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Net Sinkers in Prehistoric Archaeology: Archaeological Significance, Typology, and Function in the Levant and Beyond

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Abstract

Fishing represents one of the earliest technological domains of human subsistence, yet its archaeological visibility is limited due to the perishable nature of organic gear. Net sinkers - stone or clay weights used to submerge nets - provide one of the most durable indicators of prehistoric fishing practices. This review article synthesizes archaeological evidence for net sinkers in a global perspective, with particular focus on the Epipaleolithic and Neolithic Levant, where some of the earliest and most continuous assemblages have been documented. Comparative evidence from Europe, North America, Africa, and Asia demonstrates both technological convergence in net sinker design and regional variability reflecting local environments and fishing strategies. Typological analysis highlights recurring forms such as notched, grooved, perforated, and unmodified cobbles, while raw material studies underscore the opportunistic use of locally available stone or clay. Functional and spatial analyses reveal patterns in fishing technologies, changing subsistence strategies linked to dietary diversification, and the cooperative labour involved in net fishing. By bridging gaps left by the poor preservation of organic gear, net sinkers illuminate the technological and social dimensions of aquatic resource exploitation in prehistory.

Keywords: net sinkers; prehistoric fishing; Epipaleolithic; Levant; aquatic resources

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يمثل صيد الأسماك أحد أقدم المجالات التكنولوجية للعيش البشري، لكن رؤيته الأثرية محدودة بسبب طبيعة المواد العضوية القابلة للتحلل. تُعد ثقالات الشباك—الأوزان الحجرية أو الطينية المستخدمة لإغراق الشباك—من أكثر المؤشرات متانة لممارسات صيد الأسماك في عصور ما قبل التاريخ. تجمع هذه المقالة الاستعراضية الأدلة الأثرية لثقالات الشباك من منظورعالمي، مع التركيز بشكل خاص على العصرالإيبيبالايوليثي والعصر الحجري الحديث في بلاد الشام، حيث تم توثيق بعض من أقدم التجميعات الأثرية والأكثر استمراراً. تُظهرالأدلة المقارنة من أوروبا وأمريكا الشمالية وأفريقيا وآسيا التقارب التكنولوجي في تصميم ثقالات الشباك والتنوع الإقليمي الذي يعكس البيئات المحلية واستراتيجيات الصيد. يُبرزالتحليل النمطي أشكالاً متكررة مثل الصخورالمسننة والمخددة والمثقوبة والصخورغير المعدلة، في حين تؤكد الدراسات الخاصة بالمواد الخام على الاستخدام الانتهازي للحجر المحلي أوالطين. تكشف التحليلات الوظيفية والمكانية عن أنماط في تقنيات الصيد والتغييرات في استراتيجيات المعيشة المرتبطة بتنويع النظام الغذائي والعمل التعاوني المرتبط بصيد الشباك. من خلال سد الفجوات التي تركها سوء الحفاظ على المعدات العضوية، تُلقي ثقالات الشباك الضوء على الأبعاد التكنولوجية والاجتماعية لاستغلال الموارد المائية في عصور ما قبل التاريخ

Translation by
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Introduction

Fishing has been a key food source throughout human evolution, with evidence for fish consumption dating back to ~2 million years ago at Turkana, Kenya, and well-documented cases in the Levant at 'Ubeidiya and Gesher Benot Yaʿaqov (Braun et al. 2010; Van Neer et al. 2005; Alperson-Afil et al. 2009). Although direct evidence for fishing technology is rare in the Middle (c. 300 – 50 ka) and Upper Palaeolithic (c. 50 – 11.7 ka), exceptions such as bone harpoons, barbed points, and shell fishhooks indicate the gradual emergence of specialized gear (Yellen et al. 1995; O'Connor et al. 2011; Fujita et al. 2016), supported by indirect proxies including fish remains, use-wear patterns, and isotopic data (Richards et al. 2001).

By the Late Epipaleolithic (12,550 – 9750 cal. BC) and Mesolithic (9700 – 5000/4000 cal. BC), human groups across the Levant, the Danube Gorges, the Baltic, Scandinavia, and southern Greece increasingly targeted aquatic resources, a shift often associated with Younger Dryas climatic instability (ca. 12,900–11,700 cal. BP) (Bar-Yosef Mayer 2008; Lougas 1996; Dinu 2010; Stiner and Munro 2011; Bergsvik and Ritchie 2018; Munro et al. 2021). This transition coincided with the emergence and diversification of fishing technologies, including Late Epipaleolithic bone fishhooks associated with stone line weights (Pedergnana et al. 2021), and later Mesolithic weirs, traps, and nets preserved in waterlogged contexts in Europe (McQuade and O'Donnell 2007; Zhilin 2014; Miettinen et al. 2008). Nets, traps, and other organic fishing gear likely existed earlier but rarely survive. Durable net sinkers—stone or clay weights used to submerge nets—first appear in the Epipaleolithic and Mesolithic, with notched or grooved examples widespread at sites from these periods (Nadel and Zaidner 2002), providing the earliest direct evidence for net-based fishing strategies. At Neolithic lakeshore settlements, binding or cordage occasionally preserves on the net sinkers (Bērziņš 2008; Zhilin and Savchenko 2020; Huber and Rehazek 2014).

These developments occurred alongside broader economic and social transformations, including increasing sedentism and the gradual emergence of early agricultural lifeways. In the Levant, the Natufian period marks a key threshold characterised by prolonged site occupation, intensified plant processing, and changes in social organisation (Bar-Yosef and Belfer-Cohen 1989; Bar-Yosef 1998). Reduced mobility, longer-term residence near rivers and lakes, and the reorganisation of labour likely facilitated more consistent and technologically complex fishing practices, encouraging the wider adoption and standardisation of nets and their associated sinkers.

Net sinkers are temporally widespread (ca. 23,000 cal. BP to ca. 800–300 BC) and geographically diverse (Figs. 1. and 2 ., Tab. 1.), with documented assemblages from the Epipaleolithic Levant (Nadel and Zaidner 2002; Rosenberg et al. 2016; Ourodová 2022), Mesolithic and Neolithic Europe (Bērziņš 2008; Ridley, Wardle, and Mould 2000; Huber and Gross 2018), the Woodland period in North America (Prowse 2010; Cleland 1982), Arabian Peninsula (Cavulli and Scaruffi 2011; Marrast et al. 2019) as well as the Neolithic in Vietnam (O'Connor et al. 2011) or Namibia (undated, Sandelowsky 1971).

Their broad distribution highlights both the global significance of fishing and recurrent technological solutions to shared functional challenges.

The intensification of fishing has often been interpreted through the lens of Flannery's "Broad Spectrum Revolution" (BSR), which frames expanded exploitation of aquatic and other resources as an adaptive response to demographic pressure and environmental change (Flannery 1969). However, the BSR is increasingly regarded as a debated interpretive framework rather than a singular explanatory model. Research has shown that diversification and intensification frequently developed in contexts of resource abundance and predictability, shaped by technological systems, labour organisation, and culturally mediated subsistence choices (Zeder 2012; Florin and Ramsey 2025). From this perspective, aquatic resources—particularly when exploited using nets, traps, and weirs—represent predictable and potentially high-yield resources, whose intensified use reflects the interaction of environment, technology, and social practice rather than a simple expansion into lower-ranked foods.

The purpose of this review is to examine net sinkers as archaeological artefacts, focusing on their interpretive potential, typological diversity, and functional role within broader fishing strategies across time and space.

Net sinkers in the Levant

The Levant provides an early and the most continuous record of stone net sinkers in

Figure 1: *Global distribution of archaeological sites with significant net sinker assemblages. Map © A.-M. Marko, 2025.*

prehistory, ranging from the early Epipaleolithic (25,000 – 18,500 cal BP) to the Early Bronze Age (ca. 3,700 – 2,000 BC). Sites are concentrated along the shores of the Sea of Galilee, the Hula Valley, and the Euphrates, where aquatic resources were central to subsistence (Fig. 2.). The earliest examples come from Ohalo II, a 23,000-year-old lakeshore camp on the Sea of Galilee, where 47 double-notched basalt and limestone cobbles were recovered, weighing between 150–400 g (Nadel and Zaidner 2002). Based on the morphology of the notched cobbles, wear patterns and their context, the excavators interpreted them as net sinkers or anchors for underwater traps (Nadel and Zaidner 2002, 64).

Figure 2: *Selected Levantine sites with significant net sinker assemblages. Map © A.-M. Marko, 2025.*

Their association with abundant fish remains — mainly cichlids and cyprinids — further supports this interpretation (Van Neer, Zohar, and Lernau 2005). At nearby Ohalo I, heavier specimens reaching 1.6 kg, including one with a circumferential groove, suggest additional roles in weighting stationary nets or traps (Nadel and Zaidner 2002).

Other early sites such as Eynan ('Ain Mallaha, dated to 14,000 – 12,000 cal. BP) yielded limestone net sinkers alongside bone fishhooks and faunal evidence, pointing to the integration of multiple fishing technologies within Natufian economies (Valla et al. 1999). Similar artefacts have been reported from Abu Hureyra (dated to 13,300 – 7800 cal. BP) on the Euphrates, where notched cobbles likely served as net sinkers (Moore, Hillman, and Legge 2000). A large assemblage of over 200 notched and 300 unmodified net sinkers made of limestone originated from the Epipaleolithic site of Jordan River Dureijat (dated to 20,000 – 10,000 cal. BP, Pedergnana et al. 2021; Sharon et al. 2020; Ourodová 2022, Marko et al. in prep.).

In the Pre-Pottery Neolithic (PPN, 9,750 – 6,400 cal. BC, Birkenfeld et al. 2024), notched cobbles became increasingly standardized and widespread. At the Pre-Pottery Neolithic A (9750 – 8,500 cal. BC, Birkenfeld et al. 2024) site of 'Ein Dishna, 151 sinkers — mostly limestone, but also basalt and flint — dominated the ground stone assemblage, with most bearing opposed notches shaped by flaking or pecking (Birkenfeld et al. 2019).

Beisamoun, a Late Pre-Pottery Neolithic B/Pre-Pottery Neolithic C (7,500 – 6400 cal. BC, Birkenfeld et al. 2024) site in the Hula Valley, produced an assemblage of 96 light limestone or dolomite sinkers ranging from 20–240 g, with an average of 64 g, often shaped into oval, trapezoidal, or rectangular forms (Rosenberg et al. 2016). Their small size has led scholars to interpret them as sinkers for cast (throwing) net, which are circular and small weights are usually distributed around its edge. Later assemblages from Tel Beit Yerah extend the sequence into the Early Bronze Age (ca. 3,700 – 2,000 BC), demonstrating continuity in this fishing tradition (Rosenberg et al. 2016). Taken

together, Levantine sinkers illustrate both technological continuity and innovation: while Epipaleolithic assemblages are dominated by cobbles with two opposed notches on their long sides, probably used with stationary seine or gill nets (Fig. 3.), the lighter examples from Beisamoun appear better suited to throwing nets, a more mobile fishing technique requiring repeated casting.

Archaeological Significance

The significance of net sinkers lies in their ability to illuminate aspects of prehistoric

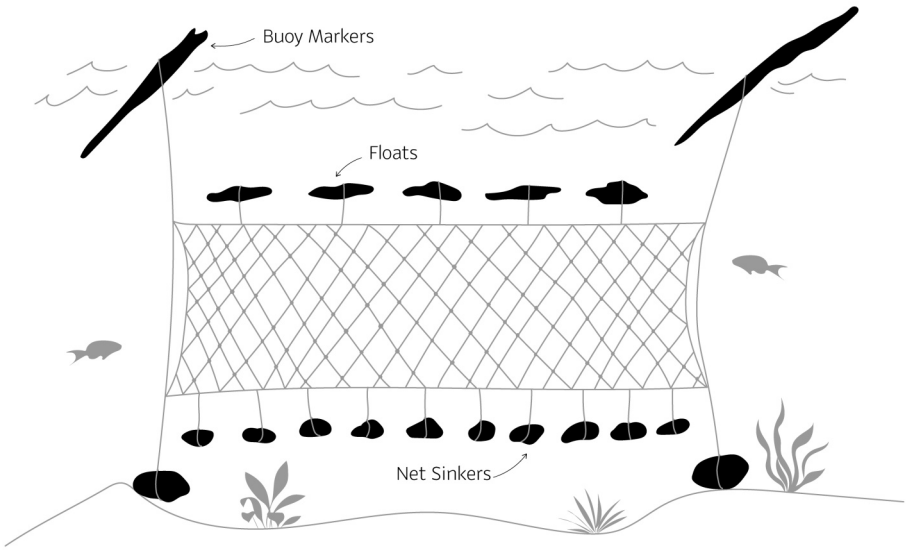

Figure 3: *Functional reconstruction of net sinkers attached to a net. Illustration © Anna Horáková.*

lifeways that are otherwise difficult to access, particularly given the scarcity of fishing evidence in the archaeological record. Archaeologists distinguish between direct and indirect indicators of fishing: direct evidence includes gear such as hooks, line weights, sinkers, nets, traps, and weirs, while indirect evidence comprises fish remains, isotopic signatures in human skeletons, or depictions of fish and fishing scenes (Sahrhage 2008; Erlandson 2001; Pajdla 2017). Yet the preservation of most fishing equipment is hampered by its organic nature. Nets, floats, rods, lines, and traps generally decay unless deposited in exceptional contexts such as waterlogged Alpine pile dwellings or Scandinavian Lake sites, leaving only rare survivals such as cord fragments or imprints (Huber and Gross 2018).

Ethnographic studies demonstrate that traps and scoop nets were likely widespread (Altman 2006; Dounias et al. 2016; Rau 1884), but these are practically invisible archaeologically because their wooden or vegetal components are rarely preserved, and the stones used to weigh them were unmodified making them indistinguishable from regular stones found at the site. Likewise, fishing with bare hands, sharpened wooden spears, stupefying techniques with poisons or mud, or unshaped stone

projectiles leave little or no trace (von Brandt 1984; Dounias et al. 2017). In contrast, hooks or gorges sometimes survive, occasionally with associated shell lures (Cavulli and Scaruffi 2011). Within this context, net sinkers stand out as the most persistent and recognizable inorganic component of net fishing technologies, making them disproportionately valuable for reconstructing prehistoric fishing practices.

Net sinkers illuminate a process of subsistence intensification in the Epipaleolithic Levant in which technological innovation and dietary diversification were mutually reinforcing. As human groups broadened their subsistence base beyond large terrestrial game to systematically exploit fish, molluscs, and small mammals, the development of new capture technologies—such as nets and net sinkers—both facilitated and amplified this expansion of resource use. The earliest securely dated net sinkers from sites around the Sea of Galilee and the Upper Jordan Valley coincide with this transition, underscoring the growing economic importance of aquatic resources (Nadel and Zaidner 2002; Ourodová 2022). Their appearance represents a significant technological development, signalling not only an increased reliance on aquatic foods but also the emergence of specialized equipment designed for mass-capture strategies.

In Europe, Neolithic sites such as Sārnate (4365-2850 cal. BC) in Latvia reveal a similarly systematic organisation of fishing, where notched as well as unmodified cobbles were used in combination with bark floats to weight and stabilize large nets (Bērziņš 2008). In North America, extensive assemblages of side-notched and end-notched sinkers document communal netting practices tied to seasonal fish runs, highlighting how such tools facilitated cooperative labour and large-scale harvesting strategies (Prowse 2010). Taken together, these examples illustrate how the durable presence of net sinkers provides a rare window into the economic transformations and technological adaptations that characterized early Holocene subsistence.

The spatial clustering of net sinkers at archaeological sites provides important insights into activity areas and site function, moving interpretation beyond typology into behavioural reconstruction. At Jordan River Dureijat, GIS-based analysis (Density-based clustering and optimised hot-spot analysis) revealed discrete clusters of notched and unmodified cobbles that may represent the remains of individual nets left in situ, offering rare glimpses into the organisation of fishing on-site (Ourodová 2022, Marko et al. in prep.). A comparable case comes from Neolithic site of Cham-Eslen (4,300 – 3,700 cal. BC) in Switzerland, where sinkers were recovered in association with preserved cordage and fragments of the nets themselves, demonstrating the direct link between these artefacts and fishing gear (Huber and Gross 2018). Similar spatial concentrations at other lakeshore and riverside sites suggest activity loci where nets were manufactured, repaired, or stored, indicating that fishing was not a marginal activity but a structured and recurrent part of settlement life. Such clustering therefore provides evidence not only of fishing techniques but also of the organisation of labour and the repeated use of spaces for aquatic resource exploitation.

Typology

Net sinkers occur in a wide variety of forms, reflecting both raw material availability and cultural traditions. Typologically, they can be grouped into several broad categories: notched cobbles, unmodified cobbles, grooved weights, perforated weights, and clay sinkers (Fig. 4., Prowse 2010; Rosenberg et al. 2016; Hiep and Huffer

Region	Site(s)	Period	Freshwater/ Marine	Raw Materials	Forms	Reference
Levant	Ohalo II, Beisamoun, Ein Dishna, Jordan River Dureijat	Epipalaeolithic–Neolithic	Freshwater	Limestone, basalt, chert	Mainly side-notched, some end-notched	Nadel and Zaidner 2002; Rosenberg, Agnon, and Kaufman 2016; Sharon et al. 2020)
Europe	Cham-Eslen (Switz.), Sārnate (Latvia)	Neolithic	Freshwater lakes	Limestone, quartzite, sandstone, schits	Unmodified + side-notched	Bērziņš 2008; Huber and Gross 2018
North America	Lamoka Lake, Skyway, Recliner (USA/Canada)	Archaic–Woodland	Freshwater rivers/lakes	Siltstone, sandstone	Massive side-notched assemblages (thousands)	Prowse 2010
Asia	Đa Bút (Vietnam), Maedun Cave (Korea)	Neolithic / Late Palaeolithic	Freshwater / marine	Schist, limestone, terracotta	Grooved, perforated, end-notched, atypical	Hiep and Huffer 2015; Phys.org 2018
Africa	Namibia (near Mariental)	Uncertain	Freshwater	Shale	Atypical, side-notched	Sandelowsky 1971
Arabian Peninsula	Ra’s al-Khabbah, Suwayh 1	Neolithic	Marine	Limestone, calcite, quartzite	Side-notched, end-notched, grooved, partly incised	Cavulli and Scaruffi 2011; Marrast, Béarez, and Charpentier 2019

Table 1: *Selected archaeological sites with significant assemblages of net sinkers around the world (simplified and adapted from Ourodová 2022, Appendix 3-7 © A.-M. Marko, 2025)*

2015). Within these broad classes, however, significant regional variation exists, pointing to both technological convergence and local innovation (Rosenberg et al. 2016; O'Connor et al. 2011).

Notched cobbles are among the most common forms worldwide (Sandelowsky 1971; Nadel and Zaidner 2002; Prowse 2010; Marrast et al. 2019). In the Levant, natural limestone cobbles were modified with one or more opposed notches, often created by flaking or pecking (Nadel and Zaidner 2002; Rosenberg et al. 2016; Ourodová 2022). Assemblages from Epipaleolithic and Neolithic sites such as Ohalo II, Beisamoun, and 'Ein Dishna demonstrate how light, standardized weights were adapted for use with throwing nets, while heavier examples may have anchored stationary nets or traps.

Comparable notched forms occur in North America, where archaeologists distinguish between side-notched, end-notched, both-notched, and atypical classes, particularly in the Great Lakes region (Prowse 2010). Here, the large numbers of standardized sinkers — sometimes in the thousands — suggest planned net production and communal fishing strategies. Similar typological variability is seen in coastal Arabian assemblages, where end-notched cobbles occur alongside lighter partly incised flat stones at Ra's al-Khabbah (Cavulli and Scaruffi 2011), and side-notched cobbles and lighter grooved flat pebbles at Suwayh 1 (Marrast et al. 2019).

These examples demonstrate that while the principle of opposed notching was widespread, regional adaptations could generate distinct morphological variants suited to different fishing environments and techniques.

Unmodified cobbles, by contrast, were often selected for their natural shape and weight, with minimal or no modification. At waterlogged Neolithic lakeshore sites such as Cham-Eslen in Switzerland, almost 1000 unmodified cobbles were recovered, many with bast bindings or cordage impressions that confirm their use as sinkers (Huber and Rehazek 2014). Similar finds at Sārnate in Latvia demonstrate that unmodified cobbles were used alongside notched examples, often wrapped in birch bark and tied with bast (Bērziņš 2008). The presence of both modified and unmodified sinkers within single assemblages underscores the flexibility of prehistoric fishers in adapting readily available stones for net weighting.

Grooved weights represent a more formalized solution, in which a transverse groove was carved around the circumference of a cobble to facilitate attachment. Such examples are known from Mesolithic–Neolithic contexts at Lepenski Vir on the Danube, where large, grooved cobbles were likely used to weight lines for catching sturgeon in strong currents (Antonovic 2006). In Southeast Asia, Neolithic sites of the Đa Bút culture in Vietnam produced small, grooved stone sinkers, sometimes with cruciform arrangements of multiple grooves, which may have secured nets or traps in variable aquatic environments (Hiep and Huffer 2015).

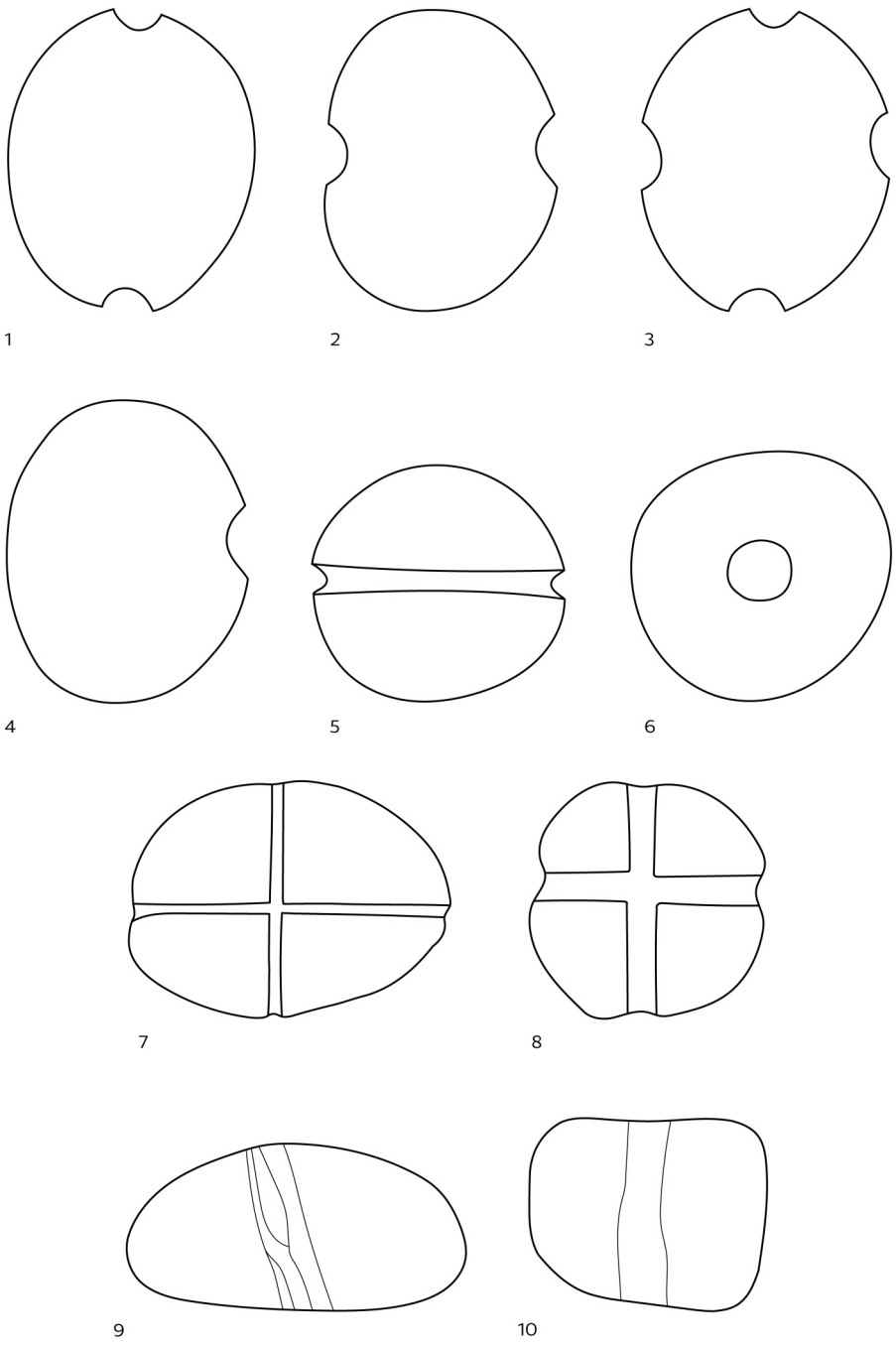

Figure 4: *Typology of net sinkers: 1) end-notched, 2) side-notched, 3) double-notched, 4) atypical, 5) grooved, 6) rounded, perforated, 7) and 8) grooved cross-like, 9) and 10) unmodified cobbles with preserved organic binding.*
Illustration © Anna Horáková.

Perforated weights, in which holes were drilled or pecked through stone blanks, appear especially in South Asia. In Harappan India, miliolite discs with perforations served as sinkers (Ruikar 2013). Clay sinkers appear sporadically in Oceania and Southeast Asia. In Vietnam and Indonesia, small terracotta sinkers with perforations or grooves were hand-shaped and sun-dried (Hiep and Huffer 2015; O'Connor et al. 2011). At Leang Buida in Sulawesi, clay sinkers with twin perforations were recovered alongside fish remains and lures, dating to the late Holocene (O'Connor et al. 2011). The use of clay rather than stone highlights adaptation to raw material availability, particularly in island or coastal settings where cobbles were scarce.

Taken together, these categories illustrate both the global importance of net sinkers and their regional variability. While the basic principle of weighting nets with durable objects is universal, the specific forms — whether notched, unmodified, grooved, perforated, or clay — reflect local ecological conditions, technological choices, and cultural traditions. In this sense, net sinkers embody both technological convergence in function and cultural divergence in form.

Raw materials

The manufacture of net sinkers was closely tied to the natural availability of raw materials in local landscapes. In most cases, fishers selected water-worn cobbles from riverbeds, lakeshores, or coastal zones, as these offered rounded forms and densities well suited to submerging nets (Nadel and Zaidner 2002; Bērziņš 2008). Limestone and basalt cobbles dominate the Levantine assemblages, reflecting the geology of the Jordan Valley and adjacent uplands (Ourodová 2022).

In Europe, granites, sandstones, and glacial erratics were often employed, as seen at Cham-Eslen in Switzerland and Sārnate in Latvia, where cobbles of varied lithology were wrapped with bast or bark to form functional sinkers (Bērziņš 2008; Huber and Rehazek 2014). The expedient selection of locally available stone underscores the practical nature of sinker manufacture: unlike lithic tools requiring high-quality knappable material, any dense cobble of adequate weight could be adapted for use, whether through notching, grooving, or simply binding in its natural state.

In other regions, raw material choices highlight both environmental constraints and cultural preferences. In Southeast Asia and Oceania, clay sinkers were manufactured where cobbles were scarce, providing a lightweight but effective alternative (O'Connor et al. 2011; Hiep and Huffer 2015). These examples demonstrate that raw material selection was not random but conditioned by geology, availability, and intended function.

Function

The primary function of net sinkers was to weigh down fishing nets, keeping them spread and submerged in the water. Their size and weight varied considerably, reflecting different fishing strategies and net types. Light notched cobbles, such as

those from Beisamoun, have been interpreted as components of throwing nets, which required relatively small, portable weights for effective casting (Rosenberg et al. 2016). By contrast, heavier examples, such as those from Epipaleolithic Levantine sites, Sārnate in Latvia or North American riverine sites, were likely attached to seine nets, or gill nets, which demanded stronger anchoring to remain fixed in place (Bērziņš 2008; Prowse 2010; Nadel and Zaidner 2002). In some contexts, larger cobbles may have served in traps or stationary weirs (Fig. 5.), while lighter variants facilitated mobile and communal fishing strategies.

Experimental archaeology has provided important insights into net sinker performance. Hannold demonstrated that notch placement significantly influenced how securely cobbles could be tied with binding, with U-shaped notches holding cords more effectively than shallow V-shaped incisions (Hannold 2019). Ethnographic parallels reinforce these findings: in Cameroon and Sri Lanka, fishers attach stones to seine and gill nets using bast or cordage, with lighter sinkers employed for fine-meshed nets and heavier weights for large-scale communal fishing (Von Brandt 1984; Dounias et al. 2016). Such comparisons underline the methodological value of integrating archaeological, experimental, and ethnographic data when reconstructing prehistoric fishing practices.

Use-wear and preservation evidence add further confirmation of function. At Cham-Eslen in Switzerland, rope imprints preserved on cobbles directly attest to their attachment to nets (Huber and Gross 2018), while at the Mesolithic site of Beregovaya 2 (9,350 – 5,295 cal. BC) in Russia, remnants of bast cordage survived, providing rare direct evidence of fibre bindings (Zhilin and Savchenko 2020). Diagnostic traces such as percussion scars, U- or V-shaped notches, and cord imprints distinguish net sinkers from ordinary cobbles, making them methodologically significant despite their deceptively simple form.

Figure 5: *Reconstruction of a net with attached net sinkers from a museum in Japan and a trap with attached sinkers from the Upper Galilee Museum of Prehistory (courtesy of Gonen Sharon).*

Beyond their practical role, net sinkers also reflect aspects of labour organisation: the construction and operation of large nets required dozens of sinkers and therefore collective effort in both manufacture and use. Their presence at archaeological sites thus speaks not only to subsistence strategies but also to the social dynamics of cooperative fishing and seasonal resource exploitation.

Taken together, the functional and use-wear evidence shows that net sinkers, while simple in form, were integral components of sophisticated fishing strategies. Their variability in size, modification, and spatial clustering speaks to different modes of resource exploitation, from small-scale opportunistic fishing to large-scale communal harvesting. Importantly, the study of their function highlights not only technological adaptation but also the organisation of labour, situating net sinkers within broader discussions of Mesolithic and Neolithic subsistence, settlement, and social practice.

Discussion

The study of net sinkers highlights the methodological challenges and interpretive opportunities posed by otherwise modest artefacts. Unlike lithic tools or ceramics, sinkers are rarely standardized, often expediently made, and easily mistaken for ordinary cobbles. For this reason, they were long overlooked in excavations or relegated to the margins of typological studies. Yet, their distribution is geographically broad, extending from the Epipaleolithic Levant to Mesolithic Europe, North America, Africa, and Asia. This ubiquity, coupled with recurring solutions such as opposed notches or circumferential grooves, underscores a fundamental technological convergence: wherever humans fished with nets, the need to submerge and stabilize them produced similar artefactual forms.

Despite this convergence, net sinkers are embedded within specific ecological and cultural contexts. Raw material selection reflects local landscapes—limestone and basalt in the Levant; limestone, quartzite, sandstone, and schist in Europe; clay in Southeast Asia—demonstrating technological flexibility.

Typological variability likewise corresponds to different fishing strategies: notched cobbles likely weighted seine and gill nets (Prowse 2010); lightweight sinkers such as those from Beisamoun were suited to casting nets (Rosenberg et al. 2016); and larger grooved or heavy notched weights may have stabilized nets in strong currents (Antonovic 2006). Experimental and ethnographic parallels confirm that weight, notch placement, and raw material all influenced performance, and that sinkers formed part of wider technological systems including floats and nets (Rau 1884; Dounias et al. 2016; Prowse 2010; Hannold 2019).

In the Epipaleolithic Levant, the spatial clustering and abundance of net sinkers at riverine and lakeshore sites underscore their structural role in subsistence organisation. Their proliferation coincides with sustained occupation of the lacustrine and riverine environments of the Jordan Rift Valley, particularly around the Sea of Galilee and the

Upper Jordan Valley (Nadel and Zaidner 2002; Rosenberg et al. 2016; Sharon et al. 2020). These ecosystems supported predictable, seasonally concentrated fish populations, making investment in net-based mass-capture technologies economically rational.

Although often interpreted through the lens of the "Broad Spectrum Revolution," the Levantine evidence does not simply signal expansion into lower-ranked resources. The scale and density of net sinker assemblages instead indicate systematic targeting of reliable, high-yield aquatic foods. From Ohalo II to Jordan River Dureijat, the repeated association of net sinkers with abundant fish remains and early hooks demonstrates that net fishing was planned and recurrent rather than incidental, in some cases preserving the outlines of discarded nets (Ourodová 2022). Preserved impressions attest to substantial fibre technologies and sustained technical expertise.

The abundance of early net sinkers therefore reflects the scaling of coordinated mass-capture strategies enabled by advances in fibre production, net construction, and maintenance. Such systems required logistical planning, labour coordination, and knowledge transmission, linking technological innovation to increasingly stable settlement patterns. Intensified fishing thus emerged from the interaction of ecological opportunity, technological capacity, and socially mediated subsistence choices, rather than as a passive response to resource stress.

Comparable spatial patterning is evident beyond the Levant. In north-eastern Europe, assemblages from Sārnate and Šventoji accumulated in discrete zones within lakeshore settlements, possibly marking areas of net repair, storage, or repeated casting (Bērziņš 2008). Similar concentrations occur in North America, particularly around the Great Lakes, where sites yielding thousands of net sinkers attest to large nets and mass-fishing operations (Cleland 1982; Prowse 2003, 2010; Hannold 2019). Ethnographic parallels emphasize that such practices are typically collective, pooling labour to exploit seasonal fish runs efficiently (Von Brandt 1984; Dounias et al. 2016).
Net sinkers therefore provide rare material evidence for cooperative economies structured around predictable aquatic resources.

Within broader anthropological debates, net sinkers are best understood not as passive indicators of dietary diversification but as material expressions of evolving technological knowledge, labour organisation, and social practice. At sites such as Ohalo II and Beisamoun, their association with permanent or semi-permanent settlement structures indicates that fishing contributed to the subsistence base supporting longer-term occupation.

Viewed comparatively, the persistence and widespread adoption of net sinkers reflect diverse regional pathways through which aquatic resource exploitation became embedded in early Holocene economic and social systems.

Conclusion

This study demonstrates that net sinkers constitute a robust and analytically powerful proxy for reconstructing prehistoric fishing practices. Anchored in the Epipaleolithic–Neolithic transition, particularly within the Levantine record, their early appearance and patterned deposition reveal that fishing was not an opportunistic supplement but a structured, technologically informed, and often cooperative subsistence activity.

Unlike most organic fishing gear, net sinkers preserve clear signals of technological choices, labour organisation, and seasonal scheduling, allowing practices to be traced across sites and through time. In doing so, they link local ecological adaptations to broader processes of economic intensification and emerging sedentism in the early Holocene. Continued integration of typological, spatial, and experimental approaches will further sharpen their capacity to illuminate how aquatic resource use shaped early subsistence economies and social life.

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