SOME TAPHONOMIC EFFECTS OF SCAVENGING CANIDS ON THE BONES OF UNGULATE SPECIES: SOME ACTUALISTIC RESEARCH AND A ROMANO-BRITISH CASE STUDY

by

Susan Mary Stallibrass

VOL 2

Dissertation submitted in fulfillment
of the requirements for the degree of
Doctor of Philosophy, in the
Department of Archaeology & Prehistory,
University of Sheffield, September 1986.

CONTAINS

PULLOUT

TABLE 3:1 BASIC DATA FOR CARCASSES

	SHEFFIELD SHEEP	GRIZEDALE ROE	GRIZEDALE RED
No. of carcasses	21	16	4
No. of elements	516	961	263
ave. bones per carcass	25	60	66
% bones attacked	52%	40%	38%

TABLE 3:2 BASIC DATA FOR THE SHEFFIELD SHEEP COLLECTIONS

	TOTAL CARCASS	'ARTIC' FOX DENS	ISOL. FOX DENS	GEN-ERAL ISOL.	S146 GROUP	TOTAL NON-CARCASS
No. of elements	516	43	53	54	28	178
Min. No. of Inds.	21	6	10	6	4	11
ave. bones per carcass	25	7	5	9	7	16
% bones attacked	52%	63%	91%	89%	89%	83%

TABLE 4:1 FREQUENCIES OF ELEMENTS IN THE SHEFFIELD SHEEP CARCASS COLLECTION (MNI = 21)

	RAW FREQUENCY	BRAIN'S INDEX	RANK ORDER
Pelvis	20	0.48	1
Tibia	19	0.45	2
Lumbar vertebrae	47	0.37	3
Femur	14	0.33	4
Mandible	13	0.31	5.5
Cervical vertebrae	33	0.31	5.5
Atlas	6	0.29	7.5
Axis	6	0.29	7.5
Thoracic vertebrae	77	0.28	9
Metatarsal	11	0.26	10
Astragalus	10	0.24	12.5
Humerus	10	0.24	12.5
Radius	10	0.24	12.5
Ulna	10	0.24	12.5
Ribs	122	0.22	15
Scapula	9	0.21	16.5
Metacarpal	9	0.21	16.5
Sacrum	4	0.19	18.5
Navicular-cuboid	8	0.19	18.5
Proximal phalange	25	0.15	20.5
Distal phalange	19	0.15	20.5
Calcaneum	6	0.14	22
Medial phalange	14	0.11	23
Patella	4	0.10	24
Sternebrae	9	0.06	25
Hyoid	1	0.02	26
TOTAL	516	AVE.: 0.32	

TABLE 4:2 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF THE BRAIN'S INDEX VALUES AND AVERAGE INTACT SIZES OF THE 26 ELEMENT TYPES IN THE SHEFFIELD SHEEP CARCASS COLLECTION

	SIZE	BRAIN'S INDEX
	Rank	Rank
Hyoid	16	26
Mandible	5	5.5
Scapula	7	16.5
Humerus	8.5	12.5
Radius	8.5	12.5
Ulna	5	12.5
Metacarpal	11	16.5
Pelvis	2	1
Femur	5	4
Tibia	2	2
Metatarsal	10	10
Patella	22.5	24
Astragalus	22.5	12.5
Calcaneum	14.5	22
Navicular-cuboid	22.5	18.5
Proximal phalange	18	20.5
Medial phalange	26	23
Distal phalange	22.5	20.5
Atlas	13	7.5
Axis	14.5	7.5
Cervical vertebrae	18	5.5
Thoracic vertebrae	22.5	9
cumbar vertebrae	22.5	3
Sacrum	12	18.5
Ribs	2	15
Sternebrae	18	25

Rho=0.46, n=26, $p<0.05$

N.B. For size: rank 1=the largest element type and rank 26=the smallest

TABLE 5:1 FREQUENCIES OF ELEMENTS IN THE GRIZEDALE ROE DEER CARCASS COLLECTION

	NO. OF BONES	BRAIN'S INDEX
Hyoid	8	0.25
Mandible	13	0.41
Scapula	12	0.38
Humerus	16	0.50
Radius	3	0.41
Ulna	13	0.41
Metacarpal	12	0.38
Pelvis	25	0.78
Femur	20	0.63
Tibia	19	0.59
Metatarsal	15	0.47
Patella	9	0.28
Astragalus	13	0.41
Calcaneum	14	0.44
Navicular-cuboid	13	0.41
Proximal phalange	8	0.30
Medial phalange	31	0.24
Distal phalange	25	0.20
Atlas	10	0.63
Axis	10	0.63
Cervical verts	57	0.71
Thoracic verts	160	0.77
Lumbar verts	77	0.80
Sacrum	12	0.75
Ribs	271	0.65
Sternebrae	55	0.49
TOTAL:	961	AVERAGE: 0.50

TABLE 5:2 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF THE FREQUENCIES OF ELEMENTS (USING BRAIN'S INDEX VALUES) IN THE SHEFFIELD SHEEP AND GRIZEDALE ROE DEER CARCASS COLLECTIONS

	GRIZEDALE ROE DEER		SHEFFIELD SHEEP	
	BRAIN'S INDEX	RANK	BRAIN'S INDEX	RANK
Lumbar vertebrae	0.80	1	0.37	3
Pelvis	0.78	2	0.48	1
Thoracic vertebrae	0.77	3	0.28	9
Sacrum	0.75	4	0.19	18.5
Cervical vertebrae	0.71	5	0.31	5.5
Ribs	0.65	6	0.22	15
Femur	0.63	8	0.33	4
Atlas	0.63	8	0.29	7.5
Axis	0.63	8	0.29	7.5
Tibia	0.59	10	0.45	2
Humerus	0.50	11	0.24	12.5
Sternebrae	0.49	11	0.06	25
Metatarsal	0.47	13	0.26	10
Calcaneum	0.44	14	0.14	22
Mandible	0.41	17	0.31	5.5
Radius	0.41	17	0.24	12.5
Ulna	0.41	17	0.24	12.5
Astragalus	0.41	17	0.24	12.5
Navicular-cuboid	0.41	17	0.19	18.5
Scapula	0.38	20.5	0.21	16.5
Metacarpal	0.38	20.5	0.21	16.5
Proximal phalange	0.30	22	0.15	20.5
Patella	0.28	23	0.10	24
Hyoid	0.25	24	0.02	26
Medial phalange	0.24	25	0.11	23
Distal phalange	0.24	26	0.15	20.5
	AVERAGE: 0.50		AVERAGE: 0.23	

Spearman's $R=0.68$, $n=26$, $p<0.01$

TABLE 5:3 A CHI SQUARED ANALYSIS OF THE RAW FREQUENCIES OF ELEMENTS IN THE SHEFFIELD SHEEP AND THE GRIZEDALE ROE DEER CARCASS COLLECTIONS

	SHEFFIELD SHEEP		GRIZEDALE ROE DEER		TOTALS
	N	X^2	N	X^2	
Hyoid	1	1.46	8	0.78	9
Mandible	13	1.69	13	0.91	26
Scapula	9	0.38	12	0.20	21
Humerus	10	0.09	16	0.05	26
Radius	10	0.48	13	0.26	23
Ulna	10	0.48	13	0.26	23
Metacarpal	9	0.38	12	0.20	21
Pelvis	20	1.17	25	0.63	45
Femur	14	0.38	20	0.20	34
Tibia	19	2.46	19	1.32	38
Metatarsal	11	0.41	15	0.22	26
Patella	4	0.06	9	0.03	13
Astragalus	10	0.48	13	0.26	23
Calcaneum	6	0.14	14	0.08	20
Navicular-cuboid	8	0.06	13	0.03	21
Proximal phalange	25	0.41	38	0.22	63
Medial phalange	14	0.19	31	0.10	45
Distal phalange	19	0.86	25	0.46	44
Atlas	6	0.03	10	0.02	16
Axis	6	0.03	10	0.02	16
Cervical vertebrae	33	0.08	57	0.04	90
Thoracic vertebrae	77	0.41	160	0.22	237
Lumbar vertebrae	47	0.31	77	0.17	124
Sacrum	4	0.45	12	0.24	16
Ribs	122	1.70	271	0.92	393
Sternebrae	9	7.98	55	4.29	64
	516	22.57	961	12.13	1477

chi squared = 34.70, with 51 degrees of freedom, $p>0.95$

TABLE 5:4, CHI SQUARED ANALYSIS OF THE NUMBERS OF ATTACKED ELEMENTS IN THE GRIZEDALE ROE DEER CARCASS COLLECTION

	ATTACKED		INTACT		TOTAL
	N	X^2	N	X^2	
Hyoid	1	1.49	7	0.99	8
Mandible	6	0.13	7	0.09	13
Scapula	5	0.01	7	0.01	12
Humerus	5	0.29	11	0.19	16
Radius	4	0.26	9	0.17	13
Ulna	4	0.26	9	0.17	13
Metacarpal	3	0.66	9	0.43	12
Pelvis	21	12.31	4	8.12	25
Femur	12	2.06	8	1.36	20
Tibia	4	1.67	15	1.10	19
Metatarsal	1	4.13	14	2.72	15
Patella	0	3.58	9	2.36	9
Astragalus	0	5.17	13	3.41	13
Calcaneum	2	2.29	12	1.51	14
Navicular-cuboid	0	5.17	13	3.41	13
Proximal phalange	2	11.37	36	7.51	38
Medial phalange	1	10.40	30	6.86	31
Distal phalange	1	8.04	24	5.31	25
Atlas	1	2.23	9	1.48	10
Axis	3	0.24	7	0.16	10
Cervical verts	17	1.41	40	0.93	57
Thoracic verts	69	0.46	91	0.30	160
Lumbar verts	54	17.82	23	11.79	77
Sacrum	5	0.01	7	0.01	12
Ribs	153	19.03	118	12.56	271
Sternebrae	8	8.79	47	5.80	55
TOTALS:	382	119.28	579	78.75	961

chi squared = 198.03, with 51 degrees of freedom, $p<0.01$

TABLE 5:5 FREQUENCIES OF ATTACKED ELEMENTS IN THE GRIZEDALE RED DEER CARCASS COLLECTION

	ATTACKED		INTACT		TOTAL	BRAIN'S INDEX
	N	%	N	%		
Hyoid	2	100	0	0	2	0.25
Mandible	2	67	1	33	3	0.38
Scapula	3	60	2	40	5	0.63
Humerus	3	100	0	0	3	0.38
Radius	0	0	2	100	2	0.25
Ulna	2	100	0	0	2	0.25
Metacarpal	0	0	2	100	2	0.25
Pelvis	5	71	2	29	7	0.88
Femur	3	60	2	40	5	0.63
Tibia	0	0	4	100	4	0.50
Metatarsal	0	0	3	100	3	0.38
Patella	2	100	0	0	2	0.25
Astragalus	0	0	3	100	3	0.38
Calcaneum	1	33	2	67	3	0.38
Navicular-cuboid	0	0	3	100	3	0.38
Proximal phalange	1	17	5	83	6	0.19
Medial phalange	2	33	4	67	6	0.19
Distal phalange	1	20	4	80	5	0.16
Atlas	1	33	2	67	3	0.75
Axis	0	0	3	100	3	0.75
Cervical vertebrae	6	35	11	65	17	0.85
Thoracic vertebrae	13	30	0	70	43	0.83
Lumbar vertebrae	11	69	5	31	16	0.67
Sacrum	1	33	2	67	3	0.75
Ribs	38	42	2	58	90	0.87
Sternebrae	3	14	19	86	22	0.79
TOTALS/AVERAGES:	100	38%	163	62%	263	

TABLE 6:1 RAW FREQUENCIES AND RANK ORDERS OF ELEMENTS IN THE FOUR SUB-COLLECTIONS OF THE SHEFFIELD SHEEP NON-CARCASS BONES

	'ARTIC.' FOX DENS		ISOLATED FOX DENS		S146 GROUP		GENERAL ISOLATED FINDS		TOTAL NON-CARCASS	
	N	RANK	N	RANK	N	RANK	N	RANK	N	RANK
Hyoid	-	-	-	-	-	-	-	-	0	24.5
Mandible	0	18	2	9.5	2	7	4	5	8	12
Scapula	3	7	0	20	3	4.5	5	3	11	6
Humerus	4	5	5	4	7	1	4	5	20	2
Radius	6	2	6	3	1	9	6	2	19	3
Ulna	6	2	3	6.5	0	16.5	3	9.5	12	4
Metacarpal	6	2	2	9.5	0	16.5	2	13	10	9
Pelvis	2	9.5	1	14.5	4	2	3	9.5	10	9
Femur	2	9.5	2	9.5	3	4.5	4	5	11	6
Tibia	1	12	10	1	3	4.5	7	1	21	1
Metatarsal	0	18	8	2	0	16.5	1	15.5	9	11
Patella	-	-	-	-	-	-	-	-	0	24.5
Astragalus	0	18	2	9.5	0	16.5	1	15.5	3	16.5
Calcaneum	0	18	1	14.5	0	16.5	0	20	1	21.5
Navicular-cuboid	1	12	1	14.5	0	16.5	0	20	2	20
Proximal phalange	5	4	3	6.5	0	16.5	3	9.5	11	6
Medial phalange	3	7	0	20	0	16.5	0	20	3	16.5
Distal phalange	3	7	0	20	0	16.5	0	20	3	16.5
Atlas	0	18	1	14.5	1	9	1	15.5	3	16.5
Axis	0	18	1	14.5	0	16.5	0	20	1	21.5
Cervical vertebrae	0	18	4	5	3	4.5	3	9.5	10	9
Thoracic vertebrae	0	18	0	20	0	16.5	3	9.5	3	16.5
Lumbar vertebrae	0	18	0	20	1	9	3	9.5	4	13
Sacrum	1	12	1	14.5	0	16.5	1	15.5	3	16.5
Ribs	-	-	-	-	-	-	-	-	0	24.5
Sternebrae	-	-	-	-	-	-	-	-	0	24.5
TOTALS	43		53		28		54		178	

KEY:
'ARTIC.': 'ARTICULATED'

TABLE 6:2 FREQUENCIES OF SKULLS IN ALL OF THE SHEFFIELD SHEEP COLLECTIONS

	TOTAL CARCASS	'ARTIC.' FOX DEN	ISOL. FOX DEN	S146 GROUP	GENERAL ISOL. FINDS	TOTAL NON-CARCASS
No. of elements	516	43	53	28	54	178
Min. Nos. of Inds.	21	6	10	4	6	11
No. of skulls	8	0	10	0	1	11
Brain's Index	0.38	0	1.00	0	0.17	1.00

KEY: Min. Nos. of Inds.: Minimum Numbers of Individuals
'ARTIC.': 'ARTICULATED'; ISOL.: ISOLATED; GEN.: GENERAL

TABLE 6:3 CHI SQUARED ANALYSIS OF RAW FREQUENCIES OF ELEMENTS, GROUPED INTO ANATOMICAL UNITS, IN THE 'ARTICULATED' AND ISOLATED FOX DEN SUB-COLLECTIONS

	'ARTICULATED' FOX DEN FINDS		ISOLATED FOX DEN FINDS		TOTALS
	N	χ^2	N	χ^2	N
FORELIMB	19	1.07	14	0.89	33
HINDLIMB	3	2.29	12	2.00	15
LOWER LIMBS	18	0.25	17	0.21	35
AXIAL/THORACIC	3	1.50	10	1.29	13
TOTALS	43		53		96

chi squared=9.50, with 7 degrees of freedom, p=0.05

TABLE 6:4 CHI SQUARED ANALYSIS OF RAW FREQUENCIES OF ELEMENTS, GROUPED INTO ANATOMICAL PARTS, IN THE COMBINED FOX DEN SUB-COLLECTION AND THE SHEEP CARCASS COLLECTION

	COMBINED FOX DEN FINDS		SHEEP CARCASSES		TOTALS
	N	X^2	N	X^2	N
FORELIMB	33	44.00	39	7.93	72
HINDLIMB	15	6.13	39	1.11	52
LOWER LIMBS	35	9.33	102	1.69	137
AXIAL/THORACIC	13	32.07	338	5.96	351
TOTALS	96		516		612

chi squared=108.22, with 7 degrees of freedom, $p<0.001$

TABLE 6:5 DIFFERENCES IN RANK ORDERS OF RAW FREQUENCIES OF ELEMENTS IN THE COMBINED FOX DEN SUB-COLLECTION AND SHEFFIELD SHEEP CARCASS COLLECTION

NO. OF PLACES DIFFERENCE IN RANK	HIGHER RANK IN COMBINED FOX DEN SUB-COLLECTION	HIGHER RANK IN SHEEP CARCASS COLLECTION	NO. OF PLACES DIFFERENCE IN RANK
		Ribs	22.5
		Thor. vertebrae	21.5
		Lumb. vertebrae	20.5
13.5	Radius		
12	Metacarpal		
11	Humerus		
11	Ulna		
9	Sacrum		
6.5	Scapula		
6	Metacarpal		
5.5	Tibia	Pelvis	5.5
		Sternebrae	5.5
		Mandible	4.5
4.5	Navicular-cuboid	Cerv. vertebrae	4.5
		Distal phalange	4
3	Calcaneum		
3	Atlas		
3	Axis		
		Medial phalange	2
1	Patella	Prox. phalange	1
1	Femur	Astragalus	1
1	Hyoid		

N.B. Total number of ranks = 26

TABLE 6:6 CHI SQUARED ANALYSIS OF RAW FREQUENCIES OF ELEMENTS, GROUPED INTO ANATOMICAL PARTS, IN THE COMBINED FOX DEN SUB-COLLECTION AND THE S146 SUB-COLLECTION

	COMBINED FOX DENS		S146 GROUP		TOTALS
	N	χ^2	N	χ^2	N
FORELIMB	33	0.03	11	0.10	44
HINDLIMB	15	0.06	6	0.20	21
LOWER LIMBS	35	2.37	0	8.00	35
AXIAL/THORACIC	13	1.89	11	7.20	24
	96		28		124

chi squared=19.85, with 7 degrees of freedom, $p<0.01$

TABLE 6:7 CHI SQUARED ANALYSIS OF RAW FREQUENCIES OF ELEMENTS, GROUPED INTO ANATOMICAL UNITS, IN THE GENERAL ISOLATED SUB-COLLECTION AND THE CARCASS COLLECTION

	GENERAL ISOLATED FINDS		CARCASSES		TOTALS
	N	X^2	N	X^2	N
FORELIMB	18	33.80	39	3.25	57
HINDLIMB	11	7.20	37	0.84	48
LOWER LIMBS	7	0.90	102	0.09	109
AXIAL/THORACIC	18	7.53	338	0.80	356
TOTALS	54		516		570

chi squared= 54.41, with 7 degrees of freedom, $p<0.001$

TABLE 6:8 CHI SQUARED ANALYSIS OF RAW FREQUENCIES OF ELEMENTS, GROUPED INTO ANATOMICAL PARTS, IN THE GENERAL ISOLATED FINDS AND COMBINED FOX DEN SUB-COLLECTIONS

	GENERAL ISOLATED FINDS		COMBINED FOX DEN FINDS		TOTALS
	N	X^2	N	X^2	N
FORELIMB	18	0	33	0	51
HINDLIMB	11	0.44	15	0.24	26
LOWER LIMBS	7	4.27	35	2.37	42
AXIAL/THORACIC	18	4.45	13	2.45	31
TOTALS	54		96		150

chi squared=14.22, with 7 degrees of freedom, $p<0.05$

TABLE 6:9 CHI SQUARED ANALYSIS OF RAW FREQUENCIES OF ELEMENTS, GROUPED INTO ANATOMICAL UNITS, IN THE RESIDUAL COLLECTIONS (I.E. THE CARCASS AND S146 COLLECTIONS) AND THE TRANSPORTED COLLECTIONS (I.E. THE FOX DEN AND GENERAL ISOLATED SUB-COLLECTIONS)

	RESIDUAL COLLECTIONS		TRANSPORTED COLLECTIONS		TOTALS
	N	X^2	N	X^2	N
FORELIMB	50	10.65	51	38.23	101
HINDLIMB	43	2.24	26	8.07	69
LOWER LIMBS	102	1.07	42	3.90	144
AXIAL/THORACIC	349	8.73	31	31.72	380
TOTALS	54		150		694

chi squared = 104.61, with 7 degrees of freedom, $p<0.001$

DIFFERENCES IN RANK ORDERS OF RAW FREQUENCIES OF ELEMENTS IN THE RESIDUAL AND TRANSPORTED COLLECTIONS

NO. OF PLACES DIFFERENCE IN RANK	HIGHER RANK IN RESIDUAL COLLECTIONS	HIGHER RANK IN TRANSPORTED COLLECTIONS	NO. OF PLACES DIFFERENCE IN RANK
13.5	Lumbar vertebrae		
12	Thoracic vertebrae	Metacarpal	12
		Radius	11
		Ulna	10.5
9	Pelvis		
8.5	Ribs	Sacrum	8.5
7.5	Cervical vertebrae		
6.5	Axis	Metatarsal	6.5
		Proximal phalange	5.5
4	Atlas		
4	Mandible		
4	Femur		
		Medial phalange	3.5
		Scapula	2.5
		Calcaneum	2.5
		Navicular-cuboid	2
1.5	Patella	Astragalus	1.5
		Distal phalange	1.5
		Hyoid	1.5
		Humerus	0.5
		Tibia	0.5
		Sternebrae	0.5

TABLE 7:1 PERCENTAGES OF ELEMENT TYPES SHOWING SIGNS OF CARNIVORE ATTACK IN THE ROE DEER, RED DEER AND SHEEP CARCASS COLLECTIONS AND THE NON-CARCASS SHEEP COLLECTION

	RED DEER CARCASSES	ROE DEER CARCASSES	SHEFFIELD SHEEP CARCASSES	SHEFFIELD SHEEP NON-CARCASSES
	%	%	%	%
Hyoid	100	13	0	-
Mandible	67	46	38	75
Scapula	60	42	89	100
Humerus	100	31	90	100
Radius	0	31	20	79
Ulna	100	31	90	100
Metacarpal	0	25	0	60
Pelvis	71	84	95	100
Femur	60	60	100	91
Tibia	0	21	95	95
Metatarsal	0	07	18	100
Patella	100	0	100	-
Astragalus	0	0	0	33
Calcaneum	33	14	50	100
Navicular-cuboid	0	0	0	0
Proximal phalange	17	5	12	64
Medial phalange	33	3	0	33
Distal phalange	20	4	0	33
Atlas	33	10	67	100
Axis	0	30	33	100
Cervical verts	35	30	27	70
Thoracic verts	30	43	45	67
Lumbar verts	69	70	79	100
Sacrum	33	42	100	100
Ribs	42	56	69	-
Sternebrae	14	15	56	-
AVERAGES:	38%	40%	53%	84%
No. of attacked bones:	100	382	276	150
Total no. of bones:	263	961	516	178

TABLE 7:2 CHI SQUARED VALUES OF ELEMENTS IN THE SHEFFIELD SHEEP CARCASS COLLECTION, SHOWING DEVIATIONS FROM THE NUMBERS OF ATTACKED AND INTACT BONES EXPECTED BY THE NULL HYPOTHESIS

χ^2	MORE ATTACKED THAN EXPECTED
6.95	Pelvis
6.54	Tibia
6.37	Ribs
6.26	Lumbar vertebrae
6.07	Femur
2.72	Humerus
2.72	Ulna
2.30	Scapula
1.75	Patella
1.75	Sacrum

MORE INTACT THAN EXPECTED	χ^2
Distal phalange	10.91
Proximal phalange	8.52
Medial phalange	8.06
Astragalus	5.73
Metacarpal	5.17
Sternebrae	5.17
Navicular-cuboid	4.61
Cervical vertebrae	4.35
Metatarsal	2.70
Radius	2.19
Thoracic vertebrae	0.76
Hyoid	0.56
Mandible	0.52
Axis	0.45
Atlas	0.01
Calcaneum	0.01

chi squared=195.82, with 51 degrees of freedom, $p<0.001$

TABLE 7:3 CHI SQUARED VALUES OF ELEMENTS IN THE GRIZEDALE ROE DEER CARCASS COLLECTION, SHOWING DEVIATIONS FROM THE NUMBERS OF ATTACKED AND INTACT BONES EXPECTED BY THE NULL HYPOTHESIS

χ^2	MORE ATTACKED THAN EXPECTED	MORE INTACT THAN EXPECTED	χ^2
19.03	Ribs		
17.82	Lumbar vertebrae		
12.31	Pelvis		
		Proximal phalange	11.37
		Medial phalange	10.40
8.79	Sternebrae		
		Distal phalange	8.04
		Astragalus	5.17
		Navicular-cuboid	5.17
		Metatarsal	4.13
		Patella	3.58
		Calcaneum	2.29
		Atlas	2.23
2.06	Femur		
		Tibia	1.67
		Hyoid	1.49
		Cervical vertebrae	1.41
		Metacarpal	0.66
		Thoracic vertebrae	0.46
		Humerus	0.29
		Radius	0.26
		Ulna	0.26
		Axis	0.24
		Mandible	0.13
0.01	Scapula		0.01
0.01	Sacrum		0.01

chi squared=198.03, with 51 degrees of freedom, $p<0.001$

TABLE 7:4 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF THE MEAT UTILITY INDEX (MUI) VALUES AND PERCENTAGES ATTACKED OF ELEMENTS IN THE SHEFFIELD SHEEP CARCASS COLLECTION

	MEAT UTILITY INDEX (MUI)		PERCENTAGE ATTACKED	
	MUI	RANK	%	RANK
Mandible	14	12.5	38	11
Scapula	45	7	89	5
Humerus	28	9	90	4
Radius	14	12.5	20	13
Metacarpal	5	16	0	17
Pelvis/Sacrum	81	3	96	2
Femur	78	4	100	1
Tibia	21	10	95	3
Metatarsal	6	14.5	18	15
Astrag./Calc.	6	14.5	19	14
Phalanges	3	17	5	16
Atlas/Axis	19	11	50	9
Cervical verts.	55	5	27	12
Thoracic verts.	46	6	45	10
Lumbar verts.	39	8	79	6
Ribs	100	1	69	7
Sternebrae	91	2	56	8

KEY:
Astrag.: astragalus
Calc.: calcaneum
verts.: vertebrae

Rho=0.71, N=17, $p<0.01$

TABLE 7:5 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF THE PERCENTAGE ATTACKED AND THE BRAIN'S INDEX VALUE OF THE 26 ELEMENT TYPES IN THE SHEFFIELD SHEEP CARCASS COLLECTION

	ATTACKED		BRAIN'S INDEX	
	%	RANK	BI	RANK
Femur	100	2	0.33	4
Sacrum	100	2	0.19	18.5
Patella	100	2	0.10	24
Pelvis	95	4.5	0.48	1
Tibia	95	4.5	0.45	2
Humerus	90	6.5	0.24	12.5
Ulna	90	6.5	0.24	12.5
Scapula	89	8	0.21	16.5
Lumbar vertebrae	79	9	0.37	3
Ribs	69	10	0.22	15
Atlas	67	11	0.29	7.5
Sternebrae	56	12	0.06	25
Calcaneum	50	13	0.14	22
Thoracic vertebrae	45	14	0.28	9
Mandible	38	15	0.31	5.5
Axis	33	16	0.29	7.5
Cervical vertebrae	27	17	0.31	5.5
Radius	20	18	0.24	12.5
Metatarsal	18	19	0.26	10
Proximal phalange	12	20	0.15	20.5
Metacarpal	0	23.5	0.21	16.5
Hyoid	0	23.5	0.02	26
Distal phalange	0	23.5	0.15	20.5
Medial phalange	0	23.5	0.11	23
Astragalus	0	23.5	0.24	12.5
Navicular-cuboid	0	23.5	0.19	18.5

Rho=0.35, N=26, $p<0.05$

KEY:
BI: BRAINS'S INDEX

TABLE 7:6 THE DISTRIBUTION OF COMPLETENESS CATEGORIES FOR THE 26 ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

% OF LENGTH:		CAT.1 1-25%		CAT.2 26-50%		CAT.3 51-75%		CAT.4 76-99%		CAT.5 complete		
	TOTAL	N	%	N	%	N	%	N	%	N	%	DAM- IN-AGED:TACT
Hyoid	1	-		-		-		-		1	100%	0:1
Mandible	21	1	5%	-		1	5%	9	43%	10	48%	11:10
Scapula	20	1	5%	-		4	20%	9	45%	6	30%	19:1
Humerus	30	-		-		11	37%	10	33%	9	30%	29:1
Radius	29	-		-		-		6	21%	23	79%	17:12
Ulna	22	-		3	14%	2	9%	10	45%	7	32%	21:1
Metacarpal	19	-		-		-		1	5%	18	95%	6:13
Pelvis	30	-		1	3%	10	33%	17	57%	2	7%	29:1
Femur	25	-		1	4%	2	8%	7	28%	15	60%	24:1
Tibia	40	-		-		1	3%	12	30%	27	68%	38:2
Metatarsal	20	-		-		-		1	5%	19	95%	11:9
Patella	4	-		-		-		-		4	100%	4:0
Astragalus	13	-		-		-		-		13	100%	1:12
Calcaneum	7	-		-		-		-		7	100%	4:3
Nav.-cuboid	10	-		-		-		-		10	100%	0:10
P. phalange	36	-		-		1	3%	-		35	97%	10:26
M. phalange	17	-		-		-		-		17	100%	1:16
D. phalange	22	-		-		-		-		22	100%	1:21
Atlas	9	-		-		-		-		9	100%	7:2
Axis	7	-		-		-		-		7	100%	3:4
Cervical v.	43	-		-		-		-		43	100%	16:27
Thoracic v.*	79	-		9	11%	18	23%	6	8%	46	58%*	36:43
Lumbar v. *	52	-		1	2%	6	12%	25	48%	20	38%*	41:11
Sacrum	7	-		3	43%	2	29%	-		2	29%	7:0
Ribs	122	12	10%	5	4%	10	8%	52	43%	43	35%	81:41
Sternebrae	9	-		-		-		-		9	100%	5:4
TOTAL/AVE.:	694	14	2%	23	3%	68	10%	165	24%	424	61%	422:272

KEY:
CAT.: CATEGORY; P.: Proximal; M.: Medial; D.: Distal; v.: vertebrae
Nav.-cuboid: Navicular-cuboid

N.B. * denotes maximum width used for completeness categories.
It should be noted that all thoracic and lumbar vertebrae retain their full lengths measured between epiphyses (or fusion surfaces).

TABLE 7:7 WHOLE BONE EQUIVALENT VALUES (WBEs) FOR THE TWELVE MEDIUM AND LARGE ELEMENT TYPES IN THE SHEFFIELD SHEEP CARCASS, NON-CARCASS AND TOTAL COLLECTIONS

	SHEFFIELD SHEEP CARCASSES			SHEFFIELD SHEEP NON-CARCASSES		
	WBE	N	WBE / N	WBE	N	WBE / N
Mandible	11.375	13	0.88	7.25	8	0.91
Scapula	8.375	9	0.93	8.375	11	0.76
Humerus	8.625	10	0.86	16	20	0.80
Radius	10	10	1.00	18.25	19	0.96
Ulna	9	10	0.90	9.125	12	0.76
Metacarpal	9	9	1.00	9.875	10	0.99
Pelvis	15.75	20	0.79	7.75	10	0.78
Femur	12.625	14	0.90	10.125	11	0.92
Tibia	18.75	19	0.99	19.375	21	0.92
Metatarsal	11	11	1.00	8.875	9	0.99
Sacrum	2.375	4	0.59	2	3	0.67
Ribs	98.125	122	0.80	-	0	-

	SHEFFIELD SHEEP TOTAL COLLECTION			ROE DEER CARCASSES		
	WBE	N	WBE / N	WBE	N	WBE / N
Mandible	18.625	21	0.89	12.25	13	0.94
Scapula	16.75	20	0.84	10.625	12	0.89
Humerus	24.625	29	0.82	15.625	16	0.98
Radius	28.25	29	0.97	12.875	13	0.99
Ulna	18.125	22	0.82	12.625	13	0.97
Metacarpal	18.875	19	0.99	11.75	12	0.98
Pelvis	23.5	30	0.78	23.125	25	0.93
Femur	22.75	25	0.91	18.375	20	0.92
Tibia	38.125	40	0.95	19	19	1.00
Metatarsal	19.875	20	0.99	15	15	1.00
Sacrum	4.375	7	0.63	11	12	0.92
Ribs	98.125	122	0.80	184.875	271	0.68

TABLE 8:1A MANDIBLES: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	SHEEP CARCASSES					ISOLATED FOX DEN FINDS		GENERAL ISOLATED FINDS		S146 GROUP		TOTAL DAMAGED		TOTAL WEATHERED	
	9	9	111	147	148	28L	28P	71	75	A	B				
SYMPHYSIS				X		X	X	X	X		X	6	29%	-	
HORIZONTAL RAMUS				X				X				2	10%	-	
ANGLE OF JAW	X	X	X	X	X	W	X	W	X	X	X	9	43%	2	10%
CORONOID PROCESS			X	X	X			X	X	X	X	7	33%	-	
CONDYLE				XW			W	X	W		W	2	10%	4	19%
longitudinal cracks long ramus				W		W	W	W	W		W			6	29%
completeness	4	4	1	3	4	4	4	4	4	4	4				
eruption state	3	3	-	3	3	3	2	3	3	1	1				

KEY:

X: signs of damage by carnivores present

W: signs of weathering present

completeness (in terms of length of original element still present):
1: 0 - 25%, 2: 25 - 50%, 3: 50 - 75%, 4: 75 - 99%, 5: complete

tooth eruption state:
-: no evidence remaining,
1: deciduous premolars still present, and second molar only partially erupted
2: permanent premolars and third molar only partially erupted
3: all molars fully erupted and in wear

Total number of mandibles = 21

Number of mandibles showing signs of carnivore damage = 11 (i.e. 52%)

Number of mandibles showing signs of weathering = 6 (i.e. 29%)

TABLE 8:1B COMPARISON OF DEGREES OF DAMAGE AND WEATHERING IN THE CARCASS AND NON-CARCASS COLLECTIONS

	CARCASSES		NON-CARCASSES	
TOTAL NUMBER OF MANDIBLES (N)	13		8	
TOTAL NUMBER OF AREAS STUDIED (N X 5)	65		40	
NUMBER OF AREAS DAMAGED	11	(17%)	15	(38%)
NUMBER OF AREAS WEATHERED	2	(3%)	10	(25%)

TABLE 8:2 DETAILS OF DAMAGE TO MANDIBLES

8:2A. DAMAGE TO THE SYMPHYSIS

	CARCASS	ISOLATED FOX DEN FINDS		GENERAL ISOLATED FINDS		S146	TOTAL NUMBER OF INCIDENCES
	147	28L	28P	71	75	B	
BROKEN OFF	X	X	X	X	X	X	6
SHREDDED		X	X	X	X	X	5
PUNCTURED		X		X			2
MOUTHED	X	X	X	X	X		5

8:2B. DAMAGE TO THE HORIZONTAL RAMUS

	CARCASS	ISOLATED FOX DEN FINDS		GENERAL ISOLATED FINDS		S146	TOTAL DAMAGED		TOTAL WEATHERED	
	147	28L	28P	71	75	B				
BROKEN OFF	X						1	5%	-	
FLAKE SCARS	X						1	5%	-	
MOUTHED	X			X			2	10%	-	
longitudinal split lines	W	W	W	W	W	W			6	29%

8:2C. DAMAGE TO ANGLE OF JAW

	CARCASSES					ISOLATED FOX DEN FINDS		GENERAL ISOLATED FINDS		S146		TOTAL DAMAGED		TOTAL WEATHERED	
	9	9	111	147	148	28L	28P	71	75	A	B				
BROKEN OFF			X												
BROKEN EDGE	X	X			X		X		X	X	X	7	33%	-	
SHREDDED				X								1	5%	-	
FLAKE SCARS	X	X		X	X							4	19%	-	
PUNCTURES	X	X		X					X			3		-	
MOUTHED										X		1	5%	-	
split lines						W		W						2	10%

8:2D. DAMAGE TO THE CORONOID PROCESS

	CARCASSES			GENERAL ISOLATED FINDS		S146		TOTAL DAMAGED		TOTAL WEATHERED
	111	147	148	71	75	A	B			
BROKEN OFF	X	X				X		3	14%	-
BROKEN EDGE			X	X	X		X	4	19%	-
SHREDDED		X			X			2	10%	-
FLAKE SCARS						X		1	5%	-
MOUTHED		X						1	5%	-

8:2E. DAMAGE TO CONDYLE

	CARCASS	ISOLATED FOX DEN FIND	GENERAL ISOLATED FINDS		S146	TOTAL DAMAGED	TOTAL WEATHERED
	147	28P	71	75	B		
BROKEN EDGE	X		X			2 10%	-
PUNCTURED			X			1 5%	-
weathered (trabecula bone exposed)	W	W		W	W		4 19%

TABLE 8:3A. SCAPULAE: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	CARCASSES						"ARTICULATED" FOX DEN FINDS			
	9	111	141	141	148	148	26K	280	146	
GLENOID AND/OR NECK					X	X				....
TUBEROSITY			X			X	X			....
SPINE	X	X	X	X	X		X	XW	X	....
DISTAL BORDER OF BLADE	XW	XW	XW	XW	XW	X	XW	XW	XW	....
CENTRE OF BLADE					W	W				....
completeness of bone	4	3	5	5	5	4	4	4	4	....
fusion state	F	F	F	F	F	F	F	F	F	...

	GENERAL ISOLATED FINDS							S146			TOTAL DAMAGED		TOTAL WEATHERED	
	36	84	92	94	115	128	147	C	D	E				
GLENOID/NECK ...	X	X		XW	X	X	X		X	X	10	50%	1	5%
TUBEROSITY ...	X	X		XW	XW	X	W			X	9	45%	3	15%
SPINE ...	XW	X		X	X		X		X	X	15	75%	2	10%
DISTAL BORDER ...	XW	XW	XW	X	XW	XW	XW	XW	XW	XW	19	95%	17	85%
CENTRE BLADE ...	W			W		W					0	-	5	25%
completeness ...	4	4	4	5	3	4	3	5	3	2				
fusion state ...	?	?	F	?	F	F	F	F	F	F				

TABLE 8:3A (Continued). SCAPULAE: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

KEY:
X: signs of damage by carnivores present

W: signs of weathering present

completeness (refers to length of original element still present):
1: 0 - 25%, 2: 25 - 50%, 3: 50 - 75%, 4: 50 - 99%, 5: complete

fusion state:
F: proximal tuberosity fused
?: no evidence remaining for fusion state

Total number of scapulae = 20

Number of scapulae showing signs of carnivore damage = 19 (i.e. 95%)

Number of scapulae showing signs of weathering = 19 (i.e. 95%)

TABLE 8:3B COMPARISON OF DEGREES OF DAMAGE AND WEATHERING OF THE CARCASS AND NON-CARCASS SCAPULAE

	CARCASSES		NON-CARCASSES	
TOTAL NUMBER OF SCAPULAE (N)	7		13	
TOTAL NUMBER OF AREAS STUDIED (N X 5)	35		65	
NUMBER OF AREAS DAMAGED	15	43%	41	63%
NUMBER OF AREAS WEATHERED	7	20%	18	28%

TABLE 8:4 DETAILS OF DAMAGE TO SCAPULAE

8:4A. DAMAGE TO THE GLENOID CAVITY AND THE NECK

	CARCASSES			GENERAL ISOLATED FINDS						S146		TOTAL DAMAGED		TOTAL WEATHERED	
	141	148	148	36	84	94	115	128	147	D	E				
BROKEN OFF				X	X							2	10%	-	
BROKEN EDGE		X	X				X		X	X	X	6	30%	-	
PUNCTURED			X	X		X		X			X	5	25%	-	
MOUTHED				X			X	X				3	15%	-	
weathered						W	W		W					3	15%

8:4B. DAMAGE TO THE PROXIMAL TUBEROSITY

	CARCASSES				"ARTICULATED" FOX DEN FIND	GENERAL ISOL. FINDS				S146	TOTAL DAMAGED		TOTAL WEATHERED	
	36	84	141	148	26K	94	115	128	147	E				
BROKEN OFF	X	X									2	10%		
BROKEN EDGE			X	X	X	X	X	X		X	7	35%	-	
trabecula bone exposed						W	W		W				3	15%

8:4C. DAMAGE TO THE SPINE

	CARCASSES					"ARTICULATED" FOX DEN FINDS			
	9	111	141	141	148	26K	280	146	
BROKEN EDGE	X	X	X	X	X	X	X	X	...
SHREDDED	X					X	X		...
PUNCTURED		X		X	X	X	X		...
weathered (trabecula bone exposed)							W		...

	ISOLATED FOX DEN FINDS					S146					
	36	84	94	115	147	D	E	TOTAL DAMAGED		TOTAL WEATHERED	
BROKEN EDGE ...	X	X	X	X	X	X	X	15	75%	-	
SHREDDED ...	X	X	X				X	7	35%	-	
PUNCTURED ...				X				6	30%	-	
weathered (trabecula bone exposed) ...	W									2	10%

8:4D. DAMAGE TO THE DISTAL BORDER OF THE BLADE

	CARCASSES						"ARTICULATED" FOX DEN FINDS			
	9	111	141	141	148	148	26K	280	146	
BROKEN OFF	X	X				X	X	X	X	...
BROKEN EDGE			X	X	X					...
SHREDDED	X				X		X	X	X	...
PUNCTURED	X	X	X	X	X	X	X	X	X	...
MOUTHED		X				X				...
longitudinal cracks running in from broken edge	W	W	W	W	W		W	W	W	...

	GENERAL ISOLATED FINDS							S146			TOTAL DAMAGED		TOTAL WEATHERED
	36	84	92	94	115	128	147	C	D	E			
BROKEN OFF ...		X	X		X	X	X		X	X	13	65%	-
BROKEN EDGE ...	X			X				X			6	30%	-
SHREDDED ...	X	X	X		X	X	X	X	X	X	14	70%	-
PUNCTURED ...	X	X	X		X	X	X	X	X	X	18	90%	-
MOUTHED ...			X		X						4	20%	-
longit, cracks running in from broken edge ...	W	W	W		W	W	W	W	W	W			17 85%

8:4E. DAMAGE TO THE CENTRE OF THE BLADE

	CARCASSES		GENERAL ISOLATED FINDS			TOTAL WEATHERED	
	148	148	36	94	128		
weathering (crazed and longitudinal cracks)	W	W	W	W	W	5	25%

TABLE 8:5A HUMERI: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	CARCASSES										"ARTICULATED" FOX DEN FINDS			
	8	20A	20B	24	86	111A	141	147	148	150	28K	280	30	146
PROXIMAL TUBEROSITIES	X	XW	XW		XW	XW	X	X	X	X	X	XW	XW	XW
PROXIMAL EPIPHYSIS	X		XW	W	X	XW	X	X	X	X	X	XW	XW	X
PROXIMAL SHAFT	X						X	X	X	X	X			
MIDSHAFT								X	X	X				
DISTAL SHAFT						X								
DISTAL EPIPHYSIS	XW							XW	W	XW	XW	W	XW	
completeness	3	5	5	5	5	5	4	4	3	3	3	5	5	5
fusion state	2	3	3	3	3	3	2	2	2	2	2	3	3	3

		ISOLATED FOX DEN FINDS					GENERAL ISOLATED FINDS				
		25A	26F	27C	28G	28N	37	40	98	132	
PROXIMAL TUBEROSITIES	...	X	X	X	X	X	X	X	X	X	...
PROXIMAL EPIPHYSIS	...	X	X	X	X	X	X	X	X	X	...
PROXIMAL SHAFT	...	X	X	X	X	X	X	X	X	X	...
MID SHAFT	...					X	X				...
DISTAL SHAFT	...	X			X	X	X		X		...
D. EPIPHYSIS	...	X	W	W	W	X		W	X		...
completeness	...	3	4	4	4	3	3	4	3	4	...
fusion state	...	-	2	2	2	-	0	3	-	2	...

TABLE 8:5A (Continued) HUMERI: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	S146							TOTAL DAMAGED		TOTAL WEATHERED	
	F	G	H	I	J	K	L				
PROX. TUBEROSITIES ...	XW	X	X	X	X	X	X	29	97%	8	27%
PROX. EPIPHYSIS ...	XW	X	XW	X	X	X	X	28	93%	7	23%
PROX. SHAFT ...		X	X	X	X	X	X	20	67%	-	
MID SHAFT ...		X			X	X		8	27%	-	
DIST. SHAFT ...		X	X		X	X		10	33%	-	
DIST. EPIPHYSIS ...	X	X	X	W	X	X	W	13	43%	13	%
completeness ...	5	3	4	4	3	3	4				
fusion state ...	3	2	2	2	-	-	2				

KEY:
X: signs of damage by carnivores present
W: trabecula bone exposed (possibly due to weathering)
(N.B. there are no split lines on any of the humeri)

completeness (refers to length of original element still present):
1: 1 - 25%, 2: 25 - 50%, 3: 50 - 75%, 4: 75 - 99%, 5: complete

fusion state:
-: no evidence remaining, 0: distal epiphysis unfused,
1: distal epiphysis fused but proximal epiphysis unfused,
2: distal epiphysis fused but fusion state of proximal epiphysis unknown
3: proximal epiphysis fused

Total number of humeri = 30

Number of humeri showing signs of carnivore damage = 29 (i.e. 97%)

Number of humeri showing signs of weathering = 21 (i.e. 70%)

TABLE 8:5B COMPARISONS OF DEGREES OF DAMAGE AND WEATHERING OF THE CARCASS AND NON-CARCASS HUMERI

	CARCASSES		NON-CARCASSES	
TOTAL NUMBER OF HUMERI (N)	10		20	
TOTAL NUMBER OF AREAS STUDIED (N X 6)	60		120	
NUMBER OF AREAS DAMAGED	30	50%	79	66%
NUMBER OF AREAS WEATHERED	10	17%	18	15%

TABLE 8:6 DETAILS OF PATTERNS OF DAMAGE AND WEATHERING TO HUMERI IN THE TOTAL SHEFFIELD SHEEP COLLECTION

8:6A PATTERNS OF ALTERATION TO THE PROXIMAL TUBEROSITIES

	CARCASSES									"ARTICULATED" FOX DEN FINDS				
	8	20A	20B	86	111A	141	147	148	150	28K	280	30	146	
BROKEN OFF	X					X	X	X	X	X				...
BROKEN EDGE				X	X						X	X	X	...
PUNCTURED		X	X	X	X							X		...
CRUSHED														...
trabecula bone exposed		W	W	W	W						W	W	W	...

	ISOLATED FOX DEN FINDS				GENERAL ISOLATED FINDS		
	26F	27C	28G	28N	40	132	
BROKEN OFF ..	X	X	X	X	X	X	...
BROKEN EDGE ..							...
PUNCTURED ..							...
CRUSHED ..							...
trabecula bone exposed ..							...

TABLE 8:6A (Continued) PATTERNS OF ALTERATION TO THE PROXIMAL TUBEROSITIES

	S146 GROUP							TOTAL DAMAGED		TOTAL WEATHERED	
	F	G	H	I	J	K	L				
BROKEN OFF ..		X	X	X	X	X	X	18	60%	-	
BROKEN EDGE ..	X							6	20%	-	
PUNCTURED ..	X							6	20%	-	
CRUSHED ..	X							1	3%	-	
trabecula bone exposed ..	W							-		8	27%

8:6B PATTERNS OF ALTERATION TO THE PROXIMAL EPIPHYSIS

	CARCASSES									"ARTICULATED" FOX DEN FINDS				
	8	20B	24	86	111A	141	147	148	150	28K	280	30	146	
BROKEN OFF	X					X	X	X	X	X				...
BROKEN EDGE											X		X	...
PUNCTURED		X		X	X								X	...
trabecula bone exposed		W	W		W						W	W		...

	ISOLATED FOX DEN FINDS				GENERAL ISOLATED FINDS		
	26F	27C	28G	28N	40	132	
BROKEN OFF ..	X	X	X	X		X	...
BROKEN EDGE ..					X		...
PUNCTURED ..							...
trabecula bone exposed ..							...

	S146 GROUP							TOTAL DAMAGED		TOTAL WEATHERED	
	F	G	H	I	J	K	L				
BROKEN OFF ..		X	X	X	X	X	X	17	57%	-	
BROKEN EDGE ..	X							4	13%	-	
PUNCTURED ..	X							5	17%	-	
trabecula bones exposed ..	W		W					-		7	23%

8:6C PATTERNS OF ALTERATION TO THE PROXIMAL SHAFT

	CARCASSES					"ARTIC." FOX DEN FIND	ISOLATED FOX DEN FINDS					
	8	141	147	148	150	28K	25A	26F	27C	28G	28N	
BROKEN OFF	X	X	X	X	X	X	X	X	X	X	X	...
CRACKS FROM EDGE			X					X				...
SHREDDED												...
FLAKE SCARS	X	X	X	X			X	X	X		X	...
PUNCTURED										X		...
MOUTHED	X		X					X	X	X	X	...

	GENERAL ISOLATED FINDS				S146 GROUP						TOTAL DAMAGED	
	37	40	98	132	G	H	I	J	K	L		
BROKEN OFF ..	X		X	X	X	X	X	X	X	X	20	67%
CRACKS FROM EDGE ..					X			X		X	5	17%
SHREDDED ..							X	X			2	7%
FLAKE SCARS ..	X		X	X	X	X				X	14	47%
PUNCTURED ..				X						X	3	10%
MOUTHED ..	X	X		X	X	X	X	X	X	X	15	50%

8:6D PATTERNS OF ALTERATION TO THE MID SHAFT

	CARCASSES			ISOL. FOX DEN FIND	GEN. ISOL. FIND	S146 GROUP			TOTAL DAMAGED	
	147	148	150	28N	37	G	J	K		
BROKEN EDGE	X		X	X	X	X	X		6	20%
CRACKS FROM EDGE			X						1	3%
FLAKE SCARS	X		X			X			3	10%
MOUTHED	X	X	X	X	X	X	X	X	8	27%

8:6E PATTERNS OF ALTERATION TO THE DISTAL SHAFT

	CARCASS	ISOLATED FOX DEN FINDS			GENERAL ISOL. FINDS		S146 GROUP				TOTAL DAMAGED	
	111A	25A	28G	28N	37	98	G	H	J	K		
BROKEN OFF		X		X		X			X	X	5	17%
FLAKE SCARS						X					1	3%
PUNCTURED					X					X	2	7%
MOUTHED	X		X	X		X	X	X	X	X	8	27%

8:6F PATTERNS OF ALTERATION TO THE DISTAL EPIPHYSIS

	CARCASSES				"ARTCICULATED" FOX DEN FINDS			ISOLATED FOX DEN FINDS				
	8	147	148	150	28K	280	30	26F	27C	28G	28N	
BROKEN OFF											X	...
BROKEN EDGE		X			X							...
PUNCTURED	X	X		X			X					...
MOUTHED		X		X								...
trabecula bone exposed	W	W	W	W	W	W	W	W	W	W		...

	GEN. ISOL. FIND	S146 GROUP							TOTAL DAMAGED		TOTAL WEATHERED	
	40	F	G	H	I	J	K	L				
BROKEN OFF	..					X	X		3	10%	-	
BROKEN EDGE	..								2	7%	-	
PUNCTURED	..								4	13%	-	
MOUTHED	..	X	X	X					5	17%	-	
trabecula bone exposed	.. W				W			W	-		13	43%

TABLE 8:7A RADII: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	CARCASSES			"ARTICULATED" FOX DEN FINDS			ISOLATED FOX DEN FINDS						
	8	9	19	26J	26K	28K	26A	26G	27F	27G	28A	28P	
PROXIMAL EPIPHYSIS			XW					X		X	X	W	...
PROXIMAL SHAFT							X	X	X	X	X		...
MID SHAFT							X			X			...
DISTAL SHAFT								X	X	X	X		...
DISTAL EPIPHYSIS	X	X			X	X	X	X		X		W	...
split lines				S			S	S				S	...
completeness	5	5	5	5	5	5	5	5	4	4	4	5	...
fusion state	3U	3U	1U	3U	3U	3U	3U	-	1	-	1	3	...

	GENERAL ISOLATED FINDS S146							TOTAL DAMAGED		TOTAL WEATHERED	
	38	75	137A	137B	139	149	M				
PROXIMAL EPIPHYSIS ..	X					X		6	21%	2	7%
PROXIMAL SHAFT ..	X							6	21%	-	
MID SHAFT ..	X	X						4	14%	-	
DISTAL SHAFT ..	X		X	X	X	X		9	31%	-	
DISTAL EPIPHYSIS ..	X	X	X	X			X	12	41%	1	3%
split lines ..					S			-		5	17%
completeness ..	4	5	4	5	5	4	5				
fusion state ..	2U	3U	2	3U	1	1	3				

TABLE 8:7A (Continued) RADII: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

KEY: X: signs of damage by carnivores present
W: trabecula bone exposed (possibly due to weathering)

completeness
(refers to length of original element still present):
1: 1 - 25%, 2: 25 - 50%, 3: 50 - 75%, 4: 75 - 99%,
5: complete

fusion state:
-: no evidence remaining, 1: distal epiphysis unfused,
2: proximal epiphysis fused, but fusion state of distal epiphysis unknown, 3: distal epiphysis fused,
U: radius fused to ulna

Total number of radii = 29

Number of radii showing signs of carnivore damage = 17 (i.e. 59%)

Number of radii showing signs of weathering = 6 (i.e. 21%)
(or possible weathering)

TABLE 8:7B COMPARISONS OF DEGREES OF DAMAGE AND WEATHERING OF THE CARCASS AND NON-CARCASS RADII

	CARCASSES		NON-CARCASSES	
TOTAL NUMBER OF RADII (N)	10		19	
TOTAL NUMBER OF AREAS STUDIED (N X 5)	50		95	
NUMBER OF AREAS DAMAGED	3	(6%)	34	(36%)
NUMBER OF AREAS WEATHERED (includes possible weathering)	1	(2%)	7	(7%)

TABLE 8:8 DETAILS OF PATTERNS OF DAMAGE AND WEATHERING TO RADII IN THE TOTAL SHEFFIELD SHEEP COLLECTION

8:8A. RADII: PATTERNS OF ALTERATION TO THE PROXIMAL EPIPHYSIS

	CARCASS	ISOLATED FOX DEN FINDS				GENERAL ISOLATED FINDS		TOTAL NUMBER OF INCIDENCES
	19	26G	27G	28A	28P	38	149	
BROKEN OFF		X						1
BROKEN EDGE			X	X			X	3
PUNCTURED	X					X		2
MOUTHED							X	1
trabecula bone exposed	W				W	W		3

8:8B. RADII: PATTERNS OF ALTERATION TO THE PROXIMAL SHAFT

	ISOLATED FOX DEN FINDS					GENERAL ISOLATED FIND	TOTAL NUMBER OF INCIDENCES
	26A	26G	27F	27G	28A	38	
FRACTURE (emanating from broken edge)					X		1
SHREDDED		X					1
PUNCTURED						X	1
MOUTHED	X	X	X	X	X	X	6

8:8C. RADII: PATTERNS OF ALTERATION TO THE MID SHAFT

	ISOLATED FOX DEN FINDS		GENERAL ISOLATED FINDS		TOTAL NUMBER OF INCIDENCES
	26A	27G	38	75	
MOUTHED	X	X	X	X	4

8:8D. RADII: PATTERNS OF ALTERATION TO THE DISTAL SHAFT

	ISOLATED FOX DEN FINDS				GENERAL ISOLATED FINDS					TOTAL NUMBER OF INCIDENCES
	26G	27F	27G	28A	38	137A	137B	139	149	
SHREDDED	X		X	X						3
PUNCTURED						X		X	X	3
MOUTHED	X	X	X	X	X	X	X	X	X	9

8:8E. RADII: PATTERNS OF ALTERATION TO THE DISTAL EPIPHYSIS

	"ARTICULATED" CARCASSES		FOX DEN FINDS		ISOLATED FOX DEN FINDS					
	8	9	26K	28K	26A	26G	27G	28A	28P	
BROKEN OFF						X	X			...
SHREDDED								X		...
PUNCTURED	X	X	X	X	X					...
MOUTHED										...
trabecula bone exposed									W	...

	GENERAL ISOLATED FINDS				S146	TOTAL NUMBER OF INCIDENCES
	38	75	137A	137B	M	DAMAGED
BROKEN OFF	.. X		X			4
SHREDDED	..					1
PUNCTURED	..	X		X	X	8
MOUTHED	..	X				1
trabecula bone exposed	..					1

TABLE 8:9A ULNAE: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	CARCASSES									
	8	9	19	20B	24	86	141	148	148	
OLECRANON	X	X	X	X	X	X	X	X	X	...
PROXIMAL SHEFT		X	X					X		...
MID SHAFT	X									...
DISTAL SHAFT									X	...
split lines										...
completeness	3	4	4	5	5	5	4	4	4	...
fusion state	3R	3R	1R	3R	3R	3R	3R	3R	-R	...

	"ARTICULATED" FOX DEN FINDS						ISOLATED FOX DEN FINDS			
	26J	26K	28K	28O	30	146	26A	27E	79	
OLECRANON	.. X	X	X	X	X	X	X	X	X	...
PROXIMAL SHAFT	..							X	X	...
MID SHAFT	..							X		...
DISTAL SHAFT	..							X	X	...
split lines	..						W			...
completeness	.. 5	4	4	5	5	4	4	2	2	...
fusion state	.. 2R	3R	3R	3R	3R	3R	3R	-	-	...

TABLE 8:9A (Continued) ULNAE: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	GENERAL ISOLATED FINDS			TOTAL DAMAGED		TOTAL WEATHERED	
	38	75	148A				
OLECRANON	X	X	X	21	95%	-	
PROXIMAL SHAFT	X			6	27%	-	
MID SHAFT			X	3	14%	-	
DISTAL SHAFT	X		X	5	23%	-	
split lines						1	5%
completeness	3	4	2				
fusion state	-R	3R	-				

KEY:
X: signs of damage by carnivores present

W: weathering in form of split line present

completeness (refers to length of original element still present):
1: 1 - 25%, 2: 25 - 50%, 3: 50 - 75%, 4: 75 - 99%, 5: complete

fusion state:
-: no evidence remaining
1: distal epiphysis unfused
2: olecranon epiphysis fused but distal epiphysis unfused
3: distal epiphysis fused
R: ulna fused to radius

Total number of ulnae = 22

Number of ulnae showing signs of damage by carnivores = 21 (i.e. 95%)

Number of ulnae showing signs of weathering (i.e. split lines present) = 1 (i.e. 5%)

TABLE 8:9B COMPARISONS OF DEGREES OF DAMAGE AND WEATHERING IN THE CARCASS AND NON-CARCASS ULNAE

	CARCASSES		NON-CARCASSES	
TOTAL NUMBER OF ULNAE (N)	10		12	
TOTAL NUMBER OF AREAS STUDIED (N X 4)	40		48	
NUMBER OF AREAS DAMAGED	14	35%	18	38%
NUMBER OF AREAS WEATHERED	0		1	5%

TABLE 8:10 DETAILS OF PATTERNS OF DAMAGE AND WEATHERING TO ULNAE IN THE TOTAL SHEFFIELD SHEEP COLLECTION

8:10A. ULNAE: PATTERNS OF ALTERATION TO THE OLECRANON

	CARCASSES									
	8	9	19	20B	24	86	141	148	148	
BROKEN OFF	X	X	X				X	X	X	...
BROKEN EDGE										...
CRACK FROM EDGE	X		X							...
FLAKE SCARS							X	X		...
SHREDDED										...
PUNCTURED				X	X	X				...
MOUTHED	X									...
trabecula bone exposed										...

	"ARTICULATED" FOX DEN FINDS						FOX DEN FINDS				ISOLATED FINDS			TOTAL NUMBER OF INCIDENCES	
	26J	26K	28K	28O	30	146	26A	27C	79	38	75	148A		
BROKEN OFF ..		X	X			X	X	X	X	X	X	X	15	68%
BROKEN EDGE ..				X	X								2	9%
CRACK FROM EDGE ..													2	9%
FLAKE SCARS ..													2	9%
SHREDDED ..						X						X	2	9%
PUNCTURED ..	X	X	X	X	X		X		X	X	X	X	13	59%
MOUTHED ..					X		X		X	X	X		6	27%
trabecula bone exposed ..	W				W								2(W)	9%

8:10B. ULNAE: PATTERNS OF ALTERATION TO THE PROXIMAL SHAFT

	CARCASSES			ISOLATED FOX DEN FINDS		GENERAL ISOLATED FIND	TOTAL NUMBER OF INCIDENCES	
	9	19	148	27E	79	38		
BROKEN EDGE			X	X			2	9%
CRACK FROM EDGE	X	X					2	9%
FLAKE SCARS			X				1	5%
MOUTHED					X	X	2	9%

8:10C. ULNAE: PATTERNS OF ALTERATION TO MID SHAFT

	CARCASS	ISOLATED FOX DEN FIND	GENERAL ISOLATED FIND	TOTAL NUMBER OF INCIDENCES	
	8	27E	148A		
BROKEN OFF	X	X	X	3	14%
SHREDDED		X	X	2	9%

8:10D. ULNAE: PATTERNS OF ALTERATION TO THE DISTAL SHAFT

	CARCASS	GENERAL ISOLATED FIND	TOTAL NUMBER OF INCIDENCES	
	148	38		
BROKEN OFF	X	X	2	9%
SHREDDED		X	1	5%

TABLE 8:11A METACARPI: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	CARCASS	"ARTICULATED" FOX DEN FINDS				ISOL. FOX DEN FIND	ISOL. GEN. FIND				
	141	28K	280	30	30	28H	149	TOTAL DAMAGED		TOTAL WEATHERED	
PROX. EPIPHYSIS						X	X	2	11%	-	
PROX. SHAFT		X		X	X	X	X	5	26%	-	
MID SHAFT			X	X			X	3	16%	-	
DISTAL SHAFT				XW	X	XW	X	4	21%	2	11%
DIST. EPIPHYSIS	W			XW	X		X	3	16%	2	11%
completeness	5	5	5	5	5	5	4				
fusion state	3	3	3	3	3	1	2				

KEY:
X: signs of damage by carnivores present

W: trabecula bone exposed

completeness (refers to length pf original element still present):
1: 1 - 25%, 2: 25 - 50%, 3: 50 - 75%, 4: 75 - 99%, 5: complete

fusion state:
1: distal epiphysis unfused
2: proximal epiphysis fused, fusio state of distal epiphysis unknown
3: distal epiphysis fused

Total number of metacarpi = 19

Number of metacarpi showing signs of carnivore damage = 6 (i.e. 32%)

Number of metacarpi showing exposed trabecula bone = 3 (i.e. 16%)

TABLE 8:11B COMPARISONS OF DEGREES OF DAMAGE AND WEATHERING OF THE CARCASS AND NON-CARCASS METACARPI

	CARCASSES		NON-CARCASSES	
TOTAL NUMBER OF METACARPI (N)	9		10	
TOTAL NUMBER OF AREAS STUDIED (N X 5)	45		50	
NUMBER OF AREAS DAMAGED	0	-%	17	34%
NUMBER OF AREAS WEATHERED	1	2%	3	6%

TABLE 8:12 DETAILS OF PATTERNS OF DAMAGE AND WEATHERING TO METACARPI IN THE TOTAL SHEFFIELD SHEEP COLLECTION

8:12A. METACARPI: PATTERNS OF ALTERATION TO THE PROXIMAL EPIPHYSIS

	ISOLATED FOX DEN FIND	GENERAL ISOLATED FIND	TOTAL NUMBER OF INCIDENCES DAMAGED
	28H	149	
BROKEN EDGE	X		1 5%
PUNCTURED	X	X	2 11%

8:12B. METACARPI: PATTERNS OF ALTERATION TO THE PROXIMAL SHAFT

	"ARTICULATED" FOX DEN FINDS	ISOLATED FOX DEN FIND	GENERAL ISOLATED FIND	TOTAL NUMBER OF INCIDENCES DAMAGED
	28K 30 30	28H	149	
BROKEN EDGE		X		1 5%
MOUTHED	X X X		X	4 21%

8:12C. METACARPI: PATTERNS OF ALTERATION TO MID SHAFT

	"ARTICULATED" FOX DEN FINDS	GENERAL ISOLATED FIND	TOTAL NUMBER OF INCIDENCES DAMAGED
	280 30	149	
MOUTHED	X X	X	3 16%

8:12D. METACARPI: PATTERNS OF ALTERATION TO THE DISTAL SHAFT

	"ARTICULATED" FOX DEN FINDS		ISOLATED FOX DEN FIND	GENERAL ISOLATED FIND	TOTAL DAMAGED		TOTAL WEATHERED	
	30	30	28H	149				
BROKEN OFF				X	1	5%	-	
PUNCTURED	X	X			2	11%	-	
MOUTHED	X	X		X	3	16%	-	
trabecula bone exposed	W		W		-		2	11%

8:12E. METACARPI: PATTERNS OF ALTERATION TO DISTAL EPIPHYSIS

	CARCASS	"ARTICULATED" FOX DEN FINDS		GENERAL ISOLATED FIND	TOTAL DAMAGED		TOTAL WEATHERED	
	141	30	30	149				
BROKEN OFF				X	1	5%	-	
PUNCTURED		X	X		2	11%	-	
MOUTHED			X		1	5%	-	
trabecula bone exposed	W	W			-		2	11%

TABLE 8:13A PELVES: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	CARCASSES												
	9	9	18	18	20A	20B	24	36	36	111	111	111A	
ILIUM	X	X	X	X	XW	X	X	X	X	X	X	X	...
SHAFT OF ILIUM													...
ACETABULUM													...
ISCHIUM	XW	XW	X		X			X	X	X	X	X	...
SHAFT OF ISCHIUM													...
PUBIS		X	X		X			X	X			X	...
SHAFT OF PUBIS													...
completeness	5	4	4	3	4	4	4	3	3	3	4	4	...
fusion state	3	3	3	3	3	3	3	4	4	4	4	4	...

		CARCASSES							"ARTICULATED" FOX DEN FINDS		ISOLATED FOX DEN FIND	
		138	138	141	141	144	148	148	26I	26I	27F	
ILIUM	..	X	X	X	X	X	X	X	X	XW	X	...
SHAFT OF ILIUM	..					X						...
ACETABULUM	..					XW			W	W		...
ISCHIUM	..	X	X	X	X	X	X	XW	X	XW	X	...
SHAFT OF ISCHIUM	..					X					X	...
PUBIS	..			X	X	X	X		XW		X	...
SHAFT OF PUBIS	..					X					X	...
completeness	..	3	4	4	4	2	4	3	3	4	4	...
fusion state	..	3	3	4	4	2	4	4	0	0	1	...

TABLE 8:13A (Continued) PELVES: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	GENERAL ISOLATED FINDS			S146 GROUP				TOTAL DAMAGED		TOTAL WEATHERED	
	75	75	149	N	O	P	Q				
ILIUM ..	XW	XW	X	X	X	X	X	29	97%	4	13%
SHAFT OF ILIUM ..			X			X		3	10%	-	
ACETABULUM ..								1	3%	3	10%
ISCHIUM ..	X	X	X	X	X	X	X	26	87%	4	13%
SHAFT OF ISCHIUM ..			X		X	X	X	6	20%	-	
PUBIS ..	X	X	XW	XW	X	X	X	19	63%	3	10%
SHAFT OF PUBIS ..					X	X	X	5	17%	-	
completeness ..	4	4	3	4	3	3	4				
fusion state ..	3	2	0	2	2	0	2				

KEY: X: signs of damage by carnivores present

W: trabecula bone exposed

completeness (refers to length of original element still presnt):
1: 1 - 25%, 2: 25 - 50%, 3: 50 - 75%, 4: 75 - 99%, 5: complete

fusion state:
0: acetabulum fusion sutures visible
1: acetabulum fused but ilium and/or ischium unfused,
2: acetabulum fused but fusion state of ilium and ischium unknown,
3: acetabulum fused, ilium and ischium either fused or unfused (or fusion state unknown), but pubis unfused,
4: pubis fused

Total number of pelves = 30

Number of pelves showing signs of carnivore damage = 29 (i.e.97%)

Number of pelves showing exposed trabecula bone = 11 (i.e. 37%)

TABLE 8:13B COMPARISONS OF DEGREES OF DAMAGE AND POSSIBLE WEATHERING OF THE CARCASS AND NON-CARCASS PELVES

	CARCASSES		NON-CARCASSES	
TOTAL NUMBER OF PELVES (N)	20		10	
TOTAL NUMBER OF AREAS STUDIED (N X 7)	140		70	
NUMBER OF AREAS DAMAGED	49	35%	40	57%
NUMBER OF AREAS POSSIBLY WEATHERED	5	4%	9	13%

TABLE 8:14 DETAILS OF PATTERNS OF DAMAGE AND WEATHERING TO PELVES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

8:14A. PATTERNS OF ALTERATION TO THE ILIUM

	CARCASSES												
	9	9	18	18	20A	20B	24	36	36	111	111	111A	
BROKEN OFF			X	X	X			X	X			X	...
BROKEN EDGE	X	X				X	X			X	X		...
FLAKE SCARS					X			X					...
SHREDDED		X								X	X		...
PUNCTURED		X	X	X	X	X	X	X	X	X	X		...
MOUTHED								X				X	...
trabecula bone exposed					W								...

	CARCASSES							"ARTICULATED" FOX DEN FINDS		ISOLATED FOX DEN FIND	
	138	138	141	141	144	148	148	26I	26I	27F	
BROKEN OFF ..	X				X	X	X	X			...
BROKEN EDGE ..		X	X	X					X	X	...
FLAKE SCARS ..											...
SHREDDED ..						X		X			...
PUNCTURED ..	X	X	X	X		X	X	X	X	X	...
MOUTHED ..			X	X							...
trabecula bone exposed ..									W		...

8:14A (Continued). PATTERNS OF ALTERATION TO THE ILIUM

	GENERAL ISOLATED FINDS		S146 GROUP				NUMBER OF INCIDENCES			
	75	75 149	N	O	P	Q	DAMAGED		WEATHERED	
BROKEN OFF ..		X	X	X	X	X	16	53%	-	
BROKEN EDGE ..	X	X					13	43%	-	
FLAKE SCARS ..							2	7%	-	
SHREDDED ..			X			X	7	23%	-	
PUNCTURED ..	X	X	X	X		X	24	80%	-	
MOUTHED ..		X					5	17%	-	
trabecula bone exposed ..	W	W					-		4	13%

8:14B. PATTERNS OF ALTERATION TO THE SHAFT OF THE ILIUM

	CARCASS	GENERAL ISOLATED FIND	S146	TOTAL NUMBER OF INCIDENCES	
	144	149	P	DAMAGED	
BROKEN EDGE	X	X	X	3	10%
FLAKE SCARS	X			1	3%
PUNCTURED			X	1	3%
MOUTHED	X	X		2	7%

8:14C. PATTERNS OF ALTERATION TO THE ACETABULUM

	CARCASS	"ARTICULATED" FOX DEN FINDS		TOTAL NUMBER OF INCIDENCES			
	144	26I	26I	DAMAGED		WEATHERED	
PUNCTURED	X			1	3%	-	
MOUTHED	X			1	3%	-	
trabecula bone exposed	W	W	W	-		3	10%

8:14D. PATTERNS OF ALTERATION TO THE ISCHIUM

	CARCASSES													
	9	9	18	20A	36	36	111	111	111A	138	138	141	141	
BROKEN OFF				X	X	X	X	X		X	X	X	X	...
BROKEN EDGE	X	X	X						X					...
FLAKE SCARS					X	X				X			X	...
PUNCTURED	X	X	X	X	X	X	X	X	X	X	X	X	X	...
MOUTHED													X	...
trabecula bone exposed	W	W												...

	CARCASSES			"ARTICULATED" FOX DEN FINDS		ISOLATED FOX DEN FIND	GENERAL ISOLATED FINDS			
	144	148	148	26I	26I	27F	75	75	149	
BROKEN OFF	.. X	X	X	X		X	X		X	...
BROKEN EDGE	..				X			X		...
FLAKE SCARS	..	X								...
PUNCTURED	..	X	X	X	X	X	X	X	X	...
MOUTHED	..					X			X	...
trabecula bone exposed	..		W		W					...

8:14D (Continued). PATTERNS OF ALTERATION TO THE ISCHIUM

	S146 GROUP				TOTAL NUMBER OF INCIDENCES DAMAGED		WEATHERED	
	N	O	P	Q				
BROKEN OFF ..	X	X	X	X	20	67%	-	
BROKEN EDGE ..					6	20%	-	
FLAKE SCARS ..					5	17%	-	
PUNCTURED ..	X				22	73%	-	
MOUTHED ..					3	10%	-	
trabecula bone exposed ..					-		4	13%

8:14E. PATTERNS OF ALTERATION TO THE SHAFT OF THE ISCHIUM

	CARCASS	ISOLATED FOX DEN FIND	GENERAL ISOLATED FIND	S146 GROUP			TOTAL NUMBER OF INCIDENCES DAMAGED	
	144	27F	149	O	P	Q		
BROKEN OFF	X			X	X	X	4	13%
PUNCTURED				X		X	2	7%
MOUTHED	X	X	X				3	10%

8:14F. PATTERNS OF ALTERATION TO THE PUBIS

	CARCASSES										"ARTICULATED" FOX DEN FIND	
	9	18	20A	36	36	111A	141	141	144	148	26I	
BROKEN OFF									X			...
BROKEN EDGE	X	X	X	X	X	X	X	X		X	X	...
PUNCTURED		X	X	X	X	X						...
trabecula bone exposed											W	...

	ISOLATED FOX DEN FIND	GENERAL ISOLATED FINDS			S146 GROUP				TOTAL NUMBERS OF INCIDENCES			
	27F	75	75	149	N	O	P	Q	DAMAGED		WEATHERED	
BROKEN OFF	.. X				X	X	X	X	6	20%	-	
BROKEN EDGE	..	X	X	X					13	43%	-	
PUNCTURED	..			X	X				7	23%	-	
trabecula bone exposed	..			W	W				-		3	10%

8:14G. PATTERNS OF ALTERATION TO THE SHAFT OF THE PUBIS

	CARCASS	ISOLATED FOX DEN FIND	S146 GROUP			TOTAL NUMBER OF INCIDENCES	
	144	27F	O	P	Q	DAMAGED	
BROKEN OFF	X	X	X	X	X	5	17%
PUNCTURED			X	X	X	3	10%

TABLE 8:15A FEMORA: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	CARCASSES														
	9	13	18	24	86	111A	111A	138	138	141	141	144	147	148	
PROXIMAL TUBEROSITY	X	X	X	X		X	X	X	X	X	W	X	X	X	..
PROXIMAL EPIPHYSIS		X	X			X						X	X	XW	..
PROXIMAL SHAFT		XW	X			X	X	XW	XW			X	X	X	..
MID SHAFT						X						X	X		..
DISTAL SHAFT	W	X				X				X		X	X	W	..
DISTAL EPIPHYSIS	XW	X	X	X	X	X	X	XW	XW	X		X	X	XW	..
longitudinal cracks				W											..
completeness	5	4	5	5	5	5	4	5	5	4	5	2	3	5	
fusion state	3	1	3	3	3	-	3	3	3	(3)	3	-	-	3	

	"ARTICULATED" ISOL. FOX DEN FINDS			FOX DEN FIND	GENERAL ISOLATED FINDS				S146 GROUP			
	26I	27B		28B	92	95	110A	110B	R	S	T	
PROXIMAL TUBEROSITY		X		X		X	XW	X	XW		X	..
PROXIMAL EPIPHYSIS		X		X	W	X		X	XW	W	X	..
PROXIMAL SHAFT		X		X		X	XW	X	XW	XW	X	..
MID SHAFT						X						..
DISTAL SHAFT	W			X		X		X	X		X	..
DISTAL EPIPHYSIS		XW		X	XW	X	XW	X	XW	W	X	..
longitudinal cracks												..
completeness	5	4		3	5	4	5	4	5	5	4	
fusion state	3	2		-	3	1	3	-	3	3	-	

TABLE 8:15A (Continued) FEMORA: PATTERNS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	TOTAL DAMAGED		TOTAL WEATHERED	
PROXIMAL TUBEROSITY	19	76%	3	12%
PROXIMAL EPIPHYSIS	12	48%	4	16%
PROXIMAL SHAFT	17	68%	6	24%
MID SHAFT	4	16%	-	
DISTAL SHAFT	10	40%	3	12%
DISTAL EPIPHYSIS	21	84%	9	36%
longitudinal cracks	-		1	4%

KEY:

X: signs of damage by carnivores present

W: trabecula bone exposed

completeness (refers to length of original element still present):
1: 1 - 25%, 2: 25 - 50%, 3: 50 - 75%, 4: 75 - 99%, 5: complete

fusion state:
-: no evidence remaining, 0: proximal and distal epiphyses unfused,
1: proximal epiphysis fused but state of distal epiphysis unknown,
2: distal epiphysis fused but state of proximal epiphysis unknown,
3: proximal and distal epiphyses both fused

Total number of femora = 25

Number of femora showing signs of damage by carnivores = 22 (i.e. 88%)

Number of femora showing exposed trabecula bone (possibly due to weathering) = 13 (i.e. 59%)

TABLE 8:15 B COMPARISONS OF DEGREES OF DAMAGE AND WEATHERING OF THE CARCASS AND NON-CARCASS FEMORA

	CARCASSES		NON-CARCASSES	
TOTAL NUMBER OF FEMORA (N)	14		11	
TOTAL NUMBER OF AREAS STUDIED (N X 6)	84		66	
NUMBER OF AREAS DAMAGED	48	57%	35	53%
NUMBER OF AREAS WEATHERED	12	14%	14	21%

TABLE 8:16 DETAILS OF PATTERNS OF DAMAGE AND WEATHERING TO FEMORA IN THE TOTAL SHEFFIELD SHEEP COLLECTION

8:16A. PATTERNS OF ALTERATION TO THE PROXIMAL TUBEROSITY

	CARCASSES													
	9	13	18	24	111A	111A	138	138	141	141	144	147	148	
BROKEN OFF		X	X		X			X			X	X	X	...
BROKEN EDGE				X		X	X		X					...
PUNCTURED	X			X		X	X							...
CRUSHED						X								...
trabecula bone exposed										W				...

	"ARTICULATED"		ISOL.							
	FOX DEN FIND		FOX DEN FIND	GENERAL ISOLATED FINDS			S146		TOTAL NUMBERS OF INCIDENCES	
	27B		28B	95	110A	110B	R	T	DAMAGED	WEATHERED
BROKEN OFF ..	X		X	X		X		X	12	-
BROKEN EDGE ..					X		X		6	-
PUNCTURED ..					X				5	-
CRUSHED ..					X				2	-
trabecula bone exposed ..					W		W		-	3

8:16B. FEMORA: PATTERNS OF ALTERATION TO THE PROXIMAL EPIPHYSIS

	CARCASSES						"ARTIC." FOX DEN FIND	ISOL. FOX DEN FIND	GENERAL ISOLATED FINDS			
	13	18	111A	144	147	148	27B	28B	92	95	110B	
BROKEN OFF			X	X	X		X	X			X	...
BROKEN EDGE						X				X		...
PUNCTURED	X	X				X				X		...
MOUTHED						X						...
trabecula bone exposed						W			W			...

	S146 GROUP			TOTAL NUMBER OF INCIDENCES	
	R	S	T	DAMAGED	WEATHERED
BROKEN OFF ..			X	7	-
BROKEN EDGE ..				2	-
PUNCTURED ..	X			5	-
MOUTHED ..	X			2	-
trabecula bone exposed ..	W	W		-	4

8:16C. FEMORA: PATTERNS OF ALTERATION TO THE PROXIMAL SHAFT

	CARCASSES									
	13	18	111A	111A	138	138	144	147	148	
BROKEN OFF			X				X	X		...
BROKEN EDGE	X								X	...
CRACK FROM EDGE								X		...
FLAKE SCARS			X				X	X		...
PUNCTURED	X	X		X	X	X			X	...
CRUSHED										...
MOUTHED	X		X	X				X		...
trabecula bone exposed	W				W	W				...

	"ARTIC." FOX DEN FIND	ISOL. FOX DEN FIND	GENERAL ISOLATED FINDS			S146 GROUP			TOTAL NUMBERS OF INCIDENCES	
	27B	28B	95	110A	110B	R	S	T	DAMAGED	WEATHERED
BROKEN OFF	X	X			X			X	7	-
BROKEN EDGE			X						3	-
CRACK FROM EDGE					X				2	-
FLAKE SCARS			X		X			X	6	-
PUNCTURED	X		X	X					9	-
CRUSHED						X			1	-
MOUTHED	X	X	X		X	X	X	X	11	-
trabecula bone exposed				W		W	W		-	6

8:16D. FEMORA: PATTERNS OF ALTERATION TO THE MID SHAFT

	CARCASSES			GENERAL ISOLATED FIND	NUMBER OF INCIDENCES
	111A	144	147	95	DAMAGED
BROKEN OFF		X			1
FLAKE SCARS		X			1
MOUTHED	X	X	X	X	4

8:16E. FEMORA: PATTERNS OF ALTERATION TO THE DISTAL SHAFT

	CARCASSES							"ARTIC." FOX DEN FIND	ISOL. FOX DEN FIND	
	9	13	111A	141	144	147	148	26I	28I	
BROKEN OFF		X	X	X	X	X			X	...
BROKEN EDGE										...
FLAKE SCARS				X		X				...
PUNCTURED			X							...
CRUSHED										...
MOUTHED			X	X		X				...
trabecula bone exposed	W						W	W		...

	GENERAL ISOLATED FINDS		S146 GROUP		TOTAL NUMBERS OF INCIDENCES	
	95	110B	R	T	DAMAGED	WEATHERED
BROKEN OFF ..	X	X		X	9	-
BROKEN EDGE ..			X		1	-
FLAKE SCARS ..					2	-
PUNCTURED ..				X	2	-
CRUSHED ..			X		1	-
MOUTHED ..		X		X	5	-
trabecula bone exposed ..					-	3

8:16F. FEMORA: PATTERNS OF ALTERATION TO THE DISTAL EPIPHYSIS

	CARCASSES													
	9	13	18	24	86	111A	111A	138	138	141	144	147	148	
BROKEN OFF		X				X				X	X	X		...
BROKEN EDGE	X							X					X	...
PUNCTURED	X		X	X	X		X	X	X				X	...
CRUSHED														...
MOUTHED								X						...
trabecula bone exposed	W							W	W				W	...

	"ARTIC." FOX DEN FIND	ISOL. FOX DEN FIND	GENERAL ISOLATED FINDS				S146 GROUP			TOTAL NUMBERS OF INCIDENCES	
	27B	28B	92	95	110A	110B	R	S	T	DAMAGED	WEATHERED
BROKEN OFF ..		X		X		X			X	9	-
BROKEN EDGE ..	X						X			5	-
PUNCTURED ..	X		X		X		X			12	-
CRUSHED ..							X			1	-
MOUTHED ..											
trabecula bone exposed ..	W		W		W		W	W		-	9

TABLE 8:17A TIBIAE: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	CARCASSES											
	8	9	9	13	19	24	36	96	111A	111A	111B	
PROXIMAL TUBEROSITY	X		X	XW			X	X	X		W	...
PROXIMAL EPIPHYSIS	X	XW	XW	XW		X	XW	XW	XW	XW	XW	...
PROXIMAL SHAFT	X	XW		XW	X				X			...
MID SHAFT												...
DISTAL SHAFT	XW											...
DISTAL EPIPHYSIS	XW											...
split lines											W	...
completeness	4	5	5	5	5	5	5	5	5	5	5	
fusion state	2	3	3	3	0	3	3	3	3	3	3	

	CARCASSES							
	138	138	141	141	144	148	150	
PROXIMAL TUBEROSITY	.. XW	XW			X			...
PROXIMAL EPIPHYSIS	.. XW	XW	X	XW		XW		...
PROXIMAL SHAFT	.. X	X		X	X		X	...
MID SHAFT	..							...
DISTAL SHAFT	..						X	...
DISTAL EPIPHYSIS	..							...
split lines	..	W					W	...
completeness	5	5	5	5	4	5	5	
fusion state	3	3	3	3	2	3	0	

TABLE 8:17A (Continued) TIBIAE: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	"ARTICULATED" FOX DEN FIND	ISOLATED FOX DEN FINDS										
	27B	25B	25C	25D	26C	27H	27I	27J	27K	28C	29C	
PROXIMAL TUBEROSITY ..	X		X		X						X	...
PROXIMAL EPIPHYSIS	XW		X		XW						XW	...
PROXIMAL SHAFT	XW	X	X	X	XW	X	X	X	X	X		...
MID SHAFT						X			X			...
DISTAL SHAFT				X		X	X		X	X		...
DISTAL EPIPHYSIS												...
split lines					W						W	...
completeness	5	4	4	4	5	3	4	4	5	4	5	
fusion state	3	0	2	-	3	-	0	0	0	-	3	

	GENERAL ISOLATED FINDS						S146 GROUP			
	3	75	76	78	149A	149B	U	V	W	
PROXIMAL TUBEROSITY ..	W	W		X						...
PROXIMAL EPIPHYSIS ..	XW	XW		XW						...
PROXIMAL SHAFT ..			X	XW	X	X	X	X	XW	...
MID SHAFT ..					X	X	X			...
DISTAL SHAFT ..					X	X	X	X	X	...
DISTAL EPIPHYSIS ..										...
split lines ..					W					...
completeness ..	5	5	4	5	4	4	4	5	5	
fusion state ..	3	3	2	3	0	0	0	0	0	

TABLE 8:17A (Continued) TIBIAE: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	TOTAL DAMAGED		TOTAL WEATHERED	
PROXIMAL TUBEROSITY	18	45%	6	15%
PROXIMAL EPIPHYSIS	22	55%	18	45%
PROXIMAL SHAFT	27	68%	6	15%
MID SHAFT	5	13%	-	
DISTAL SHAFT	12	30%	1	3%
DISTAL EPIPHYSIS	1	3%	1	3%
split lines	-		6	15%

KEY:
X: signs of damage by carnivores present

W: trabecula bone exposed
(possibly due to weathering)

completeness (refers to length of original element still present):
1: 1 - 25%, 2: 25 - 50%, 3: 50 - 75%, 4: 75 - 99%, 5: complete

fusion state:
-: no evidence remaining, 0: distal epiphysis unfused,
1: distal epiphysis fused but proximal epiphysis unfused,
2: distal epiphysis fused but state of proximal epiphysis unknown,
3: proximal epiphysis fused

Total number of tibiae = 40

Number of tibiae showing signs of carnivore damage = 38 (i.e. 95%)

Number of tibiae showing signs of weathering = 22 (i.e. 55%)
(or possible weathering)

TABLE 8:17B COMPARISONS OF DEGREES OF DAMAGE AND WEATHERING TO THE CARCASS AND NON-CARCASS TIBIAE

	CARCASSES		NON-CARCASSES	
TOTAL NUMBER OF TIBIAE (N)	19		21	
TOTAL NUMBER OF AREAS STUDIED (N X 6)	114		126	
NUMBER OF AREAS DAMAGED	39	34%	46	37%
NUMBER OF AREAS WEATHERED	23	20%	15	12%

TABLE 8:18 DETAILS OF PATTERNS OF DAMAGE AND WEATHERING TO TIBIAE IN THE TOTAL SHEFFIELD SHEEP COLLECTION

8:18A TIBIAE: PATTERNS OF ALTERATION TO THE PROXIMAL TUBEROSITY

	CARCASSES											
	8	9	13	36	86	111A	111B	138	138	141	141	
BROKEN OFF	X			X		X						...
BROKEN EDGE			X		X			X			X	...
PUNCTURED		X	X		X		X	X	X	X		...
trabecula bone exposed			W				W	W	W			...

	"ARTICULATED" FOX DEN FIND	ISOLATED FOX DEN FINDS			GENERAL ISOLATED FINDS			TOTAL NUMBERS OF INCIDENCES	
	27B	25C	26C	29C	3	75	78	DAMAGED	WEATHERED
BROKEN OFF ..	X	X	X				X	7	-
BROKEN EDGE ..				X				5	-
PUNCTURED ..						X		8	-
trabecula bone exposed ..					W	W		-	6

8:18B TIBIAE: PATTERNS OF ALTERATION TO THE PROXIMAL EPIPHYSIS

	CARCASSES											
	8	9	9	13	24	36	86	111A	111A	111B	138	138
BROKEN OFF	X											
BROKEN EDGE		X	X	X		X	X	X	X		X	X
PUNCTURED		X	X	X	X		X			X	X	X
trabecula bone exposed		W	W	W		W	W	W	W	W	W	W

	CARCASSES			"ARTICULATED" FOX DEN FIND	ISOLATED FOX DEN FINDS			GENERAL ISOLATED FINDS		
	141	141	148	27B	25C	26C	29C	3	75	78
BROKEN OFF ..					X					
BROKEN EDGE ..		X	X	X		X	X	X	X	X
PUNCTURED ..	X	X	X			X			X	X
trabecula bone.. exposed		W	W	W		W	W	W	W	W

TOTAL NUMBERS OF INCIDENCES

	DAMAGED	WEATHERED
BROKEN OFF	2	-
BROKEN EDGE	17	-
PUNCTURED	14	-
trabecula bone exposed	-	18

8:18C TIBIAE: PATTERNS OF ALTERATION TO THE PROXIMAL SHAFT

	CARCASSES										
	8	9	13	19	111A	138	138	141	144	150	
BROKEN OFF	X										...
BROKEN EDGE			X	X	X			X	X	X	...
SHREDDED				X							...
FLAKE SCARS											...
PUNCTURED		X	X	X		X	X	X			...
MOUTHED					X		X		X	X	...
trabecula bone exposed		W	W								...

	"ARTICULATED" FOX DEN FIND	ISOLATED FOX DEN FINDS								
	27B	25B	25C	25D	26C	27H	27I	27J	27K	28C
BROKEN OFF	..	X		X		X	X	X		X ...
BROKEN EDGE	.. X		X		X				X	...
SHREDDED	..									...
FLAKE SCARS	..	X	X							...
PUNCTURED	.. X		X		X		X		X	X ...
MOUTHED	.. X	X	X	X	X	X		X	X	X ...
trabecula bone exposed	.. W				W					...

8:18C (Continued) TIBIAE: PATTERNS OF ALTERATION TO THE PROXIMAL SHAFT

	GENERAL ISOLATED FINDS				S146 GROUP			TOTAL NUMBERS OF INCIDENCES	
	76	78	149A	149B	U	V	W	DAMAGED	WEATHERED
BROKEN OFF ..	X		X	X	X			11	-
BROKEN EDGE ..		X				X	X	13	-
SHREDDED ..				X	X	X		4	-
FLAKE SCARS ..	X		X			X		5	-
PUNCTURED ..	X	X						14	-
MOUTHED ..	X		X	X	X	X	X	19	-
trabecula bone exposed ..		W					W	-	6

8:18D TIBIAE: PATTERNS OF ALTERATION TO THE MID SHAFT

	ISOLATED FOX DEN FINDS		GENERAL ISOLATED FINDS		S146	
	27H	27K	149A	149B	U	TOTAL DAMAGED
BROKEN EDGE	X					1
CRACK FROM EDGE	X					1
MOUTHED	X	X	X	X	X	5

8:18E TIBIAE: PATTERNS OF ALTERATION TO THE DISTAL SHAFT

	CARCASSES		ISOLATED FOX DEN FINDS					GENERAL ISOLATED FINDS		S146		
	8	150	25D	27H	27J	27K	28C	149A	149B	U	V	W
BROKEN OFF			X	X			X					
BROKEN EDGE	X	X							X	X	X	X
SHREDDED										X		
FLAKE SCARS			X									
PUNCTURED		X	X				X					
MOUTHED		X		X	X	X	X	X	X	X	X	X
trabecula bone exposed	W											

TOTAL NUMBERS OF INCIDENCES

	DAMAGED	WEATHERED
BROKEN OFF	3	-
BROKEN EDGE	6	-
SHREDDED	1	-
FLAKE SCARS	1	-
PUNCTURED	3	-
MOUTHED	10	-
trabecula bone exposed	-	1

8:18F TIBIAE: PATTERNS OF ALTERATION TO THE DISTAL EPIPHYSIS

	CARCASS	TOTAL NUMBERS OF INCIDENCES	
	8	DAMAGED	WEATHERED
PUNCTURED	X	1	
trabecula bone exposed	W		1

TABLE 8:19A METATARSI: AREAS OF DAMAGE AND WEATHERING IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	CARCASSES		ISOLATED FOX DEN FINDS								GEN. ISOL. FIND	TOTAL NUMBER OF INCIDENCES			
	36	111	25A	25C	26B	27A	27F	28A	28E	28F	139	DAM-AGED		WEATH-ERED	
PROX. EPIPHYSIS								X			X				
PROX. SHAFT							X	X	X		X	4	%	-	
MID SHAFT							X	X		X	X	4	%	-	
DISTAL SHAFT	X	X		X	X	W	X	X	XW	XW		8	%	-	
DISTAL EPIPHYSIS	X		X	X	X				W	W		4	%	2	%
split lines						S	S		S	S				4	%
completeness	5	5	5	5	5	5	5	4	5	5	5				
fusion state	3	3	3	3	3	3	1	2	3	3*	3				

KEY: X: signs of damage by carnivores present

W: trabecula bone exposed (possibly due to weathering)

S: split lines due to weathering present

completeness
(refers to length of original element still present):
1: 1 - 25%, 2: 25 - 50%, 3: 50 - 75%, 4: 75 - 99%,
5: complete

fusion state:
1: distal epiphysis unfused
2: proximal epiphysis fused, but fusion state of distal epiphysis unknown
3: distal epiphysis fused
3*: distal epiphysis in process of fusing

Total number of metatarsi = 20

Number of metatarsi showing signs of carnivore damage = 10 (i.e. 50%)

Number of metatarsi showing signs of weathering = 4 (i.e. 20%)
(or possible weathering)

TABLE 8:19B COMPARISONS OF DEGREES OF DAMAGE AND WEATHERING OF THE CARCASS AND NON-CARCASS METATARSI

	CARCASSES		NON-CARCASSES	
TOTAL NUMBER OF METATARSI (N)	11		9	
TOTAL NUMBER OF AREAS STUDIED (N X 5)	55		45	
NUMBER OF AREAS DAMAGED	3	5%	19	42%
NUMBER OF AREAS WEATHERED	0	-	9	20%

TABLE 8:20 DETAILS OF PATTERNS OF DAMAGE AND WEATHERING TO METATARSI IN THE TOTAL SHEFFIELD SHEEP COLLLECTION

8:20A METATARSI: PATTERNS OF ALTERATION TO THE PROXIMAL EPIPHYSIS

	ISOLATED FOX DEN FIND	GENERAL ISOLATED FIND	TOTAL NUMBER OF INCIDENCES
	28A	139	DAMAGED
BROKEN EDGE	X		1
PUNCTURED		X	1

8:20B METATARSI: PATTERNS OF ALTERATION TO THE PROXIMAL SHAFT

	ISOLATED FOX DEN FINDS			GENERAL ISOLATED FIND	TOTAL NUMBER OF INCIDENCES
	27F	28A	28E	139	DAMAGED
BROKEN EDGE		X			1
MOUTHED	X	X	X	X	4

8:20C METATARSI: PATTERNS OF ALTERATION TO THE MID SHAFT

	ISOLATED FOX DEN FINDS			GENERAL ISOLATED FIND	TOTAL NUMBER OF INCIDENCES
	27F	28A	28F	139	DAMAGED
MOUTHED	X	X	X	X	4

8:20D METATARSI: PATTERNS OF ALTERATION TO THE DISTAL SHAFT

	CARCASSES		ISOLATED FOX DEN FINDS							TOTAL NUMBER OF INCIDENCES	
	36	111	25C	26B	27A	27F	28A	28E	28F	DAMAGED	WEATHERED
BROKEN OFF							X			1	-
PUNCTURED	X	X	X	X				X		5	-
CRUSHED								X		1	-
MOUTHED						X	X		X	3	-
trabecula bone exposed					W			W	W	-	3

8:20E METATARSI: PATTERNS OF ALTERATION TO THE DISTAL EPIPHYSIS

	CARCASS	ISOLATED FOX DEN FINDS					TOTAL NUMBER OF INCIDENCES	
	36	25A	25C	26B	28E	28F	DAMAGED	WEATHERED
PUNCTURED	X	X	X	X			4	-
trabecula bone exposed					W	W	-	2

TABLE 9:1 FREQUENCIES OF SPLIT LINES AND BONE TUBES FOR THE TEN MAJOR ELEMENT TYPES IN THE SHEFFIELD SHEEP COLLECTION

	TOTAL NUMBER OF BONES	NUMBER OF BONES WITH SPLIT LINES		NUMBER OF BONE TUBES	
		N	%	N	%
Mandible	21	6	29	-	-
Scapula	20	0	0	-	-
Humerus	30	0	0	5	17
Radius	29	5	17	2	7
Ulna	22	1	5	-	-
Metacarpal	19	0	0	0	0
Pelvis	30	0	0	-	-
Femur	25	1	4	7	28
Tibia	40	6	15	3	8
Metatarsal	20	4	20	0	0

TABLE 9:2 FREQUENCIES OF ELEMENT PARTS RECOVERED IN THE TOTAL SHEFFIELD SHEEP COLLECTION, FOR THE TEN MAJOR ELEMENT TYPES

	HUMERUS (N=30)		RADIUS (N=29)		METACARPAL (N=19)	
	N	%	N	%	N	%
P. Epiphysis*	10	33%	27	93%	19	100%
Shaft	30	100%	29	100%	19	100%
D. Epiphysis	25	83%	25	86%	18	95%
Complete	9	30%	23	79%	18	95%
Tube	5	17%	2	7%	0	0%

	FEMUR (N=25)		TIBIA (N=40)		METATARSAL (N=20)	
	N	%	N	%	N	%
P. Epiphysis	18	72%	29	72%	20	100%
Shaft	25	100%	40	100%	20	100%
D. Epiphysis	16	64%	37	92%	19	95%
Complete	15	60%	27	68%	19	95%
Tube	7	28%	3	8%	0	0%

	MANDIBLE (N=21)			ULNA (N=22)	
	N	%		N	%
Tooth row	20	95%	P. Epiphysis	7	32%
Complete	10	48%	D. Epiphysis	20	91%
			Complete	7	32%

	SCAPULA (N=20)			PELVIS (N=30)	
	N	%		N	%
Bicip. Tuber.	18	90%	Acetabulum	30	100%
Neck width	18	90%	Ilium/Ischium+	17	57%
Complete	6	30%	Pubis	24	80%
			Complete	2	7%

KEY:
P.: Proximal; D.: Distal; Bicip. Tuber.: Bicipital Tuberosity
* Epiphysis= either the fused epiphysis,
or the unfused fusion surface
+ the blade of at least one of these two bones is present
(at least in part)

TABLE 9:3 RATIOS OF LATER-FUSING TO EARLIER-FUSING EPIPHYSES OF LONG BONE ELEMENTS IN THE SHEFFIELD SHEEP CARCASS AND NON-CARCASS COLLECTIONS, AND BRAIN'S GOAT BONE COLLECTION

	FUSION AGE IN MONTHS (Silver, 1969)	SHEFFIELD SHEEP CARCASSES		SHEFFIELD SHEEP NON-CARCASSES		HOTTENTOT GOATS (Brain, 1969)	
		N	LF/EF	N	LF/EF	N	LF/EF
Prox. humerus	36 - 42	5		5		0	
			0.50		0.33		0.00
Dist. humerus	10	10		15		82	
Prox. radius	10	10		17		65	
			1.00		0.88		0.34
Dist. radius	36	10		15		22	
Prox. metacarpal	bb	9		10		32	
			1.00		0.90		0.72
Dist. metacarpal	18 - 24	9		9		23	
Prox. femur	30 - 36	11		7		18	
			0.82		1.00		0.50
Dist. femur	36 - 42	9		7		9	
Prox. tibia	36 - 42	18		11		13	
			0.95		0.61		0.18
Dist. tibia	18 - 24	19		18		72	
Prox. metatarsal	bb	11		9		39	
			1.00		0.89		0.51
Dist. metatarsal	20 - 28	11		8		20	
Prox. ulna	30	4		3			
			0.44		0.27		
Dist. ulna	30	9		11			

KEY:

LF: LATER-FUSING; EF: EARLIER-FUSING
Prox.: Proximal; Dist.: Distal
bb: before birth

TABLE 9:4 RAW FREQUENCIES AND RANK ORDERS OF ELEMENT PARTS FOR THE SEVEN LONGBONE ELEMENTS IN THE SHEFFIELD SHEEP CARCASS AND NON-CARCASS COLLECTIONS, AND BRAIN'S GOAT COLLECTION

	SHEFFIELD SHEEP CARCASSES		SHEFFIELD SHEEP NON-CARCASSES		BRAIN'S GOAT COLLECTION (Brain, 1969)	
	N	RANK	N	RANK	N	RANK
Humerus, prox.	5	12	5	12	0	12
Humerus, dist.	10	7	15	3.5	82	1
Radius, prox.	10	7	17	2	65	3
Radius, dist.	10	7	15	3.5	22	7
Metacarpal, prox.	9	10	10	6	32	5
Metacarpal, dist.	9	10	9	7.5	23	6
Femur, prox.	11	4	7	10.5	18	9
Femur, dist.	9	10	7	10.5	9	11
Tibia, prox.	18	2	11	5	13	10
Tibia, dist.	19	1	18	1	72	2
Metatarsal, prox.	11	4	9	7.5	39	4
Metatarsal, dist.	11	4	8	9	20	8
Ulna, prox.	4		3			
Ulna, dist.	9		11			

KEY:
prox.: proximal; dist.: distal

TABLE 9:5 FREQUENCIES OF OCCURRENCE AND LOSS OF PARTS OF THE TEN MAJOR ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	OCCURRENCES			EPIPHYSIS OR FUSION SURFACE LOST			
MANDIBLE (18-24mths) (cheek tooth row)	KN	EST	TOT	KN	EST	TOT	%
fully adult	15	1	16	0	1	1	6%
not fully adult	5	0	5	0	0	0	0%
Total/average			21			1	6%
SCAPULA (6-8mths) (bicipital tuberosity)	KN	EST	TOT	KN	EST	TOT	%
fused	17	3	20	0	3	3	15%
unfused	0	0	0	0	0	0	0%
Total/average			20			3	15%
P. HUMERUS (36-42mths)	KN	EST	TOT	KN	EST	TOT	%
fused	11	?	11+?	0	?	0+?	?
unfused	1	2+?	3+?	1	2+?	3-17	
Total/average			30			20	67%
D.HUMERUS (10mths)	KN	EST	TOT	KN	EST	TOT	%
fused	24	3	27	0	3	3	11%
unfused	1	2	3	0	2	2	67%
Total/average			30			5	17%
P. RADIUS (10mths)	KN	EST	TOT	KN	EST	TOT	%
fused	27	2	29	0	2	2	7%
unfused	0	0	0	0	0	0	0%
Total/average			29			2	7%
D. RADIUS (36mths)	KN	EST	TOT	KN	EST	TOT	%
fused	22	1	23	0	1	1	4%
unfused	5	1	6	0	1	1	17%
Total/average			29			2	7%

TABLE 9:5 (cont.)

	OCCURRENCES			EPIPHYSIS OR FUSION SURFACE LOST			
P. ULNA (30mths)	KN	EST	TOT	KN	EST	TOT	%
fused	16	6	22	9	6	15	68%
unfused	0	0	0	0	0	0	0%
Total/average			22			15	68%
D. ULNA (30mths)	KN	EST	TOT	KN	EST	TOT	%
fused	15	5	20	0	2	2	9%
unfused	2	0	2	0	0	0	0%
Total/average			22			2	9%
P. METACARPAL (birth)	KN	EST	TOT	KN	EST	TOT	%
fused	19	0	19	0	0	0	0%
unfused	0	0	0	0	0	0	0%
Total/average			19			0	0%
D. METACARPAL(18-24m)	KN	EST	TOT	KN	EST	TOT	%
fused	17	1	18	0	1	1	5%
unfused	1	0	1	0	0	0	0%
Total/average			19			1	5%
ACETABULUM (10 mths)	KN	EST	TOT	KN	EST	TOT	%
fused	30	0	30	0	0	0	0%
unfused	0	0	0	0	0	0	0%
Total/average			30			0	0%
ILIUM (by 42 mths)	KN	EST	TOT	KN	EST	TOT	%
fused	20	?	20+?	8	?	8+?	?
unfused	5	?	5+?	3	?	3+?	?
Total/average			30			16	53%
ISCHIUM (by 42 mths)	KN	EST	TOT	KN	EST	TOT	%
fused	20	?	20+?	11	?	11+?	?
unfused	5	?	5+?	4	?	4+?	?
Total/average			30			20	67%
PUBIS (by 42 mths)	KN	EST	TOT	KN	EST	TOT	%
fused	9	?	9+?	0	0	?	?
unfused	14	?	14+?	2	0	2+?	?
Total/average			30			6	20%

TABLE 9:5 (cont.)

	OCCURRENCES			EPIPHYSIS OR FUSION SURFACE LOST			
P. FEMUR (30-36mths)	KN	EST	TOT	KN	EST	TOT	%
fused	20	2	22	2	2	4	18%
unfused	0	3	3	0	3	3	100%
Total/average			25			7	28%
D. FEMUR (36-42mths)	KN	EST	TOT	KN	EST	TOT	%
fused	18	4	22	0	6	6	27%
unfused	0	3	3	0	3	3	100%
Total/average			25			9	36%
P. TIBIA (36-42 mths)	KN	EST	TOT	KN	EST	TOT	%
fused	19	?	19+?	0	?	?	?
unfused	6	2+?	8+?	3	2	5+?	?
Total/average			40			11	28%
D. TIBIA (18-24mths)	KN	EST	TOT	KN	EST	TOT	%
fused	26	1	27	0	1	1	4%
unfused	11	2	13	0	2	2	15%
Total/average			40			3	8%
P. METATARSAL (birth)	KN	EST	TOT	KN	EST	TOT	%
fused	20	0	20	0	0	0	0%
unfused	0	0	0	0	0	0	0%
Total/average			20	0	0	0	0%
D. METATARSAL(20-28m)	KN	EST	TOT	KN	EST	TOT	%
fused	18	1	19	0	1	1	5%
unfused	1	0	1	0	0	0	0%
Total/average			20			1	5%

KEY:
P.: PROXIMAL, D.: DISTAL
KN: KNOWN, EST: ESTIMATED, TOT: TOTAL

Figures in brackets e.g.: (18-24 mths) refer to fusion ages given by Silver, 1969.

TABLE 9:6 SUMMARY OF DATA REGARDING RATES OF DESTRUCTION OF FUSED AND UNFUSED EPIPHYSES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	NUMBERS OF FUSED:UNFUSED AREAS: AREAS	PERCENTAGE OF FUSED AREAS LOST	PERCENTAGE OF UNFUSED AREAS LOST
P. Metacarpal	19: 0	0%	not applicable
P. Metatarsal	20: 0	0%	not applicable
Bicipital Tub.	20: 0	3%	not applicable
Acetabulum	30: 0	0%	not applicable
P. Radius	29: 0	7%	not applicable
D. Humerus	27: 3	11%	67%
D. Tibia	27:13	4%	15%
D. Metacarpal	18: 1	5%	0%
D. Metatarsal	19: 1	5%	0%
Olecranon	22: 0	68%	not applicable
P. Femur	22: 3	18%	100%
D. Radius	23: 6	4%	17%
P. Tibia	19+?: 8+?	0-32%	23-79%
D. Femur	22: 3	27%	100%
P. Humerus	11+?: 3+?	0-62%	16-100%
Pubis	9+?:14+?	0-31%	10-33%
Ilium	20+?: 5+?	32-52%	30-80%
Ichium	20+?: 5+?	44-64%	40-90%

KEY:
P.: Proximal, D.: Distal

TABLE 9:7 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF FUSION AGE AND THE DESTRUCTION OF EPIPHYSEAL AREAS IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	FUSION AGE IN MONTHS (SILVER, 1969)		PERCENTAGE OF BONES WITH THIS FUSION SURFACE MISSING	
	AGE	RANK	%	RANK
P. Metacarpal	b. birth	1.5	0%	17
P. Metatarsal	b. birth	1.5	0%	17
Bicip. Tuber.	6 - 8	3	10%	11
Acetabulum	6 - 10	4	0%	17
P. Radius	10	5.5	3%	15
D. Humerus	10	5.5	17%	8.5
D. Tibia	18 - 24	7.5	8%	12
D. Metacarpal	18 - 24	7.5	5%	13.5
D. Metatarsal	20 - 28	9	5%	13.5
Olecranon	30	10	68%	1
P. Femur	30 - 36	11	28%	6.5
D. Radius	36	12	14%	10
P. Tibia	36 - 42	14	28%	6.5
D. Femur	36 - 42	14	36%	5
P. Humerus	36 - 42	14	67%	2.5
Pubis	by 42	17	17%	8.5
Ilium	by 42	17	53%	4
Ischium	by 42	17	67%	2.5

Spearman's rank order correlation analysis:

correlation of fusion age with percentage of bones with this fusion surface missing:

$$Rho = -0.77, \quad n=18, \quad p<0.01$$

KEY:

P.: Proximal; D.: Distal; Bicip. Tuber.: Bicipital Tuberosity
b. birth: before birth

TABLE 10:1 FREQUENCIES OF THE TWENTY-SIX ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION USING ABSOLUTE NUMBERS RECOVERED AND BRAIN'S INDEX VALUES

	ABSOLUTE FREQUENCY	BRAIN'S INDEX*	
	N	BI	RANK
Hyoid	1	0.02	26
Mandible	21	0.33	7
Scapula	20	0.31	8.5
Humerus	30	0.47	2.5
Radius	29	0.45	4
Ulna	22	0.34	6
Metacarpal	19	0.30	10
Pelvis	30	0.47	2.5
Femur	25	0.39	5
Tibia	40	0.63	1
Metatarsal	20	0.31	8.5
Patella	4	0.06	24
Astragalus	13	0.20	16
Calcaneum	7	0.11	21
Navic.-cuboid	10	0.16	18
Prox. phalange	36	0.14	20
Medial phalange	17	0.07	23
Distal phalange	22	0.09	22
Atlas	9	0.28	11
Axis	7	0.22	14.5
Cervical verts.	43	0.27	12.5
Thoracic verts.	79	0.19	17
Lumbar verts.	52	0.27	12.5
Sacrum	7	0.22	14.5
Ribs	122	0.15	19
Sternebrae	9	0.04	25
TOTAL	694	AVERAGE:	0.25

KEY:
Navic.-cuboid: Navicular-cuboid; Prox.: Proximal
verts.: vertebrae

* Brain's index values have been calculated using a Minimum Number of Individuals of 32 for the total Sheffield sheep collection

TABLE 10:2 MEASUREMENTS OF ENTIRE (FULLY FUSED) BONES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

(N.B. all measurements are to the nearest whole centimetre)

	NUMBER MEASURED	MEASUREMENTS (IN CMS.)	AVERAGE (IN CMS.)	RANK
Hyoid	2	5,5	5	16
Mandible	6	15,18,18,19,21,22	19	5
Scapula	5	15,15,16,16,16	16	7
Humerus	7	14,14,14,15,15,16,16	15	8.5
Radius	8	14,14,15,15,16,16,16,17	15	8.5
Ulna	6	17,17,19,20,21,22	19	5
Metacarpal	6	11,12,12,13,13,14	13	11
Pelvis	5	18,20,20,22,23	21	2
Femur	6	18,18,18,18,19,20	19	5
Tibia	6	20,20,21,21,21,21	21	2
Metatarsal	6	13,14,14,15,15,15	14	10
Patella	2	3,3	3	22.5
Astragalus	6	3,3,3,3,3,3	3	22.5
Calcaneum	2	6,6	6	14.5
Navic.-cuboid	5	2,3,3,3,3	3	22.5
Prox.phalange	5	4,4,4,4,4	4	18
Med. phalange	3	2,2,2	2	26
Dist. phalange	4	3,3,3,3	3	22.5
Atlas	5	6,7,7,7,8	7	13
Axis	6	6,6,6,6,6,7	6	14.5
Cervical verts.	5	4,4,4,5,5	4	18
Thoracic verts.	4	2,3,3,3	3	22.5
Lumbar verts.	4	3,3,3,3	3	22.5
Sacrum	3	10,11,11	11	12
Ribs	5	18,21,21,21,23	21	2
Sternebrae	7	4,4,4,4,4,4,4	4	18

KEY:
Navic.-cuboid: Navicular-cuboid,
Prox.: Proximal; Med.: Medial; Dist.: Distal
verts.: vertebrae

TABLE 10:3 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF ELEMENT FREQUENCIES (MEASURED BY BRAIN'S INDEX, USING AN MNI=32) AND ELEMENT SIZES USING THE TWENTY-SIX ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	AVERAGE SIZE (IN CMS.)	RANK	BRAIN'S INDEX	RANK
Hyoid	5	16	0.02	26
Mandible	19	5	0.33	7
Scapula	16	7	0.31	8.5
Humerus	15	8.5	0.47	2.5
Radius	15	8.5	0.45	4
Ulna	19	5	0.34	6
Metacarpal	13	11	0.30	10
Pelvis	21	2	0.47	2.5
Femur	19	5	0.39	5
Tibia	21	2	0.63	1
Metatarsal	14	10	0.31	8.5
Patella	3	22.5	0.06	24
Astragalus	3	22.5	0.20	16
Calcaneum	6	14.5	0.11	21
Navic.-cuboid	3	22.5	0.16	18
Prox. phalange	4	18	0.14	20
Med. phalange	2	26	0.07	23
Dist. phalange	3	22.5	0.09	22
Atlas	7	13	0.28	11
Axis	6	14.5	0.22	14.5
Cervical verts.	4	18	0.27	12.5
Thoracic verts.	3	22.5	0.19	17
Lumbar verts.	3	22.5	0.27	12.5
Sacrum	11	12	0.22	14.5
Ribs	21	2	0.15	19
Sternebrae	4	18	0.04	25

Rho=0.73, n=26, $p<0.01$

KEY:
Navic.-cuboid: navicular-cuboid
Prox.: proximal; Med.: Medial; Dist.: Distal
verts.: vertebrae

TABLE 10:4 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF THE MEAT UTILITY INDEX (BINFORD 1978) AND THE PERCENTAGE OF BONES ATTACKED FOR SEVENTEEN OF THE TWENTY-SIX MAJOR ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	MEAT UTILITY INDEX (BINFORD)		ATTACKED BONES (SHEFFIELD SHEEP)	
	VALUE	RANK	PERCENTAGE	RANK
Mandible (without tongue)	14.12	12.5	52%	11
Scapula	44.89	7	95%	4.5
Humerus	28.24	9	97%	1.5
Radius	14.01	12.5	59%	8
Metacarpal*	4.74	16	32%	15
Pelvis & sacrum	81.30	3	97%	1.5
Femur	78.24	4	96%	3
Tibia**	20.76	10	95%	4.5
Metatarsal	6.37	14.5	55%	10
Tarsals***	6.37	14.5	25%	16
All phalanges	3.37	17	16%	17
Atlas & axis	18.65	11	44%	13
Cervical vertebrae	55.32	5	37%	14
Thoracic vertebrae	46.47	6	46%	12
Lumbar vertebrae	38.88	8	80%	6
Ribs	100.00	1	69%	7
Sternebrae	90.52	2	56%	9

Rho= 0.57, n=17, $p<0.05$

KEY:
* includes carpals in Binford, 1978
** includes tarsals in Binford, 1978
*** Binford assigns these the same value as that measured for the metatarsal.
The Sheffield data refer to the astragalus and calcaneum

Source:
Binford, 1978: figures taken from Table 1.5, page 23

TABLE 10:5 A SPEARMAN'S RANK ORDER CORRELATON ANALYSIS OF THE RESIDUAL MEAT COVER WEIGHT (BINFORD 1978) AND THE PERCENTAGE OF BONES ATTACKED, FOR SIXTEEN OF THE TWENTY-SIX MAJOR ELEMENT TYPES IN THE SHEFFIELD SHEEP TOTAL COLLECTION

	RESIDUAL 'MEAT WEIGHT' (BINFORD 1978)		SHEFFIELD SHEEP PERCENTAGES ATTACKED	
	GRAMS	RANK	%	RANK
Mandible*	179	8	52	10
Scapula	385	3	95	3.5
Humerus	245	5	97	1.5
Radius	118	10	59	8
Metacarpal	42	15	32	15
Pelvis + sacrum	652	2	97	1.5
Femur	677	1	88	5
Tibia + tarsals	193	6	95	3.5
Metatarsal	45	14	50	11
All phalanges	5	16	16	16
Atlas + axis	160	9	44	13
Cervical verts.	190	7	37	14
Thoracic verts.**	113	11	46	12
Lumbar verts.***	111	12	79	6
Ribs	62	13	66	7
Sternebrae	258	4	56	9

Rho=0.68, n=16, p<0.01

KEY:
* does not include tongue
** includes tenderloin
*** includes kidneys
(N.B. Binford does not give separate weights for either tenderloin or kidneys)

Source: figures calculated from gross weight minus dry bone weight in Binford, 1978, Table 1.1. page 16, with weight for tongue taken from Table 1.2, page 17

TABLE 10:6 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF BINFORD'S MEAT UTILITY INDICES AND THE FREQUENCIES OF ELEMENTS IN THE TOTAL SHEFFIELD SHEEP COLLECTION EXPRESSED AS BRAIN'S INDICES, USING SEVENTEEN OF THE TWENTY-SIX MAJOR ELEMENT TYPES

	ELEMENT FREQUENCIES (SHEFFIELD SHEEP)			MEAT UTILITY INDICES (BINFORD)	
	TOTAL	BRAIN'S INDEX	BI RANK	MUI	RANK
Mandible	21	0.33	6	14.12	12
Scapula	20	0.31	7.5	44.89	7
Humerus	30	0.47	2	28.24	9
Radius	29	0.45	3	14.01	13
Metacarpal*	19	0.30	9	4.74	16
Pelvis & sacrum	30 + 7	0.39	4.5	81.30	3
Femur	25	0.39	4.5	78.24	4
Tibia**	40	0.63	1	20.76	10
Metatarsal	20	0.31	7.5	6.37	14.5
Tarsals***	13 + 7	0.16	14	6.37	14.5
All phalanges	36 + 17 + 22	0.10	16	3.37	17
Atlas & axis	9 + 7	0.25	12	18.65	11
Cervical vertebrae	43	0.27	10.5	55.32	5
Thoracic vertebrae	79	0.19	13	46.47	6
Lumbar vertebrae	52	0.27	10.5	38.88	8
Ribs	122	0.15	15	100.00	1
Sternebrae	9	0.04	17	90.52	2

Rho= -0.07, p>0.05, n=17

KEY:
*: includes carpals in Binford 1978
**: includes tarsals in Binford 1978
***: Binford assigns these the same value as that measured for the metatarsal.
The Sheffield data refer to the astragalus and calcaneum.

MUI: Meat Utility Index (Binford 1

Source:
Binford, 1978. Figures taken from Table 1.5, page 23.

TABLE 10:7 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF THE PERCENTAGES OF BONES SHOWING SIGNS OF CARNIVORE ATTACK IN THE TOTAL SHEFFIELD SHEEP COLLECTION AND BINFORD'S MARROW CAVITY VOLUME FIGURES USING TWELVE OF THE TWENTY-SIX MAJOR ELEMENT TYPES

	MARROW CAVITY VOLUME (BINFORD)		ATTACKED BONES (SHEFFIELD SHEEP)	
	VOLUME IN ML.	RANK	PERCENTAGES	RANK
Mandible	5.2	7	52%	9
Scapula	1.9	9.5	95%	4.5
P. & D. Humerus	38.4	3	97%	1.5
P. & D. Radius	28.0	4	59%	6
P. & D. Metacarpal	16.2	6	32%	10
Pelvis	2.8	8	97%	1.5
P. & D. Femur	48.4	1.5	96%	3
P. & D. Tibia	47.8	1.5	95%	4.5
P. & D. Metatarsal	19.0	5	55%	8
Calcaneum	1.2	11.5	57%	7
Proximal phalange	2.0	9.5	28%	11
Medial phalange	1.0	11.5	6%	12

Rho = 0.53, n=12, $p<0.05$

KEY:
P.: Proximal; D.: distal; ML.: Millilitres

Source:
Binford figures take from Binford, 1978: Table 1.6, page 24

TABLE 10:8 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF THE FREQUENCIES OF ELEMENTS (REPRESENTED BY BRAIN'S INDEX) AND THEIR BULK DENSITIES (AS PUBLISHED IN LYMAN 1982)

	BRAIN'S INDEX		LYMAN'S (1982) BULK DENSITY	
	BI	RANK	BD	RANK
Mandible	0.33	7	0.57	2
Scapula	0.31	9	0.36	15.5
Prox. humerus	0.16	23	0.24	24.5
Dist. humerus	0.39	5.5	0.39	14
Prox. radius	0.42	4	0.42	11.5
Dist. radius	0.39	5.5	0.43	10
Prox. ulna	0.11	26.5	0.30	17.5
Dist. ulna	0.31	9	0.44	9
Prox. metacarpal	0.30	11.5	0.56	3
Dist. metacarpal	0.28	14	0.49	6
Pelvis	0.47	2	0.27	21
Prox. femur	0.28	14	0.36	15.5
Dist. femur	0.25	18	0.28	20
Prox. tibia	0.45	3	0.30	17.5
Dist. tibia	0.58	1	0.50	5
Prox. metatarsal	0.31	9	0.55	4
Dist. metatarsal	0.30	11.5	0.46	8
Astragalus	0.20	21	0.47	7
Calcaneum	0.11	26.5	0.64	1
Prox. phalange	0.14	25	0.42	11.5
Medial phalange	0.07	29	0.25	22.5
Dist. phalange	0.09	28	0.25	22.5
Atlas	0.28	14	0.13	30
Axis	0.22	19.5	0.16	29
Cervical verts.	0.27	16.5	0.19	27.5
Thoracic verts.	0.19	22	0.24	24.5
Lumbar verts.	0.27	16.5	0.29	19
Sacrum	0.22	19.5	0.19	27.5
Ribs	0.15	24	0.40	13
Sternebrae	0.04	30	0.22	26

Rho=0.37, n=30, $p<0.05$

KEY:
Prox.: Proximal; Dist.: Distal; verts.: vertebrae
BI: BRAIN'S INDEX;
BD: BULK DENSITY (Lyman's (1982) Volume Density figures)

TABLE 10:9 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF THE PERCENTAGES OF ATTACKED ELEMENT TYPES AND THEIR BULK DENSITIES (AS PUBLISHED IN LYMAN 1982), IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	PERCENTAGE ATTACKED		LYMAN'S (1982) BULK DENSITY	
	%	RANK	BD	RANK
Mandible	52	13	0.57	2
Scapula	95	3.5	0.36	15.5
Prox. humerus	83	6	0.24	24.5
Dist. humerus	37	18.5	0.39	14
Prox. radius	21	21	0.42	11.5
Dist. radius	41	17	0.43	10
Prox. ulna	95	3.5	0.30	17.5
Dist. ulna	14	24	0.44	9
Prox. metacarpal	11	25	0.56	3
Dist. metacarpal	16	23	0.49	6
Pelvis	97	2	0.27	21
Prox. femur	48	14	0.36	15.5
Dist. femur	84	5	0.28	20
Prox. tibia	55	12	0.30	17.5
Dist. tibia	3	30	0.50	5
Prox. metatarsal	10	26	0.55	4
Dist. metatarsal	20	22	0.46	8
Astragalus	8	27	0.47	7
Calcaneum	57	10	0.64	1
Prox. phalange	28	20	0.42	11.5
Medial phalange	6	28	0.25	22.5
Dist. phalange	5	29	0.25	22.5
Atlas	78	8	0.13	30
Axis	43	16	0.16	29
Cervical verts.	37	18.5	0.19	27.5
Thoracic verts.	46	15	0.24	24.5
Lumbar verts.	79	7	0.29	19
Sacrum	100	1	0.19	27.5
Ribs	66	9	0.40	13
Sternebrae	56	11	0.22	26

Rho= -0.47, n=30, p<0.01

KEY:
Prox.: Proximal; Dist.: Distal; verts.: vertebraeae
BD: BULK DENSITY (Lyman's (1982) Volume Density figures)

TABLE 10:10 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF THE PERCENTAGES OF BONES WITH A FUSION SURFACE REMOVED AND LYMAN'S (1982) BULK DENSITY FIGURES, IN THE TOTAL SHEFFIELD SHEEP COLLECTION

	PERCENTAGE WITH THIS FUSION SURFACE REMOVED		BULK DENSITY LYMAN 1982	
	%	RANK	BD	RANK
Prox. metacarpal	0	11.5	0.56	1
Prox. metatarsal	0	11.5	0.55	2
Prox. radius	3	10	0.42	7
Dist. metacarpal	5	8.5	0.49	4
Dist. metatarsal	5	8.5	0.46	5
Dist. tibia	8	7	0.50	3
Dist. radius	14	6	0.43	6
Dist. humerus	17	5	0.39	8
Prox. femur	28	3.5	0.36	9
Prox. tibia	28	3.5	0.30	1o
Dist. femur	36	2	0.28	11
Prox. humerus	67	1	0.24	12

Rho= -0.89, n=12, $p<0.01$

KEY:
Prox.: Proximal; Dist.: Distal;
BD: BULK DENSITY (Lyman's (1982) Volume Density figures)

TABLE 11:1 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF BINFORD'S 24 WOLF KILLS OF CARIBOU (BINFORD, 1981) AND THE 21 SHEFFIELD SHEEP CARCASSES

	24 CARIBOU CARCASSES KILLED BY WOLVES (BINFORD, 1981)		21 SHEEP CARCASSES SCAVENGED BY FOXES (THIS STUDY)	
	SURVIVAL %	RANK	BRAINS' INDEX	RANK
Mandible	80	2	0.31	5.5
Scapula	52	6.5	0.21	19.5
Prox. humerus	11	24.5	0.12	25
Dist. humerus	41	10	0.24	14.5
Prox. radius	35	13	0.24	14.5
Dist. radius	20	21.5	0.24	14.5
Prox. metacarpal	24	16.5	0.21	19.5
Dist. metacarpal	24	16.5	0.21	19.5
Pelvis	100	1	0.48	1
Prox. femur	30	14	0.26	11
Dist. femur	15	23	0.21	19.5
Prox. tibia	22	19.5	0.43	3
Dist. tibia	48	8	0.45	2
Prox. metatarsal	37	11	0.26	11
Dist. metatarsal	20	21.5	0.26	11
Astragalus	24	16.5	0.24	14.5
Calcaneum	24	16.5	0.14	24
Tarsals*	22	19.5	0.19	22
Prox. phalange	11	24.5	0.15	23
Medial phalange	8	26	0.08	27
Dist. phalange	7	27	0.11	26
Atlas	52	6.5	0.29	7.5
Axis	74	3	0.29	7.5
Cervical verts.	36	12	0.31	5.5
Thoracic verts.	53	5	0.28	9
Lumbar verts.	68	4	0.37	4
Ribs	47	9	0.22	17

Rho=0.72, n=27, p<0.01

KEY:
Prox.: Proximal; Dist.: Distal; verts.: vertebrae

* 'TARSALS' includes unspecified bones in Binford (1981) and only the navicular-cuboid in this study

Source for Binford data on caribou carcasses:
Binford, 1981:Table 5.01, column (26)

TABLE 11:2 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF 2 NAVAJO SITE COLLECTIONS (BINFORD AND BERTRAM, 1977) OF SHEEP BONES AFFECTED BY HUMANS AND DOGS AND BRAIN'S HOTTENTOT VILLAGE COLLECTION OF GOAT BONES AFFECTED BY HUMANS AND DOGS (BRAIN, 1969)

	SHEEP BONES FROM 2 NAVAJO SITES (BINFORD & BERTRAM, 1977)		GOAT BONES FROM HOTTENTOT VILLAGES (BRAIN, 1969)	
	SURVIVAL %	RANK	SURVIVAL %	RANK
Mandible	36	1	91	1
Scapula	21	4.5	27	6.5
Prox. humerus	4	23	0	24
Dist. humerus	25	2	64	2
Prox. radius	20	6	51	4
Dist. radius	13	8	17	12
Prox. metacarpal	8	17.5	25	8
Dist. metacarpal	6	21	18	11
Pelvis	13	8	27	6.5
Prox. femur	9	13.5	14	14
Dist. femur	6	21	7	20
Prox. tibia	13	8	10	17.5
Dist. tibia	21	4.5	56	3
Prox. metatarsal	9	13.5	30	5
Dist. metatarsal	8	17.5	16	13
Astragalus	8	17.5	13	15
Calcaneum	8	17.5	11	16
All phalanges	1	24	3	22.5
Atlas	9	13.5	19	10
Axis	9	13.5	22	9
Cervical verts.	12	10	4	21
Thoracic verts.	6	21	3	22.5
Lumbar verts.	10	11	8	19
Ribs	23	3	10	17.5

Rho=0.63, n=24, $p<0.01$

KEY:
Prox.: Proximal; Dist.: Distal; verts.: vertebrae

TABLE 11:3 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF BRAIN'S HOTTENTOT GOAT COLLECTION (BRAIN, 1969) AND THE TOTAL SHEFFIELD SHEEP COLLECTION

	BRAIN'S GOAT COLLECTION FROM HOTTENTOT VILLAGES (BRAIN, 1969)		SHEFFIELD SHEEP TOTAL COLLECTION (THIS STUDY)	
	SURVIVAL %	RANK	BRAIN'S INDEX	RANK
Mandible	91	1	0.33	7
Dist. humerus	64	2	0.39	5.5
Dist. tibia	56	3	0.58	1
Prox. radius	51	4	0.42	4
Prox. metatarsal	30	5	0.31	8.5
Scapula	27	6.5	0.31	8.5
Pelvis	27	6.5	0.47	2
Prox. metacarpal	25	8	0.30	10.5
Axis	22	9	0.22	18.5
Atlas	19	10	0.28	13
Dist. metacarpal	18	11	0.28	13
Dist. radius	17	12	0.39	5.5
Dist. metatarsal	16	13	0.30	10.5
Prox. femur	14	14	0.28	13
Astragalus	13	15	0.20	20
Calcaneum	11	16	0.11	24
Ribs	10	17.5	0.15	23
Prox. tibia	10	17.5	0.45	3
Lumbar verts.	8	19	0.27	15.5
Dist. femur	7	20	0.25	17
Cervical verts.	4	21	0.27	15.5
All phalanges	3	22.5	0.10	25
Thoracic verts.	3	22.5	0.19	21
Sacrum	2	24	0.22	18.5
Prox. humerus	0	25	0.16	22

Rho=0.74, n=25, $p<0.01$

KEY:
Prox.: Proximal; Dist.: Distal; verts.: vertebrae

TABLE 11:4 A SPEARMAN'S RANK ORDER CORRELATION ANALYSIS OF BINFORD'S BENT CREEK WOLF DEN COLLECTION OF CARIBOU BONES (BINFORD, 1981) AND THE MAKAPANSGAT COLLECTION OF UNGULATE BONES (BRAIN, 1969)

	BENT CREEK WOLF DEN COLLECTION OF CARIBOU BONES (BINFORD, 1981)		MAKAPANSGAT FOSSIL CAVE COLLECTION OF UNGULATE BONES (BRAIN, 1969)	
	SURVIVAL %	RANK	SURVIVAL %	RANK
Mandible	89	2	63	1
Scapula	57	9	22	5.5
Prox. humerus	25	16	6	18
Dist. humerus	100	1	57	2
Prox. radius	75	3	48	3
Dist. radius	46	11	20	7.5
Prox. metacarpal	71	4	22	5.5
Dist. metacarpal	68	5.5	27	4
Pelvis	68	5.5	18	10.5
Prox. femur	14	19.5	5	19
Dist. femur	21	17	10	14.5
Prox. tibia	14	19.5	11	13
Dist. tibia	61	8	20	7.5
Prox. metatarsal	50	10	18	10.5
Dist. metatarsal	29	15	19	9
Astragalus	32	14	10	14.5
Calcaneum	36	12.5	13	12
All phalanges	15	18	1	23
Atlas	66	7	7	17
Axis	36	12.5	9	16
Cervical verts.	6	22	3	20
Thoracic verts.	2	23	1	23
Lumbar verts.	12	21	2	21
Ribs	0	24	1	23

Rho=0.87, n=24, $p<0.01$

KEY:
Prox.: Proximal; Dist.: Distal, verts.: vertebrae

TABLE 12:1 FREQUENCIES OF IDENTIFIED FRAGMENTS AND OF CHEWED FRAGMENTS IN THE CASTLEFORD SITE 1 COLLECTION OF ROMANO-BRITISH ANIMAL BONES

	FREQUENCIES OF FRAGMENTS		NO. OF FRAGMENTS CHEWED	PERCENTAGE OF FRAGMENTS CHEWED
Cattle	1558		88	5.65%
Pig	144		14	9.72%
Sheep-goat	412			
Sheep	15	432	63	14.58%
Goat	5			
Horse	59		3	5.08%
Dog	66		1	1.52%
Red deer	4		0	-
Cat	4		0	-
Human infant	16		0	-
Cattle sized	633		18	2.84%
Pig sized	186		8	4.30%
Sheep-goat sized	196		5	2.55%
Rabbit sized	7		0	-
Unid. mammal	4		0	-
Domestic fowl	16		0	-
Dom. duck/mallard	1		0	-
Goose sp.	1		0	-
Crow/rook	2		0	-
Raven	7		0	-
Unid. fowl/duck	5		0	-
Unidentified	5		0	-
TOTALS:	3346		200	AVERAGE: 5.98%

WHOLE BONE EQUIVALENT (WBE) VALUES FOR THE ELEVEN MEDIUM OR LARGE ELEMENT TYPES IN THE CASTLEFORD SITE 1 SHEEP-GOAT COLLECTION, AND THE PERCENTAGES OF CHEWED FRAGMENTS AND THE PERCENTAGES OF CHOPPED FRAGMENTS

	CAT. 1 1-25%	CAT. 2 26-50%	CAT. 3 51-75%	CAT. 4 76-99%	CAT. 5 complete	WBE	N	WBE/N
Mandible	21	19	7	4	4	21.625	55	0.39
Scapula	14	6	4	0	1	7.5	25	0.30
Humerus	8	12	3	0	0	7.375	23	0.32
Radius	10	20	14	8	4	28.5	56	0.51
Ulna	2	7	0	0	0	2.875	11	0.26
Metacarpal	4	7	9	4	4	16.25	28	0.58
Pelvis	14	3	3	1	0	5.625	21	0.27
Femur	6	16	3	0	0	8.625	25	0.35
Tibia	20	26	11	8	0	26.125	65	0.40
Metatarsal	2	12	7	9	8	25	38	0.66
Ribs	145	10	1	0	0	22.5	156	0.14

	WBE/N		CHEWED		CHOPPED	
	WBE/N	RANK	%	RANK	%	RANK
Mandible	0.39	5	2	8	11	10
Scapula	0.30	8	0	10.5	24	7.5
Humerus	0.32	7	26	3	61	1
Radius	0.51	3	29	2	41	4
Ulna	0.26	10	0	10.5	9	11
Metacarpal	0.58	2	21	4	21	9
Pelvis	0.27	9	19	5	38	6
Femur	0.35	6	16	7	40	5
Tibia	0.40	4	18	6	57	2.5
Metatarsal	0.66	1	32	1	24	7.5
Ribs	0.14	11	0	10.5	57	2.5

KEY: CAT.: COMPLETENESS CATEGORY; WBE: WHOLE BONE EQUIVALENT

WHOLE BONE EQUIVALENT (WBE) VALUES FOR THE ELEVEN MEDIUM OR LARGE ELEMENT TYPES IN THE CASTLEFORD SITE 1 CATTLE COLLECTION, AND THE PERCENTAGES OF CHEWED FRAGMENTS AND THE PERCENTAGES OF CHOPPED FRAGMENTS

	CAT. 1 1-25%	CAT. 2 26-50%	CAT. 3 51-75%	CAT. 4 76-99%	CAT. 5 complete	WBE	N	WBE/N
Mandible	117	24	15	8	0	40	164	0.24
Scapula	68	29	24	30	2	62.635	153	0.41
Humerus	38	31	2	3	1	21.25	75	0.28
Radius	63	45	16	3	3	40.375	130	0.31
Ulna	40	28	8	3	2	25.125	81	0.31
Metacarpal	10	16	1	2	9	18.625	38	0.49
Pelvis	60	16	4	2	0	17.75	84	0.21
Femur	33	24	9	0	0	18.75	66	0.28
Tibia	56	47	22	3	1	42	129	0.33
Metatarsal	13	32	7	1	10	28.875	63	0.46
Sacrum	3	3	0	0	0	1.5	6	0.25
Ribs	329	49	2	0	0	60.75	380	0.16

	WBE/N		CHEWED		CHOPPED	
	WBE/N	RANK	%	RANK	%	RANK
Mandible	0.24	10	4	10	64	8
Scapula	0.41	3	2	11.5	58	9
Humerus	0.28	7.5	11	4	77	3
Radius	0.31	5.5	5	8	71	5
Ulna	0.31	5.5	5	8	54	10.5
Metacarpal	0.49	1	8	6	45	12
Pelvis	0.21	11	13	2	69	6
Femur	0.28	7.5	11	4	73	4
Tibia	0.33	4	5	8	68	7
Metatarsal	0.46	2	11	4	54	10.5
Sacrum	0.25	9	33	1	83	1
Ribs	0.16	12	2	11.5	79	2

KEY: CAT.: COMPLETENESS CATEGORY; WBE: WHOLE BONE EQUIVALENT

TABLE 12:4 FREQUENCIES OF FRAGMENTS AND ELEMENTS OF SHEEP/GOAT IN THE CASTLEFORD SITE 1 COLLECTION

	NO. OF FRAGMENTS	MIN. NO. OF ELEMENTS	BRAIN'S INDEX (MNI = 16)	
	N	MNEL	BI	RANK
Hyoid	0	0	-	23.5
Mandible	55	28	0.88	2
Scapula	25	9	0.28	8
Humerus	23	11	0.34	7
Radius	56	29	0.91	1
Ulna	11	7	0.22	9.5
Metacarpal	28	14	0.44	5
Pelvis	21	13	0.41	6
Femur	25	7	0.22	9.5
Tibia	65	27	0.84	3
Metatarsal	38	23	0.72	4
Patella	0	0	-	23.5
Astragalus	1	1	0.03	16.5
Calcaneum	3	3	0.09	12
Navicular-cuboid	0	0	-	23.5
Proximal phalange	3	3	0.02	18
Medial phalange	1	1	0.01	19.5
Distal phalange	0	0	-	23.5
Atlas	2	2	0.13	11
Axis	1	1	0.06	13.5
Cervical verts.	4	4	0.05	15
Thoracic verts.	6	3	0.01	19.5
Lumbar verts.	3	3	0.03	16.5
Sacrum	0	0	-	23.5
Ribs	156	23	0.06	13.5
Sternebrae	0	0	-	23.5
TOTALS	527	212		

TABLE 12:5 FREQUENCIES OF FRAGMENTS AND ELEMENTS OF CATTLE IN THE CASTLEFORD SITE 1 COLLECTION

	NO. OF FRAGMENTS	MIN. NO. OF ELEMENTS	BRAIN'S INDEX (MNI = 39)	
	N	MNEL	BI	RANK
Hyoid	5	5	0.06	22.5
Mandible	164	40	0.51	4
Scapula	153	77	0.99	1
Humerus	75	32	0.41	7
Radius	130	50	0.64	2
Ulna	81	46	0.59	3
Metacarpal	38	26	0.33	9
Pelvis	84	39	0.50	5.5
Femur	66	15	0.19	15
Tibia	129	29	0.37	8
Metatarsal	63	39	0.50	5.5
Patella	3	3	0.04	24
Astragalus	16	16	0.21	12.5
Calcaneum	25	25	0.32	10
Navicular-cuboid	8	8	0.10	19
Proximal phalange	40	40	0.13	17
Medial phalange	14	14	0.04	24
Distal phalange	13	13	0.04	24
Atlas	8	8	0.21	12.5
Axis	9	9	0.23	11
Cervical verts.	39	39	0.20	14
Thoracic verts.	62	34	0.07	20
Lumbar verts.	35	25	0.11	18
Sacrum	6	6	0.15	16
Ribs	380	61	0.06	21.5
Sternebrae	1	1	0.003	26
TOTALS	1647	700		

TABLE 12:6 THE AREAS USED TO ESTIMATE MINIMUM NUMBERS OF ELEMENTS FOR THE TWELVE MEDIUM OR LARGE ELEMENT TYPES OF SHEEP-GOAT AND CATTLE BONES IN THE CASTLEFORD SITE 1 COLLECTION

	SHEEP-GOAT	CATTLE
Mandible	M1 present	M1 present
Scapula	head/neck	head/neck
Humerus	distal epiphysis	distal epiphysis
Radius	midshaft measurement	proximal epiphysis
Ulna	olecranon process	olecranon process
Metacarpal	proximal epiphysis	proximal epiphysis
Pelvis	acetabulum	acetabulum
Femur	midshaft measurement	proximal epiphysis
Tibia	midshaft measurement	distal epiphysis
Metatarsal	prox. epiph. = midshaft	proximal epiphysis
Sacrum	proximal epiphysis	proximal epiphysis
Ribs	Whole Bone Equivalent	(Whle Bone Equivalent)

TABLE 12:7 BRAIN'S INDEX VALUES OF THE SHEEP-GOAT AND CATTLE BONES FROM CASTLEFORD SITE 1, USING PROXIMAL AND DISTAL EPIPHYSES

	CASTLEFORD SITE 1 SHEEP-GOATS			CASTLEFORD SITE 1 CATTLE		
	NO. OF ELEMENTS	BRAIN'S INDEX (MNI = 16)		NO. OF ELEMENTS	BRAIN'S INDEX (MNI = 39)	
	N	BI	RANK	N	BI	RANK
Mandible	28	0.88	1	40	0.51	3
Scapula	9	0.28	10	77	0.99	1
Humerus, prox.	2	0.06	17	7	0.09	23
Humerus, dist.	11	0.34	9	32	0.41	6
Radius, prox.	15	0.47	4	50	0.64	2
Radius, dist.	13	0.41	6.5	20	0.26	11.5
Ulna, prox.	0	-	27.5	0	-	30
Ulna, dist.	0	-	27.5	5	0.06	25.5
Metacarpal, prox.	14	0.44	5	26	0.33	9
Metacarpal, dist.	8	0.25	11	20	0.26	11.5
Pelvis	13	0.41	6.5	39	0.50	4.5
Femur, prox.	5	0.16	12	15	0.19	17
Femur, dist.	4	0.13	13.5	8	0.10	21.5
Tibia, prox.	0	-	27.5	8	0.10	21.5
Tibia, dist,	24	0.75	2	29	0.37	7
Metatarsal, prox.	23	0.72	3	39	0.50	4.5
Metatarsal, dist.	12	0.38	8	27	0.35	8
Astragalus	1	0.03	20.5	16	0.21	14.5
Calcaneum	3	0.09	15	25	0.32	10
Prox. phalange	3	0.02	22	40	0.13	19
Med. phalange	1	0.01	23.5	14	0.04	27.5
Dist. phalange	0	-	27.5	13	0.04	27.5
Atlas	2	0.13	13.5	8	0.21	14.5
Axis	1	0.06	17	9	0.23	13
Cervical verts.	4	0.05	19	39	0.20	16
Thoracic verts.	3	0.01	23.5	34	0.07	24
Lumbar verts.	3	0.03	20.5	25	0.11	20
Sacrum	0	-	27.5	6	0.15	18
Ribs	23	0.06	17	61	0.06	25.5
Sternebrae	0	-	27.5	1	0.003	29

Cas. Site 1 sheep-goat & Lyman's Bulk Density: Rho = 0.55 n=30 p<0.01
Cas. Site 1 cattle & Lyman's Bulk Density: Rho = 0.49 n=30 p<0.01

Lyman's Bulk Density figures are taken from Lyman (1982); see Table 10:8 for their rank orders.

KEY: prox.: proximal; med.: medial; dist.: distal; Cas.: Castleford

TABLE 12:8 FREQUENCIES OF FUSED AND UNFUSED EPIPHYSES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

		FUSED	UNFUSED
Metacarpal, proximal	(BY BIRTH)	19	0
Metatarsal, proximal		20	0
Scapula, bicipital tuberosity	(6-8 MONTHS)	17	0
Pelvis, acetabulum	(10 MONTHS)	30	0
Humerus, distal		24	1
Radius, proximal		27	0
Metacarpal, distal	(18-24 MONTHS)	17	1
Tibia, distal		26	11
(Mandible, complete tooth row		15	5)
Metatarsal, distal	(20-28 MONTHS)	18	1
Ulna, proximal	(30 MONTHS)	16	0
Femur, proximal	(30-36 MONTHS)	20	0
Radius, distal	(36 MONTHS)	22	5
Humerus, proximal	(36-42 MONTHS)	11	1
Femur, distal		18	0
Tibia, proximal		19	6
Pelvis, ilium	(BY 42 MONTHS)	20	5

FIGURE 1:1 LOCATION MAP OF THE SHEFFIELD AND GRIZEDALE STUDY AREAS, AND THE ROMANO-BRITISH SITE OF CASTLEFORD

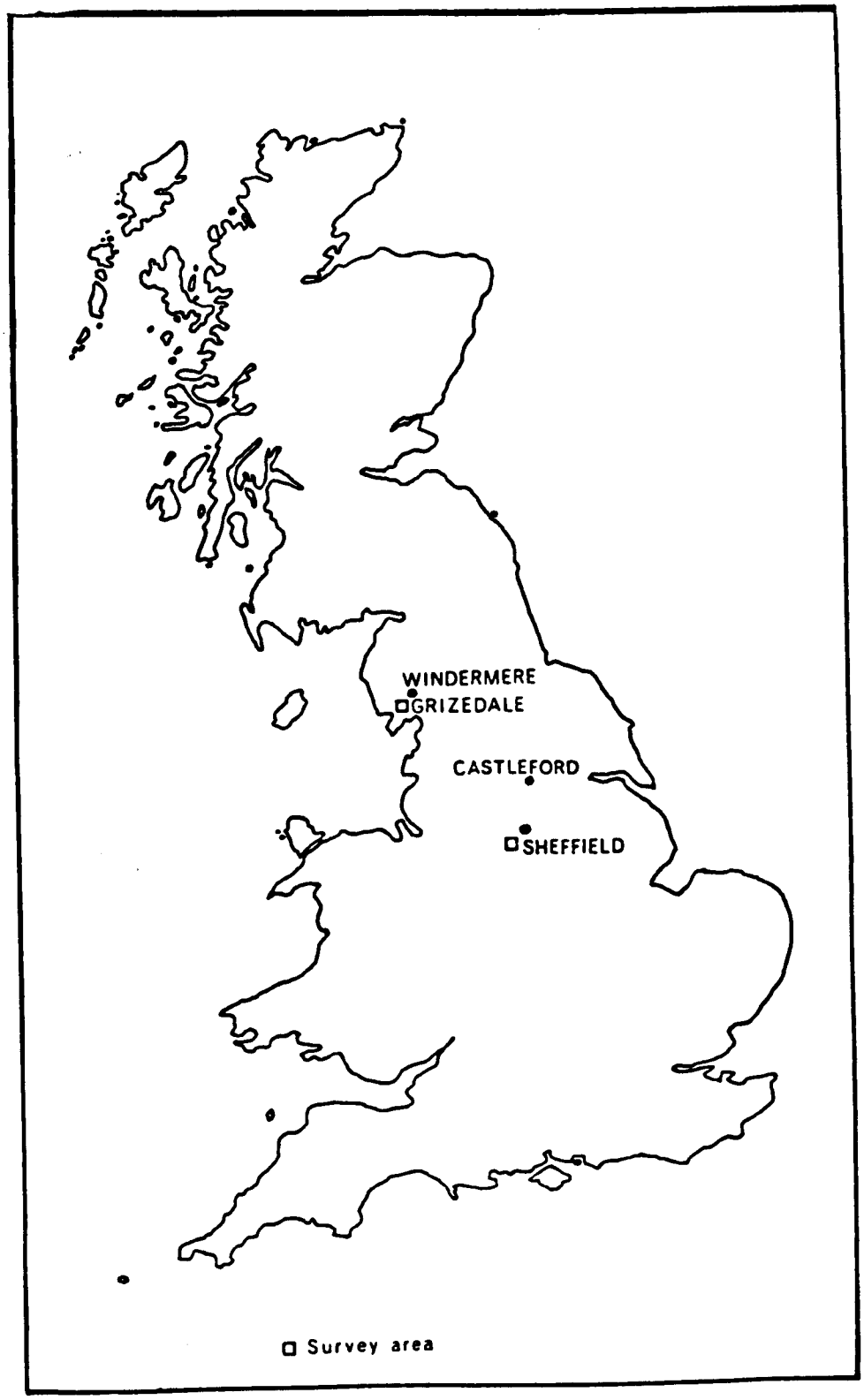


FIGURE 2:1 MAPS SHOWING THE MAIN TOPOGRAPHICAL FEATURES OF THE SHEFFIELD STUDY AREA AND THE DISTRIBUTION OF FINDSPOTS

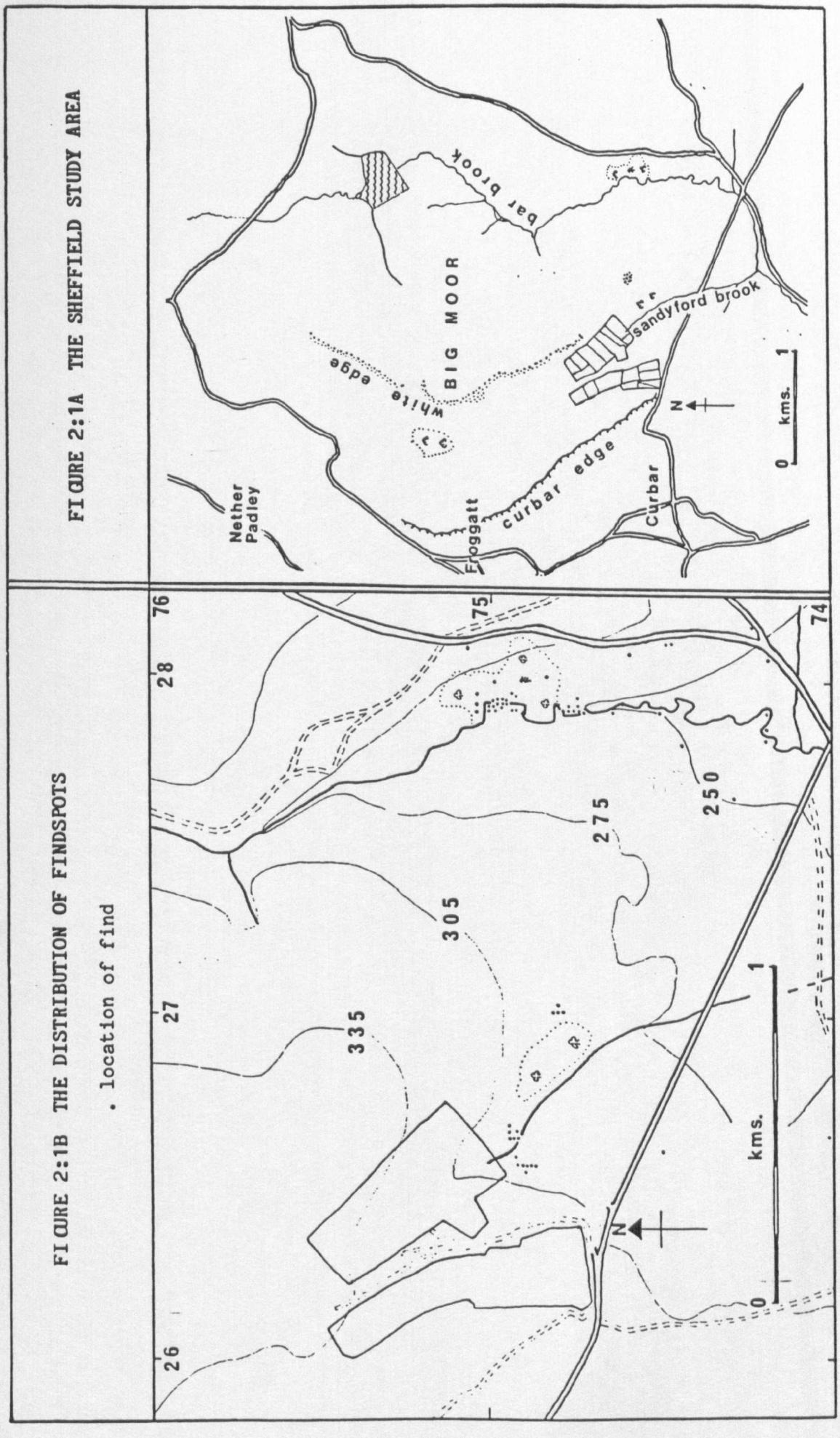


FIGURE 2:2 THE FIELD RECORDING SHEET USED IN THE ACTUALISTIC SURVEY

SHEFFIELD SHEEP CORPSE NO.

DATE previous no.

TOPOGRAPHY OF SITE

slope aspect
concave/convex
micro-relief
upslope vegetation
micro-vegetation
surface condition
recent weather

POSITION OF REMAINS GRID REF
exposed/sheltered
nearest shelter type
distance
direction

ENTIRE CORPSE/SCAVENGED CORPSE/ISOLATED BONES

CORPSE orientation
position
condition
micro-fauna

breed horned/polled
tooth/fusion data

SKETCH PLAN

PHOTO

DISTURBANCE nearest access
signs of disturbance

COLLECTED

FIGURE 2:3 DISTRIBUTION MAP OF FINDSPOTS IN THE SHEFFIELD STUDY AREA, IDENTIFYING THE DIFFERENT TYPES OF FINDS

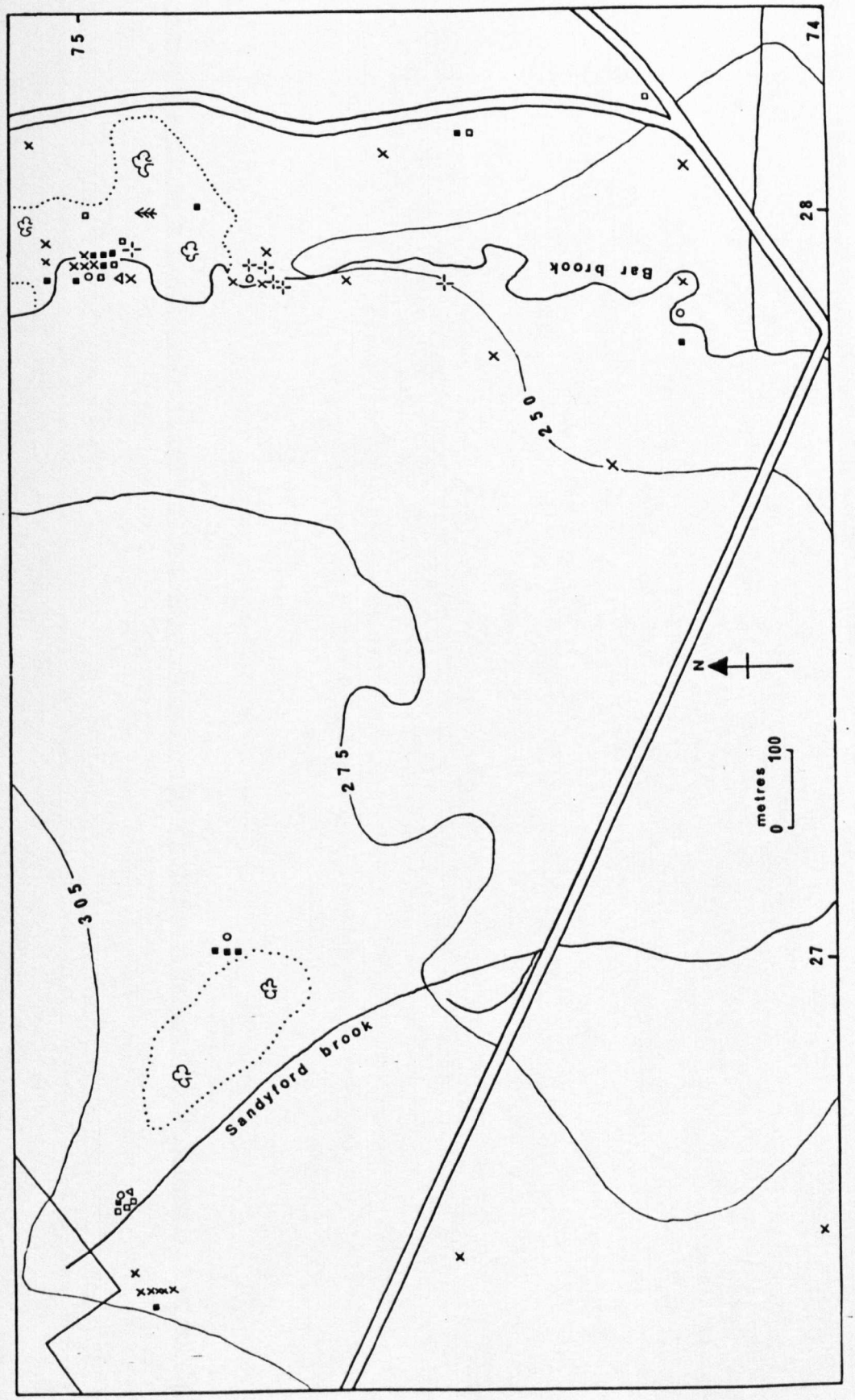


FIGURE 2:3 DISTRIBUTION MAP OF FINDSPOTS IN THE SHEFFIELD STUDY AREA

FIGURE 3:1 FLOW CHART SHOWING SOME OF THE FACTORS OBSERVED TO AFFECT THE BONES OF DEAD SHEEP IN THE STUDY AREAS

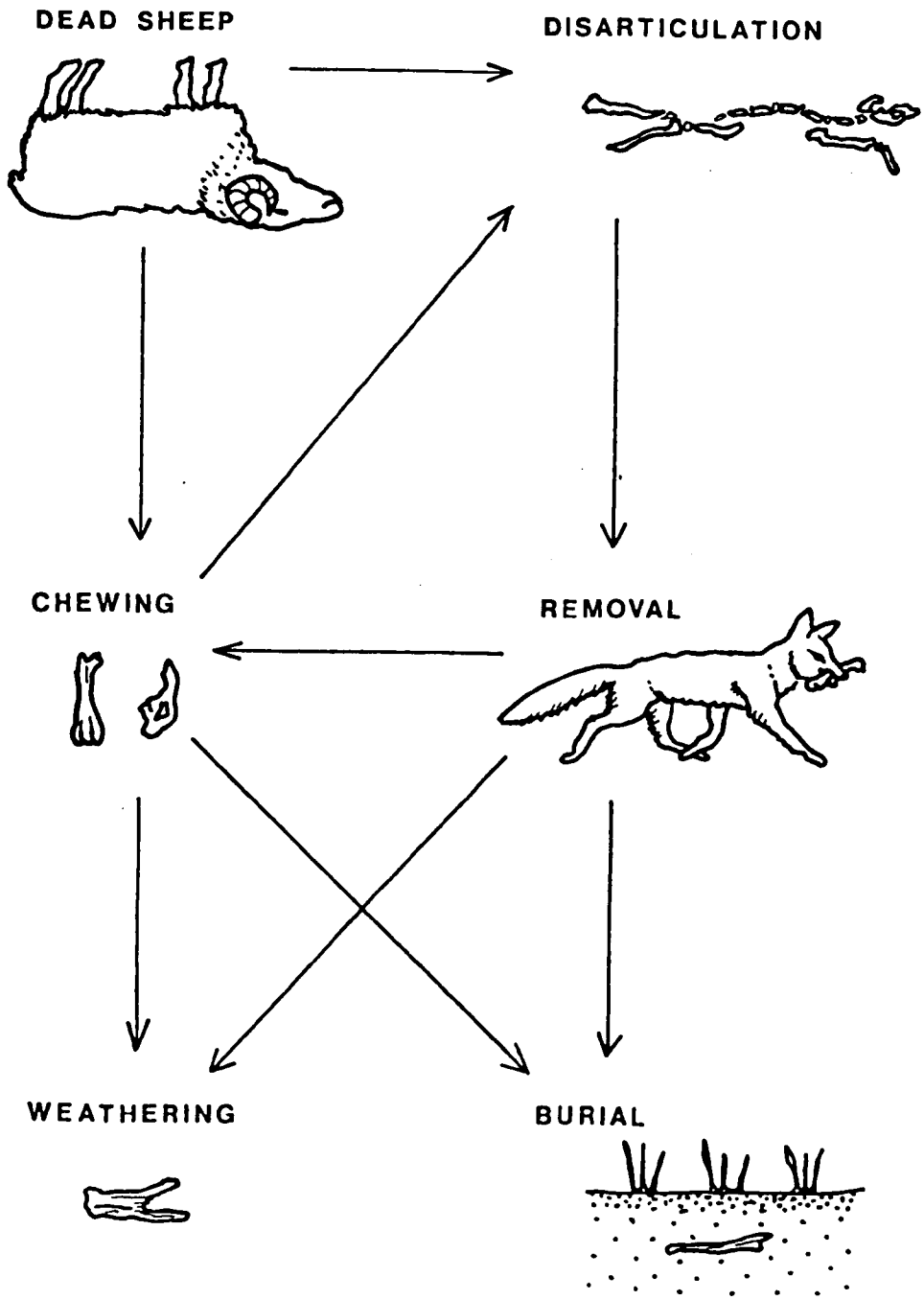


FIGURE 3:2 FLOW CHART SHOWING HOW SOME OF THE INTERNAL AND EXTERNAL FACTORS INTERACT ON THE PRESERVATION, DISTRIBUTION AND RECOVERY OF BONES FROM DEAD SHEEP IN THE STUDY AREAS

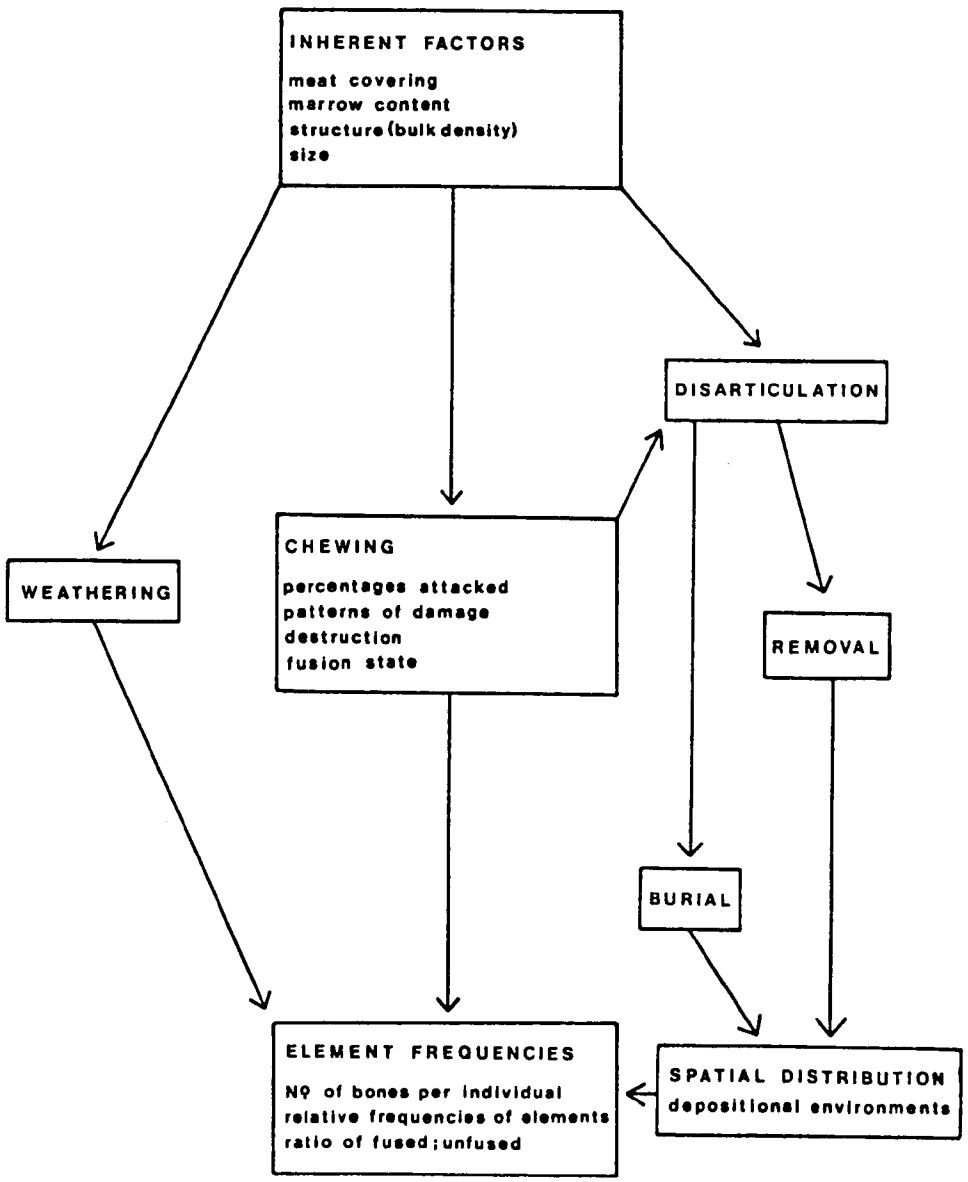


FIGURE 3:3 EXAMPLE OF A FRAGMENT RECORDING CHART (FOR THE HUMERUS)

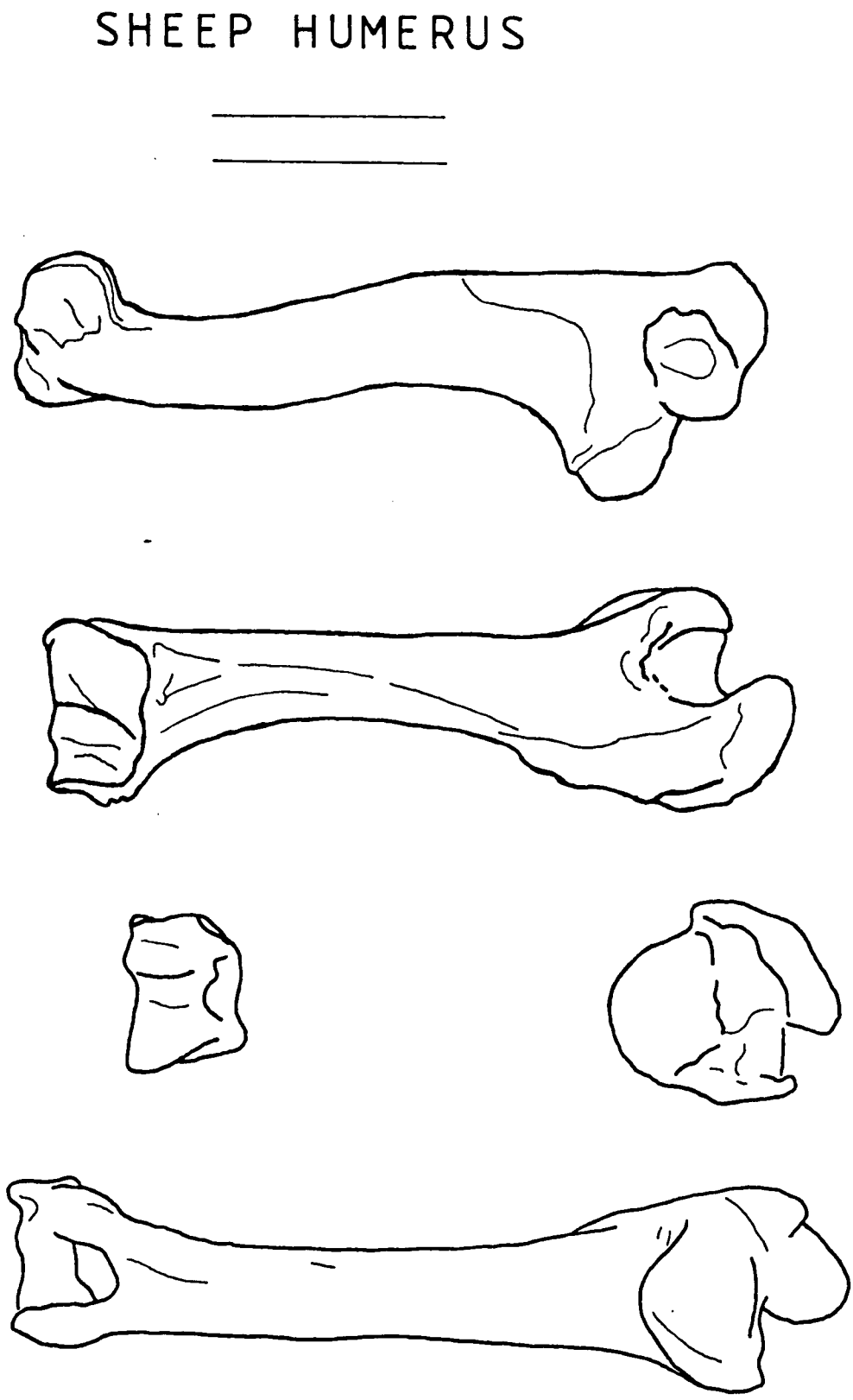


FIGURE 5:1 RAW FREQUENCIES OF THE 26 ELEMENT TYPES IN THE GRIZEDALE ROE DEER AND RED DEER CARCASS COLLECTIONS

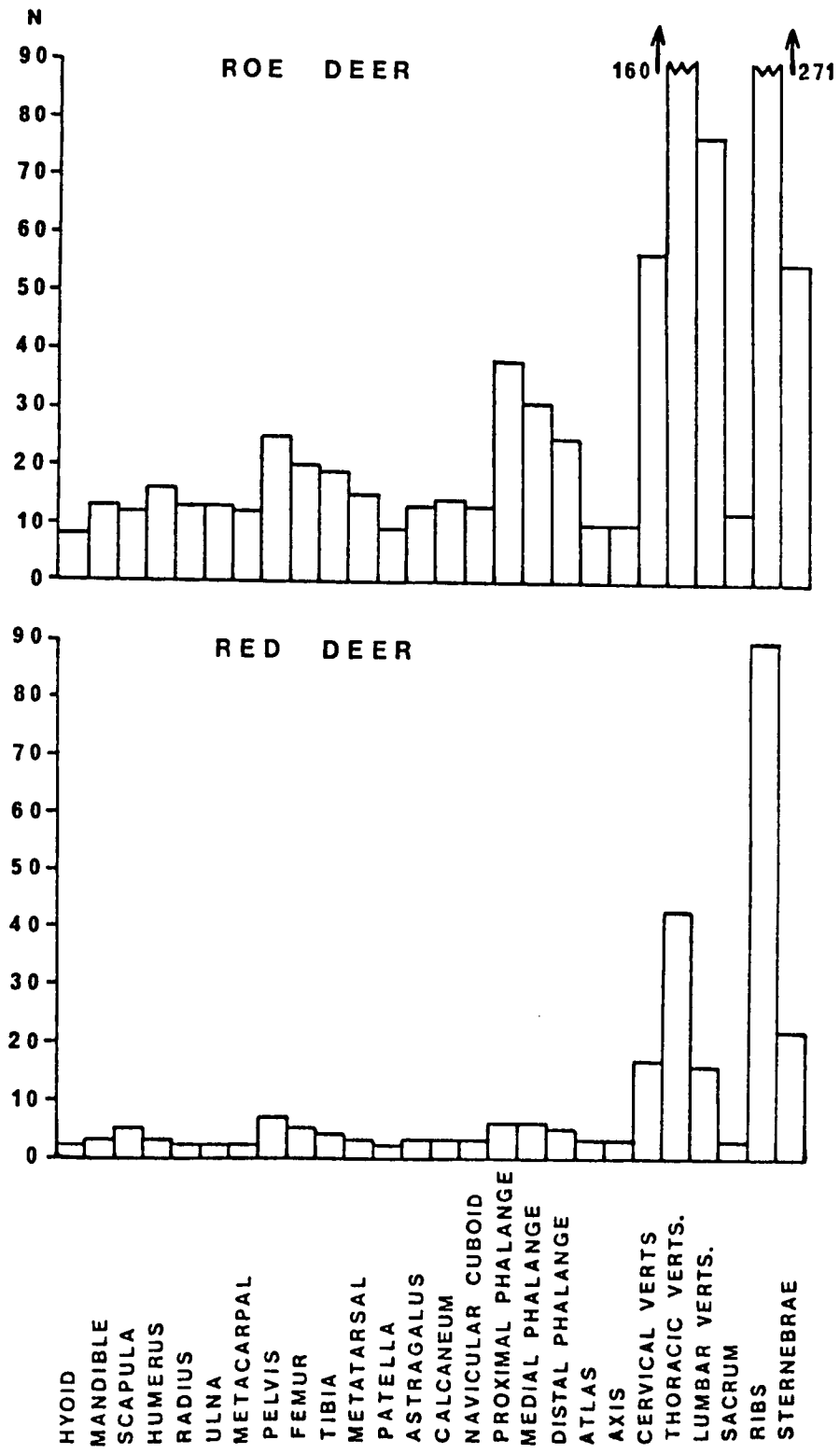


FIGURE 5:2 BRAIN'S INDEX VALUES FOR THE 26 ELEMENT TYPES IN THE GRIZEDALE ROE DEER AND RED DEER CARCASS COLLECTIONS

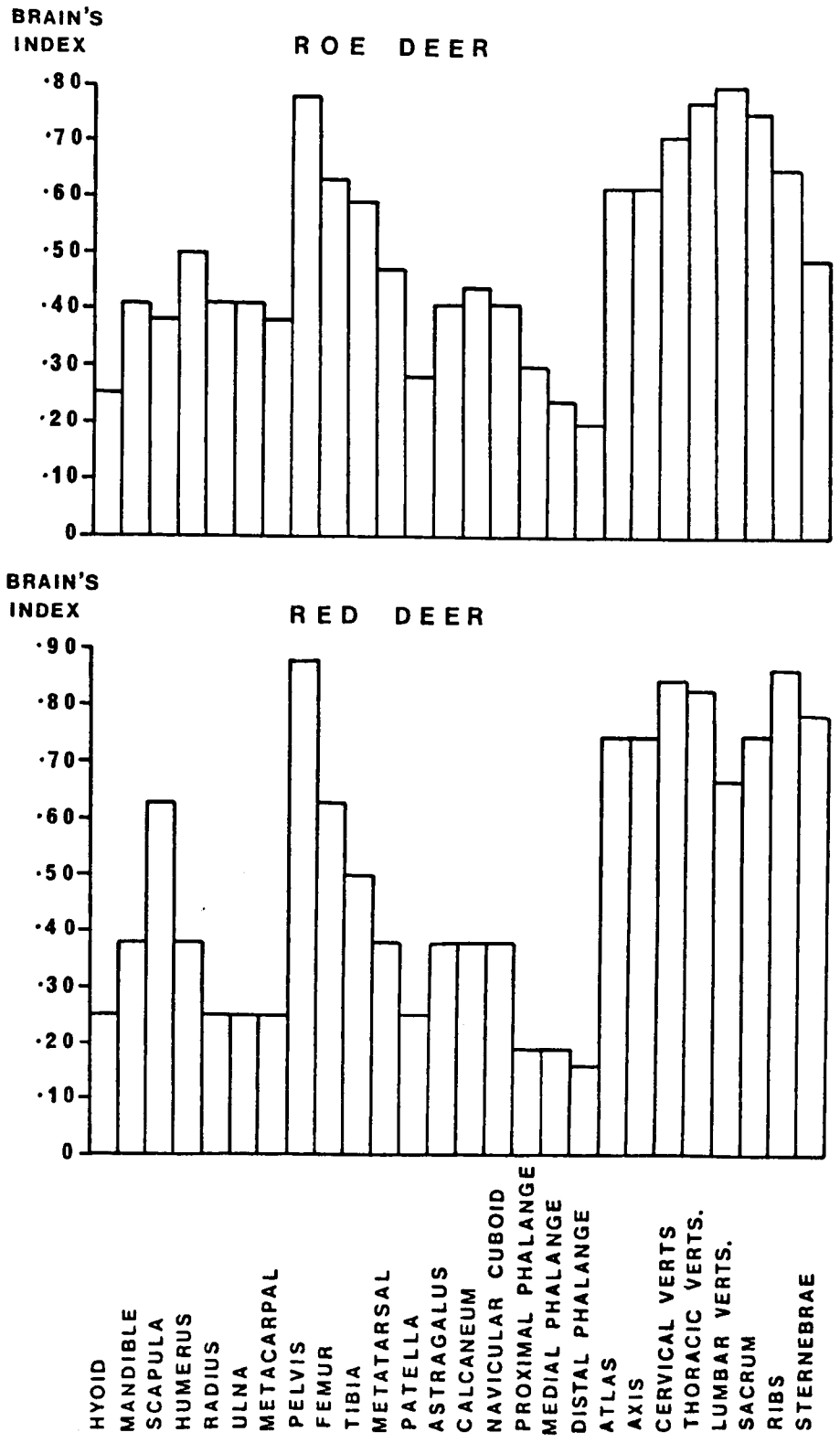


FIGURE 5:3

FIGURE 5:3 FIELD SKETCH PLAN OF THE DISTRIBUTION OF ELEMENTS RECOVERED FROM A RED DEER CARCASS, GRIZEDALE NUMBER 1979:4

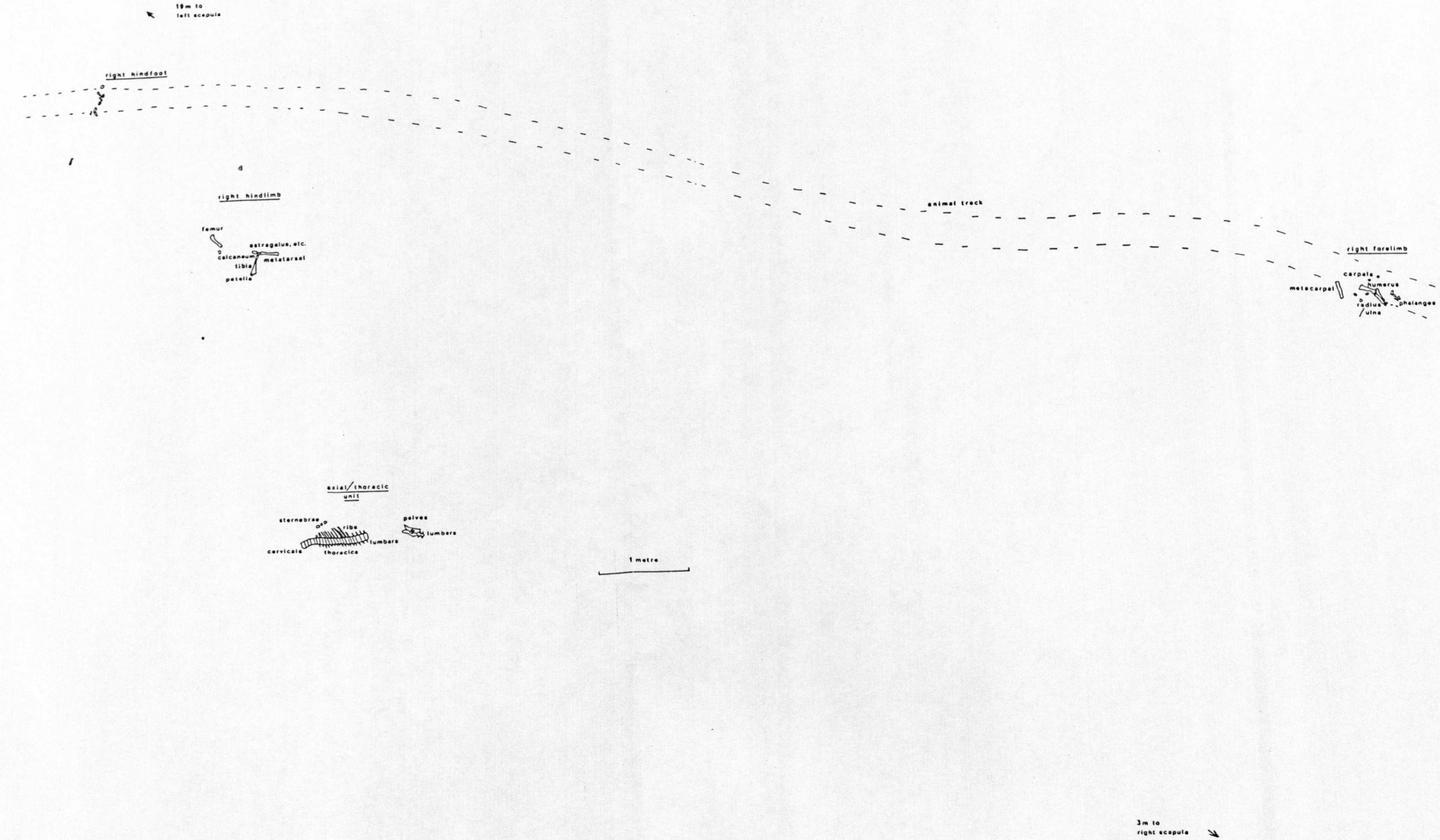


FIGURE 6:1 BRAIN'S INDEX VALUES FOR ELEMENTS IN THE 'ARTICULATED' AND ISOLATED FOX DEN SUB-COLLECTIONS

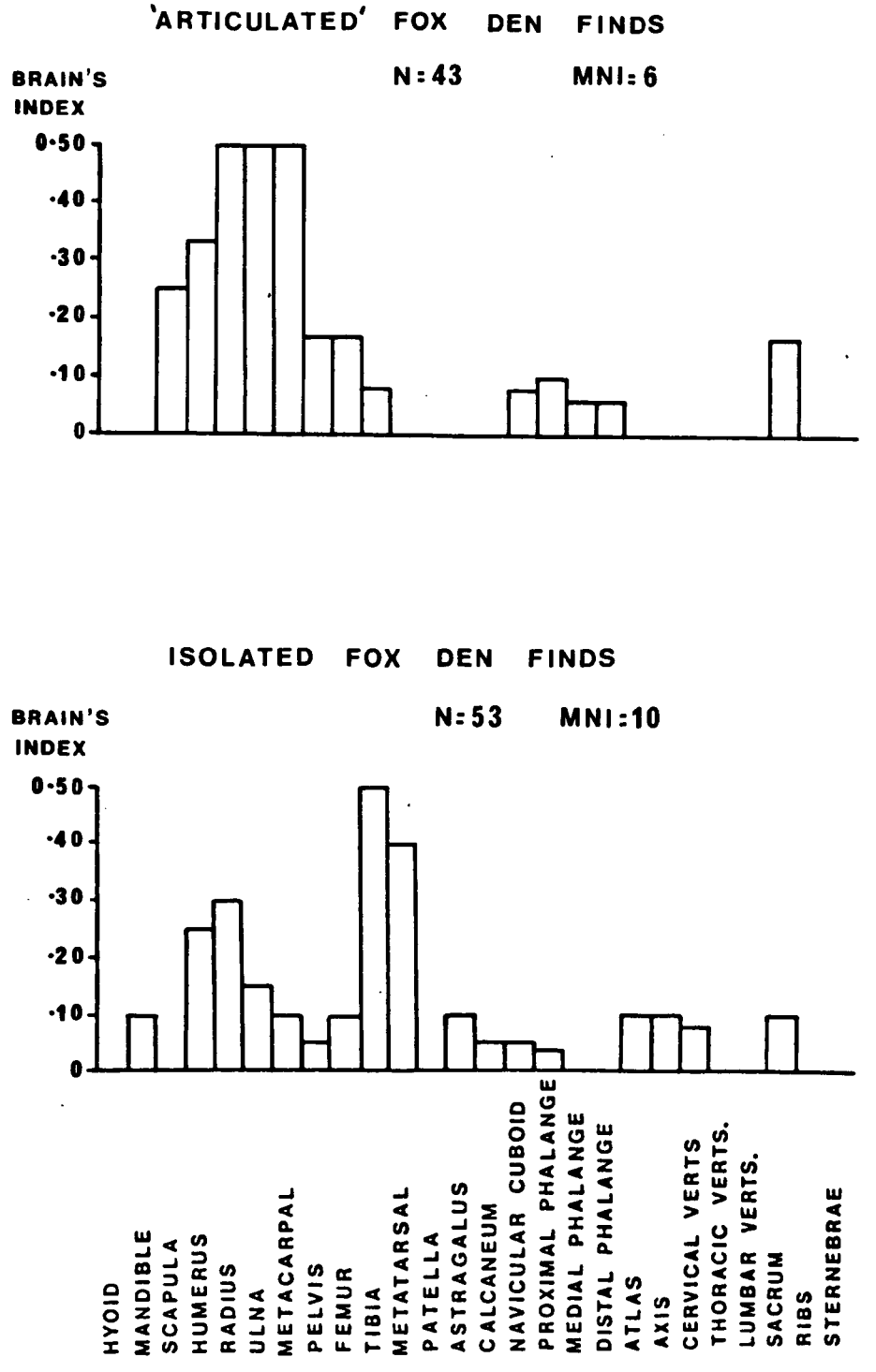


FIGURE 6:2 BRAIN'S INDEX VALUES FOR ELEMENTS IN THE COMBINED FOX DEN SUB-COLLECTION AND THE CARCASS COLLECTION

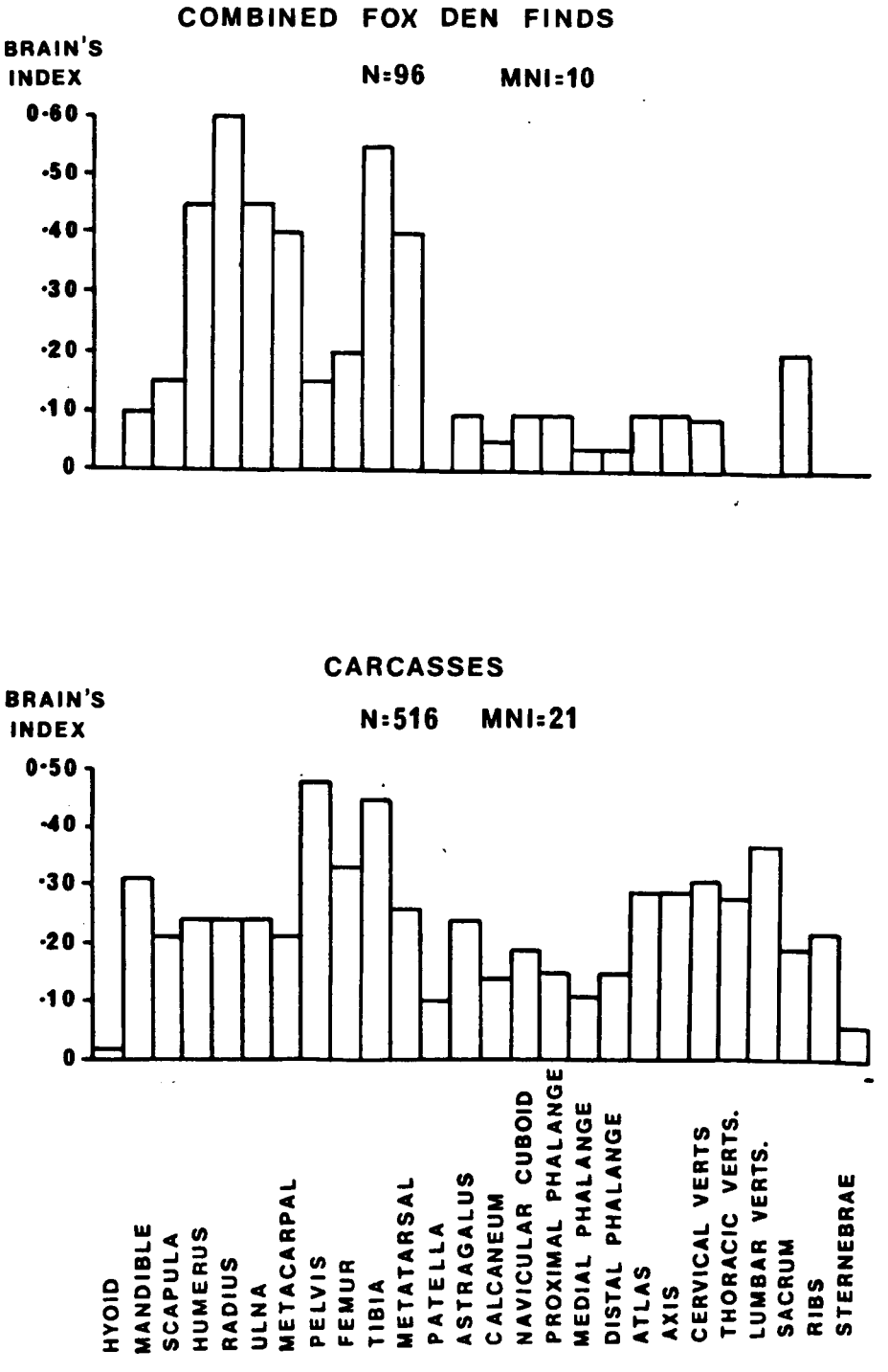


FIGURE 6:3 BRAIN'S INDEX VALUES FOR ELEMENTS IN THE COMBINED FOX DEN SUB-COLLECTION AND THE S146 SUB-COLLECTION

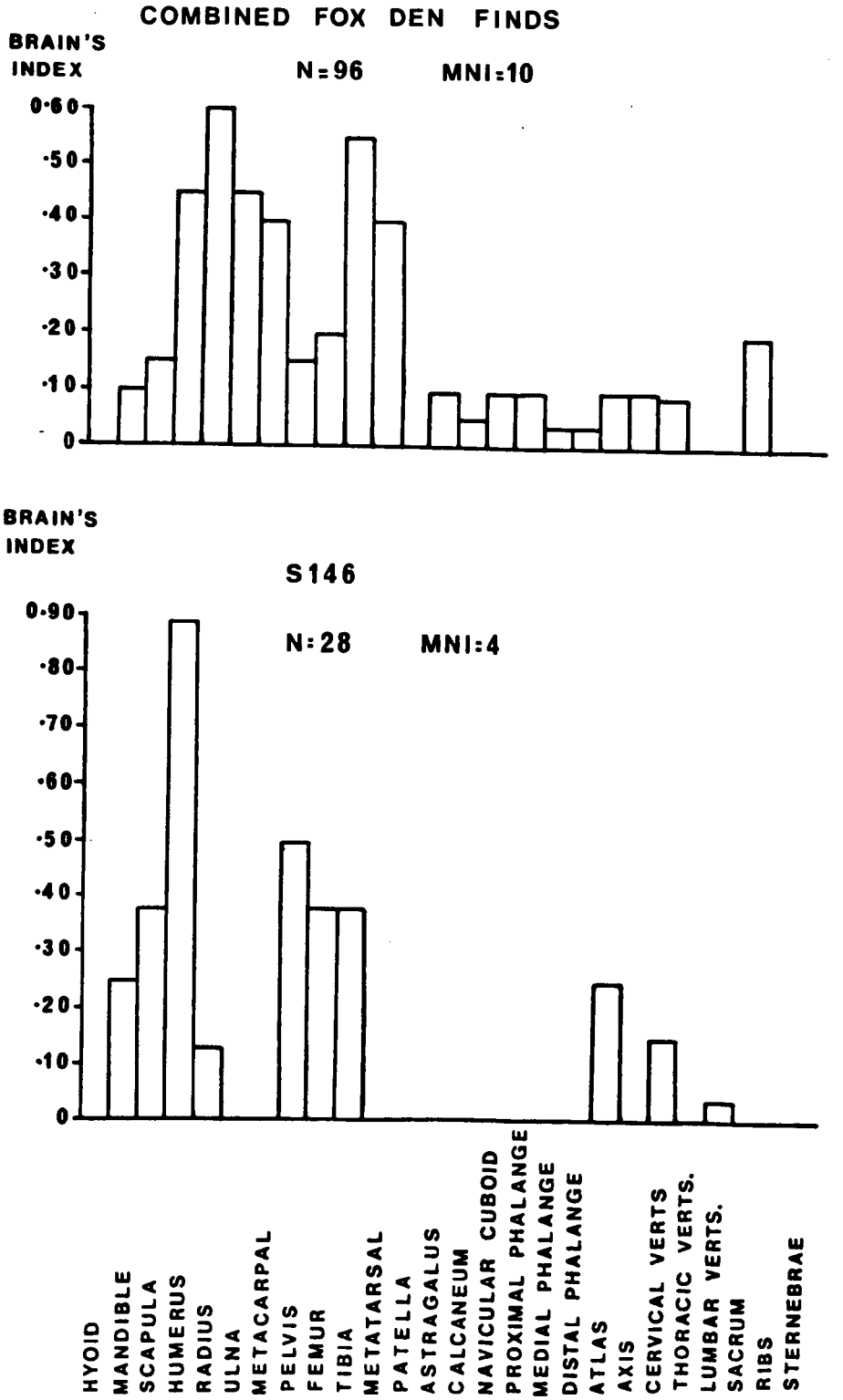


FIGURE 6:4 BRAIN'S INDEX VALUES FOR ELEMENTS IN THE GENERAL ISOLATED SUB-COLLECTION, THE CARCASS COLLECTION, AND THE COMBINED FOX DEN SUB-COLLECTION

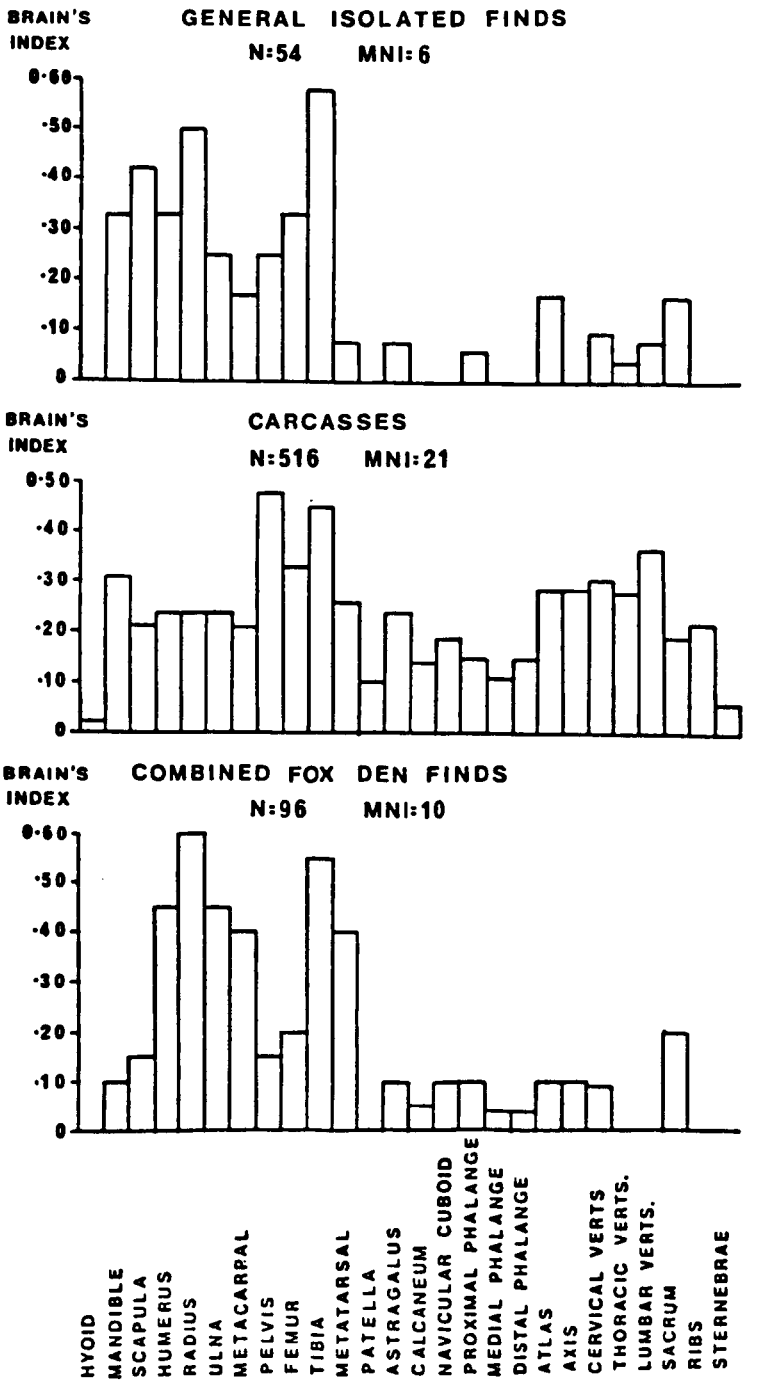


FIGURE 6:5 BRAIN'S INDEX VALUES FOR ELEMENTS IN THE RESIDUAL ASSEMBLAGE (I.E.: THE CARCASS COLLECTION PLUS THE S146 SUB-COLLECTION), AND IN THE TRANSPORTED ASSEMBLAGE (I.E.: THE COMBINED FOX DEN AND THE GENERAL ISOLATED SUB-COLLECTIONS)

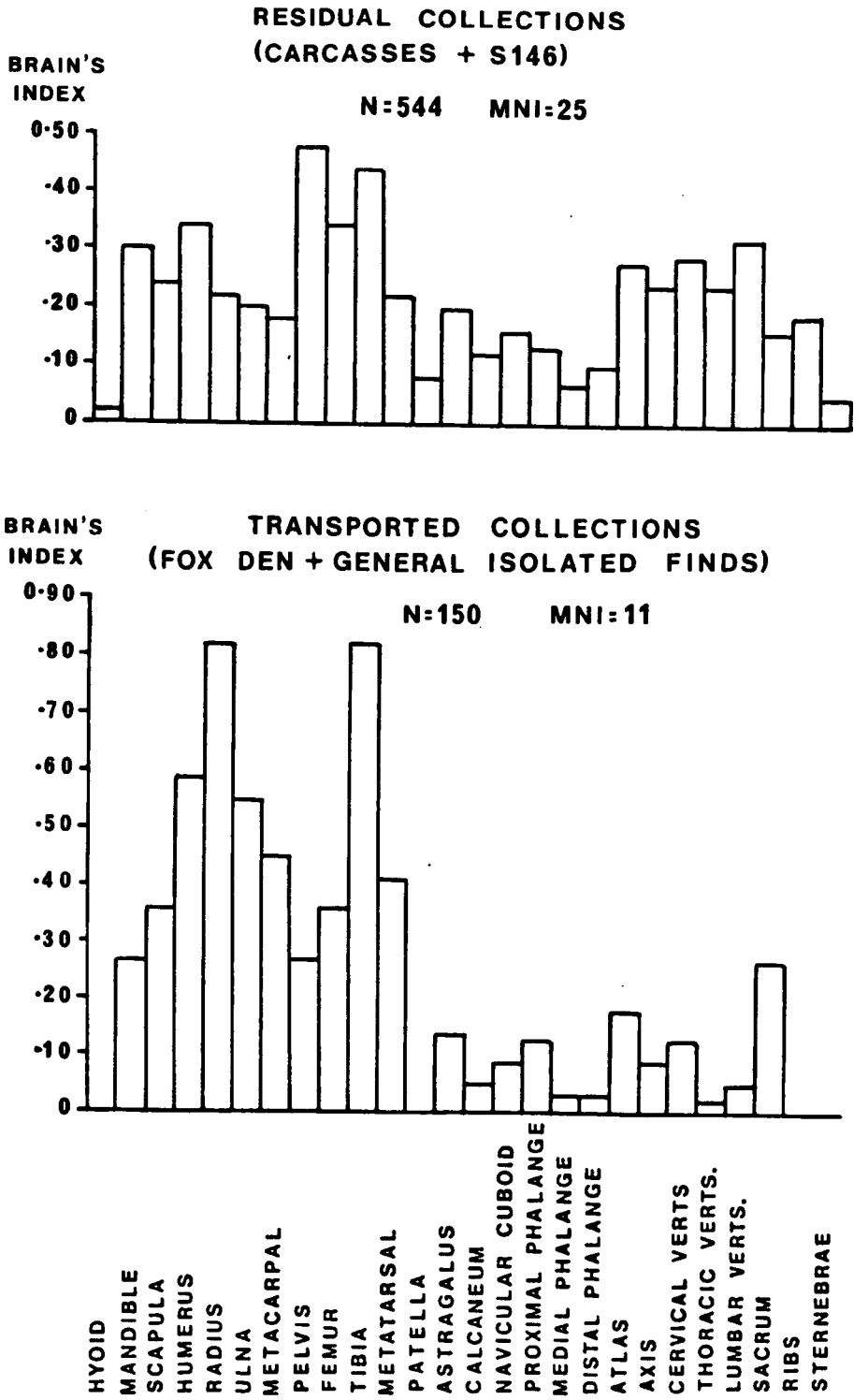
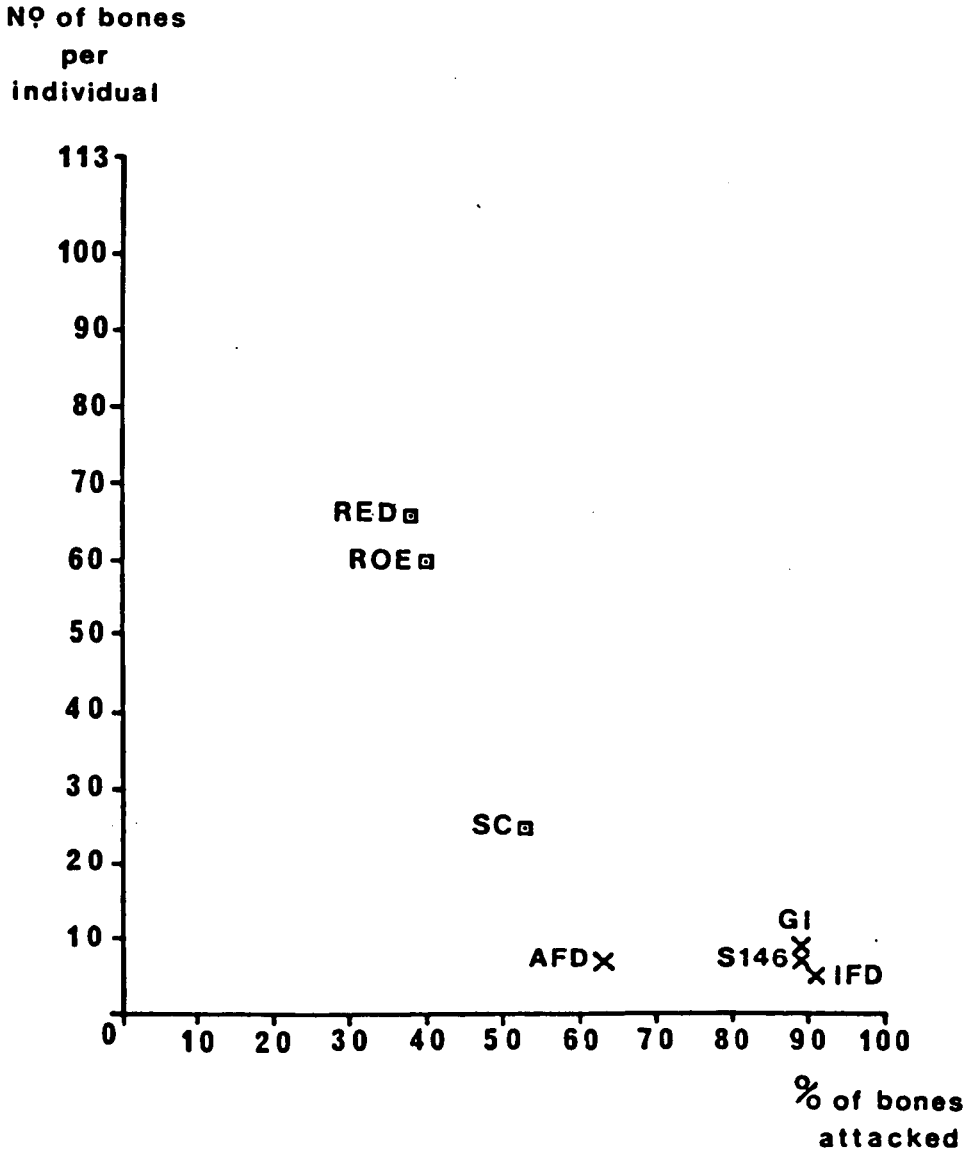
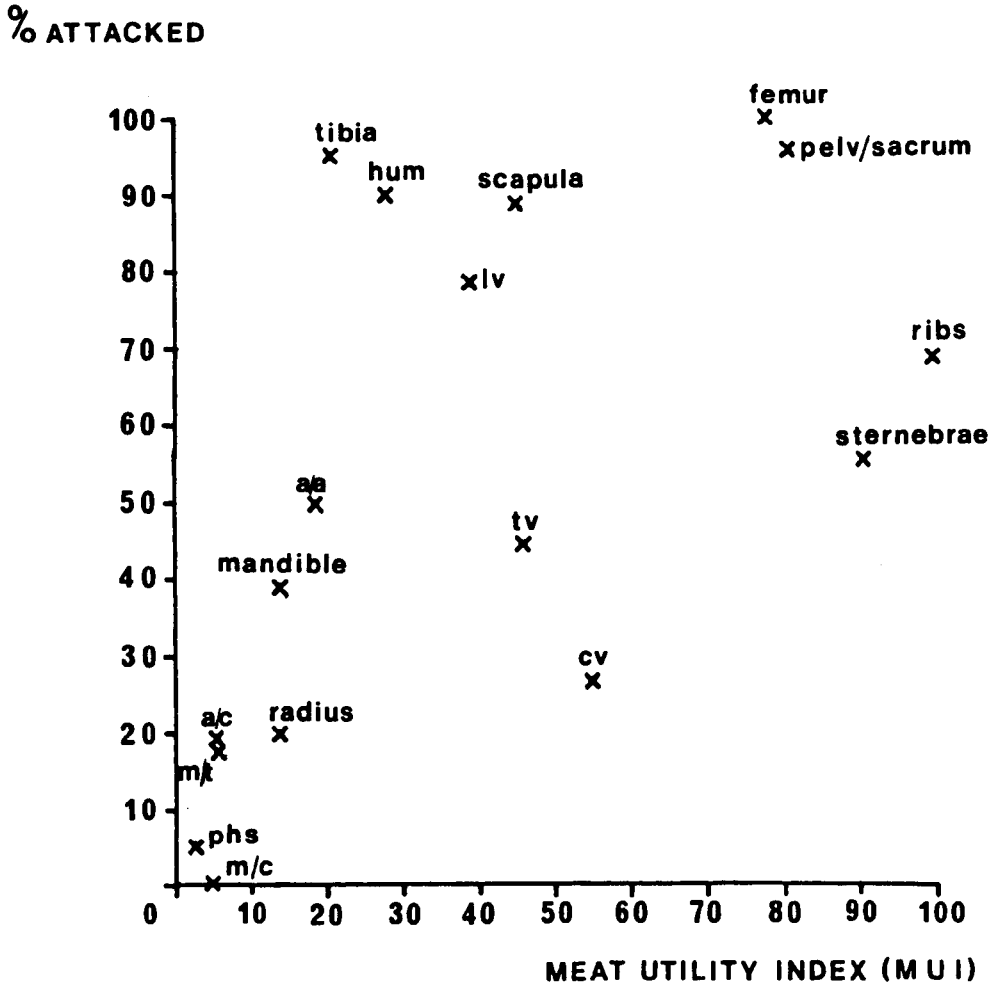


FIGURE 7:1 SCATTERGRAM SHOWING THE INVERSE CORRELATION BETWEEN THE AVERAGE PERCENTAGE OF ELEMENTS ATTACKED AND THE AVERAGE NUMBER OF BONES PER INDIVIDUAL IN THE THREE CARCASS COLLECTIONS AND THE FOUR NON-CARCASS COLLECTIONS



SC: Sheffield sheep carcass collection
AFD: 'articulated' fox den sub-collection
IFD: isolated fox den sub-collection
GI: general isolated sub-collection
S146: S146 sub-collection

FIGURE 7:2 SCATTERGRAM OF THE MEAT UTILITY INDEX (MUI) VALUES AND THE PERCENTAGES OF ATTACKED ELEMENTS IN THE SHEFFIELD SHEEP CARCASS COLLECTION



a/c ASTRAGALUS/CALCANEUM
a/a ATLAS/AXIS
cv CERVICAL VERTS.
hum HUMERUS
lv LUMBAR VERTS.
m/c METACARPAL
m/t METATARSAL
pelv PELVIS
phs PHALANGES
tv THORACIC VERTS.

FIGURE 7:3 SCATTERGRAM SHOWING THE POOR CORRELATION BETWEEN THE PERCENTAGE OF ELEMENT TYPES ATTACKED AND THEIR BRAIN'S INDEX VALUES, IN THE SHEFFIELD SHEEP CARCASS COLLECTION

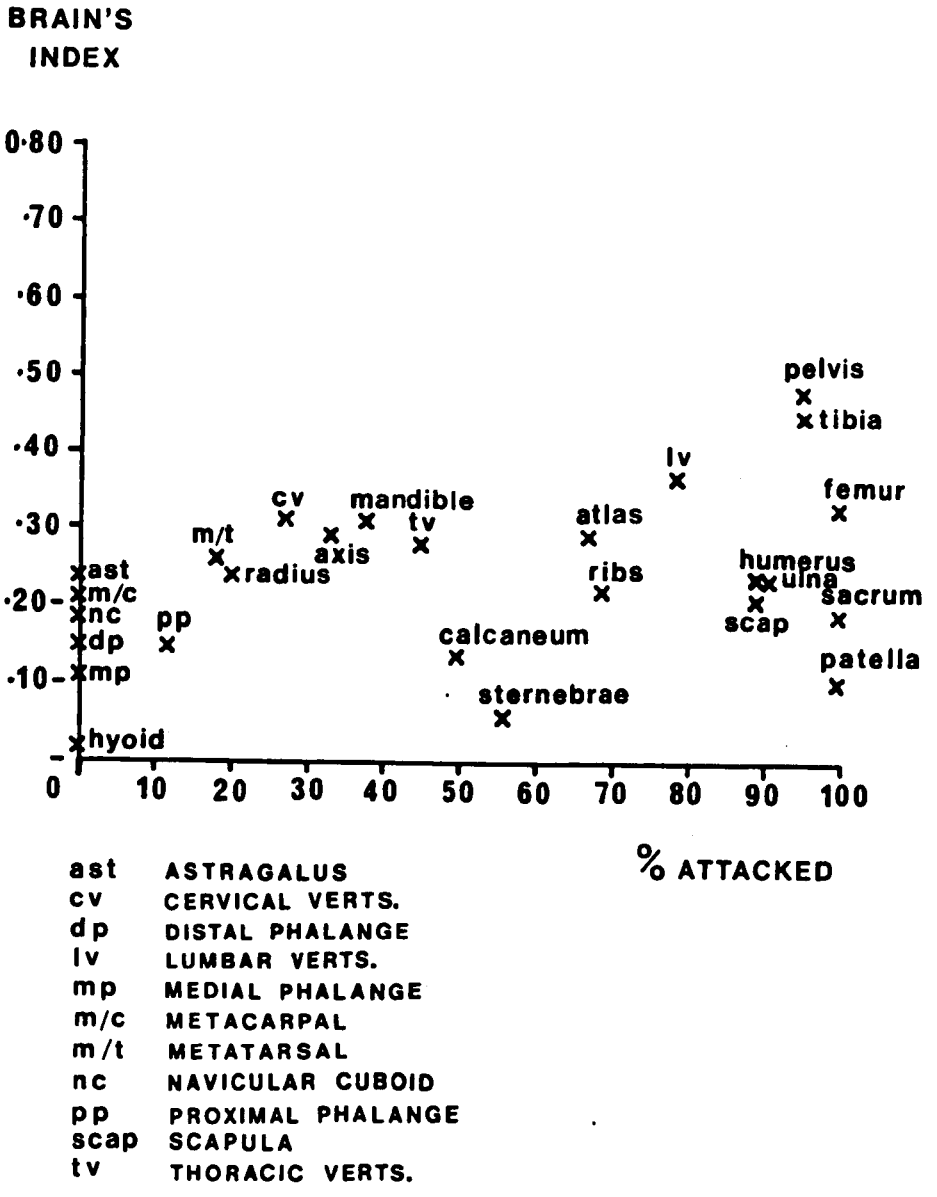


FIGURE 7:4 HISTOGRAMS OF COMPLETENESS CATEGORIES OF THE 12 MEDIUM OR LARGE ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

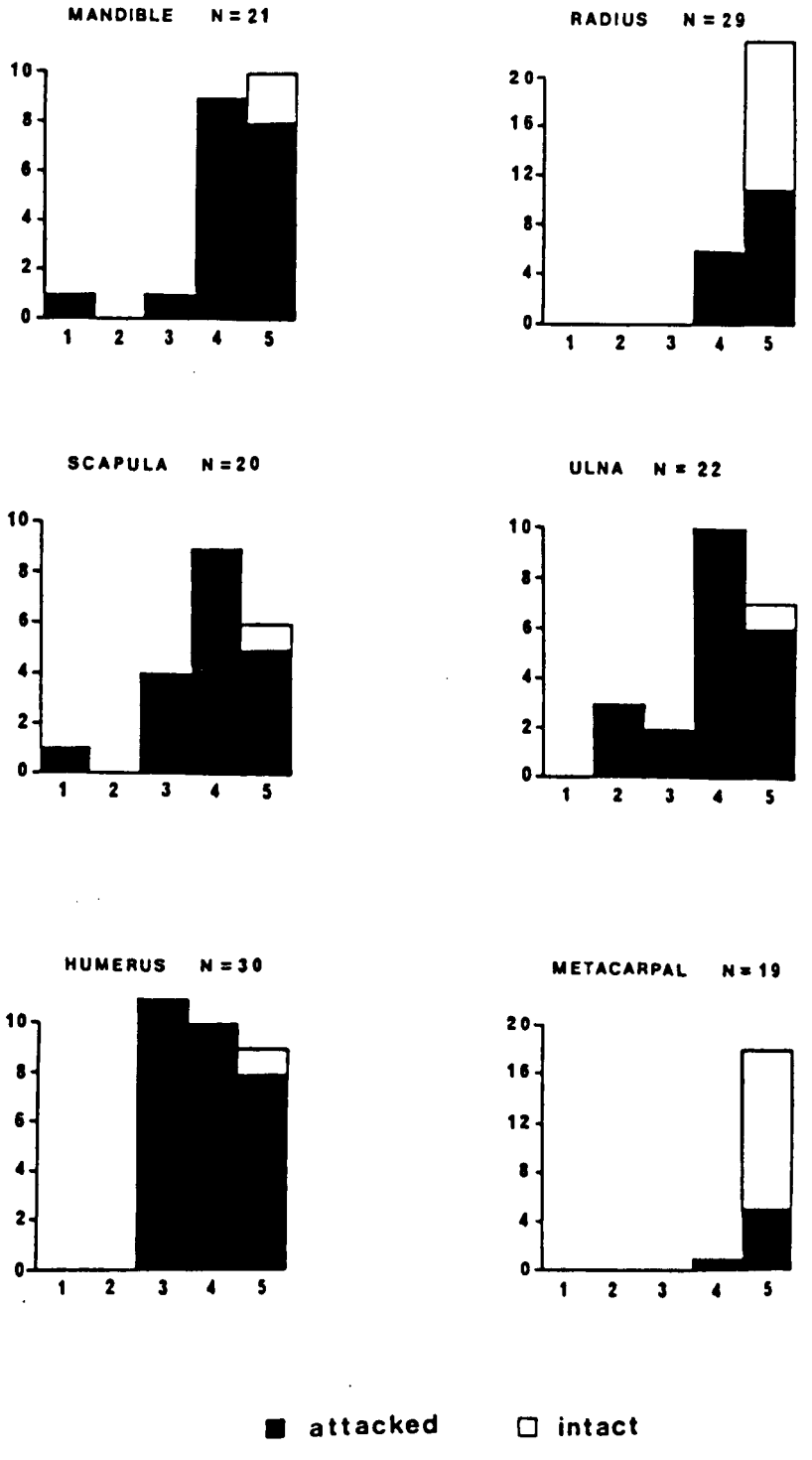


FIGURE 7:4 HISTOGRAMS OF COMPLETENESS CATEGORIES OF THE 12 MEDIUM OR LARGE ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

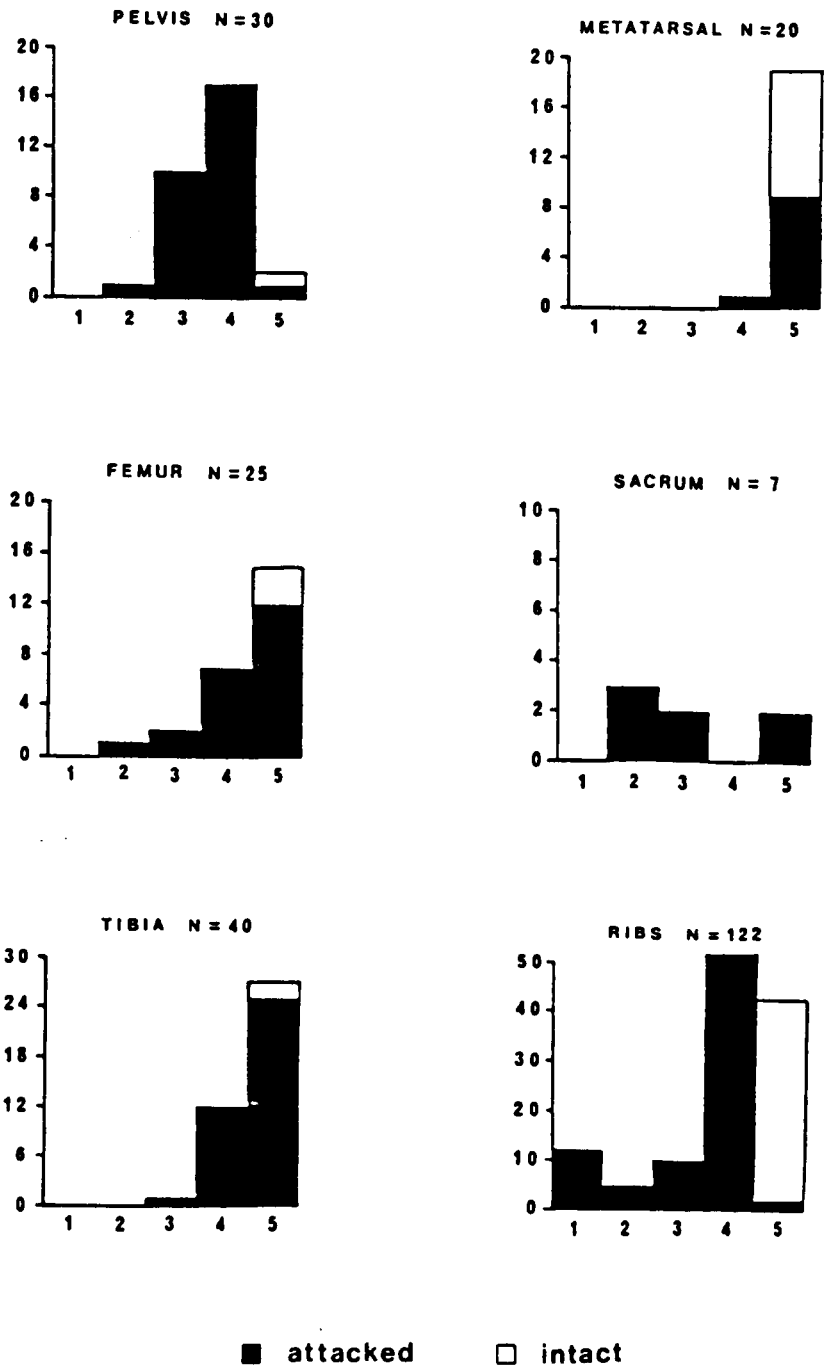


FIGURE 7:5 SCATTERGRAM OF THE RATIOS OF WHOLE BONE EQUIVALENTS (WBEs) TO THE TOTAL NUMBERS OF BONES (I.E.: WBE/N RATIOS) COMPARED WITH THE PERCENTAGES OF BONES ATTACKED, FOR THE 12 MEDIUM OR LARGE ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

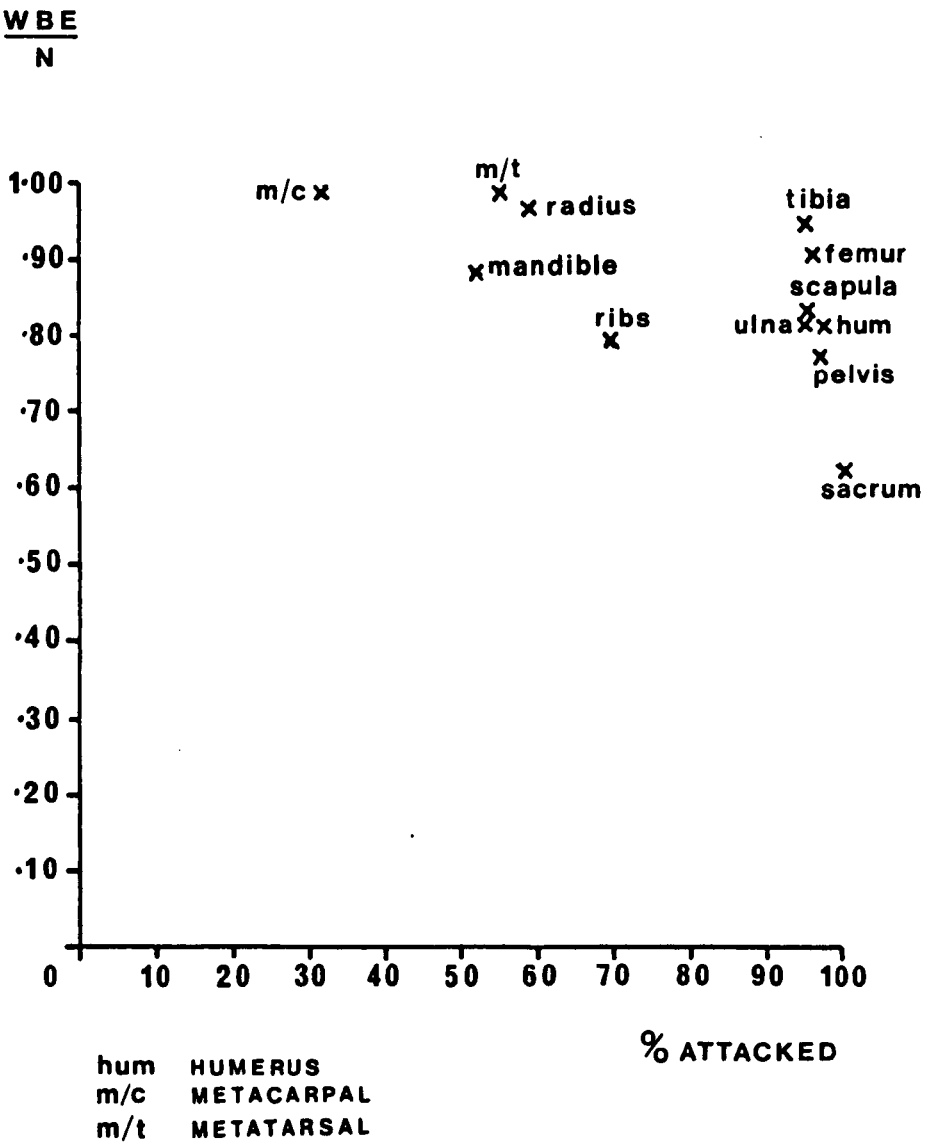


FIGURE 7:6 SCATTERGRAM OF THE RATIOS OF WHOLE BONE EQUIVALENTS (WBEs) TO THE TOTAL NUMBERS OF BONES (I.E.: WBE/N RATIOS) COMPARED WITH THE PERCENTAGES OF BONES ATTACKED, FOR THE 12 MEDIUM OR LARGE ELEMENT TYPES IN THE SHEFFIELD SHEEP CARCASS COLLECTION

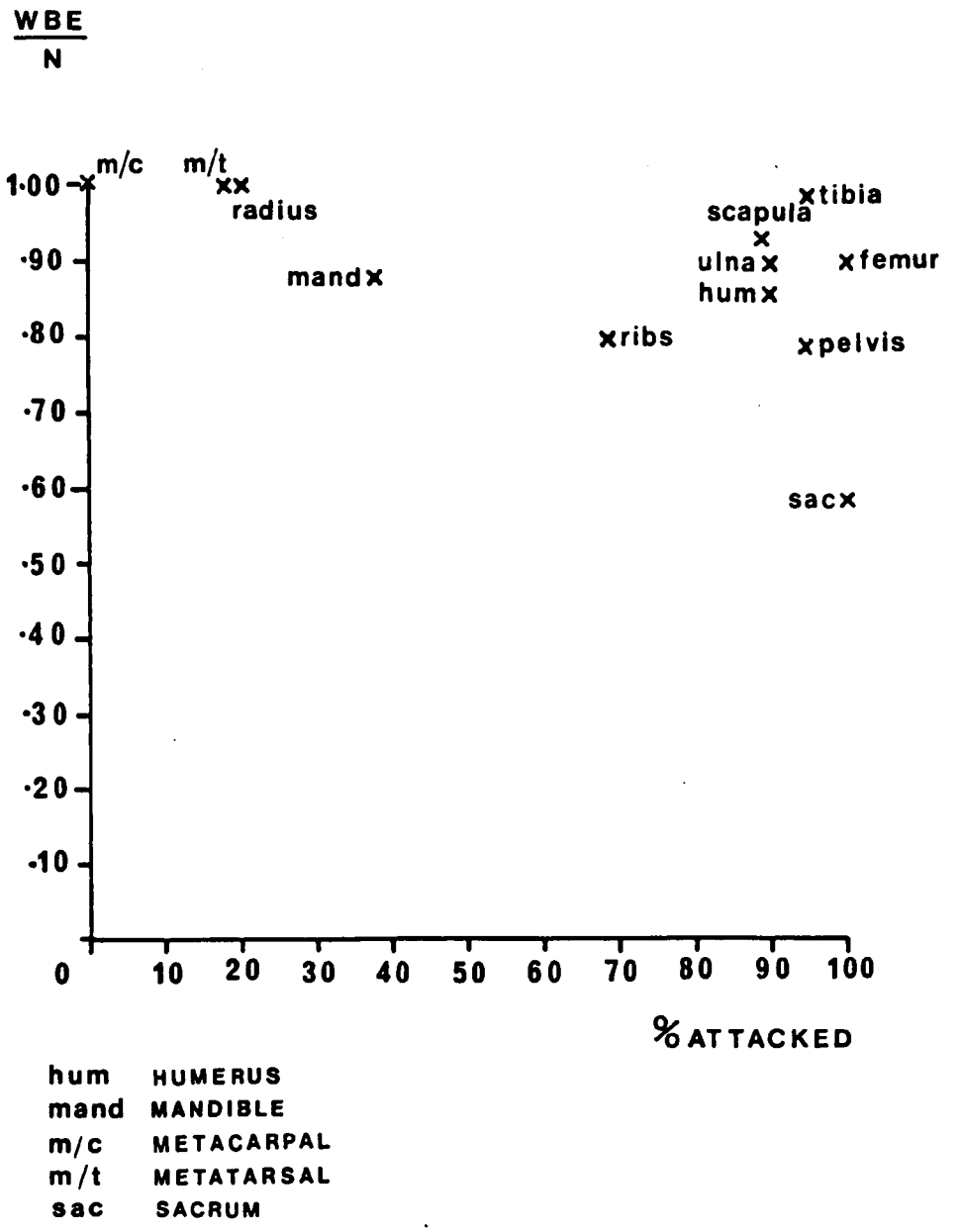


FIGURE 7:7 SCATTERGRAM OF THE RATIOS OF WHOLE BONE EQUIVALENTS (WBEs) TO THE TOTAL NUMBERS OF BONES (I.E.: WBE/N RATIOS) COMPARED WITH THE PERCENTAGES OF BONES ATTACKED, FOR THE 12 MEDIUM OR LARGE ELEMENT TYPES IN THE SHEFFIELD SHEEP NON-CARCASS COLLECTION

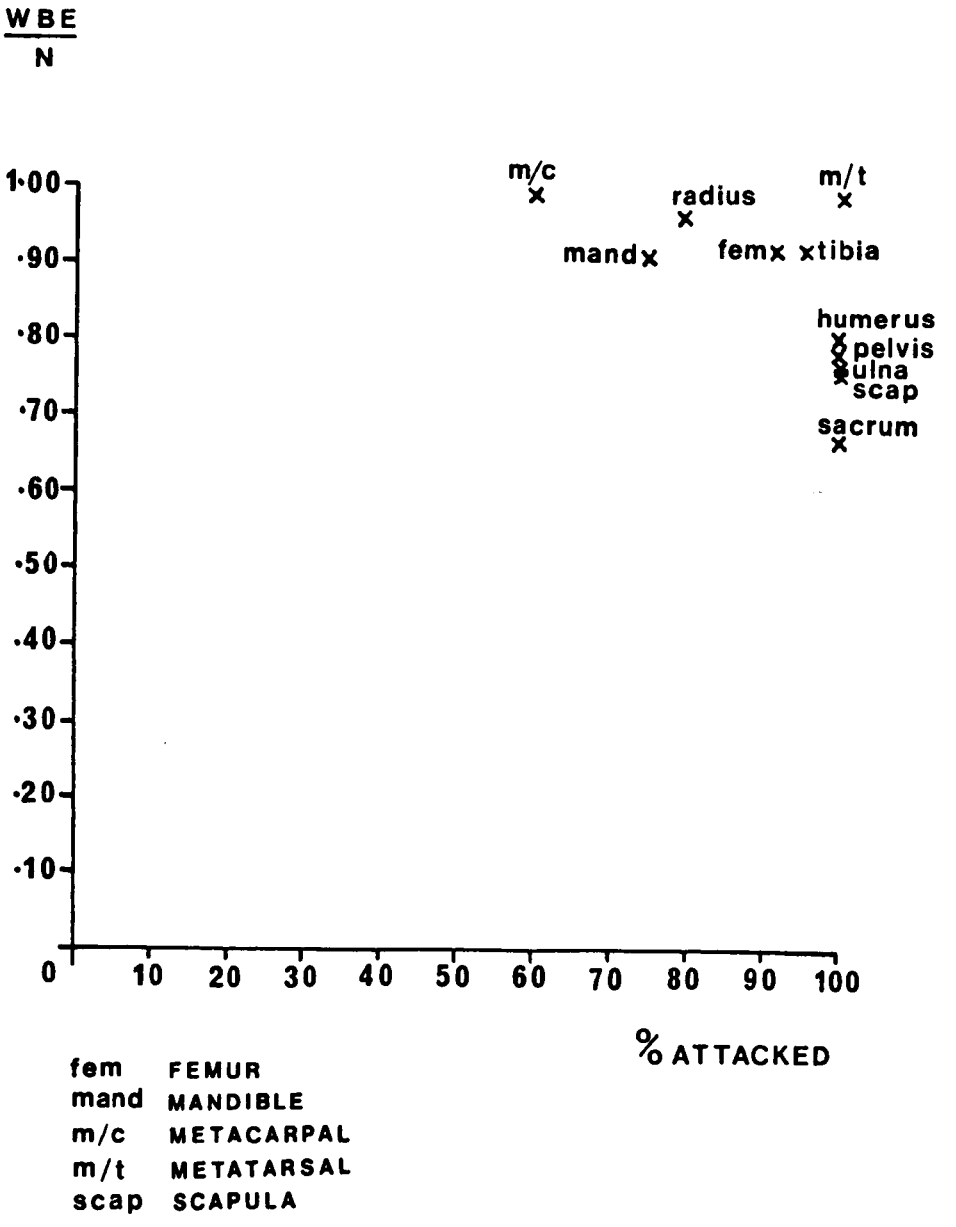


FIGURE 7:8 SCATTERGRAM OF THE RATIOS OF WHOLE BONE EQUIVALENTS (WBEs) TO THE TOTAL NUMBERS OF BONES (I.E.: WBE/N RATIOS) COMPARED WITH THE PERCENTAGES OF BONES ATTACKED, FOR THE 12 MEDIUM OR LARGE ELEMENT TYPES IN THE GRIZEDALE ROE DEER CARCASS COLLECTION

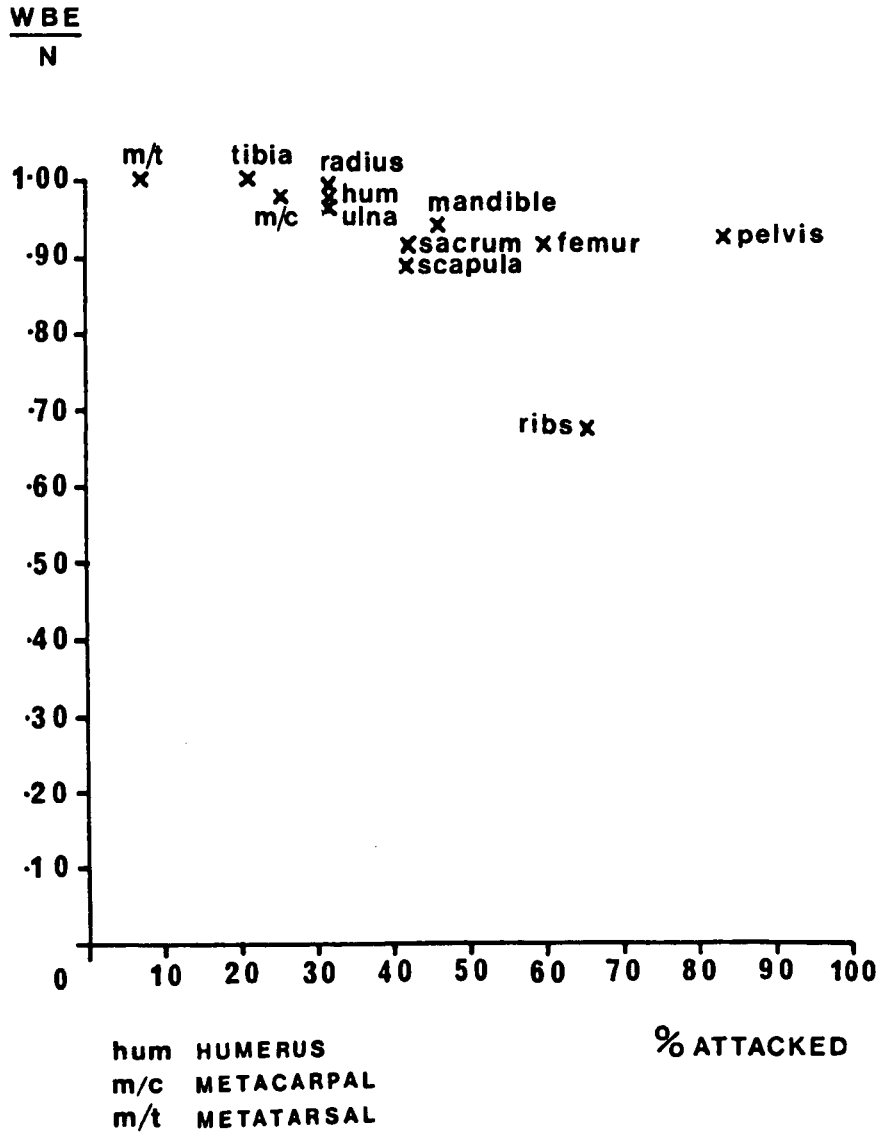
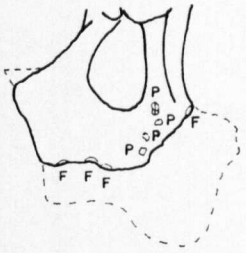


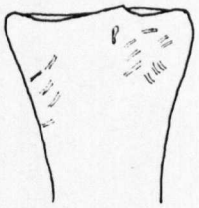
FIGURE 8:1 DIAGRAM SHOWING THE SIX TYPES OF CARNIVORE DAMAGE DEFINED IN THIS STUDY

1 PUNCTURES



Pelvis: blade of ischium, with end broken off, punctures and flake scars.

2a TOOTH GROOVES

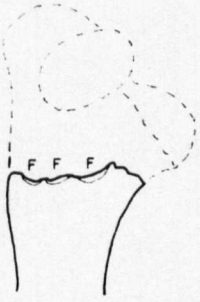


Metacarpal: proximal shaft, ventral surface, with tooth grooves.

2b PITTING MARKS

Ulna: olecranon process, medial view. End broken off, with pitting marks.

3 FLAKE SCARS

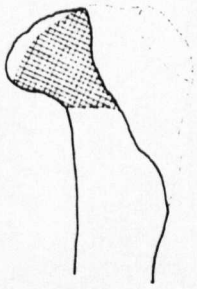


Humerus: proximal shaft, lateral view. Shaft broken off, with flake scars.

4 SHREDDING

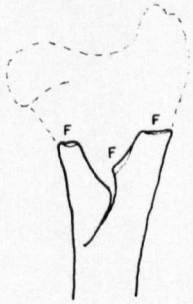
Rib: anterior view. End broken off and shredded.

5 BROKEN EDGE



Tibia: medial view. Broken edge, with trabecular bone exposed by carnivore.

6 SPIRAL FRACTURE



Femur: proximal shaft, ventral view. End broken off, with flake scars and spiral fracture.

KEY:

puncture; P

flake scar; F

exposed trabecular bone

FIGURE 9:1 THE RAW FREQUENCIES OF ELEMENT PARTS COMPARED WITH THE MINIMUM NUMBERS OF ELEMENTS FOR THE 10 MAJOR ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

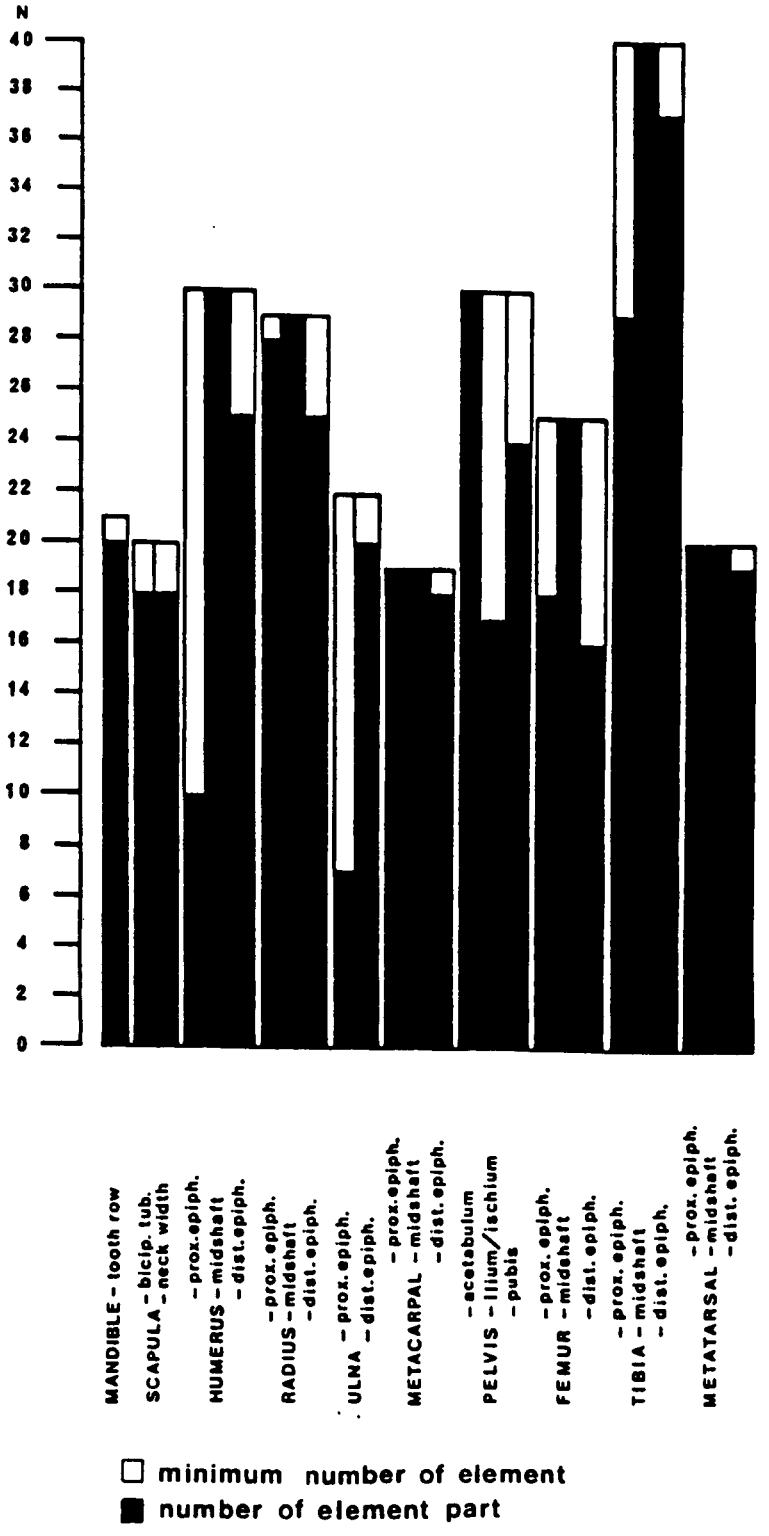


FIGURE 10:1 BRAIN'S INDEX VALUES FOR ELEMENTS IN THE TOTAL SHEFFIELD SHEEP COLLECTION

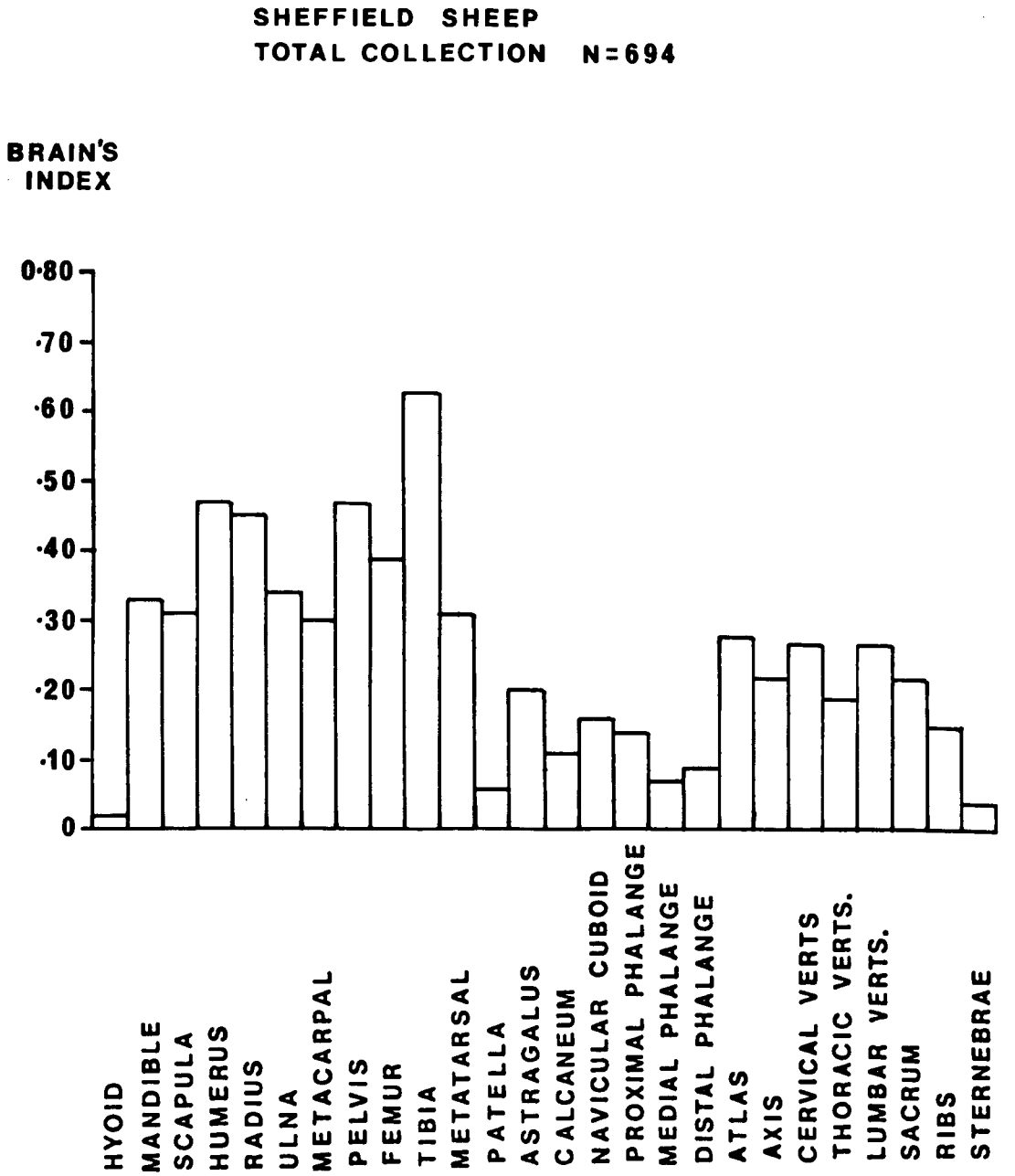


FIGURE 12:1 THE RELATIONSHIPS OF BONE COMPLETENESS VALUES (REPRESENTED BY THE WBE/N RATIOS) WITH THE PERCENTAGES OF FRAGMENTS SHOWING SIGNS OF CHEWING AND THE PERCENTAGES OF FRAGMENTS THAT HAVE BEEN CHOPPED THROUGH, USING THE 12 MEDIUM OR LARGE ELEMENT TYPES RECOVERED IN THE CASTLEFORD SITE 1 SHEEP-GOAT AND CATTLE COLLECTIONS

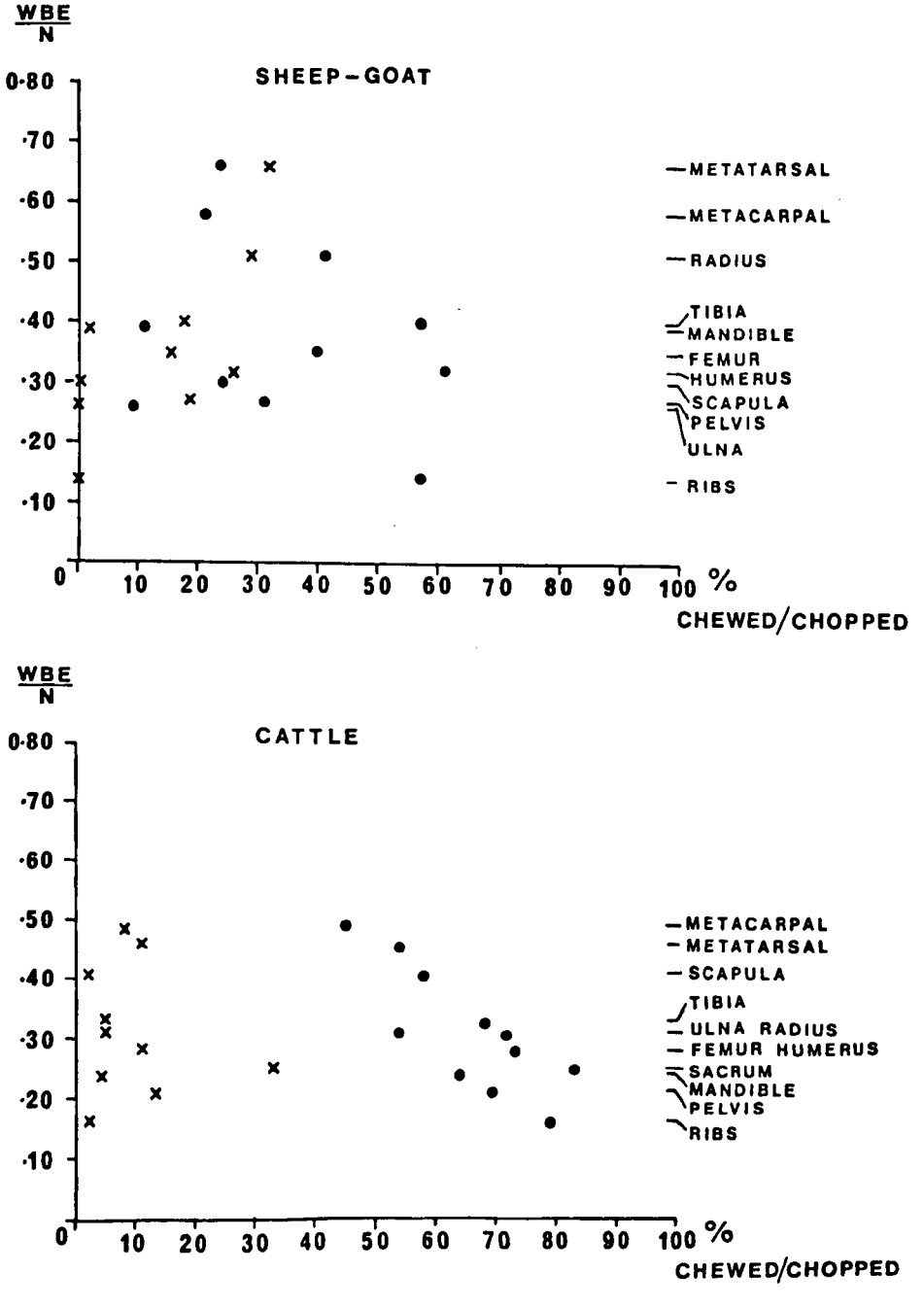


FIGURE 12:2 RAW FREQUENCIES OF FRAGMENTS OF THE 26 ELEMENT TYPES OF SHEEP-GOAT RECOVERED IN THE CASTLEFORD SITE 1 COLLECTION

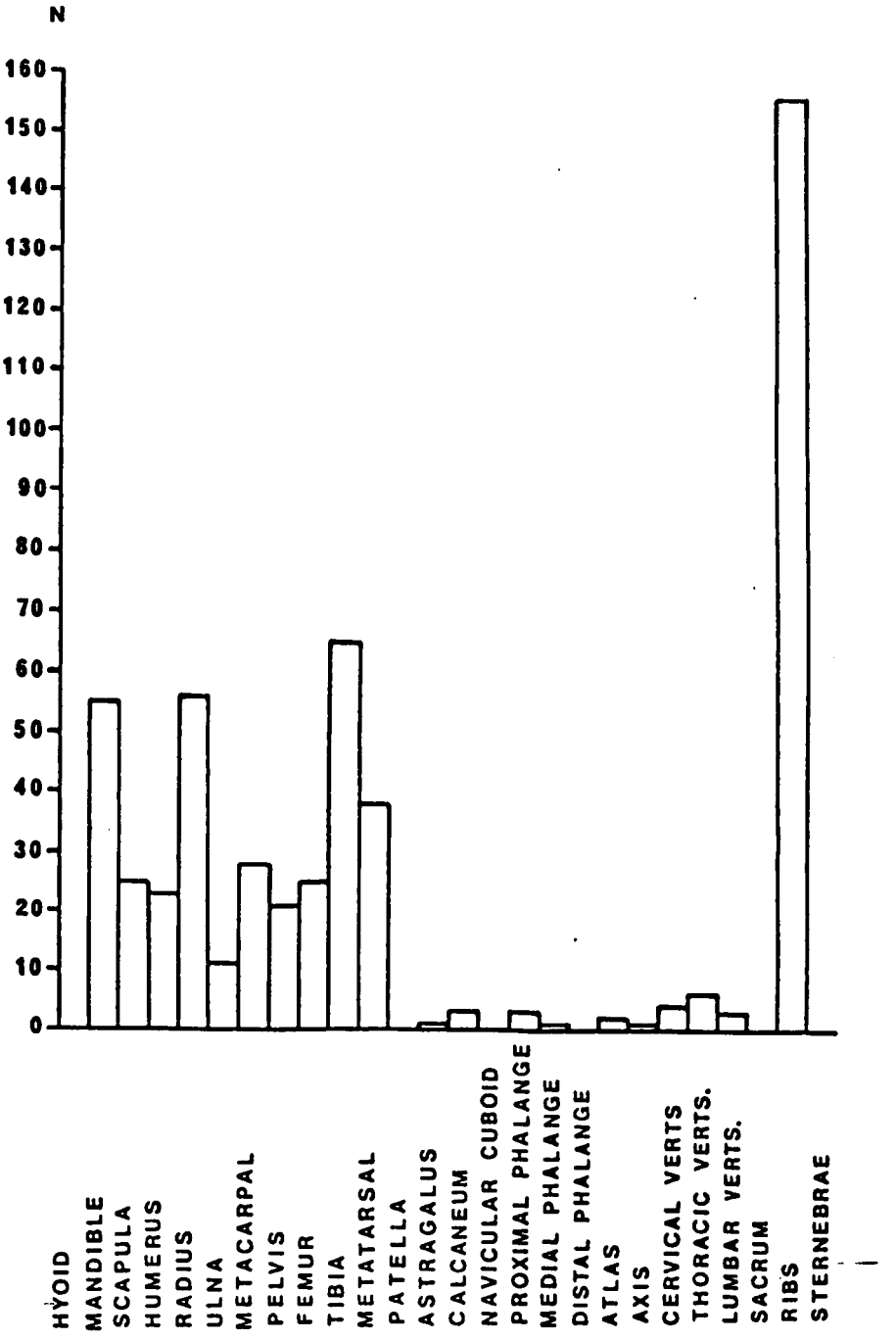


FIGURE 12:3 RAW FREQUENCIES OF FRAGMENTS OF THE 26 ELEMENT TYPES OF CATTLE RECOVERED IN THE CASTLEFORD SITE 1 COLLECTION

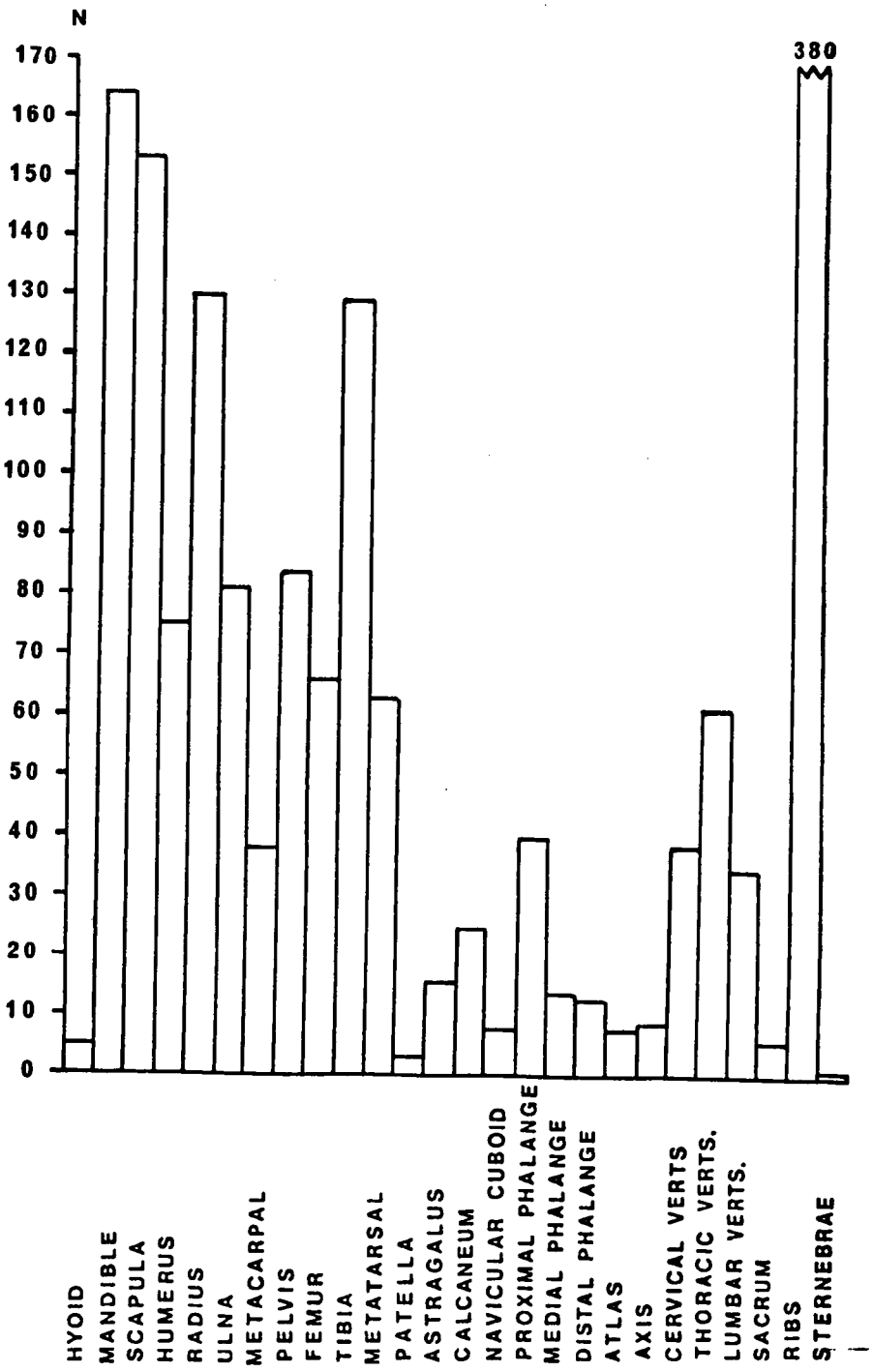


FIGURE 12:4 BRAIN'S INDEX VALUES FOR THE 26 ELEMENT TYPES OF SHEEP-GOAT AND CATTLE BONES RECOVERED FROM CASTLEFORD SITE 1

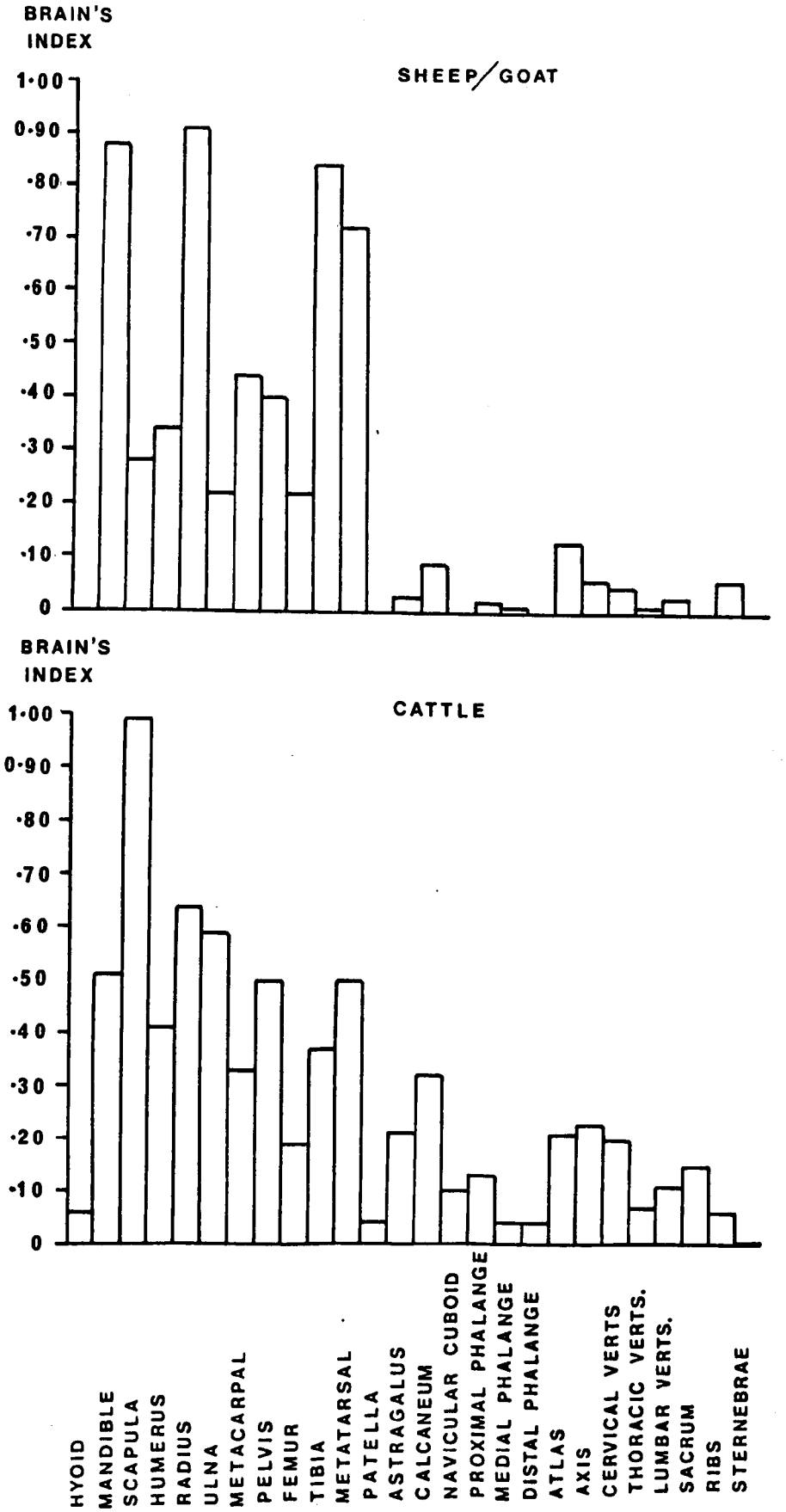


FIGURE 12:5 COMPARISONS OF THE BRAIN'S INDEX VALUES FOR SHEEP-GOAT AND CATTLE BONES RECOVERED FROM CASTLEFORD SITE 1 WITH THOSE IN THE TOTAL SHEFFIELD SHEEP COLLECTION

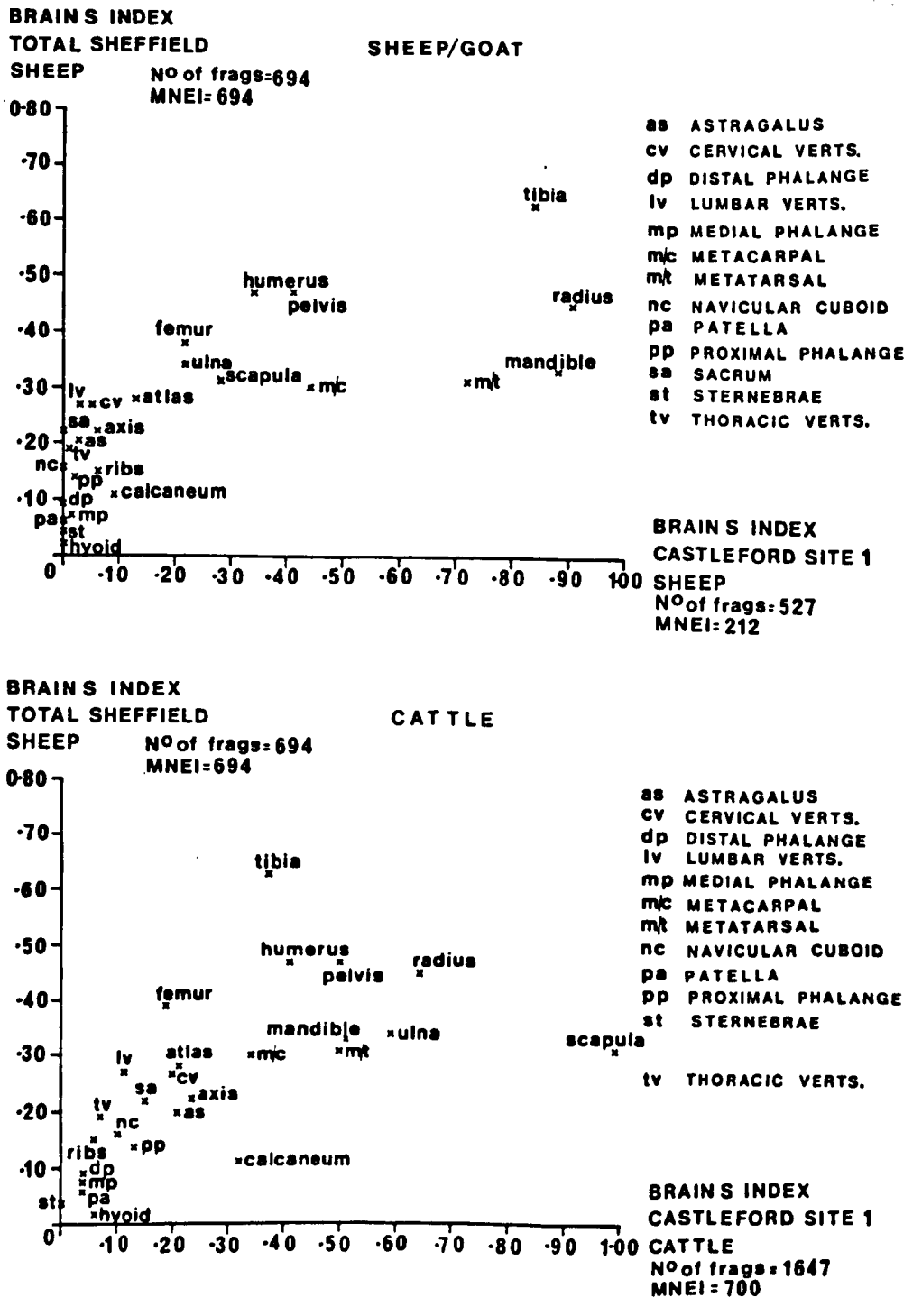


FIGURE 12:6A TOOTH WEAR SCORES (USING GRANT, 1982) COMPARED WITH THE MIDSHAFT DIAMETERS OF VARIOUS ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

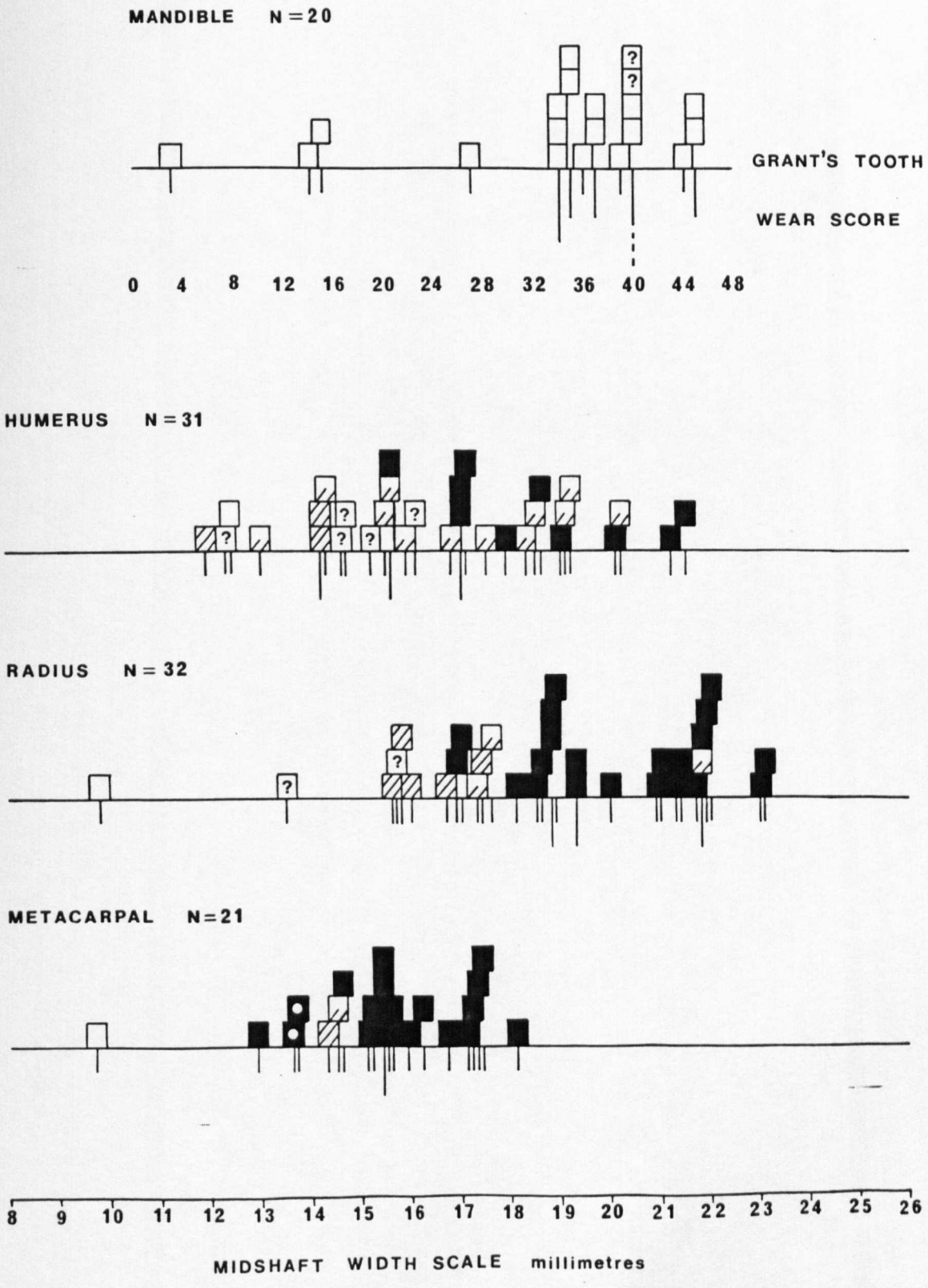
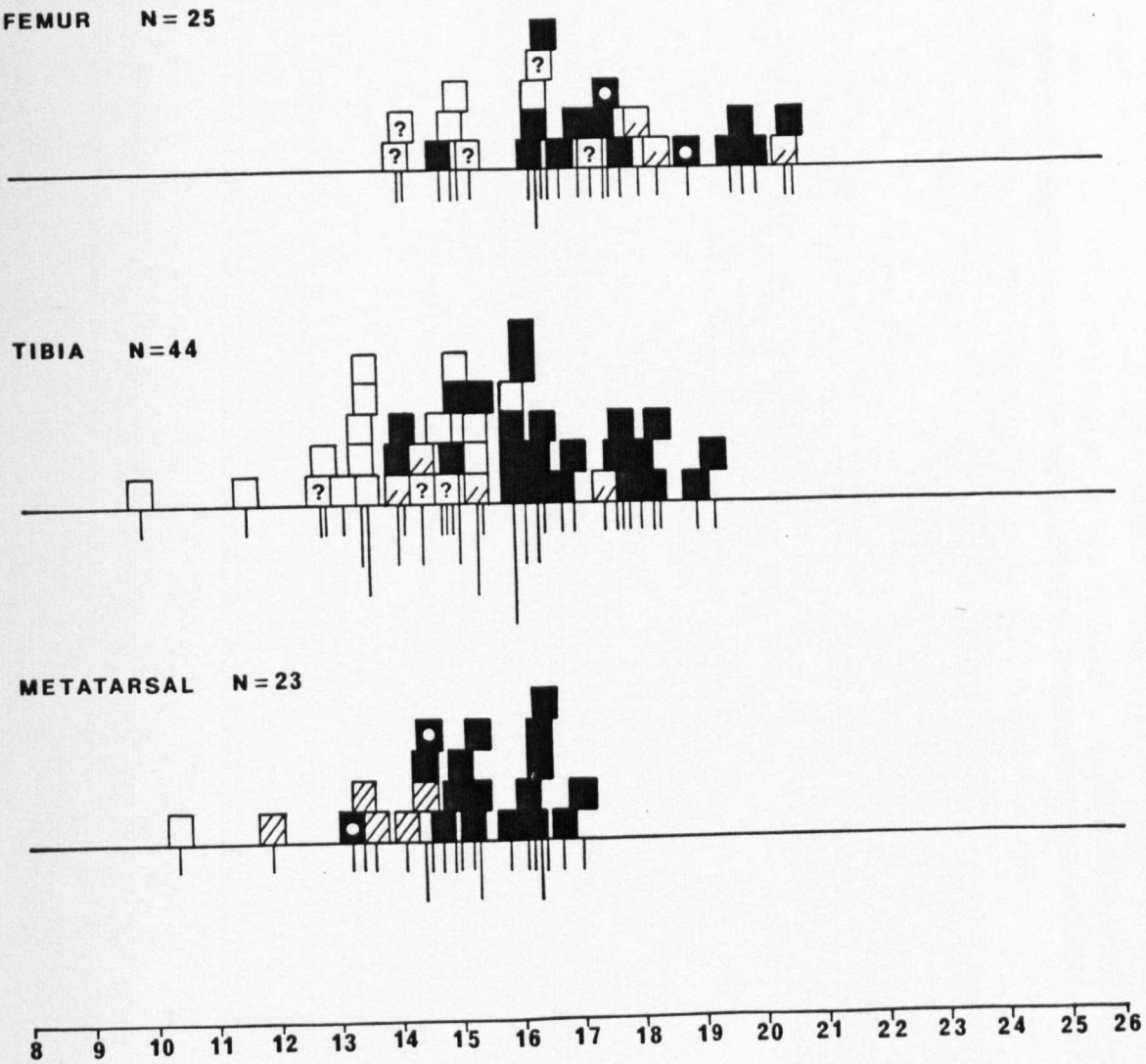


FIGURE 12:6A (continued) TOOTH WEAR SCORES (USING GRANT, 1982) COMPARED WITH THE MIDSHAFT DIAMETERS OF VARIOUS ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION



KEY TO FUSION DATA

- fully fused
- later-fusing epiphysis in process of fusing
- earlier-fusing epiphysis fused, later-fusing epiphysis unfused
- earlier-fusing epiphysis fused, fusion state of later-fusing epiphysis unknown
- ? no fusion surfaces remaining

FIGURE 12:6A (continued) TOOTH WEAR SCORES (USING GRANT, 1982) COMPARED WITH THE MIDSHAFT DIAMETERS OF VARIOUS ELEMENT TYPES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

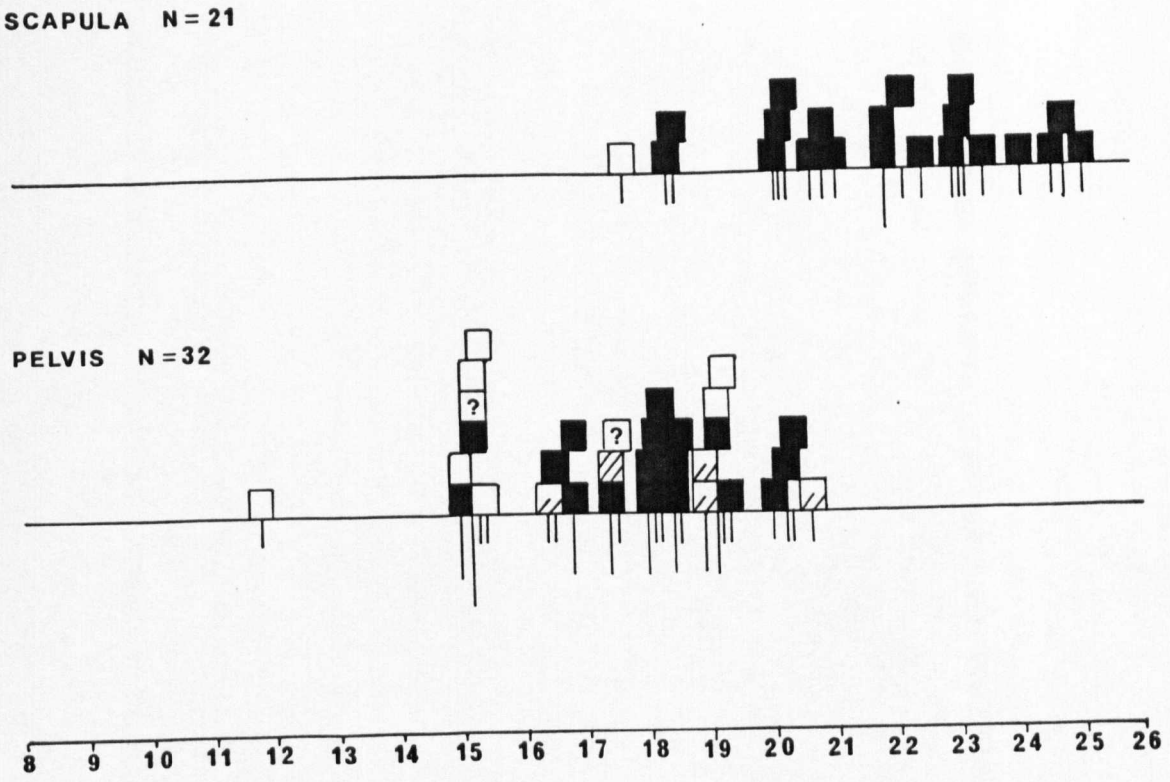


FIGURE 12:6B SEX, FUSION STATE AND ILIAL SHAFT WIDTH DATA FOR THE PELVES IN THE TOTAL SHEFFIELD SHEEP COLLECTION

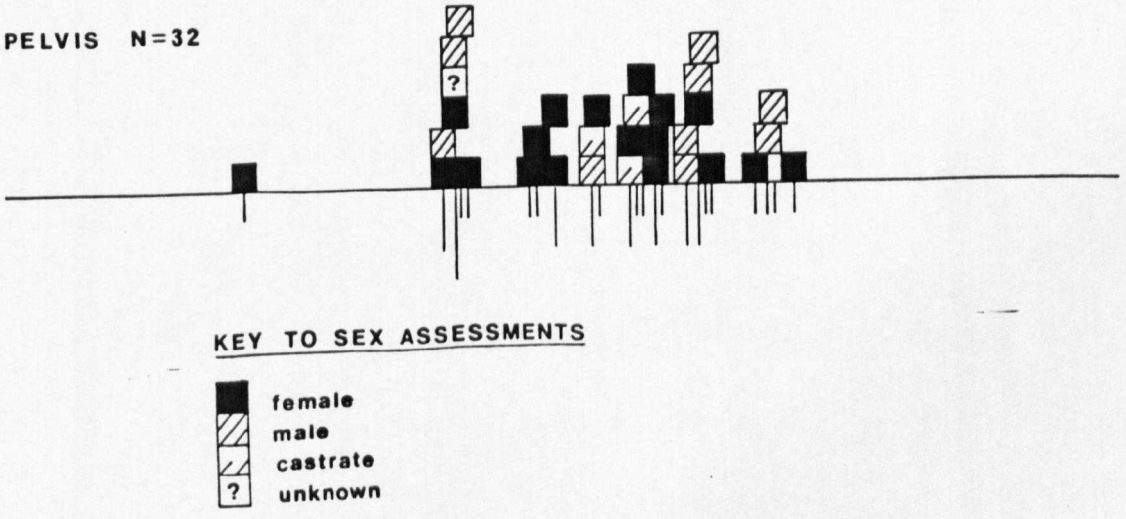


FIGURE 12:7 TOOTH WEAR SCORES (USING GRANT, 1982) COMPARED WITH THE MIDSHAFT DIAMETERS OF VARIOUS ELEMENT TYPES IN THE CASTLEFORD SITE 1 SHEEP-GOAT COLLECTION

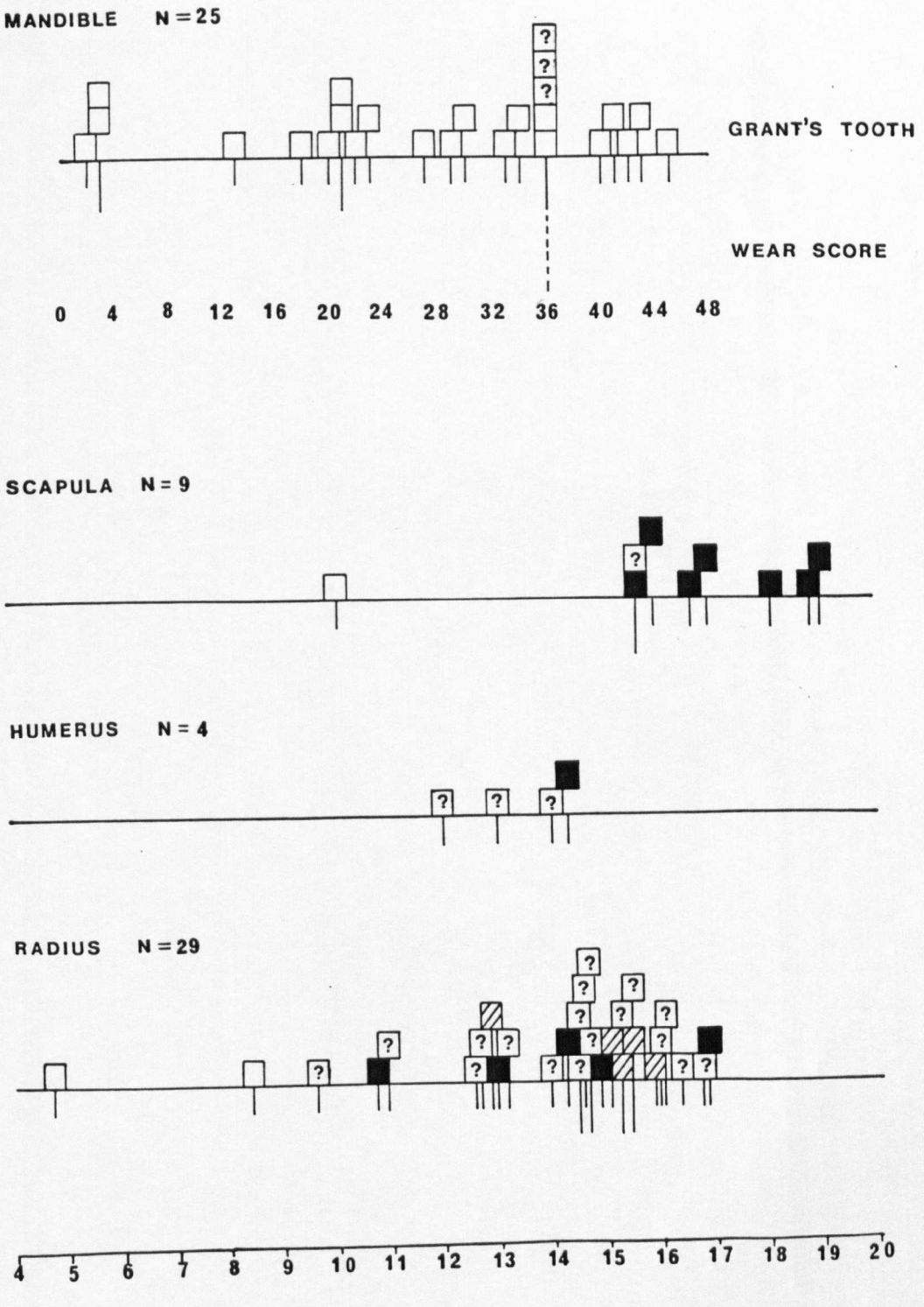


FIGURE 12:7 TOOTH WEAR SCORES (USING GRANT, 1982) COMPARED WITH THE MIDSHAFT DIAMETERS OF VARIOUS ELEMENT TYPES IN THE CASTLEFORD SITE 1 SHEEP-GOAT COLLECTION

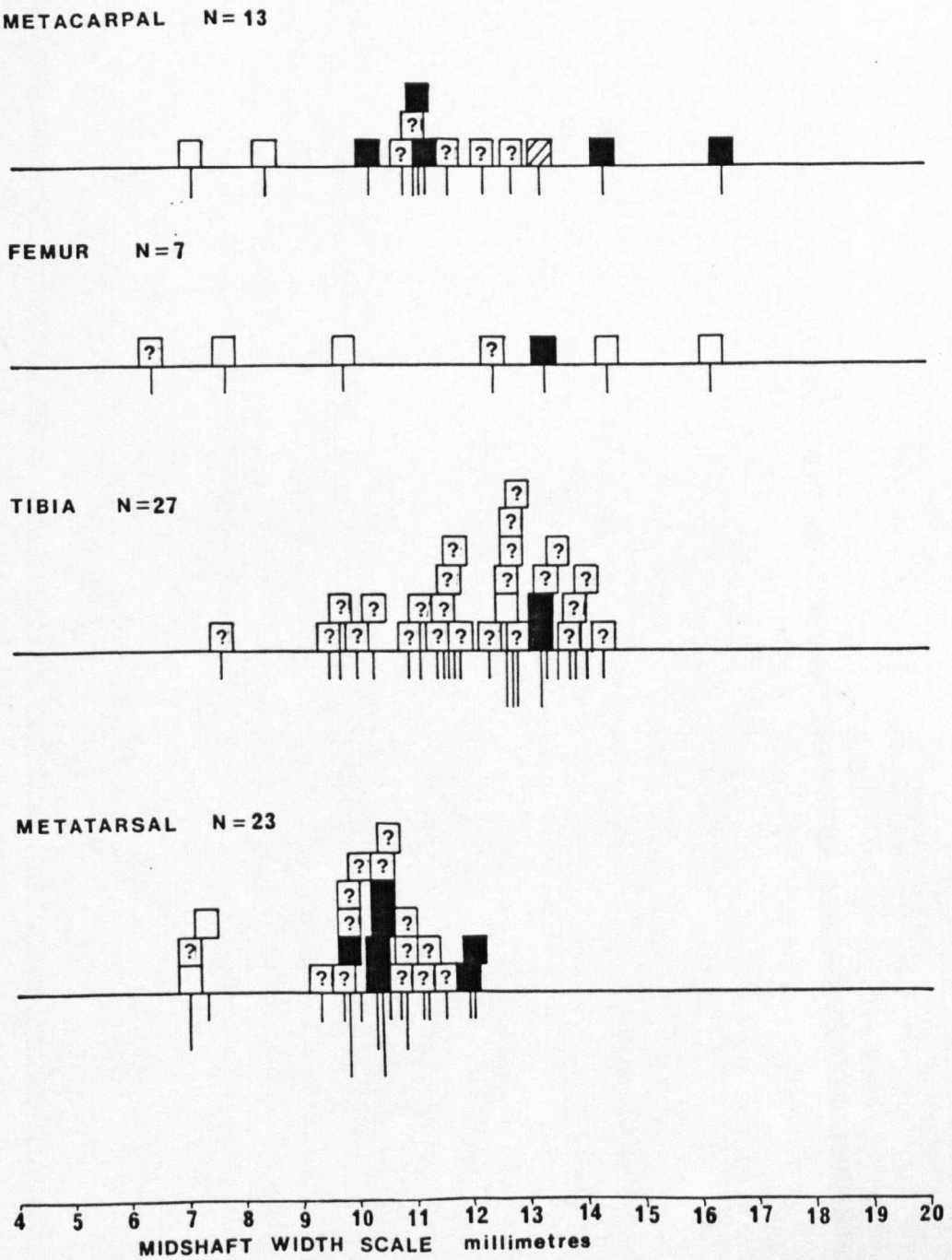


FIGURE 12:8 TOOTH WEAR SCORES (USING GRANT, 1982) COMPARED WITH THE MIDSHAFT DIAMETERS OF VARIOUS ELEMENT TYPES IN THE CASTLEFORD SITE 1 CATTLE COLLECTION

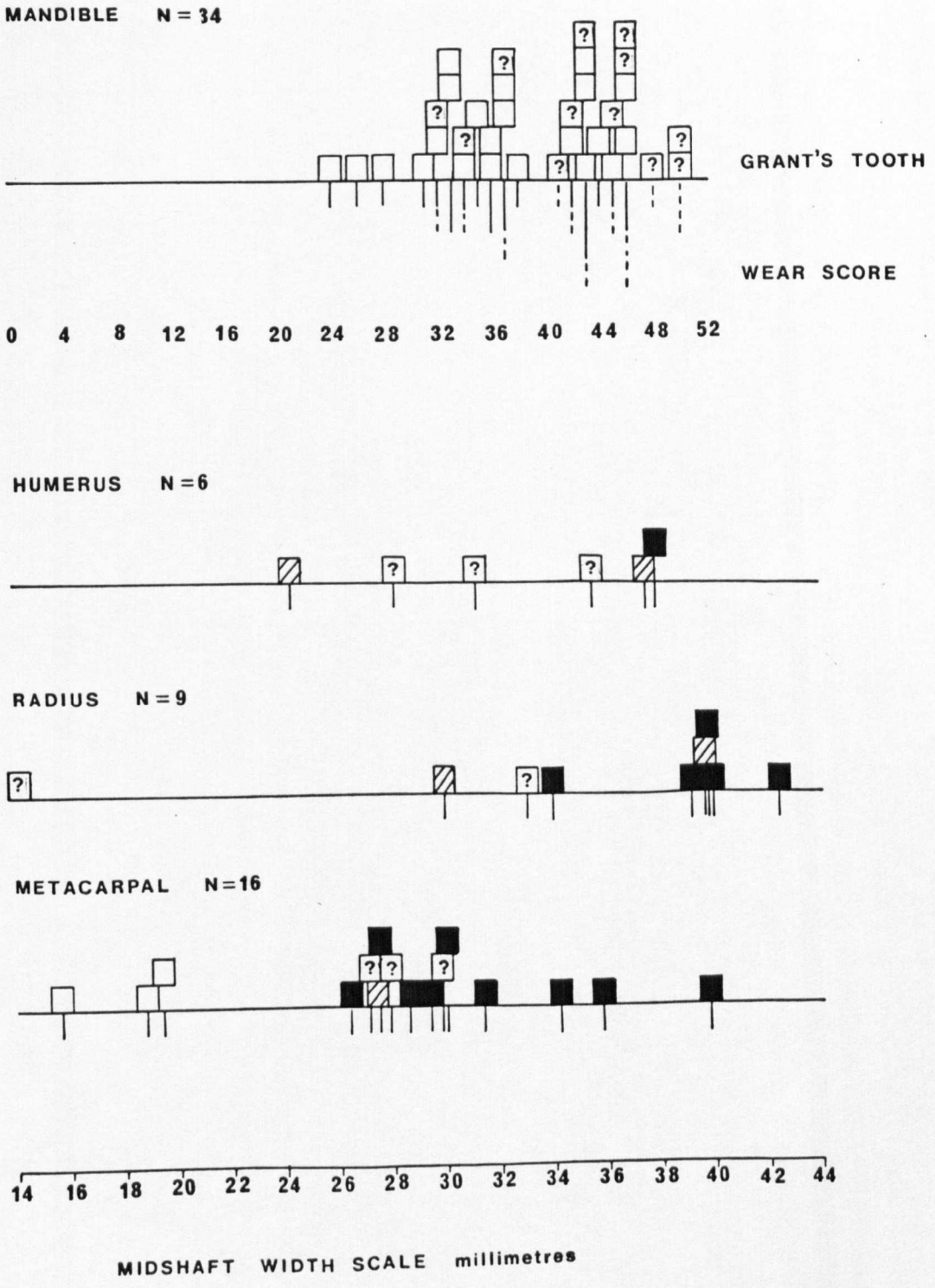


FIGURE 12:8 TOOTH WEAR SCORES (USING GRANT, 1982) COMPARED WITH THE MIDSHAFT DIAMETERS OF VARIOUS ELEMENT TYPES IN THE CASTLEFORD SITE 1 CATTLE COLLECTION

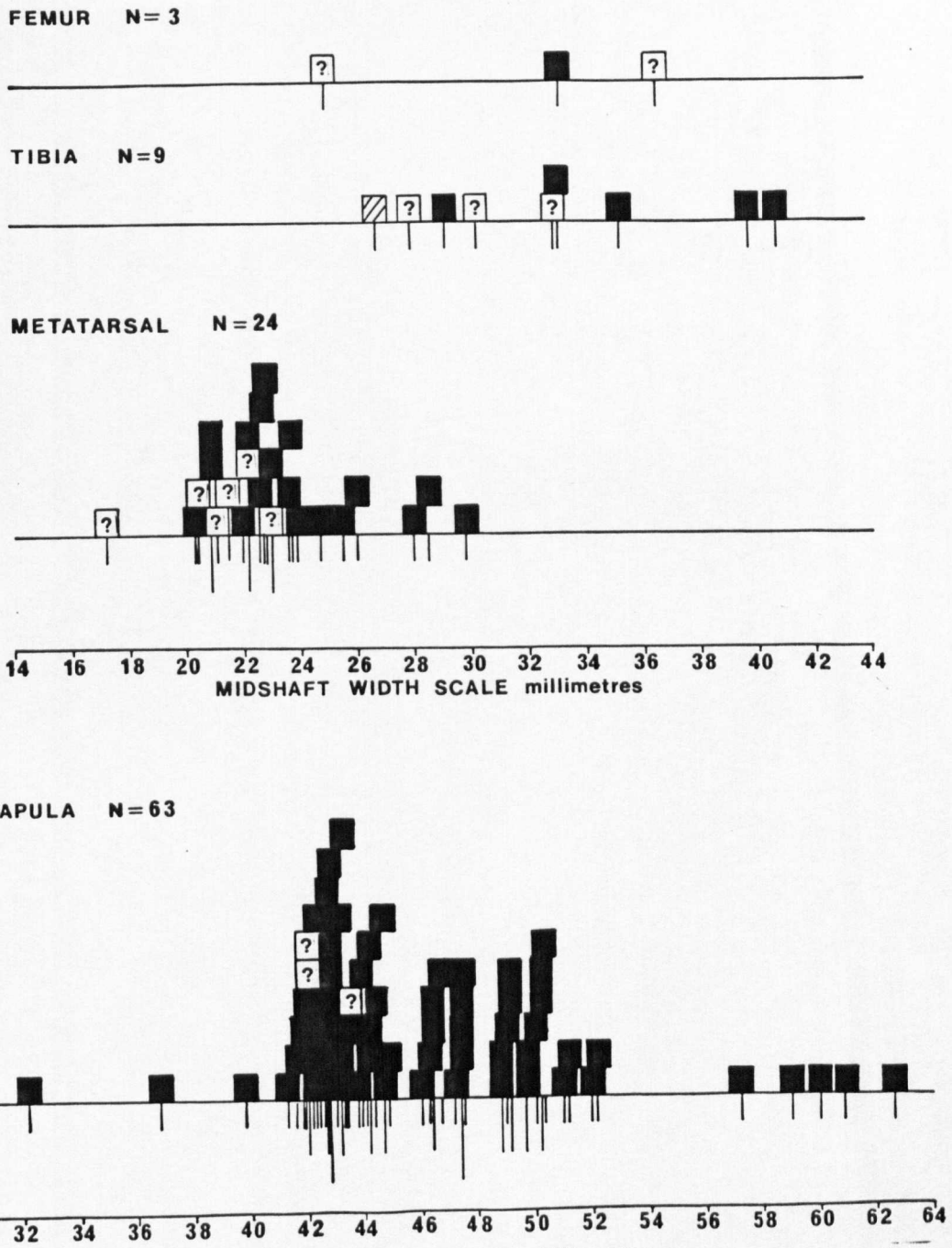


PLATE 2:1 THE SHEFFIELD SURVEY AREA

A general view of the Sheffield survey area for the actualistic study, looking south-east down the valley of Sandyford Brook towards Bar Brook. The bracken in the foreground contains some of the fox dens.

PLATE 3:1 THE LOCATION OF THE S146 GROUP

View looking north towards the site where the S146 sub-collection of non-carcass bones was collected. The collection site is just to the right of the tree closest to the dry stone wall. The bracken patch in the centre of the picture contains most of the fox dens, and Sandyford Brook runs along the base of the escarpment, between the two areas. The S146 group of sheep died in a snowdrift.

PLATE 3:2 TORN FLEECE SCATTERED FROM A SCAVENGED CARCASS

Torn fleece blown or dragged away from Sheffield sheep carcass No. 96, photographed two-and-a-half months after the animal's death. The scavenged carcass (see Plate 4:1) lies behind the photographer, 12 metres from the nearest piece of fleece. Trails of fleece such as these often led along animal tracks to redeposited, scavenged bones. The articulated remains of a lower hindlimb unit lie in the bracken to the right of the fleece (not visible in this photograph; see Plate 4:2). Appendix III lists the sequence of disarticulation, removal and burial of carcass No. 96, monitored over a period of two years.

PLATE 4:1 RESIDUAL REMAINS OF A RECENT SCAVENGED CARCASS

The remains of Sheffield sheep carcass No. 96, photographed two-and-a-half months after the animal's death (see also Plates 3:2 & 4:2, and Appendix III). The axial skeleton has been dragged into a slight gully, about three metres from the death site, and is still articulated from the skull plus one mandible (to the right) to the pelves and both femora (to the left). Both forelimbs have been removed completely. One hindlimb remains, still encased in skin and fleece, whilst one lower hindlimb has been removed 12 metres (see Plate 3:2). A butchered calf's thoracic vertebra lies beside the sheep's head, presumably deposited by a fox, and presumably scavenged from the settlement more than one kilometre away.

PLATE 4:2 A DISARTICULATED LOWER HINDLIMB UNIT

A disarticulated lower hindlimb unit from Sheffield sheep carcass No. 96, photographed two-and-a-half months after the animal's death. It has been moved 12 metres from the main carcass (see Plate 4:1, and Appendix III). The femur remains articulated to the pelvis, with the rest of the axial/thoracic skeleton, but it has had its distal epiphysis destroyed.

Note that: The proximal tibia has been destroyed.

All flesh has been removed, but ligaments still hold the tarsals and proximal phalanges onto the tibia and metatarsal.

The medial and distal phalanges have all been removed (or consumed).

PLATE 4:3 EARLY STAGES OF SCAVENGING OF A CARCASS

A Sheffield sheep carcass at an early stage of scavenging.

Note that: The snout has been attacked and the tongue has been removed through the throat, but the main ramus of the mandible is intact.

The sternebrae are all missing and the ventral portions of the ribs have been destroyed.

Most of the spine is exposed, but still lies on the fleece. Some of the cervical vertebrae are still enclosed in fleece.

Both forelimbs have been removed, from the scapulae to the hooves.

Both hindlimbs are still fully articulated with the axial/thoracic skeleton.

One hindlimb has been stripped of flesh from the proximal femur to the distal tibia, and the knee joint has been attacked severely: the distal femur and proximal tibia are both partially destroyed and the patella is missing.

The scale is in centimetres and ten centimetre blocks.

PLATE 4:4

AN ARTICULATED FORELIMB UNIT

An articulated forelimb unit detached from a carcass at an early stage of scavenging. It is complete from the scapula to the hooves.

Note that: The meat has been fully stripped off, but all of the joints are held together by cartilage and ligaments.

The skin remains on the distal half of the metacarpal down to the hooves.

There is very little damage to the bones (even the olecranon process is intact).

The scale is in centimetres and ten centimetre blocks.

A DISARTICULATED FORELIMB UNIT

A forelimb unit that has disarticulated in situ after having been removed from a carcass. All of the bones are bleached and are completely devoid of flesh or ligaments.

Note that: The distal border of the scapula has been partially destroyed, but the rest of the elements are almost intact.

Five of the six phalanges are missing.

The scale is in centimetres and ten centimetre blocks.

PLATE 4:6

A GENERAL VIEW OF THE BUTCHERY DUMP IN GRIZEDALE FOREST

Lower limbs (from the metatarsal or metacarpal down to the hooves) and heads of red deer and roe deer disarticulating in the butchery dump in Grizedale Forest. The plastic sacks contain wet waste, i.e.: entrails, etc..

Note that: Many of the skulls have rolled down the gentle slope.

PLATE 4:7

DETAIL OF THE GRIZEDALE FOREST BUTCHERY DUMP

Close-up view of some of the lower limb units disarticulating in situ in the dump. They are a mixture of red deer and roe deer; forelimbs and hindlimbs. There is very little damage by scavengers (the dump is close to a main forestry track utilised by gamekeepers and logging lorries), and most of the elements remain in anatomical positions after disarticulation. The bones are becoming buried naturally by hair and leaf litter.

PLATE 4:8

RESIDUAL BONES BECOMING BURIED AT A CARCASS SITE

The residual remains of one of the Sheffield sheep carcasses, becoming buried at the death site. Some of the fleece remains at the site, together with the contents of the animal's digestive system, and has been added to by leaf litter which is helping to bury the remaining elements. Some elements are already hidden from view.

Note that: The scapula just to the right of the scale is lying flat and is almost obscured by vegetation. This contrasts with the skull, which is lying on top of the fleece.

The scale is in centimetres and ten centimetre blocks.

PLATE 4:9

CARCASS BONES BECOMING OBSCURED BY VEGETATION AND ALGAE

The remains of another sheep carcass at its death site. A little of the fleece remains, and has been colonised by algae, as have some of the bones. The elements are not in anatomical positions. The photograph shows, clockwise from the top right: a mandible, a tibia, a scapula, a humerus, a rib and a femur. All of these are residual items in this instance. The femur and mandible are already half obscured by vegetation and are likely to become buried in these positions.
The scale is in centimetres and ten centimetre blocks.

TRANSPORTED ELEMENTS FROM A FORELIMB UNIT BECOMING BURIED

The remains of a removed forelimb unit perched on top of vegetation that is beginning to grow up around them and obscure them.

ADVANCED STATE OF WEATHERING OF A YOUNG SHEEP SCAPULA

This scapula was unique in the Sheffield sheep collection for showing an advanced stage of weathering. The thin blade has buckled and cracked, and the bone has a grainy texture.

PLATE 5:1

THE AXIAL/THORACIC UNIT OF A ROE DEER, DISARTICULATING IN SITU

Note how intact most of these bones are. Even the sternebrae and ribs are undamaged. The Grizedale collections have undergone less intensive scavenging than have the Sheffield sheep collection. Most of the vertebrae lie in groups in anatomical positions, although all of the bones are completely free from cartilage or ligaments.

The scale is in centimetres and ten centimetre blocks.

PLATE 5:2

TRANSPORTED FORELIMB UNIT OF A ROE DEER IN GRIZEDALE FOREST

The sequences of element disarticulation and removal observed in the Grizedale deer survey are extremely similar to those noted for the Sheffield sheep. This forelimb unit, from the scapula to the hooves, has been dragged into some vegetation cover where it is disarticulating in situ, having been stripped of flesh. The bones are still intact, and ligaments still hold the carpals and phalanges onto the radius/ulna and metacarpal.

The scale is in centimetres and ten centimetre blocks.

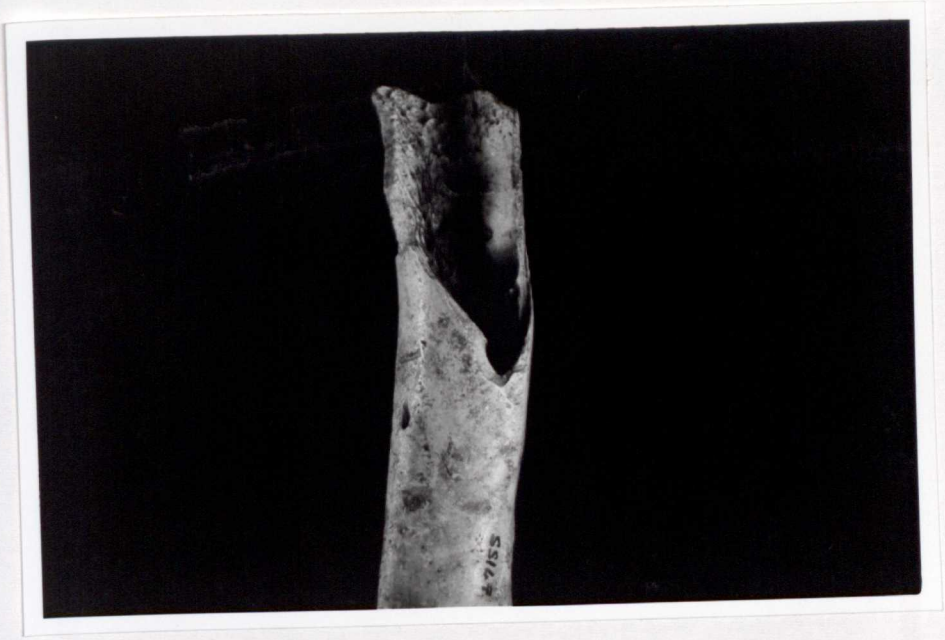
PLATE 8:1 **SIX TYPES OF CARNIVORE DAMAGE: 1. PUNCTURES**

PUNCTURES in the blade of an ilium (pelvis). The remains of PUNCTURES also form FLAKE SCARS around the BROKEN EDGES of the bone.

PLATE 8:2 **SIX TYPES OF CARNIVORE DAMAGE: 2. MOUTHING MARKS**

MOUTHING MARKS on an unfused distal radius. 2a) TOOTH GROOVES: scored across the shaft. 2b) PITTING MARKS: concentrated around the partially destroyed distal fusion surface.

PLATE 8:3 **SIX TYPES OF CARNIVORE DAMAGE: 3. FLAKE SCARS**



A FLAKE SCAR in the proximal shaft of a humerus. This one is too large to be the remains of a puncture.

PLATE 8:4 **SIX TYPES OF CARNIVORE DAMAGE: 4. SHREDDING**

SHREDDING of the diastema of a mandible. The bone is depressed with multiple parallel cracks and has been BROKEN OFF.

PLATE 8:5 **SIX TYPES OF CARNIVORE DAMAGE: 5. A BROKEN EDGE**

A fused proximal radius with a BROKEN EDGE. A small area of the epiphysis remains in situ. TOOTH GROOVES and PITTING MARKS are also present.

PLATE 8:6 **SIX TYPES OF CARNIVORE DAMAGE: 6. A SPIRAL FRACTURE**

A SPIRAL FRACTURE in a proximal femur that has been BROKEN OFF.

PLATE 8:7 TWO TYPES OF WEATHERING ALTERATION:1. EXPOSED TRABECULAR BONE

TRABECULAR BONE EXPOSED on a proximal femur where the lateral vastus muscle attaches. In this instance, it is accompanied by carnivore damage, i.e.: PUNCTURES.

PLATE 8:8 TWO TYPES OF WEATHERING ALTERATION:2. SPLIT LINES

SPLIT LINES running horizontally through the diastema and horizontal ramus of a mandible.

PLATE 8:9 TYPICAL PATTERNS OF DAMAGE TO MANDIBLES

A range of damage observed on mandibles.

Note that: the two most damaged areas are the symphysis and the angle of the jaw.

The cheek tooth row is always undamaged.

The mandible on the top left of the photograph has a SPLIT LINE running along most of the length of its horizontal ramus.

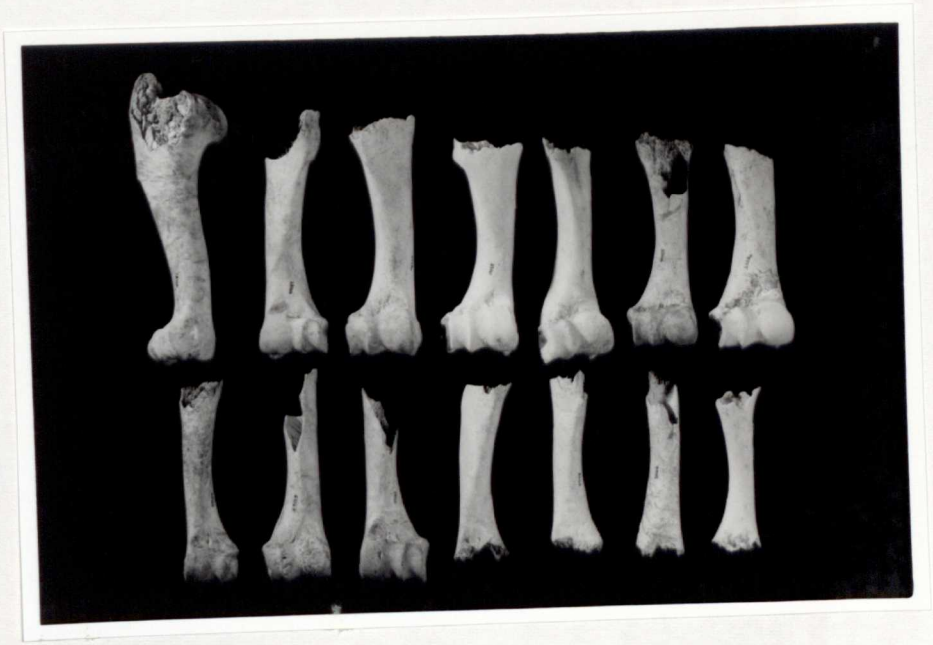
PLATE 8:10 PATTERNS OF DAMAGE TO SCAPULAE:1. TYPICAL DAMAGE

The main area of damage is the distal border of the blade, which is often BROKEN OFF, with a jagged edge, PUNCTURES and/or FLAKE SCARS.

PLATE 8:11 DAMAGE TO SCAPULAE:2. ATYPICAL EXAMPLES

Occasionally, the head of a scapula is BROKEN OFF. The badly weathered example is shown, far right (see also Plate 4:11).

PLATE 8:12 PATTERNS OF DAMAGE TO HUMERI



A range of damaged humeri. Note the tendency for the proximal epiphysis to be BROKEN OFF, with FLAKE SCARS, whilst the distal epiphysis tends to remain intact.

PLATE 8:13 TYPICAL DAMAGE TO A PROXIMAL HUMERUS

The proximal epiphysis has been BROKEN OFF, leaving a scalloped edge with FLAKE SCARS.

PLATE 8:14 HEAVY DAMAGE TO RADII

A range of the more heavily damaged radii. The distal epiphysis tends to be damaged more severely than the proximal epiphysis.

PLATE 8:15 TYPICAL DAMAGE TO RADII AND ULNAE

The radius tends to remain intact, but the olecranon process of the ulna tends to be BROKEN OFF.

PLATE 8:16 CLOSE-UP VIEW OF TYPICAL DAMAGE TO AN ULNA

The olecranon process has been BROKEN OFF, leaving a jagged edge with PITTING MARKS. The shaft has been BROKEN OFF at the point where it rejoins the radius and has also been MOUTHED.

PLATE 8:17 DAMAGE TO METAPODIALS:1. DORSAL VIEW

Metapodials tend to remain intact. The occasional damage tends to affect the distal epiphysis which may be BROKEN OFF or have EXPOSED TRABECULAR BONE.

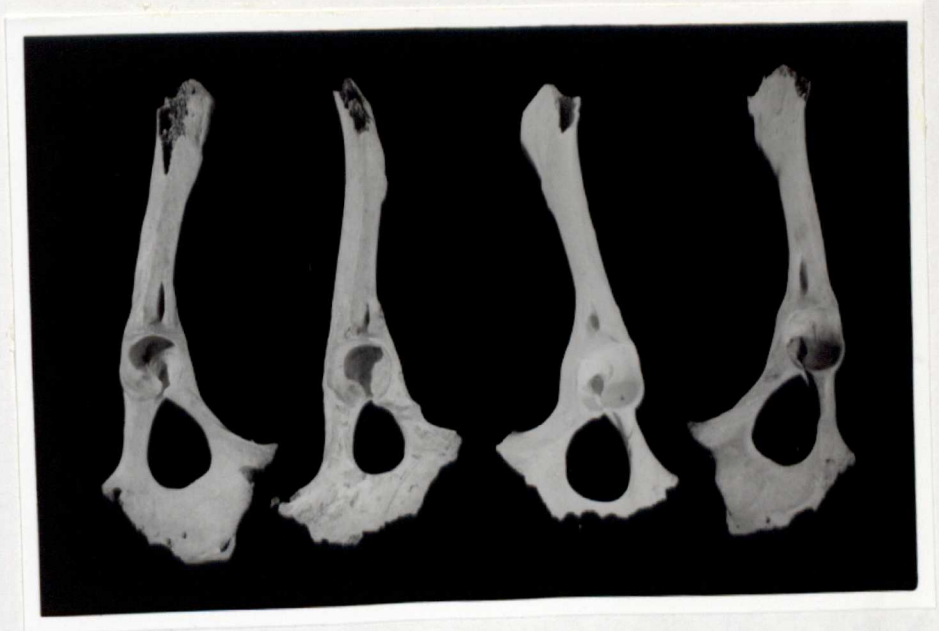
PLATE 8:18 DAMAGE TO METAPODIALS:2. VENTRAL VIEW

Occasionally, the proximal epiphysis has a BROKEN EDGE, where splinters have been removed. (Same examples as in Plate 8:17).

PLATE 8:19 TYPICAL DAMAGE TO A PELVIS: PUNCTURES

PUNCTURES in the blade of an ischium. The pubis has a BROKEN EDGE.

PLATE 8:20 TYPICAL LIGHT DAMAGE TO PELVES: VENTRAL VIEW

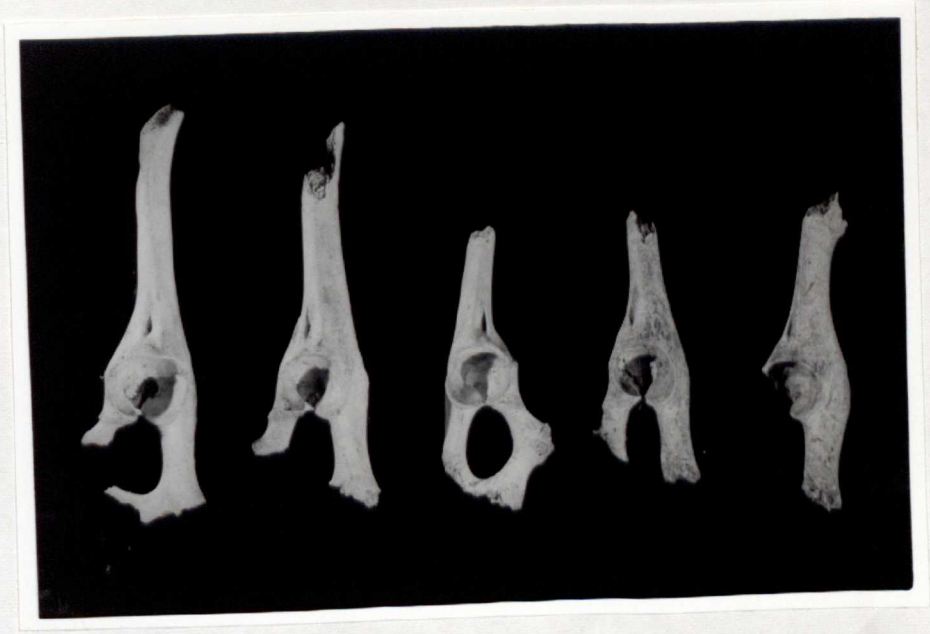


The blades of the ilia and ischia have BROKEN EDGES and PUNCTURES. The acetabula remain intact.

PLATE 8:21 TYPICAL LIGHT DAMAGE TO PELVES: LATERAL VIEW

(Same examples as in Plate 8:20). Damage is concentrated around the borders of the ilial and ischial blades, i.e.: they have BROKEN EDGES and PUNCTURES.

PLATE 8:22 TYPICAL HEAVY DAMAGE TO PELVES

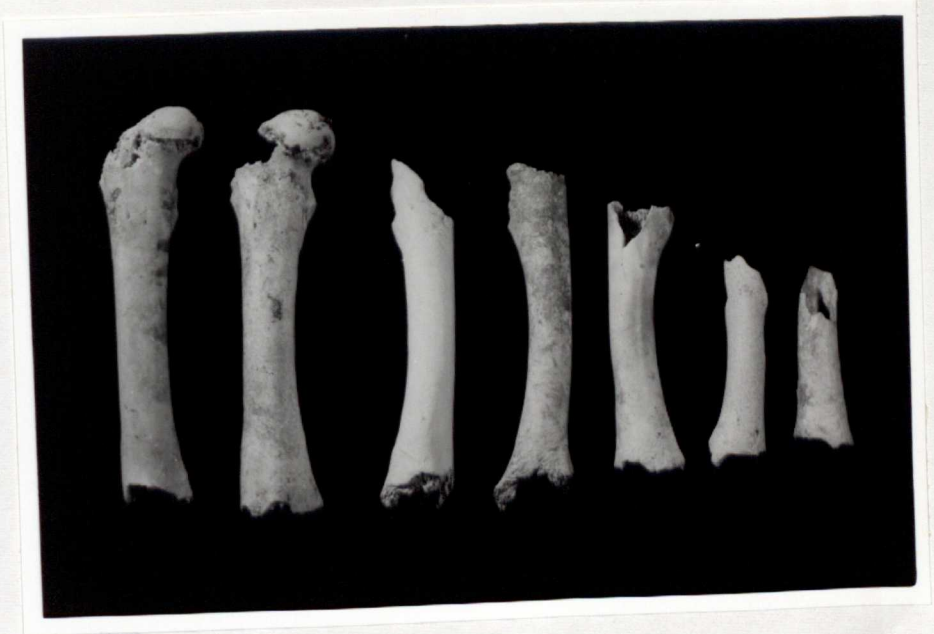


The blades of the ilia, ischia and pubes have been BROKEN OFF, sometimes down to the shafts of the bones. The acetabula are intact.

PLATE 8:23 TYPICAL LIGHT DAMAGE TO FEMORA

EXPOSED TRABECULAR BONE is quite common on the distal epiphysis, the greater trochanter and the attachment of the lateral vastus muscle. It is often accompanied by carnivore damage such as PUNCTURES.

PLATE 8:24 TYPICAL HEAVY DAMAGE TO FEMORA



The distal epiphysis is BROKEN OFF, as is the greater trochanter and, sometimes, the proximal epiphysis. SHAFT TUBES are quite common.

PLATE 8:25 TYPICAL LIGHT DAMAGE TO TIBIAE

Nearly all of the tibiae have been attacked in the area of the proximal epiphysis, which tends to have a BROKEN EDGE. The distal epiphysis is nearly always intact.

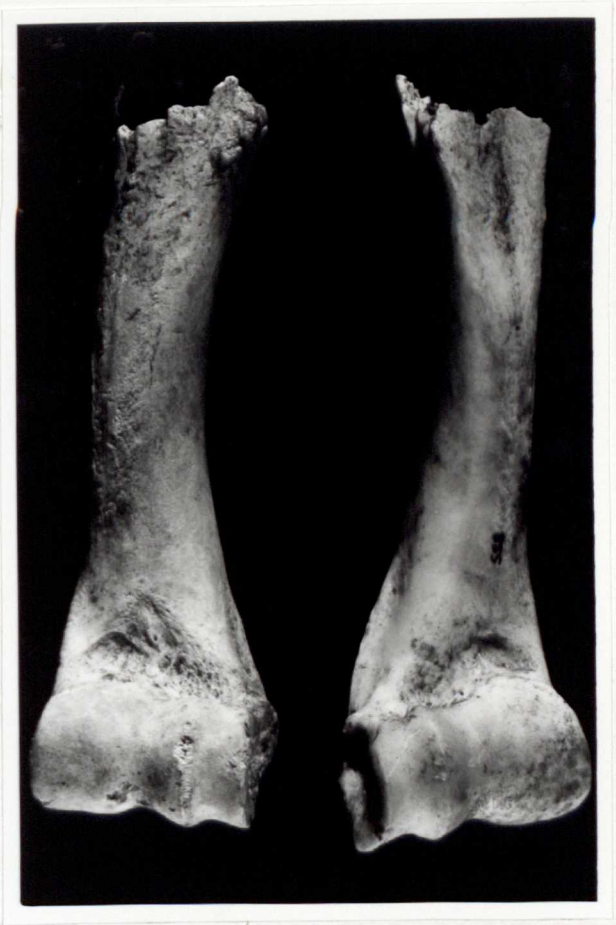
PLATE 8:26 CLOSE-UP OF A PARTIALLY DESTROYED PROXIMAL TIBIA

The crest of the proximal tibia has been attacked and is partially destroyed.

PLATE 8:27 PATTERNS OF HEAVY DAMAGE TO TIBIAE

The proximal epiphyses of all of these tibiae have been BROKEN OFF. Although the distal epiphyses are unfused, very few of them have been damaged, and BONE TUBES are scarce. One tube, probably from a totally unfused tibia, has a splinter of bone partially detached from the shaft.

PLATE 12:1 MODERN AND ROMANO-BRITISH EXAMPLES OF HUMERI SCAVENGED BY CANIDS

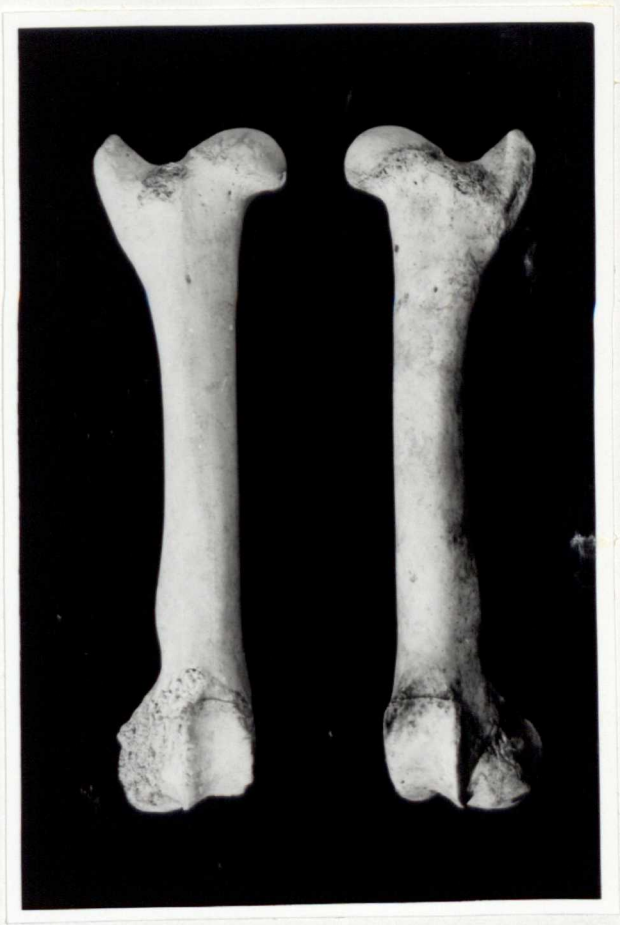


The modern example is on the right. Note that both bones have had their proximal epiphysis (or fusion surface) broken off, leaving a scalloped edge. In contrast, the distal epiphysis of each bone has suffered little or no damage.

PLATE 12:2 MODERN AND ROMANO-BRITISH EXAMPLES OF RADII SCAVENGED BY CANIDS

The modern example is on the right. Both of these bones has an unfused distal epiphysis. The ventral surfaces (shown here) have been partially crushed, with some loss of bone, giving access to the central marrow cavity.

PLATE 12:3 MODERN AND ROMANO-BRITISH EXAMPLES OF FEMORA THAT HAVE BEEN SCAVENGED BY CANIDS, AND WEATHERED



The modern example is on the left. Both of these bones has an area of exposed trabecular bone in the region where the lateral vastus muscle inserts. In the modern example (on the left), this is accompanied by some crushing and puncture marks in the bone, but this is not the case on the Romano-British example (on the right), which appears to have suffered from weathering rather than from scavenging in this region. Both bones have sustained some damage around the distal condyles. The modern bone has suffered considerable loss of bone, accompanied by punctures and mouthing marks, whilst the Romano-British example is almost intact, but does have a few punctures, particularly around the fusion line of the distal epiphysis.

RAW FREQUENCIES OF ALL SHEEP BONES COLLECTED IN THE SHEFFIELD SURVEY AREA

CARCASSES

NUMBER	SK	UP	LT	HY	MD	SC	HU	RA	UL	CP	MC	PL	FE	TI	MT
8							1	1	1					1	
9	1				2	1		1	1	3	1	2	1	2	1
13													1	1	1
18				1	2					7	1	1	1		
18A	1											1		1	
19								1	1	6	1			1	1
20A							1	1	1			1			
20B	1				2		1	1	1			1			
24							1	1	1	3	1	2	1	1	1
36						1						2		1	1
86	1				2	1	1	1	1	6	2		1	1	
111A					1	1	1					2	2	2	2
111B												1		1	
117															
138												2	2	2	
140															
141	1				2	2	1	1	1	3	1	2	2	2	2
144	1											1	1	1	
147					1	1	1						1		
148	1				1	2	1	2	2	4	2	2	1	1	2
150	1						1							1	
TOTALS	8			1	13	9	10	10	10	32	9	20	14	19	11

CARCASSES (continued)

NUMBER	PA	AS	CA	NC	TS	SS	PP	MP	DP	AT	AX	CV	TV	LV	SA	RIB	ST	LM
8																		
9		1		2		2	4	2	4	1	1	5	13	7	1	24		
13																		1
18	2					2	4	3	4	1	1	5	7	5	1	19		
18A		1	1	1									1					
19		1	1	1	2	12	4	4	4							12		
20A											1	5	13	7	1	1		
20B																		
24	1	1	1	1	2	4	2	2	1			5	13	6		23	7	1
36		1																1
86						2	2		1	1				2		2	2	
111A													1	3				
111B																		
117										1	1	3	1	5				
138																		
140										1	1	5	6			3		
141		2	2	2	3		3		1				8	6	1	12		2
144		1					1											
147																		
148	1	2	1	1	1	6	5	3	4	1	1	5	14	6		26		
150																		
TOTALS	4	10	6	8	8	28	25	14	19	6	6	33	77	47	4	122	9	5

APPENDIX I

SHEFFIELD SHEEP

'ARTICULATED' FOX DEN FINDS

	SK	UP	LT	HY	MD	SC	HU	RA	UL	CP	MC	PL	FE	TI	MT
26I												2	1		
26J								1	1	6	1				
26K		1	1			1		1	1	4	1				
27B													1	1	
28K							1	1	1		1				
280						1	1	1	1	1	1				
30							1	1	1		2				
146						1	1	1	1	4	1				
TOTALS		1	1			3	4	6	6	15	7	2	2	1	

'ARTICULATED' FOX DEN FINDS (continued)

NUMBER	PA	AS	CA	NC	TS	SS	PP	MP	DP	AT	AX	CV	TV	LV	SA	RIB	ST	LM
26I															1			
26J						1	2	1	1									
26K																		
27B				1														
28K							1											
280							2	2	2									
30																		
146																		
TOTALS				1		1	5	3	3						1			

APPENDIX I

SHEFFIELD SHEEP

ISOLATED FOX DEN FINDS

NUMBER	SK	UP	LT	HY	MD	SC	HU	RA	UL	CP	MC	PL	FE	TI	MT
25A							1								1
25B														1	
25C														1	1
25D														1	
26A								1	1						
26B															1
26C														1	
26D	1														
26E			1												
26F							1								
26G								1							
26H	2														
27A															1
27BB													1		
27C							1								
27E									1						
27F	3	3						1				1			1
27G								1							
27H-K														4	
28A								1							1
28B													1		
28C														1	
28D	1														
28E															1
28F															1
28G							1								
28H											1				
28I										1					
28P		3			1			1							
28L					1										
28M	1														
28N							1								
29A	1														
29B	1														
29C														1	
30A											1				
79									1						
TOTALS	10	6	1		2		5	6	3	1	2	1	2	10	8

APPENDIX I

SHEFFIELD SHEEP

ISOLATED FOX DENS (continued)

NUMBER	PA	AS	CA	NC	TS	SS	PP	MP	DP	AT	AX	CV	TV	LV	SA	RIB	ST	LM
25A																		
25B							1											
25C		1					1											
25D																		
26A																		
26B				1														
26C																		
26D																		
26E																		
26F																		
26G										1	1	4						
26H																		
27A																		
27BB																		
27C																		
27E			1															
27F		1					1								1			
27G																		
27H-K																		
28A																		
28B																		
28C																		
28D																		
28E																		
28F																		
28G																		
28H																		
28I																		
28J																		
28P																		
28L																		
28M																		
28N																		
29A																		
29B																		
29C																		
30A																		
79																		
TOTALS		2	1	1			3			1	1	4			1			

APPENDIX I

SHEFFIELD SHEEP

GENERAL ISOLATED FINDS

NUMBER	SK	UP	LT	HY	MD	SC	HU	RA	UL	CP	MC	PL	FE	TI	MT
3														1	
22															
23															
37							1								
38								1	1						
40							1								
49					1										
50											1				
61	1														
63															
70															
71					1										
75/92					2	1		1	1			2	1	2	
76														1	
78														1	
84						1									
93															
94						1									
95													1		
98							1								
110													2		
115						1									
128						1									
129															
132							1								
137								2							
139								1							1
145															
148A									1						
149								1			1	1		2	
TOTALS	1				4	5	4	6	3		2	3	4	7	1

GENERAL ISOLATED FINDS (continued)

NUMBER	PA	AS	CA	NC	TS	SS	PP	MP	DP	AT	AX	CV	TV	LV	SA	RIB	ST	LM
3															1			
22							1											
23																		
37																		
38																		
40																		
49																		
50																		
61																		
63																		
70																		
71												1		3				
75/92																		
76																		
78																		
84										1								
93																		
94																		
95																		
98																		
110		1					1					1						
115																		
128																		
129														1				
132																		
137							1											
139																		
145												2	2					
148A																		
149																		
TOTALS		1					3			1		4	2	4	1			

S146 GROUP

NUMBER	SK	UP	LT	HY	MD	SC	HU	RA	UL	CP	MC	PL	FE	TI	MT
146A-E					2	3									
146F-L							7								
146M-Q								1				4			
146R-T													3		
146U-W														3	
146X															
146Y															
146Z															
TOTAL					2	3	7	1				4	3	3	

S146 GROUP (continued)

NUMBER	PA	AS	CA	NC	TS	SS	PP	MP	DP	AT	AX	CV	TV	LV	SA	RIB	ST	LM
146A-E																		
146F-L																		
146M-Q																		
146R-T																		
146U-W																		
146X										1								
146Y												3						
146Z														1				
TOTALS										1		3		1				

NON-CARCASS SUB-COLLECTIONS TOTALS

	SK	UP	LT	HY	MD	SC	HU	RA	UL	CP	MC	PL	FE	TI	MT
'ARTIC.' FOX DENS		1	1			3	4	6	6	15	7	2	2	1	
ISOLATED FOX DENS	10	6	1		2		5	6	3	1	2	1	2	10	8
GENERAL ISOLATED	1				4	5	4	6	3		2	3	4	7	1
S146 GROUP					2	3	7	1				4	3	3	
TOTAL NON-CARCASS	11	7	2		8	11	20	19	12	16	11	10	11	21	9

APPENDIX I

SHEFFIELD SHEEP

NON-CARCASS SUB-COLLECTIONS TOTALS (continued)

	PA	AS	CA	NC	TS	SS	PP	MP	DP	AT	AX	CV	TV	LV	SA	RIB	ST	LM
'ARTIC.' FOX DENS				1		1	5	3	3						1			
ISOLATED FOX DENS		2	1	1			3			1	1	4			1			
GENERAL ISOLATED		1					3			1		4	2	4	1			
S146 GROUP										1		3		1				
TOTAL NON-CARCASS		3	1	2		1	11	3	3	3	1	11	2	5	3			

GRAND TOTALS

	SK	UP	LT	HY	MD	SC	HU	RA	UL	CP	MC	PL	FE	TI	MT
CARCASSES	8			1	13	9	10	10	10	32	9	20	14	19	11
NON-CARCASSES	11	7	2		8	11	20	19	12	16	11	10	11	21	9
TOTALS	19	7	2	1	21	20	30	29	22	48	20	30	25	40	20

	PA	AS	CA	NC	TS	SS	PP	MP	DP	AT	AX	CV	TV	LV	SA	RIB	ST	LM
CARCASSES	4	10	6	8	8	28	25	14	19	6	6	33	77	47	4	122	9	5
NON-CARCASSES		3	1	2		1	11	3	3	3	1	11	2	5	3			
TOTALS	4	13	7	10	8	29	36	17	22	9	7	44	79	52	7	122	9	5

KEY:

'ARTIC.': 'ARTICULATED'

SK: SKULL
UP: UPPER TEETH
LT: LOWER TEETH
HY: HYOID
MD: MANDIBLE
SC: SCAPULA
HU: HUMERUS
RA: RADIUS
UL: ULNA
CP: CARPALS
MC: METACARPAL
PL: PELVIS
FE: FEMUR
TI: TIBIA
MT: METATARSAL

PA: PATELLA
AS: ASTRAGALUS
CA: CALCANEUM
NC: NAVICULAR-CUBOID
TS: OTHER TARSALS
SS: SESAMOIDS (PROXIMAL AND DISTAL)
PP: PROXIMAL PHALANGES (ANTERIOR AND POSTERIOR)
MP: MEDIAL PHALANGES (ANTERIOR AND POSTERIOR)
DP: DISTAL PHALANGES (ANTERIOR AND POSTERIOR)
AT: ATLAS
AX: AXIS
CV: CERVICAL VERTEBRAE
TV: THORACIC VERTEBRAE
LV: LUMBAR VERTEBRAE
SA: SACRUM
RIB: RIBS
ST: STERNEBRAE
LM: LATERAL MALLEOLUS

APPENDIX II RAW FREQUENCIES OF ALL DEER BONES FOUND IN THE GRIZEDALE SURVEY AREA

ROE DEER BONES

NUMBER	SK	UP	LT	HY	MD	SC	HU	RA	UL	CP	MC	PL	FE	TI	MT
1979: 7	1			2	2							2	2	2	1
1979: 9	1			1											
1979:11	*					2	2	2	2	5	2	2	2	2	2
1979:16						1	1	1	1	5	1	2	1	1	1
1980: 1			3		1							2	1	1	1
1980: 2	1			2	2	1	1				1	2	2	1	1
1980: 3	1											2	2	2	2
1980: 4	1				2	2	2	2	2	7	1	2	2	2	2
1980: 5	1			1	2	1	2	2	2	12	2	2	2	2	2
1980: 6	1				2								1		
1980: 8					2	1	2	2	2	8	2	2	2	2	2
1980: 9						1	2	2	2		2				
1980:11	1			2		1	2	1	1			2			
1980:12	1											2	1	1	1
1980:13						1	2	1	1		1	2	2	2	
1980:14	*					1						1		1	
TOTALS	9		3	8	13	12	16	13	13	37	12	25	20	19	15

ROE DEER BONES (continued)

NUMBER	PA	AS	CA	NC	TS	SS	PP	MP	DP	AT	AX	CV	TV	LV	SA	RIB	ST	LM	SP
1979: 7	2	1	1				2		1	1	1	5	13	6	1	7		1	
1979: 9																			
1979:11	1	1	1	1	1		2	2	2	1	1	5	13	6	1	24	7		1
1979:16		1	1	1	2		4	4	4	1	1	5	13	6	1	23		1	2
1980: 1	1	1	1	1		4	2	2				4	13	6	1	26	7	1	
1980: 2	2	1	1	1	1		1	1		1	1	5	14	6	1	22	7	1	
1980: 3		2	2	2	2	4	3	2	1	1	1	5	13	6	1	26	6		
1980: 4		2	2	2	2	8	5	4	3	1		4	13	6	1	26	4	2	2
1980: 5	2	2	2	2	2	16	8	8	8	1	1	5	12	6	1	21	5	2	4
1980: 6																			
1980: 8	1	2	2	2		8	4	2	2	1	1	5	12	6	1	14	1	2	2
1980: 9						8	4	4	4							1			
1980:11										1	1	4	13	6	1	19	6		
1980:12			1	1	1		1			1	1	5	13	6	1	24		1	
1980:13						4	2	2	1				6	6		11	5		2
1980:14											1	5	12	5	1	27	7		
TOTALS	9	13	14	13	11	52	38	31	25	10	10	57	160	77	12	271	55	11	13

APPENDIX II GRIZEDALE DEER

RED DEER BONES

NUMBER	SK	UP	LT	HY	MD	SC	HU	RA	UL	CP	MC	PL	FE	TI	MT
1979: 4	*					2	1	1	1	5	1	2	1	1	1
1979: 6	1					1						2	2	2	2
1980: 7	1			2	2	1						1			
1980:10	*				1	1	2	1	1	1	1	2	2	1	
TOTALS	2			2	3	4	3	2	2	6	2	7	5	4	3

RED DEER BONES (continued)

NUMBER	PA	AS	CA	NC	TS	SS	PP	MP	DP	AT	AX	CV	TV	LV	SA	RIB	ST	LM	SP
1979: 4	1	1	1	1	1	8	4	4	4			5	13	6	1	26	4	1	
1979: 6		2	2	2	2					1	1	2	4	3	1	18	7		
1980: 7										1	1	5	13	1		20	4		
1980:10	1						2	2	1	1	1	5	13	6	1	26	7	1	
TOTALS	2	2	2	2	2	8	6	6	5	3	3	17	43	16	3	90	22	2	

GRAND TOTALS

	SK	UP	LT	HY	MD	SC	HU	RA	UL	CP	MC	PL	FE	TI	MT
ROE DEER	9		3	8	13	12	16	13	13	37	12	25	20	19	15
RED DEER	2			2	3	5	3	2	2	6	2	7	5	4	3
TOTALS	11		3	10	16	17	19	15	15	43	14	32	25	23	18

GRAND TOTALS (continued)

	PA	AS	CA	NC	TS	SS	PP	MP	DP	AT	AX	CV	TV	LV	SA	RIB	ST	LM	SP
ROE DEER	9	13	14	13	11	52	38	31	25	10	10	57	160	77	12	271	55	11	13
RED DEER	2	3	3	3	3	8	6	6	5	3	3	17	43	16	3	90	22	2	
TOTALS	11	16	17	16	14	60	44	37	30	13	13	74	203	93	15	361	77	13	13

APPENDIX II GRIZEDALE DEER

KEY:

*: skull removed by gamekeeper for its good set of antlers

SK: SKULL
UP: UPPER TEETH
LT: LOWER TEETH
HY: HYOID
MD: MANDIBLE
SC: SCAPULA
HU: HUMERUS
RA: RADIUS
UL: ULNA
CP: CARPALS
MC: METACARPAL
PL: PELVIS
FE: FEMUR
TI: TIBIA
MT: METATARSAL

PA: PATELLA
AS: ASTRAGALUS
CA: CALCANEUM
NC: NAVICULAR-CUBOID
TS: OTHER TARSALS
SS: SESAMOIDS (PROXIMAL AND DISTAL)
PP: PROXIMAL PHALANGES (ANTERIOR AND POSTERIOR)
MP: MEDIAL PHALANGES (ANTERIOR AND POSTERIOR)
DP: DISTAL PHALANGES (ANTERIOR AND POSTERIOR)
AT: ATLAS
AX: AXIS
CV: CERVICAL VERTEBRAE
TV: THORACIC VERTEBRAE
LV: LUMBAR VERTEBRAE
SA: SACRUM
RIB: RIBS
ST: STERNEBRAE
LM: LATERAL MALLEOLUS
SP: SPLINT METAPODIAL

SEQUENCE OF DISARTICULATION, REDISTRIBUTION AND BURIAL OF ONE OF THE SHEFFIELD SHEEP CARCASSES

DATE	No.	NOTES
12:4:80	96	SCAVENGED CORPSE: vertebrae picked clean throughout thorax. All visible ribs chewed off half way along length. Angles of both mandibles chewed off. Both ends of both femurs visible and chewed off. Right forelimb lying 12 metres upslope. Left forelimb lying 4 metres upslope.
19:6:80	109	SCAVENGED CORPSE: main carcass dragged into gully, 2-4 metres downslope.
PLATE 4:1		Axial/thoracic unit still fully articulated from the head to the pelves, with both femurs in situ. Right side of body exposed: ribs neatly bitten off, circa 10 centimetres from their articulations with the thoracic vertebrae. No hyoids visible. Neither forelimb located.
PLATE 3:2		Fleece dragged 8-20 metres from carcass along slope towards:
PLATE 4:2		tibia group, located 10 metres along the slope.
31:7:80	112	SCAVENGED CORPSE: main carcass still in same position as last visit. Mandibles now disarticulated. Spine and ribs still articulated, with pelves still in situ. Tibia group: moved slightly, and flipped over, but astragalus and calcaneum still attached to tibia.
12:9:80	122	SCAVENGED CORPSE: main carcass greatly disturbed. Most of spine still fully articulated, but first two thoracic and last two lumbar vertebrae coming adrift. Right mandible almost buried by leaf litter from bracken and trees. Both pelves and both femora now 3 metres upslope. Sacrum missing. Tibia group: tibia now 2 metres from metatarsal, which is still attached to both proximal phalanges. Astragalus 0.5 metres beyond the metatarsal/phalanges group. Calcaneum close to the metatarsal group.
5:12:80	125	SCATTERED BONES: one 'articulated' unit of lumbar vertebrae and one 'articulated' unit of thoracic vertebrae lying in the runnel, in anatomical positions, but no longer held together. Spines of thoracic vertebrae becoming covered by grass. At the original position: a mess of fleece and ribs.

One pelvis in same position as last recording, but other pelvis and both femora missing.
Tibia group: tibia moved 2.5 metres from last position, calcaneum becoming buried by grass and heath bedstraw (Galium saxatile).

14:4:81 note SCATTERED BONES: one pelvis still in last position.
Jumble of disarticulated vertebrae and ribs, some becoming buried by runnoff deposits in the runnel.
Tibia and astragalus now very clean.

24:3:82 145 SCATTERED BONES: only two cervical and two thoracic vertebrae still visible
(N.B. one of the cervical and one of the thoracic vertebrae becoming buried by leaf litter).
These four bones collected.
No other bones within 30 metres radius.