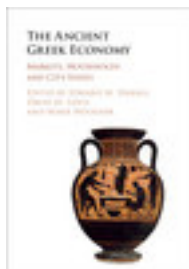


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## 'VITA HUMANIOR SINE SALE NON QUIT DEGERE'

### *Demand for Salt and Salt Trade Patterns in the Ancient Greek World*

Cristina Carusi

Before tracing the patterns of the trade in salt, it is first necessary to discuss the factors that generated these patterns. In this chapter, I start by estimating the demand for salt generated both by dietary consumption and by other productive activities. By comparing the level of demand with the availability and production of salt around the Mediterranean, it is possible to trace the main trade patterns generated by this interaction. As part of my analysis of the demand for salt, I will discuss the topic of fish processing, one of the most important and best documented productive activities in which salt was involved.

For any given community, the demand for salt is created by the dietary needs of the population and by the use of salt associated with productive activities: mainly animal husbandry and fish processing and, to a lesser extent, metallurgy, tanning, and the production of perfumes and ointments. The consumption of salt is essential for the health of the human body. In most societies, however, the amount of salt strictly necessary for the biological activities of cells and tissues is much smaller than the amount of salt actually consumed. Today, for example, according to estimates for European societies, the average individual consumption is ca. 3.2 kg of salt per annum, compared to the minimum of 1 kg strictly needed by the human body.<sup>1</sup>

The reason for this preference for salt was already clear to the ancient authors. The consumption of salt is not only a biological necessity, but also a matter of taste, whose importance must not be underestimated. This view is stated explicitly in one of Plutarch's *Table Talks* (4.4). Here the tablemates come to the conclusion that salt is the most essential and irreplaceable condiment

and serves as the main way to stimulate the appetite and make all kinds of food palatable. Indeed, hardly anything is edible without salt. The passage goes on to compare the function of salt to the role of hope for life and the role of light for colors: just as life is unbearable without hope, and colors cannot be perceived without light, in the same way flavors are disagreeable and nauseous to the taste without salt (*Mor.* 668d–f).

This was particularly true in antiquity, when cereals were by far the dominant components of the standard diet, providing ca. 70–75 percent of the caloric intake, and salt was even more essential to make palatable a particularly insipid and monotonous diet.<sup>2</sup> It is therefore no surprise that in another passage in the *Table Talks* (5.10), Plutarch states that the reason salt has been labeled ‘divine’ is because ‘men consider divine the common things which most completely support their practical needs, like water, light, and the seasons ... salt is inferior to none of these in usefulness. It serves as a kind of finishing touch or coping to the meal for the body, and adapts the food to our appetite’ (*Mor.* 685a–b, trans. Hoffleit). In this sense, adapting the food to the appetite – now as then – must be considered a primary need of the human being, not so much for ‘living’ in its narrowest sense (i.e., to assure the proper functioning of the human body), but for ‘living a life worthy of a human being,’ to put it in Pliny’s words (*HN* 31.88: *ergo, Hercules, vita humanior sine sale non quit degere*).

As a number of sources attest, the Greeks considered the consumption of salt a distinguishing trait of civilized life in contrast to ‘marginal’ and ‘alien’ peoples, who knew nothing of salt or used poor substitutes to flavor their food. One need only recall the first mention of salt in Greek literature – in the well-known prophecy of Tiresias concerning the fate of Odysseus – to emphasize the distance, in both geographical and cultural terms, between the Greeks and the peoples that Odysseus was ordered to visit in order to expiate his crimes against Poseidon. Tiresias called them ‘men that know nothing of the sea and eat their food unmixed with salt, who in fact know nothing of ships with ruddy cheeks, or of shapely oars, which are a vessel’s wings’ (*Od.* 11.121–5, trans. Murray).<sup>3</sup>

These passages reveal how taste and culture played a more prominent role in creating the demand for salt than biological needs and why the amount of salt consumed was much higher than the quantity strictly required for the functioning of the human body. In fact, the per capita consumption of salt in antiquity was decidedly higher than at present. Not only was salt an essential component of an otherwise insipid and monotonous diet, but even more important, salt was crucial for food preservation and, as such, was abundantly employed in the preparation and storage of several kinds of food at the household level.

A good indication of the individual consumption of salt in antiquity can be seen in the ration of salt allocated to slaves by Cato the Elder, that is, 1 *modius*

TABLE 15.1. *Salt Consumption in the Greek City-States*

|                  | Estimated population size | Estimated salt consumption                                     |
|------------------|---------------------------|--|
| Athens, 5th c.   | over 300,000              | 2,600 m <sup>3</sup> , ca. 50,000 <i>medimnoi</i>              |
| Athens, 4th c.   | 200,000–250,000           | 1,750–2,170 m <sup>3</sup> , ca. 33,600–41,700 <i>medimnoi</i> |
| Argos, 4th c.    | 70,000                    | 600 m <sup>3</sup> , ca. 11,500 <i>medimnoi</i>                |
| Megara, 5th c.   | 30,000                    | 260 m <sup>3</sup> , ca. 5,000 <i>medimnoi</i>                 |
| Ambracia, 5th c. | 30,000                    | 260 m <sup>3</sup> , ca. 5,000 <i>medimnoi</i>                 |
| Corcyra, 5th c.  | 55,000                    | 480 m <sup>3</sup> , ca. 9,200 <i>medimnoi</i>                 |
| Eretria, 4th c.  | 15,500                    | 135 m <sup>3</sup> , ca. 2,600 <i>medimnoi</i>                 |

per capita per annum, equal to ca. 8.7 liters (ca. 1/6 of an Attic *medimnos*).<sup>4</sup> Even if the difference between contemporary and ancient consumption – ca. 2.5 liters (corresponding to ca. 3.2 kg) against ca. 8.7 liters – appears excessive in view of unchanging biological needs, the fundamental differences between contemporary and ancient diets is a sufficient factor to account for such different levels of consumption.<sup>5</sup> This is why, in order to assess the demand for salt in an ancient community, Cato's ration is far more reliable than any other data extrapolated from the consumption of salt in contemporary societies.<sup>6</sup>

If we combine Cato's ration with the estimated population sizes of some Greek cities of the Classical age, we can try to assess, for a given community, the demand for salt generated by dietary needs. For convenience's sake, the figures in Table 15.1 consider dietary consumption as including all culinary uses of salt, such as flavoring, cooking, and preserving food (within the household), regardless of the amount of salt actually consumed. As is always the case when estimates are made with so many unknown variables, the numbers presented here are meant to give nothing more than a rough approximation of the actual level of demand.<sup>7</sup>

One should bear in mind that Athens must be considered an unusual city because the size of its population was far greater than any other contemporary Greek city. In fact, it has been calculated that out of approximately 1,000 *poleis* in existence in the fourth century, only 10 percent had a population larger than 27,000 inhabitants.<sup>8</sup> In this respect, only 100 cities or so would have generated a demand for dietary needs higher than ca. 235 m<sup>3</sup> (ca. 4,500 *medimnoi*).

Unfortunately, it is much more difficult – if not impossible – to estimate the demand for salt generated by other productive activities. As far as animal husbandry is concerned, for example, the unknown variables do not involve the dietary needs of the animals, which can be extrapolated from modern data, but the overall scale of livestock bred in a given community. In the most recent

studies on animal husbandry the prevailing idea is that in the ancient Greek world the practice and scale of stock raising varied according to three different geographical and climatic regions. In southern Greece, including Attica, the Cyclades, and southern Ionia, the scale of stock raising was less significant, but more closely integrated with agriculture. In Crete and central Greece, including the Peloponnese, Thessaly, and Aeolis, environmental conditions allowed for a more significant presence of stock raising, especially in the mountainous areas along the borders of the civic space. It was only in Macedonia and north-west Greece that environmental and political conditions allowed for the development of extensive stock raising, often associated with forms of large-scale transhumance.<sup>9</sup> In Attica, for example, where people were able to evacuate their livestock to Euboea on the eve of the Peloponnesian War (Thuc. 2.14), one can estimate that the number of animals was no higher than a few tens of thousands. If one assumes 10 g per day for one sheep, equivalent to 3 liters per year, the amount consumed by the animals can be estimated at a few hundred cubic meters per year – a figure much lower than the estimated human consumption.<sup>10</sup> We can infer that in a community in which stock raising was not practiced on a large and extensive scale the dietary needs of the livestock did not affect in a significant way the size of the aggregate demand for salt.

Leaving aside the salting of fish, which I will take up later, we do not have enough data to estimate the demand for salt for other productive activities in which salt played a major role.<sup>11</sup> Nevertheless, we can apply this inference about stock raising more widely: when, in a given community, the scale of these activities (e.g., metallurgy, tanning, production of perfumes and ointments) was not considerable, it is probable that human consumption accounted for almost the entire demand for salt.

The next step is to discuss the general availability of salt in the ancient Greek world. Around the Mediterranean basin, geographical and climatic conditions, including elevated salinity of the water, dry and windy climate, and configuration of coasts, were – and in part still are – extremely favorable to the spontaneous formation of salt.<sup>12</sup> Those areas in which coastal flooding tends to form lagoons, marshes, and coastal lakes constitute the ideal environment for the production of salt. Even though in recent centuries human intervention has drastically changed the physical features of the coasts through drainage, land reclamation, and industrial or touristic exploitation, this type of landscape was very common in the ancient Mediterranean, as both ancient authors and paleo-environmental analyses attest.<sup>13</sup>

Because the majority of Greek settlements were located near the coastline or only a short distance from it, it is not far-fetched to assume that the majority of Greek communities had access to a supply of salt. In fact, it is clear that ancient authors associated salt with the sea. The prophecy of Tiresias mentioned previously shows that for the Greeks distance from the

coast implied the absence of salt (*Od.* 11.122–37). In the same way, one of the long conversations about salt in Plutarch's *Table Talks* takes place in the context of a general discussion about the superiority of sea products over land products (*Mor.* 668d–669b).<sup>14</sup> In fact, a detailed survey of a wide variety of sources has recently shown that the production of salt was generally widespread throughout the Greek world and the Mediterranean, with seawater being its main source.<sup>15</sup>

In the only surviving ancient treatise about salt, Pliny reports that salt can be either native or artificial: native salt comes from salt mines as well as from the solar evaporation of saltwater, including the desiccation of seawater on the shore, while the most common and abundant type of artificial salt is that made from seawater drained into salt-works and then leached by streams of fresh water.<sup>16</sup> Pliny's categories, probably derived from Theophrastus, no doubt reflect the range of the productive systems available in antiquity.<sup>17</sup>

Part of the household demand for salt certainly could be met by harvesting salt spontaneously formed along the coast or by the use of seawater, sometimes aided by a process of domestic evaporation.<sup>18</sup> In the early decades of the twentieth century, Cretan peasants used to harvest and sell the salt that formed naturally in the rocky hollows of the coastline.<sup>19</sup> This ethnographic parallel suggests that the harvesting of spontaneous salt, besides meeting internal needs, could even provide the household with a certain surplus to sell on the market. In its broad features, the process was similar to the activity of the charcoal burners who operated in the common public woodlands of the Greek cities.<sup>20</sup>

The harvesting of salt along the coast, however, could be practiced only by households with easy access to the sea. In a large region like Attica, for example, where many households were probably located inland, only a small part of the population was able to engage directly in the collection of salt. The rest surely had to engage in market exchange and buy their household supply from producers or retailers.

At the other end of the productive range, there was salt produced in artificial salt-works, whose structure and functioning, to judge from literary and archeological sources, were remarkably similar to those of modern salt-works.

Modern salt-works usually consist of a series of shallow basins, separated by dykes, into which seawater is conducted, either through a system of canals and gates that exploit the slope of the terrain, or by way of water-lifting devices. Since seawater contains several impurities and different salts, evaporation must proceed in stages. For this reason, the water is run through a series of progressively smaller basins where, as evaporation proceeds, the less soluble salts precipitate and the brine reaches the desired degree of concentration. When sodium chloride crystals are formed on the surface of the brine – in the Mediterranean climate the process may take from 80–100 days – salt is harvested. Finally, the harvested salt undergoes a process of leaching by fresh water to remove the

most soluble impurities, in particular the residual magnesium that gives salt a bitter taste.

The only descriptions we have of the structures and functioning of ancient salt-works are in Marcus Manilius' *Astronomica* (5.682–92) and in Rutilius Namatianus' *De reditu suo* (475–90).

In the *Astronomica*, dated to the first century CE, the description of salt-works is included in the discussion of the influence that stars exert over men's life and inclinations:

Moreover, such men will be able to fill great salt-pans, to evaporate the sea, and to extract the sea's venom: they prepare a wide expanse of hardened ground and surround it with firm walls, next conduct therein waters channeled from the nearby sea and then deny them exit by closing sluice-gates: so the floor holds in the waves and begins to glisten as the water is drained off by the sun. When the sea's dry element has collected, Ocean's white locks are shorn for use at table, and huge mounds are made of the solid foam: and the poison of the deep, which prevents the use of sea-water, vitiating it with a bitter taste, they commute to life-giving salt and render a source of health. (trans. Goold)

In Namatianus' *De reditu suo*, dated to the fifth century CE, the author narrates his journey from Rome to Gaul along the Tyrrhenian coast. Unlike the case with Manilius, the salt-works he describes are not a generic example, but the actual salt-works belonging to the villa of his friend Albinus at Vada Volaterrana (Tuscany):

We find time to inspect the salt-pans lying near the mansion: it is on this score that value is set upon the salt marsh, where the sea-water, running down through channels in the land, makes entry, and a little trench floods the many-parted ponds. But after the Dog-star has advanced his blazing fires, when grass turns pale, when all the land is athirst, then the sea is shut out by the barrier-sluices, so that the parched ground may solidify the imprisoned waters. The natural incrustations catch the penetrating sun, and in the summer heat the heavy crust of salt cakes, just as when the wild Danube stiffens with ice and carries huge wains upon its frost-bound stream. Let him who is given to weigh natural causes examine and investigate the different effect worked in the same material: frost-bound streams melt on catching the sun, and on the other hand liquid waters can be hardened in the sun. (trans. J. Wight Duff & A. M. Duff)

Even if both descriptions are expressed in poetic language, the basic elements they reveal are perfectly consistent with the structure and functioning of modern salt-works. We can observe, in particular, the mention of channels exploiting the slope of the terrain (*mare terreni declive canalibus intrat*); many-parted ponds fed by a trench (*multifidosque lacus parvula fossa rigat*); hardened ground and firm walls (*solidum campum; certo margine*); sluices and gates to regulate the

water flow (*cataractarum claustris excluditur aequor; claudendoque negant abitum*); the solar heat causing the evaporation of seawater and the formation of a crust of salt (*crusta; canities semota maris*); and the harvested salt piled up along the borders of the salt-works (*ingentes faciunt tumulos*), where it was usually left to leach in the rain for some time.<sup>21</sup>

In addition to this, Vitruvius (10.4.1–2) explicitly mentions a water-lifting device called *tympanum* – a waterwheel with a compartmental body turned by the tread of men – which was used to irrigate gardens and supply the needs of salt-works (*ad salinas temperandum praebetur aquae multitudo*).

The recent discovery of a structure interpreted by the excavators as the remains of Roman salt-works seems to confirm the similarity between ancient and modern salt-works. The well-preserved structure, brought to light at Vigo, in Galicia, and dated to the first to second century CE, consists precisely of shallow rectangular basins, separated by lines of stones thrust into the soil and covered by a layer of clay. The basins are arranged on three different levels and their size and depth progressively decrease from one level to the other. Since the smaller basins, contrary to what is expected, are not located on the lower, but on the upper level of the structure, the most plausible assumption is that seawater was moved from one level to the other by way of water-lifting devices.<sup>22</sup>

On the basis of the available evidence, two important considerations can be put forward concerning ancient salt-works. First, we can assume that the setting up and running of artificial salt-works required substantial investments in facilities and workforce: one need only consider the excavation and upkeep of basins and channels, the consolidation of earthworks, the management of the water flow with sluices and sometimes water-lifting devices, and, last but not least, the harvesting of salt. The mobilization of these substantial investments was clearly meant to guarantee not just an occasional surplus but a large and regular production, no doubt market-oriented.

Second, given the remarkable similarity between ancient and modern salt-works and the fact that salt production is not based on a complex technology, but on the empirical knowledge of the natural process of solar evaporation, we can assume that the levels of productivity of ancient salt-works may have been not so different from those of their modern equivalents, at least until the twentieth century, when mechanization has considerably facilitated the harvesting and transport of salt.<sup>23</sup> As a result, even if we do not possess data concerning ancient salt-works, we can consider figures taken from modern salt-works to suggest at least some orders of magnitude of what the productive capacity in antiquity may have been.

In the late eighteenth century, the German naturalist Peter Simon Pallas reported that in certain years two natural salt lakes in the district of Pérécop, in the Crimea, the Staroe Osero ('Ancient Lake') and the Krasnoe Osero ('Red



Lake'), produced between them 200,000 to 800,000 *pounds* of salt, that is, ca. 3,276 tons (ca. 2,730 m<sup>3</sup>) to 13,100 tons (ca. 10,900 m<sup>3</sup>).<sup>24</sup> At the salt-works of Tragasai, in Turkey, the production of salt reached 100,000 *stai* (3,600 m<sup>3</sup>) in 1817 and ca. 1,558,307 kg (ca. 1,300 m<sup>3</sup>) in 1894.<sup>25</sup> In the 1920s, the inhabitants of the small Cretan island of Kaudos, even without a proper and organized system of production, harvested around 77 q of salt (ca. 6.4 m<sup>3</sup>).<sup>26</sup> By 1849, Thermisi, in the southern Argolid, in the territory of the ancient city of Hermione, was producing 20,000 tons of salt per year (ca. 16,000 m<sup>3</sup>).<sup>27</sup> These figures suggest that we should not underestimate the productive potential of ancient salt-works – and of solar evaporation of seawater in general. If we compare them with the estimated consumption of salt in Table 15.1, one gets the impression that, even allowing for significant differences in production, the majority of small and medium Greek communities were probably able to rely on local sources – both through individual harvesting and artificial salt-works – to supply the local market and fulfill the needs of the population.

This impression gains some support from the rarity of references to inter-regional salt trade in ancient literary and documentary sources and by the remarkable lack of references to any problem related with the supply of salt in the ancient Greek world. To my knowledge, the only explicit mention of a salt shortage concerns the siege of Athens by Demetrius Poliorcetes in 295, during which the Athenians were denied access to their territory and could not receive provisions by sea. Plutarch relates that on this occasion an acute famine hit the city and the dearth of food and other commodities pushed the price of a *medimnos* of salt up to 40 drachmas and that of a *medimnos* of wheat up to 300 drachmas (*Dem.* 33.5–6). Aside from occasional states of emergency, however, it is probable that the relatively limited quantities of salt involved in dietary consumption and the general availability of local resources prevented the salt supply from becoming a critical issue for the survival of a Greek city.

Despite the cultural and symbolic significance of salt and its irreplaceable role in the ancient diet, ancient sources clearly attest the low economic value of salt, thus reinforcing the idea that this commodity was usually abundant or easily accessible in the ancient Mediterranean. In the *Odyssey* – the same poem in which the use of salt appears as a distinguishing trait of Greek society – Odysseus, disguised as a beggar, accuses Antinous of being so uncharitable that he would not even give a grain of salt to a suppliant (*Od.* 17.455). In the description of the Niggard's character Theophrastus (10.13) stresses that he would forbid his wife 'to lend out salt, or a lamp-wick, or cumin, or oregano, or barley groats, or garlands, or sacrificial cakes, maintaining that these small items add up to a lot over the course of a year' (trans. Rusten). In a gloss by Pollux – which I will take up again later – the term *halonetoï*, 'bought with salt,' refers to those slaves who were considered inexpensive because merchants used to purchase them by carrying salt into the hinterland and exchanging the

salt with Thracians for slaves (7.14). Moreover, some scanty references to actual prices seem to indicate that salt was usually sold at a low price, especially in comparison to grain. In Plutarch's account of the siege of Athens in 295, for example, the price of salt was still seven times less than the price of wheat even in a period of acute shortage (40 drachmas vs. 300 drachmas).<sup>28</sup>

Salt is a relatively heavy and bulky commodity: if its unit value was quite low, the costs of transport were probably high. In this case, even though natural resources or more efficient methods of production caused some areas to be more productive than others, the costs of long-distance transport would have considerably reduced the profits of lower production costs. This could explain why Greek cities found it more convenient to rely as much as possible on local resources instead of turning to foreign trade, hence the rarity of references to interregional salt trade in the ancient sources.

If this was the prevailing pattern for most cities of medium and small size, it is likely, by contrast, that populous centers of consumption were not able to rely exclusively on local resources. Attica, for example, had an abundant supply of salt.<sup>29</sup> Some passages from Aristophanes' *Acharnians* seem however to imply that, at least in the fifth century, Athens imported salt from Megara.<sup>30</sup> Given the unusual level of Attic demand for salt in comparison with other cities, it is very likely that Athens had to import salt to meet its needs. On the other hand, it is significant that the only passages about Athenian imports of salt identify a neighboring city as the source. This would confirm the inference that nearby production sites were the preferred source of supply.

The remaining few references in the ancient sources to the salt trade mostly concern people living far from the sea. According to Dio Chrysostom, writing in the first century CE, there was a vast number of salt-works at Borysthenes (i.e., Pontic Olbia) from which most barbarians, as well as Greeks and Scythians living in the Tauric Chersonnese, bought their salt (36.3). Because the same salt-works were already well known for their large output by the time of Herodotus (4.53.3), we can assume that the same dynamics could have been going on well before the first century CE.<sup>31</sup>

Strabo describes how the people inhabiting the most inaccessible parts of the Caucasus used to assemble at Dioscurias, in Colchis, on the east coast of the Black Sea, in order to buy salt (11.5.6). In this case it is probable that the salt was not produced at Dioscurias, but transported there from other production sites around the Black Sea. In fact, Procopius, in the sixth century CE, observed that the Lazi of Colchis were always engaged in maritime trade with the Romans living on the Black Sea, in order to secure the supplies they needed – mainly salt and grain – in exchange for skins, hides, and slaves (*Pers.* 2.15.5).<sup>32</sup>

As stated in the gloss of Pollux mentioned previously, a similar dynamic characterized the activity of the *emporoi* who transported salt into the Thracian *mesogaia* and purchased slaves from the local population.<sup>33</sup> From Herodotus'

detailed description of the march of Xerxes' army in Thrace (7.108–16, 121), it is possible to identify the *mesogaia* mentioned in the gloss with the upper valley of the river Hebros. From the same area, namely from the Greek *emporion* of Vodenica (mid-fifth through early-third century BCE), comes a well-known Greek inscription dated to the mid-fourth century (*SEG* 43:486).<sup>34</sup> In the inscription a Thracian king grants guarantees and privileges to the *emporitai* who operated in the *emporion* of the area, in particular to the ones coming from Pistiros, Maroneia, Apollonia, and Thasos. If we leave aside the ongoing scholarly debate on the exact location of Pistiros and Apollonia, the inscription reveals the existence of a consolidated trade network between the Thracian hinterland and Greek settlements in the northern Aegean (Maroneia, Thasos, Pistiros?) as well as, possibly, on the western coast of the Black Sea (Apollonia?).<sup>35</sup> Interestingly, for both areas there is evidence pointing to the production of salt, so that the exchange of salt for slaves to which the gloss of Pollux alludes can be placed within the consolidated network revealed by the inscription.<sup>36</sup>

Another element can be added to the picture, namely an Athenian naval catalogue, dated to the late fifth century, which lists a certain Πιστυρᾶς among the slaves serving as sailors (*IG* I<sup>3</sup> 1032, line 136). As is common in slave onomastics, the name probably derives from the real or alleged origin of the slave (i.e., Pistiros). Regardless of its actual identification with one of the *emporion* in the upper valley of the Hebros or with a city on the northern coast of the Aegean facing Thasos, it is clear from the inscription that Pistiros played a major role in the trade network between the Thracian *mesogaia* and the Greek *emporoi* coming from the coast. This means that our Πιστυρᾶς might be an example of a *halonetos*, a slave bought in exchange for salt and brought to in Athens from the marketplace of Pistiros.<sup>37</sup>

The existence of established trade routes for salt linking the coast and the hinterland fits well into our analysis of the demand for salt in the Greek world. For most of the Greek cities around the Mediterranean, salt was a commonly available and low-price commodity, so that it was more convenient to procure it from local or nearby sources of supply. By contrast, for people living far from the sea, salt was much less easy to acquire and consequently had a higher economic value. The use of the term *halonetoi* to indicate slaves of little value shows that most Greeks considered salt an inexpensive commodity. For the inhabitants of inland Thrace the perspective must be reversed: for them salt was so valuable that it had to be bought in exchange for human beings.<sup>38</sup> The difference in value between the point of departure and the point of arrival made it possible for *emporoi* to make substantial profits even after deducting the costs of transport. The constant demand for salt also created the need for regular trade between the coast and the interior.

A higher economic value certainly played a major role in the wide circulation of some specific varieties of salt. According to literary sources, some varieties of salt, such as the ammoniac salt from North Africa, Cappadocian salt, or Iberian salt, were particularly renowned, because of either their taste or their use in medicine and pharmacology. The reputation that these salts enjoyed in antiquity suggests that they circulated well beyond their respective areas of production and were rather widespread across the Mediterranean.<sup>39</sup> Without doubt, their specific qualities and uses made these varieties of fine salts so valuable that, unlike the case with common salt, long-distance trade was actually profitable, not least because smaller quantities were involved than what was necessary for the ordinary consumption of salt.

The picture that I have so far described assumes that the majority of small and medium Greek cities were able to rely on the local market to fulfill the internal demand created by dietary consumption and domestic uses of salt. However, the situation was certainly different in those centers in which productive activities involving the use of salt were practiced on a large scale.

As noted previously, the only activity for which we can try to estimate the size of the demand for salt is fish processing. Here we can use the evidence provided by ancient and modern recipes for fish sauces and combine it with the capacity of some of the salting vats discovered at several sites around the Mediterranean. It is important to stress that many different types of fish sauces and salted fish were consumed in antiquity and that different products certainly required different preparations as well as the use of different quantities of salt.<sup>40</sup> However, because we do not possess data concerning the salting of slices of fish, my estimates will perforce be based on the only available data concerning fish sauces. According to a recipe in the *Geoponica* (20.46.3), *garum* in the style of the Bithynians required two *sextarii Italici* of salt (ca. 1.09 liters) for each *modius* of fish, with a salt to fish ratio equivalent to around 1:8 and the mixture fermenting in the sun for two to three months. However, the production of other fish sauces similar to *garum*, such as the *nuoc-man* of Indochina or the *gharos* of Constantinople, are based on a salt to fish ratio closer to 1:2 or, more frequently, 1:4.<sup>41</sup> As for salting vats, it is equally important to emphasize that the remains that have come to light at several sites around the Mediterranean represent only a small percentage of the production facilities that must have been functioning in antiquity and that the excavated and published vats might represent only limited sections of larger production sites. In particular, the data presented here (Table 15.2) refer all to sites dated to the Roman Imperial Age, between the first century BCE and the third century CE.<sup>42</sup>

With these caveats in mind, these data offer some rough estimates to compare with the previous approximations concerning dietary and domestic consumption of salt (Table 15.1). The comparison suggests that the demand for salt from a large salting center was quite substantial, and, on its own, it might

TABLE 15.2. *Ancient Salting Vats*

|                                 | Capacity of excavated salting vats | Estimated demand for salt for a 3-month cycle of production |
|---------------------------------|------------------------------------|---|
| Lixus (Morocco)                 | 1,013 m <sup>3</sup>               | up to 506 m <sup>3</sup> , ca. 9,700 <i>medimnoi</i>        |
| Sexi (Spain)                    | 500 m <sup>3</sup>                 | up to 350 m <sup>3</sup> , ca. 6,700 <i>medimnoi</i>        |
| Baelo Claudia (Spain)           | 269 m <sup>3</sup>                 | up to 130 m <sup>3</sup> , ca. 2,500 <i>medimnoi</i>        |
| Neapolis (Tunisia)              | 183 m <sup>3</sup>                 | up to 90 m <sup>3</sup> , ca. 1,700 <i>medimnoi</i>         |
| Sabratha (Libya)                | 100 m <sup>3</sup>                 | up to 50 m <sup>3</sup> , ca. 960 <i>medimnoi</i>           |
| Tyritake (Crimea)               | 457 m <sup>3</sup>                 | up to 220 m <sup>3</sup> , ca. 4,200 <i>medimnoi</i>        |
| Chersonnesus (Crimea)           | 2,000 m <sup>3</sup>               | up to 1,000 m <sup>3</sup> , ca. 19,200 <i>medimnoi</i>     |
| Portopalo (Sicily) <sup>a</sup> | 248 m <sup>3</sup>                 | up to 250 m <sup>3</sup> , ca. 4,800 <i>medimnoi</i>        |

<sup>a</sup> The processing installations from Portopalo can be dated back to the fifth century BCE, with several alterations following one another until the third century CE. Some of the vats are of circular shape (cf. Botte 2009: 86–8, 99).

equal or exceed the demand for dietary and domestic salt of a small or medium community.

At present, there is a clear consensus that fish and salted fish were an important component of the ancient diet.<sup>43</sup> At the same time there is little doubt that in the ancient Mediterranean fishing was practiced on many different levels: from the small fisherman who engaged in fishing as a supplement to farming and was occasionally able to sell some surplus on the market for additional income to the ‘professional’ fisherman who practiced it as a full-time occupation with investments in equipment and labor and a clear orientation toward the market.<sup>44</sup> However, fish resources are not equally distributed in the Mediterranean. It is therefore not surprising that the major processing centers attested in antiquity were located at key points along the coastal routes of migratory species, where the seasonal transit of large schools of tuna or mackerel made large-scale fishing attractive and profitable.

The archaeological evidence, consisting of the remains of production facilities and amphoras used to preserve and transport salted fish and fish sauces, suggests that between the first century BCE and the third century CE there was a huge increase in the number of processing centers, especially in north-western Africa, southwestern Iberia, and in the Crimean peninsula. This dramatic development of the fish-processing industry and the consequent increase in the level of trade are usually linked to the massive demand for salted-fish products generated by the Italian market and, above all, by the presence of Roman legions in the peripheral areas of the empire.<sup>45</sup>

This must not obscure the fact that literary and documentary sources attest the wide circulation and long-distance trade of fish sauces and salted fish coming from the Black Sea and the Gaditan area as early as the fifth century BCE.<sup>46</sup>

The wide circulation of the Gaditan products is further demonstrated by the large diffusion, especially on the Greek mainland and in the western section of the Mediterranean, of Punic amphoras used to transport fish sauces and salted fish produced at Cadiz. The area around Gades also contains the remains of salting vats dated from the fifth to the second century BCE, the most ancient of such to come to light in the Mediterranean to the present day.<sup>47</sup>

Moreover, the absence of archaeological remains of salting vats in a certain area does not mean that fish processing did not take place there. For example, the abundant literary evidence for processed fish from the Black Sea region leaves no doubt that processing activities aimed at the export market already took place in the Classical age. The most plausible assumption is that before the introduction of the archaeologically attested vats of the Roman period, different production methods were used, methods that left very few archaeological traces, such as pottery containers or wooden tubs.<sup>48</sup> In the same way, the absence of, or the difficulty of identifying, specific types of amphoras linked to the transport of processed fish from the Black Sea does not mean that the amount of exports coming from this area should be underestimated. Once more, the most plausible hypothesis is that salted fish and fish sauces were transported in other types of containers, such as different forms of pottery or perishable containers, namely baskets or wooden barrels.<sup>49</sup>

In any case, what needs to be emphasized here is that the marketing and widespread distribution of processed fish required an adequate level of investment and organization well beyond the capacities of a household economy, and a steady supply of both fish and salt that would support this type of enterprise.<sup>50</sup> Thanks to the availability of fish, some areas, such as the Black Sea region and the area around Gades, must have been able to specialize quite early in processed fish intended for the export market.<sup>51</sup> Without doubt, in the Roman period the expansion of the demand for processed fish, in the form of both high-quality brands for refined customers and less costly products for large consumer markets, led to the introduction of new or more efficient methods of production, such as the types of vats attested from the first century CE onward. However, the specialization of certain areas in fish-salting activities and the development of a fish-processing industry were strictly linked to the availability of salt. Only salt was able to transform fish – which is otherwise extremely perishable – into a durable commodity, easy to store and trade, with a high economic value.<sup>52</sup> In other words, where fishing was abundant, salt was necessary to convert fish into a major economic asset.

According to these estimates, medium and large processing centers had to rely on a substantial amount of salt in order to sustain an industry aimed at international trade. In fact, for several processing centers – such as Chersonnesus or Gades, for example – one should note that they were located in areas provided

with abundant salt resources.<sup>53</sup> Even if the absence of adequate archaeological remains and documentary sources prevent us from determining precisely the structure of ownership, production, and division of labor, it is quite plausible to assume that in these cases the local production of salt was further enhanced through investments in facilities and workforce. There are some cases, however, in which local resources could not have been able to support a substantial level of production. It is in these cases, in my opinion, that the interregional trade in salt played an important role.

A recent study of the production of salt along the south coast of the Roman province of Baetica describes a significant example of precisely this kind of dynamics. By overlaying a map of the major fish processing centers of the Roman period with a map of salt-works known since at least the Middle Ages, it was possible to observe that some of these major processing centers, such as Baelo Claudia and Malaca, did not have enough salt resources within their territory to supply their own needs for salt. Because the south coast of the Iberian Peninsula has a large number of sites suitable for the production of salt, the most plausible hypothesis is that these centers imported salt from other sites with a higher productive potential. In particular, the salt supply of many processing installations developed along the Malacitan coastline in the first century CE seems to have depended on a steady and sustained maritime trade with the Atlantic coast of Baetica, while the salting centers of Baelo Claudia and Mellaria may have relied on the resources of the nearby city of Baesippo.<sup>54</sup>

This may also have been true for Byzantium in the Classical and Hellenistic periods. Thanks to its position at the Bosphorus Strait, the city profited from the migratory streams of tuna from the Black Sea. However, despite its reputation in the ancient sources as an 'international' fishing and salting center, the city did not possess sufficient supplies of salt to meet its needs. Several pieces of evidence show that in the seventeenth and eighteenth centuries CE, and even before, Byzantium imported salt from the more productive sites of the Dnieper-Bug estuary and from the Crimean peninsula.<sup>55</sup> For this reason it is fair to assume that the same dynamics occurred also in antiquity, and that the local processing activities were supplied with salt coming from other sites along the shore of the Black Sea.

As these examples show, in those cases in which salt was a strategic resource, its economic value was certainly higher. As a result, the recourse to supplies from outside the region was economically rational despite the high transportation costs. Once more, the existence of a constant demand and the difference in value between the point of departure and the point of arrival of the commodity were crucial for establishing a regular and profitable trading relationship despite the distance involved.

It is worth emphasizing that the widespread consumption of imported fish sauces and salted fish was certainly able to meet the consumers' general need for salt to some extent and that this consumption would have otherwise impacted local resources. In this respect, the trade in salted fish can be considered an indirect form of salt trade because part of the demand for salt required for dietary needs was more conveniently met by long-distance trade of salted fish rather than salt itself. As previously noted, processed fish was a commodity with a higher unit value than salt and, as such, easier and more profitable to transport. So, it was also through the medium of salted fish and fish sauces that the surplus of salt production available in certain regions was redistributed across the Mediterranean and came to play an important, although indirect role, in interregional and long-distance trade.<sup>56</sup>

In the conversation mentioned at the beginning of this study, one of Plutarch's tablemates observes that 'ships carrying salt breed an infinite number of rats' because the females conceive just by licking the salt. In all its vagueness, this incidental reference to 'ships carrying salt' (ἀληγὰ πλοῖα) takes for granted that the sea trade of salt was not an exceptional phenomenon in the Mediterranean.

I hope to have shown here that many different trade patterns probably overlapped and intersected in the Mediterranean, as far as salt – and salted fish – were concerned. In addition to household production and salt-works producing for the local market, the dietary needs of large consumer centers, both in the hinterland and on the coast, and the demands of large-scale processing centers – working in their turn to supply large consumer centers – stimulated a steady and intense interregional and long-distance trade of salt and salted fish, while, at the same time, some qualities of fine salts and fish sauces were also exchanged, maybe in comparatively small quantities but of high economic value, in the Mediterranean market.

#### NOTES

- 1 Cf. Adshead 1992: 7; Moinier 1997: 23–4, 111–15.
- 2 Cf. Foxhall and Forbes 1982; Gallo 2001: 463–4.
- 3 For the consumption of salt as a distinguishing trait of the civilized world versus barbarian people, see also [Arist.] *Mir.* 138; Sall. *Iug.* 89.7–8; Varro *Rust.* 1.7.8; Tac. *Ann.* 13.57; App. *Hisp.* 54.227; Syn. *Ep.* 148.
- 4 Cato *Agr.* 67: *Pulmentarium familiae. Oleae caducae quam plurimum condito. Postea oleas tempestivas, unde minimum olei fieri poterit, eas condito, parcito, uti quam diutissime durent. Ubi oleae comesae erunt, hallecem et acetum dato. Oleum dato in menses uni cuique S.I. Salis uni cuique in anno modium satis est.* 'Relish for the hands: Store all the windfall olives you can, and later the mature olives which will yield very little oil. Issue them sparingly and make them last as long as possible. When they are used up, issue fish-pickle and vinegar, and a pint of oil a month per person. A *modius* of salt a year per person is sufficient' (trans. Hopper).



- 5 The same remark had already been made by Braudel 1979: 178, a propos salt consumption in the Early Modern Period being twice as much as contemporary consumption. For assessing the equivalence between weight and capacity of a given amount of salt see the recommendation of Colas 1985: 20–1.
- 6 For this reason I cannot follow Giovannini 1985: 375–7 and Mangas and Hernando 1990–91: 222–3, who both choose to use a current annual estimate of 2.5 kg per capita per annum in order to assess salt consumption respectively in central and southern Italy in the Republican era and a pre-Roman community in the Iberian peninsula.
- 7 For the estimated population sizes, see Hansen 1988b: esp. 12, and Hansen 2006b: 93–6.
- 8 Cf. Hansen 2006b: 24–34.
- 9 Cf. Chandezon 2003: 402–4; Bresson 2007: 141–3.
- 10 For animal consumption, cf. Kaufman 1978: 459–60.
- 11 For a brief outline of the use of salt in other productive activities, cf. Carusi 2008: 28–30.
- 12 Cf. Horden and Purcell 2000: 186–90.
- 13 On marshy landscapes in antiquity, cf. Traina 1988; Fantasia 1999.
- 14 For other examples, cf. Sall. *Iug.* 89.8–7; [Arist.] *Mir.* 138; Arr. *Anan.* 1.29.1; Lycoph. *Alex.* 133–5.
- 15 Cf. Carusi 2008: 45–148.
- 16 Plin. *HN* 31.73–83: ‘All salt is either native or artificial; both kinds being formed in various ways, but produced from one of these two causes, the condensation or the desiccation, of a liquid .... Sea-water, again, spontaneously produces another kind of salt, from the foam which it leaves on shore at high-watermark, or adhering to rocks; this being, in all cases, condensed by the action of the sun, and that salt being the most pungent of the two which is found upon the rocks .... Of artificial salt there are several kinds; the common salt, and the most abundant, being made from seawater drained into salt-pans, and accompanied with streams of fresh water; but it is rain more particularly, and, above all things, the sun, that aids in its formation; indeed without this last it would never dry’ (trans. by Jones).
- 17 It is widely accepted that this section of Pliny’s *Natural History* is based on Theophrastus’ lost treatise *On salts, niter, and alum* quoted by Diogenes Laertius (*Vit. Phil.* 5.42). Cf. the commentaries of Serbat 1972 and Garofalo in Conte 1986.
- 18 Cf. Cato *Agr.* 24, 88, 105; Col., *Rust.* 7.8.9, 8.6, 12.25; Plin. *HN* 18.68.
- 19 Cf. Davaras 1980: 2–4.
- 20 On charcoal burners, see Olson 1991; Bresson 2007: 81–2.
- 21 The sea salt’s production process is hinted at also in Nicander of Colophon’s *Alexipharmaca* (518–20): ‘Or else you should often administer to the patient crystallized salt (ἄλα πηκτόν) in plenty or salt foam (ἀλὸς ἄχηνη) which a salt worker (ἀνήρ ἄλοπηγός) ever gathers as it settles at the bottom when he mingles water with water.’ In addition to the only occurrence of the term that indicates a salt worker in ancient Greek, the passage seems to allude to the harvesting of salt in salt-works and to the feeding of salt-ponds.
- 22 See Castro Carrera 2006. The installation of Vigo is the only well-preserved and extensively excavated case of ancient salt-works, clearly recognizable as such. Other possible remains of ancient salt-works are discussed in Ménanteau and Villalobos 2006: 93–7; Carusi 2008: 46–7; Marzano 2013: 126–9. A completely unparalleled structure brought to light in Caunus (Turkey) in 2005 has also been interpreted as ancient salt-works by its excavators (Atik 2008). The preliminary publication records a total of 48 circular salt pans located in a rectangular area and divided into three full parcels of 12 pans each at the center and two half parcels of 6 pans each at the short ends of the rectangle. Each parcel is separated from the other by long rectangular canals (see also Marzano 2013: 126–8). Since Caunus was in all probability an important center of salt production in antiquity (Carusi 2008: 85, 237–9) and the excavated site is ideally placed for the production of sea salt, the interpretation proposed by the excavators seems plausible. On the other hand, however, the structure has no parallel with other ancient or modern known salt-works, and the lack of any connection between

- the individual pans and between the pans and the canals leave completely open the question of how the salt production process worked. In my opinion, until new data are published, the interpretation as ancient salt-works should be considered tentative.
- 23 Cf. Hocquet 2001: 41–86, 161–75. Evidence that ancient authors were aware of the different degrees of concentration reached by sea water during the evaporation process and the necessity of leaching can be found at Arist. *Mete.* 2.3.359a; Cato *Agr.* 88, 106; Plin. *HN* 31.81, 85, 92 (see Carusi 2008: 36–7).
  - 24 Cf. Baladié 1994: 155.
  - 25 Cf. Cook 1973: 222–4. It is worthwhile to observe that Tragasai's salt-works were already functioning and well known in antiquity: cf. Hellanicus *FGrHist* 4 F 34; Phylarchus *FGrHist* 81 F 65; Strabo 13.1.48; Plin. *HN* 31.85–6; Gal. 12.372 Kühn; Carusi 2008: 79–81.
  - 26 Cf. Guarducci 1930: 477–9. The production of salt on Kaudos is already attested in the third through second century BCE: cf. *IC IV* 184, fr. A, lines 11–18; Carusi 2008: 91–3.
  - 27 Cf. Jameson, Runnels, and van Andel 1994: 311.
  - 28 Other data concerning the price of salt in comparison with the price of grain come from Roman Egypt. At Tebtynis in 45–47 CE the price of three different qualities of salt went from 2 dr. and 1 ob per artaba to 4 dr. and 1 ob. per artaba (P.Mich.V 245.21–2) against 8 dr. per artaba for grain (P.Mich. II 127.I.8, 12–16, 17, 31–8). At Theadelphia in 258/9 CE the price of salt was 10 dr. per artaba (P.Lond. III 1170v.III.124), while the price of grain was 12 dr. per artaba (P.Flor. III 321.I.9). In a grain-producing country such as Egypt it is not surprising that the gap between the price of salt and the price of grain was reduced. Cf. Carusi 2008: 162–5.
  - 29 Cf. Xen. *Hell.* 2.4.30–4; *Agora XIX* L4a, lines 16–19; L4b, lines 36–8; *SEG* 33.147, lines 23–4; Cic. *Fam.* 9.15.2; Plin. *HN* 31.87; Steph. Byz. *s.v.* Ἀλαί Ἀραφηνίδης καὶ Ἀλαί Αἰξωνίδης. All the evidence is collected and discussed in Carusi 2008: 49–56.
  - 30 Ar. *Ach.* 520–2: 'Not a cucumber, a leveret, a suckling pig, a clove of garlic, a lump of salt was seen without its being said, "Halloa! These come from Megara" and their being instantly confiscated'; 760–4: Dicaeopolis: 'It is salt that you are bringing?' Megarian: 'Are you not holding back the salt?' Dicaeopolis: 'Tis garlic then?' M: 'What! Garlic! Do you not at every raid grub up the ground with your pikes to pull out every single head?' Dicaeopolis: 'What do you bring then? M: Little sows, like those they immolate at the Mysteries.' Cf. Gallo 2001: 461–2; Carusi 2008: 178.
  - 31 According to the French consul de Peyssonnel in the eighteenth century, the same salt-works were still the main source of salt supply for the Cossacks living in the hinterland (cf. Baladié 1994: 159).
  - 32 Here again, the dynamics seems characterized by a remarkable persistency: in 1672 the French Protestant exile Pierre Chardin, while sailing to Mingrelia, the ancient Colchis, relates that his boat stopped off at the salt-works of Caffa, in Crimea, to load a significant salt cargo to transport to destination (Baladié 1994: 151–2).
  - 33 Poll. 7.14: 'Bought with salt; the same as "barbarian"; hence the expression "*halonetos* slave", referring to those of no value, in so far as the merchants, carrying salt to the hinterland, obtained slaves in exchange; *halonetos*, synonymous with "barbarian", as the Thracians sold slaves in exchange of salt.'
  - 34 A more recent edition, with an updated *status quaestionis*, in Chankowski and Domaradzka 1999.
  - 35 For the identification of Pistiros with Vodenica and of Apollonia with Apollonia Pontica, see Salviat 1999: 260–71; for Pistiros and Apollonia as cities on the Aegean coast of Thrace, see Bravo and Chankowski 1999: 279–90, 315–16.
  - 36 For the production of salt on the Aegean coast of Thrace and on the western coast of Pontus, see Carusi 2008: 67–9 and 72–3, respectively.
  - 37 Cf. Carusi 2008: 169–72. On slave names as evidence for the origin of slaves see Lewis 2011: 93–8.

- 38 In the eyes of ancient authors it was common for people living far from the sea to obtain salt through trade relations: the lack of both alternatives, as in the case of the barbarian population of the Ardiaei, in Illyria, who lived far from the sea and did not mix with other people, was regarded as a marvel, since they were forced to make use of salt formed from an inland salt spring (cf. [Arist.] *Mir.* 138).
- 39 For the circulation of these types of fine salts, see Carusi 2008: 176–8.
- 40 For a survey of the different types of fish sauces and salted fish consumed in the Greco-Roman world, cf. Curtis 1991: 6–15; Botte 2009: 14–24.
- 41 Cf. Grimal and Monod 1952: 32–3, 37.
- 42 Lixus, Sexi, and Baelo Claudia: cf. Étienne and Mayet 2002: 95–6; Neapolis (Nabeul): Slim *et al.* 2007: 39–40; Sabratha: Wilson 2007: 175–7; Tyritake and Chersonnesus: Højte 2005: 142–8, 150–3. Vats of the Roman period all around the Mediterranean have remarkably similar characteristics: they are usually square or rectangular, varying in size, made of cement and tile and sunk into the ground or cut into the rock; the interior is coated with waterproof *cocciopesto*, angles are rounded or convex, and some vats contain a small depression at the bottom to aid in the cleaning process. In most cases all around the vats one can observe fragments of transport amphorae and organic remains from the salting process.
- 43 Cf. Bekker-Nielsen 2002: 32–3; Mylona 2008: 65–6, 88–90; Marzano 2013: 269–80. For a review of both past and more recent scholarship on fishing and fish-eating see Mylona 2008: 5–15.
- 44 Cf. Bekker-Nielsen 2002: 30–2. For the productive potential of Greek waters, see Mylona 2008: 33–66. For ancient fishing gear and organization of fishing, see Marzano 2013: 28–88 (mainly on the Roman world, but with useful insights into the pre-Roman Mediterranean).
- 45 Cf. Curtis 1991: 177–81; Marzano 2013: 89–122. For a more recent survey of the archaeological evidence at Mediterranean level, see Botte 2009: 24–51.
- 46 For Byzantium and the Black Sea area, see Hermipp. fr. 63 K-A *apud* Ath. 1.27e; Cratin. fr. 44 K-A *apud* Ath. 3.119b; Nicostr. fr. 5 K-A *apud* Ath. 3.118e; Antiph. fr. 78 K-A *apud* Ath. 3.118d and fr. 179 K-A *apud* Ath. 7.303f; Diph. fr. 17 K-A *apud* Ath. 4.132e; Men. *Sam.* 97–100; Arcestr. fr. 35 Olson-Sens *apud* Ath. 7.302a, fr. 38 Olson-Sens *apud* Ath. 7.303e, fr. 39 Olson-Sens *apud* Ath. 3.117a–b, fr. 40 Olson-Sens *apud* Ath. 7.284e, and fr. 41 Olson-Sens *apud* Ath. 7.314e–f; Sopat. fr. 11 K-A *apud* Ath. 3.119a; Diph. Siph. fr. 9 García Lázaro *apud* Ath. 3.120f; Polyb. 4.38.4; 31.25.5; Euthyd. fr. 1 García Lázaro *apud* Ath. 3.116b; Dorio, fr. 1 García Lázaro *apud* Ath. 3.118b; Hices. fr. 3 García Lázaro *apud* Ath. 3.116e–f; Strabo 7.4.6; Lucian *Tox.* 4; Plut. *Ant.* 29; Gal. 6.747 Kühn; *SEG* 40.625; *PSI* IV 413; cf. also Carusi 2008: 182–3. For the Gaditan area, see Ar. *Ran.* 474–5; Eup. fr. 199 K-A *apud* Steph. Byz. *s.v.* Γάδειρα; Antiph. fr. 78 K-A *apud* Ath. 3.118d; Nicostr. fr. 5 K-A *apud* Ath. 3.118e; [Arist.] *Mir.* 136; Euthyd. fr. 1 García Lázaro *apud* Ath. 3.116a–c; Gal. 6.747 Kühn; cf. also Carusi 2008: 182–6.
- 47 Cf. Kaufman 1978, Williams 1979; De Frutos Reyes and Muñoz Vicente 1996: 135–45; García Vargas 2001: esp. 26–32.
- 48 Cf. Bekker-Nielsen 2002: 33; Højte 2005: 156–7. The archaeological remains of salting vats found in eastern Sicily, dated back to the fifth through fourth century BCE, show, on one hand, that the introduction of salting vats does not necessarily coincide with an ‘industrialization’ process taking place in the Roman age, and, on the other hand, that many other processing centers yet to be researched must have existed all around the Mediterranean before the Roman period (cf. Guzzardi and Basile 1996: 202–3).
- 49 Cf. Lund and Gabrielsen 2005. The use of baskets might be confirmed by a fragment of the Athenian comic poet Cratinus: ‘I will bring Pontic salt fish in baskets’ (fr. 44 K-A *apud* Ath. 3.119b).
- 50 As Bekker-Nielsen 2002: 33, pointed out, the structure of processing installations varies from single vats or small groups of vats dispersed along the coast or within residential areas to large complexes. These differences certainly reflect variations in ownership and

division of labor, with family-owned small installations probably selling their products to large fish-processors and/or professional merchants for marketing and distribution.

- 51 For the abundance of fish cf. Étienne and Mayet 2002: 26–35 (area around Gades); Strabo 7.6.2; Polyb. 4.43–4; Dumont 1976–77: 96–113 (Black Sea).
- 52 Cf. also Horden and Purcell 2000: 190–7.
- 53 For Chersonnesus and the Crimean peninsula, see Carusi 2008: 75–6; for Gades, cf. García Vargas 2001: 20–1; Ménanteau and Villalobos 2006: 93–7.
- 54 Cf. Lagóstena Barrios 2007: 311–9.
- 55 Cf. Baladié 1994: 151, 156, 159; Carusi 2008: 76–9, 178–9.
- 56 Cf. Morère 1994: 248–9; Carusi 2008: 181–2.