Sources for Production and Trade of Greek and Roman Processed Fish

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The workshop sponsored by the Danish National Research Foundation's Centre for Black Sea Studies coincides with a heightened scholarly interest in ancient foods of all kinds and thus presents an excellent opportunity to review the present state and future directions of the study of the production and trade of Greco-Roman processed fish, salt-fish (*salsamentum* or τάριχος) and the fish sauces (*garum*, *liquamen*, *allec*, and *muria*).[1] Focus on Black Sea products seems quite appropriate for two reasons. First, development of the fishery resources of the Black Sea may have been a prime motivation behind Greek colonization of the region, perhaps as early as, or before, the seventh century BC.[2] And second, the earliest modern study devoted to the ancient processed fish industry (Köhler 1832) focused on its manifestation along the coastal areas of the Black Sea. I wish to look in some detail at the sources available for studying the production and trade in processed fish products, not only in the Black Sea area but also throughout the Greco-Roman world. Before doing so, however, I would like to comment briefly on why I think this workshop takes place at a key juncture in the study of this important aspect of ancient life during the classical period. Over nearly the last half-century study of the production and trade in fish by-products has shown a marked vitality. It was not always so.

1. *History of research*

Production and commerce in processed fish continued after the fall of the Roman Empire, though the degree of their practice varied greatly from one geographical area to another and from one period to another. Though salt-fish products, particularly *garum*, continued to receive mention during the medieval and early modern periods – in both the East and the West, in letters, literary works, government documents, and the like – the knowledge of and interest in ancient fish products became primarily the province of physicians and scientists.[3] This was no doubt a result, for varying reasons, of the declining economic and social importance of these products in most places, and because of the prominence given to the medical works of Galen and Oribasios and to the encyclopedic *Natural History* of Pliny the Elder among doctors, naturalists, and ichthyologists. So, one thinks, for instance, of references to ancient

fish products, particularly the fish sauces, in the sixteenth-century works of Francis Rabelais, Guillaume Rondelet, and Pierre Belon.[4] A thorough study of the place of processed fish products in the literary, social, and economic life of this period, however, remains a prominent desideratum.

The first serious, and still valuable, work devoted specifically to ancient fish products was entitled Τάριχος, *ou recherches sur l'histoire et les antiquités des pêcheries de la Russie méridionale*. Published in 1832 in St. Petersburg, Russia, under name of Köhler,[5] this monograph collected, for the first time, an impressive quantity of ancient literary sources devoted not only to identification of fish products and their uses but also to their manufacture. It is notable as well for its anthropological approach to the subject, since Köhler related the ancient products to those coming from contemporary Black Sea fish-salting factories. The groundbreaking work of Köhler, however, was not followed up, save in two short publications. In 1871 J.K. Smidth published, in Danish, a short article with the long title "Historical Observations on the Condition of the Fisheries among the Ancient Greeks and Romans, and on their Mode of Salting and Pickling Fish."[6] After briefly discussing ancient fishing and the fish available to the Greeks and Romans, he devotes a mere four pages to fish salting. He does, however, give some interesting tidbits on fish processing in the North Atlantic in the mid-nineteenth century. In 1892, Georg Eberl brought out a short monograph entitled *Die Fischkonserven der Alten*, devoted specifically to preserved fish, in which he concisely identifies various kinds of salt-fish and fish sauces.[7] Although more readily available, these works advanced our knowledge little beyond what Köhler had provided. The only other important 19th-century work significantly treating the topic was the 1890-dissertation, in Latin, by Paul Rhode who focused specifically on tuna fishing and its salted by-products.[8] In 1910, Robert Zahn published his Pauly-Wissowa article on *garum*, which, while collecting the ancient literary evidence, including many sources not utilised by Köhler, and citing several post-Roman sources, makes considerable use of painted inscriptions on amphorae.[9]

The works of Smidth, Eberl, Rhode, and, to a lesser extent, Köhler and Zahn, have one thing in common. Their sources are almost wholly literary in nature. By the middle of the twentieth century, however, important advances did come, particularly in our understanding of the technical characteristics of the fish sauces. For example, Pierre Grimal and Thomas Monod, in an important article published in 1952, related the nature of the ancient sauces, and how they were made, with that of the modern sauces of Southeast Asia, particularly those produced in Vietnam and Thailand. This was followed in 1961 by Claude Jardin's article, which, besides briefly noting the importance of underwater archaeology in studying ancient trade in fish by-products, includes a discussion of the chemical composition and nutritive value of the fish sauces.[10] In investigating the nutrition of fish sauce Jardin was among the first to employ in a serious way data from scientific disciplines, namely biochemistry and microbiology, to assist in understanding ancient fish by-

products. Even so, with these two exceptions, discussions of ancient processed fish products throughout the first half of the twentieth century continued to rest primarily on literary and, to a lesser degree, epigraphic evidence. This situation substantially changed in 1965.

The first comprehensive study of the Roman salt-fish industry that made extensive use of archaeological evidence for the salteries themselves was that of Michel Ponsich and Miguel Tarradell, entitled *Garum et industries antiques de salaison dans la Méditerranée occidentale*.[11] It was not that no archaeological excavations of fish-salting factories had taken place before this time; rather, it was that few classical historians had paid much attention to publications of them. Archaeology remained essentially divorced from history and literature. Ponsich and Tarradell focused on the Roman industry as it operated in southern Spain and Portugal and across the Strait of Gibraltar in Morocco. Their work highlighted the importance of the physical remains of fish processing and defined the criteria used by subsequent scholars to identify similar installations elsewhere, such as in France and Tunisia.[12] In addition, Ponsich and Tarradell's work shed a bright light on *salsamentum* as a commercial product. Prior to that time the focus had been almost exclusively on the fish sauces, the product most often receiving comment in ancient literary sources. Their work revolutionised the study of the ancient fish salting industry and imparted a liveliness to the investigations that continue to this day.

Up to this time, most historians and literary critics consistently underestimated the social and economic value of fish and their by-products. They saw the fish sauces as expensive products whose major use was as a condiment for foods and whose medicinal value was minimal at best.[13] The pejorative characterization of the sauces in ancient literature (e.g. Seneca, *Letters* 95.25; Pliny, *HN* 31.93), resulting from their seemingly bizarre production process and their ill repute for strong smell and taste, influenced modern scholars not to take them seriously. "Our stomachs would probably revolt at a dish prepared with garum", was the conclusion of one mid-twentieth-century Italian scholar.[14] But, the upsurge in interest in them in the second half of the 20th century derives from a confluence of various scholarly approaches and technological advances, of which the work of Ponsich and Tarradell represents the beginning.

First of all, the past thirty-eight years have seen a significant increase in excavations, particularly in the Western Mediterranean, and a growing awareness of the historical value of archaeological evidence. Second, scholars have begun to see more clearly the importance of combining literary and historical evidence with the archaeological and epigraphic. In addition, the growing partnership between archaeologists and scientists has become particularly important as scientific instruments and analyses begin to play a more significant role in investigating the ancient material world. Third, while not ignoring the more spectacular archaeological projects and the traditional social and political subjects, scholars have turned more attention to ancient daily

life, especially food. What ancient Greeks and Romans ate, how they cooked it, how it was processed, if necessary, what was involved in its transportation, where it was shipped, and who participated in all these activities have become questions of great import. Fourth, there has developed an increased focus by many scholars on the lower classes – freemen, freedmen, and slaves – of Greco-Roman society, the very ones who made up the population of those engaged in processing and trading fish and fish products.[15] Concomitant with this is an increased interest in non-elite populations in the provincial areas, particularly in regard to the influence the "other" had on Rome. And, finally, scholarly interest in the ancient economy, especially the role of the city in the economy, has increased significantly.[16] All of these elements have extensively augmented the source material available for a study of fish by-products far beyond what was accessible to Köhler, Smidth, Eberl, and Zahn, and have increased the number and types of questions demanding answers. I would like to survey those sources briefly, indicating what they can provide for our knowledge of ancient processed fish products. At the same time I hope to identify areas needing further investigation.

2. *Production*

Information about production of ancient processed fish products derives in the main from three types of sources: literary references, archaeological remains of salting installations, and comparative data from production methods of similar modern products. The fact that Greco-Roman literary references to processed fish products derive from many different sources and genres and, for the most part, that they are casual in nature, strongly imply that salt-fish and fish sauce were commonplace in ancient life. Of particular importance are the gastronomical works, such as the *Hedupatheia* of Archestratos (*fl.* fourth century BC), the *De re coquinaria* of Apicius (*fl*. first century AD), and the *Deipnosophistai* of Athenaios (*fl*. c. AD 200), which relay information on what fish products were eaten and how they were prepared.[17] References to fish products also come from drama, both comedy and tragedy, such as the extant works of Aristophanes and Plautus, and from Athenaios who preserves extracts from the works of many Greek dramatists, such as Nikostratos, whose works no longer exist. They come from the epigrams of Martial, the satires of Horace, and ancient scholia. They come from the didactic poetry of Manilios, from ancient letters, both literary and private, such as those of Seneca and Ausonius, and from the many papyri of Egypt, a source ignored by Zahn in his otherwise extensive 1910 Pauly-Wissowa article.[18] They come from the novel of Petronius and the oratorical work of Quintilian. They come especially from medical and veterinary treatises, such as those of Galen, Oribasios, Xenokrates, and Pelagonius, from the agricultural manuals of Cato, Varro, Columella, and Cassianus Bassus, and from the encyclopaedias of Pliny the Elder and Isidore of Seville. They even come from grammarians,

from ancient glossaries, from the *Regulae*, or "Rules", of Christian monastic orders, and from the Jewish *Talmud*.[19]

The types of information derived from literary sources vary from the mundane, such as the proper spelling or gender of the terms for fish sauce, to the more important, such as the names of salt-fish that divulge something about their preparation and detailed directions for producing fish by-products.[20] So, for example, the only description for making *salsamentum* comes from the first-century AD agricultural treatise of Columella, and then only by indirection. After describing how to salt pork, by laying down alternating layers of meat and salt, he implies that the process is the same for salting fish (Columella 12.55.4). Other authors provide the names of fish by-products that hint at the type of fish used, the part of the fish chosen, the shapes into which the fish were cut, or their saltiness. For example, θυννίδες refers to tunny, ὑπογάστρια specifies the stomach portion, τετράγωνον indicates a rectangular-shaped piece, and ἡμιτάριχος states that the salt-fish is only half-salted. Interestingly, all specific terms for salt-fish are Greek; Latin expressions, where not subsumed under the general term *salsamenta*, are mere transliterations of the Greek, such as *trigonum*.[21]

Recipes for making fish sauce, however, are more numerous and come from different periods. The earliest descriptions are in the *Historia Naturalis* (31.93-95) of Pliny the Elder and in the *Astronomicon* (5.656-681) of Manilios, both of the first century AD. Two recipes of the third century AD are found in works attributed to someone else. These include the preparations (*confectiones*) of Ps.-Rufius Festus and of Ps.-Gargilius Martialis.[22] These ancient works provide information on ingredients used and their proportions, note various additives, sometimes specify the containers used, and hint at the process of manufacture. The fact that directions for producing fish sauce found in three post-classical sources closely coincide with earlier classical descriptions indicates that production methods changed little over the centuries. These post-classical sources include the seventh-century AD encyclopedia of Isidore of Seville (*Orig*. 20.3.19-20), a recipe appearing at the head of an eighth or ninth-century AD Merovingian manuscript of a medical treatise (Paris Bibl. Ms. Latin 11219), and the tenth-century AD Greek agricultural manual called the *Geoponika* (20.46.1-6). The latter source, which may ultimately derive from the sixth-century AD Latin work of Cassianus Bassus, provides the most detailed description extant for preparing *garum*.[23]

These recipe descriptions, in combination with other genres, such as satire, allow us to draw certain conclusions about the general character of these fish by-products. Manilios, for example, makes it clear that *salsamenta* and fish sauce can be by-products of the same production process, particularly where large fish, such as tunny and mackerel, are concerned. No part of the fish was wasted. Small, whole fish or the innards of large fish were ideal for producing fish sauce. Second, basic ingredients necessary to produce fish by-products include a supply of fish, salt, and fresh water. Third, salt-fish came in various

shapes, and in appearance were probably rather coarse looking, particularly if salted with scales still attached, and shriveled up with a dry appearance, if heavily salted. Plautus (*Poen*. 240-244) tells us that, before eaten, salt-fish sometimes had to be washed with fresh water. Unfortunately, no ancient author describes in detail what fish sauce looked like, but descriptions of the production processes imply that *garum*, *liquamen*, and *muria* were salty liquids, and fairly clear, if strained, while *allec* was probably a rather thick salty mush containing scales, bones, and undissolved fish matter.[24] Odors from their production were no doubt strong, but probably not as bad as some authors, such as Martial (3.77.5) or Artemidoros (*Onirokritikon* 1.62), would have us believe when they describe *allec* and *garum* as "putrid".[25] More than this we cannot gather, but we can make reasonable conjectures from what we do know about modern fish sauces, a subject discussed below (p. 39).

Ancient authors are also excellent sources for identifying places for production. For example, the tenets of ancient dietetics stressed eating the correct foods to maintain the proper balance of humours. Foods had defined powers to promote good humours and to counteract imbalances. These powers, expressed in terms of opposites, such as heating and cooling, moist and dry, laxative and binding, and so on, were linked with time of year, geographic location, and other environmental variables. So, many medical writers when talking of the medicinal value of fish frequently stressed certain fish or fish by-products from specific locations. Among the most important of these sources, for example, is Xenokrates' *De alimentis ex fluviatilibus*, or "Food from Aquatic Animals", which dates to the first century AD.[26] In Books IV and V he discusses the dietetic value of salted fish from sea, river, and lake, and makes special note of the Spanish mackerel and the small tunny, or pelamys, of the Black Sea region. The second-century BC historian Polybios (4.38.4; 31.25.5) notes that salted fish was one of the major products the Pontic areas supplied both to the cities of Greece and to Rome itself. Galen (*On the Properties of Foodstuffs* 3.30.5), writing in the second century AD, while also remarking on these same fish products, praises the salt-fish of Sardinia as well. Gastronomic writers, in discussing particular foods, highlight delicacies from around the Mediterranean, while satirists and other critics focus on famous and expensive fish products. Archestratos (frg. 39 Olson and Sens), for example, praises the salted tunny of Sicily, while Martial (13.102) is one of many who praise *garum sociorum* from New Carthage in Spain. Geographers in describing different geographical locations often speak of the food resources of a particular region or city. Strabon, for example, describes the tunny watches of Italy (5.2.6, 8; 6.1.1) and North Africa (17.3.18), and the salting factories of Spain (3.1.8; 3.4.2, 6) and the Black Sea (7.6.2; 11.2.4; 12.3.1, 19). These differentiations are not casual. Today, various fish products from diverse regions of the world do have distinct tastes, colors, consistencies, and so forth, because not only fish but also processes can vary.[27]

The second category of sources for production of fish by-products are the numerous remains of salting installations discovered by archaeological excavations conducted in the Western Mediterranean and Black Sea regions. The best-documented area remains that part of modern Spain and Portugal that in the Roman period went under the name Baetica, the region that formed the object of Ponsich and Tarradell's 1965 book. In 1988 Ponsich updated that work by significantly increasing the number of Spanish and Portuguese sites discussed from 15 to 89.[28] Many of these had received mention in literary sources, while many others were recognised from the characteristic physical evidence. Signs that a salting installation operated at a particular location include, most prominently, salting vats (*cetariae*), usually square or rectangular in shape and varying in size and depth.[29] A waterproof coating (*opus signinum*) covered the interior walls and floor; the angles at the bottom were reinforced, and the floor also had a shallow cuvette to assist in cleaning. It has for a long time been assumed that production of fish sauce took place in small vats, usually round in shape and less deep than the larger rectangular ones assumed to have been devoted to making salt-fish (*salsamenta*). Excavations at Neapolis (mod. Nabeul), in Tunisia, however, have uncovered at least one large rectangular basin that contained bones of small fish, mainly anchovy and sardines, preserved whole. The identification of the product as the sauce *allec* seems secure. Evidently, large rectangular vats, not just small round ones, could also be utilised for fish sauce production.[30] This fact raises questions bearing on seasonality of production and on specialization of product. Excavators in Pompeii have found dolia containing the dried remains of *allec*, also made with anchovies.[31] Finds of amphorae, with shapes usually associated with salt-fish products, evidence for a salt supply (salt mines or flats), and a source of fresh water also characterise salting installations.[32]

Major salting installations discovered so far on the Mediterranean coast of Roman Baetica include Sexi (mod. Almuñecar), Malaca (mod. Malaga), and Carteia (mod. El Rocadillo). On the Atlantic coast, installations have been discovered at Baelo (mod. Belo), Barbate, Puerto Real, Gades (mod. Cádiz), Las Redes, and Cerro del Trigo. Salting installations in Hispania Tarraconensis include, on the Mediterranean coast, Rhode (mod. Rosas), Punta de l'Arenal, and New Carthage (mod. Cartagena); Atlantic sites include, especially, Gigia (mod. Gijón).[33] Most fish salteries, large and small, most likely operated independently of any state control.[34] The larger salteries had capacities well beyond what local needs would require, and, doubtless, exported a considerable amount of processed fish. The province of Lusitania (primarily modern Portugal), for example, has yielded the second largest Roman salting installation so far uncovered, and even now it is not yet fully excavated. The installations at Tróia (mod. Setúbal) in the first and second centuries AD had a salting capacity of over 600 cubic meters, and may have ultimately reached over 750 cubic meters.[35]

The largest Roman salting installation so far discovered in the Western Mediterranean was located at Lixus, on the Atlantic coast of Mauretania Tingitana (mod. Morocco). Its ten factories had a salting capacity of over 1,000 cubic meters.[36] Other North African salting installations of significant size include, in Morocco, Tahadart and Cotta, and in Africa Proconsularis, Neapolis (mod. Nabeul) and Sullecthum (mod. Salacta).[37] Although evidence of salting has been found on the Mediterranean coast of southern France, the largest installations in Roman Gaul were located on the Atlantic coast in the Bay of Douarnenez, at places like Plomarc'h.[38] And, finally, extensive excavations in the northern part of the Black Sea, especially in the Crimea at Chersonesos and along the Strait of Kerch at Tyritake and Myrmekion, have unearthed many well-preserved salting installations.[39] Unfortunately, these installations are little known outside of Eastern Europe. Indeed, though strongly hinted at in literary and epigraphic sources, salting installations in the Greek East have, generally, yet to be discovered.[40] Included among these are many sites located on the southern coast of the Black Sea, such as at Sinope and Byzantium, and along the Aegean coast of Turkey, at Clazomenae and Rhodes, to name only a few of them.

Although fish salting may have operated in the Black Sea as early as the seventh century BC, but certainly no later than the fifth century BC, archaeological excavations have yet to prove it. Finds from the fifth-century BC Punic Amphora Building in Corinth, however, do confirm references from fifth-century BC Attic comedy writers that indicate that salt-fish production and export were part of the economy of Punic colonies in the Western Mediterranean at that time. Punic fish sauce amphorae found in Corinth came either from North Africa or southern Spain. Some of them still contained rectangular bits of preserved fish, perhaps τετράγωνον. Additionally, finds of late fifth-century BC Punic salting installations at Las Redes, near Gades, substantiate an active salting industry in the Western Mediterranean at this early date.[41] Most Roman salteries date between the first century BC and the fourth century AD, with some operating into the sixth century AD.[42]

Literary sources can tell us how the ancients prepared fish by-products and can often indicate where they were produced, while archaeology, by revealing the physical remains of the installations themselves, can confirm these locations and disclose others. They cannot, by themselves, however, provide an understanding either of the physical and chemical processes the fish underwent to become the desired product, or of the nutritional and medicinal value that the ancients attributed to fish by-products. For this we must turn to modern food scientists and present-day manufacturing installations. Although certain products similar to ancient fish sauce are still being produced in parts of France, Greece, and elsewhere in areas that made up the Greco-Roman world, the most instructive comparative material can be found in Southeast Asia, in coastal areas of Vietnam, Thailand, and the Philippines.[43]

Recent studies of modern fish by-products, such as the salted herring and anchovies processed in Russian and north Atlantic salteries and the Southeast Asian fish sauces, including Vietnamese *nuoc-mam*, Thai *nam-pla*, and Filipino *patis*, indicate that present-day production methods, for the most part, parallel almost exactly those used in the Greco-Roman period. Biochemical and microbiological analyses of modern fish sauces tell us much about the Graeco-Roman examples described by ancient authors or, in some cases, uncovered by archaeologists. Whereas there are many modern methods for preserving fish by-products, ancient processes for producing fish sauce involved primarily autolysis, that is, a fermentation process of enzyme hydrolysis utilizing naturally occurring enzymes found in the digestive tract.[44]

Among variables that lead to different fish by-products are species of fish, type of salt, fish-to-salt ratio, length of processing, and minor ingredients. Of these, the species of fish in particular affects the product's nutritional value, as well as its taste, colour, and odour. Biochemical and microbiological studies have shown that fish sauce is composed of proteins in the form of amino acids, such as lysine, and of peptides, and contains numerous vitamins and minerals, such as vitamin B_{12}, sodium, calcium, magnesium, iron, manganese, and phosphorus.[45] The ancients, of course, did not know of vitamins and minerals and the like. They could only comment on the sauces themselves, noting physical characteristics and speculating on the presumed value to health born of observation and superstition.

The physical characteristics of ancient fish sauces can be conjectured from those of their modern counterparts. The taste of *patis* and *nuoc-mam*, for example, has been described as salty, with a distinct cheese-like taste; *nam-pla* has a "meaty" flavor. A recent series of studies, particularly in Japan, however, has identified in modern fish sauces significant quantities of monosodium glutamate (MSG), which, these scholars argue, imparted to the products a specific and identifiable taste, denoted *umami*, distinct from the standard four tastes of sweet, sour, salty, and bitter.[46] The color of the best Southeast Asian fish sauces varies between the clear, straw yellow to amber color of *patis* to the rather brown color of *nuoc-mam* and *nam-pla*. Scientific studies on modern fish by-products not only provide information important to our world but also produce significant data useful for understanding different aspects of the ancient world, such as health and nutrition. These investigations apparently sometimes work in reverse order as well. One recent study, for example, in attempting to reproduce the ancient *garum*, claims to have created more quickly a fish by-product that is even more nutritional than its modern counterparts.[47] If anything can be made of this, then ancient fish sauce might provide a practical contribution to the modern world.

3. *Commerce*

The same types of ancient literary evidence that supplied information on production of fish by-products also provide important data about their trade. These include histories, orations, medical treatises, geographies, encyclopedias, poetry, drama, gastronomic literature, agricultural manuals, private letters, and the like. Greek dramatists of the fifth and fourth centuries BC, for example, provide evidence of early trade between Greece, that is, Athens, cities of the Black Sea region, and Punic areas of the Western Mediterranean. This trade also finds a strong echo in later Greek and Roman authors.[48] Praise by writers in Rome or in Athens of fish by-products, probably often personally known to them through their availability in local markets, shows, or more often implies, that those products traveled in some fashion to get there. The prominence given to preserved fish products from Spain and the Black Sea by both Greek and Roman authors indicate that these were the two areas most active not only in producing but also in trading in fish by-products. Although literary sources provide us with valuable information on commerce from the point of view of the consumer living at the centre of importation, that is, in Athens and in Rome, they do little to illuminate the actual transportation of these goods or to identify individuals associated with their commerce. For that we must look to archaeological and epigraphic sources.

The artefact most important in providing information about commerce in salted fish products is one that began to receive proper attention only in the late 19th century. The amphora was the two-handle terracotta vessel used to transport food items long distances. In 1879 Heinrich Dressel established, albeit unintentionally, the first typology of Roman amphorae.[49] Basing his work on painted inscriptions (*tituli picti*) appearing on many vessels excavated on Monte Testaccio in Rome, he identified, among others, those amphorae that had held fish sauce or salt fish, and arranged them by shape. Since that time, and particularly in the last half of the twentieth century, other scholars have refined or added to this early typology or have created completely new ones, giving to them their own name or the name of the place where the vessels were discovered.[50] This has created a complex and confusing array of amphora shapes associated with fish by-products. One of the major questions yet to be answered is to what extent one can relate amphora shape to its contents and to its point of origin. So, for example, Dressel Forms 7-14, Pelichet 46, Beltrán I, Almagro 50, Camulodunum 186A, and Vindonissa 586, among many others, identify fish sauce amphorae from Spain, while Africana I and II may have carried fish by-products from North Africa.[51] Recent amphora studies have gone beyond shape to include not only chemical and fabric analysis of the clay used to make the vessels but also the *tituli picti* appearing on them.[52] This information along with the find spots of the vessels, such as shipwrecks whose cargoes contained amphorae, port cities, such as Rome, Ostia, and Pompeii, military camps, and the like, plus governmental, funerary and dedicatory

inscriptions and papyri, have revealed a vast amount of information on trade in salted fish products. Four examples suffice to illustrate this point.

First, identification of the contents of amphorae has always perplexed scholars. Some vessels bear a painted inscription, or *titulus pictus*, that records the container's contents. Most amphorae, as extant, lack a *titulus* but their shape conforms to one or another type listed in various typologies. In this case, although we can reasonably conclude that the vessel once held a fish by-product, we do not know if the contents were fish sauce or *salsamentum*. Some amphorae, usually found among cargoes of ancient shipwrecks and lacking a *titulus*, still contain identifiable fish bones. Among the most prominent shipwrecks yielding amphorae with fish bones are the Sud Perduto II, Cap Béar III, Port-Vendres II, and Saint Gervais 3, from Spain, and the Grado from North Africa.[53] Since *garum*, *liquamen*, and *muria* were liquids, skeletal fish remains might represent either *allec* or *salsamentum*, but determining which one remains difficult. One recent study has begun to tackle this problem. Desse-Berset and Desse conclude that a container with many small whole fish, particularly clupeids, like sardines and anchovies, whose bones are disarticulated and mixed up, probably held *allec*. If the number of fish contained inside is relatively few and if the fish identified are larger than clupeids and the bones are generally intact and well preserved, the product was probably *salsamentum*.[54] This type of study is fairly recent however, so the question of criteria is far from settled.

Second, the painted inscription found on many – but not all – amphorae, has a standard and fairly consistent pattern, although not every label contains every item of information.[55] The kinds of information revealed include identification of the contents, along with any reference to their quality, and the ingredients used to make the sauce, such as the type of fish used. Following this the name of the owner of the vessel, the producer of the contents, or the person responsible for transporting the vessel frequently appear. Sometimes the recipient of the vessel might be listed. The *titulus* might also contain a number, of indeterminate meaning, that could be the vessel's weight, age of the product, or an indication of an imposed tax. One example comes from a one-handled vessel called the *urceus*, the vessel most often found in first-century AD Pompeii to have contained a fish sauce. The *titulus* reads: G(ari) F(los) SCOMBR(i)/ SCAURI/T(?) MAR/ L(uci) MARI PONICI.[56] The first line translates "the flower of garum, made from the mackerel." The next line reads "[a product] of Scaurus." In the third line appears an unknown symbol followed, after a space, by what appears to be an abbreviated name. The last line contains the name, in the genitive case, of "Lucius Marius Ponicus". The label has named the product (*garum*), declared its high quality ("the flower"), disclosed its ingredients (the mackerel), and identified the producer of the sauce (Scaurus). The meaning of the sigla is unknown; while MAR may refer to a manager of one of Scaurus' workshops, though the name does not appear elsewhere in Pompeii.[57] Ponicus may be the owner of the *urceus* or the shipper

transporting the vessel. Therefore, by naming the contents, denoting its quality, specifying the product's ingredients, designating the producer, signifying perhaps its place of manufacture, and identifying the exporter, the *titulus* is at once a product label that includes information that would probably satisfy the United States Food and Drug Administration. It is as well a vehicle for product advertising.[58]

These labels are also excellent sources to learn about the individuals who participated in trade in fish products. Names appearing in *tituli* indicate that many, but not all, involved in the trade were freedmen. The *urceus* discussed above contained a product made by Aulus Umbricius Scaurus, a wealthy freeman living in Pompeii in the early to mid-first century AD.[59] This individual, to judge from numerous *urcei* bearing his *titulus*, dominated the fish sauce trade in Campania. Many *tituli* indicate that, in addition to products from his own shop, he utilised his freedmen to distribute his product from several other shops.[60] The inscription on his tomb indicates that his son rose to the highest magistracy in the city and had an equestrian statue erected in his honor in the forum at the expense of the city council. The unique mosaic floor installed in a secondary atrium of the house at Region VII. Ins. Occ. 12-16 identifies Scaurus' luxurious home.[61] This mosaic had the design of an *urceus* at each corner of the impluvium. On each mosaic *urceus* is a *titulus* identifying either *garum* or *liquamen*, products made and sold by Scaurus.

Third, Scaurus' *urceus*, carried by L. Marius Ponicus, was actually found not in Pompeii but at Fos-sur-mer at the mouth of the Rhône River in southern France. How it got there provides an important source for commerce in salted fish products. In recent decades underwater archaeology has expanded to include deep and shallow water finds of Greek and Roman ships wrecked for various reasons.[62] Most contained cargoes of amphorae not only of wine and oil but also of fish by-products. Study of the individual amphora provides important information of the kind described earlier. Plotting shipwrecks that contain fish sauce amphorae provides a graphic view of the usual sea routes followed by merchant ships. For example, a primary trade route between Spain and Italy, plotted by shipwrecks containing salt-fish amphorae, ran from Spain northward along the Mediterranean coast to the mouth of the Rhône River. From there ships headed east where the shipping lane split into two routes. One route went north of Corsica, the other ran between Corsica and Sardinia. From there ships could head to Rome, to the Bay of Naples, or elsewhere, including the Near East where Spanish salt fish amphorae have been found.[63]

At the mouth of the Rhône River, sea-going ships could offload their cargo onto riverboats that could head north into the heart of Europe. Plotting amphora finds along major rivers, such as the Rhône and Rhine Rivers, can also identify interior trade routes, by which fish by-products from Mediterranean salteries made their way to soldiers, government functionaries, and others with a taste for sea fish.[64] Fish sauce produced locally in northern

Europe also found its way into long-distance commerce. For example, recent finds in the interior of Belgium of the bones of small sea fish (mainly sprats and unidentified clupeids) have been interpreted as evidence of local transport and trade in fish sauce from the northeast coast, perhaps in the vicinity of Colijnsplaat.[65] Dedicatory inscriptions, found at Colijnsplaat in Germania Inferior and dating to the late second or early third century AD, show that fish sauce merchants, *negotiatores allecarii*, carried their products, whether local or Spanish, across the Channel to Britain.[66] Excavations in London, York, along Hadrian's Wall, and in many other places show that fish sauce from Spain and elsewhere traveled a great distance from the Mediterranean.[67]

And finally, epigraphic evidence also provides other important information about trade in fish by-products. Although, with one exception, we lack evidence for a specific price charged for a definable quantity of salt-fish or volume of fish sauce, we can ascertain the relative value of these products. Tariffs on fish by-products, such as those from Bacchias (*P.Wisc*. II.80) in Egypt and Palmyra (IGRR 3.1056.ii.35) in Syria, both of the early first century AD, or from Zarai (CIL 8.4508) in Africa Proconsularis, dating to AD 202,[68] indicate that most fish by-products were not expensive, regardless of what some literary sources might imply.[69] This is also borne out in Diocletian's *Edict of Maximum Prices* (AD 301), which specifies a highest price allowable for an amphora of fish sauce of two different qualities (III.6-7). Comparing these prices with maximum prices for other common items listed in the same document, such as honey and pork, prices for fish sauce compare relatively well. This is the strong implication as well from find spots of fish sauce containers in first-century AD Pompeii, where vessels have appeared in kitchens and gardens of houses both of the rich and of the poor alike.[70]

These examples, among many others that could be cited, suffice to give an idea of the wide range of sources now available to study the production and trade of Greco-Roman salt-fish products. I have also emphasised the individuals working today in various professions who are cooperating to discover, to analyze, and to interpret the evidence. Scholars studying these products from various angles have provided us with a far more complete understanding of them than was possible when we were restricted to literary sources alone. We now call upon historical, archaeological, epigraphic, papyrological, and art historical evidence. Studies on modern equivalents to Greco-Roman fish by-products provide comparative data that augment our knowledge of the ancient products. Scientists, including ichthyologists, biochemists, and microbiologists, have taken a more active role in assisting the efforts of ancient historians, literary critics, archaeologists, epigraphers, papyrologists, and art historians. Together they have amassed a wealth of information about a food product that played an important role in many areas of Greco-Roman society. Some of these sources, however, have hardly been tapped and much more evidence is yet to be discovered. If results accomplished in the thirty-eight years since the appearance of Ponsich and Tarradell's work are any indica-

tion of the future, the coming years will bring even more gains and exciting discoveries.

Notes

1 I wish to thank Pia Guldager Bilde, Director of the Danish National Research Foundation's Centre for Black Sea Studies, University of Aarhus, for inviting me to participate in the workshop on marine resources and trade in fish products in the Black Sea region in antiquity. I also wish to express my appreciation to Dr. Tønnes Bekker-Nielsen, of the University of Southern Denmark, for his hospitality and kindness during my stay in Esbjerg, and to the other participants in the workshop for providing an interesting and stimulating discussion.

2 Curtis 1991, 114, 118-119. The ancient Egyptians and Mesopotamians also processed fish, but it remains unclear to what extent the technology went beyond merely drying or smoking. That they salted fish seems likely, but the archaeological evidence is far from conclusive. See Curtis 2001, 173-175, 238-240 .

3 For example, Constantine Harmenopulus *Manuale legum sive Hexabiblios* 2.4.22 (n.d., but Byzantine period), Theophanes Nonus *De omnium particularium morborum curatione* 156, 158, 162 (10th century), Liutprand *Relatio de legatione Constantinopolitana* 20 (10th century), and Symeon Sethus *Syntagma de alimentorum facultatibus* passim (11th century). See Curtis 1991, 184-190.

4 Rabelais in Nock and Wilson 1931, 1, 930; Rondelet 1554-1555, 141; Belon 1555, Chapt. 25, 72. See also Curtis 1991, 186-187, 190; French 1986, 263; Chibnall 1975, 57-78; and Gudger 1924, 269-281.

5 Köhler 1832. That same year a brief article also appeared on the mackerel and ancient *garum*, Cuvier and Valenciennes 1832, 286-294.

6 Smidth 1875. First published in Danish in 1871, it was reprinted in English translation in 1875. C. Badham 1854 and Blümner 1869 are also rather superficial.

7 Eberl 1892. The last half of the 19th century also saw the appearance of Joachim Marquardt's volume on the private life of the Romans, which treats the topic of processed fish in only a few pages. He does, however, make some use of painted inscriptions (*tituli picti*) on amphorae. See Marquardt 1893, 2: 60-68.

8 Rhode 1890.

9 Zahn 1910, 841-849. The role of amphorae and their written inscriptions (*tituli picti*), as early as 1879, had already been recognized for their importance in studying ancient trade. See Dressel 1879, 36-112, 143-195. See also Remarck 1912. Blümner's updated volume on Roman private life, like Marquardt's before him, devotes little space to processed fish, and likewise adds little to Köhler's work. See Blümner 1911, 184-188.

10 Grimal and Monod 1952, 27-38; Jardin 1961, 70-96.

11 Ponsich and Tarradell 1965.

12 The Russian archaeologist, Viktor Gajdukevič, had conducted extensive excavations in the Crimea since the 1930s, but his work was largely unknown in the West until publication of Christo Danov's excellent 1962 Pauly-Wissowa article, in German, on the "Pontos Euxeinos", followed in 1971 by Gajdukevič's own *Das Bosporanische Reich*, a revised German translation of his earlier Russian work, in which he summarized the results of his excavations. Danov 1962, esp. 955-985; Gajdukevič 1971, 376-378.

13 Some scholars, influenced by the works of M.I. Finley, continue to downplay the role of salt-fish in the ancient economy, relegating them to little more than temporary hedges against periods of food shortage and famine. Cf. Gallant 1985; Finley 1999.
14 Paoli 1975, 91. In opposition to this attitude, see Curtis 1983, 232-240.
15 Cf., e.g., Étienne and Mayet 1998a, 147-165; Paterson 1998, 149-167; Garnsey 1998; Haley 1990, 72-78; D'Arms 1981.
16 Cf., e.g., Parkins 1997.
17 The fragments, with English translation, of Archestratos are most conveniently collected in Olson and Sens 2000, while Athenaios' work can be consulted in the Loeb edition of that author. Flower and Rosenbaum 1958 contains a translation of Apicius, which, while ascribed to the noted cook of the first century AD, dates to the fourth century AD.
18 Curtis 1991, 131-141; Drexhage 1993, 27-55.
19 Specific references can be found in Curtis 1991, 6-15.
20 E.g. *allec* vs. *hallex*, or ὁ γάρος vs. τὸ γάρον. See Curtis 1991, 7, n. 7 and 8, n. 9.
21 Curtis 1991, 7, n. 2.
22 Ps.-Rufius Festus *Breviarium*; Ps.-Gargilius Martialis 62. See Curtis 1991, App. I-4 and I-5, respectively.
23 For Paris Bibliothèque Ms. Lat. 11219, see Lestocquoy 1952, 185-186. For an English translation of this section of the *Geoponika*, see Curtis 1991, 12-13.
24 For strained fish sauce, see Apicius *de re Coq*. 7.6.14; *Geoponika* 20.46.2; CIL 4.7110.
25 For the text of Artemidoros, see Pack 1963, 72. Cf. Manilios *Astronom*. 5.670-674.
26 Xenokrates *ap*. Oribasios *Medical Collections* 2.58.133-152. For salt fish products in ancient medicine, see Curtis 1991, 27-37. While Xenokrates' work is unavailable in English translation, Galen's *De alimentorum facultatibus* (*On the* Properties of Foodstuffs) can be consulted in Powell 2003.
27 Voskresensky 1965, 117-128; Van Veen 1965, 227-250. Strabon is readily accessible in the Loeb edition.
28 Ponsich 1988. Since that time, four other important works covering the salteries of Baetica and other parts of Roman Spain have appeared: Étienne, Makaroun, and Mayet 1994; Lowe 1997; Lagóstena Barrios 2001; and Étienne and Mayet 2002.
29 Some vats at Vão, in Baetica, measured 1.50×1.03×1.85 m., while others at Caetobriga measured 4.00×3.70×2.00 m. See Curtis 1991, 53-54.
30 Sternberg 2000, 133-153. Similar finds have come from salting factories in Baetica at Quinta do Marim (Olhão) and in Hispania Tarraconensis at Troia. See Desse-Berset and Desse 2000, 84-92.
31 Curtis 1979, 5-23.
32 Curtis 1991, 50-51.
33 See most recently, Lagóstena Barrios 2001.
34 Curtis 1991, 148-152; Ørsted 1998, 13-35. For possible imperial participation in the production and trade in Spanish processed fish, see Liou and Marichal 1978, 131-135, No. 27, and Curtis 1991, 63.
35 Étienne and Mayet 2002, 96.
36 Ibid., 118; Ponsich 1988, 103-136.

37 Tahadart and Cotta: Ponsich 1988, 139-159; Nabeul: Sternberg 2000, 133-153; Sullecthum: Foucher 1970, 17-21. For North African salt-fish production, generally, see Ben Lazreg, Bonifay, Drine, and Trousset 1995, 103-142.
38 Curtis 1991, 74-76.
39 Curtis 1991, 118-126. See above, note 12.
40 Curtis 1991, 112-118, 129-131.
41 Curtis 1991, 47-48; Lagóstena Barrios 2001, 98-100.
42 Curtis 1991, 178.
43 Lopetcharat, Choi, Park, and Daeschel 2001, 65-88.
44 Curtis 1991, 15-22; Beddows 1985, 2: 1-39; Mackie, Hardy, and Hobbs 1971.
45 Curtis 1991, 22-24; Lopetcharat et al. 2001, 71-72.
46 Lopetcharat et al. 2001, 79-82. For *umami*, see especially Kawamura and Kare, eds. 1987, and Yamaguchi and Ninomiya 1998, 123-138.
47 Aquerreta, Astiasarán, and Bello 2001, 107-112.
48 Curtis 1991, 126-29.
49 Dressel 1879, 36-112, 143-195.
50 Cf., for example, Peacock and Williams 1986.
51 Curtis 1991, 39-44, 70, esp. Fig. 1, p. 42.
52 Peacock 1977, 261-278; Peacock and Williams 1986, 14-15.
53 Desse-Berset and Desse 2000, 75-82; Colls, Étienne, Lequément, Liou, and Mayet 1977; Auriemma 1997, 129-155; idem 2000, 27-51. Amphorae containing bones have also been found on shore on the island of Elba and at Olbia in Sardinia. See, especially, Bruschi and Wilkens 1996, 165-169.
54 Desse-Berset and Desse 2000, 91-95.
55 See, for example, Zevi 1966, 208-247; Curtis 1991, 197-200; Liou and Rodríguez Almeida 2000, 7-25, Étienne and Mayet 2002, 211-221. See also note 9, above.
56 Liou and Marichal 1978, 165, No. 69.
57 Ibid. Cf. Curtis 1991, 198-199.
58 Curtis 1984-1986, 209-228.
59 Curtis 1988b, 19-49.
60 Curtis 1988b, 28-33; Étienne and Mayet 1991, 187-194; Étienne and Mayet 1998b, 199-215.
61 *CIL* 10.1024; Curtis 1984b, 557-566.
62 See, for example, Colls et al. 1977, and Parker 1992, passim. For a Spain-Italy connection in the processed fish trade, see also Haley 1990, 72-78.
63 Curtis 1988a, 205-10; Curtis 1991, 143-144; Cotton, Lernau, and Goren 1996, 223-238; Lernau, Cotton, and Goren 1996, 35-41; Meijer 2002, 142-145.
64 Curtis 1991, 80-83; Martin-Kilcher 1990, 37-44, idem 1994 and idem 2003. Cf. also the first-century AD Spanish vessel of *garum scombri*, found in Mogontiacum (mod. Mainz), that bore a *titulus pictus* indicating that the recipient was the imperial legate P. Pomponius Secundus. See Ehmig 1996, 25-56.
65 Van Neer and Lentacker 1994, 53-62.
66 Curtis1984a, 147-158; Immerzeel 1990, 183-192.
67 Curtis 1991, 79-85; Carreras Monfort 2000, 141-149; Jones 1988, 126-131.
68 Some *tituli picti* may have included indication of an export tax levied at the port of embarkation. See Frank 1936, 87-90. But cf. Colls et al. 1977, 95-98; Ehmig 1995, 120-125.
69 For expensive fish sauce, see Pliny *HN* 31.94; Seneca *Letters* 95.25; Manilios *Astron*. 5.671; Martial 13.103.
70 Curtis 1991, 170-175.