



## Guest Editorial

## Worldwide large-scale trapping and hunting of ungulates in past societies

Human impact on the landscape took many forms during the millennia, one of which was building ever-lasting stone structures. Some landmarks in architectural innovations took place in the Near East, where later the largest ever stone-built game traps were also built. The first innovation may have been the systematic use of stones for walls of round/oval structures. This is evident in several Natufian sites, dated to ca. 15,000 years ago (Garrod, 1957; Perrot, 1966; Bar-Yosef, 1998). At the beginning of the succeeding Neolithic period (ca. 11,500–10,500 years ago), monumental public structures were established. These include the Göbekli Tepe structures and the incorporated huge carved pillars in the northern Levant (Schmidt, 2000, 2010; Dietrich et al., 2012), and the Jericho tower and annexed wall in the southern Levant (Kenyon, 1957). During the fifth and fourth millennia BCE, large burial and ritual monuments (tumuli, nawamis, dolmens, menhirs, etc.) were constructed in many parts of the old world, sometimes in the hundreds at each site. These were built in the open, in addition to the development of cities with monumental palaces and public structures. Particularly famous relevant achievements are the Egyptian pyramids and the Stonehenge compound, probably representing local architectural climaxes of complex societies. This period of increasing social complexity and unprecedented growth in the scale of construction, also reveals a new architectural phenomenon with far-reaching environmental implications – the construction of large-scale stone-built game traps for mass hunting of wild ungulate herds.

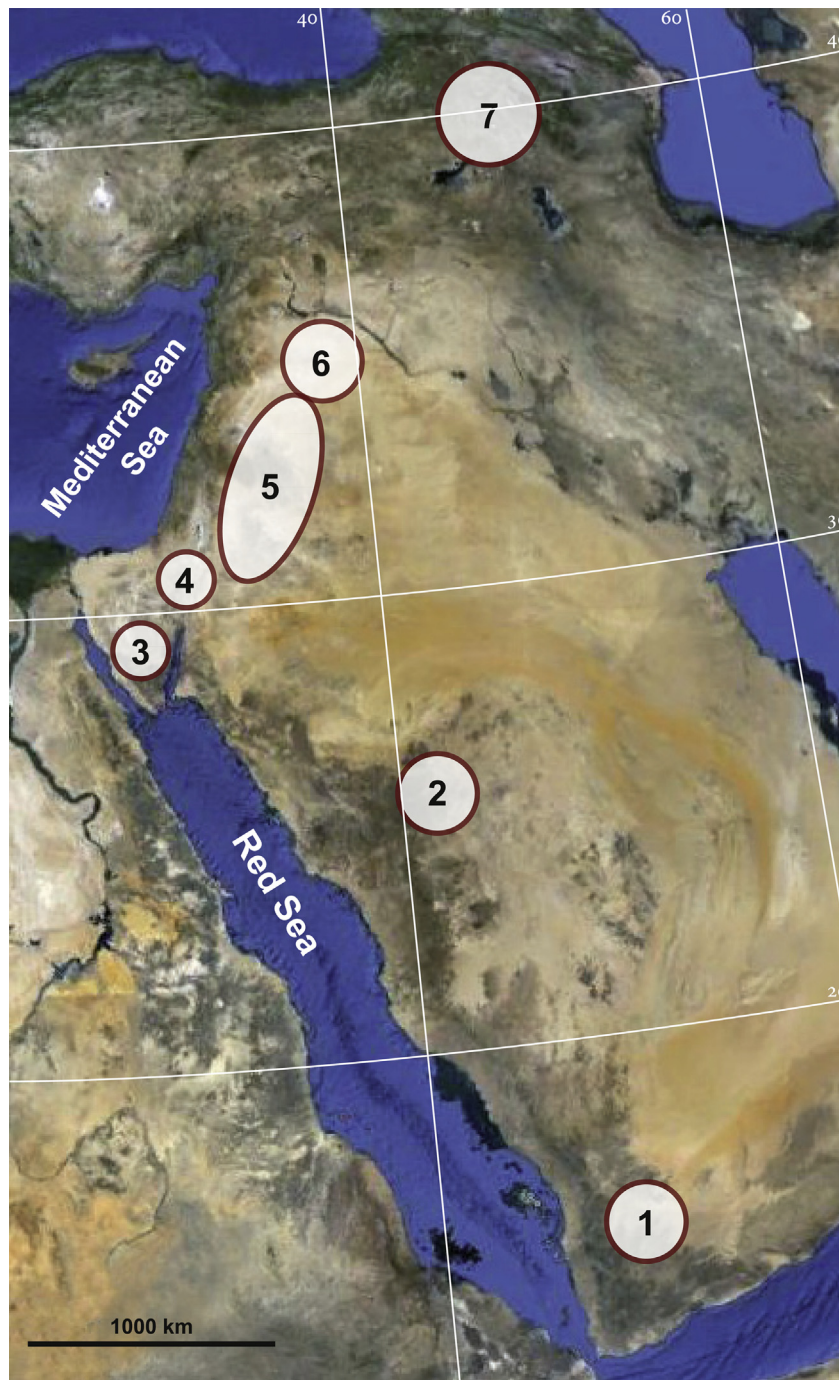
Stone-built game traps, also known as ‘desert kites’ in the Near East, may have first appeared during the Neolithic period (see a summary in Zeder et al., 2013) although so far the majority of radiometrically dated sites are placed well within the third millennium cal. BCE. Thousands of such structures have been documented throughout southwestern Asia, extending from Yemen and Saudi Arabia in the south, through the deserts of Sinai, the Negev, east Jordan and Syria, and at least as far north as the Ararat Depression in Armenia (Fig. 1). Since the early twentieth century, all such structures have been termed kites (Maitland, 1927; Rees, 1929) even though they encompass a wide variety of types in terms of dimensions, forms and function (Helms and Betts, 1987; see also Kempe and Al-Malabeh, 2013). Most interpretations regarding the function of kites involve the capture of animals, mainly for consumption purposes as well as for additional reasons (Smith, 2013; Zeder et al., 2013). Thus, they may also be referred to as large game traps.

The aim of this preface is to lay out some of the important questions which arise from numerous studies conducted in the Near East, North America and other parts of the world concerning the social, economic and environmental implications of the ancient use of large game traps. Our interest in the subject began with

a reconnaissance of archaeological sites in the Negev desert of southern Israel, during which we encountered a number of kite structures surviving from antiquity due to the arid climate and low intensity of human occupation of this area. We subsequently launched a project that involved a survey of all known Negev kites (12) and systematic excavation of four kites (Nadel et al., 2010; Bar-Oz et al., 2011a; Nadel et al., 2013). Our broad review of the literature, extensive discussions with experts studying large game traps in the Near East and beyond, and our own research has prompted us to organize an international symposium on the subject. We saw the need for broad scholarly exchange concerning methodological and theoretical approaches to the study of ancient game traps in diverse social and environmental settings around the world.

The idea for this volume was conceived during the symposium entitled “Worldwide Large-Scale Hunting of Ungulates in Past Societies”, held as a session during the 2012 annual meeting of the Society of American Archaeology, Memphis, Tennessee. The symposium addressed such topics as methods in the planning and construction of large-scale game traps, varying modes of utilization, and the study of associated assemblages of material remains. In particular, papers presented in the symposium explored archaeological evidence for mass hunting through the construction of traps and the characteristics of faunal assemblages found in or near the killing sites. The symposium included case studies from the Near East, North America and Australia. Papers presented in the symposium are included in this volume of *Quaternary International*, and three additional papers were invited later. The first and last papers of the volume were written by the symposium discussants. Smith opens the volume with a general introduction and overview of the presented papers and places them within the niche-construction framework. Speth closes this special volume and offers a range of thoughts about hunting that reflect the breadth of the symposium and directions for future research. We hope that this volume will stimulate further research and discussion regarding the role of large game traps in past social and economic organizations and their environmental impacts.

Though the case studies deal with the targeting of a wide variety of ungulate species (summarized in Smith, 2013), the papers in this volume demonstrate significant cross-cultural similarities in the construction, maintenance and use of large-scale trapping features among ancient societies. They demonstrate the similar ways in which the traps functioned in different continents and during different periods of the Holocene. The convergent development of mass-hunting features among complex societies is a global phenomenon. It was devised for manipulating ungulate herds and



**Fig. 1.** Major concentrations of kites in southwestern Asia. Note that they are all in arid and semi-arid environments, forming a long north–south arch to the east of the Mediterranean belt (1 – Yemen, 2 – Saudi Arabia, 3 – Sinai (Egypt), 4 – Negev (Israel), 5 – Jordan and northern Saudi Arabia, 6 – Syria, 7 – Armenia). New kites are discovered every year and some marked areas will no doubt be wider and even connect to others.

substantially augmenting the yield of wild game from local environments. This trajectory is evident from the studies comprising this volume. Nonetheless, it is equally significant that these innovations were developed under an especially wide variety of social contexts and that the consequences for long-term persistence of wild game populations and ecosystem sustainability seem to have varied from region to region.

*Construction and function of traps.* The modes of construction of traps and the locations in which they were situated demonstrate intimate familiarity of the hunters with their environment. Their

constructions were likely influenced by practical considerations of available building materials and the ecology and behavior of targeted game species. Numerous solutions revealed by the case studies to this basic set of constraints and requirements attest to the ingenuity of ancient societies faced with the need to intensify wild game exploitation. All over the world the traps were built in diverse and complex ways to enhance yields. The traps were mostly made of durable building materials, usually from local undressed stones (where available), though perishable materials were added to stone construction or used exclusively in others. The

sophisticated strategies and well-planned constructions enabled the capture of dozens and in some cases hundreds of animals during a single hunting event. The traps were built to be operated over long periods of time and probably used repeatedly over the course of many years. Many are still preserved on the landscape generations and even millennia after their construction.

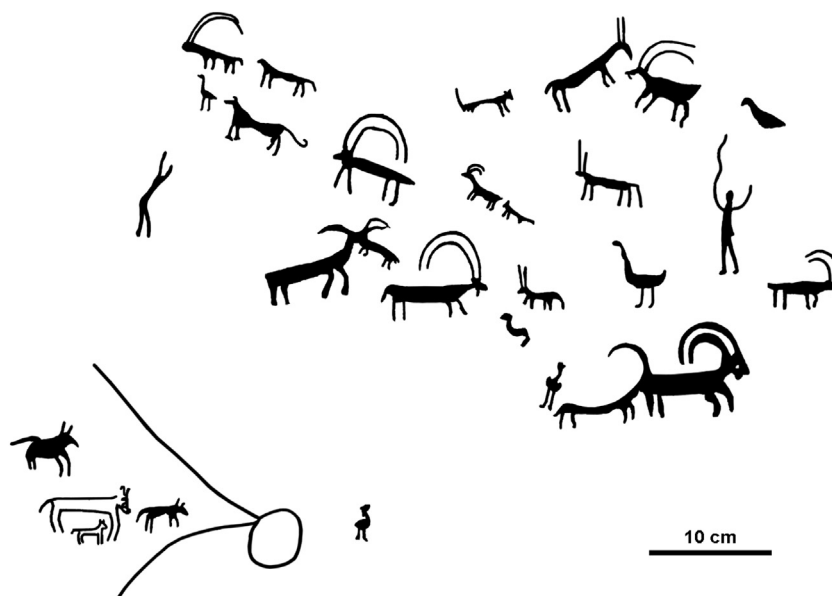
The construction, maintenance and operation of the large traps required coordinated communal efforts. In the Negev Highlands, for example, the construction of a single kite included moving more than 100 tons of rocks for building the head, excluding the arms, hunters' hides and probably other features (Nadel et al., 2013). The extensive and finely coordinated effort required by large numbers of people for a period of at least several days is also demonstrated avidly through the experiments carried out by Hockett et al. (2013). The construction of the large features in Arabia was indeed of formidable scale, especially for desert societies (Kempe and Al-Malabeh, 2013). In addition, the hunt itself must have involved a large group of people organized over a broad expanse of the landscape in order to successfully drive the animals into the openings of the traps. It is likely that in many cases such efforts were aided by the use of hunting dogs. A vivid example of this strategy is depicted in rock engravings which were discovered in close proximity to some Jordanian and Syrian kites (see below).

In rare cases, the material remains retrieved from trap features consist of animal bones found in or near the killing sites; these provide direct evidence for their function as large-scale ungulate trapping. For example, a large assemblage of Persian gazelle (*Gazella subgutturosa*) bones was retrieved from third millennium BCE deposits at Tell Kuran in northeastern Syria, in proximity to several desert kites. The analysis of the faunal remains, which were accumulated in a single depositional episode, showed that the captured animals represent a mass, unselective slaughter of a whole herd (Bar-Oz et al., 2011b; Zeder et al., 2013). Additional studies by Lubinski (2013) and Driver and Maxwell (2013) address in detail the methodological problem of analyzing faunal remains from kill sites and review the list of characteristics expected in such assemblages. Both of these studies emphasize the basic principle that assemblages produced by mass killing should reflect a snapshot of the living herd. Convincing cases of past mass procurement events

should be based on evidence of hunting by humans and that the bones were accumulated in a single depositional episode and represent a single mortality event. However, as discussed extensively by Speth (2013), a range of factors that are related to the behavior of hunters and prey, together with various taphonomic and post-depositional effects, often complicate attempts to diagnose accurately many of the expected zooarchaeological characteristics of mass kill events.

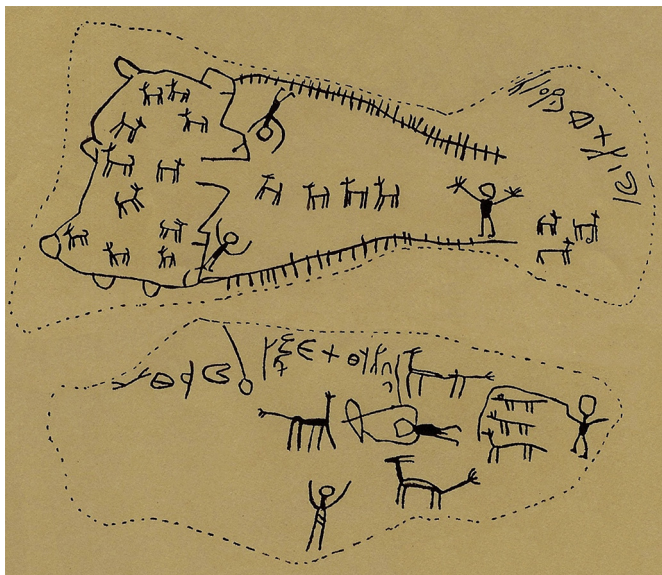
Identification of the target species and related method of trapping in most cases is not a straightforward matter. With lack of direct evidence from faunal remains, petroglyphs with depicted hunting scenes are insightful. Of particular importance are petroglyphs discovered in close proximity to some of the large-scale traps in the Near East; these support the suggestion that in the distant past the kites were used for ungulate hunting. LeMaître and Van Berg (2008) documented clear depictions of gazelles inside kites in southeastern Syria. Other animals shown in these depictions include an equid species (probably an onager, *Equus hemionus*) inside a kite. Onagers in kites are also clearly depicted in a rock drawing discovered in Sinai (Hershkovitz et al., 1987, Fig. 2). A rock art scene with a depiction of a desert kite in the Negev Highlands includes an unidentifiable ungulate species inside the kite (Eisenberg-Degen, 2010). The depiction of figures with religious connotations in Syrian rock art (humans holding maces or clubs tied to lions and bulls interpreted as representations of Mesopotamian divinities; LeMaître and Van Berg, 2008) suggests that the use of kites also had symbolic or ritual significance. In the New World, hunting scenes are also common. Examples of wild sheep hunting depicted on panels at Black Point, Nevada, are presented in this volume (Hockett et al., 2013, Fig. 10). Such artistic depictions vividly demonstrate the use of large traps to capture and kill local ungulates.

The clearest artistic evidence for the use of a desert kite as a hunting device is found on a ca. 2000 year-old engraved stone, discovered by Harding in east Jordan (Harding, 1953). The engraving presents a scene where a flock of gazelles is being trapped in a kite, possibly with the aid of dogs (Fig. 3). The associated Safaitic text explicitly states that animals were driven into an enclosed space (the term used is “sht” which is similar to the Hebrew



**Fig. 2.** Rock engravings from Sinai depicting hunting and/or management scenes of wild game. Major scene: human figures and dogs closely associated with ibex, oryx and ostrich. Bottom left: Onager driven into a kite (courtesy of I. Hershkovitz).





**Fig. 3.** A rock engraving found by Harding in east Jordan. The top scene shows the way a kite functioned at the time (ca. 2000 years ago), with gazelles captured by three hunters waving their arms. The bottom scene is a hunting episode, and there is a Safaitic text between the two (from Harding, 1953).

word ‘shuha’, a pit or a hole; Meshel, 2000; pp. 138–139). The engraving presents the entire hunting scene with great detail. A group of people are shown to drive a herd of gazelles along fences into a closed corral. A section of the corral seems to be built of organic material. Some people are raising their hands, possibly for the purpose of frightening the gazelles. In addition, a hunter with a bow and another person holding three dogs are seen on the other side of the stone. Most importantly, the gazelle herd includes specimens of different sizes, showing that a complete herd of both adult and young individuals was captured. Similarly, one can also see some variation in the length of horns of the depicted gazelle, perhaps indicating the presence of both males and females. Thus, the age and sex profile of the hunted gazelles presented on the stone invokes a catastrophic demographic structure, indicating a mass kill of an entire herd. This pattern is consistent with the mixed herd of males and females seen during seasonal migration (Kingswood and Blank, 1996).

**Type of kites in southwest Asia.** In the vast region of southwestern Asia stretching between Yemen and Armenia (Fig. 1), a large variety of kites occur, suggesting strongly that not all kites in this region were constructed to carry out precisely the same function. These structures include small V-shaped and large enclosure kites, some occurring in sequence as part of long chains (Fig. 4). The typology of kite form, which so far relied mainly on the morphology of the heads, is yet to be clarified. Preliminary typology and mapping of kites (Helms and Betts, 1987) and recent analyses of Google Earth images (e.g., Kempe and Al-Malabeh, 2010; Kennedy, 2011) support a preliminary (and definitely not final) division of kites in southwest Asia into two very broad types used in three basic ways (Fig. 4):

1. The killing kite is the smallest, and is found as an isolated structure all over southwest Asia (Fig. 4A). The most common are V-shaped and characterized by a small head at the apex. These are found in diverse environmental settings; some are built at the opening of rich pasture areas while others are distributed along ancient routes of ungulate migration. The size and topographic settings of the kites suggest that they were built to

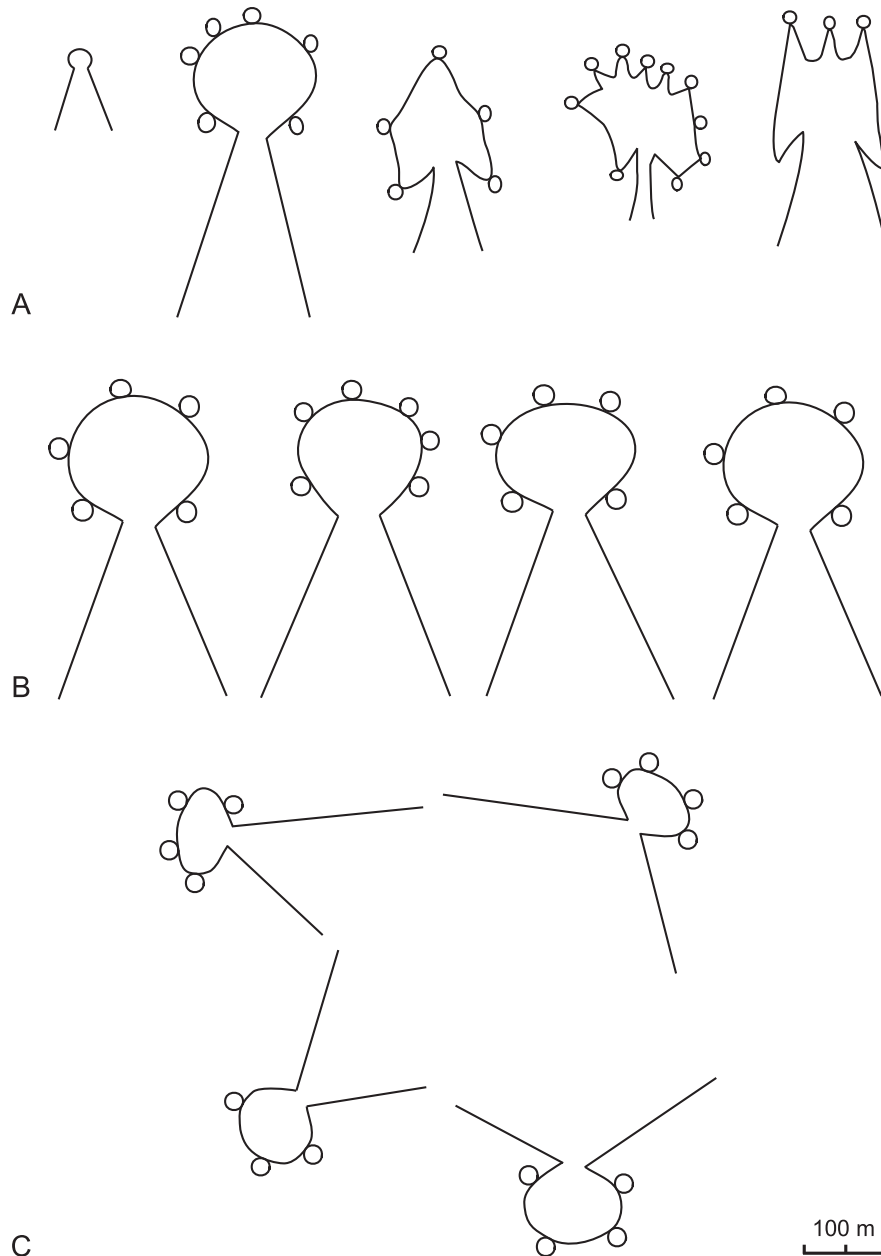
trap small numbers of local herbivore prey (e.g., Dorcas gazelle [*Gazella dorcas*], onager [*E. hemionus*] and Arabian oryx [*Oryx leucoryx*]), which locally grazed in small herds all year round (Holzer et al., 2010; Nadel et al., 2010; 2013; Bar-Oz et al., 2011a).

2. The second type, the capturing/corral kite, is usually characterized by a much larger enclosure head (commonly 100–250 m in diameter), very long arms (sometimes over 1000 m long) and a wide range of shapes (Fig. 4A, B). Commonly annexed to the head are several stone-built cells, a few meters across. These may have served as hides or pens for individual animals. Other walls are also commonly associated with this type. Such kites appear to have a more limited geographical distribution than the V-shaped kites, though they are found as far north as Armenia (personal observations). In the deserts of east Jordan and Syria they typically compose long chains across dozens of kilometres. These kites are located along the proposed migratory route of Persian gazelles and onagers which are believed to have once migrated in large numbers between breeding grounds in the south and calving grounds in the north (Legge and Rowley-Conwy, 1987, 2000; Bar-Oz et al., 2011b). The arms of the chain kites all open to the same direction and were targeted to block an entire migrating herd.

Another organization mode of the large trapping kites was in a multi-kite corral complex (Fig. 4C). This is common in southern Syria, where several such kites delineate and enclose a wide area between them (Echallier and Braemer, 1995; Van Berg et al., 2004). These structures were probably established to corral herds of livestock in large pasture areas (Echallier and Braemer, 1995, p. 61).

A combination of both types is also known, where a large enclosure type has annexed V-shaped kites. Such a complex may have enabled the corralling of a herd in the large structure, and then at the will of the hunters selected animals or small groups were driven into the V-shaped killing device. Combined complexes as described here were inspected by us in Armenia. Until enough kites of all types and in all major ecological settings are excavated, their radiometrically dates established and their material remains analyzed and interpreted, this tentative typological scheme remains no more than a suggestion to be tested. At any rate, one should be specific when discussing kites in southwest Asia, as the variety of forms and settings most probably reflects a variety of functions and a long chronological sequence. Furthermore, the study of these should incorporate the documentation and excavation of annexed and associated features, in order to better understand the complex in which they operated.

**Dating of traps in southwest Asia.** The dating of the southwest Asia desert kites is a central research aspect but it poses a major challenge given the fact that many such features represent numerous phases of building, renovation and maintenance over extended periods of time. The potential for accurate dating is further limited by the fact that many of the kites contain only a very small number of artifacts, animal bones and other organic remains (e.g., Betts, 1988; Meshel, 2000; Holzer et al., 2010; Nadel et al., 2010). This is due to the mode of use of the kites, which would have been geared to task-specific purposes and often their positioning at locations remote from occupation sites. In the Near East, reliable radiometric dates are currently available mainly for the Negev and Sinai kites (Holzer et al., 2010; Nadel et al., 2010; Nadel et al., 2013; Zeder et al., 2013). They provide compelling evidence that these kites are mostly date to the Bronze Age (third – second millennia BCE). There is also growing evidence (mostly circumstantial) that already by the Neolithic period such kite complexes were in use in some parts of southwest Asia (reviewed in Zeder et al., 2013). The direct dating of the kites remains a major research task in order to establish the chronological framework of the phenomenon on



**Fig. 4.** Schematic representations of major kite types found in southwestern Asia; see text for references and details. A) A V-shaped killing kite (left), and a variety of large trapping/enclosure kites (right). Note that heads appear in many forms (only a sample presented here), many of which have annexed cells; these may have served as individual animal pens or hides for the hunters. Compare the size of the V-shaped kite and the large complex heads; arms of the latter are not shown in full length as they can exceed 1000 m. B) A chain of enclosure kites with their large heads (corrals?), all set adjacent to each other and in the same direction. The chains are constructed of various types, here only one example depicted. C) A multi-kite corral complex where several large enclosure kites encircle a wide area between them.

a broader regional scale. Similar dating issues are relevant in all regions where large scale game traps were used. Furthermore, chronological and functional relationships between the traps and other features with which they may have been associated in the past is particularly difficult to verify due to spatially expansive distributions across the landscape in many instances.

*Historical accounts in the Near East.* Desert kites were continuously used for thousands of years, some even as late as the mid 19th and early 20th centuries. Eye-witness accounts of early travelers in the Middle East are illuminating. An explicit documentation of the kites in Syria and Jordan among the local Bedouin tribes is given by Aharoni (1946, pp. 31–33; translated from Hebrew by Meshel, 2000):

*“Not far from Rheme, Yehezkel Hankin (hunter and faithful companion of my desert travel) and I witnessed the shocking spectacle of 500–600 gazelle being hunted in kite – a gazelle trap. In order to hunt hundreds of gazelle, the Bedouin fenced off a vast area in the shape of an enormous triangle, extending over several kilometers. In the walls, which exceeded a man's height, they left windows, and in front of each window they dug a pit. When the Bedouin spotted a wondering herd of gazelles, they maneuvered it cautiously towards the opening of the kite. The cruel trap was not conspicuous in the desert landscape, since it was built of indigenous stone. After hundreds of startled gazelles had entered the kite, the Bedouin surrounded the opening, yelling wildly to frighten the animals. The trapped animals tried to escape and leap towards the windows, but*

could not reach them. They fell over the wall and into the pits. We saw many of the gazelles removed with shattered limbs; their groans were heartbreaking”.

A similar description of seasonal communal hunting of gazelles is given by Burckhardt (1831, pp. 220–221) who travelled in the Middle East in the early 19th century:

“Gazelles – These are seen in considerable numbers all over the Syrian Desert. On the eastern frontiers of Syria are several places allotted for the hunting of gazelles; these places are called masiade. An open space in the plain, of about one mile and a half square is enclosed in three sides by a wall of loose stones, too high for the gazelle to leap over. In different parts of this wall gaps are purposely left, and near each gap a deep ditch is made on the outside. The enclosed space is situated near some rivulet or springs to which in summer the gazelle resort. When the hunting is to begin, many peasants assemble and watch till they see a herd of gazelles advancing towards the enclosure, into which they drive them; the gazelles, frightened by the shouts of these peoples and the discharge of fire-arms, endeavor to leap over the wall, but can only effect this at the gaps where they fall into the ditch outside, and are easily taken, sometimes by hundreds. The chief of the herd always leaps first, the other follows him one by one. The gazelles thus taken are immediately killed, and their flesh sold to the Arabs and neighboring Fellahs. Several villages share in the profits of every masiade, or hunting party, the principal of which are near Kariatein, Hassia and Homs”.

Another historic description of the recent use of the Middle Eastern desert kites refers to the desert gazelle hunters of the Slejb (S'lubba) tribe. This description was provided by Musil who explored the region at the beginning of the 20th century (1928, pp. 26–27):

“In al-Manazer the gazelles are driven into extensive enclosures. A wall about one and a half meters high, shaped like a figure of eight, is built of stone without mortar. The lower loop is only half finished. Where the two loops meet, a narrow opening *tenijje* (or *zejs*), is left. At several places portions of the wall enclosing the upper loop are a little lower than the rest of the wall. At each of these places a hole, two or three meters deep, is dug outside the enclosures. The flock of gazelles is cautiously driven in the lower uncompleted loop. This is soon accomplished, because the two walls are about a thousand paces distant one from the other. The gazelles at first advance quietly, but later on, becoming scared, they run along the two walls and try to penetrate as rapidly as possible through the narrow opening into the upper and completely closed loop. As soon as they run through, the narrow opening is blocked up and a greyhound, *saluki*, attacks the gazelle. The frightened animals run around the wall, jump across it where it is lowest, and fall into the pits that have been dug outside. It is said that the gazelles even dream of the narrow opening, *zejz*, through which they rush to certain destruction. If a Bedouin wishes to stop a gazelle in flights he shouts. A narrow opening is in front of these, O gazelle! *Az-zejz ja razal*, and the gazelle at once stops and looks around”.

The Slejb gazelle hunting tradition was also describes by Doughty (1936, p. 325; quoted from Betts, 1989):

“The S'lubba are like herdsmen of the wild game, for when they see a troop they can break them and choose of them as it were a flock, and say, ‘These will we have today, as for those other heads there, we can take them after tomorrow’” (Doughty, 1936: 325).

Similar to the historical accounts from the Middle East, Brink (2013) and Friesen (in this volume) cite ethnographic cases from North America that demonstrate the use of large-scale traps among the Inuit (see also Hockett et al., 2013 and reference therein for the

use of drives in the Great Basin). These examples are important in highlighting the complex communal relationships that were involved in the use of such traps for mass hunting.

**The ecological impacts of large game traps.** The use of large-scale trapping features for mass hunting, such as the kites in southwest Asia, would have had a profound ecological impact on the environment. These impacts and their long term consequences for ecosystem integrity can be demonstrated through detailed archaeological and zooarchaeological studies of trapping features. The historical accounts of repeated and intensive use of kites for mass-killing of gazelles during the 19th and early 20th centuries in the Near East demonstrate the impact of uncontrolled hunting. In many places such hunting strategies culminated with the extinction or near extinction of many ungulate species with the arrival of fire arms (reviewed in Tsahar et al., 2009). Recent mass hunting using fire arms has been implicated in the ecological collapse of the Middle Eastern desert landscapes in the modern era.

**Future agenda.** The productive exchange and impressive set of papers stemming from the recent SAA symposium on ‘Worldwide Large-Scale Hunting of Ungulates in Past Societies’ has highlighted the need for a research agenda focused on reconstructing the social and environmental context as well as ecological consequences of the use of mass hunting features in antiquity. This is further emphasized by the widespread distribution of large-scale hunting features in different periods and regions of the world. These features reflect a central and so far little explored aspect of massive economic intensification among ancient societies with far-reaching implications for the long-term history of human–environmental interactions and the integrity of animal communities and indeed whole ecosystems in many parts of the modern world.

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Guy Bar-Oz\*, Dani Nadel  
Zinman Institute of Archaeology, University of Haifa,  
Mount Carmel, Haifa 31905, Israel

\* Corresponding author.

E-mail addresses: [guybar@research.haifa.ac.il](mailto:guybar@research.haifa.ac.il) (G. Bar-Oz),  
[dnadel@research.haifa.ac.il](mailto:dnadel@research.haifa.ac.il) (D. Nadel)

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