Introduction

The coastal mountains of northern Lebanon rise steeply from the narrow Mediterranean shoreline and as a result of high winter rainfall have extensive woodland and forest cover on the slopes dissected by deep craggy ravines with perennial streams. From the last glacial maximum through to the early Holocene, these areas supported diverse wild-life which was exploited by bands of Epipalaeolithic and Neolithic hunter-gatherers. However, systematic excavation aimed at exploring the everyday lives of these communities has been limited, not least due to the conflict in Lebanon between 1975 and 1990. The majority of our knowledge of the Epipalaeolithic stems from excavations in the 1960s and 1970s in Early Epipalaeolithic Kebaran levels at Ksar Akil and Jiita II (Hours 1973, 1992; Tixier 1970; Tixier and Inizan 1981; Yazbeck 2004) and from the analysis of previously excavated material from Early and Middle Epipalaeolithic Kebaran and Geometric Kebaran phases at Abri Bergy (Copeland and Waechter 1968). Each of these sites is located just north of Beirut (Figs. 1, 2). Records of the Late Epipalaeolithic Natufian in Lebanon derive largely from excavations at Saaidé II on the western flanks of the Bekaa Valley (Copeland 1991; Schroeder 1991; Garrard and Yazbeck 2013).

In 2003 a major prehistoric field project was initiated in the Qadisha Valley which cuts the highest sector of Mount Lebanon in the north-west of the country. Extensive survey identified a number of Palaeolithic and Neolithic sites in caves and rock shelters as well as in open-air localities in the lower mountain belt between the Qadisha Valley and Nahr Asfour (500-800m). Most notable amongst these was a group of three adjacent caves near to the village of Moghr el-Ahwal (MEA), where subsequent excavations yielded evidence of occupation from the Epipalaeolithic and Neolithic including rich assemblages of stone and bone tools, shell beads, animal bones and human burials (Garrard and Yazbeck 2004; 2008; 2013).

The focus of the present paper considers the wild fauna hunted and trapped at the Moghr el-Ahwal cave sites through various stages of the Epipalaeolithic and is aimed at assessing the changing prey diversity, association with climate/landscape change and reflection of human cultural and economic selectivity. This study represents a significant addition to our understanding since early faunal assemblages from sites in Lebanon are scantily recorded, with the exception of studies made by Hooijer (1961) and Kersten (1987;

1989; 1991; 1992) at Ksar ‘Akil, Clutton Brock (pers. comm.) at Jiita II and Churcher (1994) at Saaidé.

The Moghr el-Ahwal Caves

The Qadisha Valley is drained by the Nahr Qadisha river which runs for 35km from the highest reaches of Mount Lebanon (over 3,000m) to the Mediterranean. Annual rainfall currently varies between c.900mm on the coast to more than 1,500mm near the summits. Vegetation differs with altitude, ranging from evergreen oak to deciduous oak woodland to coniferous forest to subalpine shrub cover (Garrard and Yazbeck 2013). A survey of the valley identified a cluster of three caves associated with a karstic limestone outcrop known as the Timsah rock. This c.80m long rock formation is located at c.620m elevation, on mountain slopes overlooking the Qadisha ravine and lies c.400m east of Moghr el-Ahwal village. The layout of this site has been described in detail by Garrard and Yazbeck (2004; 2008) and is summarised in brief here. Cave 1 at the western end is in effect a natural arch and was not available for excavation as the floor has been cemented over, however two other caves were accessible and subject to archaeological investigation during 2004-5 and 2008. The smaller Cave 2 comprises a south-facing rock shelter with a fairly low ceiling leading to a small inner chamber. Excavation here revealed Geometric Kebaran occupation cut into by Natufian and Neolithic features all of which overlie earlier deposits which remain undated. Eighteen metres to the east, the larger Cave 3 cuts obliquely through the rock with a substantial chamber at the south-eastern end leading into a fissured area open to the sky and to a small entrance on the northern side. Four areas of the cave were explored but only Area C, in the eastern sector and close to the main entrance, had a well preserved stratigraphic record with radiocarbon dates ranging from the Kebaran, Geometric Kebaran and Natufian time periods. The dominant occupational material appeared to be Geometric Kebaran and material from earlier and later periods was more limited in the excavated area (Garrard and Yazbeck 2008; 2013).

Stratigraphy, phasing and dating

Cave 3

Area C covered 13.5 sq m and was excavated to a depth of 1.3 metres. Six phases of occupation (Phases F to A) were revealed comprising 64 loci in all. The three lowest phases provided calibrated AMS dates from charcoal which in order of depth were: Phase F - 20,577-20,091 cal BP contemporary with the mid-Kebaran (locus 461); Phase E - 19,123-18,827 BP contemporary with late Kebaran (locus 462); and Phase D - 16,578-15,799 BP mid-Geometric Kebaran (locus 456) (Table 1). These early levels were overlain by various features which appeared to be Natufian in date (Phase C). They included a shallow pit containing an upturned mortar (locus 442) from which an early Natufian date of 14,463-13,859 cal BP was obtained, which in turn overlay an ovoid bin with a stone slab surround and lime plaster base (Garrard and Yazbeck 2013). Neolithic strata were not encountered in this part of the cave although possible Bronze Age and more recent pits appeared in subsequent levels (Phase B, Phase A). Based on the lithic assemblages, by far the most prolific occupation was that relating to the Geometric Kebaran and artefacts from this phase had penetrated earlier levels and were also found in the Natufian features which cut into this occupation phase.

Cave 2

A 30 m^2 area was excavated in Cave 2 which was also made up of six phases (Phases F to A) from which 43 separate loci were uncovered. The sediments were shallow (only 50 cm) but ‘locked in’ by a rock sill across the front of the cave. The earliest deposits, Phases F - ‘red complex’ and E - ‘grey complex’, survived in isolated pockets in the cave floor but unfortunately no C^{14} dates were obtained and the lithic assemblages were sparse. Phase D was best represented at the eastern side of the cave where there was a burial pit containing a partial human skeleton with a Geometric Kebaran industry in association (locus 30). A charcoal date of 15,250-14,600 cal BP was obtained which would place it in the late Geometric Kebaran (Table 1). In contrast, Phase C was best preserved in a burial pit at the western side of the cave and several of the artefacts including a portion of a bone sickle haft (Garrard and Yazbeck 2013: Fig. 4) appeared to be Natufian, although they were mixed with earlier Geometric Kebaran material. Cutting into the earlier deposits across the centre and west of the cave were a series of burial pits recorded as Phase B, which contained disarticulated human remains from which two dates were obtained directly on the human bones of 9,595-9,524 cal BP and 9,871-9,598 cal BP (locus 18) indicating a mid-late Pre-Pottery Neolithic B phase. As in Cave 3, there was evidence of later prehistoric activity and also a series of Medieval and later pits cutting earlier levels (Phase A) but the dominant phase of early prehistoric occupation appears to have been Geometric Kebaran, and material from this period was found in later burial features cut into these levels.

It is important to note that no direct links could be made between the phasing at the two caves, whose entrances were 18 m apart. However, in both caves Phase D relates to Geometric Kebaran occupation and Phase C to Natufian features cut into Geometric Kebaran levels. In some analyses, referred to in subsequent sections, data from Phases D and C at the two caves are combined. Table 2 lists the loci encompassing the faunal remains from both sites.

Recovery of Bones from Moghr el-Ahwal Caves

Bones were recovered from sediments coarse sieved through 5mm mesh with the residues dry or wet sieved through 2mm mesh. These bones were identified using reference collections at the Institute of Archaeology, University College London and the Natural History Museum Bird Reference Collection at Tring in the UK. Faunal specimens identifiable to taxa were measured to the nearest mm, weighed and fusion status and degree of intactness recorded. Attributes resulting from taphonomic processes including weathering, surface condition, gnawing and burning were also recorded. A high proportion of bones from Cave 3 Phases C to F, were coated in a calcite-rich breccia and although this was largely removed by 4 hours immersion in 10-12% glacial acetic acid, occasional remnant coating made weight estimation uncertain. The encrustation meant that dry sieving was practised much more extensively in Cave 3 than in Cave 2 where the majority of material was wet sieved. This may account in part for the higher proportion of microfauna recovered from Cave 2.

Animal bone abundance was assessed using Number of Identified Specimens (NISP) and skeletal element representation calculated using Minimum Number of Individuals (MNI) (as described by Grayson 1984). NISP values for tortoise were determined using a method described in a previous publication by one of the authors (Edwards and Martin 2007). Morphometric data were collected for goat, roe deer, red deer and wild boar (following von den Driesch 1976).

Faunal Diversity and Inter-Cave Variation

The Moghr el-Ahwal animal remains, their identification, relative abundance and varied spatial distribution, throw light not only on the procurement strategies and subsistence economy employed by people living in the caves but also raise questions about their social organization. The greatest attention is given to fauna from Cave 3 since the stratification in area C was clear and appeared relatively undisturbed. The fauna from Cave 2 is described in more summary form, as the deposits were much shallower and may have been subject to disturbance during the excavation of successive prehistoric burial pits across the front of the cave.

Cave 3 Fauna

Table 3 shows the range and relative abundance of fauna recovered from Cave 3. This comprised 13,266 bone fragments weighing 28.63 kg of which 797 (6.0%) were identifiable to species/genus. Large ungulates were dominated by caprines of which a good number could be firmly identified as wild goat, *Capra aegagrus,* (Boessneck, 1969; Prummel and Frisch 1986). Although closely checked, no definite evidence of wild sheep, *Ovis orientalis*, was found in either cave. Wild goat would have been at home in the adjacent crags, and the nearby woodland would have provided short term cover for females giving birth (Harrison and Bates 1991). It is notable that in this assemblage caprines comprised between 65-78% of total hunted/trapped fauna across Phases F to D/C, but by Phase C numbers dropped to around 37%.

Amongst the other large mammals, red, (*Cervus elephas)*, fallow (*Dama mesopotamica*) and roe deer *(Capreolus capreolus*) accounted for 9-15% of all animals killed in the earliest phases (F to D) of occupation, but in Phase C the figure rose sharply to 44%. It is notable that the relative proportions of these three deer species varied over time. Red deer were present in low numbers through all earlier phases but absent in Phase C, while fallow deer increased between Phases D and C. Roe deer numbers accounted for around 3-4% of hunted prey throughout the early phases, but in Phase C a striking change occurred with numbers increasing to 31%, almost the same abundance as caprines. In terms of behavioural ecology, fallow and roe deer prefer well wooded areas during the day but emerge into open areas for feeding at dawn and dusk, while red deer is likely to have been more frequent in the open terrain at higher altitudes, at least in summer, although with access to woodland (Chapman and Chapman 1975; Kiabi *et al.* 2004; Lovari *et al.* 2008). The variation seen in relative abundance of these different deer species may therefore reflect temporal, environmental changes and in particular the expansion of forest/woodland habitats through the period. However the changes could also arise from selective behaviour of the local hunter-gatherers.

In addition to these relatively abundant taxa a wide variety of less frequent prey were also encountered. During the earliest phase of Cave 3 occupation small numbers of auroch (*Bos primigenius;* phalanx and humerus) were present, likely encouraged by nearby woodland cover. The wetland undergrowth alongside the river in the adjacent ravine is likely to have attracted wild boar (*Sus scrofa*) which was present in all phases apart from Phase C. Several large and small canid bones were encountered, the latter likely representing jackal which, along with wild boar, still lives in the area today. Finds of small numbers of fox (*Vulpes vulpes*), hare (*Lepus capensis*) and squirrel (*Sciurus* sp.) bones, record the capture of smaller mammals presumably for their meat and fur. A metacarpal from a brown bear (*Ursus arctos*) recovered from Phases F and E may signal either a collected item, hunting success or perhaps the death of a hibernating animal using the cave in the hunter's absence.

A range of bird bones were recovered from Cave 3 and included those from large raptors, partridges, dove and crow. The rock partridge (*Alectoris chuckar*) and occasional European partridge (*Perdix perdix*), were numerous and provided dietary diversity in Phases F to D. Remains of large birds of prey were also recovered from these earliest phases of cave occupation including an eagle (*Aquila chrysaetos*), identified from posterior phalanx IV, mandible and carpometacarpus, and a buzzard (*Buteo buteo*) identified by a tibio-tarsus. Cave interiors are unlikely habitats for large raptors so it is likely that these represent birds hunted in open country for their feathers and talons as was described for an Epipalaeolithic site in eastern Jordan by Martin *et al.* (2013).

A small scatter of bones originating from tiny vertebrates including lizards, small fish and frogs were deposited in the earliest phases and likely represent the activities of owls and other small/medium predators using the cave when the seasonal hunter gatherers were absent.

Survival of goat and deer elements and taphonomy in Cave 3

Caprines

Table 4 shows a diverse and roughly equable distribution of wild goat body parts appearing in all occupation phases which suggests that whole carcasses were carried back and butchered on site. Long bones were always fragmented and only small relatively robust bones such as astragali, calcanei and phalanges occasionally survived intact. Scapulae were largely represented by the glenoid area and pelvii by the acetabulum. Predictably phalanges survived in largest numbers.

The proportional survival of body elements was estimated in relation to a maximal MNI derived from using the proximal metacarpal as standard (MNI=13) and in view of the relatively low numbers and insignificant variation, data from all periods were pooled. Long bone fragments were divided into proximal or distal parts; phalange numbers were halved to make comparable to long bones. Fig. 3 shows the patterns of survival and indicates that long-bones and girdle elements survived moderately well but with poor representation of ulnae, proximal humeri, distal radii and femora. Bone density values, as determined by Lyman (1994) for sheep, were used to plot bone survival against density (Fig. 4). The resulting correlation coefficient ($r = 0.46$) indicates that 21% of the variance ($r^2 = 0.2116$) is attributable to bone density. Deliberate smashing/burning of bones by the cave occupants seems likely to account for the deficit.

Across all periods of occupation there is evidence of discard or deliberate placement of goat bones in and around hearths, resulting in 15% to 31% of bones showing burnt surfaces (Table 4). Traces of burnt floor areas and charcoal fragments characteristic of *in situ* activity areas were identified in Phases F, E, D/E and D (Garrard and Yazbeck 2008). Direct evidence of butchery was slight but included amongst the 214 caprine bones from Phases F and E, two second phalanges and a calcaneum appeared to have been split vertically, an os malleolare showed evidence of chopping and a phalanx 1 had faint cut marks at its distal end. Cut marks on a calcaneum shaft from Phase E/D (Fig. 5 E) and a metatarsal from Phase D were also noted. Vertical splitting of first and second phalanges was occasionally encountered in Phases E/D, D, D/C and C, presumably reflecting marrow recovery.

As mentioned previously removal of calcareous deposits was achieved to a limited extent. Amongst finds from Phases F, E and E/D to D the ‘artificial’ fusion through brecciation provided insights into butchery practise, in particular demonstrating that hind limbs were often not disarticulated prior to discard (Figs. 5 B and D). Occasional finds of paired vertebral epiphyses (Fig. 5 A) confirms that the same was true for spinal columns.

Cervids

Deer remains were much less common than those of caprines, but long-bones and girdle fragments were identified in each phase of occupation with greatest numbers and diversity in

Phase C (Table 5). Antler fragments from fallow deer occurred in almost all phases while roe deer antlers appeared only in Phase C where two were identified by refitting six fragments. Overall estimates of burning ranged from 11% to 35% across periods, similar to levels found amongst caprine remains, perhaps reflecting a generalised attitude towards animal bone discard. Only three deer bones, two second phalanges and an astragalus, displayed signs of butchery. In the proximal end of a deer-sized phalanx 1, a hole had been drilled through the shaft suggesting that this was intended as an ornament (Fig. 5 C). This find aligns with those made at other archaeological sites dating from the Palaeolithic onwards which have yielded evidence for making ornaments and beads from bone (e.g. Talbot 1983; Goring-Morris 1989; Bar-Yosef 1991; Kuhn *et al*. 2001).

Cave 2 Fauna

Turning to the smaller cave, Cave 2, excavation led to the recovery of c. 25,500 bone fragments weighing c. 90 kg of which 5.3% were identified to species/genus. As noted earlier, only three reliable radiocarbon dates, one from charcoal and two from human bone, are available for this cave (Table 1). The largest animal bone assemblage derives from the easternmost side of the cave, where the ceiling is too low for habitation and where material may have accumulated without disturbance from trampling (loci 37, 40). Unfortunately it was impossible to differentiate a boundary between Phases D and C in this area, but it seems likely from the lithics that most is Geometric Kebaran.

Despite these drawbacks, a number of significant observations can be made relating to Cave 2. For example, comparison of the faunal make-up of Cave 2 and Cave 3 reveals notable differences which cannot be attributed to any potential disturbance (compare Tables 3 and 6). The faunal assemblages comprise more or less the same species but their proportional distribution is strikingly different. Most notably there are fewer caprines in Phases F to C of Cave 2 where total NISPs vary amongst periods from 4%-44%, compared with 37.3%-78% amongst periods F to C in Cave 3. In addition, smaller mammals including fox, hare, martens, mustelids, porcupines and squirrels are relatively more numerous in Cave 2 than Cave 3, with squirrel remains outnumbering those of caprines in Phases E and F. It is notable in Cave 2 that bird bones are scarce or absent in phases with small overall bone samples and this is also the case in Cave 3. It is also of interest that the presence of equid, absent from the Cave 3 assemblage, was signalled in Phase D/C, a context described above.

Another notable feature of the Cave 2 fauna is the relatively high frequency in Phase E deposits of deer bones, especially roe deer (39.6% total NISP), compared to goats (Table 6). These are made up almost entirely from deer skull components i.e. mandibles, teeth, tooth fragments (n=45), which may indicate deliberate removal and discard of heads in Cave 2, prior to transporting the remaining carcass/body-parts to another location for consumption. There is no indication of deer head removal as a singular activity in any other period from either cave. It is unfortunate that the age of the earliest occupation Phases F and E of Cave 2 is uncertain. The sediment from these two areas, a red-orange deposit in Phase F and grey deposit in Phase E, are not found in Cave 3 and both may predate the earliest Cave 3 levels.

Differential activities at the two caves

The differential distribution of goat, deer and small prey bones between the two caves during Phases D and C (cf. Tables 3 and 6) is significant and cannot be explained by evoking interphase mixing. Various alternative explanations are more likely. The distance between the two cave entrances is only c. 18 metres over gently rising ground, so it seems very possible that both caves could have been occupied by one group of people, who divided activities between the two caves, thereby giving rise to the inter-cave variation in faunal profile. It is conceivable that the preparation and consumption of goat meat/marrow was undertaken most frequently in Cave 3 while skinning/fur preparation of smaller mammals occurred most frequently in Cave 2. It should be noted that Cave 3 is considerably larger and has a much higher ceiling than Cave 2 and it is possible that the latter was used less for habitation.

Following on from the possibility that the same group of people occupied both caves for certain periods, particularly during Phases D, D/C and C, the faunal data from these levels has been combined in Table 7 (Phases F and E are omitted owing to uncertainty in date match between the caves). It is immediately striking that this combination shows goat numbers staying relatively steady at NISP 35% to 40% across all three phases, rather than showing the marked high levels (NISP 67%-72%) seen in Phases D and D/C of Cave 3. The combined data also show a change in the numbers of deer, with the relative proportions of fallow deer diminished in Phase D/C but a significant increase of roe deer in Phase C. It is also striking that the relative numbers of fox, hare and squirrel and other small prey are greater than those found for Cave 3 alone.

While this 'two cave' occupation scenario is appealing and logical, the possibility that separate groups of people used these caves at various times of year in order to exploit seasonal variation in food resources, cannot be excluded. It is also possible that the structural differences between the two caves both in size and degree of exposure, may have resulted in occupation of one or the other at different times of year. There may also have been a time lapse between the occupation of the two caves as the single Geometric Kebaran date from Phase D at each locality places the Geometric Kebaran occupation at Cave 2 later than that for Cave 3 (Table 2).

Patterns of prey procurement

The reciprocal of Simpson's index, $1/\Sigma(\rho_i)^2$ (Grayson 1984) can be used to generate indices of prey diversity and explore relative proportionality amongst prey types. It was used here to examine all occupation phases in both caves and consider the impact on prey profile when Phases D, D/C and C from Cave 3 and Cave 2 are combined. In all cases, prey were divided into four categories: large mammals, trapped fast-moving smaller mammals, trapped birds and slow moving prey. NISP was the unit of measure. (N.B. equal proportionality of prey species is demonstrated when $1/\Sigma(\rho_i)^2 = 4$).

Diversity indices for Cave 3 are shown in Table 8 (Upper) and show a narrow range from $1/\Sigma(\rho_i)^2 = 1.06$ to 1.42 which reflects the magnitude of the bias towards large ungulates (>80% of prey) across all occupation phases and shows no notable trends of increasing diversity across periods. It is notable that for all phases apart from Phase C, the low diversity indices are due to the dominant presence of goat. In Phase C deer together with goat comprise the dominant large prey. Changes in relative abundance over time of the major prey from Cave 3 are shown in Fig. 7 and demonstrate the apparent rapid rise of roe deer and fast small mammals during Phase C, presumably in response to a marked decline in caprine number.

Considering the data from Cave 2 (Table 8, middle) it is notable that the indices for the very early Phases F and E are high, due in part, to the distinctive high levels of small prey. The more recent Phases D, D/C and C phases also show diversity indices higher than the potentially contemporary phases in Cave 3.

When Caves 3 and 2 Phases D, D/C and C data are combined (Table 8; Lower), the resultant indices $1/\Sigma(\rho_i)^2$ are 2.04, 2.20 and 1.62. These higher indices reflect an increased diversity of prey types in the pooled data, which points towards more equal proportions of game types especially during Phases D and D/C. The index for Phase C is relatively low reflecting a period when significant numbers of roe and fallow deer were combined with those of goat (Table 7). These shifts in goat and roe deer numbers in Phase C may be associated with diminishing numbers of goat although not necessarily from over-hunting, since other factors such as alterations in climatic conditions resulting in environmental change would prompt the revision of subsistence strategies. These ideas are explored in a later section.

Age Profiles and Size of Hunted Caprines

Intensive hunting of a major prey type is often associated with increased numbers of younger animals killed (Stiner *et al*. 1999; Stiner and Munro 2002; Stutz *et al*. 2008) and with this in mind we have attempted to explore age profiles of caprines from Cave 3 and Cave 2. Unfortunately numbers of elements where fusion status could be assessed were low, however if all phases of both caves are combined (Table 9) the data show that over the entire time span very few animals less than 18 months old (7.4%) were killed. Of those between 18 and 30 months of age, 26.3% died pre-fusion while amongst those older than 30 months, 54.5% died pre-fusion.

The possibility that goat kill patterns intensified overtime was examined by considering metapodial fusion amongst animals killed in the 18 to 30 month age group from Cave 3. Here metapodia recovered from Phases F to D were made up of 13 shafts with distal fused ends, 8 distal epiphyses (equivalent to 4 complete unfused shaft ends) and 2 other unfused shafts (each of which could have been attached to two of the 8 epiphyses). In contrast, metapodia from Phases D/C to C comprised 2 fused shafts, 1 unfused shaft and 5 epiphyses (equivalent to 3 distal unfused shaft ends – of which two shafts are absent). Both of these phase groupings provide data on the hunting of young and older goats but comparison is difficult given the small numbers of metapodia from Phase D/C to C. The relative frequency of epiphyses from these most recent phases in comparison to those from phases F to D could suggest intensification of goat kill, however the numbers are unreliable.

Despite a very limited data pool due to the intense fragmentation of bone, the relative sizes of caprine astragali from Phases F-D at Cave 3 (n=4) were compared to those recovered from Kebaran levels at Ksar Akil in central Lebanon (Kersten 1987; 1989). This shows they fall into the same general size category and cluster in two groups, presumably the larger representing males and the smaller females (Fig. 6).

Trends in Prey Profiles over the Broader Region

The Moghr el-Ahwal caves were inhabited by hunter gatherers across several millennia, almost certainly not continuously but frequently enough to leave behind substantial evidence of their activities. It is clear from the kill data shown in Tables 3 and 6 that hunting/trapping strategies, as at many other locations of similar date, varied over time. How do these changes equate to those seen at sites in the general region and more distantly, are they consistent with widespread shifts in human driven strategies and/or climatic variation? In the following section these questions are explored by comparing the Moghr el-Ahwal cave hunting/trapping profiles with those seen at five other central and north Levantine sites and at three located to the south in northern Israel, all of which fall within the appropriate date range and show varied environmental conditions.

Hunting patterns are presented as relative proportions of major prey groups (Fig. 7). Birds (B) are omitted from the main figure as identification and reporting is inconsistent, but numbers (some identified; others grouped as unidentified) are given in the sub-text. Tortoise (T) numbers are also confined to the sub-text since it is often unclear how NISP values were derived. The Moghr el-Ahwal prey data for each phase are shown for Cave 3 alone and in the case of Phases D, D/C and C they are also shown for the two caves combined.

Beginning with a period prior to the Epipalaeolithic in the moist and mountainous northern Levant, faunal remains from the site of Üçağizli Cave (Kuhn *et al.* 2009) are considered. This cave site lies on the steep, rocky coastline of the Hatay region of south-central Turkey and just a few km south of the Orontes river delta (Fig. 1). When occupied during the initial Upper Palaeolithic and Ahmarian (at a period of lower sea level), the cave would have been a little further from the shore but within easier reach of the resources of the Orontes delta (Mentzer 2011). At Üçağizli, wild goat and deer were equally dominant during the initial Upper Palaeolithic but with a notable presence of wild boar (in large ungulate category on Fig. 7). This faunal profile is commensurate with crags and forests on hill slopes together with wooded, well-watered, coastal/delta environments. By the Ahmarian, the prey profile had shifted such that fallow deer were the principal hunted target. Kuhn *et al*. (2009) have related this change in hunting pattern to oscillating temperature variations during the OIS 3 period which would have affected moisture, vegetation and woodland at all elevations.

Turning to the Kebaran, the two sites of Jiita II and Ksar Akil lie 45 km south of Moghr el-Ahwal in central Lebanon (Figs. 1, 2). Jiita II is a large rock shelter currently located in a craggy, steep-sided, wooded valley, c. 5 km inland from the narrow coastal plain.

Here, goats dominated the hunted assemblage, with fallow deer accounting for c. 20% of the remainder (Clutton–Brock pers. comm.). This pattern is similar to that found in Phases F-E/D and D-D/C of Moghr el-Ahwal Cave 3 (radiocarbon dated to Kebaran and Geometric Kebaran), although even in these early phases fast small game formed a significant component. A rather different scenario is seen at the Kebaran site of Ksar Akil (Kersten 1989, 1991), which is also situated in a steep-sided valley, but close to its outlet on to the coastal plain. Here, the faunal distribution is similar to that seen in the Ahmarian levels at Üçağizli, with fallow and some roe deer accounting for the majority of prey. Both sites are significantly closer to the resources of the coastal plain and at a slightly greater distance from the craggy environments favoured by wild goat, than Jiita II and Moghr el-Ahwal.

The prey profiles at Moghr el-Ahwal Cave 2 during Phase C (Natufian) demonstrate the continued importance of goat but emphasise the increasing significance of small prey. This is also the case when data from Caves 3 and 2 are combined for Phases D-D/C and Phase C. A trend away from goats towards deer, largely roe deer, seems to have taken place by Phase C and the presence of small/medium fast prey, mostly hare, squirrel and small carnivores is maintained. This latter trend is also apparent at the well-watered site of Natufian Saaidé II, which lies on the central-western flanks of the Bekaa Valley of Lebanon at c. 1,050 m altitude, overlooking land dividing the headwaters of the Orontes and Litani rivers (Figs. 1, 2); here, fast small prey are as abundant as goats (Churcher 1994).

For comparison, the faunal assemblage from the late Epipalaeolithic (cf. Natufian) levels of Direkli Cave which lies to the north of the Levantine Corridor at 850 m in the Anti-Taurus mountains of Turkey (Figs. 1, 7) is included. Here, high peaks around the cave were ideal for hunting the wild goat which make up the majority of prey recovered, while the forests and valleys below the cave yielded smaller numbers of deer and small/medium fast game (Arbuckle and Erek 2010).

Although not included in Fig. 7, a preliminary report on the fauna from Dederiyeh Cave which is located on a craggy hillside overlooking the broad and fertile Afrin valley of north-west Syria is of some interest (Fig. 1). Excavation of Mousterian and Natufian levels revealed faunal profiles which were period-specific. During the Mousterian goats made up c. 63% of hunted animals, cervids c. 23% and small fast game were very infrequent. In contrast, by the Natufian, goats were largely replaced by red deer, aurochs and wild boar with significant small game including foxes, wild cats, hares, hedgehogs and many tortoises (Griggo 2004; Gourichon 2008).

It is also of interest to compare the Lebanese localities with contemporary sites located in the warmer, drier, hill country of Galilee and Mount Carmel in the southern Levant (northern Israel); where geographic and climatic conditions favoured gazelle rather than goat as the major hunted species. They include Hayonim Cave located in a south-facing cliff overlooking the Wadi Meged which cuts through the lower Galilee hills about 12 km east of the present Mediterranean shoreline (Stiner 2005), and Meged rockshelter which is located about 1 km to the north-east (Kuhn *et al.* 2004). The third site examined is el Wad Cave and Terrace which is located at the western foot of Mount Carmel 40 km to the south-west of Hayonim, adjacent to the coastal plain (Munro 2004; Bar-Oz *et al*. 2004) (Fig. 1).

In the Kebaran period at Hayonim Cave and Meged rockshelter, the overall hunting strategy was focussed on the most numerous prey type, which in this case was gazelle, supplemented with deer, small numbers of large ungulates and small fast prey. However, the Natufian period saw major changes in subsistence strategy. At Hayonim Cave, gazelle were reduced to 40-45% of total hunted prey while small fast prey (especially hare), tortoise and birds increased dramatically (Stiner 2005). A similar strategy was represented in the faunal spectrum from the Early Natufian at el Wad Cave (Munro 2004). However, this contrasts with the assemblage from the Late Natufian at the adjacent el Wad Terrace (Bar-Oz *et al*. 2004) where gazelle continued to be the dominant prey (>80%).

In summary, it appears that factors relating to location, habitat and climate played a very significant role in the selection of prey through the Early and Middle Epipalaeolithic. However during the Late Epipalaeolithic, it has been argued that cultural developments relating to longer-term residence at certain localities and possibly increased population levels may have led to greater use of smaller, faster game as well as other changes in the faunal spectrum (Tchernov 1993; Stiner *et al.* 2000; Stutz *et al.* 2009; Zeder 2012). The combined data from Moghr el-Ahwal Caves 2 and 3 shown in Fig.7 might indicate such an increase, however caution is required given the relatively low sample sizes and the nature of the mountain forest environment of northern Lebanon which may have been unsuited to these demographic trends.

Palaeoclimate and environment

The overall radiocarbon dated sequence at the Moghr el-Ahwal caves extends from the Early Epipalaeolithic through to the Late Pre-Pottery Neolithic B (c. 20.6-9.5 ka cal BP) although the main occupational phase appears to relate to the Geometric Kebaran which is dated from 17.4-14.7 ka BP within the southern Levant (Garrard and Byrd 2013: 350-372). Earlier occupation levels, as yet undated, were identified in both caves and may extend back prior to the Last Glacial Maximum or substantially earlier. Until recently, very little investigation of palaeoclimate change had been undertaken for these periods in Lebanon, but several recent papers have been published.

The most significant in relation to the late Pleistocene Epipalaeolithic time frame has come from a 36 m core drilled in the Yammouneh basin which is located at 1360 m on the inland east-facing slopes of Mount Lebanon, about 22 km south-east of Moghr el-Ahwal (Fig. 2) (Develle *et al.* 2010; Gasse *et al.* 2011). Proxy data deriving from the sedimentation record, pollen samples and from the δ^{18}O analysis of carbonates from ostracods, has demonstrated harsh conditions at the Last Glacial Maximum perhaps extending as late as 16 ka BP. The very low karstic groundwater circulation from c. 21 - 16 ka BP has been interpreted as relating to water storage in glacial ice above 2000 m on Mount Lebanon. Evidence for possible glacial moraines has been found in the Upper Qadisha Valley as well as elsewhere in the mountain range (Moulin *et al.* 2011). After 16 ka BP there appears to have been a rapid reestablishment of humid conditions in the Yammouneh Basin with abrupt recolonisation of oak woodland from around 13 ka BP.

The data from the later sequence at Yammouneh is backed up by evidence from a pollen core from the Aammiq wetland which is located 55 km to the south in the Bekaa Valley where the reestablishment of cedar and oak forest on the adjacent mountains is documented from a period prior to 12.2 ka BP (Hajar *et al.* 2008). Evidence for the spread of Chenopodiaceae steppe is demonstrated in the Aammiq core around the period of the Younger Dryas, but during the early Holocene, there was once again a major expansion of oak forest. The δ^{18}O and δ^{13}C isotope analysis of a stalagmite from Jeita Cave (Jiita III) just north of Beirut has also found evidence for an arid phase in the Younger Dryas and increased humidity from c 11.2 ka BP (Verheyden *et al.* 2008). Further afield, a sediment and pollen core from the Ghab Valley in north-west Syria, 150 km to the north of Yammouneh, documents the expansion of deciduous oak forest from around 14.5 ka BP (Yasuda *et al.* 2000). It is argued that there is evidence for the anthropogenic clearance of woodland from about 10 ka BP in this area, contemporary with the mid-Pre Pottery Neolithic B.

Faunal remains from the Moghr el-Ahwal caves are valuable in providing evidence of environmental change on the more humid coastal side of Mount Lebanon through the late

Pleistocene. The presence of a significant number of deer and particularly fallow and roe deer from the earliest dated levels at Cave 3 onwards (from 20.6-20.0 ka BP) testify to the survival of woodland refugia at least at low elevations on the mountain from that time. This is also reinforced by the faunal record from Kebaran levels at Ksar Akil and Jiita II (Kersten 1987, 1989; Clutton Brock pers. comm.). The overall macro-faunal record from the Moghr el-Ahwal caves demonstrates hunting and trapping from a mosaic of environments: with a plentiful supply of wild goat coming from the craggy valley sides, deer, fox, mustelids and squirrels from local woodland and the presence of wild boar, wild cat (*Felis chaus*) as well as plovers pointing to dense thickets alongside the ravine.

The microfauna from the caves provide a potentially more sensitive indicator of climatic as well as possibly anthropogenic changes to the landscape. During the excavations of Cave 2, large-scale wet sieving (2mm mesh) was undertaken leading to the recovery of more than 1,500 identifiable microfaunal specimens. The mammalian bones identified to species are shown in Table 10. Mole rats, *Spalax leucodon,* were not included because they burrow to considerable depths, irrespective of occupation levels. Many of the smallest mammals are likely to have died in the cave either by chance or to have been carried in by non-human predators such as small carnivores or owls.

Evidence of environmental change across the phases of human occupation was looked for by estimating taxonomic habitat indices (THI) for the microfauna as described by Andrews (1990). This involved assessing the likely habitat preferences of each species based on established analogues (Harrison and Bates 1991; Nowak 1991) and then determining the relative proportions of species from each habitat for each phase of the site. Only the assemblages from Phases F (n=149), D (n=371) and D/C (n=280) at Cave 2 contained sufficient numbers of small mammals for analysis (Table 10).

Cumulative indices (which derive from the taxonomic habitat indices divided by the micro-mammal frequency) for these periods are shown in Fig. 8 and indicate an increase in forest and woodland associated with declines in meadow and oak parkland. The latter were most widespread during Phase F, a period when environments in the Near East are likely to have been cold and dry and it seems likely that the increased woodland and forest indicates climate amelioration with wetter, warmer conditions contemporaneous with Phases D and D/C (the Geometric Kebaran and early Natufian). This again fits with the data from the Yammouneh basin pointing to more humid conditions after c. 16 ka BP.

Conclusions

Our knowledge of the adaptations of Epipalaeolithic and early Neolithic communities in the coastal and mountain environments of the central and northern Levant are extremely limited relative to other habitats within the wider region. The Qadisha Valley Prehistory Project was initiated in 2003 to partly address this issue in one of the most mesic environments along the eastern Mediterranean seaboard. The excavations undertaken at the Moghr el-Ahwal caves have revealed an invaluable sequence extending from the period following the last glacial maximum through until the early Holocene, although with significant gaps. In both caves, the Geometric Kebaran was the period of most prolific occupation with dates from 16.6-14.6 ka cal BP (Table 1). However there was evidence for at least small scale occupation from the earlier Kebaran period, stretching back to 20.6-20.0 ka BP, and also clear activities from the Natufian and in the case of Cave 2 from the Pre-Pottery Neolithic B, extending forward to 9.8-9.5 ka BP. Systematic survey across the present olive terraces outside the caves identified lithic scatters which may be eroding from former outdoor activity and habitation areas. Thus far, this has not been investigated through excavation.

Detailed examination of the Cave 3 bone assemblages found variations in animal procurement strategies throughout the occupational sequence. Hunting of wild goat was the prime activity during the earlier phases (F-D) along with a range of other prey including various deer species, wild boar, hare, fox and birds. This diverse spectrum of prey demonstrates that hunting and trapping took place in all the accessible surrounding ecosystems including river-side marshland thickets, crags, deciduous woodland and forest, and open grassland and scrub in the higher mountains. There was a slight rise in deer numbers through the earliest phases, but this rose dramatically in the Natufian (Phase C) during which roe deer was equally common to goat. If this is considered alongside the albeit weak observation that during Cave 3 Phases D/C to C goat hunting was intensified with the slaughter of younger animals, the combined data could indicate that the availability of goat gradually decreased during these phases while deer, especially roe deer, were increasing. It could also relate to increasing humidity and forest expansion after c. 16 ka BP and potentially during the Bølling and Allerød interstadials coinciding with the Early Natufian.

Turning to Cave 2, it is striking that caprines were notably fewer in those phases potentially contemporary with occupation in Cave 3, while deer and smaller mammals, including fox and hare were more abundant. It is also clear that when data from the Geometric Kebaran and Natufian phases (D-C) from both localities are combined, goat numbers are much more even across these periods. If the caves were simultaneously occupied by the same group of people, it is possible that carcass preparation and butchery of different prey types varied between the two caves. The caves are certainly very different in size and scale and may have served different functions. Although the dates of the earlier Phases F-E at Cave 2 are uncertain, it was noted that skull fragments of deer were much commoner than found at any other levels in either of the two caves. This suggests that the removal and discard of heads was undertaken in Cave 2 before transporting remaining body parts elsewhere.

Evidence of differential ‘activity areas’ in cave occupations are well attested ethnographically (Galanidou 2000) and have been reconstructed archaeologically at a number of hunter-gatherer sites involving both animal carcass preparation and lithic manufacture and use. For example Edwards and Martin (2007) noted that different areas of the large Late Natufian and PPNA Iraq ed Dhubb cave were used to process ungulate carcasses relative to hares and smaller carnivores and this may relate to pelt preparation. Similarly, Nadel (1995; 2001) has noted differential activity areas for flint knapping at Early Epipalaeolithic Ohalo II (23 ka). An alternative possibility for the Moghr el-Ahwal caves is that they may have been independently occupied at different times of the year, perhaps selected on the basis of likely weather, wind strength, rain and snow. It is also possible that occupation occurred at different time periods in the Geometric Kebaran and Natufian without much overlap.

The patterns of change in the proportions of the prey species hunted and trapped by the Epipalaeolithic communities through time, fits well with the palaeoenvironmental changes predicted from a limited study of the microfauna from the caves. Both indicate a gradual climatic change favouring increasing woodland and forest, with a reduction in oak parkland and meadowland, most readily attributable to increased rainfall. Goats may have been driven higher into the mountains while the preferred habitats for roe deer, and consequently their availability, would have increased. It is possible that these environmental changes may also have impacted on the auroch, which favoured cool open grasslands and nearby woodland, however the very low numbers makes it is difficult to be certain. As mentioned above this fits well with the broader palaeoenvironmental evidence for increased humidity and an expansion of woodland/forest in the terminal Pleistocene.

The dramatic decline of traditionally favoured prey species and the broadening of resource base in the Late Epipaleolithic of the central southern Levant have been widely ascribed to demographic pressure (Stiner *et al*. 2000). This envisages that increasing human population size led to depletion of large game and exploitation of smaller game (Stutz *et al*. 2008). The data presented here show little indication of a significant population increase in the Phase C occupation (Natufian) at the Moghr el-Ahwal Caves, nor is there evidence from site surveys elsewhere in the coastal mountains of northern Lebanon to support this view. There is perhaps a slight suggestion from fusion studies that intensive exploitation of goats may have been initiated, but there is no strong evidence that the decrease in goat numbers was due to population expansion. Similarly, there is little indication of increased sedentism or longer-term residence in the later periods at Moghr el-Ahwal, as has been attributed to changes in animal exploitation patterns in other areas (Tchernov 1993; Zeder 2012). Rather, the body of environmental and faunal data presented in this study supports the idea that changes in prey proportions, in particular the increase in deer and decline in goats, was largely associated with changing climatic/palaeo-environmental conditions in this region.

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Tables

Table 1. Radiocarbon dates from prehistoric levels at Moghr el-Ahwal Caves 2 and 3. Note that the phase lettering system used for each cave is independent.

Table 2. Phases and loci at Caves 2 and 3 from which faunal remains were analysed.

Table 3. Cave 3. Fauna are divided by phases and expressed as Number of Identified Specimens (NISP) and percentage NISP. Bones not identified to family/genera are also detailed.
NB: tortoise* = carapace/plastron fragments (scutes) divided by 60 and added to number of long bones.

Table 4. Cave 3. Caprine elements are shown as NISP and NISP %. Numbers of burnt specimens are also indicated.

Table 5. Cave 3. Cervid elements are shown as NISP and NISP %. Numbers of burnt specimens are indicated as a percentage of all deer species combined.

Table 6. Cave 2. Fauna are divided by phases and expressed as Minimum Number of Elements (NISP) and percentage NISP. Bones not identified to family/genera are also detailed.
NB: tortoise* = carapace/plastron fragments (scutes) divided by 60 and added to number of long bones.

Table 7. Caves 3 and 2. Data from Phases D, D/C and C combined and expressed as Minimum Number of Elements (NISP) and percentage NISP. Bones not identified to family/genera are also detailed.
NB: tortoise* = carapace/plastron fragments (scutes) divided by 60 and added to number of long bones.

Table 8. Diversity indices for Cave 3, Cave 2 and Caves 3 and 2 combined estimated using Simpson's reciprocal: $1/\Sigma(\rho_i)^2$ (maximum possible = 4). Phases E and F are omitted from the Cave3/2 data as they appear to differ in age between caves. Hunted large mammals = auroch,

equid, cervid, caprine, boar; trapped small mammals = canids, felids, mustelids, squirrel, hare, fox; trapped birds = partridge, buzzard, eagle, dove, corvid; gathered prey = tortoise. NB: tortoise* = carapace/plastron fragments (scutes) divided by 60 and added to number of long bones.

Table 9. Caves 3 and 2 combined. Caprine fusion data with numbers adjusted to reflect standard numerical weighting of elements. Fusion data was taken from Silver 1969 and with reference to Noddle 1974 and Zeder 2001.

Table 10. Estimation of taxonomic habitat indices (THI: Andrews 1990) using microfauna from Cave 2 phases F to D/C. The cumulative indices indicate the relative availability of various habitats.
Note. Med. Oak = Mediterranean oak.

Figures

Figure 1. Map of Levant showing location of Moghr el-Ahwal and other Epipalaeolithic sites referred to in the text.

Figure 2. Location of Moghr el-Ahwal and other key Epipalaeolithic and Pre-Pottery Neolithic sites in Lebanon and adjacent areas. 1: Moghr el-Ahwal (EP, PPN); 2: Nebaa el Mghara (EP); 3: Jiita II, III (EP); 4: Ksar Akil (EP), Abri Bergy (EP), Antelias (EP), Dik el Mehdi (PPN); 5: Borj Barajne (EP, PPN), Tell aux Haches (PPN), Tell aux Scies (PPN); 6: Kroum el Jabal (EP); 7: Nachcharini (EP, PPN); 8: Tell Labwé (PPN); 9: Baalbek (PPN); 10 Saaidé I, II (EP, PPN); 11: Yabrud III (EP); 12: Baaz Cave (EP,PPN); 13: Ghoraifé (PPN); 14: Tell Aswad (PPN); 15: Tell Ramad (PPN); 16: Mallaha (EP), Beisamoun (PPN). Note that EP = Epipalaeolithic; PPN = Pre-Pottery Neolithic.

Figure 3. Cave 3 (all phases). Proportional representation of caprine body parts in relation to maximal MNI derived from using proximal metacarpal as standard. The numbers of phalanges are divided by two. Mandible and maxillae fragments are not included.

Figure 4. Cave 3 (all phases). Relationship between % survival and bone density for caprines. Correlation is moderate with Pearson's r = 0.46 and 21% of the variance accounted for by bone density.

Figure 5. Cave 3. Examples of bones from Phases F to D, with identification numbers shown in brackets. Bones A, B, D and E are from goat. A: Two unfused vertebral centra epiphyses (952) held in position by calcareous deposit. B: Tibia distal epiphysis and astragalus (636/7) held in position by calcareous deposit. C: Deer size phalanx 1 (1601.2) with drilled hole. D: Calcaneum and astragalus (2071) held in position by calcareous deposit. E: Calcaneum (1166) intact with cut marks on shaft. F: Squirrel mandible (871) with teeth.

Figure 6. Bivariate plot comparing goat astragalus size from Moghr el-Ahwal Cave 3 (combined Phases F, E and D: n = 4) and Kebaran levels at Ksar Akil (Kersten 1987, 1989). Bd = greatest distal breadth: GLI = greatest lateral length.

Figure 7. Relative proportions (% NISP) of faunal groups present at Moghr el-Ahwal Cave 3 and 3/2 combined (left) compared with other sites in central and northern Levant (centre), and the southern Levant (right) (see text for details and references). Large ungulates = auroch, equid and wild boar; slow/medium game = hystrix, badger, beaver, hedgehog; fast/medium game = fox, hare, canids, felids, martens, squirrel. B = all birds; B* = only birds identified to species reported; T = tortoise: all plastron, carapace and longbone/girdle fragments; T = ? tortoise present but not counted.

Figure 8. Plot showing cumulative indices of various habitats occupied by microfauna (after Andrews 1990) estimated for Moghr el-Ahwal Cave 2 Phases F, D and D/C. Steppe and wetland habitats were omitted as they show little or no variation across these periods.