MARINE FISHERIES AND THE ANCIENT GREEK ECONOMY

by

Ephraim Lytle

Department of Classical Studies
Duke University

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Approved:

Kent J. Rigsby

Kent J. Rigsby, Co-Chair

Joshua D. Sosin, Co-Chair

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CHAPTER 2—Trapping Ancient Tuna

In the previous chapter I argued that in the Greek world fishing rights at sea were generally free and accessible to all. There is, however, one certain exception to *la liberté halieutique*: tuna-traps (*tonnare* in Italian, *madragues* in French, θυννία in Modern Greek) and, perhaps in a limited number of cases, large shore-based seines (*tratta* in Italian, τράταρον τράττα in Modern Greek). In antiquity, as in very recent times, tuna-traps were deployed year after year in locations that annually witnessed large schools of tuna and related species passing close to shore. Points on the coast from which these technologies could profitably be employed would have invited, often even required, some form of civic regulation. It is not surprising then to discover ancient documentary and literary evidence pertaining to the use and regulation of *tonnare* and similar technologies in the Aegean.

This evidence has never been thoroughly collected or discussed.[1] Consequently, much of it has been misinterpreted and scholars have generally overlooked the significance that these data hold for our understanding of Greek law, the nature and scale of ancient fishing technologies, and the vital relationship between marine fisheries and many coastal city-states. This chapter is arranged in three sections. I will begin by discussing the literary and archaeological evidence for the existence in antiquity of *tonnare* and related technologies employed in the large-scale capture of tuna and similar

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[1] Much of the literary evidence for ancient tuna fishing has already been collected. See especially Paul Rhode (1890), or, more succinctly, Thompson (1947), pp. 79-90. Likewise, O. Keller, *Die Antike Tierwelt*, vol. 2 (Leipzig 1913), pp. 382-393, and A. Steier, "Thynnos," *RE* 6 (1936), cols. 720-734. Bintliff (1977) incorporates comparative evidence, including his own anthropological research, as well as a broad range of earlier evidence in a useful discussion (pp. 117-122) of the importance of seasonal tuna fisheries in the prehistoric Aegean.

species. This discussion is integral to the second section in which I discuss the epigraphic evidence for large-scale fisheries in the Hellespont, particularly at Parium where the convergence of literary and epigraphic evidence will allow us to describe the organization and operation of one outfit in surprising detail. This section will, in turn, afford a number of useful analogies for the final section, in which I collect and discuss the scattered and often difficult literary and epigraphic evidence pertaining specifically to coastal tuna operations in the Aegean. In the process I will address a number of important questions about the role and nature of state regulation in marine fisheries, arguing that these large-scale tuna operations could be owned or leased chiefly because they were tied to fixed points on the coast and were often accompanied by lookouts and other installations on shore. In those instances where these operations were owned and leased by the state the proceeds could be significant. Nevertheless, these operations were exceptional and the vast majority of marine fishing in the ancient Aegean would have been subject to no regulation whatsoever and it could only have been a source of indirect, though not necessarily insignificant, revenues. This discussion contributes to a larger portrait of the social and economic life of Greek city-states, to which marine fisheries were vital.

Section I—Ancient *Tonnare* and Related Technologies

Traditional Mediterranean trap-nets targeted migratory species, most notably bluefin tuna (*Thunnus thynnus*, L.), which once regularly attained sizes of over a thousand pounds, although it would appear that historically such large specimens were

rarely captured in Mediterranean *tonnare*.[2] The population of this remarkable fish has been decimated throughout its range by overfishing, and especially in the Mediterranean, where bluefins have nearly vanished from coastal ecosystems, taking with them a piece of at least 11,000 years of Mediterranean history.

There is, for example, good evidence that humans have hunted tuna in the bays and shallow straits of the Aegean since at least the Mesolithic period, when humans deposited large quantities of giant bluefin bones in Franchthi Cave.[3] Bluefin remains and points that could be used in hunting large tuna appear with increasing frequency in the Neolithic, particularly at sites associated with the Saliagos Culture, and Bintliff suggests that all of these sites "represent temporary camps on eminences from which the approach of tunny in adjacent bays could be observed."[4] Bluefin could once be seen during certain seasons swimming close to shore, their torpedo-like wakes clearly visible from a high

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[2] Theresa Maggio describes the capture of eight hundred pound tuna at Favignana and mentions one that weighed thirteen hundred, see *Mattanza: the Ancient Sicilian Ritual of Bluefin Tuna Fishing* (New York 2001), p.133. Thompson (1947) reports (p. 81) that in his day Sardinian and Sicilian bluefin generally did not exceed four or five hundred pounds while "the run of the fish" were closer to a hundred. In the 19th century, concerning the Adriatic, Faber (1883) reported (pp. 65-66), "the weight of tunny fish varies from 3 to 300 kilos a head, and the average may be 6 to 8 kilos fishes of 150 to 200 kilos are not uncommon, beyond 200 kilos they are rare." Many of the smaller fish would be tunas other than bluefin. Aristotle knew of one captured tuna weighing fifteen talents or well over 550 pounds on the Aeginetan standard (*HA* 607b32-33): Ἤδη δ' ἐλήφθη γίρων θύννος οὗ σταθμὸς μὲν ἦν τάλαντα πεντεκαίδεκα, τοῦδ' οὐραίου τὸ διάστημα δύο πήχεων ἦν καὶ σπιθαμῆς. This anecdote is repeated by Pliny (*NH* 9.44). The world record for a bluefin caught by rod and reel is 1,496 pounds (see http://www.igfa.org/records.asp).

[3] On the question of fishing in Prehistoric Greece, see the summary in Bintliff (1977), pp. 117-122. On Franchthi cave see T. Jacobsen, "Excavations at the Franchthi Cave: Parts 1 and 2," *Hesperia* 42 (1973), pp. 45-88 and 253-283. On the fish-bone evidence, which has still not been systematically examined or published, see S. Payne, "Faunal Change at Franchthi Cave from 20,000 B.C. - 3000 B.C," in: A. T. Clason, ed., *Archaeozoological Studies* (New York 1975), pp. 120-131. See also T. W. Jacobsen, "Franchthi Cave and the Beginning of Settled Village Life in Greece," *Hesperia* 50 (1981), pp. 303-319.

[4] On the Saliagos Culture see J. Evans and C. Renfrew, *Excavations at Saliagos Near Antiparos* [BSA Suppl. 5] (London 1968). Numerous additional Neolithic sites have been associated with this culture and Bintliff (1977) suggests that many, if not all, should be identified as seasonal fishing camps (p. 122): "The sites seem all to have occupied locations immediately adjacent to inlets suitable for fishing; in the case of Saliagos we can demonstrate that tunny formed the main diet and the site dominated fish run bays...."

place on the shoreline and indicating schools of a wide variety of sizes and structures: "like phalanxes" according to Philostratus and Oppian, whereas according to Aelian "the largest swim alone, others in pairs like wolves, and the youngest in herds like goats."[5] Even with the primitive technology available in the Mesolithic period individual bluefin could be pursued and harpooned, a method employed in antiquity and still even today.[6] Certainly by Classical antiquity, and likely much earlier, Aegean fishermen developed more elaborate methods that could trap whole schools of tuna and other migratory species entering the relatively shallow waters of straits, bays and inlets.

Even in the most primitive form, these fisheries would depend upon the skills of lookouts, often called θυννοσκόποι. A letter of Alciphron (I.20) offers good testimony for a relatively informal operation: an unspecified number of fishermen are informed by a lookout, here called a σκοπιωρός, that a number of tuna or bonito have entered the bay; they then proceed to set out the seine "around the entire bay" and pull it in, offering shares to locals to help in the endeavor. The lookout itself could be an actual stone or wooden construction or simply a lofty rock overlooking a suitable patch of water, such as we discover in the metaphor employed by the chorus in Aristophanes' *Knights* to goad

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[5] Aelian *HA* 15.3; Philostratus *Imag.* 1.13; Oppian *Hal.* 4.643. For scientific confirmation see R. L. Partridge, J. Johansson and J. Kalish, "The Structure of Schools of Giant Bluefin in Cape Cod Bay," *Environmental Biology of Fishes* 9.3-4 (1983), pp. 253-262.

[6] For the many references to hunting tuna with the harpoon (ἰχθυόκεντρον, κητοφόνος τριαίνη, *fuscina, tridens*, etc.) in antiquity, see Thompson (1947), p. 86. For good comparative evidence see R. Gillett "Traditional Tuna Fishing: A Study at Satawal, Central Caroline Islands," *Bishop Museum Bulletin in Anthropology* 1 (1987) pp. 6 and 29-30, and S. Crockford, "New Archaeological and Ethnographic Evidence of an Extinct Fishery for Giant Bluefin Tuna (*Thunnus thynnus orientalis*) on the Pacific Northwest Coast of North America," in: W. van Neer, ed., *Fish Exploitation in the Past: Proceedings of the 7th Meeting of the ICAZ Fish Remains Working Group* (Leuven 1994), pp. 163-168. Carl Safina describes at length the decline of the once-thriving New England bluefin fishery, which includes harpooners, in his *Song for the Blue Ocean* (New York 1997), pp. 7-116.

Cleon (313): ἀπὸ τῶν πετρῶν ἄνωθεν τοὺς φόρους θυννοσκοπῶν, "as you peer down from the rocks scoping out tribute like tuna."[7]

Given that they were situated on land, these lookouts must have been subject to ownership, whether by state, temple or individual. Furthermore, many of them would have overlooked λιμένες, bodies of water that Plato (and Roman law as well) specifically exempts in his law establishing free and open fishing rights at sea. The term λιμήν can cover a wide semantic range, corresponding to anything from a sheltered body of water suitable as an anchorage to a formal harbor complete with breakwaters and docks. On the one hand, it is very likely that fishing rights were, together with other harbor rights, carefully controlled in the chief harbors of many Greek cities. On the other hand, there is no reason to believe that city-states could or would have regulated fishing rights in every cove or haven. There is no evidence, literary or documentary, suggesting the regulation of any of Attica's hundreds of small beaches and coves. Elsewhere, the existence of specific and limited regulations implies a general freedom therefrom. On the island of Cos, for example, a sacred law refers to a number of lookouts that are subject to regulation, implying that local fishermen freely exploited the island's other coves and beaches.[8] The area known as Ἄγριοι Λιμένες, or "Wild Harbors," which constituted a rich fishing area in the Argolic Gulf, is perhaps another telling case: an inscription from

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[7] In addition to the evidence discussed below, see the descriptions of θυννοσκόποι in Aristotle (*HA* 537a19) and Plutarch (*Mor.* 298c), and the θυννοσκοπεῖα mentioned by Strabo (5.2.6 and 8; 17.3.16) and Synesius (*Ep.* 57), as well as Theocritus' ὥπερ τὼς θύννως σκοπάζεται Ὄλπις ὁ γριπεύς (3.26). Bintliff (1977, p. 122) suggests that the foundations of a tower at Saliagos do not represent early defensive works but the site of a tuna-watching tower. It has been suggested likewise that a number of Roman stone-built towers excavated in Spain and North Africa be identified, together with examples depicted in mosaics, as tuna-watching towers.

[8] On Cos see *Syll.*[3] 1000.9-11 and the discussion in section three below.

Epidaurus, which Jameson, Runnels and van Andel adduce as proof that the region was not exploited by ancient fishermen, is better interpreted only as evidence that fishing in the Wild Harbors was entirely unregulated.[9]

The methods devised to trap ancient tuna were varied. Likely the most common was the simple beach seine (see fig. 1). Used to target a wide variety of species, this method of fishing, often mentioned by ancient authors and even depicted on Roman mosaics (see fig. 2), remained a popular and profitable method in the Mediterranean well into the 20th century and is still used in many parts of the world even today.[10] A century ago, Wilski described in wonderful detail the operation of a traditional beach-seine on Thera.[11] Between nine and eleven fishermen, or τραττάριδοι, would awake before dawn, load the net into a boat for six rowers, set the net out parallel to the beach, and at daybreak drag it ashore. A third of the catch would go to the owner of the seine,

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[9] There was a modern tuna-trap in the region at the Bay of Salandi from at least the 19th century, on which see Apostolides (1883), p. 75; likewise Bintliff (1977), p. 240. Jameson, Runnels and van Andel suggest, however, that fishermen did not exploit the region in antiquity because there is "no mention of fishing in the arbitration between Epidauros and Hermion, which covers the Salandi area." See M. H. Jameson, C. N. Runnels, and T. H. van Andel, *A Greek Countryside: The Southern Argolid from Prehistory to the Present Day* (Stanford 1994), pp. 314-315. But the absence of any mention of fishing in this dispute, which exists in two copies, *IG* IV^2 1.75 [*SEG* 11.405], from Epidaurus, and the other, *SEG* 11.377, from Hermione, is telling for a very different reason. The wording of the inscription and the present character of the land show that Epidaurus and Hermione were interested in this region at the periphery of each state's territory chiefly because it afforded rich pasturage for goats, on which see Jameson *et al.* (1994), appendix F, "The Border Dispute Between Hermion and Epidauros," pp. 596-606. There is no reason to believe either state could have found it feasible or desirable to regulate the harbors along this remote stretch of coast that was likely exploited not only by citizens of Hermione or Epidaurus but also by local and 'transmerant' fishermen, especially the former inhabitants of the nearby and recently destroyed town of Halieis. The adjective ἄγριος carries many of the same connotations as its closest English equivalent, 'wild', i.e. it could bear refer to the richness of the harbors as fishing grounds, but just as easily to the remoteness of the place, on which meanings see LSJ, s.v.

[10] See, e.g., Oppian *Hal.* 3.124 and 4.490-503; Aelian *NA* 1.141; Plutarch *Mor.* 977f.

[11] P. Wilski, *Thera: Untersuchungen, Vermessungen und Ausgrabungen in den Jahren 1895-1902* [F. F. Hiller von Gaertringen, ed.], vol. 4.2, *Klimatologische Beobachtungen aus Thera* (Berlin 1909), specifically Nachtrag 6, "Züge aus dem Volksleben," pp. 156-182, esp. pp. 158-164.

apparently never one of the fishermen. After certain bonuses were paid to those with special functions, the rest would be divided equally among the fishermen. These fisheries were entirely unregulated, and Wilski lists thirty-eight Theran βόλοι, sites where, depending upon the winds and other factors, fishermen traditionally deployed their *tratta*. Obviously this technology could be adapted, as in the fishery witnessed in Alciphron's letter, to target tuna in daylight with the aid of a lookout. There is, however, good reason to believe that ancient technology advanced well beyond the beach seine.

Traditional Italian *tonnare* and French *madragues* are giant trap-nets of varying design and complexity (see fig. 3). The tuna are funneled into the traps by carefully positioning long barrier nets, with one usually extending directly out from the shore and often with a second placed perpendicular to the first. These nets, as well as the trap itself, are set out each spring only after the *rais* determines that the stormy winter season has safely passed, and they are taken in again at summer's end.[12] Perhaps the most famous and well documented of these traps is at Favignana in the Egadi Islands off Sicily's northwest coast. The Favignana *tonnara* is one of the last examples of a technology once

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[12] Of *tonnare* D'Arcy Thompson writes (p.86): "These are permanent constructions, based on solid foundations." This is not true of most *tonnare*, or in fact of any described by P. Pavesi, *L'industria del tonno* (Rome 1889), C. Parona, *Il tonno e la sua pesca* [*Regio Comitato Talassigrafico Italiano* 68] (Venice 1919), or, more recently, in V. Consolo, ed., *La pesca del tonno in Sicilia* (Palermo 1986). At Favignana the *rais* determines each season when and precisely where the trap will be located and the massive barrier nets are then placed accordingly. On Sicily the net was traditionally anchored by *tufo* blocks cut for this purpose (see fig.4). The blocks and anchors must be massive enough to secure the net against the drag of the current, which, given the size of the nets and the speed of the current, can be considerable. This detail may have misled Thompson into assuming the traps had permanent foundations. Indeed, Thompson cites Rhode, where the error seems to have originated (p.47): "Quae tam quam castella marina...e validis funibus constructa atque ancoris plumbeisque ponderibus lapidibusve in fundo maris devincta sunt in fretis vel inter insulas athynnis praecipue frequentatis." Rhode also asserts that in Sardinia, Sicily, Dalmatia, France and Spain the traps are used "per totum annum." This statement is decidedly not true and seems to be a logical deduction derived from the false assumption that the stone anchors are permanent foundations.

widespread. Due to the combined pressures of overfishing, pollution, and technological change, these traps have almost entirely disappeared with their quarry.[13]

Mediterranean tuna-traps occur in a wide variety of forms, such that no two *tonnare* are identical. The traditional Sicilian trap is essentially a long rectangle 200-400 meters in length, as much as forty meters wide and between twenty and fifty meters deep. It consists of a series of net "rooms" which can be closed off as needed (see fig. 5).[14] The trapped tuna are then herded from one room to the next by opening and closing the "gates"—sections of net that lie on the sea floor until being lifted into place by means of ropes running to the surface. The last room, called in Italian *la camera della morte*, has a densely woven net floor, which, as it is drawn up, brings the tuna to the surface for the final slaughter, the *mattanza*. There are many published reports of the *mattanza*, few more compelling than that of Jacques Cousteau, who recorded his experience diving in the Tunisian *tonnara* at Sidi Daoud near ancient Carthage.[15] Concerning these "great labyrinthine fish-traps" D'Arcy Thompson agreed with many earlier scholars in

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[13] A century ago there were dozens of *tonnare* on Sicily alone. Already rendered uncompetitive by factory long-liners and seiners, Mediterranean *tonnare* now have no bluefin to catch. The lone survivors are subsidized by tourists who pay to witness the spectacle. In the 1990's the *tonnaroti* at Favignana attributed their *tonnara*'s continued operation chiefly to its location well out to sea where the migrating tuna are funneled between the islands. Here the *tonnaroti* manage to survive on what Maggio describes (p. 122) as "the last trickle of what was once a great river of tuna."

[14] Maggio (2001), p. 129. For a detailed description of this traditional technology see V. Fodera's *The Sicilian Tuna Trap* [General Fisheries Council for the Mediterranean, Studies and Reviews 15] (Rome 1961). Numerous studies have been published in Italian; in addition to those cited above, see, e.g., G. L. Danzuso and E. Zinna, *La mattanza: il ritorno de Ulisse* (Catania 1987) or B. Centola, *Le città del mare: la pesca con le tonnare in Italia* (Avagliano 1999).

[15] See J.-Y. Cousteau and F. Dumas, *The Silent World* (New York 1953), pp. 217-9.

suggesting that they "remain unaltered from ancient times."[16]

Thomas Gallant, however, rejects outright any suggestion that modern *tonnare* had ancient predecessors, boldly asserting that the "true madrague, contrary to popular opinion, was not known or used in antiquity."[17] This would come as a surprise to the Italian and French authors who confidently assert the opposite.[18] But Gallant's claim has met little opposition from scholars writing in English. Indeed, it has often been repeated. For example, Jameson, Runnels and van Andel write, "The role of the tunny in historical times has often been exaggerated, according to Gallant, and this is so even after the development of the true madrague, unknown in antiquity, as a system for large-scale capture of the fish."[19] Perhaps more worrisome is that Gallant's claims have occasionally formed the basis of additional re-interpetations, with important historical implications.[20]

The only evidence Gallant gathers for his claim is that that "the description of tunny fishing presented in Aelian and Oppian bears absolutely no resemblance to the true

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[16] Thompson (1947), p. 86, following Rhode (1890), who likewise asserts that the modern traps do not differ from their ancient predecessors except perhaps in scale (p. 47): *nec nisi magnitudine sumptibusque impensis profecto differunt ab illis veterum machinationibus.*

[17] (1985), p. 21.

[18] See the many general works on *tonnare* cited below, as well as the many fascinating histories of individual *tonnare*, such as F. Maurici and F. Vergara, *Per una storia delle tonnare siciliane: la tonnara dell'Ursa* (Palermo 1991); N. Ravazza, *L'ultima mucciara: storia della tonnara di Bonagia* (Trapani 2000); G. Conte, *Addio amico tonno: indagine sulle tonnare di Portopaglia, Portoscuso e Isola Piana dal XVI secolo ai giorni nostri* (Calgiari 1985); S. Rubino *La tonnara Saline: tradizioni e riti di una tonnara* (Alghero 1994).

[19] Jameson *et al.* (1994), p. 314.

[20] E.g. Jameson, Runnels and van Andel's recent treatment of the Southern Argolid attempts to overturn many of Bintliff's influential theories, among them the idea that rich Aegean fisheries, and the fishermen that exploited them, played an important role in the emergence and development of civilization in prehistoric Greece. The authors' chief counterweight to Bintliff is Gallant. See Jameson *et al.* (1994), pp. 309-314.

madrague and only a very general one to the *tonnara*."[21] Gallant makes a categorical distinction between a "true madrague" and a *tonnara*, but the terms *madrague* and *tonnara* are essentially synonymous. Gallant's sole source for the workings of a *tonnara* is Faber's fascinating study of 19th century fisheries in the Austro-Hungarian regions of the Adriatic. Faber refers to Adriatic tuna traps as *tonnare*, whereas they are elsewhere more precisely referred to as *tonnarelle*, "little traps."[22] A typical 19th century *tonnarella* in the Adriatic may indeed have been considerably less involved than a "true madrague," requiring no long barrier and generally consisting of individual nets configured in such a way as to trap the fish between the net and the shore (see fig. 6).[23] Faber describes its operations as follows:

> When the shoal has entered the enclosure, the entrance is at once closed by drawing ashore a sufficient quantity of slack netting, which is left hanging for this purpose at the outer end of the net, by means of a rope, which is kept on shore. The alarm is then sounded by throwing stones near the inlet through which the fish have just passed, and by raising a hue and cry, in which all join, in order to drive the shoal towards the end of the enclosure. The scene is now one of intense excitement and bustle, the nets are hauled in, and the fish are killed by means of spikes and oars, thrown ashore, disembowelled, and sent to market.[24]

Of the fifteen *tonnarelle* on the Dalmatian coast the largest employed only thirty-four men and the smallest eight, with the average operation employing a dozen.[25]

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[21] Gallant (1985), p. 22.

[22] Gallant's only cited sources for *madragues* are the brief descriptions in A. von Brandt, *Fish Catching Methods of the World* (Surrey 1964), pp. 70-1 and 81-2 and J. Dumont, "La Pêche du Thon à Byzance à l'époque hellénistique," *REA* 78-79 (1976-1977), pp. 96-119, esp. p. 108.

[23] Faber (1883), pp. 111-13.

[24] Ibid., p. 112.

[25] Ibid., pl. I.

A similar operation during the same period in Greece is described by Apostolides. In spring as many as 20 vessels set out from Spetzes for the coast at the mouth of the Argolic Gulf, into which, it would appear, tuna migrated in considerable numbers. Here each operation would attach one end of a very long net to the shore and then stretch it out perpendicular to the shoreline for some distance into the Gulf. The fishermen would then erect tall masts, atop which they would place the individuals given the task of observing and signaling the approach of the tuna, which would then be encircled by manipulating the ends of the nets with a series of lines.[26]

Gallant makes much of the fact that ancient descriptions of tuna fishing generally differ from the *tonnarelle* described by Faber and Apostolides, asserting that ancient tuna fisheries would consequently have been much less efficient even than primitive tuna fisheries in the Adriatic, let alone "true madragues." But there is no reason that a plethora of technologies should not have existed simultaneously in antiquity, just as in very recent times.[27] In other words, the existence of more "primitive" technologies hardly precludes the existence of more "advanced" ones. And there is, in fact, much ancient and medieval evidence that complicates Gallant's claims. Most problematic is a passage in Oppian's *Halieutica* that begins by describing how the schools of giant bluefin enter the Mediterranean in the spring and are densest in the south of Spain and France

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[26] Apostolides (1883), pp. 39-40.

[27] E.g. in addition to the tuna seines employed by the fishermen from Spetzes Apostolides recorded (1883, pp. 74-76) the existence of no fewer than ten θυνεία, or tuna-traps, in Greece, including three in the Argolic Gulf, one of these at Salandi. Bintliff (1977) later described a tuna-trap at the same location (p. 240): "[B]y the water's edge stands a thick post about twelve feet high, up which runs a ladder of slats nailed into the wood. At the top is a crude chair of three branching little stakes. In front of the pole in the shallows is an arc-like arrangement of stones, and beyond this a large series of nets set at right angles to the promontory into the bay."

and then again off Sardinia, Sicily and Southern Italy.[28] The passage, which concludes the third book, culminates in a description of a method of capture that closely parallels the operation of modern *tonnare* (3.640-48):

> τὰ δ' αὐτίκα δίκτυα πάντα
> ὥστε πόλις προβέβηκεν ἐν οἰδμασιν·ἐν δὲ πυλωροὶ
> δικτύῳ, ἐν δὲ πύλαι, μύχατοί τ' αὐλῶνες ἔασιν.
> οἱ δὲ θοῶς σεύονται ἐπὶ στίχας, ὥστε φάλαγγες
> ἀνδρῶν ἐρχομένων καταφυλαδόν·οἱ μὲν ἔασιν
> ὁπλότεροι, τοὶ δ' εἰσὶ γεραίτεροι, οἱ δ' ἐνὶ μέσῃ
> ὥρῃ· ἀπειρέσιοι δὲ λίνων ἔντοσθε ῥέουσιν,
> εἰσόκεν ἰμείρωσι καὶ ἀγρομένους ἀνέληται
> δίκτυον· ἀφνειὴ δὲ καὶ ἔξοχος ἵσταται ἄγρη.
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> Immediately all the nets are set in the swells like a city, and the net has its gate-keepers and its gates, and inner courtyards within. The tuna rush swiftly on in rank and file, like phalanxes of men advancing tribe by tribe, the younger together here, the older there, and those too in middle age, and they flow endlessly within the nets as long as they are so compelled and the net is capable of holding them. And the catch is rich without comparison.

Oppian's metaphors of "gates" and "gate-keepers" and distinct "inner courts" only make sense if he is speaking of a tuna-trap consisting of multiple fixed nets that can be divided by net "doors" into distinct "rooms."[29] These are the very same analogies employed by modern *tonnaroti*.

Gallant can hardly ignore what appears to be a clear reference to a tuna-trap but he insists that although the description seems to be "schematic" it cannot describe a "true

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[28] 3.620-630: Θύννων δ' αὖ γενεὴ μὲν ἀπ' εὐρυπόροιο τέτυκται/ Ὠκεανοῦ· στείχουσι δ' ἐς ἡμετέρης ἁλὸς ἔργα/ εἰαρινοῦ μετὰ λύσσαν ὅτ' οἰστρήσωσι γάμοιο./ τοὺς δ' ἤτοι πρώτους μὲν Ἰβηρίδος ἐνδοθεν ἅλμης/ ἄνέρες ἀγρώσσουσι βίῃ κομόωντες Ἴβηρες·/ δεύτερα δὲ Ῥοδανοῖο παρὰ στόμα θηρητῆρες/ Κελτοὶ Φωκαίης τε παλαίφατοι ἔννατῆρες·/ τὸ τρίτον ἀγρώσσουσιν ὅσσοι Τρινακρίδι νήσῳ/ ἐγναίται πόντου τε παρ' οἰδμασι Τυρσηνοῖο./ ἔνθεν ἀπειρεσίοις ἐνὶ βένθεσιν ἄλλοθεν ἄλλος/ κίδνανται καὶ πᾶσαν ἐπιπλώουσι θάλασσαν, "The race of tuna comes from the wide Atlantic, ranging into the reaches of our sea when they desire to spawn in the spring. And the Iberians, proud of their strength, first capture them in the Iberian Sea. Then they are hunted near the mouth of the Rhodanus by the Celts and the ancient inhabitants of Phocaea, then again by those who live on Sicily and along the surf of the Tyrrhenian Sea. And from there they scatter in the measureless depths, some here, some there, all across the whole Mediterranean."

[29] On μύχατοί τ' αὐλῶνες, Oppian's scholiast gives βαθύτατοι, τελευταῖοι.

madrague" because "again, it is quite clear that the nets were set out only after the fish had been sighted."[30] But even the most elaborate 20th century Sicilian *tonnare* were not set out until the proper season and they employed lookouts to watch constantly for tuna entering the trap, which would then need to be closed and the tuna herded from room to room. It is quite possible that Oppian has here included the role of the lookout in the setting of the nets by analogy with their role described in so many other sources. And, as we shall see, there are a number of other references in our ancient sources that would seem to refer in passing to what could only be tuna trap-nets.[31]

In fact, a number of scholars have detected underwater remains, chiefly large anchors, of what they suspect were once ancient tuna-traps.[32] A hint as to the scale of these ancient *tonnare* is perhaps to be found in Aelian's brief mention of κητοθηρεῖα, a term, he tells us, that the Italians and the Sicilians use to refer to the places where they store their giant nets and all the other gear required in the bluefin fishery, which they

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[30] Gallant (1985), p. 22.

[31] So e.g. Lucian's *Timon* 22: ...οἷος αὐτοὺς ὁ θύννος ἐκ μυχοῦ τῆς σαγήνης διέφυγεν οὐκ ὀλίγον τὸ δέλεαρ κατα πών, "...because so great a tuna has escaped from the innermost chamber of the net after devouring no small quantity of bait." Lucian could be mixing two distinct fishing metaphors, but taken on its face the metaphor seems to refer to the process whereby tuna are lured into the *tonnara*. All of these allusions are collected and discussed by Rhode (1890), esp. pp. 47-49. See also the brief article, chiefly treating Oppian, by G. Mastromarco, "La pesca del tonno nella Grecia antica. Dalla realtà quotidiana alla metafora poetica," *RCCM* 40 (1998) [*Studi in onore di A. Masaracchia*], pp. 229-236.

[32] Much of the evidence is summarized in P. A. Gianfrotta's article "Archeologia subacquea e testimonianze di pesca," *MEFRA* 111 (1999), pp. 9-36, at p. 19. Additionally, Ponsich reports that an underwater survey near the remains of an ancient *garum* installation near Belo discovered the remains of numerous massive anchors. In his view, these anchors "confirmarían la existencia en la Antigüedad de una almadraba." See M. Ponsich, "Archéologie sous-marine à Belo," *MCV* 12 (1976), pp. 469-70 and, on the *garum* installation, M. Ponsich, "A propos d'une usine antique de salaisons à Belo (Bolonia-Cadix)," *MCV* 12 (1976), pp. 69-79.

refer to as the κητεῖα.[33] Aelian's description calls to mind the great warehouses that mark the sites of Sicily's abandoned *tonnare* (see figs. 7-9).[34] And cursory archaeological investigations have detected evidence of ancient tuna salting operations at many Sicilian sites shared with modern *tonnare*.[35] Ponsich and Tarradell observed precisely the same phenomenon at many of the ancient salting installations in Spain and North Africa.[36] These installations are occasionally referred to in our Latin sources as *cetariae* or *cetaria*, and tuna fishermen as *cetarii*.[37] Subsequent research has greatly

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[33] Ael. *NA* 13.16: Τὴν τῶν θύννων θήραν Ἰταλοί τε καὶ Σικελοὶ κητείαν φιλοῦσιν ὀνομάζειν· τά τε χωρία, ἔνθα αὐτοῖς εἴωθε θησαυρίζεσθαι τὰ πλέκτυα τὰ μεγάλα καὶ ἡ λοιπὴ παρασκευὴ ἡ θηρατική, καλεῖται μέντοι κητοθηρεῖα, τοῦ θύννου τὸ μέγεθος ἐς τὰ κήτη βουλομένων τὸ λοιπὸν ἀπιστρέφειν, "The Italians and the Sicilians prefer to call their tuna fishery a κητεία; and the places where they are accustomed to house the massive nets and the other gear are called κητοθηρεῖα, wishing hereafter to distinguish the size of their tuna as belonging among the cetaceans." Strabo reports as well that the finest tuna fisheries, κητεῖοι, are found near Cumae (εἰσὶ δὲ καὶ κητεῖοι παρ' αὐτοῖς ἄριστοι, 5.4.4). This evidence suggests that the Sicilian Sophron's mime, *The Tuna Fisherman*, of which unfortunately only the barest traces remain, may originally have been titled ὁ κητοθήρας, rather than ὁ θυννοθήρας, as it is known to later authors (frs. 45-48 K-A).

[34] In Italy, the term *tonnara* refers collectively to the tuna-traps themselves as well as to the installations on shore. For a catalogue of these sites, with photographs of the remains of the warehouses, see S. Scimè, "Schede delle tonnare siciliane," in: Consolo (1986), pp. 180-192.

[35] G. Purpura, "Pesca e stabilimenti antichi per la lavorazione del pesce in Sicilia: I—S. Vito (Trapani), Cala Minnola (Favignana)," *Sicilia Archaeologica* 48 (1982), pp. 45-60; "II—Isola delle Femmine (Palermo), Punta del Molinazzo (Punta Raisi), San Nicola (Favignana)," *Sicilia Archaeologica* 57-58 (1985), pp. 59-85; "III—Torre Vindicari (Noto), Capo Ognina (Siracusa)," *Sicilia Archaeologica* 69-70 (1989), pp. 25-37. Archaeological remains near the site of the ancient Sardinian city of Cornus have likewise been attributed to an ancient *tonnara*, see A. Taramelli, "Cuglieri. Ricerche ed esplorazioni nell'antica Cornus," *Notizie degli scavi* (1918), p. 288. Pliny (*NH* 32.151) draws a connection between the island's name and tuna: *Sarda ita vocatur pelamys longa ex oceano veniens*; Pollux (6.48) lists Sardinian salt-fish, Σαρδὼα ταρίχη, together with that of other regions well-known for their rich fisheries. This and other evidence is discussed by E. Pais, *Storia della Sardegna e della Corsica durante il dominio romano* (Rome 1923), pp. 522-523.

[36] (1965), pp. 97-98 and fig. 1. Many of these sites originally included warehouse-like structures that housed not only rows of vats for producing *garum* but open halls and storage spaces of a scale and design that does indeed suggest an analogy with modern *tonnara*.

[37] For the entries *cetaria* and *cetarium* *OLD* gives only "a fish-pond." *TLL* hazards no definition for *cetaria, -ae* but offers *piscinae* for the neuter plural *cetaria*, based on Horace *sat.* 2.5.44: "More tuna will swim up and your *cetaria* will overflow" (*plures adnabunt thynni et cetaria crescent*). The scholia to this passage give alternately *cetaria dicuntur proprie loca in quibus salsamenta fiunt* and *officina, in qua liquamen*

increased our understanding of the scale of these operations; Ponsich identifies a hundred ancient installations in Baetica and Mauretania Tingitana alone.[38] New evidence continues to be uncovered.[39] Ponsich is convinced that these factories were supplied by

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conficitur (see O. Keller, *Pseudacronis scholia in Horatium vetustiora*, vol. 2 (Leipzig 1904 [repr. Stuttgart 1967]), p. 172). And Pliny refers specifically to the most-praised *garum* as being made "from mackerel in the *cetariis* of New Carthage" (*nunc e scombro pisce laudatissimum in Carthaginis Spartariae cetariis—doctorum id appellatur...*, 31.94), which should refer, as indeed Étienne already suggests (1970, p. 308), to the salting basins so richly documented by archaeologists. And elsewhere Pliny relates that "in the *cetariis* of Carteia [a giant octupus] was accustomed to leave the sea and enter the open tanks and eat the pickling fish" (*Carteiae in cetariis assuetus exire e mari in lacus eorum apertos atque ibi salsamento populari*, *NH* 9.92). When captured, the remains of this octupus were said to have weighed 700 pounds (*reliquiae adservatae miraculo pependere pondo* DCC, 9.93). The terms *cetaria* and *cetarium* clearly referred specifically to salt-fish installations. Other scholars, however, follow *OLD*; Fairclough e.g. asserts in a note to this line in his Loeb addition of Horace that "*cetaria* were artificial preserves." Interestingly enough, the term may have been applicable, much like the term *tonnara*, both to the fisheries and to the accompanying installations on shore: another reference in Pliny refers to a tumulus on Cyprus "close by the *cetarias*" (37.66). The tomb apparently had a marble lion adorned with emerald eyes, which gleamed so brightly, even deep into the sea, that it scared away the tuna until the fishermen replaced the eyes with different stones. A fragment of the comic poet Posiddipus (fr. 18 K-A), preserved only in Bekker's *Anecdota Graeca* (Κύπριον· τὸ ταρίχιον. Ποσείδιππος Μεταφερομένοις, 102.32), refers specifically to Cypriot salt-fish. Finally, for *cetarii* as an ancient term for *tonnaroti* see a reference in Varro's *Menippeae* to "the tuna-fishermen who, when they wish to spy the tuna in the sea, climb a tall mast" (*cetarios, cum videre volunt in mari thynnos, escendere in malum alte*, fr. 209, Krenkel). Krenkel comments (p. 371), erroneously: "Gegenüber der Küstenfischerei ist bei Varro eine mobile Beobachtungsstation dichter am Schwarm und kann ihm folgen." As we have seen "a tall mast" need not refer to the mast of a ship, but likely refers to a lookout set up on a beach. Elsewhere *cetarii* seems to refer specifically to purveyors of salt-fish (see Varro 8.17.12 and 8.46.1).

[38] See Ponsich (1988), fig. 6.

[39] See e.g. the additional evidence cited in Curtis (1991); A. M. McCann, J. Bourgeois, E. K. Gazda, J. P. Oleson, and E. L. Will, *The Roman Port and Fishery of Cosa: A Center of Ancient Trade* (Princeton 1987); and J. C. Edmondson, *Two Industries in Roman Lusitania: Mining and Garum Production* [BAR Int. Ser. 362] (Oxford 1987), esp. pp. 100-151 and appendix 3, "Roman Cetariae in Lusitania," a catalogue of forty identified or suspected installations. Recent survey work, largely in Tunisia, has more than doubled the number of known installations in North Africa, see N. Ben Lazreg, M. Bonifay, A. Drine and P. Trousset, "Production et commercialisation des *salsamenta* de l'Afrique ancienne," in: P. Trousset, ed., *L'Afrique du Nord antique et médiévale. Productions et exportations africaines; actualités archéologiques* (Nantes 1995), pp. 103-142, esp. pp. 104-116. Finally, research into specific amphora types offers an entirely new, but still largely undigested, store of evidence. The most recent discussion is found in B. Ejstrud, "Size Matters: Estimating Trade of Wine, Oil and Fish-sauce from Amphorae in the First Century AD," in: Bekker-Nielsen, *Ancient Fishing* (2005), pp. 171-182. Bekker-Nielsen (2002) includes a brief synopsis of the evidence (pp. 33-35). On the surprising concentrations of *garum* amphora, which outnumber wine and oil types in the finds from the Roman colony of Augusta Raurica in Switzerland, at least during the 1st centuries BC and AD, see S. Martin-Kilcher *Die römischen Amphoren aus Augst und Kaiseraugst* I-III [Forschungen in Augst 7] (Basel 1987-94), p. 469 and 474. On similar finds from Gloucester, D. P. S. Peacock and D. F. Williams, *Amphorae and the Roman Economy* (London 1986), p. 27. The evidence from shipwrecks is still impossible to quantify, but the *garum* and salt-fish amphora types show up with surprising frequency, on which see A. J. Parker, *Ancient Shipwrecks of the Mediterranean and the Roman*

almadrabas, as *tonnare* are called in Spanish, and he suggests that this technology likely originated in the Eastern Mediterranean well before it arrived in Baetica and Tingitana.[40]

This archaeological evidence for large-scale salt-fish and fish-sauce production is not restricted to the Western Mediterranean and the Atlantic. The salt-fish industry in the city of Chersonesus on the Crimea provides one example: collecting the evidence for some 90 salting vats identified by Russian archaeologists since the 1930's, Vladimir Kadeev estimates that these vats would have had a total capacity of more than 2000 cubic meters, greater than that of twenty-five standard swimming pools.[41] Archaeological evidence for such operations in the Aegean is largely absent, but it can certainly be inferred, albeit on a smaller scale, from literary and papyrological sources. Pliny, for example, states that the city of Clazomenae was praised for its *garum* (31.94), although this reputation could perhaps be attributed to its industries abroad: Strabo notes that the Clazomenians owned lookouts in the Crimea (11.2.4). But Thasos was clearly an exporter of locally produced salt-fish. Thasian salt-fish appears to have been readily

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Provinces [BAR 580] (Oxford 1992), and I. Pekáry, *Reportorium der hellenistischen und römischen Schiffdarstellungen* [*Boreas* beiheft 8] (Munich 1999).

[40] (1988), pp. 26: "La pesca mediante almadraba es muy antigua y, sin duda, habría que buscar sus orígenes en las civilizaciones del cercano Oriente. Desde el período republicano romano y más aún durante el reinado de Augusto, las almadrabas se extendieron por todo el mundo occidental mediterráneo, y, más concretamente, en la zona del estrecho de Gibraltar, quizá en perjuicio de los pescadores púnicos."

[41] See V. N. Kadeev, *Ocherki istorii ekonomiki Khersonesa Tavricheskogo v I-IV vekakh n. e.* (Kharkov 1970), p. 12 and n.4. For the purposes of this calculation I have used the standard pool size of 9.2 x 4.8 meters with shallowest and deepest depths of 1.0 and 2.5 meters. The most recent discussion of Black Sea evidence is J. M. Højte, "The Archaeological Evidence for Fish Processing in the Black Sea Region," in: Bekker-Nielsen, *Ancient Fishing* (2005), pp. 133-160. Most of the salting installations are 2nd century AD, but literary sources suggest that the Black Sea was an important source of salt-fish already in the 5th century BC and likely even earlier. See also J. Lund and V. Gabrielsen, "A Fishy Business. Transport Amphorae of the Black Sea Region as a Source for the Trade in Fish and Fish Products in the Classical and Hellenistic Periods," in: Bekker-Nielsen, *Ancient Fishing* (2005), pp. 161-170.

available at Athens in the fifth century BC.[42]

Whether or not we assume, with Ponsich, that the raw material for the *garum* and salt-fish industries would have been supplied by *madragues*, and that this technology originated in the Eastern Mediterranean before spreading to the Black Sea and to the West, it is apparent that the history of this and similar technologies is more complicated than Gallant suggests. Sicilian *tonnare* have oral histories dating back at least as far as the Arab occupation, as is reflected in certain Arabic terms still employed in the operation and in the "curious and ancient" songs that were until recently sung by the fishermen.[43] Some also have documented histories dating back to the ninth century, when it would appear that a number of new traps were founded in Sicily and at points farther west. The *tonnara* at Favignana, for example, was founded, or perhaps re-

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[42] A fragment of Cratinus begins: "You know the Thasian fish-sauce..." (fr. 7 K-A: εἶδες τὴν Θασίαν ἅλμην...). As the rest of the fragment illustrates, the speaker is clearly referring to a person, but the joke seems to rely on the ready availability of Thasian sauce, as does a reference in Aristophanes' *Acharnians* (671): οἱ δὲ Θασίαν ἀνακινοῦσι λιπαράμπυκα, "And some stir up the brightly-banded Thasian." The scholiast explains what Aristophanes' audience already knew, "Thasian" is Thasian fish-sauce: Θάσιόν φασι βάμμα λέγεσθαι ἐκ τῶν ἀπὸ πυρὸς ἰχθύων. ἴδιος Θασίαν ἐκάλουν. Höppener (1931, p. 24) follows the editors in taking an interesting papyrus from the Zenon archive as referring specifically to a jar of salted tuna imported from Thasos, *PSI* V.533r2.44-45 (Philadelphia, 3rd c. BC): ταρ(ιχευθέντων ἀπολλ/κτων πεπουκὸς Θάσι(ον) χερ(άμιον) α, "One Thasian jar of prepared salt-fish from choice seasonal tuna." The same list of expenditures includes an entry for a jar from Peparethus in the Sporades (rich fishing grounds even today) of cubed and salted bonito (l. 37: κυβίων πεπουκὸς Πεπαρη(θίων) χερ(άμιον) α).

[43] E.g., *rais* from the Arabic word for 'boss', and the term *madrague* itself, the likeliest etymology for which derives it, like the Spanish *almadraba*, from Arabic, an etymology already available to Rhode (1890) and supported by J. Corominas and J. A. Pascual, *Diccionario crítico etimológico castellano e hispánico* I (Madrid 1980), p. 182. On the "curious and ancient" songs (Thompson, 1947, p. 86), recorded as early as the 17th century by Athanasius Kircher in his *Musurgia universalis* (Rome 1650, repr. New York 1970), see especially Elsa Guggino, "I canti della memoria," in: V. Consolo, ed., *La pesca del tonno in Sicilia* (Palermo 1986), pp. 85-114, esp. p. 90, where she discusses the likelihood that certain of the phrases preserved in these songs (e.g. "e aiamola aiamola") predate the Arab occupation by many centuries. Maggio (2001) reports that the songs are now all but forgotten, even by most of the *tonnaroti*.

founded, by Arabs in 807 AD.[44] Nor was this technology limited to Sicily: the tenth century traveler Amad al-Rāzī marveled at the elaborate fisheries in the Gulf of Cadiz.[45]

Certain scholars have suggested that these traps may have been an Arab invention, a view, however, that finds little direct support.[46] The likelier explanation is that the appearance of evidence for *tonnare* at the time of the Arab conquests is chiefly due to coincidence: throughout much of the Western Mediterranean the ninth and tenth centuries are characterized by an economic revival as well as by the appearance of documentary evidence after centuries of relative silence.[47] McCormick observes that the abandonment of salt-fish installations in the sixth and seventh centuries, and presumably of the accompanying trap-nets, followed by the re-emergence of large-scale tuna fisheries two centuries later, corresponds to the broader economic patterns independently suggested by other evidence.[48] Ponsich, however, is adamant that the clearest period of

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[44] Maggio (2001), p. 57.

[45] See Lévi-Provençal, trans., "La *Description de l'Espagne d'* Amad al-Rāzī," *Al-Andalus* 18 (1953), pp. 51-108, esp. paragraph 58, p. 93.

[46] So Mack Smith (1968), p. 8, speaking of early medieval Sicily: "Apart from agriculture, there was a vigorous fishing industry, and perhaps an altogether new and elaborate technique of tunny fishing was now adopted." But the conclusion arrived at by most scholars is summed up by Maggio (2001, p. 57): "The Arabs gave the tonnaras their music and their terminology, but they brought no great technical innovations to the tuna trap."

[47] By analogy, see H. W. Pleket, "Greek Epigraphy and Comparative Ancient History: Two Case Studies," *EA* 12 (1988), pp. 25-37, where he discusses the epigraphic evidence for early water-mills, another ancient technology that is often discussed as a Medieval "invention," arguing that the notion of a "technological revolution" in the early Middle Ages has been greatly exaggerated, as has the corresponding idea of ancient technological "stagnation" (see, e.g. L. White, *Medieval Technology and Social Change* [Oxford 1963]). See also O. Wikander, *Exploitation of Water-Power or Technological Stagnation? A Reappraisal of the Productive Forces in the Roman Empire* (Lund 1984). The case against stagnation is further strengthened by recent re-appraisal of the Barbegal Mill. Long held to have been constructed no earlier than the fourth century it now appears that the mill was already in use in the second century and, in fact, went out of use by the fourth. See P. Leveau, "The Barbegal Water Mill in its Environment," *JRA* 9 (1996), pp. 137-153.

[48] See M. McCormick, *Origins of the European Economy: Communications and Commerce AD 300-900* (Cambridge MA 2001), esp. pp. 633-634, n.67.

decline is actually much earlier than McCormick's discussion would seem to suggest. According to Ponsich and Tarradell, many of the installations ceased to operate in the third century, and even the large installations such as Lixus, which continued to produce pottery at least into the 6th century, operated on a greatly reduced scale.[49] In their view, the archaeological evidence from the *garum* installations in Baetica and Tingitana bears unmistakable witness to a very real crisis in the third century.[50]

Returning to Gallant's minimalist claims about ancient fishing technology, it must be conceded that Aelian seems to be describing a technology somewhat different from the *tonnara* to which Oppian alludes. But, as we shall see, the distinction between these two technologies is not as clear-cut as one might suppose. Nor is it necessary to presume that Gallant's distinction between a "true madrague" and everything else is a useful one when offering generalizations about the efficiency or scale of ancient fisheries. Even in the nineteenth century, in many locales, particularly in Spain and France, fishermen and the owners of salting and canning operations continued profitably to employ coastal seine operations rather than *madragues*.[51]

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[49] McCormick (2001) indicates that the final pottery types from Lixus could be as late as the 7th century and that types from a number of other sites described by Ponsich could perhaps be down-dated as well. This would move the date for the final disappearance of these installations down by perhaps a century from the late 5th-early 6th century frame proposed by Ponsich (1988, p. 26).

[50] See Ponsich and Tarradell (1965), pp. 113-118 and fig. 59, esp. p. 117: "La répercussion de la crise du III[e] siècle dans l'industrie du garum apporte une contribution nouvelle à ce que nous connaissons déjà sur ce qu'elle représenta dans la transformation économique des grands industries de l'Extrême-Occident romain." Ponsich's later work (1988) includes a great deal of additional evidence while holding fast to the same conclusion. His proposed cause of the collapse is not entirely convincing, see pp. 232-233: "El crecimiento masivo de estas lucrativas industrias, propicias a la inflación de los productos, fue quizás el mal que provocó la rápida caída de los precios y el abandono de las fábricas, del que tenemos evidencia a partir de finales de siglo II después de J.C. en la mayoría de los sitios excavados...."

[51] J. Bourge, e.g., reported in the early 20th century that *madragues* were unknown along the coasts of Provence, where the fishermen preferred to employ other methods of catching tuna, see his "Études sur les

Aelian's description records one method of ancient tuna fishing that he tells us is widely used by the inhabitants of the Black Sea cities of Heraclea, Tium and Amastris (*N.A.* 15.5):[52]

> For the tuna a great deal of gear is prepared: nets, boats and a high lookout, which is planted on a specific beach with a wide and entirely unobstructed view...the trunks of two tall pines are stood upright and wide planks, liberally interwoven, both hold the trunks apart and provide easy means for the watchman to climb up. The boats are rowed, each with six men on either side, all young and strong rowers. The nets are very long, not at all light but held up with cork floats and [at the bottom] laden with lead.[53] The lookout, gifted both with naturally sharp eyesight and a certain unspeakable skill, sees the fish and tells the fishermen from precisely where they are arriving...

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migrations du *Scomber Thynnus* (Thon commun) dans le bassin occidental de la Méditerranée," *Revue tunisienne* 12 (1915), pp. 85-97.

[52] Aelian alleges the same practice is known on Naxos and Eretria: οὐκοῦν, ὦ φίλοι Ἕλληνες, καὶ Ἐρετριεῖς ἴσασι ταῦτα καὶ Νάξιοι κατὰ κλέος, τῆς θήρας τῆς τοιαύτης μαθόντες ὅσα Ἡρόδοτός τε καὶ ἄλλοι λέγουσι, "And the Eretrians, my Greek friends, also know of these things, and the Naxians as well according to legend, having learned of such a fishery all that Herodotus and others relate." The mention of Herodotus is a clear allusion to the oracle given to Pisistratus by Amphyllitus (6.62): ἔρριπται δ' ὁ βόλος, τὸ δὲ δίκτυον ἐκπεπέτασται/ θύννοι δ' οἰμήσουσι σελήνης διὰ νυκτός, "The net has been cast, the seine has been spread, the tuna will roil in the moonlight." Aelian's account should not, however, be taken as reliable evidence for the existence of such fisheries at Naxos and Eretria, which appear to be named simply because in Herodotus' account the oracle is reported after Pisistratus has returned to Athens from Eretria having received the assistance of Lygdamis, identified as a Naxian.

[53] A. E. Schofield (Loeb) translates this line as follows: "The nets are of considerable length; they are not too light and so far from being kept floating by corks are actually weighted with lead." This translation exacerbates the obscurity already present in Aelian, who has not entirely understood the account he is borrowing, which may have passed through many hands. The Greek οὐκοῦφα λίαν καὶ ἀντέχοντα τοῖς φελλοῖς, μολίβῳ γε μὴν βρῦθόμενα, intends to describe nets made of a very heavy web (οὐ κούφα λινᾶ?) and additionally weighted with lead on the bottom, along the 'lead-line,' (βολυμόσκοινο in Modern Greek, see Wilski (1909), p. 164). But the net would certainly have had cork floats on the top (the 'cork-line,' φελλόσκοινο) required to hold up (hence ἀντέχοντα) the otherwise very heavy net. At Favignana the many kilometers of net were traditionally held up by Sardinian cork, only to be replaced by iron buoys and eventually plastic. *I Parion* 5, discussed at length below, records various members of a tuna fishing operation from Parium; a certain Tongilius Cosmus is described as φελ[λο]χαλαστοῦντος, which would seem to indicate that he is in some way responsible for the cork-line (see below). In a fragmentary third century A.D. mosaic, now in the Sousse Museum in Tunisia, a fishermen is depicted standing in the stern of an oared vessel holding a massive club with which he is poised to strike a giant fish enclosed in the seine. Unmistakably depicted are two floats (and part of what appears to be a third), connected by lines to the top of the net; see fig. 10.

Here Aelian includes another detail the crucial significance of which seems to have been overlooked by most previous scholars:[54]

> If it is necessary for the fishermen to set the nets along the headland he indicates this, and if closer in he indicates it even as the general gives the signal or the chorus leader the keynote...[55]

Aelian then restates more elaborately the role of the lookout, followed by a description of the operation of the seine:

> ...and he will often announce the exact number, rarely missing the mark. This is what then takes place: as soon as the school of tuna turns and heads out to sea the man guarding the lookout and knowing their tendencies cries at the top of his lungs precisely where the men should pursue the fish in rowing straight for open water. After first taking one end of an exceedingly long rope, fixed at the other end to the net, and tying it to one of the trunks supporting the lookout, they row out side by side in an orderly column, rowing in concert since the net is distributed between the boats. The first boat pays out its share of the net and turns back, then the second, then the third and finally the fourth must do the same. But the rowers in the fifth boat bide their time until it is appropriate while some boats row in one direction, pulling a share of the net with them, and the other boats do the same in a different direction, then they cease altogether. And the tuna being stupid and incapable of any deed that requires daring remain schooled together and motionless.[56] Thus the rowers, as if an entire city were stormed, net an entire nation, so to speak, of fishes.

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[54] This detail is entirely ignored by Gallant (1985), who insists (p. 22) that Aelian and Oppian describe technologies deployed only after the fish were spotted.

[55] εἰ δέοι γε μὴν πρὸς τὴν ἀκτὴν παρατεῖναι τὸ δίκτυα, καὶ τοῦτο ἐκδιδάσκει· εἰ δὲ ἐνδοτέρω, δίδωσιν ὥσπερ οὖν στρατηγὸς τὸ σύνθημα ἢ χορολίκτης τὸ ἐνδόσιμον....

[56] I translate νωθεῖς as 'stupid' rather than, with Scholfield, 'sluggish,' which runs counter to the tuna's most common ancient attribute as witnessed in the popular etymology deriving θύννος from θύω. So Athenaeus 7.303b: ὀνομάσθη δὲ θύννος ἀπὸ τοῦ θύειν. Likewise Athenaeus 7.324b; *Etym. M.*, s.v. θύννος; Eustathius *ad Od.* 2.23.20-21 (Stallbaum): δήλονδ' ὅτι παρὰ τὸ θύνω τὸ ὁρμῶ, διπλωθέντος τοῦ μ εἰς β ὀλου, γίνεται ὁ θύννος, similarly *ad Il.* 3.669.2-3 (vander Valk). Oppian's playful θύννοι μὲν θύνοντες (*Hal.* 1.181) is an allusion to this popular etymology, as his literal-minded scholiast is careful to point out. But νωθεῖς in the sense of 'stupid' would not be incousistent with a fish elsewhere coupled with ἀφροσύνη because it willingly enters the nets (*Hal.* 3.576 and 597; Lucian *Jupp. Trag.* 25). As for the additional πεπαυμένοι μένουσί τι καὶ ἀτρεμοῦσιν, Aelian is clearly no fishermen and has very likely never seen firsthand the operation he is describing, but when encircled in a seine or trapped in a *tonnara* tuna do exhibit an unusual demeanor. Cousteau describes his experience in the *camaradella morte*, called in Tunisia the *corpo*, before the final slaughter: "Sunk in the crystalline water...we had unconsciously taken on the psyche of the animals. In the frosty green space we saw the herd only occasionally. The noble fish, weighing up to four hundred pounds apiece, swam around and around

Gallant summarizes Aelian's description as follows: "Two significant observations can be made concerning this type of fishing. First, it was a shore based system, incapable of extending much more than a 100 m into the sea. Second...it is extremely labour intensive, requiring sixty-one men."[57] In other words, it would have been relatively ineffective and certainly inefficient.

With respect to Gallant's second point, the fishery described by Aelian would in fact have required more than sixty-one men, given that the rowers were likely not responsible for simultaneously paying out the massive net or overseeing its operation. Modern *tonnare* are equally labor intensive. This fact can explain the co-existence, both in ancient and modern times, of simpler beach seines and other less labor-intensive methods. As for Gallant's other observation, it is true that the operation described by Aelian is essentially shore-based, but Gallant's estimate as to its potential reach is arbitrary and would seem to correspond roughly to that of Adriatic *tonnarelle*.[58]

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counter-clockwise, according to their habit. In contrast to their might, the net wall looked like a spider web that would rend before their charge, but they did not challenge it. Above the surface, the Arabs were shrinking the walls of the *corpo*, and the rising floor came into view...the death chamber was reduced to a third of its size. The atmosphere grew excited, frantic. The herd swam restlessly faster, but still in formation. Their eyes passed us with almost human expressions of fright." This would seem to be precisely the sense intended by the author of an epigram attributed to Meccius (*Anth. Pal.* 6.33), who describes seine-fishermen "having fenced around" (φράξαντες) with the nets a "circling school of tuna" (ῥόμβον θύννεον).

[57] Gallant (1985), p. 23.

[58] As Faber illustrates, these traps were generally located in sheltered bays, where the trap-nets would be protected from the strong currents prevalent around Sicily and in other parts of the Mediterranean. The stronger the current the more weight required to anchor the net, making it increasingly difficult to pull in and then reset each time tuna are trapped, especially with small crews. And a true *tonnara*, although more efficient in that the nets themselves would remain in place during the season, with the trapped fish continuously herded into interior rooms while the trap itself remained open, nevertheless often required more than a hundred *tonnarotti* for the labor-intensive *mattanza* (see Cousteau (1953), p. 218: "hundreds of Arabs converged in steady flat-bottom rowboats..."). In other words, the evolution from simple fixed net to a more permanent trap-net is partly a function of geography and resources and not merely a matter of evolving more efficient technology.

In fact, I would suggest that Aelian's account cannot correspond to a simple beach seine, or even a technology equivalent to Adriatic *tonnarelle*, but that it shares important features with modern *tonnare* and could accurately be described as a kind of coastal purse seine.

It is important to bear in mind that Aelian's account has passed through any number of hands, which may explain how it manages to conflate temporally what are two distinct features of the operation. The first stage, when the nets are set out either "along the headland" or "closer in" precedes the phase in which the school, once sighted, is encircled by the concerted effort of the fishermen. These nets are, in fact, barrier nets, and have likely been set out well in advance, which explains another important, and overlooked detail, namely that in Aelian's account the boats are launched only when "the school turns and heads out to sea." Wherever along its length the migrating tuna encounter the nets set "along the headland" or "closer in" they are forced to turn and head directly out to sea. Aelian seems to be describing barrier nets of precisely the sort that accompany traditional *tonnare*.

In modern *tonnare* these barrier nets funnel the tuna into fixed traps, whereas in Aelian's account it appears that they simply ensure that the fish arrive in a patch of water suitable for the deployment of a large seine. But here again Aelian's description suggests the deployment not of a simple beach seine but a kind of purse seine. The modern purse seine is closed at the bottom by a cable running through rings along the lead-line, effectively sealing the net, which is then hauled aboard by means of a powerful hydraulic winch. Obviously no such operation existed in antiquity, but earlier purse seines, such as those used in the menhaden fishery in the 19th century, were deployed by small boats.

The net itself was pursed by hand (fig. 11), and the earliest boats were driven by oars (fig. 12).

A purse seine is not only suggested by Aelian's description of the order in which the net is deployed and then maneuvered carefully into position around the "motionless" school, but it would explain yet another peculiar detail: the first four boats are described as deploying their sections of the seine in concert while the fifth boat refrains from deploying its section of the net "until the appropriate time." The fifth boat may have carried a section of net with a densely woven web suitable for being re-deployed as a floor analogous to the floor in the *camera della morte*. The appropriate time, which is not more clearly defined in the passage, would have been after the seine had been closed and its circumference sufficiently reduced. The tuna or mackerel could then be harvested directly from the circled seine.

This reconstruction finds additional support from a passage in Philostratus that seems to describe an identical method (*Imagines* 1.13):

> A man peers out from the high tower, the lookout, someone sharp at arithmetic and keen-sighted, since it is his task to scan the sea as widely as possible, and when he sees the school approach he must shout as loudly as he can to the boats exactly how many thousands are in the school, and the men then trap a rich spoil by fencing them off with a deep net that can be closed around them...

There are a number of boats but they are involved in deploying a single massive seine, more similar to a purse seine than a beach seine, given that it is described as κλειστός, i.e. "capable of being closed."

Philostratus' description also includes a number of additional and important details:

> With the fish trapped in the net a roar rises from the fishermen.[59] Some they have already taken aboard, others they are in the process of taking. But unable to handle such a host they open the net and allow some to escape...

Philostratus' description has been overlooked by Gallant, who insists that ancient nets did not advance beyond the beach seine, whereas here, and in Aelian's account as well, we clearly see a different and far more effective kind of seine.[60] Philostratus' fishermen have encircled the school and seem to be harvesting the catch from within the circled seine, a process depicted in our mosaic from Sousse and alluded to by Aeschylus in a famously graphic passage describing the Greeks slaughtering those Persians still alive in the water after Salamis (*Persians* 424-428):

> τοὶ δ' ὥστε θύννους ἤτιν' ἰχθύων βόλον
> ἀγαῖσι κωπῶν θραύμασίν τ' ἐρειπίων
> ἔπαιον ἐρράχιζον, οἰμωγὴ δ' ὁμοῦ
> κωκύμασιν κατεῖχε πελαγίαν ἅλα,
> ἕως κελαινὸν νυκτὸς ὄμμ' ἀφείλετο.
>
> They were smiting us with broken oars and planks from the wrecks as if we were tuna or some seine full of fish, and groans together with piercing cries continued to spill across the open sea until all was obscured by the black veil of night.

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[59] Cousteau (1953), p. 218: "He ordered the ritual to begin. A barbarian roar broke from the fishermen and they chanted an old Sicilian song, traditional to the *matanza*. To its cadence the boatmen hauled in the walls of the net."

[60] Gallant asserts emphatically (p. 25) that all ancient nets were entirely shore-based, a claim that is clearly contradicted by literary sources. Bekker-Nielsen, in an article intended to refute Gallant's claim, turns our attention to passages in the New Testament (e.g. Mt. 4.18-19 and Lk. 5.2-7) that refer to nets employed entirely from boats in the Sea of Galilee. He similarly points out that there are numerous representations of fishermen deploying nets from boats in Roman mosaics and corrects Gallant's discussion of ancient nets on a number of other points as well; see "Nets, Boats and Fishing in the Roman World," *ClMed* 53 (2002), pp. 215-233. I have by no means attempted an exhaustive search, but additional literary references certainly exist: the fifth chapter of the *Kephalaia of Mani* includes a metaphor of "fishers of men," each with his own ship and net (see C. Schmidt, ed., *Manichäische Handschriften der Staatlichen Museen Berlin* (Stuttgart 1935), vol. I, p. 43), and the description given by Gripus, the fisherman in Plautus' *Rudens* (906-914), who goes out in "a fierce tempest" and with his net hauls in a sunken chest from "a raging sea," suggests he was in a ship. Finally, in a letter of Alciphron a fisherman describes his fellow fishermen loading their nets in their boats and setting out from shore a short distance before setting them out (1.1).

Philostratus' added detail that the fishermen are actually releasing part of the catch from the seine is interesting and, I would argue, good evidence that Philostratus' description, while obviously including much elaboration based on other accounts, also depends on an actual painting, if only because he, or his source, seems to misunderstand this particular detail.

Rather than depicting fishermen intentionally releasing a portion of their catch, the painting likely depicted one of two possibilities. The first, and perhaps the more probable, is that it depicted fish escaping as the fishermen attempted to close the seam and effectively purse the circled seine. A second possibility is that the painting depicted fishermen releasing not fish but dolphins from the seine. A number of ancient sources describe the cooperation between fishermen and dolphins. Plutarch remarks (*Mor.* 977f):

> δελφὶς δὲ περιληφθείς, ὅταν συναισθηται γεγονὼς ἐν ἀγκάλαις σαγήνης, ὑπομένει μὴ ταραττόμενος ἀλλὰ χαίρων· εὐωχεῖται γὰρ ἄνευ πραγματείας ἀιφθόνων ἰχθύων παρόντων·
>
> The dolphin, having been encircled, when it perceives that it is trapped in the folds of the seine, simply waits, not disturbed, but pleased, since it feasts without toil on the fish that have been effortlessly gathered.

Admittedly, Plutarch goes on to describe various ways in which fishermen attempt to prevent dolphins from feeding in the seine, simply sewing identification tags on first-time trespassers but beating repeat offenders. Likewise, Aelian reports that tuna-fishermen in the Black Sea, and elsewhere as well, having encircled the tuna in their seine, pray to Poseidon Ἀλεξίκακος that they have captured no swordfish or dolphins as well (see fig. 13).[61] And Aristotle, discussing the fact that cetaceans have lungs, remarks that this "is

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[61] *NA* 15.6: Θύννων δὲ ἄρα ἡρημένων τῇ θήρᾳ τῇ Ποντικῇ (ἐγὼ δ' ἂν φαίην ὅτι καὶ Σικελικῇ· ἢ τί καὶ βουλόμενος ἂν τὸν ἡδὺν Θυννοθήραν ὁ Σώφρων ἔγραψε; πάντως δὲ καὶ ἀλλαχόθι ἄγραι τῶνδε τῶν θύννων εἰσί) τῷ οὖν δικτύῳ ἤδη περιπλακέντων αὐτῶν Ποσειδῶνι πάντες εὔχονται ἀλεξικάκῳ τηνικάδε. καὶ ὁπόθεν καὶ τοῦδε τοῦ δαίμονος ἀξιῶ τὸ ὄνομα εἰπεῖν, ἐμαυτὸν καὶ μάλα

why the dolphin when captured in the nets swiftly dies through suffocation" (διὸκαὶ λαμβανόμενος ὁ δελφὶς ἐν τοῖς δικτύοις ἀποπνίγεται τάχεως διὰ τὸ μὴ ἀναπνεῖν, *HA* 7.589b).

These accounts, however, are balanced by other sources that testify to an active cooperation between dolphins and fishermen. The basic relationship is hinted at already by Homer, who conjures the vivid image of a dolphin driving a school of fish into a secluded harbor.[62] Hesiod's description of the shield of Heracles includes in the middle dolphins chasing fish while a fisherman stands watching and poised to hurl his net.[63] And Pliny the Elder not only repeats a number of the ubiquitous tales, some not at all unlikely, of friendship between humans and dolphins, but also includes a number of detailed accounts of dolphins working in concert with fishermen.[64]

One such account is set in Narbonne, where the dolphins actively drive the grey mullet into the shallows "and they do this with such zeal that they are often gladly trapped in the nets, but, lest they cause panic amongst the trapped fish, they then slip

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γε ἁπάντων τε καὶ βουλόμενος ἱπενφήμησα τοῦτό οἱ, δέονται τοῦ Διὸς ἀδελφοῦ τοῦ θαλάττης κρατοῦντος μήτε τὸν ἰχθὺν τὸν ξιφίαν τῇδε τῇ ἴλῃ συνήμπορον ἀφικέσθαι μήτε μὴν δελφῖνα, "In the Pontic fishery (I could as easily add Sicily as well, since what else does Sophron intend to describe in his pleasant *Tuna Fishing*? And there are likewise tuna fisheries elsewhere as well) once the tuna are trapped, already circled around by the net, all the fishermen pray to Poseidon, Averter of Harm. As for where this name for the god comes from, I think it worthwhile to explain, as indeed I have asked myself why they should choose this name for the god: they are asking the brother of Zeus, the lord of the sea, to see that neither swordfish nor dolphin have arrived together with the school of tuna."

[62] *Il.* 21.22-4: ὡς δ' ὑπὸ δελφῖνος μεγαλήτεος ἰχθύες ἄλλοι/ φεύγοντες πιμπλᾶσι μυχοὺς λιμένος εὐόρμου/ δειδιότες·

[63] *Scutum* 209-15: πολλοί γε μὲν ἂμ μέσσον αὐτοῦ/ δελφῖνες τῇ καὶ τῇ ἰθύνεον ἰχθυάοντες/ νηχοσύνῃσιν ἴκελοι· δοιὼ δ' ἀναφυσιόωντες/ εἰργάδες δελφῖνες ἐφοίνεον Ἔλλοπας ἰχθῦς./ τῶν δ' ὑπὸ χάλκειοι τρόμον ἰχθύες· αὐτὰρ ἐπ' ἀκτῆς/ ἧστο ἀνὴρ ἁλιεὺς δεδοκημένος, εἶχε δὲ χερσὶν/ ἰχθύσιν ἀμφίβληστρον ἀποῤῥίψοντι ἐοικώς, "And in its middle are many dolphins rushing here and there after the fish, and they seem to be actually swimming. Two silver dolphins are spouting and devouring the silent fish while below them are bronze fish trembling. And a fisherman sits watching on the shore, holding a casting net in his hands poised to hurl it over the fish."

[64] *NH* 9.24-9.33.

carefully back out between the boats and the nets and the wading fishermen without creating a general exodus."[65] Pliny alludes to an account given by Marcianus of "the same kind of fishing" in the Iasian Gulf, with the difference being that it takes place at night by torchlight and is therefore certainly targeting something other than grey mullet, perhaps garpike (*Belone belone*).[66] But some evidence associates dolphins with ancient tuna fisheries as well. Strabo recounts how at Pharmacia in Chaldaea, dolphins following schools of tuna, mackerel and bonito are caught together with the fish. But only here, he adds, do the fishermen kill the dolphins for their blubber, which they use for many purposes.[67]

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[65] *NH* 9.32: *opere proelium fervet includique retibus se fortissime urgentes gaudent ac, ne id ipsum fugam hostium stimulet, inter navigia et retia nantesve homines ita sensim elabuntur ut exitus non aperiant.*

[66] *NH* 9.33: *quae de eodem genere piscandi in Iasio sinu Marcianus tradit hoc differunt, quod ad tonemque inclamati praesto sint parmaeque e manibus accipiant et suum quaeque cumba e delphinis socium habeat quamvis noctu ad faces.* Oppian includes a similar, but much more detailed account (*Hal.* 5.425-447) of a night fishery using firelight in conjunction with dolphins, and places this fishery specifically in Euboea. Oppian's account is paralleled closely by Aelian (*De nat. animal.* 2.8) who similarly sets the fishery in Euboea (I suspect Antigonus of Carystus may be the ultimate source) and even includes the same misunderstanding of the role played by the firelight in attracting the fish, as noted by Mair (1928, p. 494, n.a). In both accounts the firelight frightens the fish, which are then herded together into a dense school by dolphins that are subsequently rewarded for their toil. In Oppian's version the fishermen employ bronze lanterns (λύχνου χαλκείου θοὸν αὐλας). Aelian includes a detailed description of how the fires are lit in a special container on the ship's bow designed to cast the gleam onto the surface of the water: χαλήνην εἶναι χρή, καὶ εἰ ταῦθ' οὕτως ἔχει, τῆς πρῴρας τῶν ἀκατίων κοίλας τινὰς ἐξορτῶσιν ἰσχαρίδας πυρὸς ἐναφάζοντος· καὶ εἰσὶ διαφανεῖς, ὡς καὶ στέγειν τὸ πῦρ καὶ μὴ κρύπτειν τὸ φῶς. λύχνους καλοῦσιν αὐτάς. There were a number of night fisheries in the ancient Mediterranean. But Apostolides includes in his *La pêche en Grec* a fascinating description (pp. 49-50) of a traditional night fishery for garpike in the Sporades, just north of Euboea, where he tells us "une grande partie de la population se livre, en automne, à la pêche de Bélones." On dark nights they set out to sea where they are assisted by dolphins in finding the fish, which they then lead into shallow water with a fire built for that very purpose. Once in shallow water they employ a special seine to trap the school. Apostolides reports that in this fishery a single boat employing an ancient method could in a few hours capture more than 1000 kilograms of garpike.

[67] 13.3.19: ὅλως δὲ κατὰ τοὺς τόπους τούτους ἡ παραλία στενὴ πέλαγος ἐστίν· ὑπάρχεται γὰρ εὐθὺς τὰ ὄρη μετάλλων πλήρη καὶ δρυμῶν, γεωργεῖται δ' οὐ πολλά· λείπεται δὴ τοῖς μὲν μεταλλευταῖς ἐκ τῶν μετάλλων ὁ βίος, τοῖς δὲ θαλαττουργοῖς ἐκ τῆς ἁλιείας καὶ μάλιστα τῶν τηλαμύδων καὶ τῶν δελφίνων· ἐπακολουθούντων γὰρ ταῖς ἀγέλαις τῶν ἰχθύων, κορδύλης τε καὶ θύννης καὶ αὐτῆς τῆς τηλαμύδος, μαίνονταί τε καὶ ἐνάλωτοι γίνονται διὰ τὸ πλησιάζειν τῇ γῇ προαλέστερον δελεαζόμενοι οὓς μόνοι οὗτοι κατακόπτουσι τοὺς δελφῖνας καὶ τῷ στέατι πολλῷ

In modern Pacific tuna fisheries, dolphins are the preferred method of finding tuna. When a purse seiner spots a school of dolphins it will intentionally encircle it, attempting to capture in the process the accompanying tuna. This practice has killed millions of dolphins, which are then simply dumped overboard as by-catch.[68] The Russians used an identical method to harvest dolphins in the Black Sea, although the population soon collapsed and in the mid 1960's the practice was abandoned.[69] There is

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χρῶνται πρὸς ἅπαντα, "On these shores the coastal plain is exceedingly narrow, but the regions above are full of metals and oak forests. Little is plowed, leaving to the inhabitants a livelihood from mining or fishing, especially for bonito and dolphins. For the latter follow the schools of fish, the mackerel and the tuna and the same bonito, which the dolphins both grow fat on and by which they are enticed to come rashly near to the shore. The Pharmacians alone cut up the dolphins and employ the fat for a multitude of purposes." In his Loeb edition, H. L. Jones translates δελεαζόμενοι as "caught with bait." But dolphins are nearly impossible to capture with hook and line and the word here clearly refers to their being drawn close to shore by the schools of fish that they are hunting, where they were likely captured in the seines or harpooned, a usage paralleled in Lucian *Timon* 22. Strabo's assertion that the Pharmacians alone slaughter dolphins is contradicted by Oppian, who records how Thracians, specifically the Byzantines, hunt them with harpoons (*Hal.* 5.519-588).

[68] See Ellis (2003), pp. 219-235. In 1972 well over 300,000 dolphins were killed, and an estimated 5 million between 1959 and 1972. Under pressure from environmentalists, purse seiners devised a method of releasing captured dolphins from the seine, although dolphins continued to be killed at alarming rates when intentionally encircled, leading, in 1990, to the Dolphin Protection Consumer Information Act establishing "dolphin-safe" labeling for tuna captured by other methods. This led to greatly reduced by-catch in the American fleet. But, according to National Marine Fisheries Service reports, current populations of spotted dolphins and eastern spinner dolphins sit at near 20 and 35%, respectively, of their historic levels and show no signs of recovering. Nevertheless, the Bush Administration has supported easing environmental protections in part by allowing foreign tuna caught by encircling dolphins to be sold under the "dolphin-safe" label, and the NMFS announced on December 31, 2003, that encircling dolphins has "no significant adverse impact on dolphin populations." See Ellis (2003), pp. 232-235. In August of 2004 a U.S. District Court reinstated these protections, asserting, "This court has never, in its 24 years, reviewed a record of agency action that contained such a compelling portrait of political meddling." See Lisa Leff's AP article dated August 10, 2004, "U.S. Barred from Weakening Dolphin Rules."

[69] In the early 20th century the Turks began to intensively harvest common dolphins (*Delphinus delphis*) in the Black Sea with rifles, a practice later adopted by the Bulgarians. After WWII the Soviets began to target dolphins with purse seines, capturing an estimated 75,400 in 1954. In the same year the Turks killed an estimated 160,000. By the mid-sixties the population, once estimated at more than a million, had plummeted, prompting all Black Sea states except Turkey to ban the practice. Nevertheless, the population has yet to recover, perhaps due in part to the Turks' persistence in harvesting dolphins with rifles. See L. Ivanov, *The Fisheries Resources of the Mediterranean. Part 2: Black Sea* [General Fisheries Council for the Mediterranean, Studies and Reviews 60] (Rome *FAO* 1985), esp. pp. 91-2 and Y. P. Zaitsev, *Fisheries and Environment Studies in the Black Sea System. Part 2: Impacts of Eutrophication on the Black Sea Fauna* [Studies and Reviews. General Fisheries Council of the Mediterranean, Studies 64]. (Rome *FAO* 1993), pp. 63-86, esp. p. 80.

little question that marine mammals, including the common dolphin, the Azov porpoise (*Phocaena phocaena*) and the nearly extinct monk seal (*Monachus monachus*), are present in Black Sea ecosystems in numbers that represent but a fraction of their ancient populations. Unfortunately, the same is true of tuna, bonito, bluefish and virtually every other species of large pelagic fish once present in the Black Sea.[70]

In any case, there is little reason to doubt, based on Plutarch, Aelian and modern analogies, that ancient seine operations would have regularly trapped dolphins. But the references in ancient literary sources that treat dolphins as sacred, especially to Poseidon, far outnumber the references to their being killed or captured.[71] Indeed the latter sources treat such practice as anomalous, at least among Greeks. Whether the painting described by Philostratus depicted fishermen releasing dolphins from a seine, or fish escaping as the fishermen attempt to close the net, it is certain that it depicted a technology much different from Gallant's technologically primitive beach seine.

Furthermore, the seine operation described by Aelian and Philostratus suggests a natural evolution from beach seines to elaborate Sicilian *tonnare*. In both accounts multiple boats are employed in a single operation, with Aelian carefully specifying that there are five. In this scenario the four long rowboats would each be responsible for bringing aboard one side of the net, now a four-sided square. The fifth boat, having

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[70] See Zaitsev (1993), p. 78, where he reports that by the mid-1980's the Black Sea ecosystem was composed almost entirely of "small forage-fish." Whereas in the 1930-50's anchovy and sprat made up only 35% of the total catch, in the 1980's those two species now comprised between 75 and 80% of the total, which also included whiting, horse mackerel and certain demersal species, while "large fish disappeared in commercial numbers." I mention these facts merely as a reminder of how radically landscapes and ecosystems can change in an age of industrial metabolism. Rostovtzeff's notion of vibrant and economically vital fisheries grew not only from his mastery of an astonishing range of material, but also from knowledge of seas that afforded easier analogies than our own.

[71] See Thompson (1947), pp. 52-56.

deployed the "floor" and containing the *rais*, would be responsible for directing the operation, either from within the net, as in Sicilian *tonnare*, or from just outside of it. The ancient description of harvesting the tuna from the circled seine is nearly identical to that which occurs in the Sicilian *camera della morte*, when the tuna are brought to the surface for the *mattanza*. Indeed, this ancient purse-seine operation, complete with long barrier nets, may have involved a *mattanza* that looked very much like the scenes depicted by 18th century artists: fishermen in four rowed vessels, forming a square around the trap, are bringing the net, and with it the tuna, to the surface for the final slaughter, with the *rais* directing the operation from a fifth boat either within or just outside the enclosure (see figs. 14-15). Many of these traps eventually evolved into larger and more elaborate operations requiring additional boats on each side (see figs. 16-17).

It would have soon occurred to ancient fishermen that in certain cases the process could be simplified and the purse seine made into a relatively fixed operation. That the intermediary technology never altogether disappeared is not surprising, given that even in the modern period tuna-traps have assumed, as we have already seen, a wide variety of forms, depending on both natural factors such as water depth, currents, and fish populations, as well as any number of other considerations ranging from the availability of markets to the traditional practices of local fishermen.[72] In the late 19th century Adriatic, intermediary technologies were in fact more practical than elaborate Sicilian tuna-traps. And as recently as two decades ago Greek fishermen were still employing a

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[71] The difference between large beach seines and *madragues* proper is not always even recognized. For example, a 16th century engraving is entitled *Almadraza de Cadiz SIVE THYNNORUM PISCATIO APUD GADES* but what is depicted is not a trap-net but a massive seine being hauled ashore by at least twenty-five men (see fig. 18).

fishing strategy to catch bluefins that is similar in many respects to that described by Aelian.[73] Likewise, the operations described by Aelian and Philostratus would have targeted not only large bluefin but also a number of similar (and in some locales more prevalent and important) species such as bonito and mackerel. These smaller species require a web with meshes too small to be employed in fixed nets in places exposed to strong currents and weather. At Favignana, even with modern nylons, the deployment of a *tonnara* was often a precarious endeavor.[74] In other words, the purse seine operation described by Aelian would have allowed for considerable flexibility in targeting different species. Add to this the considerable additional costs required to operate an ancient *tonnare*, not least being the massive anchors, and it is easy to see how in antiquity, as in modern times, different technologies would have proven most efficient in different places at different times.

SECTION II—*I.Parion* 5 and Large-Scale Fisheries in the Hellespont

I.Parion 5 is an enigmantic inscription discovered at Callipolis. The Roberts demonstrate, arguing in part from the mix of Roman names with Greek *cognomina*, that it

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[73] E. Lefkaditou, P. Megalofonou, G. Demetrio and N. Tsimenides report that in the late 1980's fishermen from Rodopi in Northern Greece were using gillnets 1,000 meters long and 32 meters deep to encircle bluefins (p. 154): "They are utilized by 4 vessels of Rodopi, in spring to catch in this case, individuals from 10-60 kg...Fishing is carried out by two vessels that work in 20-30 m depth, surrounding the sighted shoal and driving the fish into the gillnets by noise." This particular method is distinct from the purse-seine, also employed by a handful of Greek vessels, and essentially adapts nylon gill-nets to a traditional coastal technology not unlike that described by Apostolides. See "Fisheries for Large Scombrids in Greek Waters: Catches of Bluefin Tuna (*Thunnus Thynnus*, L.)," in M. Savini and J. F. Caddy, eds., *General Fisheries Council for the Mediterranean Report of the Second Technical Consultation, Athens, Greece, 28 March– 1 April 1988* [FAO Fisheries Report 412] (Rome 1989), pp. 153-163.

[74] See Maggio (2001), pp. 130-131.