

Fishing Gear from a 7th-Century Shipwreck off Dor, Israel

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The ancient anchorage of Dor, Israel, contains wreck-sites from several periods. Underwater exploration of one Byzantine wreck discovered the remains of a medium-size boat constructed with iron nails. Coin-finds dated it to *c.*665 AD, after the Muslim conquest. The wreck was probably caused by natural agents, but an event in the Byzantine-Muslim conflict can not be discounted. The artefacts include a group of objects testifying to the practice of light-fishing. Literary sources indicate a prevalence of light-fishing, but archaeological finds are very rare. This discovery clearly indicates light-fishing in late antiquity. A sounding-lead and steelyard can be seen as auxiliary to the fishing.

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The ancient site of Tel Dor is located on the central Carmel coast, 25 km south of Haifa near one of the best-protected natural shelters along the Israeli coast (Fig. 1). The site has been inhabited intermittently at least since 2000 BC, during the Middle-Bronze, Late-Bronze, and Iron Ages, and Persian, Hellenistic, Roman and Byzantine periods. It was often occupied by rich and complex cultures with maritime connections to the whole East Mediterranean (Stern, 1993). The southern anchorage of Dor (so-called Tantura lagoon) is located 500 m south of Tel Dor. It is an elongated body of water (*c.*1–7 m deep, 960 m long and 150 m wide). It is protected from the west by a partly-submerged kurkar (Aeolian sandstone) ridge. The sea-bottom of the anchorage is covered by a layer of fine quartz sand (1–3 m thick) overlying hard marshy clay of terrestrial origin.

Excavations and surveys carried out in the anchorage revealed numerous remains of ancient shipwrecks buried and preserved under the sand. These include wooden hulls, cargoes, anchors and small artefacts (Kingsley and Raveh, 1996). Several hull-remains from Byzantine shipwrecks were discovered in the more protected central and northern parts of the anchorage. During the early 1980s a hull-section of a 6th-century Byzantine shipwreck (Tantura A) was partly excavated by the Israel Antiquities Authority (IAA) (Raveh and Kingsley, 1993: 1, 371–3). Between 1994 and 1998, the University of Haifa

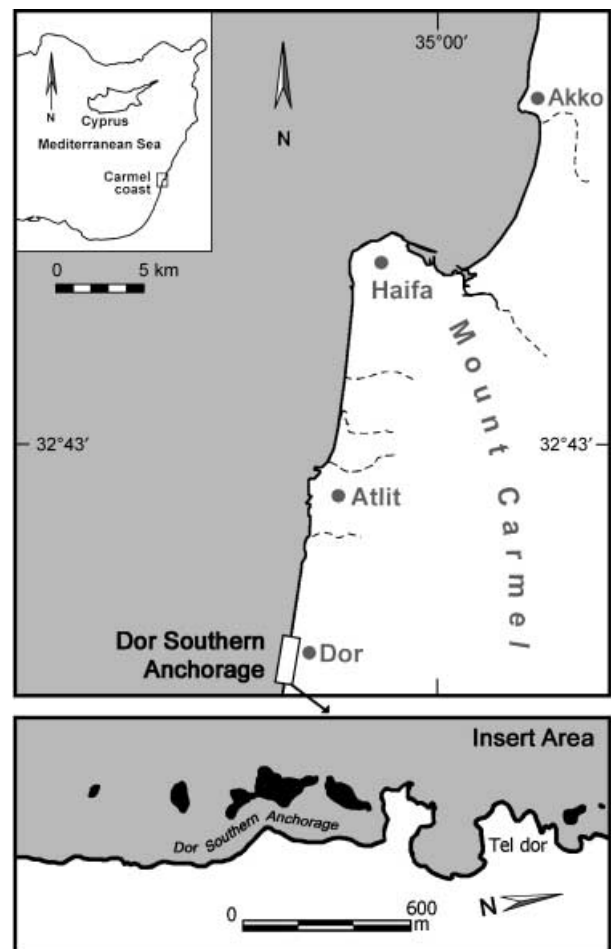


Figure 1. Location map: Dor and the South Anchorage. (B. Galili)

with the Institute of Nautical Archaeology (INA) studied a Byzantine ship's hull, constructed without the use of mortises and tenons (Tantura F). In 2002–04, a wooden hull of a Byzantine wreck (Dor 2001/1) loaded with scores of kurkar building stones was excavated by the University of Haifa (Mor, 2005).

In the more exposed southern area of the anchorage Byzantine ballast-stones covering fragments of wood-planking were recovered by the University of Haifa and S. Kingsley (Dor wreck 4; DW4 2000 season). Underwater surveys in the area revealed a couple of bronze steelyards (bearing inscriptions and crosses), 15 Byzantine iron anchors, and Byzantine amphoras (Raveh and Kingsley, 1993: 1, 371–3). An additional Byzantine assemblage, dating to the 7th century, was recovered in the south-eastern part of the anchorage (Fig. 2). This assemblage contained fishing gear and associated artefacts and is described and discussed below.

The assemblage with the fishing gear

The assemblage under discussion was exposed by winter storms, and subsequent underwater rescue surveys were carried out in 1998–99 by the IAA. It included a pile of kurkar ashlar stones and metal artefacts. Most metal artefacts were recovered in a relatively small area (c.15 × 25 m) at a depth of 2.5 to 3.5 m, c.5 to 30 m south of the ashlar. The hull was represented by scores of square-sectioned iron nails, 13–21 cm long. Traces of fibres, probably used for sealing, were preserved on some of them. Scores of small



Figure 2. An aerial photograph of Dor South Anchorage and the location of the Byzantine wreck. (E. Galili)



Figure 3. A bronze steelyard weight in the shape of a woman. (Israel Antiquities Authority)

wooden sheaves or fishing-net floats concreted into a single mass may represent remnants of the rigging, or fishing net(s). Additional artefacts recovered included a basket-shaped pottery vessel containing grape remains, a bronze cooking-pot with two ear-shaped handles, a ploughshare, bronze coins, and a steelyard counter-weight in the shape of a woman's bust (Fig. 3). The counter-weight may be associated with the Byzantine steelyards bearing Greek inscriptions recovered previously about 20 m north of it (Raveh and Kingsley, 1993).

The iron tools included two distinct professional assemblages. Firstly, a shipwright's kit, comprising an axe, a builder's hammer with a nail-extractor, a drill with a wooden handle and a 92-cm-long, sharpened iron bar with a hole near the sharp tip; secondly, the set of fishing gear described and discussed in detail below. Twenty-seven bronze coins were found scattered on the bottom among the other artefacts and

were dated to the first half of the 7th century AD. A further survey using a metal-detector exposed 53 bronze coins concreted into a lump weighing 433 gm (Fig. 4). The coins were minted from the reign of Anastasius I (498–518 AD) to that of Constantine II (641–668 AD). The latest coins in the lump were dated 659–663/4 AD.

The artefacts used for fishing and fishing-related activities included: lead fishing-net sinkers, an



Figure 4. Bronze Byzantine coins from the wreck, some concreted together. (Israel Antiquities Authority)

iron fishing-spear head with five prongs, an iron fire-basket for a lantern, and what may have been fishing-net floats. Furthermore, a sounding-lead and steelyard parts recovered at the site were probably also associated with fishing activities.

Lead fishing-net sinkers (Fig. 5)

Altogether 159 fishing-gear sinkers were recovered from the site. Of these 153 were folded rectangular sinkers (class L2.3 according to Galili *et al.*, 2002). The other six belonged to different classes, one or two of each class (Table 1). Two amorphous pieces of lead-casting waste weighing a total of 174 gm were also recovered. The L2.3 sinkers belonged to four different groups and may have originated from more than one cast-net. Most of them (150 of 153) are of identical width and thickness and have the same hole-diameter. These can be subdivided into three sub-groups according to their length: 75 long; 30 of medium length; and 36 short or broken specimens (Table 1). The additional three L2.3 sinkers are thicker, wider and decorated with herringbone and dot motifs (D1 and E2 types respectively in Galili *et al.*, 2002).

The remaining six sinkers include: 2 cast rings (L1.3.2); 1 cast tube (L1.2); 1 plano-convex cast ring (L1.3.1); and 2 bent plates for tubes (L2.2). Five of these sinkers have an inner-hole diameter of 7–19 mm. They probably originated from a lead-line or a foot-rope of a seine rather than



Figure 5. A group of lead fishing-net sinkers from the wreck. (J. Galili)

Table 1. *Properties of the fishing-gear sinkers recovered from the wreck at Dor (see Galili et al., 2002).*

Av. width or range (mm)	Av. length or height or range (mm)	Av. thickness of plate/ring or range (mm)	Av. weight or range (gm)	Av. diameter of hole or range (mm)	No. of items	Type of sinker and identification categories (length or height in mm)	Finishing technique	Notes
19	28	3.5	55	13	1		Tube-cast L1.2	
24	14	3	27	15–19	2		Ring-cast L1.3.2	
—	external diameter = 47	8	59	inner diameter = 35	1		Plano-convex cast ring L1.3.1	
34	29	2	37	14	2		Bent plate for a tube L2.2	
13	31	3	30	7				
8.5–10	20–31	1–1.5	5.8	2	36	Narrow short broken (20–31)	Folded rec. L2.3 narrow	Some are broken
8.5–10.5	40–54	1–1.5	9.4	2	39	Narrow medium length (40–54)	Folded rec. L2.3 narrow	
8.5–10	61–72	1–1.5	14.2	2	75	Narrow long (61–72)	Folded rec. L2.3 narrow	
11–12	56	1–1.5	15	2	3	Medium width	Folded rec. medium width	Herringbone (D1)+ dots (E2)

from a cast-net. These sinkers may be intrusive from other wrecks or from fishing activities in the anchorage. Another possibility is that they represent collected scrap intended for recycling. This possibility is supported by the recovery of casting waste from the site.

Iron fishing spear

The striking-head of the spear is 290 mm long, 155 mm wide, and weighs 569 gm; it has five evenly-distributed barbed prongs (Fig. 6). Opposite the prongs is a hollow, conical, shaft-housing (width at the base 32 mm) which held the vanished wooden handle. The spear-head was forged by joining five separate pieces of iron. First, a 44-cm-long iron bar was flattened in the middle and its ends were hammered into round barbed points and then bent to form a wide U-shaped base. The three additional prefabricated round barbed bars were then hammer-forged to the base between the external points. Lastly, the handle-housing was joined by forging it into the middle of the base.

Fire-basket of a lantern

The lantern for maintaining fire in a water-craft, called *'lampara'* by traditional fishermen, was used to attract marine creatures. The recovered iron fire-basket is 460 mm long, 240 mm wide, 100 mm deep and weighs 1700 gm. It was formed of a shallow flat-bottomed ellipsoid basket joined

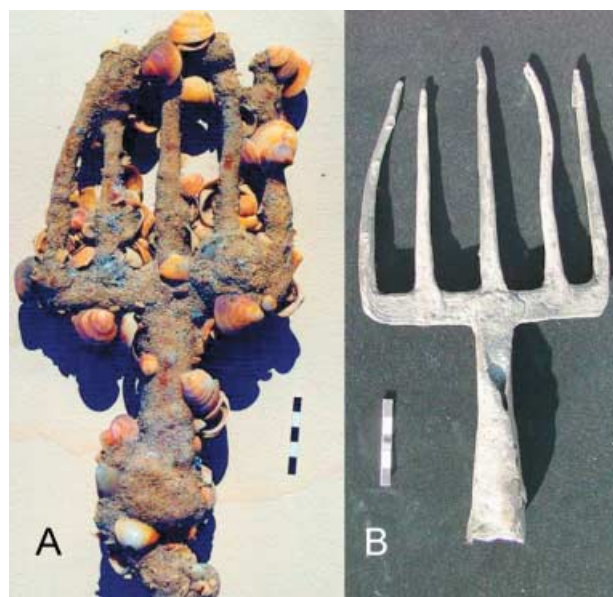


Figure 6. Five-pronged fishing-spear made of iron. (Israel Antiquities Authority)

to a long handle-housing, to protect the wooden handle (Fig. 7). The device, made of a grid forming a basket and a ring-shaped rim, was forged and riveted of two major and three minor iron pieces. The oval ring forming the rim was forged from a round-sectioned iron bar (1160 mm long and about 10 mm in diameter), which was bent into the desired form. A second iron bar (660 mm long) was forged into a hollow handle on one side, while the opposite side was flattened and then

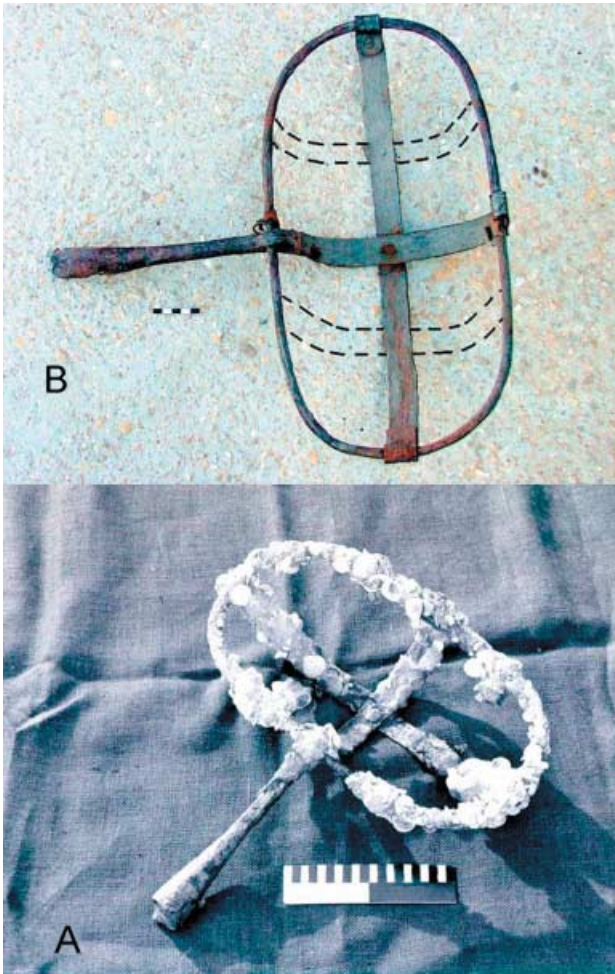


Figure 7. Fire basket made of iron. (E. Galili)

bent into a shallow half-circle, forming the middle of the basket grid. This second bar was joined to the rim by a bent protruding tongue in its centre and a riveted bend at its end. The grid forming the basket was finished by three pieces, one lengthwise and two crosswise; parts of two of them are missing. The inner diameter of the housing-hole, which contained the vanished wooden handle, is 30 mm.

Sounding-lead

The sounding-lead is shaped like a tall conical bell with straight sides (Fig. 8). It weighs 6410 gm and is 145 mm high. Its bottom edge is 92 mm in diameter. The holed suspension-lug was cast with the body, the internal diameter of the hole is 18 mm. A trapezoidal lug is separated from the conical body by a moderately-sloping shoulder (135°). The deep hemispheric tallow-



Figure 8. A sounding-lead. (Israel Antiquities Authority)

cup has no interior walls or nipples. The bottom shows signs of numerous impacts. It contained traces of tallow from large herbivores (Rosen *et al.*, 2001).

Literary sources for fishing-tool lists

Lists and inventories of fishing tools of any given society represent its relationships with the sea (Oswalt, 1976; Kuniholm, 1982; Brinkhuizen, 1983; Bekker-Nielsen, 2002). To understand better the recovered fishing-tools kit it will be compared to similar ancient literary, poetic and iconographic fishing-tool kits. Compilation of fishing-tool lists can be derived from several ancient writing sources.

According to Plato (Soph. 220a–221c, 355–347 BC) there are two classes of fishing—encircling and striking. Encircling uses traps, nets and similar implements. Striking is executed by hooks

and spears. Striking at night is classified as fire-hunting. Striking during the day is classified as barb-hunting because striking-tools are barbed. Barb-hunting is divided into two: striking from above with the spear; and striking from below by the hook. The scheme reflects a careful, ‘Socratic’ analysis of classical Mediterranean fishing tools and reflects the importance of fire-fishing in the ancient Mediterranean. According to Plato’s scheme the artefacts recovered from the Dor wreck may be listed as: encircling tools, represented by the cast net-sinkers and perhaps by the floats; striking tools, represented by the fishing spear which belongs to the sub-class of tools striking from above; and fire-fishing tools represented by the remnants of the fire-basket.

Following Plato, several dedicatory epigrams in the *Greek Anthology* contain fishing-tool lists (trans. Paton, 1916). One example is an early epigram from the Hellenistic Period, by Leonidas of Tarantum (Epigram A. G. 6, 4):

Diophantus the fisherman, as is fit, dedicated to the patron of his craft these relics of his old calling, his hook easily gulped down, his long poles, his line, his creels, this weel [wicker basket], device of seafaring netsmen for trapping fish, his sharp trident weapon of Poseidon, and two oars of his boats’ (Paton, 1916; Gow and Page, 1965: 360).

Another example, from the *Garland of Philip*, is dated to the beginning of the 1st century AD:

His string-tipped rods and sea-swimming oar, the throat-biting barbs of his curved hooks, the lead-fringed nets, and the cork, spokesman for the weel, and his two rush-plaited creels, and the light-arousing fiery flint, pregnant with flame, and the anchor, that trap for drifting ships,—these Piso the fisherman brought to Hermes, his right hand already tremulous, overburdened with many labours’ (Philip, VII, Gow and Page, 1968: 320).

The nets listed in the epigrams are personal items and are probably cast-nets with their lead sinkers, the typical net of the individual fisherman. Also listed are traps with their floats, hooks with rods and a fishing spear. The mentioning of flint for lighting fire in several epigrams demonstrates the importance of ‘fire-fishing’. As in the Dor assemblage, the epigrams mention auxiliary artefacts such as oars and anchors which are associated with the sea but are not exclusively used by fishermen.

The *Haliutica* by Oppian (2nd century AD) which describes fishing methods is an additional well-known literary source for ancient fishing-

tool kits (Mair, 1928). When Oppian lists fishing by hooks (Hal. 3.79–3.84) he divides it into fishing with and without rod. The second class (without rods) is divided into two sub-classes: a line with a single hook and systems with many lines and hooks. This binomial classification scheme is similar to the one used by Plato. Oppian lists several nets, including: casting-net, draw-net, drag-net, round bag-net, cover-net, ground-net, ball-net and crooked trawl (Hal. 3.79–3.84). ‘Fire-fishing’ is also mentioned and refers clearly to ‘fire-fishing’ by trident and less definitely by nets (Hal. 4.635).

Archaeological sources of fishing tools

Fishing tools have been recovered from underwater sites as well as from numerous coastal sites, all along the Mediterranean coast (Parker, 1992, *passim*). In Israel remnants of fishing gear have been recovered from wrecks, harbours and land sites. Finds of fishing-gear sinkers from Caesarea and on a Roman wreck off the Carmel coast enables typologies of these artefacts to be established (Oleson, 1994; Galili *et al.*, 2002). The finds indicate that, generally, fishing-gear sinkers are very prevalent; hooks are common; netting tools are often found; but fishing spears are very rare on the Israeli coast.

An early fishing-tool kit from the Eastern Mediterranean was found on a Late-Bronze-Age shipwreck from Uluburun in southern Turkey (Pulak, 1998). It contained lead sinkers for nets and lines, netting-tools for making and mending nets, fish-hooks, a harpoon, and a bronze trident fishing spear. On land, a fishing kit, dated to the 6th century BC, was deposited as a votive gift in the archaic temple in Isthmia (Raubitschek, 1998: *passim*). It included a multi-pronged fishing spear (Isthmia VII, no. 457) and lead net-sinkers, (Isthmia VII, no. 456) which were probably the remains of a cast-net according to the classification of Galili *et al.* (2002).

A more recent fishing kit was found in the Serçe Limani shipwreck in South Turkey (11th century AD). This included three large nets with floats, a smaller casting-net, a multi-tined spear, netting tools, spindle-whorls for making lines, and fishing-gear sinkers, some of which had Christian symbols (Van Doorninck, 1997: *passim*). Fishing tools are depicted in Roman and Byzantine iconographic representations, generally mosaics, from numerous Mediterranean countries. Striking tools seen in mosaics include hooks,



Figure 9. An iconographic representation of fishing using a multi-pronged fishing-spear from Roman North Africa. (E. Galili)

with and without rods, and multi-pronged spears (Fig. 9). Encircling tools depicted in mosaics include traps, cast nets, and beach and open-sea seines. A representation of fishing by spear from the Roman period is found on a tombstone from Brac in Croatia (Fig. 10). The components of the Dor fishing-tools list, except for the fire-fishing, are fully represented in the mosaics. It is noteworthy that the numerous Greek and Roman iconographic depictions of fishing scenes sampled so far have shown no evidence of ‘fire-fishing’.

Discussion

The archaeological evidence, historical documents and finds recovered from the sea-bed, mainly anchors, demonstrate that the Dor south anchorage has been used by watercraft from the Middle Bronze Age, c.2000 BC. The relatively high number of Byzantine shipwrecks indicates that the anchorage was active during the Byzantine

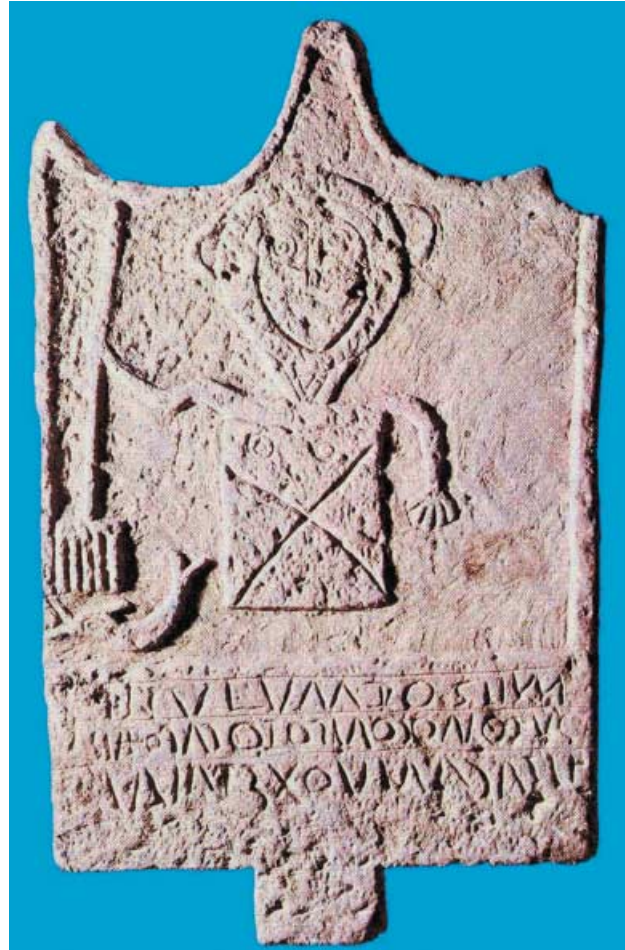


Figure 10. An iconographic representation of fishing by five-pronged fishing-spear from the Roman period. (The Archaeological Museum in Zadar, Croatia)

period (Wachsmann and Raveh, 1984; Raban, 1993; Raveh and Kingsley, 1993).

Date and nationality of the wreckage

Since the latest coins in the coin-lump recovered with the fishing-tools kit were dated to 659–663/4, the wreck must have occurred not much later than 665 (Syon and Galili, in press), that is to say, after the Muslim conquest. For quite some time after the Muslim conquest of the South Levantine coast the natives maintained their languages, religions, currency and general mode of life, and the Muslims were disinclined to engage in nautical affairs (Gil, 1983). About two decades later, the Eastern Mediterranean started to witness coastal and maritime military activities by the Muslims as well as by the Byzantines. In AD 640 Caesarea, south of Dor and still an active port, was occupied by the Muslims and the

Byzantine army was evacuated by sea (Gil, 1983). Alexandria, the major Egyptian sea-port, was taken by the Muslims in AD 642 and then reoccupied shortly by the Byzantine navy. A Muslim fleet built at Acco invaded Cyprus in 648–9 and in 655 the Muslim navy defeated the Byzantine navy off the Lycian coast (Hitti, 1957: 436–42). These mutual raids continued and the possibility that the discussed wreck, and possibly other wrecks from the area at this period, were the victims of the Byzantine-Muslim maritime conflict is a realistic possibility.

Site formation

Judging by the distribution of the artefacts on the sea-bed, site-formation and post-deposition processes may be proposed. Probably the assemblage containing the fishing-gear kit represents the remains of a local or foreign watercraft wrecked near the shoreline while anchoring. During the wrecking event the vessel drifted ashore and broke up in the shallow water in the breaker-zone, at a depth of 1–2 m. The hull disintegrated and the heavy metal artefacts were scattered on the sea-bottom. They rapidly settled into the shifting sand and were deposited on the clay layer. The wooden hull vanished due to marine erosion, decay, and possibly salvage activities by the local inhabitants. The buried artefacts have not been available for recovery until recently.

The ship

The iron nails provide some indication as to the size of the ship. It seems that it was a medium-

sized vessel. The fishing-gear finds indicate that it was directly engaged in fishing or carried a smaller fishing-boat. The other finds may indicate that it was engaged in other commercial activities as well.

Uses of the fishing gear from the wreck

The set of fishing-net sinkers recovered from the Dor wreck fits the characteristics of cast-net sinkers (Galili *et al.*, 2002). Modern traditional fishermen usually use various seines to catch fish attracted by light and the probable floats may represent such nets; cast nets do not have floats. Cast nets were also used in antiquity to capture fish attracted to light as demonstrated by a manuscript from the 11th century (Fig. 11).

Fishing-spear heads have been recovered from archaeological excavations on land and from underwater sites. Spears recovered on land may also have been used for hunting or for symbolic purposes. However when they are associated with other artefacts related to fishing they can be considered as fishing tools. The archaeological finds listed indicate that multi-pronged spears, clearly associated with fishing, were used in the Eastern Mediterranean at least since the Late Bronze Age.

Descriptions of ancient lanterns as fishing tools are rarely encountered in archaeological publications, though fishing with the help of artificial light was widely practised in the ancient Mediterranean and in Europe (Von Brandt, 1972: 106; Rosen, 1991: fig. 11). It is easy to identify fishing-gear sinkers, fishing hooks and spears. On



Figure 11. A Late-Byzantine image of light-fishing using a cast-net. (Codex Gr/Z 479=881, Biblioteca Nazionale Marciana, Venice)

the other hand the various uses of lanterns, or their remnants, are hard to identify. Furthermore, lamps or parts of lamps found in shipwrecks have up to now not been considered as fishing equipment.

The fact that no hooks were discovered in the Dor assemblage may be accidental. On the other hand, fishing hooks are habitually discovered by archaeologists in wrecks and in harbour-bottoms (Parker, 1992). Generally only nets and fishing spears are used in night-fishing by light in the Mediterranean. The attraction of sea-life to light cancels the need for baited hooks. The absence of fishing hooks may testify that this assemblage represents a specialized professional kit belonging to fishermen fishing by artificial light. Traditional light-fishing using fire is still practised in the Mediterranean. For example: inshore fishermen from Acitrezza, a village in Sicily, fish by a system named *ariba*. Their tools consist of a torch (using firewood or gas); a mirror directing the light down; and a harpoon tied to a long arm. This method is practiced at night close to the coast and is used for catching fish and octopus. Modern lanterns are used in Israel to fish for sardines (*Clupea* sp.) by encircling seines.

Uses of the auxiliary tools

The Dor sounding-lead belongs to class 4A of Oleson's classification (Oleson, 2000). According to his tentative assessment, this tall bell type appeared from the 1st century AD onward and tends to be found off the Israeli coast. Recent finds from the Israeli coast enable an enhancement of Oleson's suggestion. This type of sounding-lead has been associated with Late-Roman-Byzantine shipwreck complexes (Galili and Sharvit, 1998; Galili *et al.*, 2000). Two such sounding-leads decorated with crosses were recovered from the north Carmel coast in association with Byzantine coins (Galili *et al.*, 2000). Another two, also marked with crosses and associated with Byzantine coins, were recovered off Ashkelon Mayumas (Galili *et al.*, 2001). Judging by these and other finds, it is suggested that this sounding-lead type was used from the 3rd to 7th centuries AD. The sounding-lead from Dor, dated by the Byzantine coins, supports this assumption.

Sounding-leads are not mentioned among the fishing tools listed by ancient writers nor were they identified in the examined mosaics. However, they are essential tools for fishermen and navigators, especially on dark nights or during heavy fog (Galili *et al.*, 2000). They can be used



Figure 12. Modern traditional fishermen in Turkey weighing their daily catch with balance scale. (Z. Friedman)

to identify both the depth, by the length of the line, and the nature of the sea-bed, by the material sticking to the tallow in the tallow-cup. Fishermen use shore-marks to navigate and to locate fishing grounds. In antiquity, in the absence of organized lighthouse systems, shore-marks were visible and clearly-identifiable only during the day. The light of oil-lamps did not reach far and an occasional beach-fire could have sent a wrong message. When a fisherman went 'fire-fishing' at night the course from Dor to the fishing ground was defined by stars, but to locate a specific fishing ground the sounding-lead was used. When returning home at night or in conditions of low visibility the sounding-lead was an essential navigational aid. The recovery of the sounding-lead with the fishing gear supports the assumption that the assemblage represents the remnants of a sea-craft engaging in 'fire-fishing' at night.

Steelyards have been recovered from several Mediterranean Greek, Roman and Byzantine shipwrecks (Parker, 1992: 30, 107, 205, 250, 323, 444). Obviously they were used by seamen in a variety of commercial purposes, including fishermen who used them for weighing their catch. The surest way to obtain fresh fish in antiquity was by buying them from the fishermen upon landing. By using his own steelyard a fisherman assured the correct weight of the catch. Therefore it was only natural for a traditional fisherman to carry his own steelyard aboard as is done today (Fig. 12).

Conclusions

A better comprehension of fishing in antiquity can be derived by analysing and comparing fishing-tool kits. Written sources from antiquity indicate that light-fishing was an important form of fishing in the eastern Mediterranean. However there is an absence of iconographic evidence for light-fishing in the Greek and Roman periods. Evidence of light-fishing devices recovered during underwater archaeological research is also generally

absent. Lanterns or parts of them may have been recovered but not recognized as fishing tools. The multi-component light-fishing kit discovered in Dor is rare archaeological evidence for light-fishing in late antiquity, and may be the first material evidence for this practice in the ancient eastern Mediterranean. The Dor fishing-tool kit demonstrates how much in common and how conservative were fishing-gear assemblages, and thus the fishing techniques and tools of the eastern Mediterranean.

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