On the Pastoral Economies of Harappan Gujarat: Faunal Analyses at Shikarpur in Context

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***Abstract**: The faunal remains from Shikarpur, an important settlement of the Indus Civilization (2600-1900 BC) in Gujarat, are examined in order to explore patterns of consumption and the organization of livestock production. Overall, there is very little variation in either consumption or production patterns through the Integration Era occupation of the site suggesting that pastoral economies that supplied the residents with livestock were resilient in the face of social and possibly climatic changes that characterized this period. Cattle and buffalo were generally kept for secondary products prior to consumption at advanced age while goats and sheep were kept primarily for meat and consumed at younger ages. Throughout its occupation, the residents of Shikarpur generally consumed more cattle and buffalo than did their neighbors at Bagasra. Within the site, the residents of the walled enclosure consumed a more varied diet than their neighbors outside the walls, a pattern also observed at Bagasra.*

Keywords: Indus Civilization, Pastoral Economy, Zooarchaeology, Faunal Analysis, Consumption, Production, Land-use

Introduction

The bones of animals consumed as food are among the most ubiquitous of all objects recovered from excavations of the cities and towns of the Indus Civilization (2600-1900 BC). As such, they provide a rich source of information regarding the pastoral economies by which Indus people obtained the dietary staples of meat and milk integral to the their lifestyle. Here, the faunal remains from Shikarpur, a small walled Indus settlement recently excavated by archaeologists from the Maharaja Sayajirao University of Baroda, are examined with the goal of exploring patterns of consumption and the organization of livestock production by which these animals were raised. The primary questions guiding these analyses relate to diachronic change in these patterns through time from the establishment of the site to its eventual abandonment as well as synchronous intrasite variation between different residential areas of the settlement. These findings are then compared to the results of faunal analyses undertaken at other contemporaneously occupied Indus settlements in the region. As excavation and laboratory methods structure faunal datasets, the most detailed and reliable intersite

comparisons will be with the nearby Indus settlement of Bagasra[1] (Bhan et al. 2004; Bhan et al. 2005; Sonawane et al. 2003), which was excavated by the same team of archaeologists and the faunal remains analyzed by the present author (Chase 2007,2010,2012). Although the present study includes materials from a greater area of the site and has generated a differently structured dataset, the findings presented here nevertheless generally corroborate those presented in Joglekar and Goyal's (2011) preliminary analysis of the faunal remains from a single trench from the first season of excavation. Beyond the inherent significance of documenting the patterns of everyday life in Harappan Gujarat, studies such as these are an important step towards a reconstruction of the economic and social changes that accompanied the emergence and eventual decline of the South Asia's first urban civilization in one of its most important yet socially and environmentally distinct regions.

Background

The manufacture and use of classically Harappan material culture as known from Harappa and Mohenjodaro throughout the geographically distinct region of Gujarat is a defining characteristic of the Integration Era (2600-1900 BC) of the Indus Civilization (Kenoyer 1998; Possehl 2002; Sonawane and Ajithprasad 1994; Sonawane 2005; Wright 2010). During this period, Harappan material culture was most conspicuous at the large walled city of Dholavira (~50 ha) on the island of Khadir (Bisht 2000) and at a series of much smaller (<10 ha) settlements located in Kachchh and along the coasts of Saurashtra (figure 1). Evidence for craft activities at most of these sites including Shikarpur and Bagasra (Sonawane et al. 2003), the two sites under consideration here, as well as Lothal (Rao 1979), Nageshwar (Hegde et al. 1991), Surkotada (Joshi 1990), Kanmer (Kharakwal et al. 2012), and Khirsara (Nath et al. 2013), demonstrates their residents involvement in the manufacture of highly valued ornaments from locally available raw materials (Law 2013). This evidence for crafting along with the presence of programmatically standardized steatite seals featuring the Indus script and their associated sealings (Frenez and Tosi 2005) at these sites further indicates that at least some residents participated in the interregional trade and exchange networks that integrated the Indus Civilization during the Integration Era. Despite their small size, portions of many of these sites were surrounded by massive walled enclosures constructed of dressed stone and/or mud brick (often in the typical Harappan ratio of 1:2:4). Indus settlements in Gujarat were not merely agricultural villages, but rather important locations for the production of Harappan (material) culture as well as enduring nodes in the social and economic networks that linked the residents of Gujarat to the wider Indus world.

Excavations at Shikarpur and Bagasra demonstrate all of these features of the Integration Era in Gujarat. Located on opposite sides of the narrowest stretch of the Gulf of Kachchh that separates the erstwhile island of Kachchh from Saurashtra, Shikarpur has been excavated from 2007 and 2014,[2] and Bagasra was excavated between 1996 and 2005 (Sonawane et al. 2003). The ceramic assemblages at both sites feature classically Harappan styles alongside distinctly local wares of the Anarta style

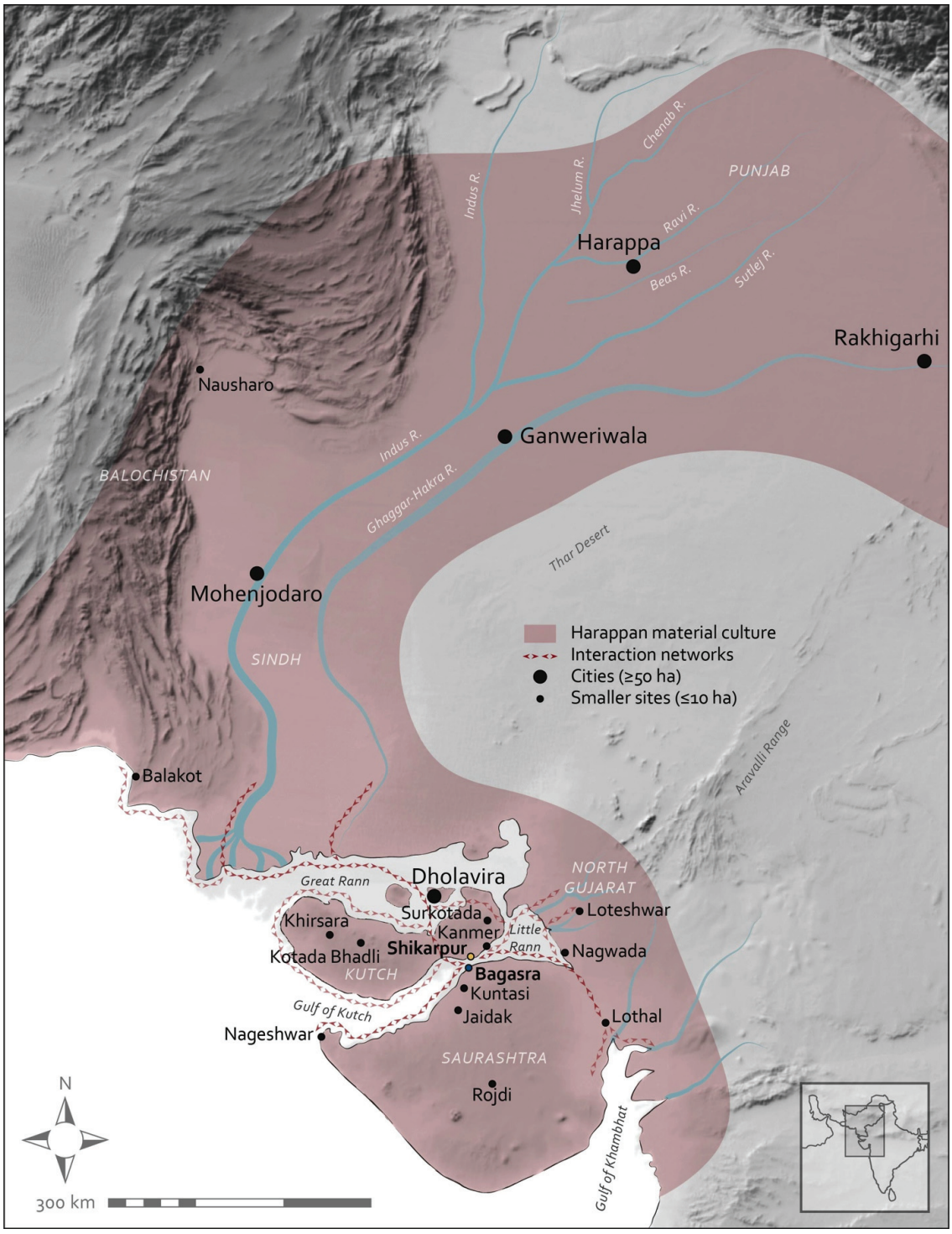


Figure 1: A map of the Indus Civilization highlighting sites mentioned in the text

from their earliest occupations and Sorath Harappan styles in their later levels. Both settlements also featured monumental walled enclosures constructed of mud bricks and dressed stones often referred to as fortifications in the literature. While no occupation preceding the construction of the walled enclosure has yet been discovered at Shikarpur, the walled enclosure at Bagasra was set upon the thinly stratified remains

of a previous occupation at the site that may date to as early at 2550 BC. The walled enclosure at Bagasra had walls approximately seven meters thick at their base with outside dimensions of approximately 65 x 57 m, enclosing about 0.3 ha of the roughly 2 ha site. The walled enclosure at Shikarpur had walls approximately 10 meters thick at their base with outside dimensions approximately of 120 x 120 m, enclosing about 1 ha of the roughly 4ha site. Both sites are characterized by approximately 6 m of cultural stratigraphy from their initial establishment to their eventual abandonment. Although small, these sites were certainly enduring places in the social landscape of Harappan Gujarat throughout their occupations.

The widespread production and use of classically Harappan material culture by the residents of Shikarpur and Bagasra demonstrates that they were active participants in the interregional economic and social networks of the Indus Civilization (Chase et al. 2014b). The presence of manufacturing debris at both sites, for example, indicates that the residents of each were actively involved in the production of highly valued Harappan ornaments from locally available raw materials. The use of distinctively local material culture at both sites, however, is an equally clear demonstration of local agency in the constitution of Harappan Gujarat and complicates simple narratives of migration and settlement. Moreover, while the residents of both sites displayed common symbols of Harappan social identity *vis-à-vis* personal adornment, they nevertheless appear to have maintained different sets of private domestic practices. These findings suggest the existence of a complex social landscape beneath a veneer of material homogeneity in the borderlands of Harappan Gujarat (c.f., Meadow and Kenoyer 1997). It is with recognition of this social complexity both within as well as between settlements that the present analyses were undertaken. Specifically, archaeological samples and analytical methods have been chosen specifically to generate datasets that will allow for reliable comparisons of patterns of consumption and livestock production in different residential areas at Shikarpur as well as facilitate comparisons with analogous areas at Bagasra throughout the occupational sequences at these two important Indus settlements.

Materials and Methods

Bone fragments recovered from archaeological sites are the material remains of a series of socially embedded technological processes by which animals are raised or acquired, exploited, exchanged, slaughtered, processed into meat, consumed, and their bones ultimately discarded and incorporated into the archaeological record (Chase 2005). When interpreted in relation to their archaeological context, aspects of the data generated through the examination and documentation of faunal remains provide information regarding some or all of these stages in the *chaînes opératoires* of the pastoral economy as is done with other craft technologies (Miller 2007: 13-40; Vidale et al. 1992). As is the case with all archaeological materials, however, faunal remains themselves do not directly speak to these questions; rather, interpretation of their social significance is based upon analyses of data, which is generated through observation, i.e. laboratory methods. Faunal datasets and their associated interpretive possibilities

are therefore structured as much by the documentation procedures by which they are generated and the analytical protocols to which they have been subject as they are by the human behaviors that led to their initial deposition and the site formation processes that conditioned their incorporation into the archaeological record (Meadow 1980). As laboratory and analytical methods must be tailored to address particular research questions, no particular set of methods is *a priori* better than another, and faunal analysts like specialists of all types vary both individually and regionally in the methodological protocols that they follow (for surveys of recent approaches, see O'Connor 2000; Reitz and Wing 2008). Nevertheless, because methods structure data, comparative analyses such as those undertaken below are most reliable when they derive from assemblages that have been collected and studied following similar procedures and deriving from similarly excavated archaeological contexts. The methods by which the material was excavated, the types of contexts chosen for analyses, and the laboratory procedures followed vary only slightly between Shikarpur and Bagasra.

The Excavated Samples

As per standard practice in South Asian archaeology, Shikarpur and Bagasra each have been excavated in numbered 5 x 5 m units (4 x 4 m trenches separated by 1 m baulks) laid out in an orthogonal grid oriented to the cardinal directions (figure 2). While the excavation practices at Shikarpur were largely similar to those at Bagasra, an important innovation in recording and documentation was the introduction of *lots* as the smallest stratigraphic unit. Lots are grouped together into *features* and *layers* as typically recorded in earlier excavation campaigns (such as at Bagasra). Based upon architectural and artifactual (esp. ceramic) patterning, the layers of each trench are assigned to temporal *phases*. Here, I refer to residential *areas* defined as either inside or outside of the sites' walled enclosures. Bone fragments from these archaeological contexts were picked largely by hand from the matrix, washed in plain water and laid to dry in the pottery yard, and packed into cloth bags for transport to the zooarchaeology laboratory at the Maharaja Sayajirao University of Baroda.

The scale of any social interpretation based upon analyses of the faunal remains from Shikarpur must be commensurate with the samples under consideration. Below, most interpretations are undertaken at the phase and spatial area level of resolution with the recognition that each combines material from the numerous lots and features that comprise the layers assigned to that phase. At Shikarpur and Bagasra, layers are generally characterized by a series of occupational cycles: typically the construction and continual use and maintenance of a structure or activity area followed by disrepair and the accumulation of domestic debris prior to subsequent reconstruction and reuse. The samples under consideration therefore aggregate the results of many depositional events over a reasonably long span of time and can therefore be taken to be representative of the broadest range of human activities in the phase under consideration. The specific trenches from which faunal remains were studied are indicated in figure 2.

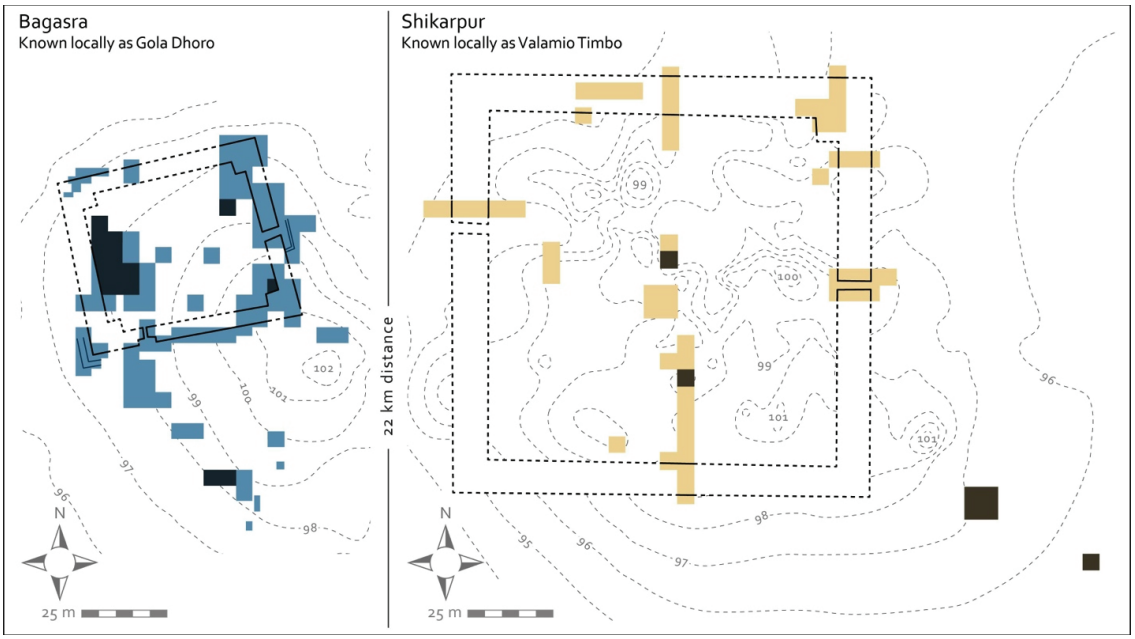


Figure 2: Plans of Shikarpur and Bagasra showing excavated trenches. The faunal remains included in this study are from trenches highlighted in dark shading.

As of 2014, excavations have revealed three phases of occupation at Shikarpur. Phase 1 begins with the construction of the walled enclosure and the use of classically Harappan material culture alongside local Anarta ceramic styles. Phase 2 is characterized by the continued use of Harappan material culture alongside local Sorath ceramic styles and the continued maintenance of the walled enclosure. During both phases 1 and 2, the walled enclosure demarcated residential space into inside and outside areas. Phase 3 is characterized by ephemeral settlement, some of which overlay the defunct walls. Interpretations of the faunal analyses presented below largely derive from comparisons of preliminary data from Shikarpur with more comprehensively studied and reported data from Bagasra (Chase 2007, 2010). At this site, excavations have revealed a shallow Phase 1 occupation that preceded the construction of the

Shikarpur	Bagasra	Summary
N/A	Phase 1	• Walled enclosure not yet constructed at Bagasra • Anarta ceramics along with classical Harappan material culture
Phase 1	Phase 2	• Walled enclosure operative and maintained at both sites • Classical Harappan material culture and Anarta ceramics • Sorath style ceramics in upper levels
Phase 2	Phase 3	• Walled enclosure operative but no longer maintained at either site • Sorath style ceramics and classical Harappan material culture
Phase 3	Phase 4	• Ephemeral settlement layers above defunct walls at both sites • Harappan material culture no longer produced • Later Sorath style ceramics predominate

walled enclosure during Phase 2 and its maintenance during Phase 3 (Sonawane et al. 2003). At Bagasra, Phase 4 is defined by largely ephemeral settlement overlaying the defunct walls, as is the case at Shikarpur during Phase 3. Based upon material culture similarities between the two sites, it appears that Phases 2-3 at Bagasra correspond with Phases 1-2 at Shikarpur, and Phase 4 at Bagasra corresponds with Phase 3 at Shikarpur.

Laboratory and Analytical Methods

The laboratory methods employed to study these materials were nearly identical to those employed an earlier study of the faunal remains from Bagasra, which are presented in greater detail elsewhere (Chase 2007: 71-82). Reconstructions of meat *consumption* at Shikarpur are based primarily on the relative frequency of bones belonging to different taxonomic categories. At the broadest level of specificity, mammalian bone fragments from Shikarpur belonging to large (cattle and buffalo-sized) and medium (goat and sheep-sized) mammals were separated from the remains of small mammals (dog-sized and smaller) and aquatic animals (primarily belonging to fish and crab species). These very general taxonomic categories are here referred to as *rough count* data. As a consideration of pastoral economies, the present analyses are concerned primarily with those specimens included in the large and medium mammal category. As is discussed below, this fraction includes the vast majority of the assemblage. The detailed analyses of the smaller mammals, fish, crab, and birds are outside the scope of this study. At Shikarpur, shells and shell fragments, many of which are the debris of the shell ornament industry, are typically recorded with other antiquities and are not included in the present analyses.

For the mammalian bone from large and medium-sized animals that comprises the vast majority of the material under consideration, a diagnostic zone system modified from Watson (1979), was applied to control for the effects of differential fragmentation and identification. Specifically, only those bone fragments belonging to a predefined list of skeletal portions (typically the articular surfaces of the proximal and distal portions of the long bones) are included in what is referred to here as *diagnostic count* data. Following this identification protocol, the more easily identified fragments of distinctively shaped bones (e.g., the proximal scapula) are not artificially overrepresented in relation to more difficult to identify fragments (e.g., long bone shaft fragments), nor are fragments of larger-boned and thus more easily identified species (e.g., cattle and buffalo) artificially over-represented in relation to smaller-boned species (e.g., goats and sheep). These diagnostic pieces can be reliably categorized into a set of broadly inclusive, yet precisely defined, taxonomic categories that potentially include a number of difficult to distinguish species. The Large Artiodactyl (LART) category includes the large artiodactyls, domestic cattle (*Bos sp.*) and buffalo (*Bubalus sp.*) along with wild *nilgai* (*Boselaphustragocamelus*), and potentially large deer species. The Medium Artiodactyl (MART) category includes non-pig medium artiodactyls, domestic goats (*Capra hircus*) and sheep (*Ovisaries*), along with blackbuck antelope (*Antilopecervicapra*), gazelle (*Gazellabennetti*), and potentially a series of small deer

species). The Sus (SUS) category includes only the remains of pigs (*Sus sp.*), the domestic status of which has yet to be subject to detailed study in the context of third millennium BC Gujarat.

With the exception of pigs, the species included in the above categories are osteologically very similar to one another. Only certain portions of the skeleton can be used to reliably distinguish between them. Specific osteological criteria by which the bones of goats can be distinguished from those of sheep, for example, have been proposed and contentiously debated in the zooarchaeological literature for over forty years (e.g., Balasse and Ambrose 2005; Boessneck 1969; Halstead et al. 2002; Payne 1985; Prummel and Frisch 1986; Zeder and Pilaar 2010; Zeder and Lapham 2010). Much of this debate stems from the fact, demonstrated by studies of large and diverse comparative collections, that animal populations vary geographically and temporally such that a criterion that reliably distinguishes these species in one region during a particular time period may not be so reliable in another (Zeder and Pilaar 2010). By way of contrast, the literature regarding the distinction of osteologically similar wild species in South Asia (e.g., Joglekar et al. 1994; Pawankar and Thomas 2001)is less well developed. Coupled with the grave implications of error (e.g., unreliable environmental reconstructions based on the relative abundance of particular wild species), this state of affairs necessitates an exceptionally conservative approach to species identifications in South Asian archaeological contexts (Meadow and Patel 2003). Nevertheless, all complete epiphyseal portions and teeth that may possibly distinguish these osteologically species were reserved for attempted species-level identification based upon the extant literature and notes, drawings, and photographs derived from the author's osteological studies of comparative collections housed at the Maharaja Sayajirao University, Deccan College, The Field Museum in Chicago, and the Natural History Museum London.

Livestock *production* at Shikarpur is most reliably undertaken through the investigation the ages at which animals were slaughtered for consumption via documentation of the relative degree of wear on the teeth of domestic animals. As they age, the teeth of ruminants (cud-chewing animals including sheep, goats, cattle, and buffalo) continually wear down. By matching the pattern of dentine exposure on the occlusal surface of these animals' mandibular teeth with standard keys widely used and discussed in the zooarchaeological literature, the relative age of an animal can be determined. As described in more detail elsewhere (Chase 2007: 99-104), wear on teeth of goats and sheep was documented using Payne's (1973, 1987) system and assigned to a range of wear stages following a refinement of his correlation table based upon the mandibles excavated from a modern butchers' dump in Bathinda, Punjab (Chase 2005). Wear on the teeth of cattle and pigs was recorded using Grant's (1982) system, and mandibles and teeth assigned to wear stages of the form used by Payne following Hambleton's (1998) conversion method using a correlation table compiled from the data presented in Grant (1982). Following Zeder (1991), specimens attributable to a range of wear stages were equally allotted to these stages *contra* Payne (1973). While

mandibles incorporating several ageable teeth are most reliably assigned to wear stages following this system, the small number of mandibles in the highly fragmentary assemblage at Shikarpur was insufficient for meaningful intrasite comparisons without the inclusion of loose teeth. Because each mandible contains several teeth, only deciduous fourth premolars (dP4) and third molars (P3) were included in these analyses to reduce the possibility of including several teeth from the same individual thus skewing the results. Histograms of mandibles and loose teeth at each wear stage were then transformed into a cumulative frequency graph often referred to as a *mortality profile* in the zooarchaeological literature. The interpretation of mortality profiles is typically undertaken by comparing observed profiles with profiles derived from hypothetical models (e.g., Payne 1973; Redding 1981; Stein 1986) of different herding or procurement strategies or those documented through ethnoarchaeological research (e.g., Chase 2005). In the present study, this approach is supplemented by a direct comparison of mortality profiles from Shikarpur with those from Bagasra.

Consumption: Who Ate What?

The animal bones documented in this study are ultimately the remains of the residents' meat-based meals. Did patterns of meat consumption change through time at Shikarpur? How do these consumption patterns at Shikarpur compare with those documented at Bagasra? Are there differences in consumption practices evident in the samples from inside the walled enclosure as compared to those from outside as there are at Bagasra? Answers to these questions are based primarily data regarding the relative frequency of bones belonging to different taxonomic categories of animal.

Of the 21560 bone fragments documented in this study, approximately 94% were recorded only to the broadest level of taxonomic specificity described by *rough counts* as defined above. Even at this cursory level of detail it is clear that aquatic resources were only a minor contributor to diets at Shikarpur, accounting for no more than 3% of the faunal remains from any analytical context. While there is some variation between phases and areas, this is of a relatively minor degree. This is in clear contrast to Bagasra, where the remains of aquatic species range between 8-30% of the faunal assemblages from Phases 2-4 at the site (Chase 2007: 245-249).

Of the 1262 specimens included in the *diagnostic counts* at Shikarpur as shown in figure 3, the large majority can be attributed to domestic species. Based on a wide range of diagnostic criteria, most complete identifiable skeletal elements of non-pig medium artiodactyls can be positively attributed to domestic goats or sheep with only a very few attributable to wild antelope or gazelle species. One lower second molar belonging to an equid species, most likely a wild ass (*Equus hemionus*) given its size intermediate between that of a domestic horse and donkey, was documented in the faunal sample from Shikarpur but is not included in the diagnostic counts presented in figure 2 as diagnostic counts only include dP4/M3 mandibular teeth. Given the relative paucity of bone fragments attributable to wild taxa among the sample of pieces selected for species-level identifications, it is reasonable to interpret the inclusive taxonomic

categories MART as being primarily comprised of the bones of goats and sheep and LART as being comprised primarily of cattle and buffalo. The SUS category contains only the remains of pigs. This reliance upon domestic animals and pigs is very similar to that documented at Bagasra (Chase 2007: 255-257).

Rough Counts		Phase 1 Inside	Phase 1 Outside	Phase 2 Inside	Phase 2 Outside	Phase 3 Total
Mammallian	Medium/large mammal	5936	7933	4122	1547	1479
	Small mammal	14	3	1	3	1
	Total	*5950*	*7936*	*4123*	*1550*	*1480*
Aquatic	Fish	106	123	78	15	2
	Crab	89	84	11	2	0
	Turtle	6	0	1	0	0
	Total	*201*	*207*	*90*	*17*	*2*
Avian	Bird	0	0	3	1	0
Diagnostic Counts		**Phase 1 Inside**	**Phase 1 Outside**	**Phase 2 Inside**	**Phase 2 Outside**	**Phase 3 Total**
LART	Large artiodactyl	152	296	135	74	62
	Cattle or buffalo	87	50	59	14	28
	Nilgai	1	1	1	0	0
	Total	*240*	*347*	*195*	*88*	*90*
MART	Med. artiodactyl, non-pig	67	44	47	5	5
	Goat or sheep	20	19	18	2	2
	Blackbuck or gazelle	2	7	3	0	0
	Total	*89*	*70*	*68*	*7*	*7*
SUS	Pig	18	11	25	1	6

Figure 3: Taxonomic representation at Shikarpur by phase and area

At this level of specificity, cattle (and possibly some buffalo) are the most abundant type of animal consumed at Shikarpur during all phases, ranging from 69-92% of the bones in each analytical context. As cattle are much larger than sheep, goats, and pigs, it is quite clear that the flesh of these animals was the most commonly consumed meat at Shikarpur. This high representation of cattle in the faunal assemblage from Shikarpur is generally similar to the representation of cattle throughout the Indus Civilization (Meadow and Patel 2003; Joglekar et al. 2013a) and especially at nearby Indus settlements in Gujarat (Goyal and Joglekar 2012; Joglekar et al. 2013b; Thomas et al. 1997), and is generally similar to the findings from Shikarpur presented earlier by Joglekar and Goyal (2011).

Regarding change in consumption patterns through time at Shikarpur, figure 4 shows that there is no major difference between the representation of major taxonomic categories between the Phase 1 and 2 samples. This is the case with the Phase 1 and 2

assemblages from inside and outside the walls as well as when samples from these areas are considered in aggregate. As there is little apparent change through time in terms of gross consumption patterns at Shikarpur during the phases when the residents most actively participated in the interregional networks of the Indus Civilization, it is appropriate to pool the samples from these two phases in subsequent analyses. During Phase 3, however, when the walls were no longer operative, there is a significant increase in in representation of the bones of cattle and buffalo at the expense of goats and sheep as compared to earlier phases.

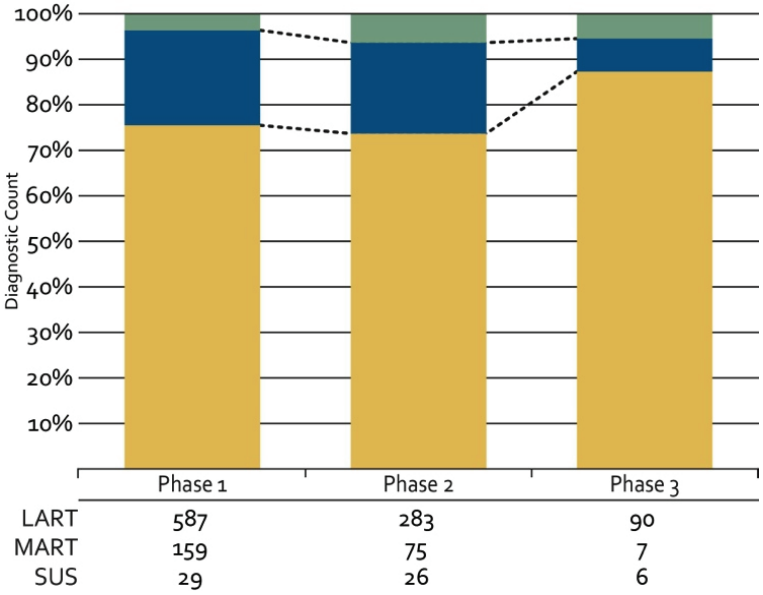


Figure 1: Taxonomic representation recorded by diagnostic counts at Shikarpur through time. LART includes primarily bone fragments from cattle and buffalo, MART from goats and sheep, and SUS from pig. Variation in the distribution of skeletal specimens is statistically significant (95% confidence) according to the chi-square (χ^2) statistic with the greater relative abundance in the LART category during Phase 3 accounting for most of the variation; variation between Phases 1 and 2 is not significant when the Phase 3 sample is excluded.

The taxonomic data presented in figure 5 show that the remains of small stockand pigs are represented in relatively greater numbers at Bagasra than they are at Shikarpur. Taken in conjunction with the greater representation of aquatic taxa at Bagasra noted above, these findings indicate that the residents of Shikarpur and Bagasra maintained different patterns of meat consumption. Specifically, the residents of Bagasra generally ate a more diverse diet that included a greater amount of mutton, pork, and aquatic foods than did their neighbors at nearby Shikarpur. Unlike at Shikarpur, however, there is statistically significant albeit modest variation in taxonomic representation between the aggregate assemblages through time. Specifically, the assemblage from Phase 2 is distinguished by a slightly greater proportion of small stock and pigs, which as discussed below and elsewhere (Chase 2010), is largely accounted for by the greater consumption of mutton and pork within the walled enclosure during this period.

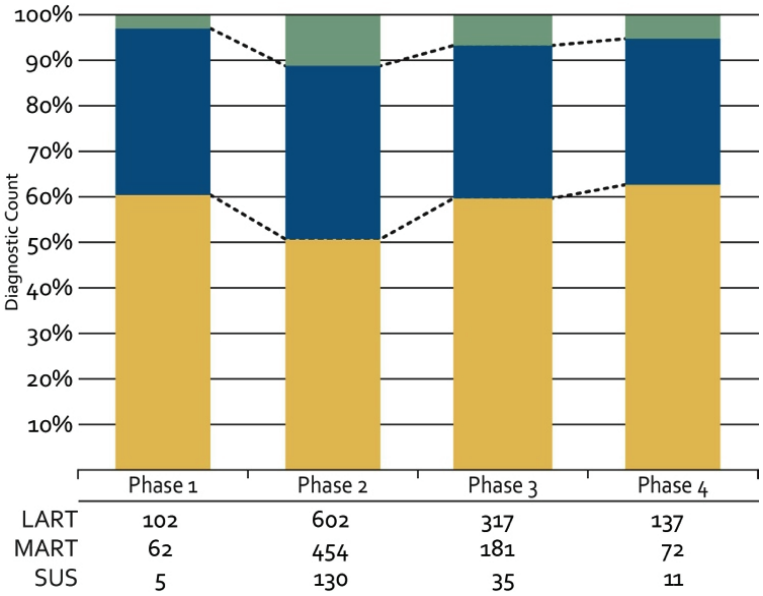


Figure 2: Taxonomic representation recorded by diagnostic counts at Bagasra through time. LART includes primarily bone fragments from cattle and buffalo, MART from goats and sheep, and SUS from pig. Variation in the distribution of skeletal specimens is statistically significant (95% confidence) according to the chi-square (χ^2) statistic with the greater relative abundance in the SUS and MART categories during Phase 2 accounting for most of the variation.

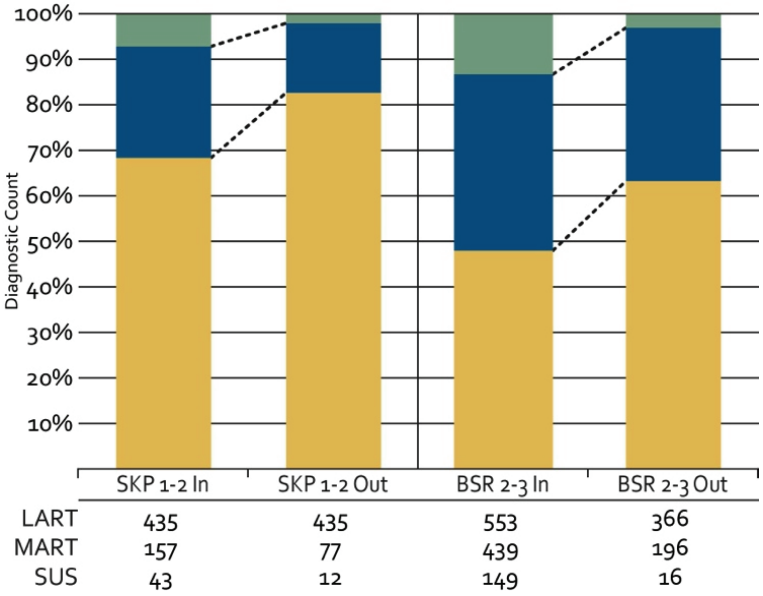


Figure 3: Taxonomic representation recorded by diagnostic counts at Shikarpur (SKP) and Bagasra (BSR) during the main periods of occupation (Phases 1 and 2 at Shikarpur and Phases 2 and 3 at Bagasra) in different spatial areas at each site (inside and outside of the walls). LART includes primarily bone fragments from cattle and buffalo, MART from goats and sheep, and SUS from pig. At both Shikarpur and Bagasra, variation in the distribution of skeletal specimens is statistically significant (95% confidence) at according to the chi-square (χ^2) statistic.

Considering intrasite variation at Shikarpur, the data presented in figure 6 show statistically significant variation in the representation of bones from different taxonomic categories inside and outside of the walls at the site during the phases when they were operative. Specifically, the residents of the walled precinct appear to have consumed more mutton and pork than did their neighbors outside the walls. A noted above, similar pattern of intrasite variation in patterns of meat consumption is present at Bagasra during Phases 2-3 when the walled enclosure was operative (Chase 2010). Taken together, these observations clearly signal the differences in consumption patterns between the residents of the walled enclosures at both of these nearby Indus settlements with the residents inside the walls consuming a more varied diet than did their neighbors outside. As few excavation projects or faunal studies in Gujarat have examined the issue of intrasite variation, it is difficult to comment on the extent to which this pattern is characteristic of other Indus settlements in the region.

At Shikarpur, the bones from all portions of the skeleton of all categories of animal are present in assemblages from all areas and all phases from the site, indicating the local butchery of animals for consumption. At Bagasra, there is evidence for a moderate degree of intrasite redistribution of mutton, with the limb bones of goats and sheep a bit more common within the walls and head portions more common outside the walls during Phase 2 at the site (Chase 2010). While this pattern is indeed apparent during contemporaneous Phase 1 at Shikarpur, the variation is not statistically significant, likely a function of the relatively smaller sample sizes at Shikarpur. This does not preclude the possibility of a moderate degree of intrasite distribution of mutton during this period, as was the case at Bagasra (Chase 2010). The data are simply not yet suitable to conclusively address questions of meat distribution within the site. Similarly, the number of cut-marks recorded on bone fragments from Shikarpur, many of which are heavily encrusted with mineral accretions (*kankar*), is not sufficient to evaluate the extent to which the residents of different residential areas at Shikarpur prepared meat differently as was the case at Bagasra (Chase 2012).

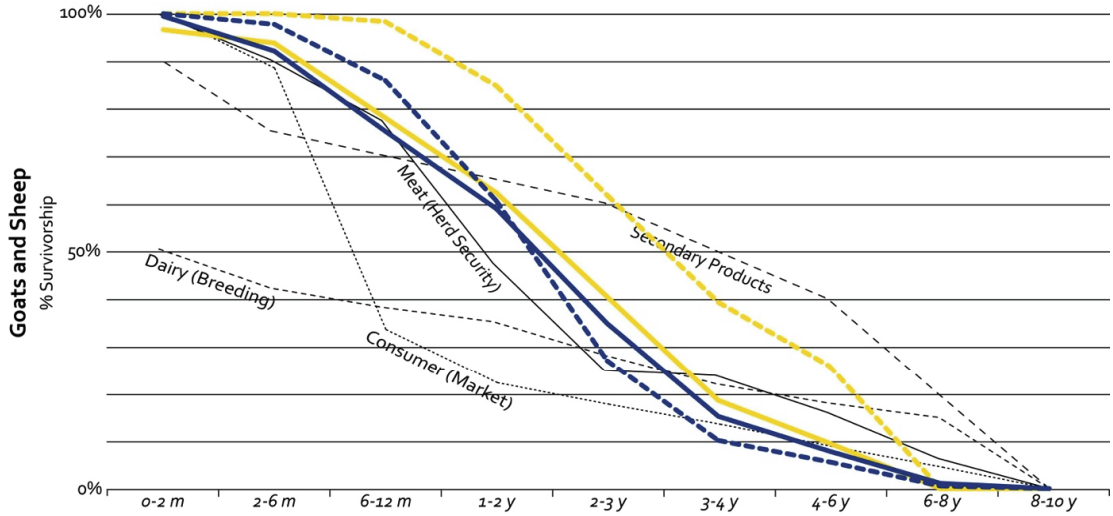
Production: How were Livestock Animals Raised?

A more complete examination of the pastoral economy must consider patterns of livestock production that supplied the residents of Shikarpur with the animals that they consumed as food. How were different types of domestic animals raised? To what ends were they exploited prior to consumption? How do these consumption patterns at Shikarpur compare with those documented at Bagasra? These related questions are answered most directly through an examination of the ages at which different categories of domestic livestock were slaughtered for consumption.

As with the taxonomic data discussed above, figures 7 and 8 show that there is no statistically significant difference between the mortality patterns from Phase 1 and Phase 2 in either spatial area of the site. When Phase 1 and 2 samples from each area are combined as they are in figure 6 above, the datasets are not significantly different between areas for either taxonomic category. The statistical similarity of the

survivorship curves from different phases and spatial areas within each taxonomic category is partially a factor of the small sample sizes of these datasets.

The mortality profile for goats and sheep shown in figure 7 matches quite closely with Redding's (1981) hypothetical model of subsistence-oriented production emphasizing herd security rather than specialist production. In this model, goats and sheep are raised primarily for meat. While some are slaughtered after they attain their adult weight in their second year, enough older animals alive to ensure the long-term viability of the herd. Redding's model of subsistence herding presumes that producers raise animals for their own consumption. This is consistent with the local production of these animals as suggested by the analysis of variation of Sr isotope ratios in the tooth enamel of a sample of goat and sheep teeth from Bagasra, which shows that most of these animals were likely raised near to the site (Chase et al. 2014a).

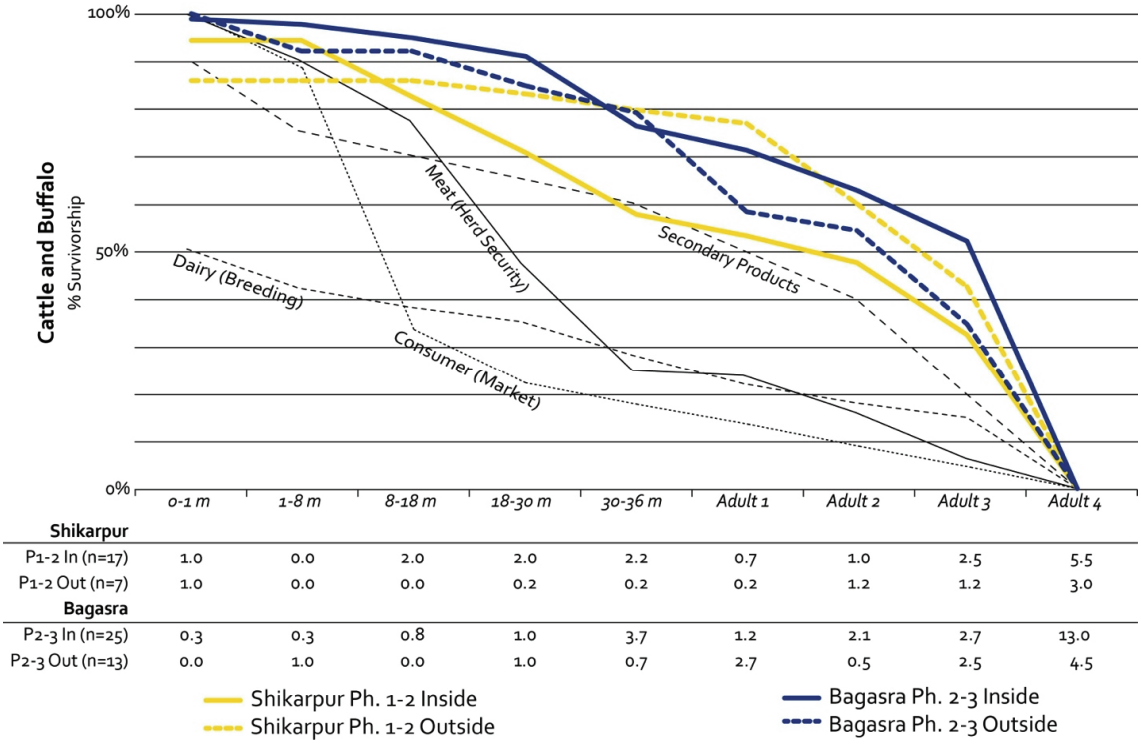


	0-2 m	2-6 m	6-12 m	1-2 y	2-3 y	3-4 y	4-6 y	6-8 y	8-10 y
Shikarpur									
P1-2 In (n=8)	0.3	0.3	1.3	1.3	1.8	1.8	0.8	0.8	0.0
P1-2 Out (n=15)	0.0	0.0	0.3	2.0	3.5	3.3	2.1	3.8	0.0
Bagasra									
P2-3 In (n=47)	0.3	3.3	7.8	7.8	11.4	9.0	3.5	3.2	0.6
P2-3 Out (n=80)	0.0	2.0	9.3	20.4	26.6	13.5	3.8	4.1	0.4

Figure 4: Mortality profiles of goats and sheep from inside and outside of the walled enclosure at Shikarpur compared with corresponding areas at Bagasra. Pairwise comparisons survivorship curves from inside or outside areas within either site are not significantly different from one another according to the Kalmogorov-Smirnov statistic nor are comparisons of aggregate curves between sites (not shown).

In contrast to goats and sheep, figure 8 shows that well more than half the cattle at Shikarpur were kept to adulthood age prior to consumption. This pattern is generally consistent with the exploitation of their so-called secondary products (esp. milk and traction). It contrasts strongly, however, with the pattern documented elsewhere in the world wherein young male cattle are culled at young ages in an effort to reduce the cost of caring for them while increasing the amount of milk available for human

consumption (Halstead 1998; Payne 1973). This may be explained by a need for a relatively large number of bulls and bullocks. The residents of the site also may have obtained animals initially bred by others. This would have been the case, for example, if they obtained young cows and kept them for milk prior to consumption, as is the case among many communities in the region today. This pattern is indeed suggested by an analysis of Sr isotope ratios in the tooth enamel of cattle and buffalo from Bagasra, which shows that many of the cattle consumed at the site during Phases 2 and 3 were initially raised considerably further afield than were the goats and sheep (Chase et al. 2014a).



	0-1 m	1-8 m	8-18 m	18-30 m	30-36 m	Adult 1	Adult 2	Adult 3	Adult 4
Shikarpur									
P1-2 In (n=17)	1.0	0.0	2.0	2.0	2.2	0.7	1.0	2.5	5.5
P1-2 Out (n=7)	1.0	0.0	0.0	0.2	0.2	0.2	1.2	1.2	3.0
Bagasra									
P2-3 In (n=25)	0.3	0.3	0.8	1.0	3.7	1.2	2.1	2.7	13.0
P2-3 Out (n=13)	0.0	1.0	0.0	1.0	0.7	2.7	0.5	2.5	4.5

Figure 5: Mortality profiles of cattle and buffalo from inside and outside of the walled enclosure at Shikarpur compared with corresponding areas at Bagasra. Pairwise comparisons survivorship curves from inside or outside areas within either site are not significantly different from one another according to the Kalmogorov-Smirnov statistic nor are comparisons of aggregate curves between sites (not shown).

Figures 7 and 8 demonstrate that these patterns of livestock production are not significantly different from those documented at Bagasra (Chase 2007: 108-122, 2010). Despite differences in patterns of meat consumption between these neighboring sites, livestock were raised and/or acquired in a similar way by the residents at each throughout Phases 2 and 3.The similar mortality profiles from different spatial areas at both Shikarpur and Bagasra through time further suggest that Harappan Gujarat was characterized by resilient patterns of livestock production throughout the Integration Era. While this pattern may be characteristic of Harappan Gujarat more generally, comparable datasets do not exist from any other excavated sites in the region.

Discussion

An important first observation regarding the pastoral economy at Shikarpur is that the heavy reliance on domestic animals with a particular focus on cattle did not significantly change through time at the site. This is supported by the fact that the ways in which domestic animals were raised also appears to have continued without significant change through these phases. Taken together, these findings suggest that the residents of the site were supplied with meat via pastoral economies that were largely resilient in the face of the social changes reflected in the material culture shifts that distinguish Phases 1 and 2 at the site. This pattern of resilience in the organization of pastoral production and consumption pattern is largely similar to that documented through Phases 2 and 3 at the nearby site of Bagasra. The residents of both of these important crafting and trading settlements obtained their daily provisions via pastoral economies that were resilient in the face of social and possibly climatic changes that took place during the course of the Integration Era in Gujarat.

There is, however, clear evidence for variation in patterns of consumption between Shikarpur and Bagasra. As noted above, the residents of Shikarpur consumed on average more beef than their neighbors at Bagasra throughout the main periods of occupation under consideration here. There may be several possible explanations for this. Intrasite variation in consumption patterns, for example, may be reflective of general differences in food preferences maintained by the residents of these two nearby sites. This would be consistent with interpretations of other classes of material culture, which suggest that the residents of Shikarpur and Bagasra maintained different domestic practices in the private sphere despite their display of a common Harappan identity (Chase et al. 2014b). Intrasite variation in consumption patterns may also relate to the differences in the economic orientation of the two sites. As noted above, preliminary analyses of Sr isotope ratios in the tooth enamel of cattle and buffalo teeth from Bagasra suggest that a portion of these animals were raised elsewhere during their first year or so of life prior to being brought to the site, where they were generally kept until adulthood prior to consumption (Chase et al. 2014a). If this pattern is also found at Shikarpur, it may indicate that the residents of the site were more actively engaged in the regional networks through which cattle circulated. Finally, this difference may be characteristic of broader intraregional variation in pastoral land use practices, with the different relative abundance of taxonomic groups at Shikarpur and Bagasra reflective of Kachchhi vs. Saurashtran patterns of livestock production. Recent faunal analyses at the walled Indus settlement of Kanmer (Goyal and Joglekar 2012) located approximately 25 km east along the southern coast of Kachchh showing similarly high representations of cattle are consistent with this hypothesis. Further comparable faunal analyses at sites in each region at newly excavated sites in Kachchh such as Khirsara and KotadaBhadli as well as at other Indus sites in Saurashtra are required to further understand intrasite variation in the pastoral economies of Harappan Gujarat.

Within Shikarpur, variation in consumption patterns suggests economic and/or social

differences between the residents of the walled enclosure and their neighbors outside. As noted above the residents of the walled enclosure consumed a more varied diet that included more mutton and pork than did their neighbors outside the walls, as was the case at Bagasra (Chase 2010). While it is not surprising that the massive walled enclosures at each site demarcated social as well as spatial distinctions, the precise meaning of these differences requires further investigation. While the bones from all of the taxa consumed are located in each area, variations in the relative amounts of different types of meat consumed may indicate differences in relative wealth as well as the varying cuisine preferences of residents from different backgrounds. These two sources of social distinction are very likely related and will require more detailed studies of intrasite variation in other classes of material culture, especially the ceramic vessels involved in the preparation, presentation, and consumption of food at Bagasra and Shikarpur as has been undertaken at the former site by Lindstrom (2013). Regardless of variation in consumption patterns, the livestock consumed in each area of each site were generally produced in a similar fashion. The pastoral economies that supplied the residents of Indus settlements in Gujarat were highly resilient and able to supply a diverse population with the pastoral products that were staples of the Harappan lifestyle throughout the Integration Era.

The pastoral economy by which the residents of the Shikarpur obtained livestock does appear to have undergone changes during the final phase of occupation prior to the abandonment of the settlement. During this last phase when the walled enclosure was no longer operative, there appears to have been an increase in cattle consumption at the expense of other livestock animals. This is not the case at Bagasra, where there does not seem to have been much significant change in the proportion of livestock consumed at the site. This suggests that although local pastoral economies may have changed with the decline of Harappan settlements in Gujarat, these changes were not uniformly manifest even at these two nearby settlements. The ephemeral nature of the latest occupation layers at both sites suggests that they had become residential nodes in a complex rural landscape rather than as the enduring locations of commerce and culture as they were during the Integration Era. Perhaps the variation exhibited between Shikarpur and Bagasra during their last phases is evidence for the emergence of a complex rural landscape characterized by a mix of villages and pastoral encampments as known from historic and contemporary times. Further exploration of the changes in land-use practices associated with the transformation of the Indus Civilization in Gujarat during the Localization Era requires further faunal analyses in conjunction with investigations of livestock mobility using biogenic isotopes at these and other later settlements in the region.

Conclusion

This study presents a conservative, reliable, and replicable methodology for further considerations of inter- and intrasite variation in the organization of the pastoral economies that supplied the residents of Indus settlements in Gujarat with the livestock integral to the Harappan lifestyle. Applying these methods to Shikarpur and

comparing the resultant data to the nearby settlement of Bagasra has revealed patterns of pastoral production that appear to have been resilient in the face of social and possibly climatic changes throughout the Integration Era in Gujarat. Variation in patterns of consumption between these sites—as well as within them—supports the notion that the superficial material similarities characteristic of Indus settlements in the region mask more subtle, yet nevertheless archaeologically visible social distinctions in this dynamic borderland region during the Integration Era (Chase et al. 2014b). Finally, this work has established a baseline for comparison with other settlements in the region and represents an important step towards a reconstruction of the social and environmental changes that accompanied the transformation of the Indus Civilization in Gujarat. Ultimately, however, the interpretations presented here must be framed as hypotheses subject to evaluation with data generated from other Indus sites in the region and beyond. If these were to be significantly modified by subsequent comparable analyses, this study will have truly been successful in contributing to a more fully developed understanding of South Asia's first experiment with urban society.

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Notes

[1]*The archaeological site referred to here as Bagasra, the name of the nearest modern village, is also known as Gola Dhoro, the local name of the mound itself. Initially referred to in the literature as Bagasra (Sonawane et al. 2003), it has been referred to in subsequent publications as Gola Dhoro (Bhan et al. 2004; Bhan et al. 2005; Chase 2010). Here, maintaining convention, it is referred to it as Bagasra.*

[2]*As excavations at Shikarpur are in progress, the information presented here is derived primarily from unpublished seasonal reports prepared each year by the Department of Archaeology, Maharaja Sayajirao University of Baroda and submitted to the Archaeological Survey of India.*

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