elder Philostratos from Lemnos, who wrote in the third century AD, describes (*Imagines* 1.13) a painting showing tuna fishing – without giving many details, however, since the text refers to a drawing. The second-century author Oppian (*Hal.* 3.620-648) prefers metaphoric language (doubtless making interpretation more difficult), pointing out that the nets take the shape of a city, with precincts and gates. His near-contemporary Aelian (*N.A.*, 15.5) describes the setting of the nets from the five boats advancing in line (this volume, p. 186), but does not explain how the tuna are encircled. The best way to get an idea of this fishing technique applied to tuna is possibly to combine these descriptions and compare them with similar fishing techniques described by the Spanish chroniclers mentioned earlier.

According to Philostratos, Oppian and Aelian, the manoeuvres always begin with the sighting of the fish, from a high point which literary and epigraphic sources normally refer to using a derivative of the verb *skopeo* (watch, observe or sight): *skopia*, *thynnoskopeion*. In Aelian, the watchtower is a structure of pine timber, to which the net that was thrown after the sighting of the fish would be attached. This kind of wooden watchtower, in which two converging posts bend towards the sea, as described by Aelianus, is known throughout the Mediterranean in the Byzantine, Medieval and Modern periods, but its existence in Kyzikos, in the Hellenistic period of a watchtower (*skopia*) belonging to the municipality (Robert, 1950, 81-83) and rented by a guild of fishermen, might indicate that this structure was more than a simple wooden frame. In fact, on the Andalusian coasts around the Strait, the *torres almenaras*, conceived in the modern period for the surveillance and defence of the coastline against the incursions of the Barbary pirates also played an important role as watchtowers for tuna fishing. Sometimes, as with the *almadraba* of Torres de Hércules, in Cádiz, these towers were built especially for watching the horizon during fishing operations. The presence of these towers for fishing became so pervasive that the *avistador* (corresponding to the *skopiazon* of ancient sources) was commonly called *torrero*, “tower-man”.

Once the tuna-watcher, whose wonderful wisdom is praised by Aelian (*N.A.* 15.5), had estimated the size and direction of the school, fishing operations would begin. Once again, Aelian reports that each of the five boats advancing in line drops a net, but he does not extend his description to the other operations, although he does not forget to point out that the rowers capture the fish as if they were assaulting a city.

The picture of a besieged city is also evoked by Oppian (*Hal.* 3.640-641), who indicates that the fishing technique consisted of encircling the school with the net,

consistent with Philostratos (*cf.* also Manilius, *Astron.* 5.667: *circum vallata sagena*); he also adds that the method recalls the image of a city with its gates and guards (*Hal.* 3.643). This last remark has led to belief in the existence of static nets, similar to the ones used nowadays. The insistence of ancient authors on the encircling operation resulting from throwing the nets from boats, however, seems to point not to a passive device to trap the fish, but to an active system similar to modern *vista* and *tiro almadrabas*. This is also implied by the use of the term *sagena* or *sag n* to refer to the net itself.

Oppian could be describing a hybrid device, a very primitive sort of *almadraba de buche*, including *sagena* and a death chamber; alternatively, he may be referring to something else, and has been misinterpreted. The latter seems more likely, because when comparing the *almadraba* to a city, the poet seems to be picturing the most characteristic image of a city: its walls. The comparison between *sagena* fishing and the conquest of a city by siege (an image also present in Manilius and Aelian, who refers back to Homer) is an old Greek literary *topos* (Mastromarco, 1998), in the different versions of which citizens are compared to the tuna trapped in the *sagena*; and hence Oppian's comparison, a few lines earlier, comparing tuna with the phalanxes of an emigrating nation which is surrounded and annihilated.

Leaving the explicit reference to gates and guards aside for a moment, although we will return to it shortly, a joint analysis of the texts by Philostratos and Oppian points to a circular manoeuvre encircling the school of tuna. The operation was, according to Aelian, carried out from five boats setting the net with which, thanks to the strength of the rowers, the school was blocked shortly after being sighted. According to Perez de Messa (1595), a similar fishing technique was used in Conil during the Modern Period by six or seven boats, although in this last case, the boats were already forming a circle before the arrival of the tuna.

Nothing in the ancient references points to the existence of nets arranged concentrically, with the possible exception of Oppian's reference to precincts and guards, which recall the connections between the *boliches* (*sedales de boliche*) and the *sedal de segunda* in Conil's *almadraba* (see above; Sáñez Reguart, 1791-1795); the boats called *calones* would be located in the gaps between nets, called *cabestreras*, the rowers beating the water to prevent the fish from escaping through the gaps. In Colibre's *almadraba* (Rosellón), some of the nets were lifted to direct the fish from one chamber to another, so the precincts, gates and guards of Oppian can be understood as a reference to several nets somehow connected. This net structure by sections is also confirmed by Philostratos, who says that sometimes the fishermen would open the net partially to let some of the fish go, preventing the net from breaking under the weight of too many of them.

The conclusion seems clear. In sum, during antiquity, the literary sources are focused on a relatively late period (second-third centuries AD), describing some type of fishing technique *a la vista* (García Vargas, 2001). The possibly earliest mention

of a static *almadraba* trap is not found in the ancient “literature” until the provisions of Byzantine emperor Leo VI “the Philosopher” (*Const.* 57), regulating some aspects of these fishing techniques and devices – that in his time (the early tenth century) were known as *epokhai* or *remorae piscatoriae* – especially the minimum distance between nets to prevent them from damaging each other. Leo VI himself believed that the lack of previous legislation on this issue was due to the fact that it was a fishing technique unknown before his own time.

Ancient tuna fishing in epigraphic sources

The ancient epigraphic sources coming from Greek cities, referring to coastal fishing, are also devoted to tuna fishing techniques *a la vista*. Legal inscriptions (Fernández Nieto, 2006) often define public or private ownership of watchtowers or towers (*thynnoskopieia*), in which rental and fees were commonly a matter of dispute between neighbouring communities; all the fishermen’s trades and denominations mentioned in the few sources generated by fishermen guilds refer to the typical operations performed in an *almadraba de vista y tiro* (Fernández Nieto, 2002).

Two inscriptions from Parion, dating shortly after the foundation of the Caesarian colony, refer to the organisation and operation of two fishermen’s guilds created to rent two watchtowers from which to sight tuna (Robert, 1950, 81-91). Unfortunately, one of them (*CIG II add.* 3654b = *IGSK* 25.6) is in a very fragmentary condition, but the preserved text mentions a fishermen’s corporation, created in a place called *Phroy*[...]. There was a *skopiazôn* or watchman among them. The other inscription is preserved in full (*IGR* 1.817 = *IGSK* 25.5) and refers to a fishermen’s guild organised in a place called *Neilaios* within the colony. Among the members of this corporation, under the leadership of the principal investors (*arkhontes*), there are five net-masters (*diktyarchai*), two of whom also act as watchmen, and five boat-masters (*lambarchai*). This indicates that the fishing involved at least five boats. The inscription portrays the typical labour organisation for *almadrabas de vista y tiro* in the Strait of Gibraltar in the Modern period. Indeed, the trades mentioned clearly reflect those with which we are already familiar. The number of boats is five, corresponding to the five mentioned by Aelian (*N.A.* 15.5) for the operation of setting the net, and the six or seven mentioned by Pérez de Messa for the Conil *almadraba* in the late sixteenth century.

The situation in Parion during the late Republican period perhaps reflects continuity from the Hellenistic period. If we compare this information with that provided, for the same geographical context, by literary sources (above, p. 207), we can conclude that between this period and the middle imperial period, the fishing devices today known as *almadrabas de vista y tiro* were very common in the Aegean. The situation in the west must have been very similar.

Historical models of fisheries management

Ownership of fishing grounds: legal basis and historical development

Gianfranco Purpura is authoritative about the absence of any kind of public monopoly over coastal fishing during Antiquity: “*in nessun caso nel mondo greco ed orientale – e poi nel romano – è attestata la concessione statale del mare o del lido*” (Purpura, 2008). F.J. Fernández Nieto (2006, 207) argues a similar case for the ancient Greek world, based on philosophical texts (Plato, *Leg.* 7.824a; Arist., *Econom.* 2.2.3a [1346b]) and a rich collection of Greek legal inscriptions illustrating many examples of privately owned fishing grounds or of the rental to individuals, not of coastal fishing rights, but of the public watchtowers themselves. P. Ørsted (1998) also asserts that the state did not exert monopoly over or concede rights for coastal fishing, based on the Roman legal concept of the sea as *res communis*.

It seems unlikely that, in normal conditions, private individuals could impose any kind of restriction on coastal fishing. An opinion of Ulpian (*Dig.* 8.4.13.pr.) records a legal dispute over the tuna fishing prohibition imposed by the owner of the Geronian *fundus* over the purchaser. The seller claimed that he or his estate had been damaged because he kept an adjacent estate, called Botriano, dedicated to this activity (*Venditor fundi Geroniani fundo Botriano, quem retinebat, legem dederat, ne contra eum piscatio thynnaria exerceatur*). The judge’s decision, in this case, is to uphold the prohibition, but only in consequence of the *bona fides* of the contract. It is clear that, under normal conditions, no private law restrictions could be applied to the sea (*quamvis mari, quod natura omnibus patet, servitus imponi privata lege non potest*). The text is, however, more interesting for what it allows *de facto* than for what it disallows *de iure*. It seems that this is one of the earliest examples of private ownership being imposed on the shore. This would justify the application of private law limitations on fishing on coastal estates, provided that the owners had previously agreed over the issue. If that is the case, the *servitus thynnos non piscandi* would belong to the sort of relationship between provincial estates mentioned by Gaius (*Inst.* 2.31) as susceptible to be agreed upon on the basis of *pactiones et stipulationes*.

This process leading to private ownership over fishing rights which took place in the Severan period, would have its culmination in the *pars orientalis* at dates much later than those witnessing the collapse of the western empire. The Byzantine emperor Leo VI’s “fishing legislation” implies an extension of regal rights not just over the shoreline, but also over the sea. The development of new static trap devices (*epokhai*) required new legislation affirming the exclusive ownership of the *dominus* of the coastal waters adjacent to the properties, or at least over a certain section of them. Therefore, Leo VI establishes, through constitution number 56 that “the owner will have exclusive ownership over the shoreline, having the right to

prohibit unauthorised fishing on the beaches”. Constitution 57 establishes that the minimum distance between neighbouring *almadrabas* shall be 365 steps – *orgyai* – (700m), or 350m (182½ steps) to each side. Constitution number 102 forces owners for whom the adjacent shoreline extension is not large enough to respect the minimum distance, to communally set a single net, calculating costs and profits in proportion to the size of the estates. Finally, constitution number 103 eliminates this proportional division by imposing an equal one, irrespective of the size of the estates, because “fish are not always in the same place waiting for fishermen, and because the bigger part cannot survive without the smaller”. With this, the fishing device is in legal terms detached from the shoreline upon which it relies, something to be expected when the fishing system does not depend on the beach as is the case with static or semi-static *epokhai* or *remorae pescatoriae*.

It is interesting to note that legal disputes among owners, which constitution number 104 attempts to regulate, establishing a statute of limitations for infractions related to distance between nets, include churches, monasteries, hospitals, charities and public tax institutions among the owners of *almadrabas*. These were affluent institutions, able to fund capitalisation costs, although the statute of limitations was longer for them (forty years) than for non-institutional owners (ten years, extended to twenty *in absentia*).

There were some attempts to recover public ownership of fishing grounds during the reign of Michael VII (1071-1078), although, during Nikephoros III Botaneiates’ (1078-1081) reign, private ownership of the shoreline and the sea itself was definitely sanctioned, “returning what belonged to God to God”, returning to the churches and monasteries of Constantinople full ownership over their *skalai* and *epokhai* (docks and fixed nets) as a natural extension of their landed property (Dagron, 1995, 66).

Management of ancient and medieval tuna nets in the Mediterranean. From the *liberum mare* to the privately owned resource. Territorialisation processes

The inscriptions from Parion, cited above, point to a continuity of a lending system originating in the Hellenistic period over the Roman period, in which fishermen’s guilds acquired temporary exploitation rights over certain publicly owned estates in exchange for an annual fee or *telos*. The inscription IGSK 25.5 reveals the internal organisation of one of such *societas* or *koinôn*, as well as the social position of its members, the relationships among them, and their different trades. The basic criterion for membership is kinship, including both free and dependents (freedmen and serfs). The *manceps* or *archôn* of this association is a free man called *P. Avius Lisimachos*, who shares control over the nets with his son *P. Avius Ponticus* and three other diktyarchs, including a man freed by *Lysimachos* (*P. Avius Bithys*),

a free man (*M. Apicius Quadratus*) and the slave (*Epagathos*) of an Artemidoros who does not seem to be a member. One of the five boat leaders (*lembarchai*) is a slave belonging to the *manceps*; another is a slave of the freedman Bithys; a third belongs to the eponymous magistrate mentioned in the inscription, *L. Flavius*, priest of the Imperial cult, while the two others are slaves belonging to a certain Asklepios, who holds no position in the guild. The helmsmen (of the larger boats?) are a freeman (*Tubellius [L?]aetus*) and a slave belonging to Lysimachos, whereas the floats-keeper, in charge of the floats on the nets (*Tomgillius Cosmus*) and the secretary and accountant of the association (*Cassius Damassipus*), are free men having no kinship links to the *manceps*.

The complex system of dependent relationships between the members of the guild and the indirect relationship of the guild itself (through a freedman) with the city's magistrates, point to the guild being part of the community's socioeconomic life. We can assume that, at least on the Sea of Marmara, fishing was an "urban" activity, subject to the regulations affecting the renting of real estate belonging to the colony. As usual, the cession of the properties refers to the exploitation of the rented resources and existing buildings, but real rights are not yet considered.

This situation will have changed over time, but it is difficult to admit legal processes leading to private ownership of publicly owned tuna fishing installations prior to the second century AD. In those owned privately, the concept of the *res communis* affecting the sea and the shoreline would, as we mentioned earlier, prevent exclusive ownership claims over the exploitation of the shore. Therefore, we cannot refer to state monopoly (public ownership of certain coastal properties is a different matter) or concessions of such (non-existent) monopolies to private owners, typical phenomena in "aristocratic" processes of territorialization of fishing grounds. The communal organization of labour and the personal nature of the concessions point in the same direction, keeping fisheries within the area of jurisdiction of public and citizen magistrates, and regulating rights and fees due during the term of duration of the *conductio*.

The process leading to private ownership of the shore and the sea began during the middle Imperial period, due to *pactiones et stipulationes inter privatos*. It had its culmination in the east, with the legislation of Leo VI and Nikephorus III, involving profound transformation of the legal consideration of the sea and the shoreline, to which the typical property rights affecting rural estates could therefore be extended. The progressive acquisition of public *almadrabas* by aristocratic houses and religious institutions also played a part in breaking previous management systems, which, at least from the Hellenistic period, were based on the leasing of public watchtowers and their respective fishing grounds.

The privatisation of publicly owned Byzantine fisheries from the tenth century onwards follows a general trend of private acquisition of leading economic activities by the aristocracy and the Church, thus creating a set of economic activities

outside the direct control of the state, managed by monasteries and imperial, aristocratic and ecclesiastical foundations: the *oikoi*. They would finally control the entire economic process, owning fisheries, buildings, workshops, harbours and commercial fleets in several cities (Dagron, 2002, 427-428.). The *oikoi* would basically operate in urban contexts, for the houses from which the corporation's properties were managed were also based on cities, although they also owned rural property. In fact, the economic role of the *oikos*, in which imperial tax institutions and the imperial house itself had a part, should not be seen as something different or alien to the state's structure, but as a special private system aimed at guaranteeing the cities' supply and organising local charities. As such, and because of its aims, the *oikos* had privileged taxation status. In these conditions, and despite the quasi-privatisation of property related to economic processes, we cannot yet refer to the territorialisation process that will eventually remove it from the urban control.

If we now focus on a region closer to Spain, we also find examples of concession of fishing rights to bishops and monasteries in Norman Sicily, at a similar date to that for Byzantium (eleventh-twelfth centuries). Nevertheless, it is normally assumed that the Norman state was able to retain most of the state's property accumulated during the Byzantine and Islamic periods (Bresc, 1981, 17), because there is no evidence of clear predominance of a manor system until the reign of Alfonso V of Aragon. The most common management system was, until the mid-fifteenth century, the leasing of public *almadrabas* to private individuals in exchange for a fee and a certain amount of fish as church tax. We are familiar with the social composition of companies of "*gabellotti*" (Costanza, 1999, 33-35), as well as the relationship between these entrepreneurs and those providing the initial capital: members of the local aristocracy or the traders, Sicilian or not, who distributed salted fish. Once again, we find the relationship between those exploiting the fishery and the citizen elite that we could infer in the case of Parion. At least in Sicily, management procedures for *almadrabas* remained fundamentally urban until a very late period, leading us to think that they were part of a pre-established territorial framework, not yet playing *per se* the territorialisation and population role that they would eventually play.

In Sicily, the conditions for this transformation came with the kings of Aragon, especially since the creation by Alfonso V, after the annexation of Naples, of the Kingdom of the Two Sicilies. The abandonment of bush agriculture and the economic retreat to the grain-producing areas of the inland regions during the twelfth century due to the dangerous conditions of the coastline, was, from the beginning of the Aragonian presence, compensated by encouraging for fishing settlements and *almadrabas* that helped to repopulate the region (Ravazza, 2000, 22-23). The general climate of insecurity produced by warfare and piracy led to fortification of the *almadrabas*. They began to attract fishing and peasant population, and contributed to the economic restoration of the coast. From the mid-fifteenth century, this repopulation

process came to rely on the aristocratic houses that were enjoying the concession of fishing property rights in a feudal regime, previously in the hands of the state. It is now that we can properly refer to a process in which the aristocrats took over of the *almadrabas*, fundamentally trap-like devices, and the coastal resources associated with the activity (timber, salt, textile plants, animals, floats, labour and services from the inhabitants of the fishery...). This had an impact on their role as population attractors and as elements for the territorialisation of the coastline.

In Castile, the Atlantic *almadrabas*, in this case *de vista* or *tiro*, performed a similar function after the Strait of Gibraltar was conquered by the crown. In a true social and political *limes*, reflected in place names such as “de la Frontera”, aristocrats progressively accumulated land, population and assets, including exploitation rights over *almadrabas* and other maritime resources, such as salt-pans. In exchange, the nobles had to commit themselves to the defense of the border which, from the second half of the thirteenth century onwards, separated Castile from the kingdom of Granada. In this case, repopulation difficulties also led to effective reliance on aristocratic control, after a very brief period in which some *almadrabas* were controlled by the military orders.

The process by which the Andalusian *almadrabas* were transferred to the aristocracy goes back to 1299, when Alfonso Pérez de Guzmán the Good received the Guadiconís’ *almadraba*, between the capes of Roche and Trafalgar, from Fernando IV, along with authorisation to establish the settlement which later became Conil (Santos, 2003). The monopolistic strategy of the Pérez de Guzmán family in relation to the *almadrabas* originated as their possessions grew from Niebla to the Kingdom of Granada, in the following centuries, thanks to their grant as Dukes of Medina Sidonia. They were not, however, the only nobles to create *almadrabas*. Some villages and cities under aristocratic control also established these net-systems, which became a common issue for litigation over property rights between aristocratic houses and villages, or between two aristocratic houses, in a general environment dominated by the monopolistic pretensions of the Pérez de Guzmán-Medina Sidonia.

Here, the monopolistic issue is of less interest than the ability of some families to impose exclusive rights over fisheries that were to attract population, especially, as in Sicily, from the mid-fifteenth century. The number of legal actions to prevent others from establishing *almadrabas* increased hugely during this century, despite the fact that a royal order signed by Charles I, and dated in 1551 – directly related to the regulation of sardine fishing imposed by the Marchioness of Ayamonte on her own estate – insisting that “the sea was common to all” (Carriazo, 2001, 50). The state would not regain the fishing rights over the western *almadrabas* until the late eighteenth century. It was then that the static nets (*buche*) were introduced in the area, in the context of a public debate dominated by the theses of the productivists and the national nature of coasts, seas and fishing resources.

Economic framework and commercial distribution of *almadraba* tuna fishing

From very ancient times, fishermen specialised in the *almadraba* system were a “privileged” group in poverty-ridden fishing societies, largely because of the commercial significance of salted tuna products. Given their added value, they have traditionally been an important part of the “exports” shipped from urban ports and tuna-fishing settlements.

In the second century BC, Polybius (*Hist.* 4.38.4-5) lists salted tuna among the superfluous things (*pros de periousian*) that Athens received from the Black Sea, showing that it was a luxury. Apart from those coming from the Black Sea (Dumont, 1976-1977, 100; Braund, 1995, 163; Purcell, 1995, 138), Athenian classical literature also mentions the salted products from Phoenician Cádiz (García Vargas & Ferrer Albelda, 2006) in a specific literary context: comedy. It is a literary genre with its own rules, in which food was commonly used as a very effective literary topic, not only because the description of the characters’ diets made it easy to portray their social status but because the greed of the rich for luxury foodstuffs, especially fish, provided a large number of comic possibilities with which to make fun of their greed for *tryphê* and hypocritical pretensions of virtuous conduct (Ferrer Albelda & García Vargas, 2001).

The role of fish and fish preserves was not, therefore, just a literary topic, but the result of very specific social developments, which led to the emergence of a social class rich enough to consume increasing amounts of expensive fish (García Vargas, 2001, 24, n. 37). It is clear that the increase in demand was favoured by the development of the market institution, as well as by enhanced trade between Athens and the rest of the Mediterranean.

The situation in the other Greek *poleis* was probably very similar. The development of a literature of the *tryphê* in the western Greek world from the fifth century BC onwards suggests rapid development of this phenomenon in the cities of Sicily and *Magna Graecia* (Degani, 1982; Wilkins & Hill, 1994). This was the source of most of the wheat consumed in the Peloponnese, the traffic of which was controlled by Corinth (Dunbabin, 1948, 214). The scarce amphora remains of these products from Cádiz were found precisely in these regions: Corinth (Williams, 1979, pls. 105-24) and Olympia (Gauer, 1975, pl. 22, no. 3). The role of preserves from Cádiz in places like Athens can perhaps be extended to other Greek cities of the central and eastern Mediterranean, in the context of urban elite consumption.

In the far west, the urbanisation of the Atlantic and the Mediterranean coasts of Iberia generated a series of “markets”, closer to the Cádiz-based merchants who, from the late sixth century BC onwards, focused their activity on the marketing and consumption of salted fish. The type T-11.2.1.3. (Ramon, 1995, map 116) map of the distribution of western Phoenician amphorae can be used as evidence of the marketing of western Phoenician salted fish towards the eastern coast of the Ibe-

rian Peninsula and the Balearic islands, where its presence is attested in a few coastal settlements of varied ethnic and cultural adscription.

During the time of Cato the Censor, salted fish products from the Black Sea were a luxury on the dining tables of Rome. According to Pliny (*N.H.* 19.57), the taste for *garum* was in this period considered to be a questionable fashion. Nevertheless, ostentatious consumption spread fast among the Roman aristocracies during the second century BC, as a result of the enormous wealth streaming to the *urbs* after the conquest of *Hispania* and the defeat of Macedonia, and also as a result of the Greek fashions adopted by the city's upper classes.

It is likely that the fact that most exported products were made with red tuna and other prestigious fish, such as the sea bream, had an impact on the general perception of salted fish products, and specifically *garum*, as a luxury well into the Republican period. Archaeology provides evidence of the predominance of tuna products among the food remains found inside transport amphorae from the fifth century BC onwards (García Vargas, 2006a; 2006b). The export of products made with minor scombroids, such as different types of mackerel (*Scomber scombrus* and, especially, *Scomber japonicus*), begins to be more common from the first century BC onwards.

We have argued elsewhere (García Vargas, 2008) that the “democratisation” of taste was well under way during the early empire. This relative “gastronomic revolution” enabled mass production of mediocre preserves affordable for wider population groups, urban or rural, civilian or military (García Vargas, 2007). We are referring to *garum* cheaper than *sociorum*, fish sauces of inferior quality than the ordinary *garum* (*hallec*, *muria*, *liquamen*), solid salted products (*salsamenta*) made with mackerel, less exclusive than the *melandryae* or tuna loin steaks.

The growing monetisation of exchanges and the monetary “injection” caused by the energetic expenditure of urban aristocracies and the imperial policy towards some tax categories increased the circulation of wealth in cities through medium- and long-range merchants. This clearly benefited salted fish producers, along with other products, such as wine, not included in the *annona*.

This “democratisation” of the consumption of salted products not only affected the number of exploited species, but also the way they were captured (García Vargas, 2003). The large *almadrabas* continued to operate, but their exploitation costs and the limited short term profits offered in return, made them viable only for rich rural land owners and corporations which, such as the one we know from Parion, could count on external capitalisation. Simpler fishing systems, for the capture of mackerel, horse mackerel (*Trachurus trachurus*) or similar species, must have proliferated. Although also costly, and profitable only in the medium term, they did not require so much financial effort as the big tuna fishing devices. It is the case of the seine, operated by a limited number of men (from sixteen to twenty-four), including some on land, and the crew of the single boat (García Vargas, 2001). The little seines required for the capture of the sardine, controlled from the land or

from a small vessel, were even smaller. All these techniques provided sufficient fish at a low cost, according to Oppian (*Hal.* 3.589-591), who presents a stoic-like anecdote according to which the mackerel which had escaped from the full nets battled to enter it from without, finally trapping themselves by their heads in the meshes of the net. This reminds us that these fisheries must have also used simple net techniques, with much lower labour costs.

Although sardines (*Sardina pilchardus*) and other engraulids (anchovies: *Engraulis encrasicolus*) are present in the archaeological record from a very early date (García Vargas *et alii*, in press: sixth century BC), their role in diet and trade was restricted to local circuits and regional distributive patterns (Amores *et alii*, 2007). From the third century AD, however, these species predominate in the large excavated salting factories, as well as in the amphorae in which the products originating in the Atlantic and the Mediterranean factories were distributed. N. Desse and E. Desse-Berset (Desse, 1993, 341-346; Desse & Desse-Berset, 1993, 327-340) have related this fact to the overexploitation of mackerel fishing grounds, establishing a need for the commercial exploitation of smaller species. Recently, Morales and Roselló (2006, 63-73) have pointed out that the recorded variations in ancient fishing and fish consumption cannot be fully explained by overexploitation of fishing grounds; they may also be the product of environmental changes or socio-economic phenomena.

The socio-economic transformations are clear from the final years of the second century AD, in which the structure of the Roman state goes into a major crisis as a result of the collapse of the distribution networks for coinable metal (Chic García, 2005). We therefore favour, without ruling out the existence of overexploitation, the likelihood of a restructuring of the commercial fishing industry in the Late Empire, favouring the capture of smaller species.

A constitution passed by Honorius and Theodosius, dated to AD 415 (*C. Th.* 14.20) attempts to legislate in favour of the imperial house's fish providers, who argued that taxes did not allow them to purchase the thirty pounds of first-class fish that they had to provide in exchange for one *solidus*. This reminds us that although the majority of the fish marketed in ancient cities was of low to medium quality, there was always a market for first rate products.

In case of exceptionally large captures, the price of regular and white tuna (*Palamides: Sarda sarda*) could drop dramatically in fishing communities. This was the case in Constantinople in 582 when, during a severe famine (Dagron, 1995, 73), a miraculously abundant catch provided the markets with a sudden supply of food, and a nine-pound tuna could be bought for only twelve *folles*. It appears that under normal conditions, tuna was not a cheap product, especially not the select parts such as dry cured tuna (*homotarikhos*) or tuna belly (*hypogastrion*). In fact, the concentration of the Byzantine tuna fisheries, or of the taxes extracted from their exploitation, into the hands of bishops and religious orders, is clearly related

to the ecclesiastical need for quality food, especially for Lent and the common penitential periods of the liturgical calendar.

An anecdote about the life of saint Luke the Stylite (died AD 979) shows how the saint provides an abundant catch to the members of a fishing collective through a miracle performed from his column in Constantinople (*Life of St. Luke* 38-40 ed. Vanderstuyf, quoted in Dagron, 1995, 61). After blessing the nets, and after at least two catches, the saint angrily demands the proportion due from the second catch in church taxes, for the fishermen are trying to cheat about the number of fish caught. This “protection” offered by Luke to the Chalkedonian fishermen can be interpreted, on the basis of later Byzantine fishing legislation, as a claim to fishing rights on the part of monasteries and bishops.

The bishops and monasteries that owned fisheries (*epochai*) also had the means to market the product: urban ports (*skalai*), warehouses and shops, fleets and “commercial agents” in other cities (Dagron, 2002, 458). During the term of office of the patriarch John the Almoner (early seventh century), the church of Alexandria owned a fleet of twelve merchant ships (Jones, 1964, vol. 2, 867). All were hit by a storm on the Adriatic Sea during a commercial voyage and had to jettison their cargo. The loss was estimated at 25,000 gold *solidi*. On another occasion, a captain of John’s fleet was sent to *Britannia* with a cargo of Egyptian wheat to relieve a famine in the island (Whittaker, 1983, 168). Some monasteries, such as the Pantokrator in Constantinople or the Amonites of Thessalonike and Hierissos, sent fleets, either their own or chartered, from headquarters to their *emporía* or *aulai* in other cities to trade and to collect the rents they were due (Dagron, 2002, 422). Large secular landowners did likewise; their involvement in these economic urban transactions often kept them apart from an autarchic life style, which was more of a literary *topos* than a social reality.

In the western world, the relationships among these same aristocrats included bonds of interdependence, often reinforced by exchange and gift-giving dynamics in luxury goods, among which salted fish. This is the case of the gift of *muria Barcinonensis* that Paulinus (future bishop of Nola) had prepared in one of his possessions and given to his friend Ausonius of Bordeaux. The gift is answered with a friendly and learned reprimand from his friend (Ausonius, *Ep.* 25), for the use of the word *muria* to refer to what was nothing but a *garum* that Ausonius called *liquor sociorum*. The literary resonance of the name suggests a very exclusive product, *hematitou* (made of blood), prepared in the Spanish fashion, probably with mackerel, *bonito* or bullet tuna. All this means that major amounts of fish were still moving through the trade routes, although after the fall of the western empire the commercialisation and distribution patterns for sea products had changed considerably, in Europe as well as in Byzantium. With regards to Vandal Africa, we should note the case of Carthage, where (in the circular harbour, although not in the city) tuna remains were found, apparently testifying to the export of quality salted products as late as the sixth century AD (Hurst, 1994, 319).

The situation described above includes more modest trade circuits which moved tuna sub-products of poorer quality and lower price, made from the discarded parts of the fish: the heads and the spine. A Baetic amphora, rescued from the Chiessi shipwreck (Bruschi & Wilkens, 1996, 165-69) lost in the second half of the first century AD off the isle of Elba, contained pieces of tuna heads, a part of the fish which, according to Athenaeus (*Deipn.* 4.135e), was typical of the poor classes.

In the cities of fifteenth-century Sicily, almost all good quality fish were consumed by a very exclusive elite, as the price of tuna was higher than that of all other fishes except eels (Bresc, 1981, 15). The discarded parts from the tuna salting process: heads, bones and bloody parts, were sold to the Sicilian salting factories at a lower price than the flesh from the back (loin), the belly and the trunk, for local consumption (Bresc, 1981, 15; cf. Ladero Quesada, 1993, 354 for a similar situation in Spain). Nevertheless, luxury products became the main factor in the commercial revival of the Sicilian fisheries. The growth of the Sicilian coastal cities coincided with the emergence of new “markets” for luxury products in Liguria and peninsular Italy, including the courts of the popes first in Avignon, then in Rome, which became the main destinations for the tuna prepared in Mediterranean fisheries. The *almadrabas*, therefore, benefited from the economic growth of the Late Middle Ages and the early Renaissance, which created the conditions for the restoration of the trade in luxury products, also promoted by the financial “injection” derived from the exploitation of new metal resources, first in Europe and later in America.

During the Middle Ages, the manorial system was essential to the economic structure of *almadraba* fisheries. It provided basic resources: textile fibres for ropes and nets, timber for boats, casks, wagons and oxen, salt for salting, etc. From the sixteenth century on, the services due to the lords became regulated through contracts, which established reciprocal relationships. Until the mid-sixteenth century, the Dukes hired a “company of the *almadrabas*”, the owners of which would provide the fishing vessels. From that time on, the Duke himself became the boat owner, eliminating all competition. Personnel was paid in kind according to professional category, their labour supplemented with that of slaves and serfs, who took care of the jobs on land and the hardest tasks on the beaches.

A central aspect of the activity of the *almadraba* was the commercialisation of the catch. Commercial dynamics, indeed, affected the performance of fisheries. During most of the sixteenth century, both demand and prices were high. Salted tuna products were highly appreciated on the eastern Spanish coast and in the Mediterranean, hence the exploitation system called *a la valenciana*, “Valencian style”. Merchants from Florence were often seen in the *almadrabas*, although they were not as common as Catalans, Majorcans and traders from Valencia.

In some years, salted fish products, especially tuna in casks, were packed in Zahara and shipped from the Salado river (Conil). This has been confirmed by studies of the commercial activity of the Dukes of Puerto de Santa María (Franco Moreno & Moreno

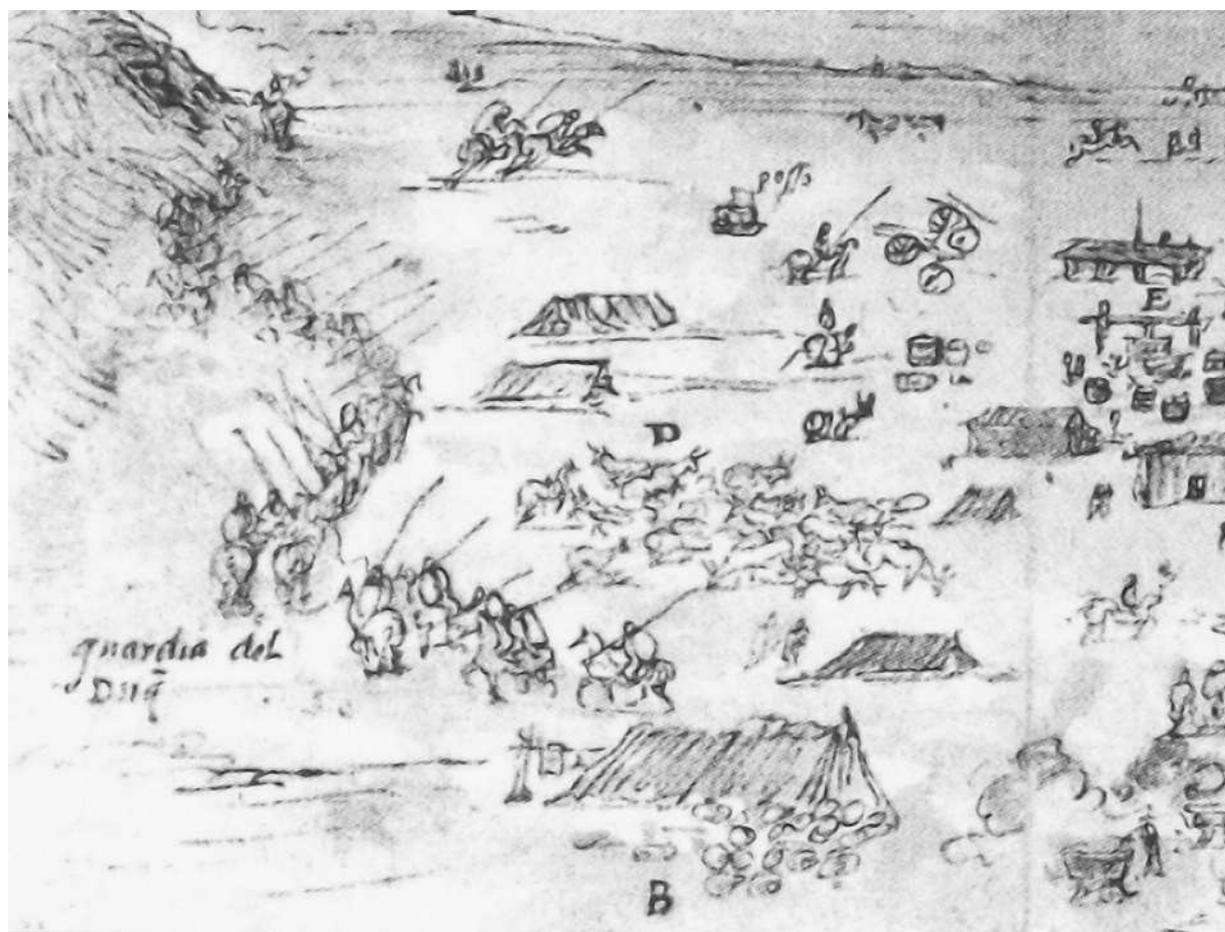
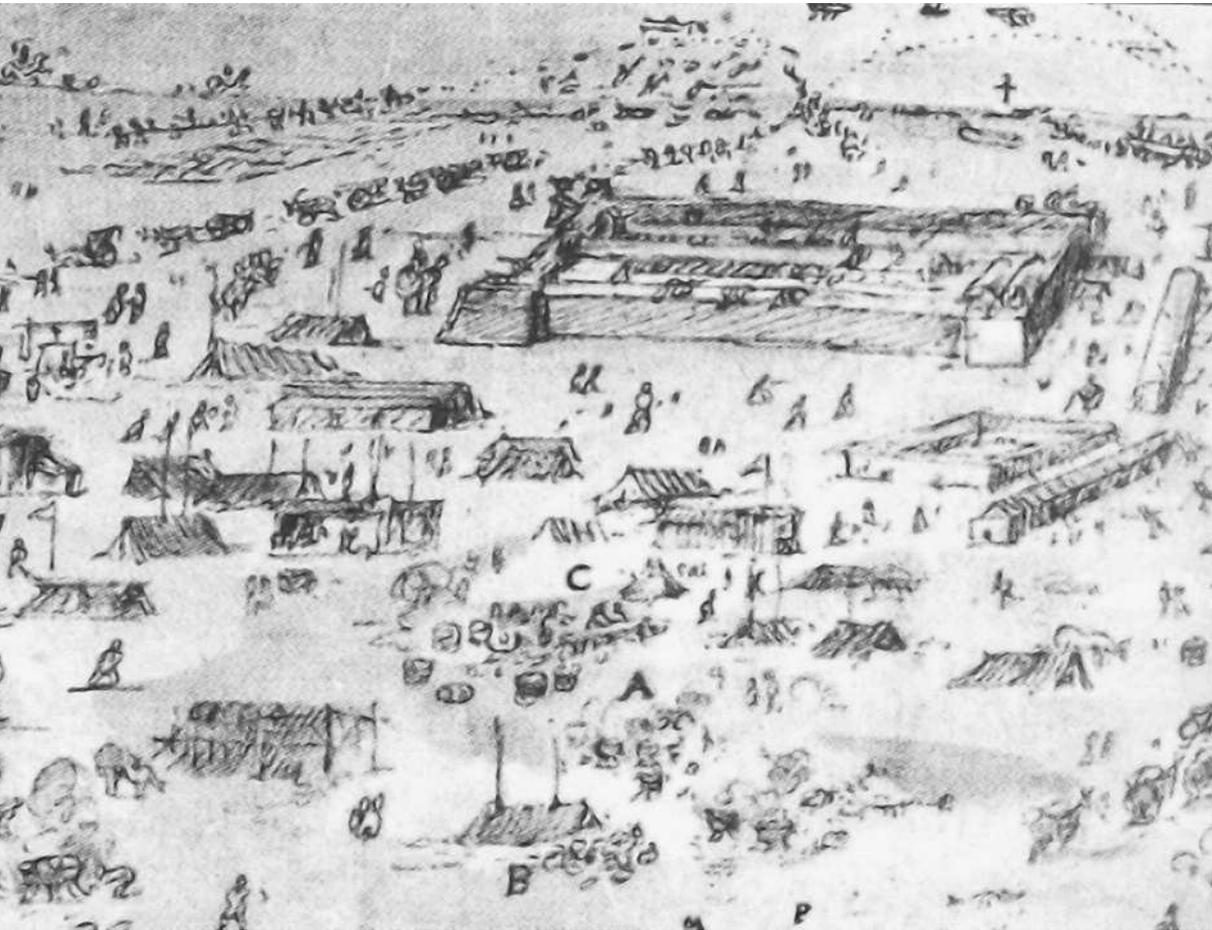


Figure 5. Zahara's almadraba in a sketch by Wyngaerde (sixteenth century).

Ollero, 1981). In the best period, the catch was sold in a single operation, but this became increasingly difficult. This is confirmed by some contemporary descriptions of *almadrabas* such as those by Santibáñez or Pedro de León (Antón Solé, 1965).

During the sixteenth century, the first symptoms of crisis begin to appear. The factory of Zahara (an *almadraba* located between Vejer de la Frontera and Tarifa) called “Mesón del Sol”, which did not have a stable year-round population until the nineteenth century, was promoted. It was visited by buyers from Andalusia, eastern Spain, Castile, Italy and Flanders, all of whom were seeking quality products (“sweet” and “refined” tuna), but at the end of the sixteenth century, demand declined due to the competition of other salted fish, cod or hake, and dumping strategies were used by traders to keep prices down.

The *Extractos de la Pesquería de Atunes, de sus Productos y sus gastos* and the annual *Libros de Almadras* (Bohórquez Jiménez, 1999; Guillaume-Alonso, 2006; Santos, 2007) reveal something of the economic organisation and productivity of



fishing for the Duchy of Medina Sidonia in the sixteenth century (with Conil and Zahara as the most important centres of production). The importance of these documents lies in the fact that they not only contain the total production of the *almadrabas* in long time series, but they distinguish income and expenditure. The former include the fresh tuna sold in the retail market, the tuna sold “because of its small size” (Guillaume-Alonso, 2006, n.10), the salt sold, the barrels, and the fish sold wholesale to traders (from twenty to thirty a year). The latter include the wages paid to the land and sea workers, the cost of the barrels, the salt, the flour used for baking bread, and other sundry expenses. Ultimately, we can distinguish between two major commodity flows: those sold through different agents and those who took the high quality tuna in barrels to different parts of the Mediterranean, and those sold to smaller traders, including those from Andalusia. This was salted and fresh fish consumed among the lower classes, thanks to the dietary constraints and taboos regarding meat in the society of the Ancien Regime.

Wyngaerde's sketch (figure 5; Kagan ed., 1989) show us that there were pans everywhere, overflowing with heads and bones, cooking the remains of tuna fish: this was a way to obtain the fat that was used to treat the boats. Álvarez de Toledo (2007) describes another production system in which fat was collected from tuna during the salt pressing process. The production of the *almadrabas* was thus not limited to fresh and salted tuna fish, but also included heads, bones, bloody parts and fat.

We particularly have to consider the role of the tuna economy in the Duchy's economic and financial fabric (Salas Almela, 2006): tuna sales provided cash which was essential to the Duke's finances. Payments were made in Madrid, where the Duchy had an agent, saving the transactional expenses involved in making payments over long distances. In other words, the income from tuna fishing was enjoyed in Madrid, which was already an important economic centre during the reign of Philip II. The financial importance of the tuna economy may also explain why this activity retained its prestige, even though catches after 1580 were considerably smaller than before.

Final considerations

The first point to consider is the possibility of drawing general, diachronic conclusions concerning tuna fishing in the Mediterranean from ancient times to the early Modern period. Although the *almadraba* is historically a relevant analytical unit and can be seen as a unitary social system in itself, it does contain elements of both continuity and discontinuity.

1. The most relevant elements of historical continuity are: i) trade-oriented economic specialisation, even at a long distance, ii) the constant relationship between technical and social systems and forms of territorial, political and social organisation, with different models of territorialisation at each point in time, and iii) the contextualisation of *almadraba* fishing in the dominant social and economic system in each period.
2. The most important transformation processes include i) going from an urban to a rural socioeconomic context, where repopulation and military functions are more important, ii) going from an urban system of ancient social relations (not excluding personal dependence) to another pyramidal system based on patronage, iii) going from a management model based on the idea of *mare liberum* to another in which the ownership of the sea and coast is predominant, tending towards a feudal organisation controlled by nobles and military and religious orders.

The second point is to consider processes of both continuity and change, together with a need to view the historic evolution of fishing techniques in their socio-cul-

tural context. Economics, political systems, product trade methods, legal concepts regarding ownership, etc., are all important for understanding the specific characteristics of fishing in a specific period. A global/local perspective of this kind, capable of articulating local dynamics against the background of overall continuities and transformations, requires interdisciplinary research and different sources for long historical periods. The conclusions will only be relevant if the data are viewed as part of a global perspective. Following Morán, we agree that “a research strategy to understand transforming societies needs to be concerned with process, with history, with the role of political and economic power as it influences social relations in time and space on a number of scales from local to global” (Morán, 1996, 9).