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Source: *Paléorient*, 2013, Vol. 39, No. 2 (2013), pp. 201-219

Published by: Paleorient and CNRS Editions and CNRS Editions

Stable URL: <https://www.jstor.org/stable/43578394>

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# RETHINKING HALAF AND UBAID ANIMAL ECONOMIES: HUNTING AND HERDING AT TELL ZEIDAN (SYRIA)

K. GROSSMAN and M. HINMAN

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**Abstract:** This study re-evaluates current models of Halaf and northern Ubaid subsistence strategies in light of new faunal data recovered from Tell Zeidan, a prehistoric settlement at the confluence of the Balikh and Euphrates rivers in Northern Syria. Our data indicates that a major shift in the animal economy at Zeidan took place between the Halaf and Ubaid periods. The Halaf period faunal assemblage from Tell Zeidan includes more than 50% wild game. Faunal data from other Halaf sites show that, while a heavy reliance on wild game was common, Zeidan was the only large, permanent settlement with a faunal assemblage that included more than 50% wild game. During the Ubaid period, the animal economy at Zeidan shifted to focus on the exploitation of domesticated taxa (90% of the assemblage), an intensification probably driven by population increase at the site. This increasing use of domesticates does not, however, appear to have been a regional trend, as many Ubaid settlements continued to exploit high percentages of wild game. This study of faunal remains from Tell Zeidan presents a valuable new corpus of zooarchaeological data from a large, permanent settlement in Northern Mesopotamia and provides useful insights into changing regional patterns of animal exploitation during the Halaf and Ubaid periods.

**Résumé:** Cette étude propose une réévaluation des modèles actuels de stratégies de subsistance des cultures de Halaf et d'Obeïd du Nord à la lumière des nouvelles données archéozoologiques de Tell Zeidan, un village préhistorique à la confluence de la rivière Balikh et de l'Euphrate en Syrie du Nord. Les données récentes indiquent qu'un changement majeur dans l'économie animale eut lieu à Zeidan entre les périodes de Halaf et d'Obeïd. Durant la période de Halaf, l'assemblage faunique comprend ainsi plus de 50 % d'animaux sauvages. Même si les données des autres sites contemporains montrent qu'une forte dépendance au gibier était assez commune, Tell Zeidan est toutefois le seul grand établissement permanent à présenter un assemblage faunique où le gibier est nettement supérieur à 50 %. Au cours de la période d'Obeïd, l'économie animale à Zeidan s'est modifiée pour se concentrer sur l'exploitation des taxons domestiques, représentant alors 90 % de l'assemblage ; une intensification probablement liée à l'augmentation de la population sur le site. Cependant, cette utilisation croissante des animaux domestiques ne semble pas refléter une tendance régionale, comme l'attestent de nombreux établissements d'Obeïd où les pourcentages de gibier demeurent élevés. Cette étude présente un corpus nouveau et important de données archéozoologiques pour un grand site permanent du nord de la Mésopotamie et apporte des précisions utiles sur l'évolution des tendances régionales concernant l'exploitation des animaux au cours des périodes de Halaf et d'Obeïd.

**Keywords:** Near East; Neolithic; Chalcolithic; Zooarchaeology; Halaf / Ubaid Transition; Subsistence economy.

**Mots-clés :** Proche-Orient ; Néolithique ; Chalcolithique ; Archéozoologie ; Transition Halaf/Obeïd ; Économie de subsistance.

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## INTRODUCTION

The Neolithic-Chalcolithic transition stands out as a key moment in the socio-economic development of the Near East,

bridging the gap between the earliest agricultural villages and the emergence of the first states. In Northern Mesopotamia, the later Neolithic and early Chalcolithic are respectively referred to as the Halaf and Ubaid periods. In this paper, we examine the evidence for hunting and herding systems in order

to contribute to models of socio-economic organization for the Halaf and Ubaid periods.

The Halaf and Ubaid periods are particularly interesting periods in which to study subsistence strategies because, while domesticated animals had been available for several millennia, communities made widely varying choices about how much to rely on domesticated animals relative to wild ones (Akkermans 1993; Zeder 1995). In recent decades, archaeologists have developed several models to explain what appears to be a wide range of variability in subsistence strategies at sites across Northern Mesopotamia during these two periods. These models posit that, during the Halaf period, large, permanent settlements subsisted on agricultural yields along with some pastoralism. Smaller, seasonally occupied settlements located in well-watered regions also practiced pastoralism. Those in more arid regions, however, pursued a mixed strategy of hunting and pastoralism (Akkermans 1993; Campbell 1992b; Cavallo 2000). Models explaining subsistence strategies during the Ubaid period suggest that settlements in arid regions continued to use a significant proportion of wild animals. These same models indicate, however, there may have been a trend toward intensification of pastoral production at settlements located above the 200 (or 250) mm/annum isohyet (Akkermans and Schwartz 2003; Zeder 1995 and 1998a).

In this paper, we revisit and build on these models through a study of the Halaf and Ubaid animal economies at Tell Zeidan, a large, prehistoric settlement in Northern Syria. Recent excavations at the site have uncovered evidence for continuous occupation over the course of the Halaf and Ubaid periods. The excavated faunal remains from Zeidan form an important new corpus of zooarchaeological data for study of: a) diachronic patterns in animal economies at the site itself, and b) synchronic comparisons with contemporary Halaf and Ubaid settlements. It is important to integrate the Zeidan fauna into models of Halaf and Ubaid subsistence strategies, because Zeidan had both an unusual emphasis on wild fauna in the Halaf period and an unusually dramatic shift toward domesticated fauna in the Ubaid period.

## NORTHERN MESOPOTAMIA DURING THE HALAF AND UBAID PERIODS

The Halaf period is generally dated to approximately 5900 – 5300 BC.<sup>1</sup> Nieuwenhuyse (2007: 23) has noted that the label

1. All dates are calibrated.

Halaf “refers simultaneously to a specific stage in the prehistory of Mesopotamia, to a certain cultural constellation—the ‘Halaf package’—, to a distinct, heterogeneous pottery assemblage, and finally, to a particular ceramic technology and decorative style”. The label Halaf does *not*, however, refer to a unified cultural or political entity. Archaeologists have traditionally identified archaeological sites as Halaf based on similarities in material culture, particularly the distinctive painted pottery, geometric stamp seals, figurine styles, and *tholos* architectural form (Campbell 1992b). Akkermans, however, argues that the Halaf was primarily a ceramic tradition in which the widely-distributed, painted pottery served to represent differences among interacting groups rather than cultural unity (Akkermans 1993: 207, 318-332; Akkermans and Schwartz 2003: 115-116).

Halaf settlements were centered in the Jezirah of Northern Syria and Iraq, with most sites located in the rain-fed agricultural zone (Akkermans and Schwartz 2003: 115, 118). Among Halaf sites, there were a few large, permanently occupied settlements of up to 10-15 ha but usually only a few hectares, as well as many small settlements of less than one hectare that were only temporarily or seasonally occupied (Akkermans and Schwartz 2003: 118-119). The nearly 20 ha site of Domuztepe may have had a peak population of 1500 people (Kansa *et al.* 2009: 897), and the population density at Tell Kurdu was sufficiently high to require streets and alleys between structures (Özbal *et al.* 2004: 40). At the same time, however, sites like Sabi Abyad and Khirbet esh-Shenef had large open areas and low population density (Akkermans 1993: 118-119). Halaf period population sizes and population density appear to have been lower than in the following Ubaid period.

Despite the presence of this two-tier settlement hierarchy, there is very little evidence for political centralization or social hierarchy during the Halaf period. Although Watson and LeBlanc have pointed to specialization in function among Halaf sites and argued that the sites dominating the pottery trade were chiefly centers (Watson 1983), there is actually no evidence that large settlements had regional political power (Akkermans and Schwartz 2003: 150). The Burnt House at Arpachiyah may provide potential evidence for the concentration of power by individuals or institutions (Campbell 2000: 25), but most archaeologists argue that there were no overarching political institutions unifying settlements across the region (Breniquet 1996; Huot 1994; Forest 1996). In the realm of social organization, Nieuwenhuyse (2007: 47) contends that the painted pottery may well have played a role in a social hierarchy based on achieved status. However, Akkermans (1993: 289) argues that social organization revolved around

'egalitarian' family and kin ties. Social hierarchy and political power may have been emerging over the course of the Halaf and Ubaid periods, but evidence for such developments in the Halaf period is quite limited.

By the start of the Halaf period, sheep, goats, cattle, pigs, and dogs had been domesticated for millennia. Nevertheless, there is a high degree of variation in the way Halaf settlements relied on domesticated versus wild animals. Akkermans (1993) has developed a model in which settlement size and permanence are the main factors that determine the subsistence strategies of Halaf settlements. He distinguishes two types of settlements: 1) large permanent settlements engaged in agriculture and with a lesser focus on domestic animals; and 2) small temporary settlements whose primary subsistence activity is either pastoralism or hunting. In his model, these two types of settlements interacted with each other so that individual sites' subsistence strategies were not necessarily self-sufficient. Subsequent researchers have generally accepted Akkermans' model, although a few have suggested modifications. Cavallo (2000) adds environment as a causal factor in distinguishing the large agricultural and small pastoral settlements in moister regions from the small hunting settlements in more arid regions. Campbell (1992a) hypothesizes that the small hunting settlements in arid regions may actually have been self-sufficient rather than linked to larger agricultural settlements. These models suggest that large settlements do not focus on hunting but settlements in arid regions do. Large settlements outside the zone of rain-fed agriculture, such as Zeidan, are not covered by these models.

While the Halaf culture was a uniquely Upper Mesopotamian phenomenon, the Ubaid period and ceramic tradition were first defined in the southern Mesopotamian alluvium. Like the term Halaf, the term Ubaid also refers to a site (Tell al-'Ubaid, close to the Euphrates in the southern alluvium), a time period (6<sup>th</sup> and 5<sup>th</sup> millennia BC), and a material culture package (the 'Ubaid horizon') that includes architectural forms, decorative motifs, religious or cult items, ceramics, administrative technologies, and burial practices (Carter and Philip 2010). During the second half of the Ubaid period, around 5300 BC, some components of the highly-recognizable, southern Mesopotamian Ubaid material culture began to spread to other regions of the Near East, including Upper Mesopotamia, Anatolia, the Gulf, and Western Iran. Early research suggested a wholesale break in the ceramic traditions of Upper Mesopotamia at the onset of the Ubaid period (e.g., Mallowan and Rose 1935), but recent studies indicate that a phase of Halaf-Ubaid Transitional pottery bridged the divide between the Late Neolithic and Early Chalcolithic periods

(Davidson and Watkins 1981; Watkins and Campbell 1987). The shift to Ubaid material culture in Northern Mesopotamia was, therefore, a transformation rather than a disjunction.

Still, there were some important changes in settlement patterns in Northern Mesopotamia during the Ubaid period. There was a marked transition to permanent and enduring settlements (Akkermans and Schwartz 2003: 159), and survey evidence even suggests the development of complex settlement hierarchies in certain regions (Wilkinson *et al.* 1996). The Iraqi Jazira, for example, hosted smaller hamlets (*ca* 1 ha), medium sized villages (5-6 ha) and even a large regional center (15-20 ha). Although these settlement hierarchies might suggest the development of political hierarchy on a regional scale, there is little information to attest to relationships of economic or political dependency between settlements.

Indeed, evidence for social stratification in Upper Mesopotamia during the Ubaid period is tenuous (Carter and Philip 2010: 12-13). Suggestions of incipient hierarchy and stratification have been made based on several factors, including the recovery of large buildings, such as at Tepe Gawra (Rothman 2002) and evidence for long-distance trade in valuable commodities, such as obsidian (Breniquet 1989) and copper (Tobler 1950: 211-213). The use of stamp seals in Upper Mesopotamia also attests to ownership, control of goods, and possibly some form of administration (Stein 2010a). Finally, "headshaping" was widely practiced during the Ubaid period and may have been a physical manifestation of inherited social rank (Lorentz 2010). Nevertheless, none of these features in-and-of themselves necessarily indicates the presence of a socio-political elite. In fact, there do not seem to be any markings of status in grave goods until the very end of the Ubaid period (Akkermans and Schwartz 2003: 178). Thus, although evidence for economic, social, and political hierarchy during the Ubaid period is not as limited as during the Halaf period, the extent of such developments is still an open question.

Subsistence practices during the Ubaid period in Upper Mesopotamia included agriculture (both rain-fed and using flood-basin irrigation), as well as pastoralism and hunting. Current understandings of Ubaid hunting and pastoralism, however, are constrained by the limited number of available zooarchaeological studies (Parker *et al.* 2008). The few studies that have been published show that, at some settlements in Upper Mesopotamia, the Ubaid diet consisted mostly of domesticated animals, while at others wild species continued to comprise a significant percentage of the diet (Zeder 1995; Akkermans and Schwartz 2003: 175), just as during the Halaf period. For example, Zeder argues that, during both the Halaf and Ubaid periods, settlement location may

have influenced the relative abundance of wild fauna, with wild game more heavily exploited in drier regions, where settlements were more isolated and developed unique, mixed subsistence strategies. In well-watered areas of the Upper Khabur, however, where settlements were more economically interdependent, Zeder's study shows a greater reliance on domesticated animals and, indeed, an intensification in the usage of domesticates from the Halaf into the Ubaid period (Zeder 1995 and 1998a). As she acknowledges, exceptions to her categorization of sites based on location exist even within her study region: for example, Kuran, in the well-watered Khabur Basin, has 27% wild fauna (Zeder 1998a: Table 2). Since Zeder only had a small number of sites on which to base her model, adding Zeidan to the regional dataset will aid in determining the strength of the correlations she identifies between location, economic interdependence, and subsistence strategies.

Our analysis of the Zeidan fauna will contribute to discussions about socio-economic developments during the Halaf and Ubaid periods in Upper Mesopotamia in several ways. By integrating Zeidan into a regional study of animal economies, we will present a more comprehensive view of the regional variability and patterning in Halaf and Ubaid subsistence strategies. Through a diachronic study of the animal economy at Zeidan and an analysis of the linkages between subsistence change and socio-cultural factors, we hope to contribute to a better understanding of the Halaf-Ubaid transition.

## TELL ZEIDAN

Tell Zeidan is a 12 ha, triple-mounded prehistoric site in north-central Syria (fig. 1). The site sits at the junction of the Balikh and Euphrates Rivers, a few kilometers outside the modern city of Raqqa (fig. 2). The soils of the lower Balikh River Valley are rich, but the area is quite arid, lying just at the 200mm/annum rainfall isohyet (Wilkinson 2003: Fig. 6.2). We know that crops were grown at the site, because barley, emmer, and einkorn wheat were recovered from flotation (Stein 2009). Irrigation, probably making use of seasonal inundations, would have been necessary to grow these crops.

In contrast to the rich agricultural land of the Balikh River Valley, the uplands immediately surrounding the valley are a semi-arid steppe. The areas immediately adjacent to the rivers would have supported riparian vegetation such as riverine forests, marshes, and wetlands, particularly at the confluence of the Balikh and Euphrates Rivers. Thus the region around

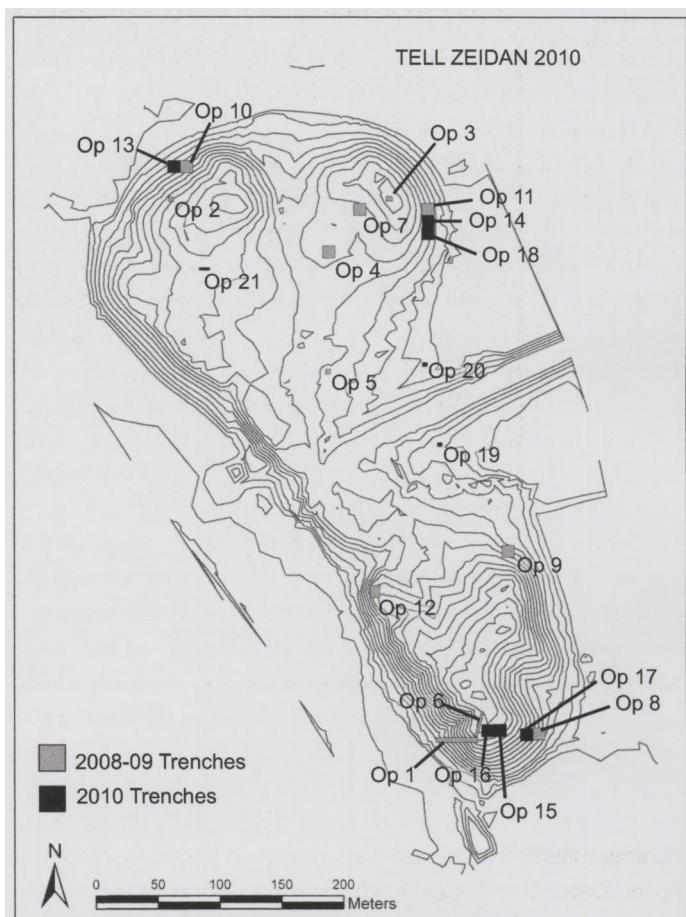


Fig. 1 – Zeidan Site Plan.

Zeidan included a diverse array of ecological niches that would have supported a wide variety of wild animals.

Archaeologists have known about the large mound of Zeidan since the early 20<sup>th</sup> century (e.g. Contenau 1928; Rutten 1931). Surveys in the Balikh Valley observed large quantities of prehistoric sherds on the tell surface, particularly Halaf and Ubaid painted wares, and recognized the site as one of the largest Ubaid settlements in Northern Mesopotamia (Mallowan 1946; Akkermans 1993; Trentin 2010). Excavations at Zeidan did not begin until 2008, when the Oriental Institute of the University of Chicago and the Syrian Directorate General of Antiquities and Museums began a joint project at Zeidan (Stein 2009; 2010b and 2011). The project is directed by Prof. G. Stein of the Oriental Institute, and by the director of the Raqqa Museum in Syria (A. al-Khabour in 2008 and M. Sarhan in 2009-2010). The project has drawn together a multi-disciplinary group of specialists, including ceramicists, archaeobotanists, bioarchaeologists, lithics specialists, artists,

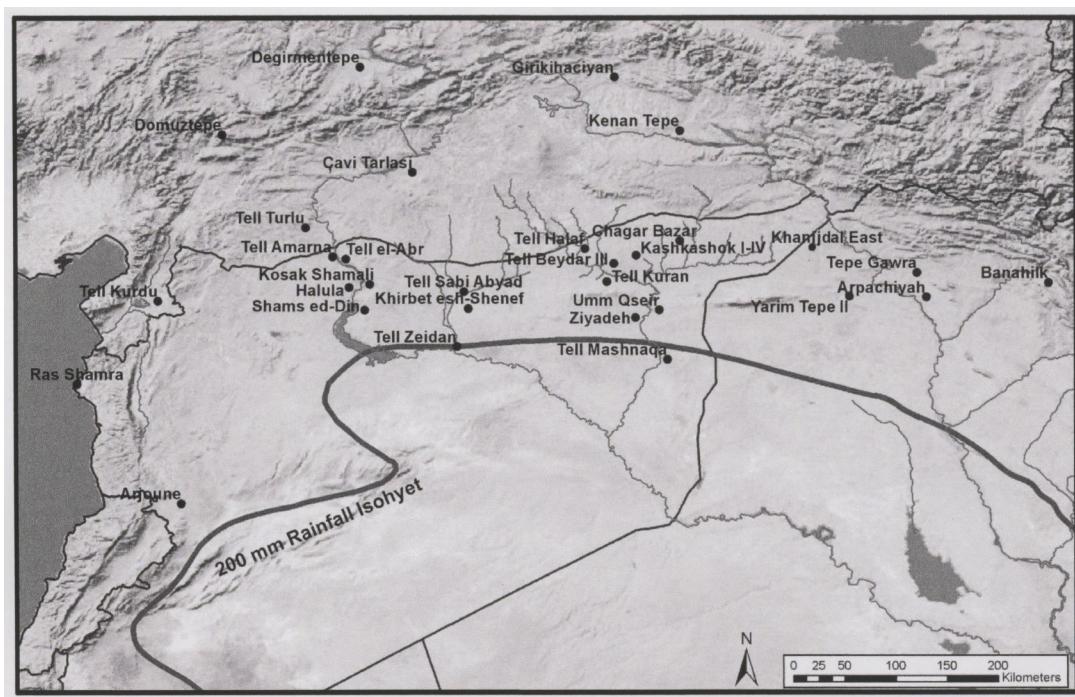


Fig. 2 – Map of Halaf and Ubaid Sites.

photographers, remote sensing specialists, and database managers. Zooarchaeological analysis is a major component of the research agenda. During the 2009 season, K. Grossman began a diachronic study of faunal remains from the Halaf, Ubaid, and Late Chalcolithic periods, and M. Hinman joined her in 2010 to study the Halaf fauna for her master's thesis.

Surface collections and excavations conducted by Stein since 2008 indicate that the Halaf period occupation of Zeidan extended over at least 6 ha, covering the entire northwest and northeast mounds, as well as the southwest portion of the south mound. This makes Zeidan one of the largest known settlements for the Halaf period. However, Halaf sites were often not occupied over their whole extent simultaneously (Akkermans and Schwartz 2003: 118-120). Excavators recovered 4 m of Halaf deposits dating to 5600-5400 BC from the step trench on the south mound, in Operation 1 (Stein 2009 and 2011), but only 1.25 m of Halaf deposits dating to 5890-5710 BC from the deep sounding on the border between the northeast mound and lower town, in Operation 4 (Stein 2009). It is likely that Zeidan hosted a permanent Late Halaf occupation but also had at least ephemeral occupation on parts of the site earlier in the Halaf period. Although the evidence from Operation 4 indicates ephemeral occupation outside the main mounds, the depth of occupation in Operation 1 indicates that some parts of the site were occu-

pied permanently over a long period of time. The two excavation areas were too limited in extent to permit thorough investigation of contexts, but the presence of mudbrick architecture corroborates the evidence for permanent occupation.

The Ubaid period settlement of Zeidan covered all 12 ha, with a deep stratigraphic sequence—at least 6 m in places (Stein 2009). Ubaid period remains include mudbrick houses, craft production areas, a large enigmatic building, and burials. The long sequence of well-stratified radiocarbon dates (Stein 2009: 135-136; 2011: 126), deep deposition sequence, and wide variety of remains indicate a long-lived, permanent, and densely populated Ubaid settlement.

#### THE FAUNAL ASSEMBLAGE FROM TELL ZEIDAN

Abundant faunal remains were recovered from every trench at Zeidan, and all faunal remains recovered in the course of excavations were saved for analysis. Most were collected by hand in the course of excavation. A few intact floor contexts were screened, and some deposits were also subjected to flotation. These collection methods yielded large quantities

of animal bones each season, so sampling was crucial. The faunal sample for this study consists of all Halaf period faunal remains available for study,<sup>2</sup> as well as 17% of the bags from the more extensive Ubaid period excavations. The Ubaid remains come from a selection of securely dated primary and secondary contexts that are discussed further below.

Once selected for analysis, the faunal remains were washed and dried. They were analyzed completely in the field, using Schmid (1972), Boessneck (1969), Brown and Gustafson (1979), Pales et Lambert (1971), and Uerpman (1986) to aid with species and element identifications, and following von den Driesch (1976) for standard measurements of complete elements. Zooarchaeological data were recorded using a spreadsheet system developed by G. Stein for his work at Hacinebi Tepe<sup>3</sup> and modified slightly by K. Grossman for the Zeidan project. This system involves coding archaeological context, taxonomic identification, element, symmetry, fusion status, tooth-wear, fragmentation (amount, origins and planes), cultural modification (burning, working, butchering), sex, domestication, pathologies, measurements, and weight for each bone fragment (table 1).

## THE HALAF FAUNAL ASSEMBLAGE

### Sample Reliability

The Halaf faunal assemblage consists of 1321 bones, of which only 261 (19.8%) are identifiable to the genus level (table 2). Furthermore, 664 fragments (50.0%) consist of less than one quarter of the original bone, so this is a small and fragmentary sample. Nevertheless, a number of arguments support the use of this small sample to draw conclusions about Halaf subsistence at Zeidan. First, although most of the bones come from a single operation, Operation 1, its deep occupational sequence is evidence that the bones do not come from a specialized cache. Second, the rank order of the four most abundant genera is the same based on both NISP and MNI analyses (see table 2 for NISP and MNI), and this convergence supports qualitative conclusions about the relative importance of genera. Third, a comparison of the proportions of large, medium, and small specimens identified to the genus level with the proportions of such specimens identified only to size shows that the subset identified to genus may be biased toward

2. Although the intention was to analyze all excavated Halaf period remains, a few bags recorded in the excavation database could not be located for analysis during the 2010 field season.

3. Based on a coding system devised by Redding *et al.* 1978.

**Table 1 – Total Fragment Counts and Percentages.**

Identification	Halaf		Ubaid	
	Fragment Count	% of Total Fragments	Fragment Count	% of Total Fragments
<i>Bos taurus/primigenius</i>	39	3,0%	410	3,0%
<i>Ovis aries/gmelini</i>	8	0,6%	181	1,3%
<i>Capra hircus/aegagrus</i>	10	0,8%	71	0,5%
<i>Sus domesticus/scrofa</i>	7	0,5%	238	1,7%
<i>Ovis/Capra</i>	55	4,2%	1272	9,3%
<i>Canis</i> sp.	5	0,4%	17	0,1%
<i>Equus africanus</i>	0	-	2	0,0%
<i>Equus hemionus</i>	13	1,0%	28	0,2%
<i>Equus</i> sp.	88	6,7%	70	0,5%
<i>Capreolus capreolus</i>	2	0,2%	5	0,0%
<i>Cervus elaphus</i>	1	0,1%	12	0,1%
<i>Gazella</i> sp.	29	2,2%	83	0,6%
<i>Capreolus</i> or <i>Gazella</i>	0	-	8	0,1%
<i>Dama mesopotamica</i>	3	0,2%	34	0,2%
<i>Lepus</i> sp.	0	-	2	0,0%
<i>Vulpes</i> sp.	1	0,1%	0	-
<i>Nesokia</i> sp.	0	-	5	0,0%
Rodent	0	-	5	0,0%
<i>Ovis</i> or <i>Capra</i> or <i>Gazella</i>	13	1,0%	180	1,3%
Small Canid	0	-	1	0,0%
Small Carnivore	0	-	1	0,0%
Medium Carnivore	0	-	1	0,0%
Small Artiodactyl	0	-	2	0,0%
Medium Artiodactyl	3	0,2%	30	0,2%
Large Artiodactyl	0	-	9	0,1%
Bovid	0	-	74	0,5%
Small Mammal	24	1,8%	294	2,1%
Medium Mammal	318	24,1%	4307	31,4%
Large Mammal	234	17,7%	2059	15,0%
Mammal, Size Indt.	247	18,7%	0	-
Fish	0	-	2	0,0%
Tortoise	0	-	7	0,1%
Indeterminate	221	16,7%	4294	31,3%
<b>Total</b>	<b>1321</b>	<b>100%</b>	<b>13704</b>	<b>100%</b>

larger mammals, but only slightly. Fish and bird bones are not preserved in the sample but this fact does nothing to undermine the main results of this study. In sum, the assemblage may be small, but it still could permit qualitative conclusions about the relative importance of genera. Note, furthermore, that many of the faunal assemblages from other Halaf sites are also small (see Discussion).

### Taxonomic Identifications and Quantification

We established the relative importance of different species in the sample using the Number of Identified Specimens

**Table 2 – NISP and MNI of Bones Identifiable to Genus Level, including Ovis/Capra.**

Genus	Halaf				Ubaid			
	MNI	%MNI	NISP	%NISP	MNI	%MNI	NISP	%NISP
<i>Bos</i>	2	10,5%	39	14,9%	8	13,6%	410	16,9%
<i>Ovis</i>	2	10,5%	8	3,1%	15	25,4%	181	7,4%
<i>Capra</i>	2	10,5%	10	3,8%	7	11,9%	71	2,9%
<i>Ovis/Capra</i>	0,0%		55	21,1%	0,0%		1272	52,3%
<i>Sus</i>	1	5,3%	7	2,7%	6	10,2%	238	9,8%
<i>Canis</i>	1	5,3%	5	1,9%	2	3,4%	17	0,7%
<i>Equus</i>	5	26,3%	101	38,7%	8	13,6%	100	4,1%
<i>Cervus</i>	1	5,3%	1	0,4%	1	1,7%	12	0,5%
<i>Capreolus</i>	1	5,3%	2	0,8%	1	1,7%	5	0,2%
<i>Gazella</i>	2	10,5%	29	11,1%	5	8,5%	83	3,4%
<i>Dama</i>	1	5,3%	3	1,1%	4	6,8%	34	1,4%
<i>Lepus</i>	0	0,0%	0	0,0%	1	1,7%	2	0,1%
<i>Nesokia</i>	0	0,0%	0	0,0%	1	1,7%	5	0,2%
<i>Vulpes</i>	1	5,3%	1	0,4%	0	0,0%	0	-
<b>Total</b>	<b>19</b>	<b>100,0%</b>	<b>261</b>	<b>100,0%</b>	<b>59</b>	<b>100,0%</b>	<b>2430</b>	<b>100,0%</b>

(NISP) quantification (e.g. Grayson 1984; Gautier 1984). NISP, which is a count of all identifiable bone fragments, is a measure of the maximum number of animals from which the bones could have come. Out of 1321 bone fragments, 579 (43.8%) are identifiable only as small, medium, or large mammals, 247 (18.7%) as mammals of indeterminate size, and 221 (16.7%) as completely indeterminate; 261 fragments (19.8%) were identified to the genus level, including *Ovis/Capra* (table 2). Identifiable specimens belong to the genera *Equus*, *Ovis*, *Capra*, *Bos*, *Gazella*, *Cervus*,<sup>4</sup> *Canis*, *Capreolus*,<sup>5</sup> *Dama*,<sup>6</sup> *Sus*, and *Vulpes*. In order, the genera most abundant in the sample are *Equus* (38.7%), *Ovis/Capra* (28.0%), *Bos* (14.9%), and *Gazella* (11.1%). Summing the proportions of the wild genera—*Equus*, *Gazella*, *Cervus*, *Capreolus*, *Dama*, and *Vulpes*—yields a striking total of 52.5% wild fauna. Since some of the *Ovis*, *Capra*, *Bos*, and *Sus* may also be wild, there is actually a minimum of 52.5% wild fauna by NISP. Heavy exploitation of wild fauna seems to be a characteristic of the site as a whole since high percentages are found in both Operations 1 (53%) and 4 (40%).

4. Identification of *Cervus* based on morphological criteria in Brown and Gustafson (1979).

5. Identification of *Capreolus* based on post-cranial morphology (especially metapodia) illustrated in Pales et Lambert (1971).

6. *Dama* has been identified on the basis of size, as well as the morphology of antlers and of post-cranial elements.

## Analyses of the Main Genera in the Halaf Sample

### *Equus*

The *Equus* remains likely come from the onager, *Equus hemionus*, which roamed steppe areas like those predominant around Zeidan (Uerpmann 1982). Of the 101 *Equus* specimens,<sup>7</sup> 13 have diagnostic features identifying them as onager, while the remaining specimens do not have diagnostic features. The identification as onager is consistent with finds of onager at other Halaf-period sites in the vicinity (Uerpmann 1982; Cavallo 2000). Body part distributions suggest that people killed onager offsite and preferentially brought back the upper limbs, especially the more easily removed forelimb. Aging the remains based on the method in Cavallo (2000: 62)<sup>8</sup> shows that hunters killed 13.3% of animals in their first year, 29.6% of animals in their second year, 7.1% in their third year, and 50.0% as mature animals. The relatively high mortality of animals 1-2 years old indicates that hunters took advantage of young animals in herds.

### *Ovis and Capra*

Out of 73 bones of Caprines, 10 are identifiable as *Capra* and 8 as *Ovis*, with the remainder not distinguished. Therefore sheep and goat may have been present in approximately equal proportions. Since domesticated sheep and goat are the main animals used at most Halaf settlements,<sup>9</sup> and the steppe environment around Zeidan would not have been ideal for wild sheep and goat, the remains probably come mostly from domesticated *Ovis aries* and *Capra hircus*. Nevertheless, we should not exclude the possibility of wild *Ovis* and *Capra* in this assemblage. Because of the small sample, there is insufficient evidence to reconstruct herd management strategies and the role of secondary products.

### *Bos*

There are 39 *Bos* fragments. The sample probably consists mainly of *Bos taurus* with a few wild *Bos primigenius*.

7. The large number of Halaf *Equus* remains at Zeidan does seem to be a general phenomenon, and does not seem to derive from a specialized context. This is corroborated by the broad recovery of *Equus* bone fragments from both Operations 1 and 4. In Operation 1, 46% of the analyzed contexts yielded equid remains. In those contexts, equid remains comprised 3% to 42% of the identified fragments with most of those contexts yielding 9% to 21% *Equus* remains by NISP. Only three contexts were analyzed from the small Halaf exposure in Operation 4; nevertheless, one of these was found to have 15% *Equus* remains by NISP.

8. Cavallo created three categories of post-cranial elements—those that fused early, middle, and late—based on Silver's (1970) age-of-fusion for equids.

9. See reviews in Akkermans 1993, and Cavallo 2000.

Domesticated cattle were a standard component of pastoral economies in the Halaf period,<sup>10</sup> and there is no reason to expect a significant population of wild cattle in the steppe around Zeidan. As with the *Ovis* and *Capra*, however, we should not completely exclude the possibility of wild cattle in this assemblage.

#### *Gazella*

There are 29 *Gazella* fragments. The remains probably belong to *Gazella subgutturosa*, the only species found at sites along the Euphrates and Balikh rivers (Cavallo 2000: 63). Like onager, gazelle would have been at home in the steppe around Zeidan (Zeder 1994: 103).

#### Summary

In sum, the Halaf faunal assemblage from Zeidan consists of 1321 bone fragments, of which 261 (19.8%) are identifiable to the genus level. Analysis of this sample indicates that the inhabitants of Zeidan derived about half of their animal products from keeping domestic sheep, goat, and cattle. They obtained the other half by hunting the wild onager and gazelle that roamed the steppe surrounding the settlement.

### THE UBAID FAUNAL ASSEMBLAGE

#### Sample Reliability

This faunal sample's large size and wide range of contexts makes it a reliable source for studying Ubaid subsistence at Zeidan: 13,704 bone fragments dating to the Ubaid period have been analyzed. This is only 17% of the many bags of animal bones recovered from Ubaid contexts. The faunal remains selected for analysis all come from secure primary and secondary archaeological contexts, and 16% of the remains were recovered from dry-sieving (0.5 cm screens). Contexts include trash deposits and living surfaces that accumulated up against the faces of a massive mudbrick wall in Operation 1; trash deposits that filled a large gully in Operation 7; deposits built up against the walls of a small Ubaid building and from deposits on the working surfaces of an open-air production area filled with kilns in Operation 8; deposits from floors and trash deposits associated both with a very large building and with smaller buildings below it in Operation 9; and depos-

its from the floors of Ubaid houses and fills of large pits in Operations 11 and 14 (see fig. 1).

#### Taxonomic Identification and Quantification

Of the 13,704 bone fragments analyzed, 9,410 (68.7%) are identifiable to class or a lower taxonomic level, while 4,294 (31.3%) are completely indeterminate. Of the total bone fragments, 2430 (17.7%) are identifiable to the genus level, including *Ovis/Capra*. As in the Halaf sample, the majority of the recovered faunal remains are mammalian. Despite Zeidan's location at the swampy confluence of the Balikh and Euphrates Rivers, there are few avian, amphibian, or fish remains.

In contrast with the Halaf pattern, the largest quantities of identifiable Ubaid faunal remains come from domesticated animals—*Ovis*, *Capra*, *Bos*, and *Sus*<sup>11</sup>. *Ovis* and *Capra* make up 11.1 % of the total bone fragments, *Bos* make up 3.0%, and *Sus* make up 1.7% (table 1). Looking only at fragments identifiable to genus, however, domesticated *Ovis* and *Capra* together make up 62.6%, domesticated *Bos* 16.9%, and domesticated *Sus* 9.8% of the sample, so that cumulatively 89.3% of the fauna are domesticated (table 2).

In addition to the domesticated species, large numbers of wild fauna are also present (9.9% by NISP). Although the percentage of wild fauna is nowhere near that of the preceding Halaf period, hunting was still an important component of the Ubaid subsistence economy. Hunters targeted a diverse range of species, including *Cervus*, *Capreolus*, *Dama*, *Gazella*, and *Equus*. While most equid remains are onager (*Equus hemionus*), as in the Halaf period, a few have diagnostic features that suggest they may come from asses (*Equus asinus*).<sup>12</sup>

#### Analyses of the Main Genera

##### *Ovis* and *Capra*

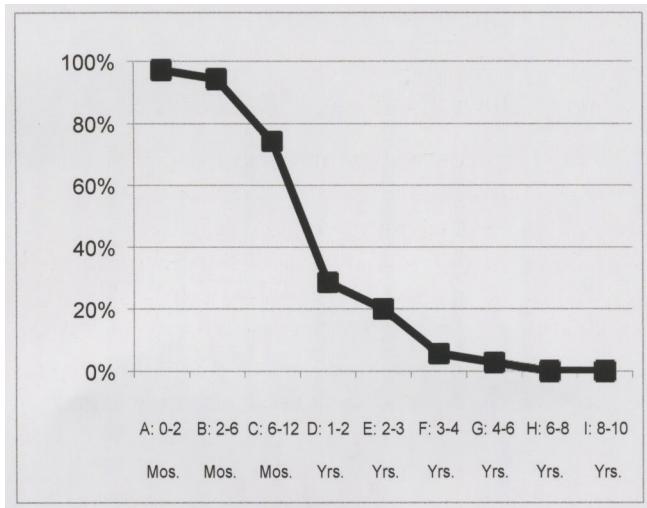
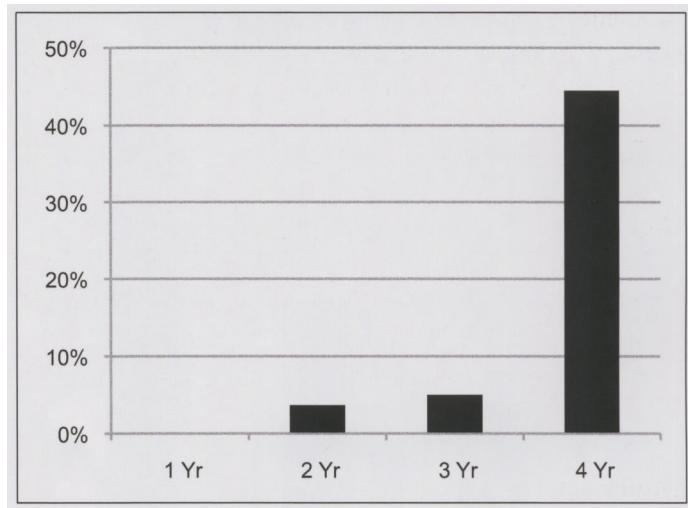
There are 1,272 bone fragments identified as *Ovis/Capra*, 181 as *Ovis*, and 71 as *Capra*. Eleven *Ovis/Capra* fragments were identified as wild. The remaining fragments are from domesticated individuals. Using NISP, ratios of *Ovis* to *Capra* bone fragments are about 2.5:1, while MNI<sup>13</sup> yields a similar ratio of roughly 2:1. Over two-thirds of the sheep and goats

11. Six *Bos* fragments, eleven *Ovis/Capra* fragments, and two *Sus* fragments were identified as wild based on size and in some cases horn core morphology.

12. The two elements identified as *E. africanus* were both astragali, and the identification was based on the strong development of the medial muscular tubercle (Uerpmann 1986: 259).

13. Presented in table 2.

10. See reviews in Akkermans 1993 and Cavallo 2000.

**Table 3 – Ubaid period *Ovis/Capra* survivorship curve (n=35).****Table 4 – Ubaid period percent mortality in *Bos* (n=69).**

were killed before two years of age. While Sudo (2010) has suggested that sheep were raised for their wool as well as meat in the Ubaid period, at Zeidan the high mortality rate of very young animals suggests that caprines were being raised for meat and perhaps milk. In fact, the survivorship curve (table 3) is consistent with Payne's idealized curve for a meat production strategy (1973: Fig. 1).

#### *Bos*

NISP yields a count of 410 *Bos* fragments, 6 of which were identified as wild. Based on post-cranial epiphysial fusion, the majority of *Bos* were kept alive through at least the first three years life (table 4). The first major kill-off seems to have occurred around 4 years of age, when 45% were killed. This pattern suggests a mixed production strategy, where the *Bos* individuals that lived beyond 4 years of age were females kept for milk production and as breeding stock, while the fully-grown males were killed for meat. These findings contribute to an emerging picture of the importance of milk in Neolithic and Chalcolithic subsistence strategies (Evershed *et al.* 2008).

#### *Sus*

Pigs, the third most common taxon (238 fragments, 2 of which were identified as wild<sup>14</sup> based on their large size), are generally kept solely for meat. Given their quick growth and large litter sizes (Redding 1992: 104), they are a very efficient

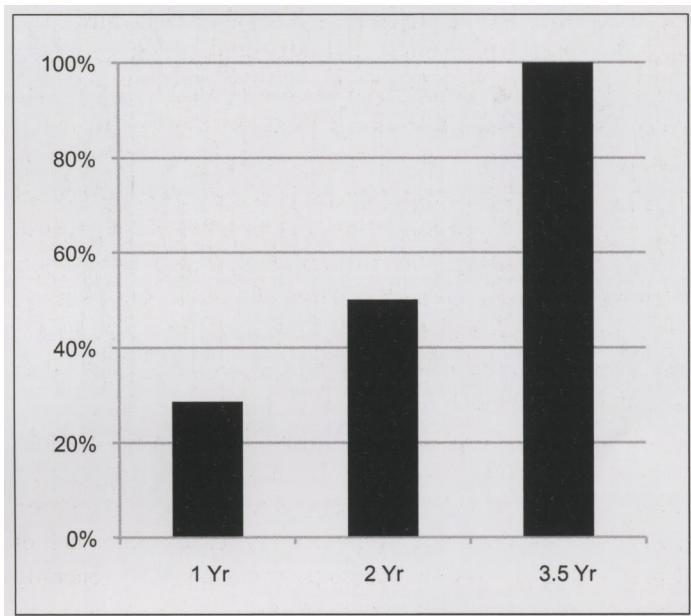
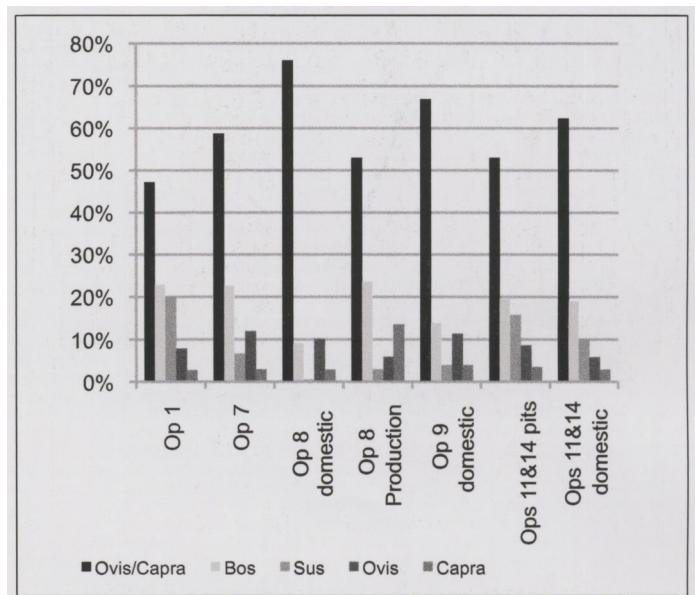
meat source. A mortality profile constructed using post-cranial fusion shows that half of the pigs were killed by their second year and almost all by 3.5 years of age (table 5). This suggests that only limited breeding stock were retained and all non-breeding stock killed for meat.

#### Intrasite Variability

The relative abundance of the domesticated animals is similar across the site: sheep and goats comprise the majority of the sample, followed by cattle and then pigs (table 6). One unusual divergence from the site-wide homogeneity, however, is the high percentage of goat remains found in the production area of Operation 8. Fifteen percent of the remains of domesticated species in this operation are goat, as compared to 3-4% in the other operations. Operation 8 is actually the only area where goats predominate over sheep, but the sample size from this operation is too small to encourage speculation about this anomaly (it yielded 5 *Capra* and 2 *Ovis* bone fragments).

Excavators suggested that the bones recovered from large pits in Operations 11 and 14 might be refuse from a large feasting event or events. However, the ratio of domestic to wild animals, the relative abundances of the main domesticates, and even the distributions of body parts were nearly the same from the pits and from the floors of other Ubaid houses around the site. If these bones were the remains of feasts, the menu did not differ significantly from more quotidian meals. While the pits did yield an unusually diverse range of taxa, illustrated by fish bones and tortoise carapace, it is likely that the taxonomic

14. This does not mean, however, that all other fragments necessarily came from domestic *Sus*, merely that only two have been identified as wild based on osteometrics.

**Table 5 – Ubaid period percent mortality in Sus (n=26).****Table 6 – Ubaid period intrasite variability in relative abundances of major taxa.****Table 7 – Ubaid period intrasite variability in body part distributions.**

Anatomical parts	Op 1	Op 7	Op 8 Domestic	Op 8 Production	Op 9 Domestic	Ops 11 & 14 Pits	Ops 11 & 14 Domestic
Antler/ Horn	2%	1%	4%			3%	4%
Axial	22%	32%	27%	21%	29%	41%	33%
Cranial	44%	35%	31%	16%	29%	24%	27%
Lower Forelimb	2%	2%	3%	6%	4%	3%	3%
Lower Hindlimb	2%	4%	6%	6%	8%	4%	5%
Lower Limb, indet.	6%	8%	9%	21%	6%	4%	5%
Upper Forelimb	17%	15%	15%	24%	17%	15%	16%
Upper Hindlimb	5%	5%	5%	5%	6%	5%	6%

diversity of Operations 11 and 14 is simply a function of the large sample size.

There are similarly small variations across operations in the distributions of body parts (table 7). The most striking anomaly comes from Operation 1, where 44% of the bone fragments are cranial elements. In contrast, the proportion of cranial elements from other areas ranges from 16% to 35%. Because of the limited horizontal area of Operation 1, there is

little contextual information to suggest why cranial bones are so abundant. One possibility is that butchery took place in this area and cranial elements were discarded as inedible garbage.

### Summary

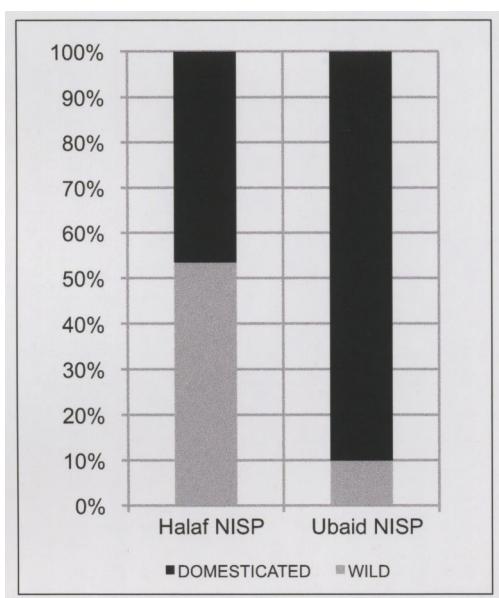
In sum, the Ubaid faunal assemblage from Zeidan consists of 13,704 bone fragments, of which 2340 (17.7%) are identifiable to the genus level. Analysis of this sample indicates that the inhabitants of Zeidan derived the vast majority of their animal products from keeping domestic sheep, goat, cattle, and pigs. They also, however, supplemented their diets with a wide variety of wild game. There is very little spatial variability in the faunal assemblage.

These results indicate a dramatic shift in the animal component of Zeidan's subsistence strategy from the Halaf to the Ubaid period. After using 52% wild animals in the Halaf period, the inhabitants of Zeidan used just 10% wild animals and 90% domesticated ones in the Ubaid period (table 8).

### REGIONAL PATTERNS IN HALAF AND UBAID ANIMAL ECONOMIES

In the section below, we compare Zeidan's faunal remains to assemblages from contemporary Northern Mesopotamian

**Table 8 – Proportions of wild and domesticated taxa at Tell Zeidan.**



sites. This will highlight the uniqueness of Zeidan's faunal assemblage in the Halaf period, as well as showcase the regional diversity in both the Halaf and the Ubaid period animal economies. Interestingly, it will show that Zeidan's shift from an equal exploitation of wild and domesticated taxa during the Halaf period to the almost sole exploitation of domesticated taxa during the Ubaid was not part of a regional trend towards increased use of domesticates.

Faunal assemblages from seventeen sites<sup>15</sup> are available for a regional comparison of animal use in the Halaf period (see table 9).<sup>16</sup> With the one exception of Chagar Bazar, the faunal assemblages from these sites cluster so that the percentage of wild animals is either below 8% or above 20%. There are nine sites whose faunal assemblages consist almost exclusively of domesticated animals, including less than 20% wild fauna. They are Arpachiyah (Hijara 1980), Çavı Tarlası (Schäffer und Boessneck 1988), Gerikihaciyan (McArdle 1990), Sabi Abyad (Cavallo 2000), Tell Turlu (Ducos 1991), Tell Amarna

(Saña 2004), Chagar Bazar (Saña 2006), Arjoune (Grigson 2003), and Domuztepe (Kansa *et al.* 2009). Meanwhile, there are eight sites whose faunal assemblages contain at least 20% wild fauna. They are Banahilk (Laffer 1983), Khirbet esh-Shenef (unpublished manuscript by Hendrichs 1990 cited in Akkermans 1993)<sup>17</sup>, Shams ed-Din (Uerpmann 1982), Umm Qseir (Zeder 1994), Yarim Tepe II (Bibikova 1981; corrections suggested in Akkermans 1993), Zeidan, Tell Kurdu (Özbal *et al.* 2004), and Ras Shamra (Poulain 1978). Thus, while Uerpmann has stated that it is "normal" for Neolithic sites to have up to 20% hunted animals (Uerpmann 1982: 44), it is in fact equally common for Halaf sites to have even more than 20% hunted animals.

The data from Zeidan and these other Halaf settlements suggest that earlier models of Halaf subsistence strategies, which were developed before many of these datasets had been published, should be re-evaluated. Akkermans's model of Halaf subsistence—which subsequent studies have generally accepted (e.g., Campbell 1992b; Cavallo 2000; Akkermans and Schwartz 2003; Nieuwenhuyse 2007; Kansa *et al.* 2009)—incorporates two types of settlements: large permanent agro-pastoral settlements and smaller seasonal settlements focusing on pastoralism or hunting (Akkermans 1993, publication of 1990 dissertation). Zeidan, however, represents a type of settlement not included in previous models: a large permanent agricultural settlement with an important hunting component.

This expanded corpus of zooarchaeological remains shows that incorporating a significant proportion of wild animals was a standard subsistence strategy at various types of settlements in the Halaf period, rather than a practice restricted to small, temporary settlements in arid regions. Use of wild animals is correlated with location in an arid environment, but some settlements well within the rain-fed farming zone also chose to use at least 20% wild fauna. The expanded dataset does show that faunal assemblages composed almost entirely of domesticated animals nearly always come from sites that were permanently occupied over a long period of time, but the converse is not true. Both short-term occupations and important permanently occupied settlements yield faunal assemblages with over 20% wild fauna. While subsistence strategies involving over 50% wild fauna are relatively unusual, these too come from both small hunting stations (Umm Qseir and Shams ed-Din) and large permanent settlements (Zeidan).

15. The faunal assemblage from Tell Halula is not included in this study, because the publication (Saña 1999) is not available in the United States.

16. Although a few of the sites fall on the boundaries of the area traditionally demarcated as Halaf and do not contain a majority of Halaf pottery, they belong in this comparison because their proximity and the presence of some Halaf pottery indicate that they interacted with the other Halaf sites.

17. Hendrichs U., *De Dierresten van Khirbet esh-Shenef, een Laat-Halaf Vindplaats in Noord-Syrie*. 1990. Amsterdam: A. E. van Giffen Instituut voor Prae- en Protohistorie. [unpublished manuscript]

Table 9 – Wild fauna from Halaf sites.

Bone assemblages	Site	Location	Occupation area (ha)	'Short-term occupation'	No. of identifiable bones	% Wild	
> 20% wild	Umm Qseir <sup>1</sup>	Middle Khabur	0,15	Y	2446	57	
	Shams ed-Din <sup>2</sup>	Euphrates Valley	< 2,5*	Y	1396	54	
	Tell Zeidan	Southern Balikh Valley	6	N	261	52	
	Ras Shamra <sup>3</sup>	Mediterranean	*	N	341	39	
	Khirbet esh-Shene <sup>4</sup>	Balikh Valley	0,25	Y	110	36	
	Yarim Tepe II <sup>5</sup>	Iraqi Jazira	< 1*	N	2184	28	
	Tell Kurdu <sup>6</sup>	Amuq	15	N	6549	23	
	Banahilk <sup>7</sup>	Diyana Plain	< 1,6*	N	810	22	
< 20% wild	Chagar Bazar <sup>8</sup>	Khabur Basin	*	N	482	18	
	Gerikihaciyan <sup>9</sup>	Southeast Anatolia	< 2*	N	2132	7	
	Tell Turlu <sup>10</sup>	Southeast Anatolia	*	N	123	5	
	Sabi Abyad <sup>11</sup>	Northern Balikh Valley	2	N	2465	3	
	Tell Amarna <sup>12</sup>	Euphrates Valley	Small*	Y	435	3	
	Arjoune <sup>13</sup>	Western Syria	Small*	Y	1485	2	
	Çavı Tarlası <sup>14</sup>	Southeast Anatolia	< 0,7*	N	~3377	2	
	Domuztepe <sup>15</sup>	Southeast Anatolia	Almost 20	N	6035	2	
1. Hole and Johnson 1986-1987; Zeder 1994; Review in Akkermans 1993; 2. Al-Radi and Seeden 1980; Uerpmann 1982; Review in Akkermans 1993; 3. Schaeffer 1962; Poulain 1978; Review in Akkermans 1993; 4. Akkermans 1993; Unpublished manuscript by Hendrichs (1990), cited in Akkermans 1993; 5. Merpert and Munchaev 1969, 1971a-b, 1973, 1984 and 1987; Merpert et al. 1976, 1977, 1978 and 1981; Munchaev and Merpert 1971, 1973 and 1981; Bibikova 1981. Review in Akkermans 1993, with suggested corrections to Bibikova 1981; 6. Özbal et al. 2004; Özbal 2006; 7. Watson 1983; Laffer 1983; Review in Akkermans 1993;				8. McMahon et al. 2001; Tunca and Baghdo 2006; Sana 2006; 9. Watson and LeBlanc 1990; McArdle 1990; Review in Akkermans 1993; 10. Breniquet 1987 and 1991; Ducos 1991; 11. Akkermans 1993 and 1996; Cavallo 2000; 12. Tunca and Molist 2004; Saña 2004; 13. Parr 2003; Grigson 2003; Review in Akkermans 1993; 14. Von Wickede 1984; von Wickede and Misir 1985; von Wickede and Herboldt 1988; Schäffer and Boessneck 1988; Review in Akkermans 1993; 15. Campbell et al. 1999; Kansa et al. 2009; 16. Mallowan and Rose 1935; Hijara 1980; Campbell 2000; Review in Akkermans 1993.			
*Due to the burial of Halaf deposits under later deposits and the limited area of excavations, the horizontal extent of Halaf occupation at many sites is not yet clear. Site size may serve as a measure of maximum possible area, but in many cases the actual occupation area was probably much smaller.							

Faunal assemblages from Ubaid settlements also demonstrate a wide range of variation in the proportions of wild and domesticated taxa. Unlike during the Halaf period, this variation is not well correlated with location, and most settlements are permanent (table 10).<sup>18</sup> Four sites have faunal assemblages with less than 20% wild fauna. They are Zeidan, Kenan Tepe (Parker *et al.* 2008), Khanijdal East (Wilkinson and Tucker 1995), and Tell Kurdu (Özbal 2006). There are also four sites with at least 20% wild fauna: Mashnaqa (Zeder 1995

18. Four sites with published Ubaid fauna are not included. The Değirmentepe fauna (Esin 1986) is published only as a list and rank order of taxa. Tell el-Abr (Croft 2006), Kashkashok I and III (Zeder 1995 and 1998a), and Ras Shamra (Poulain 1978) all have very small published samples ( $n < 50$ ) and so are unsuitable for rigorous comparison. Finally, Tell Beydar III has been re-dated as a Late Ubaid to Late Chalcolithic 1 site (Suleiman and Nieuwenhuyse 2003), but the fauna was published as LC1-2 before the re-dating (Van Neer and De Cupere 2000), and it is unclear whether any of the fauna should now be re-labeled as Ubaid.

and 1998a), Kuran (Zeder 1995 and 1998a), Kosak Shamali (Gourichon and Helmer 2003), and Ziyadeh (Zeder 1998b). Based on these proportions, Zeder (Zeder 1995 and 1998a) is certainly correct to point to the continued importance of wild fauna at Ubaid settlements. In fact, subsistence strategies involving over 20% wild fauna are just as common in the Ubaid period (4 out of 8) as they were in the Halaf (8 out of 17). Zeder also suggested that wild fauna continued to be particularly important in the southern steppic zone, while settlements within the zone of rain-fed agriculture intensified their exploitation of domesticated taxa (Zeder 1995 and 1998a). Our review shows, however, that high proportions of wild animals are not as correlated with location in the southern steppic region as they were during the Halaf period. That is, settlements with high proportions of domesticated animals are not restricted to the wetter rain-fed zone, and settlements with high proportions of wild animals are evenly split between the rain-

Table 10 – Percentages of Main Taxa from Ubaid Sites.

Site	Location	Site Size (ha)	NISP	OVIS/CAPRA %NISP	BOS %NISP	SUS %NISP	EQUUS %NISP	GAZELLA %NISP	OTHER WILDS %NISP	%Dom/ %Wild
Mashnaqa <sup>1</sup>	Middle Khabur	5	1273	51	13	5	13	1	17	69/31
Kuran <sup>2-3</sup>	Khabur Basin	0,25	180	73	0	0	4	9	8	73/27
Zeidan	Balikh	12	2422	63	17	10	4	3	3	90/10
Kosak Shamali <sup>4</sup>	Euphrates Valley	0,5	246	46	9	6	3	12	24	61/39
Kenan Tepe <sup>5</sup>	Upper Tigris	4,5	631	67	21	8	0	0	4	96/4
Khanijdal East <sup>6</sup>	Iraqi Jazira	2-janv	183	26	37	35	1	2	1	97/3
Ziyadeh, c. 4350 <sup>7</sup>	Middle Khabur	2	282	47	16	3	9	10	15	66/34
Ziyadeh, c. 4700 <sup>7</sup>	Middle Khabur	2	2063	34	7	2	28	21	8	43/57
Tell Kurdu <sup>8</sup>	Amuq	7-mai	130	60	23	15	0	0	3	97/3

1. Zeder 1995 and 1998a-b (only Mashnaqa faunal remains dated to 4500 BC);  
 2. Zeder 1995 and 1998a-b (only Kuran faunal remains dated to 4500 BC);  
 3. Akkermans and Schwartz 2003: 166;  
 4. Gourichon and Helmer 2003 (Canis and unidentifiable medium ruminants not included in counts);  
 5. Parker et al. 2008;  
 6. Wilkinson and Tucker 1995: Table 9 (not including *Canis*);  
 7. Zeder 1998b;  
 8. Özbal 2006.

fed zone and the drier zone. Zeidan, for example, is located in the southern steppic region but has a very low proportion of wild animals.

Out of the eight sites reviewed, three offer the opportunity to look at shifts in subsistence practices over time. At Ziyadeh, faunal analyses exist for different levels within the Ubaid period and show a decrease in wild fauna over time, although the final level is still 34% (Zeder 1995; 1998a and b). A comparison of Halaf and Ubaid faunal assemblages is possible at two sites, both of which show decreases in wild fauna over time: Zeidan's proportion of wild fauna decreased from 52% to 10% and Kurdu's from 23% to 3% (Özbal *et al.* 2004; Yener *et al.* 2000). Thus, subsistence shifts in the Ubaid period definitely involved an increase in the relative importance of pastoralism at some settlements. As shown above, however, Ubaid subsistence *in general* does not seem to be characterized by a shift to pastoralism. That Zeidan should contrast with the regional pattern is not so surprising, however, as it was by far the largest of the Ubaid settlements with analyzed faunal remains.

## HUNTING AND HERDING AT ZEIDAN

The unusual emphasis on wild animals at Zeidan during the Halaf period and the unparalleled shift to domesticates during the Ubaid period both call for explanation. In trying to understand subsistence strategies, it is always important to consider environmental constraints. Since archaeologists have pointed to population increases and the development of

socio-economic stratification as important changes that may be accompanying the Halaf-Ubaid transition, those are also important factors to consider in our analysis of shifting subsistence strategies at Zeidan.

The most likely explanation for the emphasis on hunting in the Halaf period is that there were certain seasons when wild animals were available in particularly high concentrations, while other resources were particularly difficult to obtain. Thus, although hunting played an usually large role at Zeidan during the Halaf period, it was still just one element of a diversified subsistence economy involving hunting, herding, agriculture, and gathering of wild plants.

No direct evidence concerning seasonality is available from the faunal assemblage at Zeidan, but it is possible to formulate a picture of the annual cycle based on information about seasonality at the nearby sites of Umm Qseir (Zeder 1994: 111) and Sabi Abyad (Cavallo 2000: 112), as well migration patterns for onager and gazelle, as follows:

In autumn, the inhabitants of Zeidan may have hunted onager that migrated southward for the winter.<sup>19</sup> During the winter, the inhabitants of Zeidan probably killed some of their domesticated sheep and goat for meat. In late spring and summer, the inhabitants of Zeidan may have hunted the large herds of gazelle that migrated from their winter habitat in the southern

19. Based on comparison to the modern Syrian wild ass, there is some suggestion that onager would have migrated from as far north as Armenia in summer to as far south as the Persian Gulf in winter, leading them to pass through Syria in the autumn (Tristram 1889, cited in Clutton-Brock 1992). Evidence from nearby Mureybet also suggests seasonal culling of equids (Legge and Rowley-Conwy 1991).

deserts to summer in the northern Syrian steppe.<sup>20</sup> This seasonal hunting of onagers and gazelles may have been carried out as mass kill events in nearby desert kites<sup>21</sup> (see, e.g. Bar-Oz *et al.* 2011; Legge and Rowley-Conwy 1987). Alternatively, it may have been a strategy of Zeidan's inhabitants to locally hunt the animals that threatened cereal crops in the spring (see, e.g. Uerpmann 1982: 45–46), thus saving the grain and procuring meat at the same time. The plentiful hunting opportunities in the spring would have been followed by the late spring harvest, completing the annual cycle. Viewing the diversified Halaf subsistence economy from the perspective of seasonality thus illustrates how hunting could have played such an important role.

Why, then, did seasonally-organized hunting not play this same role in the Ubaid period? The dramatic shift to domesticates is surprising. Since recent studies have suggested that the Halaf-to-Ubaid transition was a shift in material culture, rather than a wholesale movement of peoples or the uniform adoption of a complete "cultural package" (Breniquet 1996; Stein and Özbal 2007) we should not expect to see abrupt changes in food preferences. The shift at Zeidan is also surprising because Zeder (1995 and 1998a) suggests that Ubaid settlements in the drier steppic zones continued to rely heavily on wild game, as they had in the Halaf period. Zeidan's divergence from this pattern requires explanation.

The increased reliance on domesticated animals at Zeidan does not seem to be related to environmental change between the Halaf and Ubaid periods. If that were the case we would expect to see a change in the relative abundances of the wild taxa, as habitats were transformed. In both the Halaf and Ubaid periods at Zeidan, however, the rank order of the most common wild taxa was the same: *Equus*, *Gazella*, *Dama*, *Cervus*. Since *Equus* and *Gazella* inhabited steppic regions, while *Dama* and *Cervus* prefer woodland areas, this rank order suggests the predominance of steppe over woodland in both periods. In fact, while there is some evidence for environmental change over the course of the Ubaid period in Southern Mesopotamia (Hole 1994), there is little evidence for similar changes in the north (Wilkinson 2003).

Since environmental change can be excluded as the cause of the subsistence shift, sociocultural factors must be involved. The increasing importance of domesticated animals at Zeidan cannot indicate a change to year-round settlement, as seasonal

hunting during the Halaf period was part of a diversified subsistence economy supporting year-round occupation of the site. The most likely possibility is that the increasing importance of the domesticated animals was part of a strategy of economic intensification related to population increases at the settlement.<sup>22</sup> By 'intensification' we mean the replacement of wild animals with domesticated ones in order to increase the total quantity of animal products for the site of Zeidan. Use of domesticated animals would have had the potential to increase total production for two reasons. First, the inhabitants could choose how many domesticated animals to raise, as long as there was sufficient pasture, whereas they could not choose to increase the wild population. Second, domesticated animals provide both meat and secondary products, while wild ones provide only meat.

There is no question that Zeidan needed to increase subsistence production in the Ubaid period, because the population was much larger than in the Halaf period. The size of the site increased from 6 ha to 12 ha, and the Ubaid levels show dense occupation. Still, Morrison (1994) cautions against confusing correlation with causation and warns that an increase in population is neither the only thing that causes intensification, nor does it always cause intensification. In this case, however, there is a specific reason that the increase in population would have led to the intensification of subsistence production at Zeidan. The Halaf period subsistence strategy relied heavily on a single resource—onager—that would have been available in limited and unpredictable quantities.<sup>23</sup> As the population expanded in the Ubaid period, this limited resource could no longer account for the same proportion of subsistence production. However, this is a site-specific explanation that should not be applied indiscriminately to other sites. For example, Kurdu's increase in domesticated species actually corresponds to a decrease in site size.

The change at Zeidan from a mixed animal economy exploiting wild and domesticated species to one primarily of domesticated species would have wrought dramatic shifts on many attendant aspects of social life, from work patterns (as more shepherds were needed) to architecture (with new pens to be built for housing animals, and expanded spaces for animals

20. Legge and Rowley-Conwy 2000: 439–440; Cavallo 2000: 65. But see also Bar-Oz *et al.* 2011 who suggest a slightly later (mid-late summer) season for mass gazelle hunting.

21. Although we do not have enough data on the sex and age-at-death of the Zeidan gazelle and onager populations to propose a catastrophic-kill event like those proposed by Bar-Oz and colleagues (2011).

22. Although some archaeologists have posited a general demographic growth during the Ubaid period (Carter and Philip 2010), the specific reasons for population increase at Zeidan are as yet unknown. A paucity of survey data immediately around Zeidan makes it difficult to attribute a population increase at the site to factors such as organization of the regional settlement pattern.

23. Onagers, like the gazelles (following the suggestions of Bar-Oz *et al.* 2011) may have been overhunted during the preceding period.

within and outside settlements) to cuisine (as new recipes were devised for the shift in meat sources). These changes in daily practices might also have impacted social organization, particularly socio-economic stratification. Since Russell (2012) argues that the keeping of domesticated animals might lead to the commoditization of animals as wealth and thus contribute to the development of inequality, we suggest that increases in the *scale* of pastoral production could potentially also contribute to social inequality.

As discussed earlier, there is limited evidence for social stratification in the Ubaid period of Northern Mesopotamia. If there were an increase in social stratification, however, it would likely be visible at Zeidan, one of the largest Ubaid settlements in the region. Such nascent socio-economic stratification might be archaeologically visible in the spatial variation of food remains. However, we have shown that there is little spatial variability in the relative abundances of taxa and body parts at Zeidan. This implies that, if there were significant variations in socio-economic rank among the people living in different parts of the settlement, these differences were not marked by the animal component of their diet. It is still possible that socio-economic inequality found expression in ownership of herds of varying sizes, which is not visible in this study.

## CONCLUSIONS

The animal remains of Late Neolithic and Early Chalcolithic Zeidan form an important new dataset for reconstructing the animal economies of prehistoric societies in Upper Mesopotamia. Integrating the data from Zeidan into the corpus of zooarchaeological data from Upper Mesopotamian sites sheds new light on regional patterns in subsistence strategies and their transformation over time.

For the Halaf period, we have shown that wild animals played a greater role in subsistence strategies than previous studies have suggested. At Zeidan, half of the faunal assemblage comes from wild animals. Zeidan is not alone among Halaf settlements in using over 50% wild animals, although it is the only large permanent settlement known to do so. Hunting fits into an annual cycle of complementary seasonal resources, both wild and domesticated. Herds of onager and gazelle would have been particularly attractive targets from autumn to early spring, and their crop robbing tendencies would have made them easy prey. An up-to-date comparison of the faunal assemblages from Zeidan and other Halaf sites shows that it

was normal for Halaf settlements, even large permanent ones, to include at least 20% wild animals in their subsistence strategies. In sum, hunting in the Halaf period played a significant role in the self-sufficient subsistence strategies of major Halaf sites as well as smaller ones.

In the Ubaid period, the subsistence economy at Zeidan shifted dramatically to focus mostly on domesticated animals. Population increases at the settlement may have necessitated this shift. Interestingly, however, there is no spatial variability in the faunal remains to suggest socio-economic stratification. This implies that if there were significant rank or wealth differences in the Ubaid period, differentiated consumption of animal products was probably not a primary means for their expression. Widening the view to include other Ubaid sites in Upper Mesopotamia, it is clear that, despite the evidence from Zeidan, we cannot posit a region-wide shift in subsistence practices accompanying the Halaf-Ubaid transition. While the largest settlement (Zeidan) and a few others underwent intensification processes, many other settlements continued to rely on mixed subsistence strategies incorporating high proportions of wild fauna, just as Halaf settlements did.

These results call for a re-evaluation of the role of diversity in the organization of the Halaf and Ubaid economies and for more widespread analyses to understand and explain subsistence changes accompanying the Halaf-Ubaid transition. When the political situation in Syria permits, our team hopes to conduct further excavations to expand the Halaf sample, analyze more of the excavated Ubaid remains, and extend the study chronologically by including the Late Chalcolithic period. We hope that other teams will contribute to the study of subsistence changes in the Halaf-Ubaid transition by conducting zooarchaeological analyses at additional Ubaid sites in Upper Mesopotamia, since there are currently so few. It would be particularly useful to investigate additional sites that have both Halaf and Ubaid occupations. While we have identified and offered explanations for an important subsistence shift at Zeidan, additional analyses from other sites are key to understanding and explaining the variability in Halaf and Ubaid subsistence strategies.

## ACKNOWLEDGEMENTS

Research at Tell Zeidan was funded by the National Science Foundation (Grants 0917904 and 0638477) and by the Oriental Institute of the University of Chicago. We are grateful to the directors of the Tell Zeidan Project, Dr. Gil Stein and Mr. Mohammed Sarhan,

for the opportunity to study this material. We would like to thank the Syrian Directorate General of Antiquities and Museums and especially Dr. Michel Maqdissi for facilitating the project. Thanks are also due to G. Stein and T. Paulette for their comments on early drafts of this article, as well as to three anonymous reviewers whose comments were invaluable. Any errors, of course, are our own.

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