HERODIUM

Final Reports of the 1972–2010 Excavations Directed by Ehud Netzer

Volume I
Herod's Tomb Precinct

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Israel Exploration Society
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Jerusalem 2015

THIS VOLUME WAS MADE POSSIBLE BY
THE SAMIS FOUNDATION

ISBN 978-965-221-099-9

Editing by Robert Amoils
Layout by Avraham Pladot
Typesetting by Marzel A.S. — Jerusalem
Printed by Old City Press Ltd., Jerusalem

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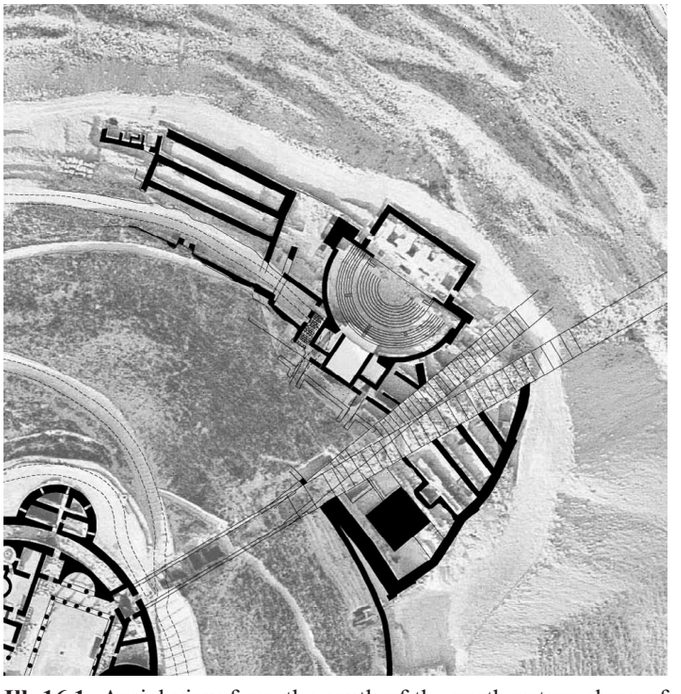
CHAPTER 16

FINDS OF ANIMAL REMAINS FROM THE EXCAVATIONS ON THE NORTHERN SLOPE OF HERODIUM (AREA A), 2006-2010

Ram Bouchnick*

Rich finds of animal remains were revealed during the renewed Herodium excavations. These excavations were carried out in strata dated to the time of Herod's reign and later on, prior to his death, when the artificial mount was constructed, and to the period of the First Jewish Revolt against the Romans up to the Bar-Kokhba Revolt. During this study a comparison was made between two assemblages of animal remains (bones, teeth, and horns) discovered on the northern slope of Mount Herodium (Area A), one of which came from the area of the theater (Ill. 16.1). This assemblage (n=1,401) serves as evidence of the activity of Herod's construction team (which included architects, but also laborers, managers, and clerks) at Herodium which temporarily lived in the theater, built the late (monumental) stairway, partly destroyed and covered the theater, and constructed the artificial, cone-shaped mount. The second assemblage is a later one which came from the tomb precinct, and it serves mainly as evidence of the days of the First Revolt at Herodium, but also of the activity there in the preceding period and during the brief one following the revolt, when a Roman garrison was apparently stationed in the Mountain Palace-Fortress. The tomb precinct furnished evidence of intensive activity by the rebels and of the functioning of a refuse site there after the revolt, at a time when extensive clean-up operations were undertaken in the Mountain Palace-Fortress (n=301). The refuse that was taken to the tomb precinct was made up mainly of remains left by the rebels who had been active in the building on the mount during the revolt. All of the excavated loci yielded vast finds of well-preserved animal remains (mammals, birds, and fish). These remains enable us to learn about many aspects of the subsistence economy, ethnicity, and trade relations of Herodium's inhabitants at various times.



Ill. 16.1. Aerial view from the south of the northeastern slope of Mount Herodium, with schematic reconstructions of the structures revealed there (mausoleum, theater, and storerooms).

METHODS

During the excavations, a meticulous manual collection of animal bones was carried out. All the remains that were found were brought to the zooarchaeological laboratory at the University of Haifa, where they were processed according to the following protocol:

1. All of the animal bones submitted by the excavators were examined and recorded in this zooarchaeological laboratory. As mentioned above, these bones had been collected manually.
2. Recording: all of the animal remains from all of the excavated loci were recorded on a data sheet. These data were assembled in a Windows Excel file.
3. Sorting: the animal bones from each locus and basket were separated into identified skeletal parts and those that were unidentifiable. The latter were counted only if their length exceeded 4 cm.
4. Packing and Measurement: selected skeletal parts, such as joints found intact, lower jaws, and individual teeth, were separated from the finds and packed, after measurement, in a separate bag that contained the particulars of the locus, the basket, and the serial number of the skeletal part.
5. Taxonomic Identification: the readily identified skeletal parts, including bone joints (birds and mammals) and teeth (mammals), were recognized from their location in the animal's skeleton. These skeletal parts also helped us to determine the species of the animal to which they belonged. This was achieved by reference to the laboratory's comparative collection. When necessary, use was made of morphological indicators that distinguish between taxonomically related animal species (Davis 1987). The distinction of goats (*Capra hircus*) from sheep (*Ovis aries*) was based on morphological features of selected bones (according to Boessneck 1969, and Zeder and Lapham 2010). The skeletal parts of sheep and goats that could not be attributed to a particular species were classed in the caprine group.
6. Fish bones found in various excavation units were identified by Omri Lernau.[1] These bones were separated into groups according to their anatomical position in the fish skeleton and identified by comparing them to the modern fish comparative collection. The detection method made possible the determination of the level of certainty in the identification of fish families and species. The final report includes only those identifications that were certain. The names of the fish skeleton parts are based on Wheeler and Jones (1989).
7. Measurements: the measurement of intact skeletal parts was carried out according to the protocol of Driesch (1976). The margin of error of measurement with a digital slide gauge was 0.1 mm.
8. MNI, MNE, MAU, and NISP: the relative frequency of the various animal species that were found was obtained with the aid of MNI (minimum number of individuals), MNE (minimum number of elements), and MAU (minimum animal units). These values were reckoned on the basis of the assumptions described in Lyman (2008). NISP (number of identified specimens) served as a basic index of the frequency of a species (Grayson 1984).
9. Gathering of Taphonomic Information: the surfaces of the bones were scanned to locate taphonomic evidence indicative of the processes of destruction, preservation, and deposition undergone by the bones of an animal from the moment of its death to the time of their exposure by the archaeologist.
   a) Evidence of climatic damages — various processes in the vicinity of the place where the bones were deposited leave their mark on the surfaces of the latter (Behrensmeyer 1978).
   b) Evidence of plant activity — the root tips of plants are acidic and therefore their contact with a bone leaves an etch mark on the surface of the latter.
   c) Signs of animal activity — signs of the bites of predators and of the gnawing of rodents are notable on the bone surfaces when there

was a time gap between the animal's death and its burial.

d) Evidence of human activity — evidence of butchering (Binford 1981) and burning (Stiner et al. 1995) notable on the bone surfaces can serve as an aid in learning about the pattern of slaughtering and dismemberment of an animal, as well as about the patterns of cooking and roasting animals before they were eaten.

10. Mortality Profile — an analysis of the management of the flocks of the domesticated animals found at the site, from which one learns about the form of management of a flock and the characteristics of its utilization based on two main methods:
    a) The state of fusion of the animal's joints, which takes place at various stages in its life in accordance with its species (Silver 1969);
    b) The frequency of milk teeth in relation to permanent teeth and the extent of tooth wear (Grant 1982).
11. Statistical data processing was done using the software PAST (Hammer et al. 2001).

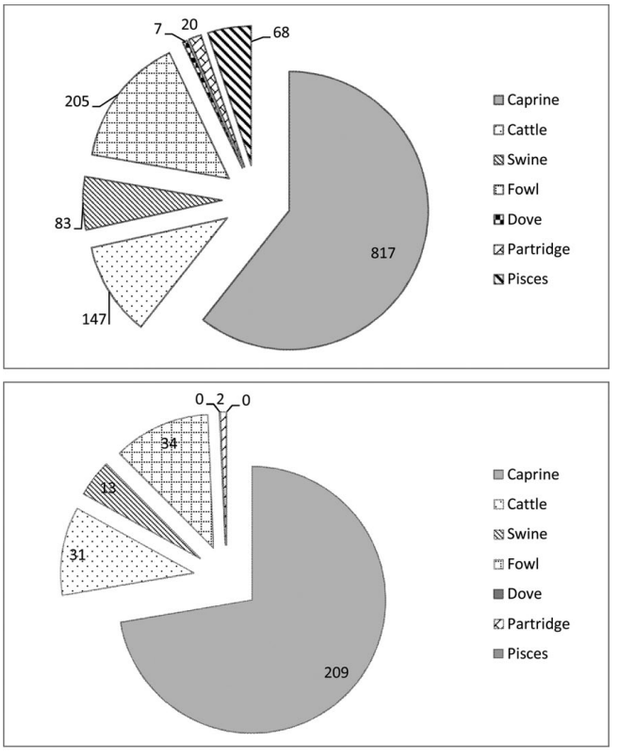
RESULTS

The bone assemblages from Herodium contained 1,702 intact and broken animal bones (the measurements of all the measurable skeletal parts are specified in Appendices 1 and 2). Part of the bones (861) could be attributed to the animal species to which they belonged and the rest (841) could be assigned only to a size group (Table 16.1). The majority of the bone finds (1,401) consist of remains originating from excavated loci dated to the latter part of Herod's reign (Table 16.2). These finds were revealed in the vicinity of the theater and give expression to the period of increased activity of Herod's construction team there. The other assemblage (301) was unearthed in the vicinity of the precinct of Herod's tomb, and it comes from excavation loci dated to the time of the First Jewish Revolt (Table 16.3). The distribution of the animal bones found in the various excavation units according to loci and baskets is specified in Appendix 3.

Table 16.1: Total NISP and taxa representation of the animal finds belonging to the latter part of Herod's reign (LPHR) and the First Jewish Revolt (FJR) in the renewed Herodium excavations.

Period	Total NISP	Taxa
LPHR	1401	Goat, Sheep, Sheep/Goat, Cattle, Pig, Mountain Gazelle, Hare, Chicken, Pigeon, Partridge, Raptor, Passerine, Pisces
FJR	301	Goat, Sheep, Sheep/Goat, Cattle, Pig, Horse/Donkey, Mountain Gazelle, Chicken, Partridge, Raptor, Passerine

The composition of the animals and their frequency in the bone assemblages from the different periods in the tomb precinct at Herodium are presented in Table 16.4 and Ill. 16.2. For both periods it is notable that the domesticated animals, primarily sheep and goats, were the most common species



Ill. 16.2. Distribution of the main animal species in the animal economy of Herodium's inhabitants in the latter part of Herod's reign (a) and during the First Jewish Revolt (b), as revealed by the renewed Herodium excavations.

Table 16.2: NISP, MNE, and MNI for mammals found in the excavation units associated with the laborers in the area of the theater during the renewed Herodium excavations.

Mammals	*Capra hircus*		*Ovis aries*		*Capra/ Ovis*		*Bos taurus*		*Sus scrofa*		*Gazella gazella*		*Lepus capensis*		
	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	
Head:															
Horn					3	3	2	1							
Skull frag.					20	1									
Occipital					1	1									
Mandibular ramus					5	5									
Mandibular Teeth			1	1	50	46	3	3	11	11					
Maxillar Teeth					20	19	5	4	5	5					
Petrosum					2	2	2	1							
Body:															
Atlas					2	1									
Cervical					3	1									
Thoracic					17	14	1	1							
Lumbar					5	4	1	1							
Rib					61	41	5	3	17	3					
Sacrum					2	2									
Forelimb:															
Scapula	2	2			7	4			1	1					
Humerus	2	2	2	2	19	9	1	1	1	1	1	1			
Radius			2	2	15	7	1	1	5	4					
Ulna					4	4	1	1	1	1					
Metacarpus	1	1	1	1	15	8	5	2	2	2					
Carpals					1	1									
Hindlimb:															
Pelvic Acetabulum					36	9	1	1					1	1	
Femur	1	1			35	7	4	1	3	1					
Tibia	1	1			12	5	3	1	4	2					
Central 4th					2	2									
Astragalus	1	1	4	4	3	2			1	1					
Calcaneus	1	1			1	1	2	2	4	3					
Metapod					8	2			12	9					
Metatarsus	1	1	2	2	10	6	2	2	1	1					
Tarsal					2	2									
Toes:															
Phalanx 1	8	7	7	6	2	1	5	4	1	1					
Phalanx 2	2	2	5	5			2	2	3	2					
Phalanx 3	1	1	2	2			4	4							
UIDLB (shaft)					454		97		11						
NISP	21		26		817		147		83		1		1		1096
%NISP	2%		2%		75%		13%		8%		0%		0%		100%
MNI	1		2		8		2		1		1		1		16
MNE		20		25		210		36		48		1		1	

Table 16.2 contd.: NISP, MNE, and MNI for birds and fish found in the excavation units associated with the laborers in the area of the theater during the renewed Herodium excavations. The finds were dated to the latter part of Herod's reign.

Aves	*Gallus gallus*		*Columba livia*		*Alectoris chukar*		Passiformes		Raptor		Pisces		
	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	
Head:													
Skull frag.											2	2	
Bill	1	1											
Opercular											1	1	
Body:													
Atlas													
Thoracic	2	2											
Vertebrae											14	12	
Rib	4	4											
Sternum	16	11			2	2							
Furcula	6	4											
Synsacrum	11	11							1	1			
Forelimb:													
Scapula	9	9			1	1							
Coracoid	17	16	2	2	1	1							
Humerus	13	12	1	1	1	1							
Radius	8	8			1	1							
Ulna	5	4	1	1	4	4	1	1					
Carpometacarpus	2	2	1	1									
Hindlimb:													
Pelvic Acetabulum													
Femur	19	14	1	1	2	2	1	1					
Tibiotarsus	25	18			4	4			1	1			
Tarsometatarsus	14	6			4	4	1	1					
Toes:													
Phalanx 1													
Phalanx 2	1	1											
Phalanx 3													
UIDLB (shaft)	52		1		1						51		
NISP	205		7		20		3		2		68		305
%NISP	67%		2%		7%		1%		1%		22%		100%
MNI	11		1		2		1		1				16
MNE		123		6		19		3		2		15	

Table 16.3: NISP, MNE, and MNI for mammals found in the excavation units associated with the rebels in the tomb precinct during the renewed Herodium excavations. The finds were dated to the time of the First Jewish Revolt.

Mammals	*Capra hircus*		*Ovis aries*		*Capra/ Ovis*		*Bos taurus*		*Sus scrofa*		*Equus sp.*		*Gazella gazella*		*Mus musculus*		
	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	
Head:																	
Horn					1	1											
Skull frag.					1	1											
Mandibular ramus					2	2	1	1									
Mandibular Teeth			1	1	5	5	1	1	1	1			1	1			
Maxillar Teeth					1	1	2	2									
Petrosum					1	1	1	1									
Body:																	
Atlas					2	2											
Cervical					1	1											
Thoracic					6	2											
Lumbar					2	1											
Rib					11	5	4	3									
Forelimb:																	
Scapula					1	1											
Humerus					8	5			1	1							
Radius			1	1	4	3											
Ulna					1	1							1	1			
Metacarpus	1	1			2	2	1	1	1	1							
Hindlimb:																	
Pelvic Acetabulum					4	2			2	1							
Femur					6	2	1	1									
Tibia					2	1											
Astragalus			3	3	1	1									1	1	
Calcaneus	1	1			1	1											
Metapod			1	1	3	2	1	1	1	1	1	1			1	1	
Metatarsus			1	1	1	1											
Tarsal					1	1											
Toes:																	
Phalanx 1	2	2	1	1	1	1	2	1	2	2							
Phalanx 2	3	3							4	4							
Phalanx 3	1	1	2	2	1	1											
UIDLB (shaft)					139		17		1		1						
NISP	8		10		209		31		13		2		2		2		277
%NISP	3%		4%		75%		11%		5%		1%		1%		1%		100%
MNI	1		1		3		2		1		1		1		1		11
MNE		8		10		47		12		11		2		2		2	

Table 16.3 contd.: NISP, MNE, and MNI for birds (no fish remains were present) found in the excavation loci associated with the rebels in the tomb precinct during the renewed Herodium excavations. The finds were dated to the time of the First Jewish Revolt.

Aves	*Gallus domesticus*		*Alectoris chukar*		Passiformes		Raptor		
	NISP	MNE	NISP	MNE	NISP	MNE	NISP	MNE	
Head:									
Skull frag.									
Bill					1	1			
Opercular									
Body:									
Atlas									
Rib	2	2							
Sternum	3	2							
Synsacrum	2	2							
Forelimb:									
Scapula									
Coracoid	1	1							
Humerus	1	1							
Radius									
Ulna									
Carpometacarpus									
Hindlimb:									
Pelvic Acetabulum									
Femur									
Tibiotarsus	3	3	2	2					
Tarsometatarsus							1	1	
Toes:									
Phalanx 1	1	1							
Phalanx 2	1	1							
Phalanx 3	1	1							
UIDLB (shaft)	5								
NISP	20		8		1		1		24
%NISP	83%		8%		4%		4%		100%
MNI	2		1		1		1		5
MNE		14		2		1		1	

(latter part of Herod's reign [LPHR]: 61%, n=861; First Jewish Revolt [FJR]: 82%, n=227). However, it can be seen that sheep and goats were of significantly greater importance in the rebel's diet. The division of a flock into its component sheep and goats reveals that the site's inhabitants preferred sheep to goats in both assemblages (*Capra hircus*: LPHR — 45%, n=21; FJR — 44%, n=8; *Ovis aries*:

LPHR — 55%, n=26; FJR — 56%, n=10). A similarity in the rate of consumption of beef in both periods also came to light (*Bos taurus*: LPHR — 10%, n=147; FJR — 11%, n=31). It should be mentioned that both assemblages were found to contain the bones of domestic pigs and wild boar (Ill. 16.3), animals that Jews are forbidden to eat. However, the rate of consumption of pork by the laborers in the latter part of Herod's reign was higher (*Sus scrofa*: LPHR — 6%, n=83; FJR — 4%, n=13). Moreover, a few donkey (*Equus cabalus*) bones were also present in the later assemblage. Among the wild animals, there were a few remains of gazelles (*Gazella gazella*) in both assemblages, and those of rabbits (*Lepus capensis*) only in the earlier one. Remains of the house mouse were found only in the later assemblage.

Ill. 16.3. Lower jaw (mandible) apparently of a young domestic pig (left) and upper jaw (maxila) probably of a wild boar (right), as revealed by the renewed Herodium excavations.

Wild and domesticated birds were also of significant importance in the animal economy at the site. The main representatives were chickens (*Gallus gallus*: LPHR — 15%, n=205; FJR — 7%, n=20) (Ill. 16.4). Also found were remains of rock doves and partridge. However, while partridge remains

Ill. 16.4. Fowl bones, as revealed by the renewed Herodium excavations.

were present in the assemblages from both periods (*Alectoris chukar*: LPHR — 1%, n=20; FJR — 1%, n=2), those of the rock dove were revealed only in the assemblage from the earlier one (*Columba livia*: LPHR — 1%, n=7). A few remains of birds of prey and songbirds were also present in the assemblages from both periods. Clear evidence of extensive trade between Herod's laborers and seafarers is provided by the finds of the remains of edible fish in the excavation units close to the theater (*Pisces*: LPHR — 5%, n=68).

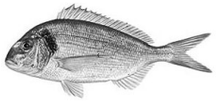
The presence of the remains of wild animals in both bone assemblages helps us to reconstruct the appearance of the site's early environment. The remains of gazelles and rabbits alongside those of partridge and birds of prey testify to the great similarity between the present-day features of the environment and those that prevailed in this area during the first centuries before and after the Common Era (Table 16.4). A similar picture is provided by various studies (e.g., Liphschitz 1986; Tsahar et al. 2008; Baruch and Bottema 1999) which dealt with research into climatic conditions in the southern Levant in the first centuries before and after the Common Era.

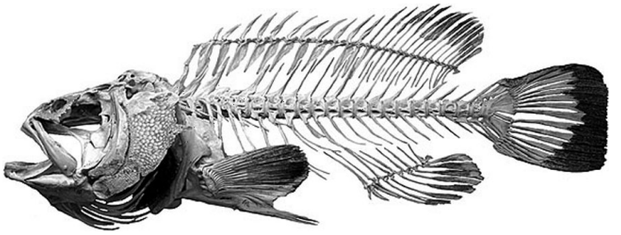
Table 16.4: NISP, %NISP, and variety of animal species represented in the finds from the latter part of Herod's reign (LPHR) in comparison to those from the time of the First Jewish Revolt (FJR), as revealed during the renewed Herodium excavations.

Species	LPHR		FJR	
	NISP	%NISP	NISP	%NISP
Capra hircus 	21	1%	8	3%
Ovis aries 	26	2%	10	3%
Capra / Ovis	817	58%	209	70%
Bos taurus 	147	11%	31	10%
Sus scrofa 	83	6%	13	4%
Equus sp. 	0	0%	2	1%
Gazella gazella 	1	0%	2	1%
Lepus capensis 	1	0%	0	0%
Gallus gallus 	205	15%	20	7%
Columba livia 	7	1%	0	0%
Alectoris chukar 	20	1%	2	1%
Raptor 	2	0%	1	0%
Passiformes 	3	0%	1	0%
Pisces 	68	5%	0	0%
Total	**1401**		**301**	

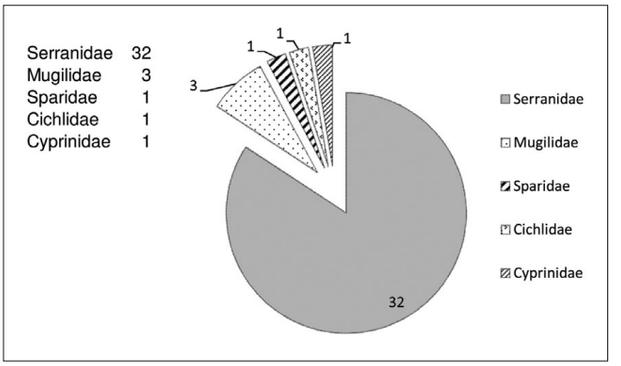
The fish remains discovered on the northern slope of Mount Herodium (Area A) were all found near the theater in loci dated to the period of preparing the site for the construction of the artificial mount by Herod's construction team, and are presented in Table 16.5 and Ill. 16.5. Most of the fish bones were found in L.A12110 (n=46) and in complementary locus L.A12121 (n=18), as well as in L.A12118 (n=4). These excavated loci were probably used as a refuse dump by Herod's construction team. The fish bone assemblage included 68 bones and skeletal parts (Table 16.5, Ill. 16.5), 38 of which were classified into families, genera, and species of fish. Most fish came from the Mediterranean Sea (95%), and most of the bones belonged to the Epinephelus family (Serranidae — 83%, n=32) (Ill. 16.6). Among the Epinephelus family the following species were identified: dusky grouper (*Epinephelus marginatus*) and white grouper (*Epinephelus aeneus*). Also found were mullet remains including a single bone of a thinlip grey mullet (*Liza ramada*). Another representative of sea fish discovered was sea bream (Sparidae — 3%, n=1). Among the freshwater fish (5%) remains of two families from the Sea of Galilee were found. A single bone of tilapia (Cichlidae — 3%, n=1), and a single bone of carp (Cyprinidae — 3%, n=1). The discovery of fish remains in Herodium could attest to trade relations between Herod's construction team and fishermen of the Mediterranean and the Sea of Galilee (Ill. 16.5). Statistical analysis (chi-square test) of the differences between the two bone assemblages indicates a statistically significant difference (Table 16.6).

Table 16.5: NISP, %NISP, and variety of Pisces families represented in the finds from the latter part of Herod's reign as revealed during the renewed Herodium excavations.

Family name	Common name	NISP	%NISP
Serranidae 	Epinephelus (grouper)	32	83%
Mugilidae 	Mugill (mullet)	3	8%
Sparidae 	Sparus (dennis)	1	3%
Cyprinidae 	Cyprinus (carp)	1	3%
Cichlidae 	Cichlid (tilapia)	1	3%
no identification		30	44%
identification		38	56%
Total		68	



Ill. 16.5. Distribution of the Pisces family in the animal economy of Herodium's inhabitants in the latter part of Herod's reign, as revealed by the renewed Herodium excavations.



Ill. 16.6. Grouper fish (Serranidae) skeleton, common edible fish (from a context datable to the latter part of Herod's reign), as revealed by the renewed Herodium excavations.

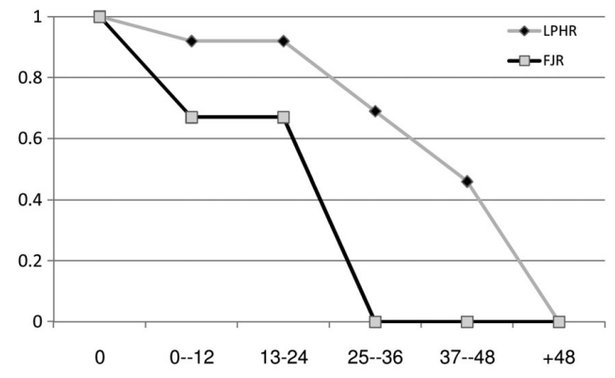
Table 16.6: Statistical analysis (chi-square test) of the differences between the various animal groups dating to the latter part of Herod's reign (LPHR) and those from the time of the First Jewish Revolt (FJR), as revealed during the renewed Herodium excavations.

A vs. B		
One constraint		
N1:		1401
N2:		301
Deg. freedom:	9	
Chi^2:		50.718
p (same):	7.89E–08	
Monte Carlo p (same):	0.0001	
Fisher exact p (same):	N/A	

GROUP / SHEEP	YES	NO
LPHR	817	582
FJR	209	86
$\chi 2$ [Yates Corrected]	15.29	
df	1,	
p-value	<.0001	

GROUP / GALLUS	YES	NO
LPHR	205	1194
FJR	20	275
$\chi 2$ [Yates Corrected]	12.44	
df	1	
p-value	<.0001	

An analysis of the demographic structure of the animal flocks, based on the extent of bone fusion, became possible with regard to the flocks of sheep and goats in both assemblages, and with regard to the bones of cattle and pigs only in the case of the earlier one (Tables 16.7–10), on account of the small size of the later assemblage. A demographic analysis of the structure of the flocks, based on teeth eruption and the extent of their wear, became possible only with regard to the teeth of sheep and goats (Table 16.11), on account of the small size of the teeth samples from cattle and pigs. We learn from the results that the laborers in the theater enjoyed eating the meat of both calves and adult cattle (Table 16.9). They also consumed pork from both young and adult pigs (Table 16.10; Ill. 16.3). However, a more detailed mortality profile was obtained for the large assemblage of sheep and goats (Tables 16.7–8, 16.11), from which we learn that in the latter part of Herod's reign most of the sheep and goats were slaughtered at an advanced age (half of them at an age exceeding four years; see Table 16.8; Ill. 16.7). During the First Revolt (despite the small size of the assemblage), all of the sheep and goats were slaughtered during the first three years of their lives. These results indicate different patterns of consumption of the meat of sheep and goats in the two periods under study here. At the time of the First Revolt there was increased utilization of young individuals, a phenomenon testifying to the utilization of the yield of the flocks of sheep and goats as a source of meat, while in the latter part of Herod's reign the consumption pattern at the site was based on the eating of meat from adult individuals. This pattern points to the utilization of the sheep and goats for various secondary purposes, including milk and wool, by the inhabitants of the Herodium area prior to their sale as meat to the laborers.



Ill. 16.7. Mortality profile of sheep and goats according to the wear of milk teeth (DP4) and permanent teeth (P4, M3) in a comparison between the latter part of Herod's reign (LPHR) and the time of the First Jewish Revolt (FJR), as revealed by the renewed Herodium excavations.

Table 16.7: Bone fusion data for sheep and goats from the time of the First Jewish Revolt in the renewed Herodium excavations (after Silver 1969).

Age (month)	Bone	Part	Age of fusion (Month)	# Fused	# Unfused	% UF
Infant (0–12)	Metapodial	Proximal	0	4	1	
	Acetabulum		10	3	1	
Total				7	2	22%
Juvenile (13–24)	Scapula	Proximal	13	0	1	
	Humerus	Distal	13	4	0	
	Phalanx 1	Proximal	16	3	0	
	Phalanx 2	Proximal	16	3	0	
Total				10	0	0%
Sub-adult (25–36)	Metapodial	Distal	36	1	2	
	Calcaneus		36	0	1	
Total				1	3	75%
Adult (37–48)	Femur	Distal	42	0	2	
	Femur	Proximal	42	0	2	
	Tibia	Proximal	42	0	1	
Total				0	5	100%
Old-adult (49 +)	Radius	Distal	84	1	0	
	Humerus	Proximal	84	0	2	
Total				**1**	**2**	**66%**

Table 16.8: Bone fusion data for sheep and goats from the latter part of Herod's reign in the renewed Herodium excavations (after Silver 1969).

Age (Month)	Bone	Part	Age of fusion (Month)	# Fused	# Unfused	% UF
Infant (0–12)	Metapodial	Proximal	0	13	0	
	Radius	Proximal	10	2	4	
	Acetabulum		10	18	7	
Total				33	11	25%
Juvenile (13–24)	Scapula	Proximal	13	6	2	
	Humerus	Distal	13	8	3	
	Phalanx 1	Proximal	16	9	5	
	Phalanx 2	Proximal	16	6	1	
	Tibia	Distal	24	4	4	
Total				33	15	30%
Sub-adult (25–36)	Metapodial	Distal	36	6	7	
	Calcaneus		36	1	1	
Total				7	8	53%
Adult (37–48)	Femur	Distal	42	1	6	
	Femur	Proximal	42	3	10	
	Tibia	Proximal	42	1	0	
Total				5	16	76%
Old-adult (49 +)	Radius	Distal	84	1	3	
	Ulna	Proximal	84	0	1	
	Humerus	Proximal	84	1	0	
Total				2	4	66%

Table 16.9: Bone fusion data for cattle from the latter part of Herod's reign in the renewed Herodium excavations (after Silver 1969).

Age (month)	Bone	Part	Age of fusion (Month)	# Fused	# Unfused	% UF
Infant (0–12)	Metapodial	Proximal	0	4	0	
	Acetabulum		10	0	1	
Total				4	1	20%
Juvenile (13–24)	Phalanx 1	Proximal	24	2	2	
	Phalanx 2	Proximal	24	1	1	
Total				3	3	50%
Sub-adult (25–36)	Tibia	Distal	30	2	0	
	Metapodial	Distal	36	0	1	
Total				2	1	33%
Adult (37–48)	Calcaneus		42	0	1	
	Femur	Distal	48	0	1	
	Tibia	Proximal	48	0	1	
	Humerus	Proximal	48	0	1	
Total				0	4	100%

Table 16.10: Bone fusion data for pigs from the latter part of Herod's reign in the renewed Herodium excavations (after Silver 1969).

Age (month)	Bone	Part	Age of fusion (Month)	# Fused	# Unfused	% UF
Infant (0–12)	Metapodial	Proximal	0	8	0	
	Phalanx 2	Proximal	12	0	3	
	Radius	Proximal	12	4	1	
	Scapula	Proximal	12	1	0	
Total				13	4	23%
Juvenile (13–24)	Phalanx 1	Proximal	24	1	0	
	Tibia	Distal	24	0	1	
Total				1	1	50%
Sub adult (25–36)	Metapodial	Distal	27	1	4	
	Calcaneus		30	0	4	
Total				1	8	89%
Adult (37–48)	Tibia	Proximal	42	0	2	
Total				0	2	100%

Table 16.11: Mortality profile of sheep and goats according to the extent of wear of milk teeth (DP4) and permanent teeth (P4, M3) in a comparison between the latter part of Herod's reign (LPHR) and the time of the First Jewish Revolt (FJR), as revealed by the renewed Herodium excavations.

Age (in months)	LPHR		FJR	
	NISP	%NISP	NISP	%NISP
0	0	100%	0	100%
0–12	2	92%	1	67%
13–24	2	92%	0	67%
25–36	3	69%	2	0%
37–48	3	46%	0	0%
48+	10	0%	0	0%
Total	20		3	

Ill. 16.8. Cuts marks on distal epiphysis of caprine foot (Metapodia), as revealed by the renewed Herodium excavations.

A study of the state of preservation of the bones shows their surfaces are almost free of climatic damages. However, approximately one-third of the bones removed from the Herodian excavation units had suffered damages caused by plant roots (33%, n=463), while bones from the time of the revolt were damaged to a slightly less extent (24%, n=72). The moderate rate of climatic and plant damages makes it easier for us to identify the evidence of the activity predators (2%, n=25) and rodents (0.04%, n=5) notable on the bone surfaces.

It was also possible to identify evidence of the slaughtering and utilization of the animals that was visible on the bone surfaces (Ill. 16.8). These marks enable us to identify the processes of preparing the meat for consumption, including the stages of slaughtering, the stripping of the hide, and dismemberment (Table 16.12). The rate of appearance of butcher's marks on the surfaces of the bones from the Herodian assemblage is average, i.e., 6% (n=83). A lower rate of such marks was found in the assemblage from the time of the First Revolt, *c.* 4% (n=11). It should be mentioned that butcher's marks on pig bones were present only in the Herodian assemblage. These marks indicate that this animal, forbidden to be eaten by members of the Jewish faith, was consumed by members of Herod's construction team. Also noted were burn marks on a few of the bone surfaces, evidencing processes of cooking and roasting (Table 16.13). Their rate of appearance is low, i.e., slightly less than 1% (n=11) in the Herodian assemblage and slightly less than 2% (n=5) in the assemblage from the time of the First Revolt. Worthy of mention is the fact that among the bones featuring burn marks in the assemblage from the time of the First Revolt, evidence of only superficial burning was recorded, while bones from the Herodian assemblage revealed evidence of the roasting of skeletal parts at the center of the fire source.

An analysis of the distribution of the skeletal parts became possible in the assemblages of sheep and goat bones, which are well represented, with the aid of the large bone assemblages from both periods. However, it was not possible to do this in the case of the cattle and pig bones on account of the meager representation of these species. This analysis provides us with a proper representation of most of the groups of skeletal parts from both of the periods on which this study has focused (Table 16.14; Ill. 16.9). However, an analysis of the pattern of preservation of the skeletal parts reveals a considerable difference. Fleshy cuts from the upper parts of the front and hind legs and the axial skeleton are very common in both assemblages.

Table 16.12: Distribution of butchery marks on bones from the renewed Herodium excavations (butchery mark codes follow Binford 1981).

Locus	Basket	Species	NISP Butchery marks	% Butchery marks in loci
A2963	10017	*Capra hircus*	1	9%
A12019	10154	*Ovis aries* Caprine *Bos taurus*	1 5 1	10%
	10161	*Capra hircus* *Bos taurus* *Gallus gallus*	1 1 1	4%
A12021	10166	Caprine *Bos taurus*	1 1	3%
A12022	10172	Caprine	1	5%
A12023	10167	Caprine *Bos taurus*	2 1	9%
	10179	*Bos taurus*	1	9%
A12045	10219	Caprine	1	33%
A12063	10231	Caprine	1	33%
A12066	10242	Caprine	5	21%
A12076	10255	Caprine	1	25%
A12083	10281	Caprine	1	2%
A12087	12087	Caprine	3	30%
A12095	10326	Caprine	2	100%
A12100	10331	Caprine *Sus scrofa*	2 2	7%
	10350	Caprine *Gallus gallus*	1 1	18%
A12106	10354	*Bos taurus*	1	6%
A12110	10365	Caprine Bos size	7 2	5%
A12118	10377	Caprine	1	6%
	10410	*Bos Taurus* *Gallus gallus*	1 1	13%
A12119	10415	Caprine	1	9%
A12124	10437	Caprine *Bos taurus*	1 3	8%
A12133	10474	Caprine	1	8%
A12136	10469	Caprine	1	20%
A12144	10513	Caprine	2	9%
A12145	10503	Caprine	2	33%
A12150	10508	*Gallus gallus*	1	16%
A12170	10577	Caprine	1	4%
A12173	10585	*Bos taurus*	1	5%
A12179	10111	Caprine	1	6%
A12181	10122	Caprine	3	17%
A12182	10125	Caprine	2	26%
A12184	10175	Caprine	1	9%
A12185	10182	Caprine	1	7.7%
Total			83	6%

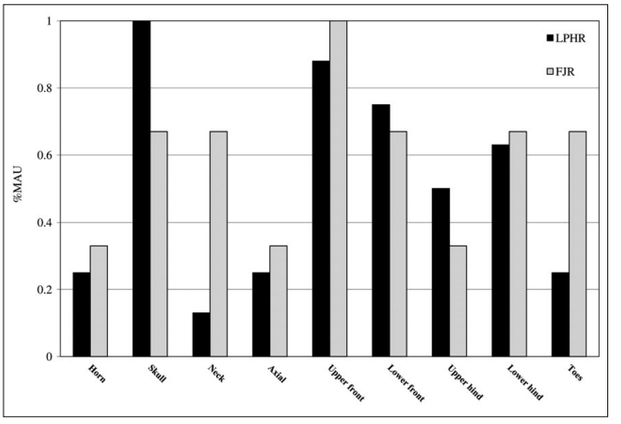
Locus	Basket	Species	NISP Butchery marks	% Butchery marks in loci
A2582	5128	Caprine Bos size	1 1	5%
A2583	5140	Caprine	1	4%
A2591	5194	Caprine *Capra hircus*	1 2	5%
A2604	5272	Caprine	1	5%
A2612	5280	Caprine	1	14%
A2628	5314	Caprine	1	6%
A2775	6190	*Bos taurus*	1	9%
A2999	12105	Caprine	1	10%
Total			11	4%

Table 16.13: Distribution of burnt bones in the renewed Herodium excavations.

Locus	Basket	Species	NISP burn	% Burn
A12019	10116	Caprine	2	3%
A12022	10172	Bos taurus	1	5%
A12023	10179	Bos taurus	1	9%
A12023	10167	Ovis aries	2	6%
A12100		Caprine	1	6%
A12124	10437	Caprine	3	6%
A12158	10529	Caprine	1	14%
Total			11	1%
A2591	5194	Caprine	1	2%
A2628	5314	Caprine	4	25%
Total			5	2%

Table 16.14: Distribution of caprine skeletal parts in a comparison between the latter part of Herod's reign (LPHR) and the time of the First Jewish Revolt (FJR), as revealed by the renewed Herodium excavations.

	LPHR		FJR	
	MAU	%MAU	MAU	%MAU
Horn	2	25%	1	33%
Skull	8	100%	2	67%
Neck	1	13%	2	67%
Axial	2	25%	1	33%
Upper front	7	88%	3	100%
Lower front	6	75%	2	67%
Upper hind	4	50%	1	33%
Lower hind	5	63%	2	67%
Toes	2	25%	2	67%



Ill. 16.9. Distribution of skeletal parts of sheep and goats in a comparison between the latter part of Herod's reign (LPHR) and the time of the First Jewish Revolt (FJR), as revealed by the renewed Herodium excavations.

CONCLUSIONS

The study of the animal bones found during the excavations on the northern slope of Herodium has furnished us with much information about daily life long ago in the court of King Herod on the border of the Judean Desert. New details about the subsistence economy and trading of the site's inhabitants in the various periods came to light during the processing of the finds. From the patterns of meat consumption at the site, we learn that pure, domesticated animals, primarily sheep and goats, were utilized with great frequency. In contrast to this, only relatively few remains of cattle and donkeys were found, as compared to those revealed at the contemporaneous sites of Shuʿfat (Bouchnick and Bar-Oz, unpublished report) and Burnat (Bouchnick et al. 2006).

It seems that due to the fact that Herodium was an official site, the arid environmental conditions had little effect on the raising and utilization/consumption of domesticated animals with high water requirements, such as cattle and sheep. Perhaps trade relations with the local people near the site had a greater effect on the variety of animal species eaten at Herodium. These shepherds provided mainly adult animals (possibly unfit for the production of milk and wool) to Herod's construction team. However, during the First Jewish Revolt some of the desert-frontier residents rebelled against Roman rule and found refuge near the tomb of Herod. These rebels inherited the herd's crop (namely young individuals that were not necessary to ensure the future of the herd).

Additional evidence of the characteristics of meat consumption at the site can be obtained from the relatively great utilization of bird meat, primarily chicken. This phenomenon is particularly notable among the members of Herod's construction team. Moreover, the frequency of the remains of rock doves and partridge in the Herodian assemblage, as well as the evidence of the utilization of edible fish (Tables 16.4–5; Ills. 16.2, 16.5; see Sapir-Hen et al. 2011), is indicative of the consumption of luxury foods by Herod's construction team. Moreover, the finds of fish remains from excavation units associated with its activity provide us with direct evidence of trade, since the site of Herodium is located far from any water source in which fishing could take place. Therefore this appears to be important evidence of the establishment of extensive trade relations between the site's inhabitants and fishermen dwelling on the seashore or the banks of streams. This finding could indicate the central role of Herodium in Herod's kingdom.

Important information about the ethnic and cultural origins of Herodium's inhabitants at various times can be gained from the extent of utilization of the meat of impure animals. Hesse (1990) mentions that the pig serves as a clear cultural marker when a comparison is made between Jews and non-Jews in ancient populations. The finds indicate that pigs possibly served as a food source during both periods under study. However, their frequency in the finds from the latter part of Herod's reign is greater than that in the finds from the later period. It is important to mention the presence of pig bones in the excavation units dated mainly to the time of the First Revolt, a period notable for the zeal with which the rebels strictly observed the commandments. Nevertheless, it seems that most of the pig bones (n=11) from L.A2582, L.A2583, and L.A2591 came from a refuse dump dated to the time when a Roman garrison took control of Herodium. The finds show that this garrison carried out clean-up operations on the floors of the Mountain Palace-Fortress, piling the removed refuse containing the bone remains on the dump. From this we learn of the heightened strictness of Herodium's inhabitants with regard to refrainment from eating pork at the time of the First Revolt.

Also meriting mention is the fact that pig remains of low frequency were also found at sites inhabited by Jews, including the refuse dumps of Jerusalem (Bouchnick et al. 2007), Horbat Rimmon (Horwitz 1998), and elsewhere. However, at sites populated by large non-Jewish communities, a notable frequency of pig bones was found, e.g., in the eastern *cardo* in Jerusalem (Horwitz, unpublished report b) and at Binyanei Ha'Uma (Horwitz, unpublished report a), these being sites where the Tenth Roman Legion was stationed after the suppression of the revolt, as well as at Caesarea, the seat of the Roman prefects/procurators (Cope, unpublished report in Horwitz and Studer 2005), Dor (Sapir-Hen 2011), and other sites.

From an analysis of the distribution of skeletal parts of the sheep and goats, we learn that most of these parts were common in the assemblages from both of the periods under study. It should be mentioned that the fleshy upper parts of the front and hind legs were present in high frequency both in the latter part of Herod's reign and during the First Revolt. However, one is struck by the low frequency of axial skeletal parts for both periods. Moreover, evidence forthcoming from a scanning of the surfaces of sheep and goat bones and the butcher's and burn marks on them indicate that all the stages of the slaughtering of the animals and their preparation for consumption took place within the area of the site during both of the periods under study.

An analysis of the demographic structure of the flocks of sheep and goats whose remains were revealed at the site makes us aware of the differing

patterns for the latter part of Herod's reign and for the time of the First Revolt. The Herodian assemblage contains many remains of adult animals that had probably been utilized for various secondary purposes (wool and milk) before they were eaten. In contrast, what is notable about the time of the First Revolt is the greater utilization of individuals of a younger age for consumption. This pattern seems to stand in contrast to the frequency of luxury foods found only in the Herodian excavation units. However, it seems that the Herodian laborers who worked at the site acquired the sheep and goats that they ate from herdsmen on the border of the desert. These herdsmen supplied the laborers mainly with animals that had left the work cycle on account of their advanced age. However, at the time of the First Revolt, those who rebelled against Roman rule and found refuge in the vicinity of the precinct of Herod's tomb were certain inhabitants of the desert border. These rebels were able to obtain not only the cull of the flock, i.e., adult animals that had left the work cycle, but also the harvest of the flock, i.e., young animals that were not needed to ensure its future. Such individuals were an economic burden to the herdsmen. Therefore they were marketed as meat. It is important to mention that in the latter part of Herod's reign there were present in Herodium simple laborers alongside senior work managers. It seems that this class gap can explain the presence of luxury foods and fleshy skeletal parts on the one hand next to those of adult sheep and goats on the other hand. The presence of numerous remains of edible fish in only a few excavation units (L.A12110 and L.A12121) and not uniformly distributed over the area lends support to this hypothesis.

NOTES

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1. My thanks to Omri Lernau for his assistance in identifying the fish remains.

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Appendix 1. Measurement of mammal bones from the renewed excavation in the theater at Herodium. A catalogue number was allocated to each bone that was measured.

#	Class	Species	Bone	Part	F/U	DPA	SDO				
190	Mammal	*Capra/Ovis*	Ulna		U	24.49	21.09				
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**Bd**	**BT**	**HDH**		
12	Mammal	*Ovis aries*	Humerus	Dis, shaft	F		34.01	31.35	16.52		
76	Mammal	*Capra hircus*	Humerus	Dis, shaft	F		33.78	32.54	16.31		
153	Mammal	*Capra hircus*	Humerus	Dis, shaft	F		33.8	32.4			
48	Mammal	*Capra/Ovis*	Humerus	Dis, shaft	F		31.35	29.84	15.02		
167	Mammal	*Capra/Ovis*	Humerus	Dis, shaft	F		34.22	32.02	16.37		
349	Mammal	*Capra/Ovis*	Humerus	Pro, shaft	F	45.95					
350	Mammal	*Capra/Ovis*	Humerus	Dis, shaft	F			25.65	17.67		
688	Mammal	*Capra/Ovis*	Humerus	Dis, shaft	F		26.63		16.68		
561	Mammal	*Gazella gazella*	Humerus	Dis, shaft	F				13.99		
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**GLP**	**LG**	**BG**	**SLC**		
47	Mammal	*Capra/Ovis*	Scapula	Dis, shaft	F			18.83	18.39		
231	Mammal	*Capra/Ovis*	Scapula	Dis, shaft	F	33.74	27.01	21.01	20.93		

262	Mammal	*Capra/Ovis*	Scapula	Dis, shaft	F	33.69	28.76	23.98			
483	Mammal	*Capra/Ovis*	Scapula	Pro, shaft	F		33.62	28.23			
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bd**					
166	Mammal	*Capra hircus*	Tibia	Dis epypisis	U	27.4					
165	Mammal	*Capra/Ovis*	Tibia	Dis, shaft	F	31.58					
174	Mammal	*Capra/Ovis*	Tibia	Dis, shaft	F	28.67					
	Mammal	*Capra/Ovis*	Tibia	Dis, shaft	F	30.47					
	Mammal	*Capra/Ovis*	Tibia	Dis, shaft	F	27.56					
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bd**	**GLI**	**GLm**	**Dm**	**DI**	
141	Mammal	*Capra hircus*	Astragal				30.9	28.3	16.4	16.1	
263	Mammal	*Ovis aries*	Astragal			21.66	32.74	31.18	18.47	18.27	
186	Mammal	*Ovis aries*	Astragal				33.2		18.17	19.27	
187	Mammal	*Ovis aries*	Astragal			21.33	33.66	31.77	19.31	19.22	
188	Mammal	*Capra/Ovis*	Astragal			16.31	29.33	27.02	17.37	15.21	
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**GL**				
466	Mammal	*Capra/Ovis*	Calcaneus		F	58.99	22.07				
307	Mammal	*Bos taurus*	Calcaneus		U		62.98				
489	Mammal	*Sus scrofa*	Calcaneus		U		24.19				
	Class	**Species**	**Bone**	**Part**	**F/U**	**GB**					
175	Mammal	*Capra/Ovis*	Cntral 4th			25.92					
343	Mammal	*Capra/Ovis*	Cntral 4th			24.36					
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**Bd**	**GL**	**DD**	**SD**	
163	Mammal	*Capra hircus*	Metacarpaus	Dis, shaft	F		28.93				
259	Mammal	*Ovis aries*	Metacarpaus	Dis, shaft	F		29.1				
4	Mammal	*Capra/Ovis*	Metacarpaus	Pro, shaft	F	23.2					
109	Mammal	*Capra/Ovis*	Metacarpaus		F,F	24.31	28.21			16.67	
156	Mammal	*Capra/Ovis*	Metacarpaus	Pro, shaft	F	35.9					
320	Mammal	*Capra/Ovis*	Metacarpaus	Pro, shaft	F	26.55				16.08	
338	Mammal	*Capra/Ovis*	Metacarpaus	Dis epypisis	U						
571	Mammal	*Capra/Ovis*	Metacarpaus	Dis, shaft	F		28.06				
580	Mammal	*Capra/Ovis*	Metacarpaus	Pro, shaft		21.68					
590	Mammal	*Capra/Ovis*	Metacarpaus	Pro, shaft	F	24.38					
107	Mammal	*Capra hircus*	Metatarsus	Dis, shaft	F		24.41				
260	Mammal	*Ovis aries*	Metatarsus	Dis, shaft	F		24.72				
83	Mammal	*Capra/Ovis*	Metatarsus	Pro, shaft	F	19.22					
164	Mammal	*Capra/Ovis*	Metatarsus	Pro, shaft	F	22.86					

339	Mammal	*Capra/Ovis*	Metatarsus	Dis epypisis	U						
308	Mammal	*Bos taurus*	Metatarsus	Pro, shaft	F	40.93					
333	Mammal	*Bos taurus*	Metatarsus			49.41	49.06	243.99	25.6	27.49	
758	Mammal	*Sus scrofa*	Metatarsus4		F	15.6	16.77	85.95		13.06	
479	Mammal	*Capra/Ovis*	Metapod	Dis epypisis	U						
760	Mammal	*Sus scrofa*	Metapod	Pro, shaft	U	12.52					
529	Mammal	*Sus scorfa*	Metapod	Pro, shaft	F	23.32					
#	**Class**	**Species**	**Element**	**Part**	**F/U**	**GL**	**PL**				
547	Mammal	*Capra/Ovis*	Sacrum		F	80.45	72.28				
#	**Class**	**Species**	**Element**	**Part**	**F/U**	**Bd**	**BFd**				
265	Mammal	*Ovis aries*	Radius	Dis, shaft	F	31.57	27.36				
191	Mammal	*Ovis aries*	Radius	Dis epypisis	U	30.3	27.17				
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**Bd**	**GL**	**SD**		
52	Mammal	*Capra hircus*	Phalanx1		F	14.2	13.91	38.65	12.46		
577	Mammal	*Ovis aries*	Phalanx1		U		12.58		10.54		
235	Mammal	*Ovis aries*	Phalanx1		U	13.33					
236	Mammal	*Ovis aries*	Phalanx1		U		12.43		10.99		
335	Mammal	*Ovis aries*	Phalanx1		F	13.2	12.36	37.41	11.65		
24	Mammal	*Capra/Ovis*	Phalanx1		F	12.67	12.5	38.72	10.77		
43	Mammal	*Bos taurus*	Phalanx1		F	25.95	26.09	65.96	23.22		
515	Mammal	*Bos taurus*	Phalanx1				27.59				
551	Mammal	*Bos taurus*	Phalanx1		U		19.62				
560	Mammal	*Sus scorfa*	Phalanx1		F		14.37		13.24		
53	Mammal	*Capra hircus*	Phalanx2		F	12.43	9.64	23.75	10.24		
674	Mammal	*Capra hircus*	Phalanx2		U		12.2		9.69		
336	Mammal	*Ovis aries*	Phalanx2		F	11.57	9.48	21.81	8.09		
318	Mammal	*Ovis aries*	Phalanx2		F	13.14	11.27	24.96	9.75		
237	Mammal	*Ovis aries*	Phalanx2		F	10.76	8.42	21.65	8.77		
506	Mammal	*Ovis aries*	Phalanx2		F	13.55			24.23		
784	Mammal	*Bos taurus*	Phalanx2		F	24.82	20.99	38.4	20.78		
763	Mammal	*Sus scrofa*	Phalanx2		U		13.51		12.69		
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**DLS**	**LD**	**MBS**			
337	Mammal	*Ovis aries*	Phalanx3			57.88	47.25	17.53			
785	Mammal	*Bos taurus*	Phalanx3			53.46	47.34	16.62			
786	Mammal	*Bos taurus*	Phalanx3			28.53	22.92	7.04			

Appendix 2. Measurement of bird bones from the renewed excavation in the precinct of Herod's tomb. A catalogue number was allocated to each bone that was measured.

#	Class	Species	Bone	Part	F/U	DIA							
285	Aves	*Gallus domesticus*	Pelvis			9.09							
286	Aves	*Gallus domesticus*	Pelvis			8.23							
287	Aves	*Gallus domesticus*	Pelvis			8.74							
705	Aves	*Gallus domesticus*	Pelvis			8.04							
706	Aves	*Gallus domesticus*	Pelvis			5.92							
707	Aves	*Gallus domesticus*	Pelvis			9.53							
708	Aves	*Gallus domesticus*	Pelvis			7.85							
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**GL**	**Did**	**L**				
537	Aves	*Gallus domesticus*	Carpometacarpus		F	10.47	35.97	8.89					
698	Aves	*Gallus domesticus*	Carpometacarpus			10.48	34.31	7.65	32.04				
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bd**	**Bb**	**BF**	**GL**	**Lm**	**BF**		
125	Aves	*Gallus domesticus*	Coracoid		F	12.01	10.89	4.76	54.44	50.26			
523	Aves	*Gallus domesticus*	Coracoid		F				50.37	48.11	11.66		
737	Aves	*Gallus domesticus*	Coracoid		F		12.4	9.87	49.13	47.29			
738	Aves	*Gallus domesticus*	Coracoid		F		12.07	9.07	46.88	45.23			
739	Aves	*Gallus domesticus*	Coracoid		F			9.97	54.34	52.98			
740	Aves	*Gallus domesticus*	Coracoid		F		13.79	11.17					
741	Aves	*Gallus domesticus*	Coracoid		F								
735	Aves	*Columba livia*	Coracoid		F		11.26	8.21	39.95	37.99			
736	Aves	*Columba livia*	Coracoid		F		12.43	8.48	40.43	39.42			
67	Aves	*Alectoris chukar*	Coracoid		F	7.96	11.58	8.02	38.15	37.29			
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**Bd**	**Dd**	**GL**	**Lm**	**SC**	**Dp**	
130	Aves	*Gallus domesticus*	Femur		F	14.54	13.82	8.99	71.22			12.24	
232	Aves	*Gallus domesticus*	Femur		F	16.42	15.84	16.19	81.92	77.77	7.42	13.74	
362	Aves	*Gallus domesticus*	Femur	Dis, shaft	F		15.26	13.52					
521	Aves	*Gallus domesticus*	Femur	Pro, shaft	F	16.43						12.11	
594	Aves	*Gallus domesticus*	Femur		F	14.25	13.17	11.69			7.02	12.78	
595	Aves	*Gallus domesticus*	Femur	Pro, shaft	F	14.79					7.14	12.98	
596	Aves	*Gallus domesticus*	Femur	Pro, shaft	F	13.82						12.31	
601	Aves	*Gallus domesticus*	Femur	Pro, shaft	F								
730	Aves	*Gallus domesticus*	Femur	Pro, shaft	F	15.44					6.29	13.56	
731	Aves	*Gallus domesticus*	Femur	Pro, shaft	F	13.9						14.04	
732	Aves	*Gallus domesticus*	Femur	Dis, shaft	F		14.08	13.24					
733	Aves	*Gallus domesticus*	Femur	Dis, shaft	F		13.75	11.24					
473	Aves	*Alectoris chukar*	Femur	Pro, shaft	F	12.55							

525	Aves	*Alectoris chukar*	Femur	Pro, shaft	F	12						8.34	
298	Aves	Passiformes	Femur	Pro, shaft	F	7.76						6.42	
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**Dip**	**Bd**	**GL**	**SD**	**SC**		
79	Aves	*Gallus domesticus*	Humerus	Dis, shaft	F			13.97			7.67		
322	Aves	*Gallus domesticus*	Humerus	Dis, shaft	F			14.84			6.86		
520	Aves	*Gallus domesticus*	Humerus		F	17.11	18.1	13.25	64.97		6.25		
581	Aves	*Gallus domesticus*	Humerus	Pro, shaft	F	14.61							
699	Aves	*Gallus domesticus*	Humerus	Proximal	F	16.92	17.53			5.04			
700	Aves	*Gallus domesticus*	Humerus	Distal	F			14.43					
701	Aves	*Gallus domesticus*	Humerus		F			13.43		6.21			
183	Aves	*Columba livia*	Humerus	Pro, shaft	F	14.42	14.22						
702	Aves	*Alectoris chukar*	Humerus		F	14.22	14.87	10.98	57.98				
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**Bd**	**GL**					
18	Aves	*Gallus domesticus*	Phalanx1			5.67	4.1	16.49					
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bd**	**GL**	**SC**					
327	Aves	*Gallus domesticus*	Radius		F	6.57	60.92	2.97					
713	Aves	*Gallus domesticus*	Radius			5.51	56.05	2.51					
714	Aves	*Gallus domesticus*	Radius			5.99	58.27	2.76					
715	Aves	*Gallus domesticus*	Radius					2.9					
716	Aves	*Gallus domesticus*	Radius			5.18	44.78	2.79					
717	Aves	*Gallus domesticus*	Radius			5.45	46.03	2.72					
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Dic**							
361	Aves	*Gallus domesticus*	Scapula	Pro, shaft	F	12.45							
	Aves	*Gallus domesticus*	Scapula		F	11.19							
582	Aves	*Gallus domesticus*	Scapula	Pro, shaft	F	11.22							
599	Aves	*Gallus domesticus*	Scapula		F	12.3							
724	Aves	*Gallus domesticus*	Scapula		F	12.25							
725	Aves	*Gallus domesticus*	Scapula	Pro, shaft	F	10.56							
726	Aves	*Gallus domesticus*	Scapula	Pro, shaft	F	11.2							
727	Aves	*Gallus domesticus*	Scapula	Pro, shaft	F	10.86							
	Class	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**Bd**	**GL**	**SC**				
65	Aves	*Gallus domesticus*	Tarsometatarsus	Dis, shaft	F		11.53						
66	Aves	*Gallus domesticus*	Tarsometatarsus	Pro, shaft	F	12.01			5.96				
233	Aves	*Gallus domesticus*	Tarsometatarsus	Pro, shaft	F	13.78							
363	Aves	*Gallus domesticus*	Tarsometatarsus		U,F			76.88					
522	Aves	*Gallus domesticus*	Tarsometatarsus	Dis, shaft	F		11.91		6.05				
539	Aves	*Gallus domesticus*	Tarsometatarsus		F		11.39	68.57	5.51				
559	Aves	*Gallus domesticus*	Tarsometatarsus		F	14.19	13.25	84.54					

564	Aves	*Gallus domesticus*	Tarsometatarsus	Dis, shaft	F		13.07						
600	Aves	*Gallus domesticus*	Tarsometatarsus	Dis, shaft	F								
576	Aves	*Alectoris chukar*	Tarsometatarsus	Pro, shaft	F	11.19							
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**Dip**	**Bd**	**Dd**	**GL**	**SD**	**SC**	**La**
17	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F			11.33	11.15				
293	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F			11.32	11.18				
323	Aves	*Gallus domesticus*	Tibiotarsus	Pro, shaft	F		19.67					6.37	
324	Aves	*Gallus domesticus*	Tibiotarsus		U		18.29	10.19	12.49	116.24			113.11
92	Aves	*Gallus domesticus*	Tibiotarsus	Pro, shaft			17.43						
470	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F			11.69	12.09		24.75		
604	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F	11.24			11.32				
605	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F				11.08				
606	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F	10.05			10.71				
607	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F	9.26			10.68				
743	Aves	*Gallus domesticus*	Tibiotarsus		F		19.29	11.96	11.85	107.86		6.08	103.91
744	Aves	*Gallus domesticus*	Tibiotarsus		F		19.13	12.13	12.22	116.79		6.68	112.38
745	Aves	*Gallus domesticus*	Tibiotarsus		F		19.03	10.8	11.46	107.74		6.03	104.84
746	Aves	*Gallus domesticus*	Tibiotarsus		F		16.33			102.16		5.43	99.42
748	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F				10.17			5.22	
749	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F			11.67	11.55			6.16	
750	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F				9.88			5.07	
751	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F			10.14	10.44			5.61	
752	Aves	*Gallus domesticus*	Tibiotarsus	Dis, shaft	F				11.01				
50	Aves	*Alectoris chukar*	Tibiotarsus	Dis, shaft	F			7.89	7.46				
223	Aves	*Alectoris chukar*	Tibiotarsus	Dis, shaft	F			8.18	6.47				
496	Aves	*Alectoris chukar*	Tibiotarsus	Pro, shaft	F		17.43						
562	Aves	*Alectoris chukar*	Tibiotarsus	Pro, shaft	F		16.62						
747	Aves	Raptor	Tibiotarsus	Dis, shaft	F			16.27	13.58			7.94	
#	**Class**	**Species**	**Bone**	**Part**	**F/U**	**Bp**	**Dip**	**GL**	**SC**	**Did**			
602	Aves	*Gallus domesticus*	Ulna	Dis, shaft	F				5.17	8.11			
718	Aves	*Gallus domesticus*	Ulna			7.03	9.41	50.51	3.44	5.87			
742	Aves	*Gallus domesticus*	Ulna	Pro, shaft	F	8.51	11.84						
603	Aves	*Alectoris chukar*	Ulna	Dis, shaft	F				3.96	6.19			
369	Aves	*Alectoris chukar*	Ulna		F					5.88			
157	Aves	*Alectoris chukar*	Ulna	Pro, shaft	F				4.02	6.46			
296	Aves	Passiformes	Ulna	Pro, shaft	F	6.45	8.98						

Appendix 3. Distribution of identified and unidentified animal bones according to the locus and basket in which they were found during the renewed Herodium excavations: latter part of Herod's reign (a) and time of the First Jewish Revolt (b).

Appendix 3a.

Layer	Area	Locus	Basket	#Identified	#Unidentified	Caprine	*Bos taurus*	*Sus scrofa*	Wild mammal	*Gallus domesticus*	Aves	Caprine size	Cattle size	Gallus size	Total
4b	A	2591	10156	1	0	1									1
4a	A	2802	10130	2	0		1	1							2
3	A	2931	10026	4	3	3		3				1			7
4a–5	A	2938	6661	1	3	1						2		1	4
3–2a/b–1?	A	2949	6643	2	2	2						2			4
3	A	2963	10017	5	4	3				2		4			9
3–2a/b–1?	A	2966	10038	0	3								3		3
2a	A	2980	10061	3	3				2	1		2	1		6
2a	A	2982	10077	2	15	1				1		13	1	1	17
6–7	A	2983	10073	1	2	1						1	1		3
2–3	A	2992	10086	2	0	2									2
1–2	A	2995	10091	5	2	3				1	1	2			7
2b	A	2999	10105	2	8	1					1	7		1	10
3–4–5	A	12003	10109	0	7							7			7
3–4	A	12018	10141	8	10	8						10			18
3–4	A	12018	10147	59	76	34	6			14	3	60	6	10	135
3	A	12019	10154	46	31	35	2			8	1	24	5	2	77
3	A	12019	10161	41	29	25	5			10	1	28	1		70
3	A	12021	10166	28	29	17	4			7		22	6	1	57
2–3	A	12022	10172	19	0	13	1			3	2				19
2–3	A	12023	10167	18	14	13	1			2	1	14			31
2–3	A	12023	10179	7	4	4	3						4		11
3	A	12043	10211	0	2								1	1	2
2–3	A	12045	10205	1	1			1				1			2
2–3	A	12045	10219	1	2	1						2			3
2–3	A	12058	10225	0	7			0.06[1]				4	3		7
3	A	12062	10235	3	0	3									3
2–3	A	12063	10231	3	0	2					1				3
1–2	A	12065		3	0	3									3
2–3	A	12066	10242	12	12	10	1				1	12			24
3–6	A	12067		7	0	6				1					7

Layer	Area	Locus	Basket	#Identified	#Unidentified	Caprine	*Bos taurus*	*Sus scrofa*	Wild mammal	*Gallus domesticus*	Aves	Caprine size	Cattle size	Gallus size	Total
3–6	A	12067		7	0	4				1					7
3–6	A	12072	10253	12	5	6	1	2		3		3	2		17
3–6	A	12072	10260	8	16	7				1		9	6	1	24
3–6	A	12072	10253	12	5	5	1	2		3		3	2		17
3–6	A	12072	10260	8	16	7				1		9	6	1	24
2–3	A	12076	10255	3	1	3						1			4
3	A	12078	10273	3	1	3						1			4
3–6	A	12079	10270	8	12	6		2				8	3	1	20
3–6	A	12079	10270	8	12	5		2				8	3	1	20
3–3b	A	12083	10281	33	13	31				2		11	2		46
3–3b	A	12083	10313	11	4	5	4	1			1	3	1		15
2	A	12087	12087	9	1	5	2			2		1			10
3–3a	A	12092	10341	2	2		1			1		2			4
3–3a	A	12094	10324	1	0	1									1
3–3a	A	12095	10326	2	0	2									1
3a	A	12096	10319	11	7	7	1	2				7			17
2–3a	A	12100	10331	29	28	7		18	1	3	4	22		2	57
2–3a	A	12100	10350	6	5	4				2		4		1	11
2–3a	A	12100		13	3	3		9		1		3			16
3–3a	A	12103	10346	3	6	2	1					5		1	9
3a	A	12106	10354	8	10	4	2				2	8	2		18
3	A	12107	10362	3	3			1	1		1	3			6
3–6	A	12109	10369	1	2					1		1	1		3
3–6	A	12109	10369	1	2					1		1	1		3
2–3a	A	12110	10365	144	48	25				52	4	26	3	19	129
3–3a	A	12112	10373	3	4	1		1		1		2	2		7
3	A	12117	10384	3	9	2		1				5	4		12
3	A	12117	10406	3	9	2		1				5	4		12
3	A	12118	10377	6	10	4				2		8		2	16
3	A	12118	10394	7	2		3						2		5
3	A	12118	10410	4	11	2	1			1		7		4	15
3–3a	A	12119	10415	6	5	1	1			3	1	5			11
2–3	A	12123	10140	1	1					1		1			2
2–3	A	12123	10422	1	3						1	3			4

Layer	Area	Locus	Basket	#Identified	#Unidentified	Caprine	*Bos taurus*	*Sus scrofa*	Wild mammal	*Gallus domesticus*	Aves	Caprine size	Cattle size	Gallus size	Total
2–3	A	12123	10432	11	8	4	1			5	1	5	2	1	19
3–3a	A	12124	10437	24	23	4	4			14	2	11	6	6	47
3–3a	A	12127	10463	1	4	1						3	1		5
2–3	A	12130	10467	2	2	2						2			4
3	A	12131	10454	11	11	7		3		1		11			22
2–3	A	12133	10474	2	10			2				6	2	2	12
3	A	12134	10472	12	8	6	3	2			1	7	1		20
3–3a	A	12135	10491	3	5	2				1		5			8
2	A	12136	10469	3	2			3				2			5
3	A	12137	10480	0	3							3			3
6	A	12143	10499	4	1			3			1	1			5
2–3	A	12144	10513	5	2	4		1				2			7
3	A	12145	10503	5	1	5						1			6
3	A	12150	10508	9	7	5				2		6	3		16
3	A	12156	10532	5	6	1	1			3		6			11
3	A	12158	10529	3	4	3						4			7
3	A	12159	10539	3	14	3						8	4	2	17
3	A	12161	10545	1	3					1		3			4
3	A	12164	10564	9	3	6				2	1	3			12
3–3a	A	12165	10556	1	4					1		4			5
2–3a	A	12166	10552	1	5	1						3	2		6
3	A	12168	10578	4	3			4				3			7
3	A	12170	10577	13	14	7	1	2		3		14			27
3	A	12173	10585	4	15	2	2					2	13		19
3	A	12175	10594	2	1				0.07[2]		2	1			3
2–3a	A	12177	10598	1	4	1						4			5
3–3a	A	12179	10111	11	7	3		8				7			18
3	A	12181	10122	14	13	5		9				13			27
3	A	12181	10123	15	16	7		9				16			32
3–3a–2	A	12182	10125	6	7	2		3			1	7			13
3	A	12184	10175	6	3	4		1		1		3			9
3–3a–2	A	12185	10182	5	3	2						3	2		7
Total				805	685	413	55	93	4	165	36	555	99	63	1490

[1] = 0.0625; [2] = 0.07692307

Appendix 3b.

Layer	Area	Locus	Basket	#Identified	#Unidentified	Caprine	*Bos taurus*	*Sus scrofa*	Wild mammal	*Gallus domesticus*	Aves	Caprine size	Cattle size	Gallus size	Total
4b	A	2582	10156	22	20	10	3	2	2	5		17	2	1	42
4b	A	2583	10130	20	8	11		7		1	1	7		1	28
4a–4b	A	2584	5147	0	3							3			3
4b	A	2591	10156	1	0	1									1
4b	A	2591	5194	35	28	24	4	2		5		24	4		63
3–4a–4b	A	2596	5209	0	4							4			4
3–4a	A	2598	5265	7	3	4	1			1	1	2	1		10
4a	A	2602	5268	7	14	6	1					11	3		21
4a	A	2604	5272	4	14	4						13	1		18
4a	A	2612	5280	3	4	3						4			7
4a	A	2613	5308	4	4	3	1					4			8
4a	A	2618	5281	1	1			1				1			2
4a	A	2624	5314	1	0	1									1
4a	A	2628	5314	5	11	5						9	2		16
4a–4b	A	2772	6179	8	1	4	1		1			1			9
2b–4a	A	2775	6190	5	6	2	2		1			4	2		11
4a	A	2802	10130	2	0		1	1							2
4a–5	A	2938	6661	2	2	2						1		1	4
	A	2980	10061	3	3				2	1		2	1		6
	A	2982	10077	2	15	1				1		13	1	1	17
	A	2995	10091	5	2	3				1	1	2			7
	A	2999	10105	2	8	1				1		7		1	10
	A	12003	10109	1	6	1						6			7
	A	12065		3	0	3									3
Total				143	157	89	14	13	6	16	3	135	17	5	301