

EXPLOITATION OF BIRDS DURING THE NATUFIAN AND EARLY NEOLITHIC OF THE SOUTHERN LEVANT

EITAN TCHERNOV

Department of Evolution, Systematics and Ecology
The Hebrew University of Jerusalem
Jerusalem 91904, Israel

ABSTRACT: There is a punctuational increase in the species diversity of bird remains from the Kebaran (early Epipaleolithic) to the Natufian (late Epipaleolithic) in the southern Levant. The intensive and extensive exploitation of very large spectrum of species continued to the PPNA (Pre-Pottery Neolithic A) and the PPNB (Pre-Pottery Neolithic B), excluding levels where early domestication was found. Reliance on such a large variety of bird species demanded an elaborated hunting experience and usage of versatile techniques, which seem to traditionally continue from the early Natufian to the PPNB. In some cases evidences for clear preferences for specific body parts (used also for tools and ornamentations) for each group of birds could be shown. It is only through the earliest long-term occupation of Natufian and PPN southern Levantine sites, that profound ecological changes have taken place. Consequently a significant increase in the exploitation of a large spectral array of animal species, grains, plants and birds was the main response for overusage of the area and draining the food resources. The drastic increase in the spectra of animal species exploited is due to the exclusive and extensive exploitation of the limited resources around the site by killing off the game and spending ever more time and energy to maintain constant intake of food which drained the resources to a critical level. The growing scarcity of large game forced people not only to broaden the spectrum of hunted animals, but also to concentrate on retrieving greater diversity of minor resources (mostly birds), as well as trying to manipulate wild populations (gazelles). The traditional resource animal species (mainly large game) became progressively insufficient under these conditions. Sedentary people were forced to rely on much less energetically (amount of meat per catch) rewarding animals, and many small species became highly represented in Natufian and PPN sites, of which the shift into highly specialized bird hunting seemed to be of great importance. The evolution of commensalism that suddenly appeared under the special conditions of sedentism, and the punctuational speciation of commensal animals like *Passer domesticus*, is discussed.

KEYWORDS: "BROAD SPECTRUM", COMMENSALISM, NATUFIAN, PPNA, PPNB, SEDENTISM

RESUMEN: El trabajo demuestra la existencia de un aumento en la diversidad específica de restos de aves en el Levante meridional desde el Kebariense (epipaleolítico temprano) hasta el Natufiense (epipaleolítico tardío). La explotación intensiva y extensiva de un muy amplio espectro de especies se prolonga hasta el neolítico precerámico (NPCA) y el neolítico precerámico B (NPCB), a excepción de niveles en donde se constata una domesticación temprana. La dependencia de una tan extensa variedad de especies aviares requiere tanto una elaborada experiencia cinegética como un uso de técnicas versátiles, que parece haberse prolongado desde el natufiense inicial hasta el NPCB. Ocasionalmente se ha podido comprobar la preferencia por determinadas partes corporales (asimismo usadas como ornamentos y herramientas) en diferentes grupos de aves. A partir de las primeras ocupaciones prolongadas en yacimientos levantinos meridionales (natufienses y NPC) comienzan a producirse profundos cambios ecológicos. El aumento significativo en la explotación de una amplia gama de especies animales (incluidas aves) y vegetales (incluyendo granos) parece ser por tanto una respuesta consecuente con la supratilización del terreno y la merma en los recursos alimentarios que ésta acarrea. El aumento acusado del espectro de especies animales explotadas se debe a la exclusiva explotación extensiva de los limitados recursos al ir acabando con la caza tradicional y dedicar progresivamente más tiempo y energía para mantener una ingestión constante de alimento que sobreexplota los recursos hasta niveles cada vez más críticos. La escasez creciente de caza mayor no sólo forzó la ampliación del espectro cinegético sino también a concentrarse en la captura de recursos de menor importancia (fundamentalmente aves) y a la manipulación de poblaciones silvestres (gacelas). Los recursos animales tradicionales (caza mayor) se hicieron progresivamente más insuficientes dentro de esta dinámica. Las gentes sedentarias tuvieron que depender de animales progresivamente menos rentables (en términos de biomasa/captura) y muchas especies de pequeño tamaño se recuperan con altas frecuencias en yacimientos natufienses y del PPN. En este marco resulta particularmente relevante el surgimiento de una caza especializada de aves. El trabajo concluye con una breve discusión sobre la evolución del comensalismo que surge súbitamente en el marco del sedentarismo y con la especiación de especies comensales tales como el gorrión común, *Passer domesticus*.

PALABRAS CLAVE: "AMPLIO ESPECTRO", COMENSALISMO, NATUFIENSE, SEDENTARISMO, NEOLÍTICO PRECERAMICO A, NEOLÍTICO PRECERAMICO B

INTRODUCTION

After hundreds of millennia of Pleistocene hominid evolution, in a certain geographical region small groups of hunters and gatherers, with ephemeral occupation of land and high residential mobility, suddenly gave rise to larger, functionally interdependent groups, hierarchically organized along economic and social lines. This event came to full realization during the later part of the Epi-Palaeolithic of the southern Levant (Tchernov, 1991, in press). The sedentary settlements and agricultural communities of the southern Levant developed from the Epi-Paleolithic hunter-gatherer's way of life (Hovers, 1989; Hovers et al., 1988). Social and economic changes from the foraging mode of subsistence are clearly visible with the appearance of the Natufian entity, when sedentism, intensive harvesting of wild cereals and some storage took place (Bar Yosef, 1981, 1983; Henry, 1983, 1989).

The transition from a situation in which the entire population within a given area was spontaneously organized from bands of hunter gatherers to another one with relative large societies of sedentary foragers, is probably one of the best examples of an abrupt increase in the socio-economy of man. Belfer-Cohen (1991) argued that the shift to sedentism in the Levantine sequence took place within a short time span which explains why archeologists have great difficulties in identifying the transition phase between the Geometric Kebaran complex and the Early Natufian. Hence sedentism seems to be a very late phenomenon in human evolution. Bar-Yosef and Belfer-Cohen (1989) agree that the irreversible transformation of several families, extended families, or even small bands into higher social organization acquired new properties, such as division of labor, formation of task groups or intergroup identification.

According to Valla (1987, 1988) C⁽¹⁴⁾ dates show that the most ancient period of the Natufian would be dated from ca 12,500 B.P. up to ca 11,000 B.P.; the recent phase would last up to about 10,500 B.P., followed by the final phase up to about 10,200 B.P. The Natufian entity emerged within a relatively limited area; from the Euphrates in the north (Moore, 1989) to the Negev highlands in the south and the Jordanian plateau in the east (Bar-Yosef & Belfer-Cohen, 1989; Henry, 1985, 1989). Most of the "Early" and "Middle" Natufian sites were found within the Mediterranean and Irano Turanian phytogeographic regimes, and its core area was concentrated along the pistacia-oak belt (Figure 1). It seems that the Natufian area was increasing in time when they dispersed into marginal and, eventually, into desert areas (Henry, 1985, 1989; Betts, 1989; Garrard et al., 1988). Yet these peripheral sites were much smaller in size (Bar-Yosef & Belfer-Cohen, 1989), and were probably inhabited by populations with higher mobility patterns.

While nomadism, or mobility, was the rule in human behavior throughout the major part of history, vagility among other mammals seems to be an uncommon behavioral pattern. It is hence surprising that man, who became in later prehistoric time such a dominant factor in most ecosystems, at a certain time and a certain place shows such a punctuational shift from a mainly nomadic way of life with ephemeral occupation of habitats, to sedentism some 12,000 years ago. In order for large carnivores to detect large prey more efficiently, they have to cover large foraging areas, and therefore became more mobile animals. The only way to decrease mobility, or to reduce the foraging area, and to establish a more sedentary behavioral pattern, is to shift to predation of smaller animals, or to become less specialized or more omnivorous (Harestad & Bunnell, 1979; Shipman & Walter, 1989). Much the same is true for herbivorous mammals; the larger they are, the more mobile they are. By analogy, during the shift of the Natufians to sedentism, we may expect them to change their

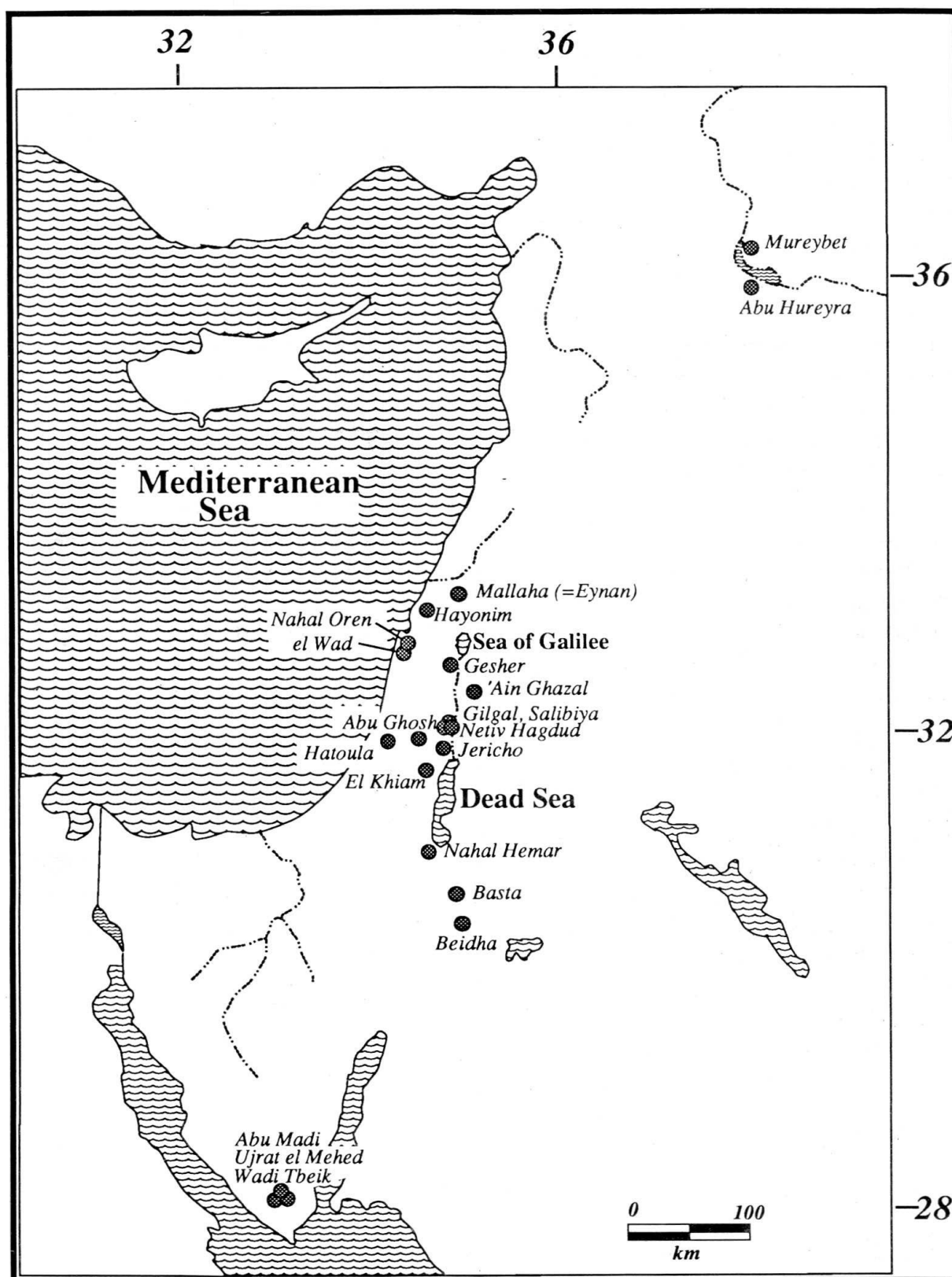


FIGURE 1 -A map of the southern Levant showing the main Natufian, Pre-Pottery Neolithic A and Pre-Pottery Neolithic B sites within the Mediterranean, Irano-Turanian and Arabian regimes, where essentially sedentism took place and the earliest villages are known.

exploitation behavior by including a broader spectrum of food resources, to become more vegetarian, or, in general, gain more omnivorous habits. Indeed, shifting into the sedentism strategy caused changes in the feeding behavior of man. This conforms to the "ecological rule" which states that whenever an organism will shift into a lower stage in the ecological pyramid, or from a stage of a primary consumer to a secondary consumer, it will loose energy, or use less rewarding food. Indeed, the transformation of human populations into a less mobile life cycle, brought them into a lower trophic level.

A prolonged occupation of a site will cause an enormous drain on the adjacent areas, which ultimately will turn into a barren land. High exploitation of the resources, killing off the game, and spending more time just to maintain constant level of food intake within the limited area available for the people, will utterly alter the natural habitats around the sites. A centripetal ecological gradient will be created by the intensive anthropogenic activities around the site (Tchernov, 1991). It is expected that the belt closest to the occupational site will be constantly and extensively used by the inhabitants. Ecologically it will be completely devoid of plants and animals. The peripheral belts around the core of the site will show a gradual relaxation in the exploitation of the resources, but the width of these ecological belts will fluctuate due to the seasonal changes brought about in the carrying capacity of the area. Habitats will gradually turn to be more natural in the outer belts, so that hunting can be practised only at a certain distance from the site. It is important to emphasize that the constant degradation of biological resources from and around early human settlements created a unique and isolated mini-ecosystem that was virtually devoid of most plants and animals, but opened new niches and opportunities for preadapted colonizers.

In order to overcome the overexploited region deficiencies, more satisfactory technologies for food gathering, meat retrieval and efficient storage, should have been adopted if people kept on living in the same place. Under these circumstances, especially when the area around the site has no sufficient or constant supply of food to support the local inhabitants, there will be a pressure to develop symbiotic relationships with nomadic people. Indeed, connections with remote populations are evidenced particularly from the conchiological record of all Natufian sites (Mienis, 1987; Bar-Yosef, in press), showing that trading with remote regions was highly developed during this period, and that obligate socio-economic mutualism had been already established between nomadic and sedentary populations.

The Avian Component in the "Broad Spectrum"

Diet of the Natufian and Early Neolithic Populations

During the Neolithic, the strategic solution in order to survive in a degrading and progressively-exhausted habitat was to rely more strongly on animal husbandry and farming. But during the early Natufian economical solutions should have been sorted out in other directions, and the ultimate ones followed the behavioral patterns of other vagile animals that shift into low mobility, as has been mentioned in the introduction, by adopting a wider ecological niche (=broader spectrum exploitation of the local resources, Flannery, 1972). In an analogous way to other large mammals with restricted mobility, the ultimate outcome of human sedentism triggered larger scale and much more intimate biological interactions with coexisting (=sympatric and syntopic) species.

A significant increase in the species diversity of terrestrial molluscs (Tchernov, 1991), birds and reptiles was recorded in the Natufian. The great majority of the species which were used for food, were either small sized animals, not at all used before the Natufian, among which many species of birds (in particular passeriformes) various species of lizards and snakes, fishes and land snails constituted a significant portion (Figure 2). All these non-rewarding small animals abruptly became very abundant and an integrative part of the food resources for the Natufian and early Neolithic villagers.

At the same time the earliest 'villagers' continued to practice intensive and specialized hunting of specific species of small and large game. Hence, the early sedentary populations were not only shifting into a broader dietary spectrum, and relying on a greater proportion of smaller ("lower ranked") animal species, but, contrary to earlier periods, they gradually focused their hunting efforts on specific species. The specialization toward hunting certain small species like *Lepus*, Phasianidae (mainly *Alectoris* and *Coturnix*) and Waterfowl in extremely high proportions and throughout the year, is well recorded in all Natufian and PPNA sites, and throughout their sequence. One of the main hunting targets among birds is the chukar partridge (*Alectoris chukar*). Its tarsometatarsi, especially their distal parts, for example, were regularly and intensively used as a raw material for manufacturing beads (Pichon, 1984, 1987, 1989). Other specializations were aimed towards waterfowl and birds of prey. Among the small mammals *Lepus* became the most popular prey. But *Gazella gazella* which always significantly outnumbers all other ungulates is still the main food resource of the Natufian people. The Natufians exerted also a highly sophisticated male selection culling on the local populations. The representation of males in the Natufian sites fluctuate between 60-80%, depending on the site and date (Horwitz et al., 1991).

SEDENTISM AND COMMENSALISM

One of the most interesting phenomena that followed the long term occupation of the Natufian sites is the abrupt appearance of commensals around human habitations (Tchernov, 1984, in press). When new habitats were created by the Natufians within and around the primeval villages, they attracted special colonizers, basically omnivorous and catholic vertebrates (mice, rats, wolves, sparrows, etc.), which found themselves co-existing broadly in and around the anthropogenic sites, the result of which was, on an evolutionary scale during a relatively short period, the development of indirect commensal relationships by the newly created subspecies or species.

These species are able to use human habitats and consequently might reduce to a minimum their gene exchanges with surrounding populations. Indeed, one of the most interesting phenomena that followed the long term occupation of the Natufian sites is the abrupt appearance of commensals around human habitations (Tchernov, 1984, in press). Once a more constant availability of food and/or shelter was provided, it could have attracted fostered (commensal) populations of certain species which would consequently gain an advantage over non-commensal ('wild') populations. Such one-sided symbiosis may increase the survivorship rate, especially of juveniles, of the active commensal partner due to a series of causes, among them:

1. Presence of kitchen middens within and around the sites could have been used as a permanent supply of food.

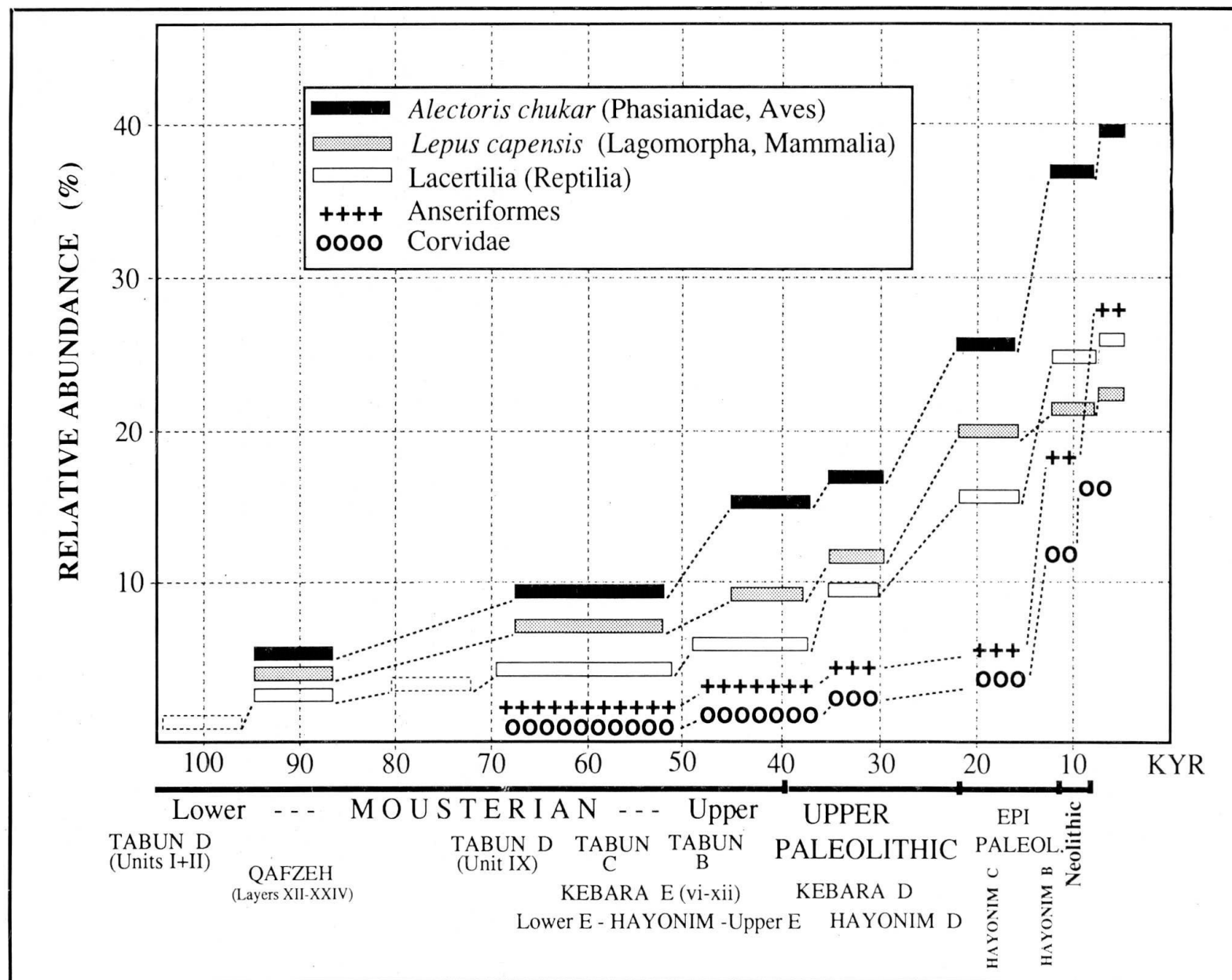


FIGURE 2 - The main changes in the subsistence strategy and feeding behavior of the Natufian sedentary people. The growing scarcity of large game forced people not only to broaden the spectrum of hunted animals, but to concentrate on a greater diversity of minor resources. Relative frequencies of *Lepus capensis* (MNI based on Pm_1 ; given in %) in relation to all rodents (MNI of M_1). An abrupt increase in the frequency of this species took place during the Epipaleolithic. The relative abundance of Lacertilia (lizards) and snakes, as compared to all rodent taxa. The MNI was based on lower jaw counts. Relative frequencies of *Alectoris chukar*, Anseriformes and Corvidae (given in %) in relation to all birds (based on MNI of humeri).

2. A relatively predator-free habitat; in particular an increase in the availability of protected dens and resting sites.

3. The proximity of intensive human activities may largely deter most of the other coexisting species. As a consequence, low species diversity in the close vicinity of the sites will decrease inter-specific competition, at the cost of increasing intra-specific competition, and hence high selection, genetic drift and consequently the amount of biological changes.

The most abundant commensals in the Middle East are *Mus domesticus*, *Rattus rattus*, *Rattus norvegicus* (late colonization), and *Acomys cahirinus* (restricted to semi-arid and arid regions) which belong to the Muridae, Rodentia; *Passer domesticus* (Ploceidae, Passeriformes), and *Columba livia* (Columbiformes). Carnivores like the jackal (*Canis aureus*) and the fox (*Vulpes vulpes*) may show accidental to more permanent associations with man in rural regions (a stage intermediate to plesiobiosis and early commensalism). The domestication of the dog, which could have been the consequence of an earlier commensal relationship between wolves and man, later played an important role in human behaviour which remains to this day.

Passer domesticus is not known prior to the Natufian, and much like *Mus domesticus*, could have been punctuationally speciated (Tchernov, 1962) from an ancestral form which I called *P. predomesticus*, and found to be closely related to the African sparrow *P. iagoensis* (Markus, 1964) (Figure 3).

The frequency distribution of skeletal elements of the house sparrow does not show whether this species was used in any way by the Natufians, in spite of its great abundance within and around their sites (at least at Hayonim cave) (Figure 4).

EXPLOITATION OF BIRDS IN THE PPNA

The onset of the early Neolithic may be placed in the southern Levant around 10,300-10,200 B.P. (based on dated wood, mainly *Tamarix*). The reading of C¹⁴ in phase BI and II in Murebet was around 10,600-10,500 B.P. Hence, there is no evidence for synchronicity for the onset of the Neolithic between the northern and southern Levant (Bar-Yosef, 1989). The Neolithic succession was determined and coined by Kenyon (1957) based on her excavations at Jericho, as Pre-Pottery Neolithic A, Pre-Pottery Neolithic B (PPNA, PPNB) and Pottery Neolithic (PN). The emergence of the large Early Neolithic communities (Cauvin, 1987; Bar-Yosef, 1989) was already associated with either cultivated or intensively collected wild barley. Exploitation of vegetal resources seems to have greatly increased (various legumes, oats, acorns, pistachio nuts and figs (Kislev et al., 1986), while the exploitation of animal resources seems to continue along with the Natufian tradition; specialized hunting of a large array of vertebrates, among which many small species of mammals, birds and reptiles are represented.

In many ways the PPNA may be accepted as a prolongation of the Natufian period. The economic basis was a mixture of cultivation of emmer, barley and legumes. Fruits and wild seeds were collected including nuts and acorns. Plant remains indicate the practice of cultivation of wild barley and the systematic gathering of seeds and fruits in the region up to about 10 km around each site. Specialized hunting and trapping of a large spectrum of animals, but in particular water birds, as well as selective hunting of gazelles and some fishing in a few sites, provided the meat component in

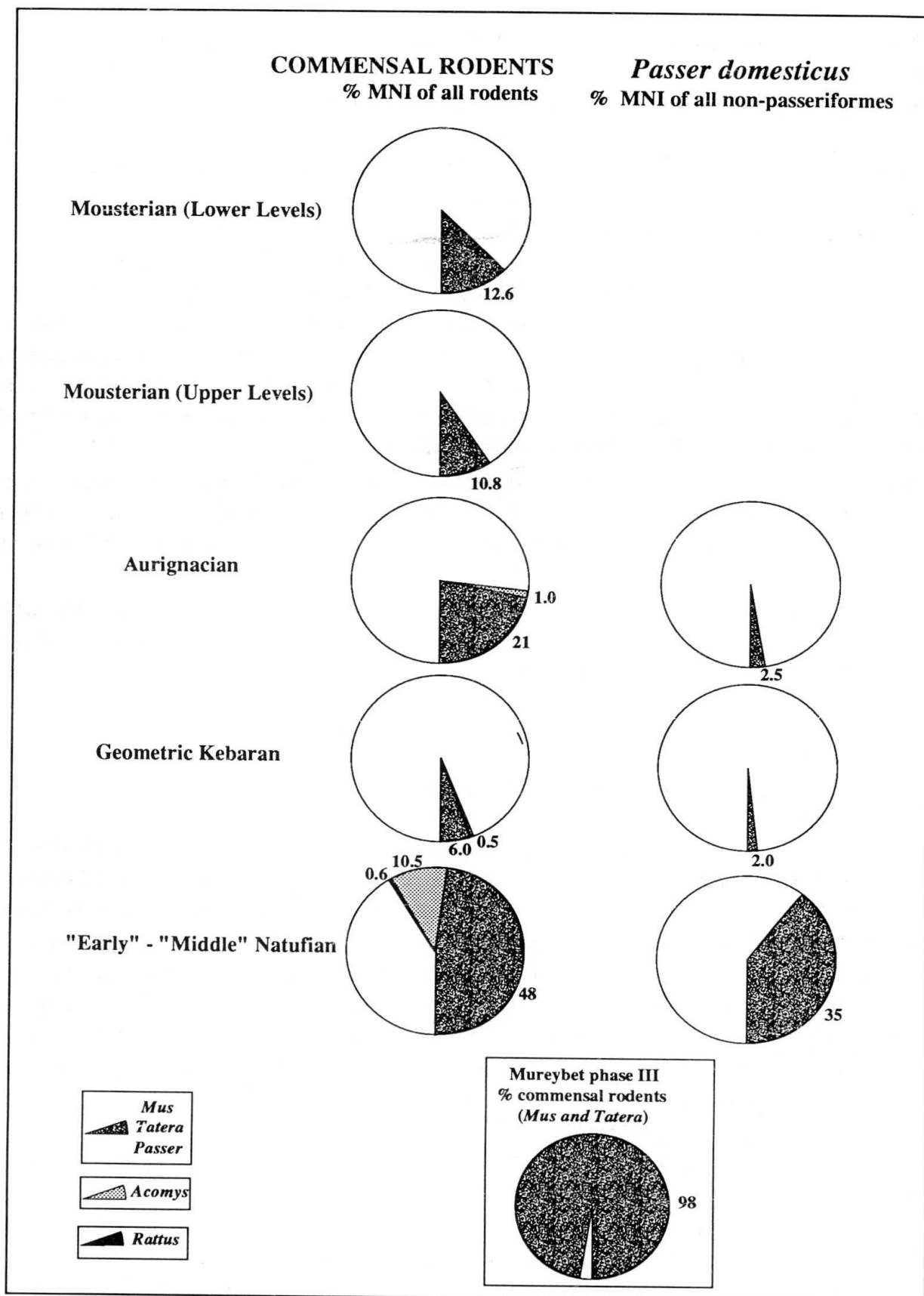


FIGURE 3 - Relative frequencies of commensal rodents (*Mus*, *Rattus* and *Acomys*, Muridae) and *Passer domesticus* (Ploceidae) from the Middle Paleolithic to the Natufian period.

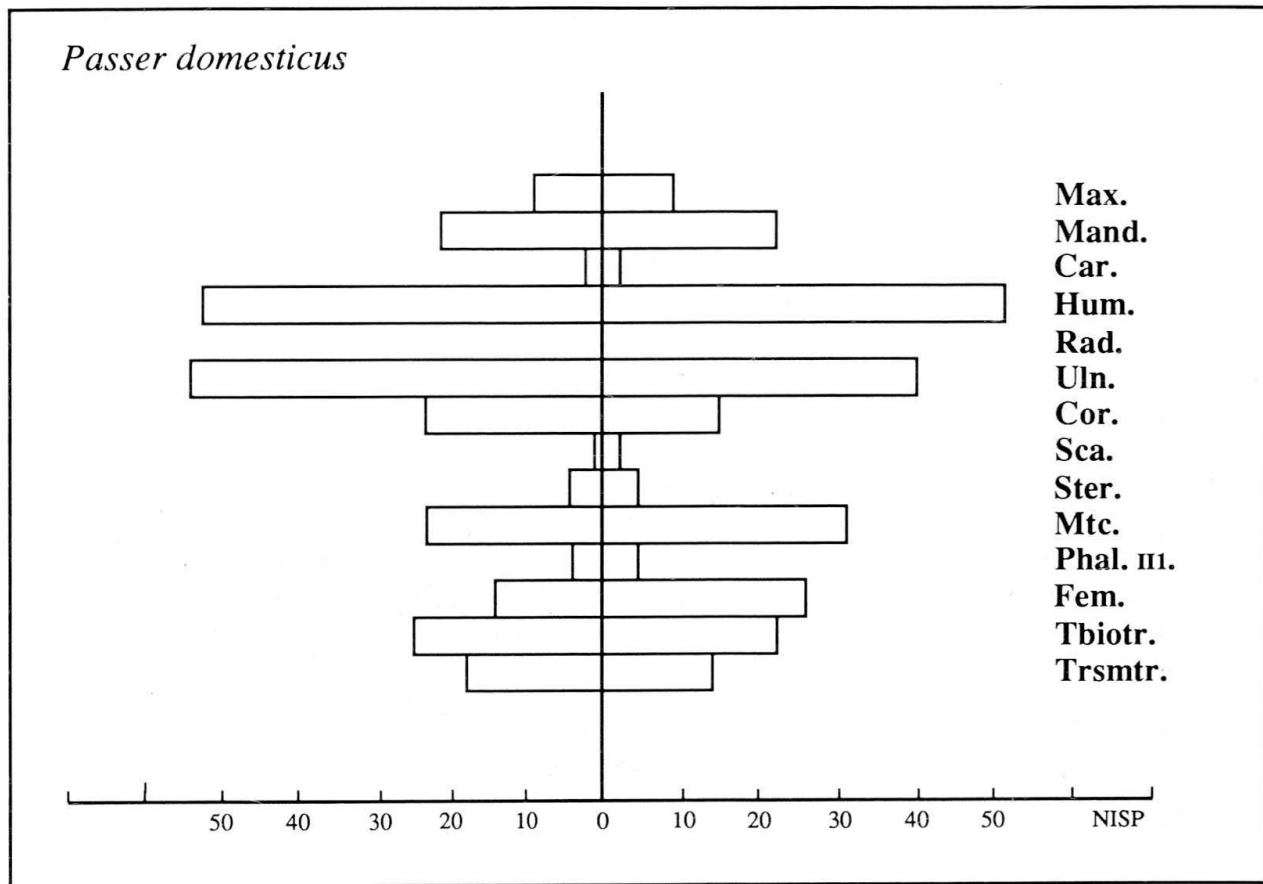


FIGURE 4 - A comparison of the relative representation of the skeletal parts of *Passer domesticus* from the Natufian layers of Hayonim cave. Modified after Pichon (1984).

the diet. In this respect, this strategy seems to be a direct continuation of the Natufian tradition. Gazelles were still the main game animal in the Mediterranean belt.

PPNA sites are not very common in the southern Levant, and much less information is available on the archaeozoology of this interim period between the Natufian early sedentism and the beginning of domestication in the PPNB period.

The mound of Netiv Hagdud lies (Figure 1) at about -190/-200 m below sea level at the outlet of Wadi Kakar, 14 km north to Jericho (Bar-Yosef et al., 1991). The site of Netiv Hagdud in the Jordan Valley was recently analyzed in some detail, and may cast more light on the exploitation of animals and birds during this period.

Increase in the exploitation of a large spectral array of animal species, grains and plants, could have been only the consequence of overuse of an area and draining the food resources for a long period of time (Tchernov, in press). The traditional sources of animal species hunted for meat under these conditions, became insufficient so that sedentary human populations were enforced to rely on much less energetically (amount of meat per catch) rewarding animals, and many small species became newly and highly represented in all Natufian layers (Figure 5). But it is not only the almost revolutionary broadening of the exploited animal species what is intriguing, but the specialization toward hunting certain small species (like *Lepus* and *Alectoris*) in extremely high proportions and

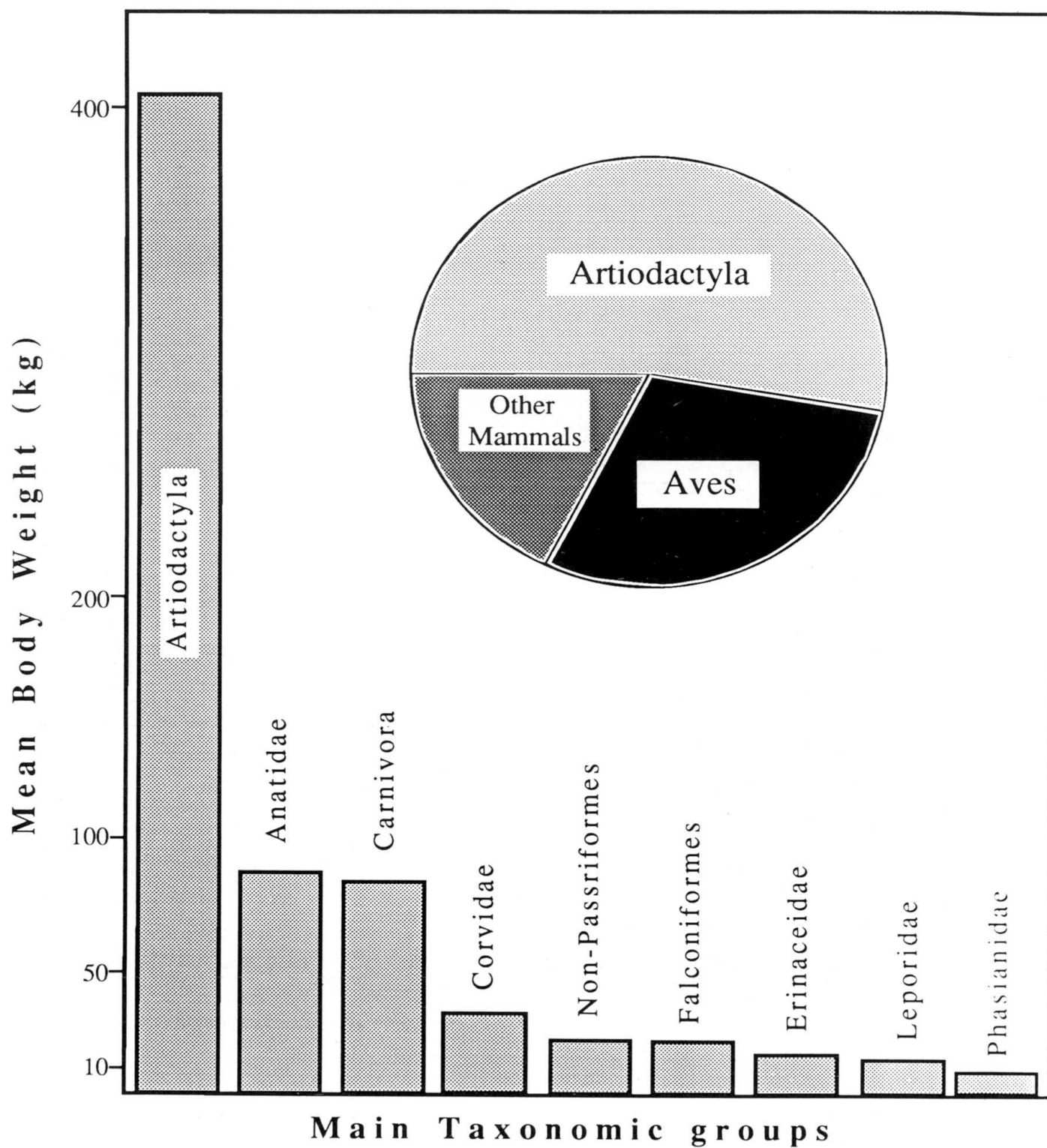


FIGURE 5 - The gross proportion of the mean body weight (given in Kg) of the main taxonomic groups that were exploited by the PPNA people in the site of Netiv Hagdud.

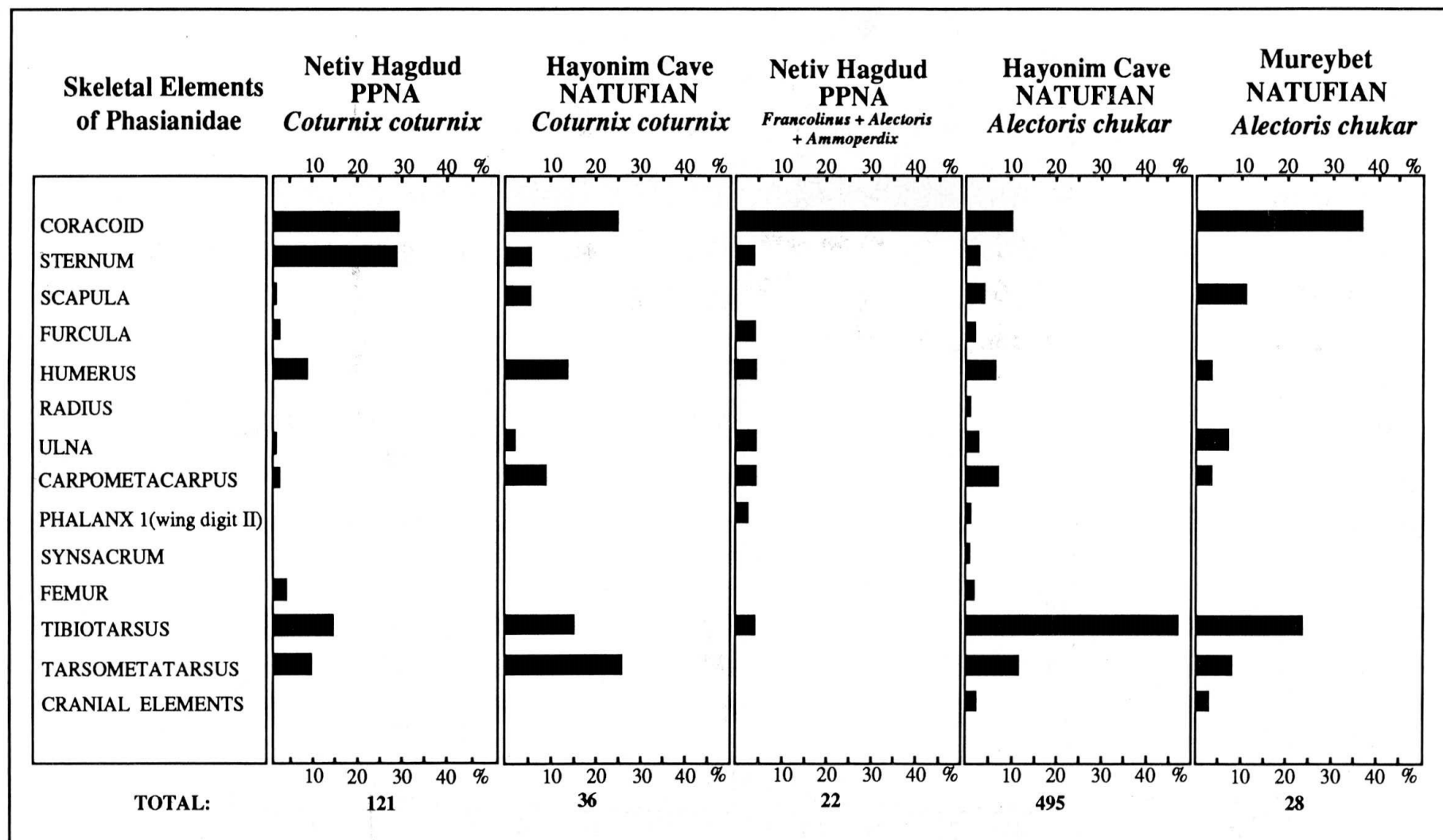


FIGURE 6 - A comparison of the relative representation of the skeletal parts of several species of Phasianidae in PPNA and Natufian sites. There is a clear preference for the coracoid (as well as all the "triosseum" complex in Netiv Hagdud), probably indicating a special exploitation of the pectoral muscles. The tibiotarsus and the tarsometatarsus appear also in abundance in most of the sites. The distal part of the tarsometatarsus of *Alectoris chukar* was intensively used during the Natufian period for manufacturing beads (Pichon, 1984).

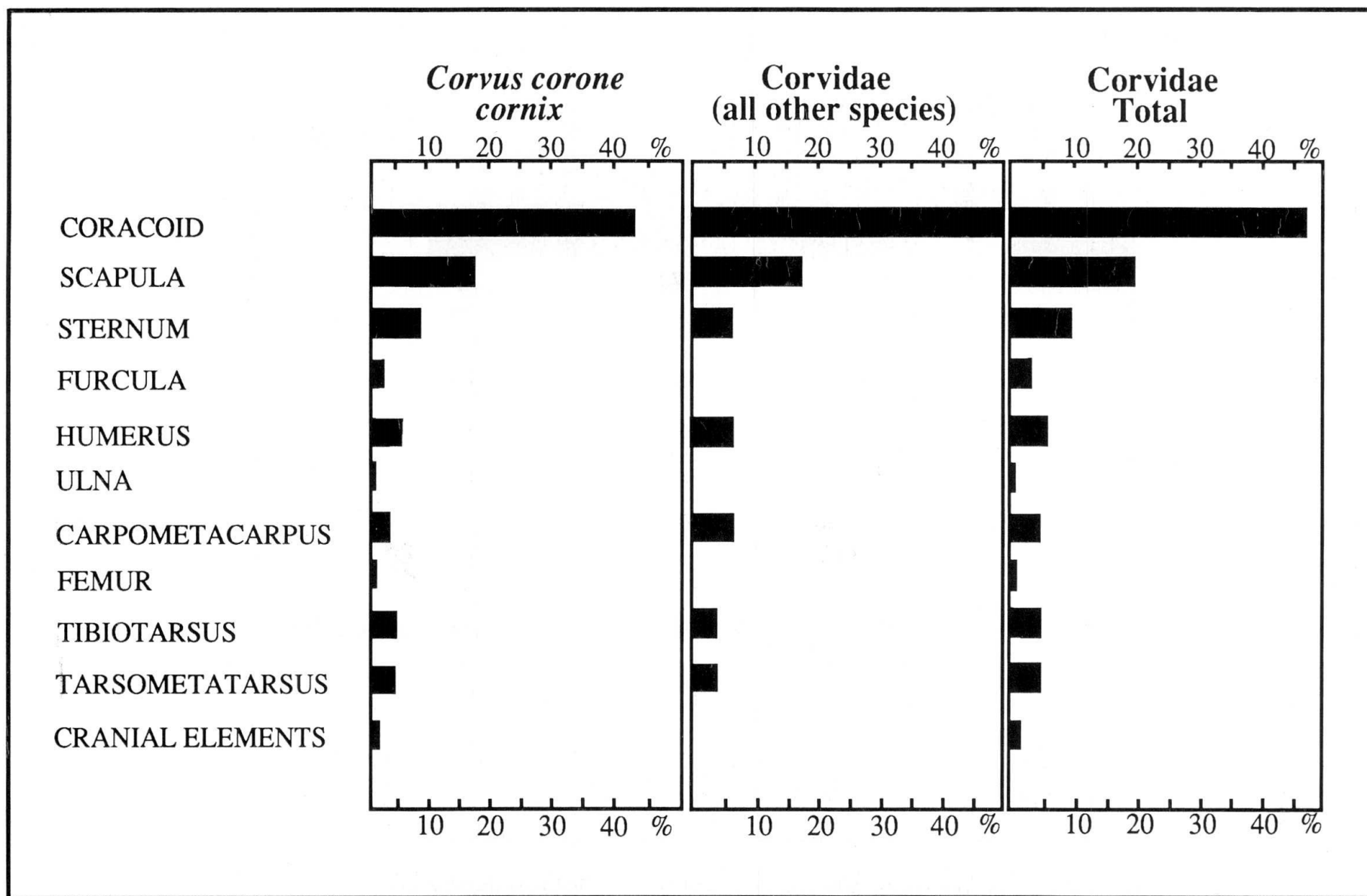


FIGURE 7 - A relative representation of the skeletal parts of Corvidae, mainly *Corvus corone* from the PPNA of Netiv Hagdud. There is a conspicuous preference for the "triosseum" complex, or the pectoral muscles of this group which was heavily exploited by the community of Netiv Hagdud.

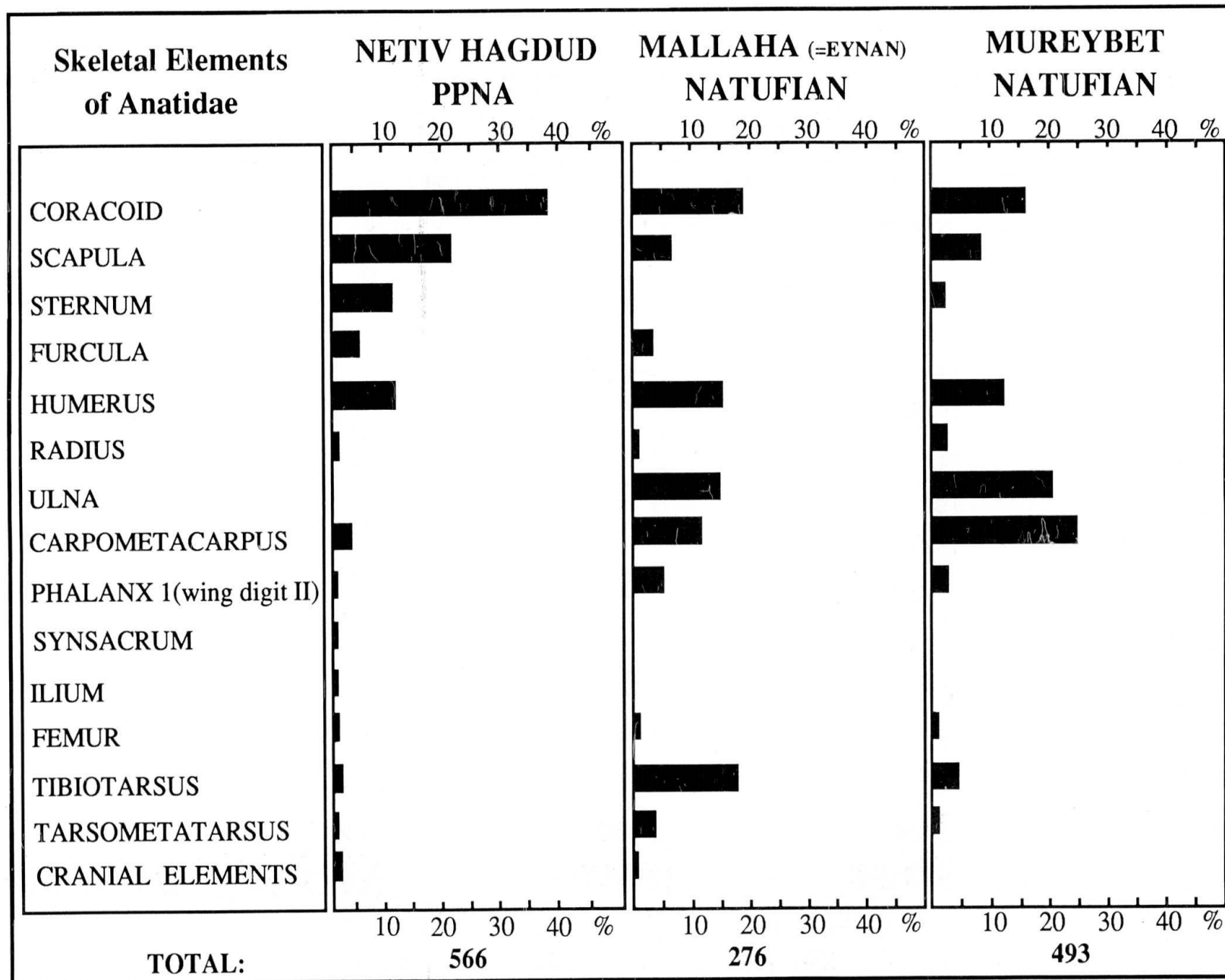


FIGURE 8 - A comparison of the relative representation of the skeletal parts of ducks (Anatidae) in the PPNA of Netiv Hagdud and two Natufian sites. There is a general preference for the "triosseum" complex in both periods. There is, however, higher selection for the wing and foot portions during the Natufian.

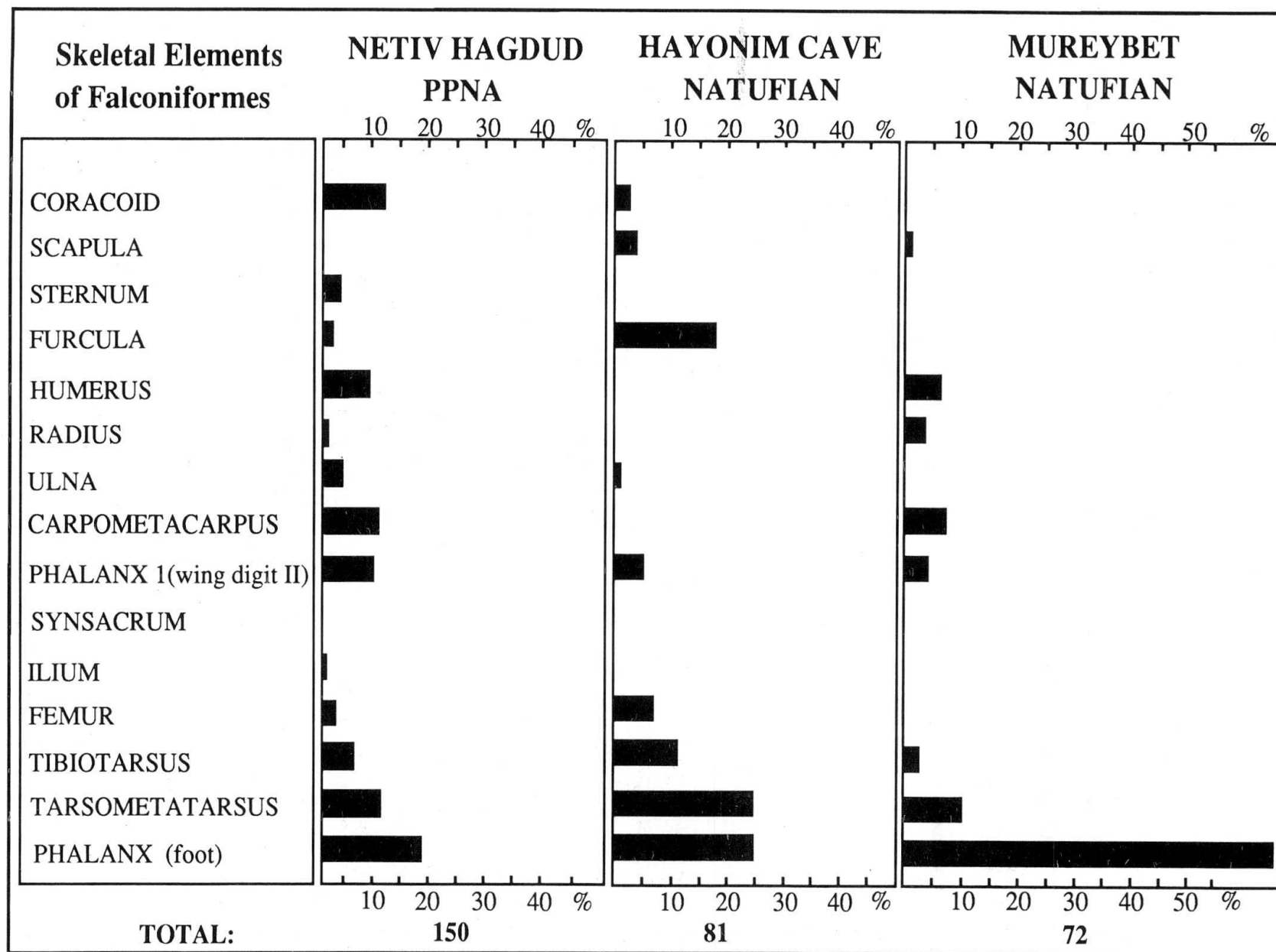


FIGURE 9 - A comparison of the relative representation of the skeletal parts of several species of falconiform birds in PPNA and Natufian sites. During these periods there is a clear preference for collecting foot phalanxes, as well as tarsometatarsi and tibiotarsi. As for other skeletal elements there is no consistent pattern among the sites.

Skeletal Elements	<i>C. coturnix</i>		<i>Francolinus+Alectoris</i> <i>+Ammoperdix</i>		<i>Alectoris chukar</i>		<i>C.coturnix</i>		<i>Alectoris chukar</i>	
SITES	N e t i v H a g d u d ^(a)				H a y o n i m C a v e ^(b)				M u r e y b e t ^(b)	
	P	P	N	A	N a t u f i a n				N a t u f i a n	
Skeletal Elements	n	%	n	%	n	%	n	%	n	%
Cranial elements	-	-	-	-	11	2.2	-	-	1	3.6
Coracoid	35	28.9	12	55.2	51	10.3	9	25.0	10	35.6
Sternum	34	28.1	1	4.6	15	3.0	2	5.6	-	-
Scapula	1	0.8	-	-	22	4.4	2	5.6	3	10.7
Furcula	2	1.7	1	4.6	13	2.6	-	-	-	-
Humerus	11	9.1	1	4.6	34	6.9	5	13.8	1	3.6
Ulna	1	0.8	1	4.6	12	2.4	1	2.8	2	7.2
Radius	-	-	-	-	3	0.6	-	-	-	-
Carpometacarpus	1	1.7	1	4.6	36	7.3	3	8.4	1	3.6
Wing phalanx II	-	-	-	-	8	1.6	-	-	-	-
Pelvical elements	-	-	-	-	5	1.0	-	-	-	-
Femur	5	4.1	-	-	9	1.8	-	-	-	-
Tibiotarsus	18	14.9	1	4.6	214	43.3	5	13.9	8	28.5
Tarsometatarsus	12	9.9	4	17.2	62	12.6	9	25.0	2	7.2
Total	121	100	22	100	495	100	36	100	28	100

TABLE 1 - Number of skeletal elements and their percentage representation in the Phasianidae in natufian and PPNA sites.

(a) Tchernov, unpublished data; (b) Pichon (1984, 1987).

Skeletal Elements	<i>Corvus corone cornix</i>	<i>Corvus monedula</i>	<i>Corvus ruficollis</i>	<i>Corvus rhipidurus</i>	<i>Pica pica</i>	Corvidae Total
Coracoid	144 (44.31%)	10 (43.48%)	2 (100%)	-	4 (100%)	160 (45.07%)
Scapula	60 (18.46%)	5 (21.74%)	-	-	-	65 (18.31%)
Sternum	32 (9.85%)	1 (4.34%)	-	1 (100%)	-	34 (9.58%)
Furcula	11 (3.38%)	-	-	-	-	11 (3.10%)
Humerus	19 (5.84%)	2 (8.69%)	-	-	-	21 (5.91%)
Ulna	3 (0.92%)	-	-	-	-	3 (0.84%)
Carpometacarpus	14 (4.31%)	2 (8.69%)	-	-	-	16 (4.54%)
Phalanx 1, wing digit III	1 (0.31%)	-	-	-	-	1 (0.28%)
Ilium	1 (0.31%)	-	-	-	-	1 (0.28%)
Femur	4 (1.23%)	-	-	-	-	4 (1.13%)
Tibiotarsus	12 (3.69%)	1 (4.34%)	-	-	-	13 (3.66%)
Tarsometatarsus	18 (5.54%)	1 (4.34%)	-	-	-	19 (5.35%)
Upper Jaw	1 (0.31%)	-	-	-	-	1 (0.28%)
Lower Jaw	3 (0.92%)	1 (4.34%)	-	-	-	4 (1.13%)
Quadratum	2 (0.62%)	-	-	-	-	2 (0.56%)
Total	325	23	2	1	4	Grand Total: 355
M.N.I.	72 (=144/2 corac.)	5 (=10/2 corac.)	1 (=2/1 corac.)	1	2 (=4/2 corac.)	80 (=160/2 corac.)
Total Weight Estimation (kg)*	72x395= 28.440	5x240= 1.200	0.675	0.440	2x175= 0.350	Total: 31.105

TABLE 2 - Number of skeletal elements and their percentage representation in the family Corvidae and the minimum number of individuals (MNI). Assuming that each hunted individual reflects a complete carcass consumed in the site, the meat weight estimations also represented. Weights of the Corvidae were recorded by the author. (*) The weight of: *Corvus corone cornix*: 330-460 g (x=395), *Corvus monedula*: 190-290 g (x=240), *Corvus ruficollis*: 500-850 g (x=675), *Corvus rhipidurus*: 330-550 g (x=440), *Pica pica*: 150-200 g (x=175).

Anatidae	Netiv Hagdud ^(a)		Mallaha (Eynan) ^(b)		Mureybet ^(b)	
	P	P N A	N	A	N	A
Skeletal Elements	n	%	n	%	n	%
Coracoid	219	38.7	53	19.2	78	15.9
Scapula	129	22.8	24	8.7	42	8.5
Sternum	64	11.3	-	-	10	2.0
Furcula	39	6.9	8	2.9	-	-
Humerus	67	11.8	43	15.6	73	14.9
Radius	4	0.7	4	1.5	14	2.8
Ulna	-	-	41	14.9	98	19.9
Carpometacarpus	20	3.5	28	10.2	123	24.9
Wing phalanx II	1	0.2	14	5.1	15	3.0
Synsacrum	1	0.2	-	-	-	-
Femur	4	0.7	3	1.1	5	1.0
Tibiotarsus	6	1.1	43	15.6	27	5.5
Tarsometatarsus	1	0.2	13	4.8	8	1.6
Cranial elements	10	1.7	2	0.7	-	-
Total	566	100	276	100	493	100

TABLE 3 - Number of skeletal elements and their percentage representation in the family Anatidae in natufian and PPNA sites. (a) Tchernov, unpublished data. Based on the following species: *Anas platyrhynchos*, *Anas querquedula*, *Anser albifrons*; (b) After Pichon (1984, 1987). Based on the following species: *Anas platyrhynchos*, *Anas querquedula*, *Anas clypeata*, *Anas crecca*, *Marmaronetta angustirostris*; *Aythya* spp., *Tadorna tadorna*, *Bucephala clangula*.

SITES	Netiv Hagdud ^(a)		Hayonim ^(b)		Mureybet ^(b)	
	P	P N A	N	A	N	A
Skeletal Elements of Falconiformes	n	%	n	%	n	%
Coracoid	19	12.7	2	2.5	-	-
Scapula	-	-	3	3.7	1	1.4
Sternum	6	4.0	-	-	-	-
Furcula	3	2.0	14	17.3	-	-
Humerus	13	8.7	-	-	4	5.6
Radius	1	0.7	-	-	2	2.8
Ulna	7	4.7	1	1.2	-	-
Carpometacarpus	17	11.3	5	6.2	5	6.9
Wing phalanx II	16	10.7	1	1.2	3	4.2
Synsacrum	1	0.7	-	-	-	-
Femur	7	4.7	6	7.4	-	-
Tibiotarsus	13	8.7	9	11.1	2	2.8
Tarsometatarsus	18	12.0	20	24.7	8	11.1
Foot phalanges	29	19.1	20	24.7	47	65.2
Cranial elements	-	-	-	-	-	-
Total	150	100	81	100	72	100

TABLE 4 - Number of skeletal elements and their percentage representation in the Falconiformes in natufian and PPNA sites. (a) Based on the following species: *Milvus migrans*, *Buteo* spp., *Pernis apivorus*, *Aquila* spp., *Falco* spp., *Accipiter* spp., and undetermined Falconiformes. Tchernov, unpublished data; (b) Based on the following species: *Buteo* spp., *Aquila* spp., *Falco* spp., Pichon (1984, 1987).

throughout the year (Pichon, 1989). The abrupt increase in the amount of Phasianidae (*Alectoris chukar*) and waterfowl (mainly Anatidae) is clearly shown in Figure 2. The body part frequencies of partridges indicate that very often, and in contrast with the ducks, they did bring the whole body (not the skull though) to the site, but from most of the species they selected only the legs that included femora, tibiotarsi, tarsometatarsi and many phalanges that could have been used, especially the sharp claws, as tools. Figures 6 to 9 and Tables 1 to 4 show the different preferences for body parts obtained from each one of the avian groups. The impression gained is that raptors were used for different purposes and not only as a food resource. For example, the tarsometatarsi of *Alectoris chukar* (Table 1; Figure 6), especially their distal parts, were regularly and intensively used as raw material for manufacturing beads (see details in Pichon, 1984, 1987, 1989).

But when dealing with some other common groups of birds the purpose of use becomes still clearer. All groups of birds of great importance in terms of biomass (Anatidae, Phasianidae and Corvidae but not Falconiformes) (Tables 1 to 4; Figures 6 to 9) show a clear preference for the "triosseum" complex; scapula, coracoid and sternum, on which the "breast" muscles, pectoralis major and pectoralis minor, are attached. Obviously the purpose of carrying this special part of the body was for specific exploitation of these massive and clean muscles, yet very lean. Some other less common non-passeriform groups of birds show a much higher frequency of the pectoral girdle.

For the Falconiformes a completely different selective attitude is exemplified by the relative frequency of their skeletal elements (Table 4; Figure 9). In this group legs (tarsometatarsi but in particular the phalanges) were more frequently selected and transported to the home base, while coracoids and sternebrae of all the raptors are largely absent, except for *Milvus migrans* and the unidentified falconiforms, the majority of which may anyhow belong to *Milvus migrans*. It is hence reasonable to assume that, in contrast with all other raptors, kites were also used as a food resource in a similar procedure as ducks by tearing the pectoral muscles out of the carcass. In general foot elements are much more abundant than elements from the pectoral girdle and the forelimbs. Obviously the local inhabitants handled most of the falconiformes differently. The body part frequencies indicate that very often, and in contrast with the ducks, they did bring the whole body (not the skull though) to the site area, but of most species they selected only the legs, mainly the phalanges, from which the sharp claws could have been used as tools.

Although there is a plethora of avian material, mainly from the Natufian period (Hayonim Terrace, Hayonim cave (Layer B), Eynan (=Mallaha) and Hatoula) which still awaits a thorough research from different paleobiological and zooarchaeological perspectives, some concluding results from the Natufian and early Neolithic (PPNA, PPNB) avifaunas can be already made in the southern Levant. The systematic list which is given in Tables 5 a,b,c, summarizes the updated information of all the birds from this region during this period. This list can therefore be used as a basic reference for further ornithoarchaeological studies in the region and this publication is a unique opportunity to make the summarized data available for the first time to a larger audience of faunal analysts and archaeologists in general.

HAYONIM CAVE ^(a)	MALLAHA ^(a)	MUREYBET ^(a)	NETIV HAGDUD ^(b)	GILGAL ^(c)	JERICO ^(d)	JERICO ^(d)	'AIN GHAZAL ^(e)
N A T U F I A N			P P N A			P P N B	
Podicipitiformes	Podicipitiformes	Podicipitiformes	Podicipitiformes	Podicipitiformes	Podicipitiformes	Podicipitiformes	Podicipitiformes
-	<i>Podiceps cristatus</i>	-	-	-	-	-	-
-	<i>Podiceps nigricollis</i>	<i>Podiceps nigricollis</i>	-	-	-	-	-
-	<i>Tachybaptus ruficollis</i>	-	-	-	-	-	-
-	-	-	Pelecaniformes	Pelecaniformes	Pelecaniformes	Pelecaniformes	Pelecaniformes
-	<i>Palacrocorax carbo</i>	-	-	-	-	-	-
-	<i>Phalacrocorax pygmaeus</i>	-	-	-	-	-	-
-	-	-	-	-	-	-	-
Ralliformes	Ralliformes	Ralliformes	Ralliformes	Ralliformes	Ralliformes	Ralliformes	Ralliformes
<i>Rallus aquaticus</i>	<i>Rallus aquaticus</i>	-	-	-	-	-	-
<i>Crex crex</i>	-	-	-	-	-	-	-
<i>P. porzana</i>	-	<i>P. porzana</i>	-	-	-	-	-
<i>Fulica atra</i>	<i>Fulica atra</i>	-	<i>Fulica atra</i>	-	-	-	-
<i>Gallinula chloropus</i>	<i>Gallinula chloropus</i>	-	-	-	-	-	-
-	<i>P. porphyrio</i>	-	-	-	-	-	-
Charadriiformes	Charadriiformes	Charadriiformes	Charadriiformes	Charadriiformes	Charadriiformes	Charadriiformes	Charadriiformes
<i>V. vanellus</i>	-	-	-	-	-	-	-
-	-	-	<i>Hoplopterus spinosus</i>	<i>Hoplopterus spinosus</i>	-	-	-
-	-	<i>Philomachus pugnax</i>	-	-	-	-	-
-	-	<i>Tringa stagnatilis</i>	-	-	-	-	-
-	<i>Tringa nebularia</i>	<i>Tringa nebularia</i>	-	-	-	-	-
-	-	-	-	-	-	-	-
-	<i>Scolopax rusticola</i>	-	-	-	-	-	-
-	-	-	-	-	<i>Numenius arquata</i>	-	-
Gruiformes	Gruiformes	Gruiformes	Gruiformes	Gruiformes	Gruiformes	Gruiformes	Gruiformes
-	-	-	-	-	-	<i>G. grus</i>	-
-	-	-	-	-	<i>Anthropoides virgo</i>	-	-
<i>T. tetrax</i>	-	<i>T. tetrax</i>	-	-	-	-	-
<i>Otis tarda</i>	<i>Otis tarda</i>	-	<i>Otis tarda</i>	-	-	-	cf. <i>Otis tarda</i>
<i>Chlamydotis undulata</i>	-	-	-	-	<i>Chlamydotis undulata</i>	<i>Chlamydotis undulata</i>	cf. <i>Chlamydotis undulata</i>
-	-	-	-	-	-	-	-
Ciconiiformes	Ciconiiformes	Ciconiiformes	Ciconiiformes	Ciconiiformes	Ciconiiformes	Ciconiiformes	Ciconiiformes
-	-	-	<i>Leptoptilus crumeniformes</i>	-	-	-	-
-	<i>Ardea cinerea</i>	<i>Ardea cinerea</i>	-	-	-	-	-
-	-	<i>Egretta alba</i>	-	-	-	-	-
-	<i>Egretta garzetta</i>	<i>Egretta garzetta</i>	-	-	-	-	-
-	-	-	-	-	<i>Ciconia niger</i>	-	-
-	<i>Ciconia ciconia</i>	-	<i>Ciconia ciconia</i>	-	-	-	-
-	-	-	-	-	<i>Columba oenas</i>	-	-
Columbiformes	Columbiformes	Columbiformes	Columbiformes	Columbiformes	Columbiformes	Columbiformes	Columbiformes
<i>Columba livia</i>	<i>Columba livia</i>	<i>Columba livia</i>	<i>Columba livia</i>	<i>Columba livia</i>	-	-	<i>Columba livia</i>
<i>Columba palumbus</i>	-	-	-	-	-	-	-
<i>Streptopelia</i> spp.	-	<i>Streptopelia</i> sp.	<i>Streptopelia decaocto</i>	<i>Streptopelia</i> sp.	-	-	-
<i>Pterocles alchata</i>	-	-	-	-	-	-	-

TABLE 5a -A comparison of the avifaunal assemblages in several natufian, PPNA and PPNB sites in the southern Levant. (a) Pichon (1984, 1987); (b) Tchernov, unpublished data; (c) Noy et al., 1980; (d) G.S. Cowles & J. Blandemar, personal communication; (e) Köhler-Rollefson (1988, 1989).

HAYONIM CAVE ^(a)	MALLAHA ^(a)	MUREYBET ^(a)	NETIV HAGDUD ^(b)	GILGAL ^(c)	JERICHO ^(d)	JERICHO ^(d)	'AIN GHAZAL ^(e)
N A T U F I A N			P P N A			P P N B	
Anseriformes	Anseriformes	Anseriformes		Anseriformes	Anseriformes	Anseriformes	Anseriformes
<i>T. tadorna</i>	<i>T. tadorna</i>	<i>T. tadorna</i>	<i>T. tadorna</i>	<i>T. tadorna</i>	-	-	-
-	<i>Casarca ferruginea</i>	-	-	-	-	-	-
<i>A. anser</i>	<i>A. anser</i>	<i>A. anser</i>	-	-	-	<i>A. anser</i>	-
-	<i>Anser erythropus</i>	-	-	-	-	-	-
<i>Anser albifrons</i>	-	-	<i>Anser albifrons</i>	<i>Anser albifrons</i>	-	-	-
-	<i>Anas penelope</i>	<i>Anas penelope</i>	-	-	-	-	cf. <i>Anas</i> sp.
<i>Anas crecca</i>	<i>Anas crecca</i>	<i>Anas crecca</i>	-	-	<i>Anas crecca</i>	<i>Anas crecca</i>	-
-	<i>Anas querquedula</i>	<i>Anas querquedula</i>	<i>Anas querquedula</i>	<i>Anas</i> sp.	-	-	-
<i>Anas platyrhynchos</i>	<i>Anas platyrhynchos</i>	<i>Anas platyrhynchos</i>	<i>Anas platyrhynchos</i>	<i>Anas platyrhynchos</i>	<i>Anas platyrhynchos</i>	<i>Anas platyrhynchos</i>	-
-	<i>Anas acuta</i>	<i>Anas acuta</i>	-	-	-	-	-
-	<i>Anas clypeata</i>	<i>Anas clypeata</i>	-	-	-	-	-
-	<i>Marmaronetta angustirostris</i>	<i>Marmaronetta angustirostris</i>	-	-	-	-	-
-	-	<i>Netta rufina</i>	-	-	-	-	-
-	<i>Aythya ferina</i>	<i>Aythya ferina</i>	-	-	-	-	cf. <i>Aythya</i> sp.
<i>Aythya nyroca</i>	<i>Aythya nyroca</i>	<i>Aythya nyroca</i>	-	-	-	-	-
<i>Aythya fuligula</i>	<i>Aythya fuligula</i>	<i>Aythya fuligula</i>	-	-	-	-	-
-	<i>Aythya marila</i>	<i>Aythya marila</i>	-	-	-	-	-
-	<i>Melanitta fusca</i>	-	-	-	-	-	-
-	<i>Bucephala clangula</i>	<i>Bucephala clangula</i>	-	-	-	-	-
-	<i>Mergus albellus</i>	<i>Mergus albellus</i>	-	-	-	-	-
-	-	<i>Mergus serrator</i>	-	-	-	-	-
-	<i>Mergus merganser</i>	-	-	-	-	-	-
-	<i>Oxyura leucocephala</i>	-	-	-	-	-	-
-	<i>Cygnus</i> sp.	-	-	-	<i>C. cygnus</i>	-	-
Falconiformes	Falconiformes	Falconiformes	Falconiformes	Falconiformes	Falconiformes	Falconiformes	Falconiformes
<i>Pandion haliaëtus</i>	<i>Pandion haliaëtus</i>	<i>Pandion haliaëtus</i>	-	-	-	-	-
-	-	-	<i>Pernis apivorus</i>	-	-	-	-
-	-	-	-	-	<i>M. milvus</i>	-	-
-	-	<i>Milvus migrans</i>	<i>Milvus migrans</i>	-	<i>Milvus migrans</i>	<i>Milvus migrans</i>	-
<i>Neophron percnopterus</i>	-	-	-	-	-	-	<i>Neophron percnopterus</i>
<i>Gyps fulvus</i>	-	-	-	-	-	-	-
<i>Aegypius monachus</i>	-	-	-	-	-	-	-
-	-	<i>Circus macrourus</i>	<i>Circus</i> sp.	-	-	-	<i>Circus</i> sp.
-	-	<i>Circus pygargus</i>	-	-	-	-	-
-	-	<i>Circus aeruginosus</i>	-	-	-	-	-
<i>Accipiter nisus</i>	-	<i>Accipiter nisus</i>	<i>Accipiter</i> sp.	-	<i>Accipiter nisus</i>	-	<i>Accipiter</i> small sp.
<i>Accipiter gentilis</i>	-	<i>Accipiter gentilis</i>	-	-	<i>Accipiter gentilis</i>	<i>Accipiter gentilis</i>	<i>Accipiter gentilis</i>
<i>B. buteo</i>	<i>B. buteo</i>	<i>B. buteo</i>	<i>B. buteo</i>	<i>B. cf. buteo</i>	-	-	<i>B. buteo</i>
<i>Buteo rufinus</i>	<i>Buteo rufinus</i>	<i>Buteo rufinus</i>	<i>Buteo rufinus</i>	-	-	-	-
-	-	-	-	-	-	-	<i>Aquila cf. rapax</i>
<i>Aquila pomarina</i>	-	-	<i>Aquila pomarina</i>	-	-	-	-
-	-	<i>Aquila clanga</i>	<i>Aquila</i> sp.	-	<i>Aquila clanga</i>	<i>Aquila</i> sp.	-
<i>Aquila chrysaetos</i>	-	<i>Aquila chrysaetos</i>	-	-	<i>Aquila chrysaetos</i>	-	<i>Aquila chrysaetos</i>
<i>Falco naumanni</i>	-	<i>Falco naumanni</i>	<i>Falco</i> spp.	-	-	-	-
<i>Falco tinnunculus</i>	-	<i>Falco tinnunculus</i>	-	-	-	-	-
<i>Falco subbuteo</i>	-	<i>Falco subbuteo</i>	-	-	-	-	-

TABLE 5b - A comparison of the avifaunal assemblages in several natufian, PPNA and PPNB sites in the southern Levant. (a) Pichon (1984, 1987); (b) Tchernov, unpublished data; (c) Noy et al., 1980; (d) G.S. Cowles & J. Blandermar, personal communication; (e) Köhler-Rollefson (1988, 1989).

HAAYONIM CAVE ^(a)	MALLAHA ^(a)	MUREYBET ^(a)	NETIV HAGDUD ^(b)	GILGAL ^(c)	JERICHO ^(d)	JERICHO ^(d)	'AIN GHAZAL ^(f)
N A T U F I A N			P P N A			P P N B	
Galliformes	Galliformes	Galliformes	Galliformes	Galliformes	Galliformes	Galliformes	Galliformes
-	-	<i>P. perdix</i>	-	<i>T. tadorna</i>	-	-	-
<i>Alectoris chukar</i>	<i>Alectoris chukar</i>	<i>Alectoris chukar</i>	<i>Alectoris chukar</i>	<i>Alectoris chukar</i>	<i>Alectoris chukar</i> *	<i>Alectoris chukar</i> *	<i>Alectoris chukar</i>
-	-	<i>F. francolinus</i>	<i>F. francolinus</i>	-	-	-	-
-	-	-	<i>Ammoperdix hay</i>	-	-	-	-
<i>C. coturnix</i>	<i>C. coturnix</i>	-	<i>C. coturnix</i>	-	<i>C. coturnix</i>	-	<i>C. coturnix</i>
<i>Phasianus colchicus</i>	-	-	-	-	-	-	-
Strigiformes	Strigiformes	Strigiformes	Strigiformes	Strigiformes	Strigiformes	Strigiformes	Strigiformes
<i>Tyto alba</i>	-	-	-	-	-	<i>Anas crecca</i>	-
-	<i>B. bubo</i>	-	-	-	-	-	-
<i>Asio otus</i>	-	<i>Asio otus</i>	-	-	-	-	cf. <i>Asio</i> sp.
<i>Otus scops</i>	-	<i>Asio flammeus</i>	-	-	-	-	-
<i>Athene noctua</i>	-	<i>Athene noctua</i>	<i>Athene noctua</i>	-	-	-	-
<i>Strix aluco</i>	-	-	-	-	-	-	-
Apodiformes	Apodiformes	Apodiformes	Apodiformes	Apodiformes	Apodiformes	Apodiformes	Apodiformes
<i>Apus affinis</i>	-	-	-	-	-	-	-
Coraciiformes	Coraciiformes	Coraciiformes	Coraciiformes	Coraciiformes	Coraciiformes	Coraciiformes	Coraciiformes
<i>Alcedo atthis</i>	-	-	-	-	-	-	-
<i>Merops apiaster</i>	-	-	-	-	-	-	-
<i>Coracias garrulus</i>	-	<i>Coracias garrulus</i>	-	-	-	-	-
<i>Upupa epops</i>	-	-	-	-	-	-	-
Passeriformes	Passeriformes	Passeriformes	Passeriformes	Passeriformes	Passeriformes	Passeriformes	Passeriformes
<i>Melanocorypha calandra</i>	-	-	<i>Melanocorypha calandra</i>	-	-	-	-
<i>Galerida cristata</i>	-	-	<i>Galerida cristata</i>	-	-	-	-
<i>Alauda arvensis</i>	-	-	-	-	-	-	-
<i>Hirundo</i> 2 spp.	-	-	-	-	-	-	-
-	-	-	<i>Pycnonotus xanthopygos</i>	-	-	-	-
<i>Motacilla</i> 2 spp.	-	-	-	-	-	-	-
-	-	-	<i>Lanius excubitor</i>	-	-	-	-
<i>Lanius</i> spp.	-	-	-	-	-	-	-
<i>T. troglodytes</i>	-	-	-	-	-	-	-
<i>Nectarinia osaea</i>	-	-	-	-	-	-	-
<i>Šaxicola torquata</i>	-	-	-	-	-	-	-
<i>Oenanthe</i> 2 spp.	-	<i>Oenanthe hispanica</i>	-	-	-	-	-
<i>Monticola solitarius</i>	-	-	-	-	-	-	-
<i>Phoenicurus ochruros</i>	-	-	-	-	-	-	-
<i>Erithacus rubecula</i>	-	-	-	-	-	-	-
<i>Luscinia</i> 2 spp.	-	-	-	-	-	-	-
<i>Turdus</i> 3 spp.	-	-	<i>Turdus merula</i>	-	-	-	-
<i>Prinia gracilis</i>	-	-	-	-	-	-	-
<i>Sylvia</i> 3 spp.	-	-	-	-	-	-	-
<i>Phylloscopus sibilatrix</i>	-	-	-	-	-	-	-
<i>Regulus regulus</i>	-	-	-	-	-	-	-
<i>Muscicapa striata</i>	-	-	-	-	-	-	-
<i>Remiz pendulinus</i>	-	-	-	-	-	-	-
<i>Parus major</i>	-	-	-	-	-	-	-
<i>Emberiza</i> 2 spp.	-	-	-	-	-	-	-
<i>Fringilla coelebs</i>	-	-	cf. <i>Fringilla</i> sp.	-	-	-	-
-	-	-	<i>C. coccythraustes</i>	-	-	-	-
<i>Serinus</i> sp.	-	-	<i>Serinus</i> sp.	-	-	-	-
<i>Carduelis</i> 3 spp.	-	-	-	-	-	-	-
<i>Loxia curvirostra</i>	-	-	-	-	-	-	-
<i>Passer domesticus</i>	-	-	<i>Passer domesticus</i>	-	-	-	-
<i>Passer hispaniolensis</i>	-	-	-	-	-	-	-
<i>P. petronia</i>	-	-	-	-	-	-	-
-	-	-	<i>Onychognathus tristrami</i>	-	-	-	-
<i>Sturnus vulgaris</i>	-	-	<i>Sturnus vulgaris</i>	-	-	-	-
<i>O. oriolus</i>	-	-	-	-	-	-	-
<i>Garrulus glandarius</i>	<i>Garrulus glandarius</i>	<i>Garrulus glandarius</i>	-	-	-	-	-
<i>P. pica</i>	-	-	<i>P. pica</i>	-	-	-	-
<i>Corvus monedula</i>	<i>Corvus monedula</i>	-	<i>Corvus monedula</i>	-	<i>Corvus monedula</i>	-	-
-	-	-	<i>Corvus ruficollis</i>	-	-	<i>Corvus ruficollis</i> *	<i>Corvus ruficollis</i> **
-	-	-	<i>Corvus rhipidurus</i>	-	-	-	-
-	-	-	-	-	<i>Corvus frugilegus</i>	<i>Corvus frugilegus</i>	-
<i>Corvus corone</i>	<i>Corvus corone</i>	<i>Corvus corone</i>	<i>Corvus corone</i>	<i>Corvus corone</i>	-	-	<i>Corvus corone</i>

TABLE 5c - A comparison of the avifaunal assemblages in several natufian, PPNA and PPNB sites in the southern Levant. (a) Pichon (1984, 1987); (b) Tchernov, unpublished data; (c) Noy et al., 1980; (d) G.S. Cowles & J. Blanderman, personal communication; (e) Köhler-Rollefson (1988, 1989). (*) Cowles & Blanderman (personal communication) mentioned *Alectoris barbara* from this site; however, this species never existed in the southern Levant, and was never sympatric with *A. chukar*. The only species that existed in this region throughout the Middle and Upper Pleistocene of the Levant is *Alectoris chukar*.

BIBLIOGRAPHY

- Bar-Yosef, O. (1981)** - The "Pre-Pottery Neolithic" Period in the Southern Levant. In: Cauvin, J. & P. Sanlaville (eds.): *Préhistoire du Levant*: 551-570. C.N.R.S., Paris.
- Bar-Yosef, O. (1983)** - The Natufian in the Southern Levant. In: Young, T.C.; P.E.L. Smith & P. Mortenson (eds.): *The Hilly Flanks. Essays on the Prehistory of Southwestern Asia*: 11-37. The Oriental Institute of the University of Chicago. Studies in Ancient Oriental Civilization No. 36. The Oriental Institute, Chicago, Illinois.
- Bar-Yosef, O. (1989)** - The PPN A in the Levant - An Overview. *Paléorient* 15: 57-63.
- Bar-Yosef, D.E. (in press)** - Late Paleolithic and Neolithic marine shells in the southern Levant as cultural markers. In: Hayes, C.F. & L. Ceci (eds.): *Shell Bead Conference*. Rochester Museum and Science Center.
- Bar-Yosef, O. & A. Belfer-Cohen (1989)** - The Levantine PPNB Interaction Sphere. In: HersHKovitz, I. (ed.): *Peoples and Cultures in Change. BAR (International Series)* 508: 59-72.
- Bar-Yosef, O.; A. Gopher; E. Tchernov & M.E. Kislev (1991)** - Netiv Hagdud: An early Neolithic Village site in the Jordan Valley. *Journal of Field Archaeology* 18: 405-424.
- Belfer-Cohen, A. (1991)** - The Natufian in the Levant. *Annual Review of Anthropology* 20: 167-186.
- Betts, A. (1989)** - The Pre-Pottery Neolithic period in eastern Jordan. *Paléorient* 15: 147-153.
- Cauvin, J.C. (1987)** - Chronologie relative et chronologie absolue dans le néolithique du Levant nord et d'Anatolie entre 10.000-8.000 B.P. In: Aurenche, O.; F. Hours & J. Evin (eds.): *Chronologies in the Near East: Relative Chronologies and Absolute Chronology 16,000-4,000 B.P.* . BAR (International Series) 379: 325-342.
- Flannery, K.V. (1972)** - The origins of the village as a settlement type in Mesoamerica and the Near East: A comparative study. In: Tringham, R.; P.J. Ucko & T.W. Dibbley (eds.): *Man, Settlement and Urbanism*: 23-53. Duckworth, London.
- Garrard, A.N.; A. Betts; B. Byrd & C. Hunt (1988)** - Prehistoric Environments and Settlement in the Azraq Basin: An Interim Report on the 1984 Season. *Levant* 18: 1-20.
- Harestad, A.J. & F.L. Bunnell (1979)** - Home range and body weight: a reevaluation. *Ecology* 60: 389-402.
- Henry, D.O. (1983)** - Adaptive Evolution within the Epipaleolithic of the Near East. In: Wendorf, F. & A. Close (eds.): *Advances in World Archaeology* 2: 99-160.
- Henry, D.O. (1985)** - Preagriculture sedentism: the Natufian example. In: Price, T.D. & J.A. Brown (eds.): *Prehistoric Hunter-Gatherers: the emergence of complex Societies*: 365-384. Academic Press, New York.
- Henry, D.O. (1989)** - *From Foraging to Agriculture: the Levant at the End of the Ice Age*. University of Pennsylvania Press, Philadelphia.
- Horwitz, L.K.; C. Cope & E. Tchernov (1991)** - Sexing the bones of mountain-gazelle (*Gazella gazella*) from prehistoric sites in the southern Levant. *Paléorient* 16: 1-11.
- Hovers, E. (1989)** - Settlement and Subsistence Patterns in the Lower Jordan Valley from Epipalaeolithic to Neolithic Times. In: HersHKovitz, I. (ed.): *Peoples and Cultures in Change. BAR (International Series)* 508: 37-52.
- Hovers, E.; L.K. Horwitz; D.E. Bar-Yosef & C. Cope-Miyashiro (1988)** - The site of Urkan-E-Rub IIa: A case study of subsistence and mobility patterns in the Kebaran period in the Lower Jordan Valley. *Mitekufat Haeven* 21: 20-48.
- Kenyon, K. (1957)** - *Digging Up Jericho*. Ernest Benn, London.
- Kislev, M.E.; O. Bar-Yosef & A. Gopher (1986)** - Early Neolithic domesticated and wild cereals from Netiv Hagdud region in the Jordan Valley. *Israel Journal of Botany* 35: 197-201.
- Markus, M.B. (1964)** - Premaxillae of the fossil *Passer domesticus* Tchernov and the extant South African Passerinae. *The Ostrich* 35: 245-246.
- Mienis, H. (1987)** - Molluscs from the excavation of Mallaha (Eynan). In: Bouchud, J. (ed.) : *La faune du gisement natufien de Mallaha (Eynan)*, Israel: 177-178. Mémoires et Travaux du Centre de Recherche Français de Jerusalem. N° 4, Association Paléorient, Paris.

- Moore, A.M.T. (1989) - The transition from foraging to farming in southwest Asia. In: Harris, D.R. & G.C. Hilman (eds.): *Foraging and Farming: The Evolution of Plant Exploitation*: 620-631. Unwin Hyman, London.
- Pichon, J. (1984) - *L'avifaune natufiennne du Levant. Systématique, Paléoécologie, Paléoethnozoologie*. These 3e Cycle (unpublished dissertation). Université Pierre et Marie Curie, Paris.
- Pichon, J. (1987) - L'avifaune. In: Bouchud, J. (ed.): *La faune du gisement natufien de Mallaha (Eynan) Israel*: 115-150. Mémoires et Travaux du Centre de Recherche Français de Jerusalem, Association Paléorient, Paris.
- Pichon, J. (1989) - L'environnement du natufien en Israel. In: Bar-Yosef, O. & B. Vandermeersch (eds.): *Investigations in South Levantine Prehistory. BAR (International Series) 497*: 61-74.
- Shipman, P. & A. Walker (1989) - The costs of becoming a predator. *Journal of Human Evolution* 18: 373-392.
- Tchernov, E. (1962) - Paleolithic avifauna in Palestine. *Bulletin of the Research Council of Israel* 11(3): 95-131.
- Tchernov, E. (1984) - Commensal animals and human sedentism in the Middle East. In: Clutton-Brock, J. & C. Grigson (eds.): *Animals and Archaeology. BAR (International Series) 202*: 91-115.
- Tchernov, E. (1991) - Of mice and men. Biological markers for long-term sedentism: A reply. *Paléorient* 17: 153-160.
- Tchernov, E. (in press) - Biological evidences for human sedentism in Southwest Asia during the Natufian. In: Bar-Yosef, O. & F.R. Valla (eds.): *The Natufian Culture and the Origins of the Levantine Neolithic*. International Monographs in Prehistory, Ann Arbor, Michigan.
- Valla, F.R. (1987) - Chronologie relative et chronologie absolut dans le Natoufien. In: Aurenche, O.; I Evin & F Hours (eds.): *Chronologies in the Middle East: Relative Chronologies and Absolute Chronology 16,000-4,000 B.P. BAR (International Series) 379*: 267-294.
- Valla, F.R. (1988) - Aspects du sol de l'abri 131 de Mallaha (Eynan). *Paléorient* 14(2): 283-297.

