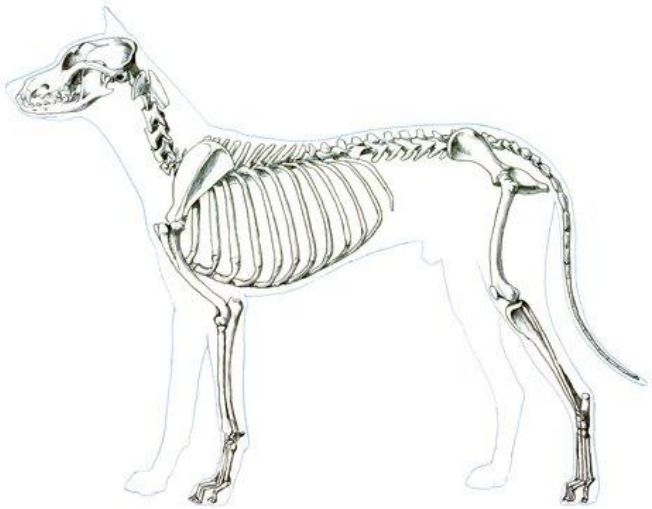
On the morphology of the domesticated dog in medieval Norway

An Osteometric study

By Jorg Jovius Tiberius Knoest



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[**Front page**: Image of dog skeleton. http://hippie.nu/~unicorn/tut/img/basics/animalanatomy/canine-skeleton.jpeg (downloaded 21-04-2013]

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Abstract

There is a large amount of bones at the Osteological collection in the Natural History Museum in Bergen, from Norwegian urban settlements from the middle ages. A large amount of bones from excavations all over Norway have yet to be studied. 778 bones from 31 different excavations have been used in morphometric analysis in this study In order to understand what the medieval dog looked like in Norway.

An old method for gender determination has been used on dog skulls. And special worksheets have been created to record data from individual bones. Different types of skulls have been determined based on ratios and indices.

Table of content

1. Introduction

The data that is the focus of this paper is the bones from the domesticated dog (*Canis familiaris*) that have been selected from assemblages of bones from the Middle Ages. These assemblages have been collected during urban archaeological excavations, mainly in the last half of the 20th Century. The assemblages is part of the collection of subfossil bones that is curated and stored at the University Museum of Bergen. Here, millions of bones, mainly from archaeological excavations, from more than 1,660 localities are being stored (Hufthammer, 2014:1).

The dog bones from the medieval Norwegian urban sites, in general been identified to the level of bone element and species, but not studied in detail. The aim of this thesis is to study the morphological variation of the dog in the Norwegian urban sites in the Middle Ages. Morphometric measurements on previously predefined points from similar studies as well as new measurements are used to determine the size and shape of the medieval dogs in these assemblages.

These bones will be compared to modern dog breeds that can be found in Norway today, breeds that are recorded to have been in Norway for a very long time. As mentioned by Hufthammer (1994), there have been many attempts in order to associate prehistoric canine skeletons with modern races (Studer, 1901; Brinkmann, 1923-24; Wagner, 1930). Based on modern studies to the plasticity of dogs, Evans (2013) conclude that there is probably no basis for any association.

The modern dog races referred to in this study are therefore used only to provide a comparison to shape and size. We would never expect to find dogs that looked the same as the modern breeds we find today, as the modern dogs are the result of the accumulation of traits from these earlier ancestors. But it does help us to picture what a dog looked like.

Because someone who isn`t a geneticist, or a paleontologist, or geologist, their concept of time might be different from these scientists. Wolf (*Canis lupus*) is the ancestor of the dog, and the process of domestication started at least 12,000 years ago. Some people might think that the Middle Ages is a very long time ago, and therefore dogs would resemble their ancestors a great deal more than they do today. On the other hand however, it might be just a very short time in which we have

not seen a great deal of change in the appearance of other animals other than their general size (such as livestock). Dogs however, are extremely plastic in their appearance. Copies of DNA codons can lead to an extreme change in physical traits in a very short period of time (Evans, 2013).
Exactly how different or similar dogs from the Middle Ages are from the dogs we know and love today might not be what we`d expect.

Therefore, besides using modern Norwegian dog breeds for comparison to the medieval dogs, six modern wolf skeletons have been included in the comparative material in order to roughly illustrate how much these dogs resemble wolves. These are not medieval wolves, so this will not be an accurate comparison, but merely a visual aid to put the shape and size of medieval dog skeletons in context.

Despite the abundance of material, relatively few studies about animal life and husbandry during the Middle Ages in Norway have been conducted before the 20th Century. Written sources can sometimes give us some insight into the circumstances of animal life in the Middle Ages. Official documents, such as King Magnus' Lagaböters law from 1274, *i.e.* country laws. Similar to these are city laws and countryside laws, along with letters and documents regarding animals (Hufthammer, 1994).

When it comes to literary sources, there is always a chance of misinterpretation, and the validity of these old documents may also vary. Therefore, analysis of the osteological material at hand is of great importance. Not only to verify the accuracy of these older literary sources, but also to further our understanding of medieval society in Norway.

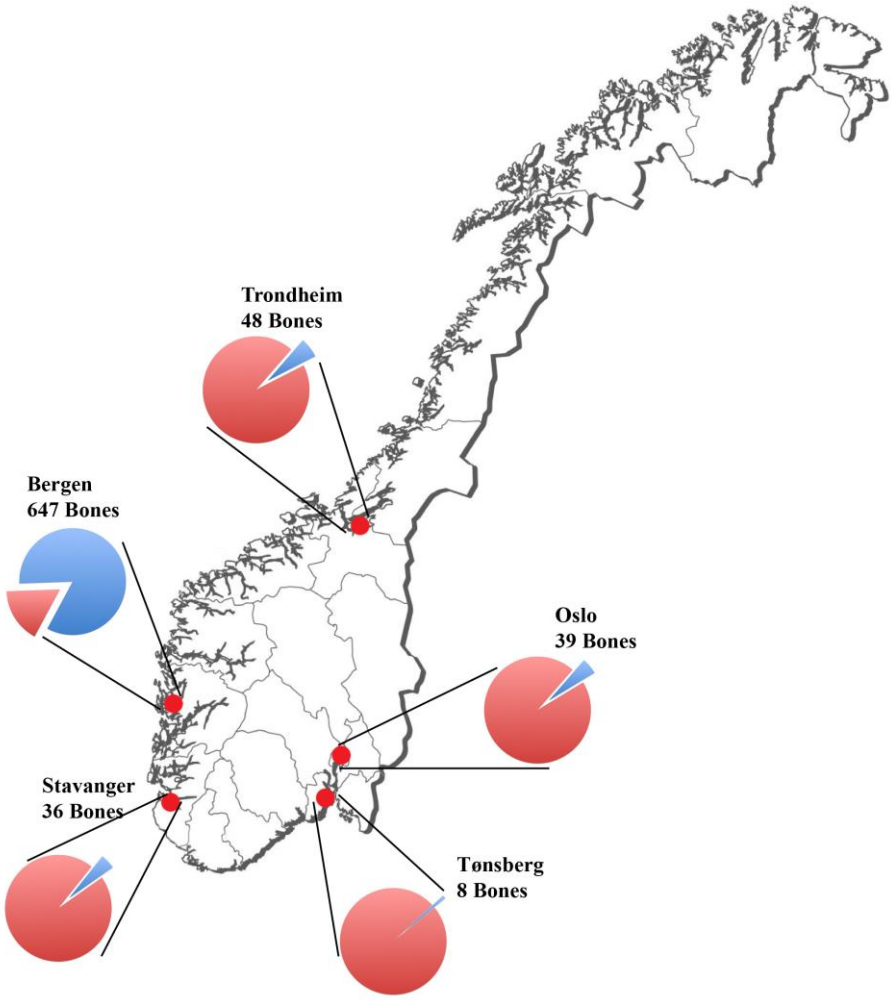
Although there have been several studies conducted on livestock and game animals from this material (Hufthammer correspondence), only two studies in the past hundred years have been the focus of the dog in Norway. These were extensive studies by Brinkmann (1920) and an article about the medieval assemblages from Bryggen by Hufthammer (1994). In this study I will complete the picture of the type of dogs that existed in the Middle Ages in Norway by using all the dog bones that have been identified in the Osteological collection at the University Museum of Bergen.

2. Material

The osteological material used in this thesis has been excavated from medieval (c. AD 900-1600) urban cultural layers and include different excavations from 5 medieval Norwegian towns: Trondheim, Bergen, Stavanger, Tønsberg and Oslo (Figure 2.1). The bone assemblages are being curated and stored at the Osteological collection of the University Museum in Bergen.

From the assemblages, a total of 1184 dog bones have been selected for this study out of which 778 were used in morphometric analysis (Table 2.1). The bones that have been selected for morphometric analyses are: the Cranium (*skull*), Mandibula (*lower jaw*), Scapula (*shoulder bone*), Humerus (*upper arm bone*), Radius (*forearm bone*), Ulna (*forearm bone)*, Femur (*thigh bone*) and the Tibia (*shin bone*).

Fig 2.1 The number of dog bones from the medieval towns: Trondheim, Bergen, Stavanger, Tønsberg and Oslo (blue) that were used in the morphometric analysis.



All the 1184 dog bones have been examined. However, in the morphometric study only the cranial and long bones have been included. Both complete bones as well as fragments have been measured. Many of the smaller bones that were present in the assemblages have also been measured and recorded, but are left out of the analysis. A complete overview of the bones that were measured is displayed in appendix α.

Table 2.1
Type of bone element and number of bones from the cities of Trondheim, Bergen, Stavanger, Tønsberg and Oslo used for analysis. As well as the percentage of the total each town represents.

Bone Element	Trondheim	Bergen	Stavanger	Tønsberg	Oslo	Sum
Cranium	1	85	1	2	5	94
Mandibula	6	95	11	1	4	117
Scapula	3	49	1		2	55
Humerus	9	89	4	2	7	111
Radius	6	79	9	1	6	101
Ulna	7	69	5	1	2	84
Femur	4	71	3		5	83
Tibia	12	110	2	1	8	133
Sum	48	647	36	8	39	778
%	6.2	83.2	4.6	1	5	100.0

The bone assemblages included in this thesis are from a total of 28 different archaeological excavations. Each excavation is assigned a museum number under the acronym JS. (In Norwegian: J stands for “jordfunnet” or “found in soil” in English and S stands for “skjeletmateriale” or “skeletal material” in English). Each new excavation receives a new JS number (Hufthammer, 2014:57).

The information about all the assemblages that have been used in morphometric analysis in this thesis is displayed in table 2.2.

Table 2.2

The medieval urban bone assemblages that contain dog bones; Museum catalogue number, town and site, the number of dog bones included in the analysis.

Museum number (JS)	Locality	Total number of dog bones	Age	Reference
92	Trondheim, Søndregaten 5	5	–	Archive, University Museum
632	Trondheim, Televerkstomten	13	AD 900–1900	Bergland, 2014. Archive, University Museum
765	Trondheim, Folkebibliotekstomten	5	AD 900–1125 and AD 1225–1475	Lie, 1989. Hufthammer & Walløe, 2013
845	Trondheim, Erkebispegården	25	AD 1537–1660	Hufthammer, 1999. Archive, University Museum
152	Bryggen (1921)	1	Before 1476	Archive, University Museum
355	Bryggen (1956)	1	–	–
375	Bryggen (1505)	4	–	–
380	Bryggen (1958)	8	–	–
386	Bryggen (1958)	1	–	–
387	Bryggen (1958)	3	–	–
397	Bryggen (1959)	556	Medieval (Tua804: 755 ± 70 BP)	Archive, University Museum
401	Bryggen (1960-1)	5	–	–
406	Bryggen (1960-2)	10	–	–
492	Bryggen (1967)	14	–	–
529	Bryggen (1970)	11	–	–
540	Bryggen (1972)	25	c. AD 1100-1350	Archive, University Museum
1442	Bryggen	8	–	–
519	Stavanger, Skagen 3	26	AD 1100–1272	Lillehammer, 1971. Archive, University Museum
1389	Stavanger, Stavanger torg	9	Mostly more recent than 1550	Hufthammer & Walløe, 2013. Archive, Univerisity Museum
1518	Stavanger, 1000–årsstedet, Haakon VII gate	1	–	–
159	Tønsberg, Laurentiuskirken	1	Middle Ages	Archive, University Museum
644	Tønsberg, Baglergaten 3	3	c. AD 1200–1350	Brendalsmo, 1983. Archive, University Museum
664	Tønsberg, Baglergaten 2–4	2	AD 1200–1350	Hufthammer & Walløe, 2013. Archive, University Museum
694	Tønsberg, Øvre Langegaten 57/59	2	c. 14th century – recent	Flodin et al., 1983. Archive, University Museum
599	Oslo, Oslogaten 7, søndre felt	8	c. AD 1050–1624	Molaug, 2002. Archive University Museum
768	Oslo, Kanslergaten 10	3	AD 1200–1350	Lie, 1991.
702, 809	Oslo, Nordre felt I and II	25	c. AD 1050–1500	Hufthammer & Walløe, 2013. Archive, University Museum

2.1 Trondheim

From urban cultural layers in Trondheim, Sør-Trøndelag county 48 bones have been included in the analysis (Table 2.3).

Table 2.3
The Number of different bone elements and total number of dog bones in four medieval bone assemblages from Trondheim.

Museum number (JS)	Cranium	Mandibula	Scapula	Humerus	Radius	Ulna	Femur	Tibia	Sum
92	1	1		2			1		5
632				1	2	4	1	5	13
765				1				4	5
845		5	3	5	4	3	2	3	25
Sum	1	6	3	9	6	7	4	12	48

2.2 Bergen

A total of 647 dog bones from Bergen, Hordaland county have been included in the morphometric analysis. This town has the highest number of excavations where dog bones have been recovered, as well as the highest number of bones that were in good enough condition for morphometric studies (Table 2.4).

Table 2.4
The number of different bone elements and total number of dog bones in 10 medieval bone assemblages from Bergen.

Museum number (JS)	Cranium	Mandibula	Scapula	Humerus	Radius	Ulna	Femur	Tibia	Sum
152	1								1
355	1								1
375	4								4
380	7	1							8
386	1								1
387	1				1			1	3
397	35	78	48	86	74	66	64	105	556
401		3		2					5
406	9	1							10
492	3	4			1	1	1		10
529		2		1	2		4	2	11
540	12	5	1		1	2	2	2	25
1442	7	1							8
Sum	81	95	49	89	79	69	71	110	655

2.3 Stavanger

From medieval cultural layers of the town Stavanger, Rogaland county, a total of 36 bones were suitable for analysis (Table 2.5).

Table 2.5
The number of different bone elements and total number of dog bones in four medieval bone assemblages from Stavanger.

Museum number (JS)	Cranium	Mandibula	Scapula	Humerus	Radius	Ulna	Femur	Tibia	Sum
599	1			3	2		1	1	8
702		3	1	3	2	1	1	4	15
768						1	1	1	3
809	1	1	1	1	2		2	2	10
Sum	2	4	2	7	6	2	5	8	36

2.4 Tønsberg

From the county of Tønsberg, Vestfold County, 8 bones were used for analysis and are displayed in table 2.6.

Table 2.6
The number of different bone elements and total number of dog bones in four medieval bone assemblages from Tønsberg.

Museum number (JS)	Cranium	Mandibula	Scapula	Humerus	Radius	Ulna	Femur	Tibia	Sum
159		1							1
644	1			1	1				3
664	1					1			2
694				1				1	2
Sum	2	1	0	2	1	1	0	1	8

2.5 Oslo

A total of 39 dog bones from Oslo, Oslo County could be used in morphometric analysis (Table 2.7).

Table 2.7
The number of different bone elements and total number of dog bones in four medieval bone assemblages from Oslo.

Museum Number (JS)	Cranium	Mandibula	Scapula	Humerus	Radius	Ulna	Femur	Tibia	Sum
599	1			3	2		1	1	8
702		3	1	3	2	1	1	4	15
768						1	1	1	3
809	1	1	1	1	2		2	2	10
Sum	2	4	2	7	6	2	5	8	36

2.6 The modern comparative material.

Bone elements of modern dog breeds have been measured for the purpose of comparison. The modern dog skeletons that are being used for the comparative analysis are in the modern skeletal collection of the University Museum. The dogs are mainly from Norway and the skeletons have been included in the years 1908–1989. Skeletons and skulls from of 54 individuals, belonging to 20 different types of breeds have been used in this thesis. These breeds represent 4 of the 7 dog breeds that are native to Norway, as well as dog breeds that were commonly found in Norway since the beginning of the 1900s. The morphotypes these modern breeds belong to consists of hunting dogs, herding dogs, working dogs, sporting dogs (retrieving dogs), terriers and lap dogs (Evans, 2013). The material was collected irrespective of age or gender, and was accumulated through donations by private dog owners to the museum, and purchases/exchanges from other museums. A total of 22 dogs from 16 different breeds are represented only by their skull and lower jaw (one individual's breed is unknown), while 32 dogs from 5 different breeds are represented by a complete skeleton (Table 2.8). The breed Buhund is also known as "Norwegian Sheep Dog". The breed Elkhund was known as "Dyrehund" during The Middle Ages. In this thesis the terms "Buhund" and "Elkhund" are being applied. The majority of the dog breeds are represented by a single individual. A complete overview of bones that have been measured is displayed in appendix β.

Table 2.8
The different modern dog breeds that have been used in this thesis for the purpose of comparison, represented by cranium or entire skeleton. *One individual was registered as Norwegian Sheep Dog. **4 of these individuals were registered as Dyrehund. [+]Native to Norway.

Breed	Number of individuals represented by their cranium	Number of individuals represented by their complete skeleton
Black Elkhound[+]		1
Boxer	1	
Buhund*[+]		7
Bulldog	2	
Dachshund	1	
Dalmatian	1	
English Guard Dog	1	
Finnehund		2
Fox terrier	2	
German Shepard	1	
Greyhound	4	
Grey Elkhound**[+]	1	5
Ludehund[+]		15
Mops	1	
Norwegian Harehund	1	
Poodle	1	
Russian Greyhound		1
Scottish Sheep Dog	1	
Silk Poodle	1	
Swedish Foxhound	1	
Unknown	1	
Whipped	1	
Sum	22	32

Besides the Museum's assemblage of modern Norwegian dogs, this thesis uses some of the results from Wagner (1930). The material Wagner studied has been collected from 1847 to 1924 and originates from Norway, Denmark and Germany. Wagner (1930) states that 77 years is a long time in which a particular breed can undergo many changes. However, for the purpose of this thesis it might be positive that his material is dated closer to the Middle Ages than the Norwegian material, as it might help sketch a more complete picture of the plasticity of the dog's form and shape. This thesis uses 17 dog races and consists out of 144 individuals that have been included in Wagner's study (Table 2.9). Because this thesis uses different morphological point of measurements on the cranium than Wagner, only the bones from the limbs have been used. Some of the dogs from Wagner has used in his study come from the Museum's assemblage. However, because Wagner displayed his measurements for multiple dogs of the same breed in averages, it was not possible to find out which bones from the assemblage have been used in that study.

Table 2.9
The number of individuals from the different breeds from Wagner's study (1930) used in this thesis.

Breed	Number of individuals
Boxer	28
Bulldog	6
Dachshound	4
Dingo	2
Doberman Pinscher	6
Dwarf Pinscher	2
Foxterrier	10
German Shepherd	14
Irish Wolfhound	2
Norwegian Harehund	12
Pekinese	4
Pointer	14
Poodle	2
Schnauzer	8
Setter	24
St. Bernard	2
Whippet	4
Sum	144

In addition to these modern dog breeds, 6 skeletons of the modern wolf (*Canis lupus)* from the museum collection have been added to the comparative material. This comparison is only a rough illustration, since modern wolves might differ significantly from wolves that lived during the Middle Ages. It is impossible to say how similar medieval dogs were to medieval wolves based on the comparative assemblages that are used in this thesis. Because there are only 6 individual wolves there is little statistical value in their measurements. This is purely to illustrate that although the wolf and dog share a common ancestor (Wang & Tedford, 2010), dogs from the Middle Ages do not necessarily (if at all) have a closer resemblance to wolves than modern dogs have to wolves.

3. Method

3.1 Selection of the sub-fossil bones

The majority of the bones in the assemblages have been given an ID number during their excavation (appendix α). Bones that have been used in analyses for this thesis have been given an extra ID number to make the graphs easier to read. These "graph IDs" are given anew to each type of bone, and do not carry over between different bones. i.e., an individual with graph ID 1 for the cranium, is not the same individual for graph ID 1 for the Humerus.

The assemblages from Bryggen seemed to have been collected very selectively by the archeologists. As described by Hufthammer (1994:215), the material has not been collected by sieving nor utilization of any other technique that would have allowed the small bones and fragments to be retained. This causes an overrepresentation of large and easily recognizable bones.

Two bones have previously been wrongly identified as dog bones, and turned out to be fox bones.

The excavation JS 397 in Bergen has produced the majority of the dog bones used in this thesis. The number of bones that are useful for morphological studies (complete bones and/or fragments that is- cranial or long bones that can be measured) is rather scarce from the other towns. Because of this, the assemblages from all the 5 medieval towns had to be combined and viewed as a whole in statistical analysis

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3.2 Nomenclature

The anatomical terminology that is used in this thesis to indicate the individual bones (Figures 3.1) are the terms that is being taught at the Veterinarian study at the University of Antwerpen, and the animal anatomy book for veterinarians by Robert Barone (1999). This paper also uses every-day English terms for simplification of certain anatomical features on the head and face of the dog (Figure 3.2).

Fig 3.1 Names on the dog skeleton, edited from Barone (1999: 40).

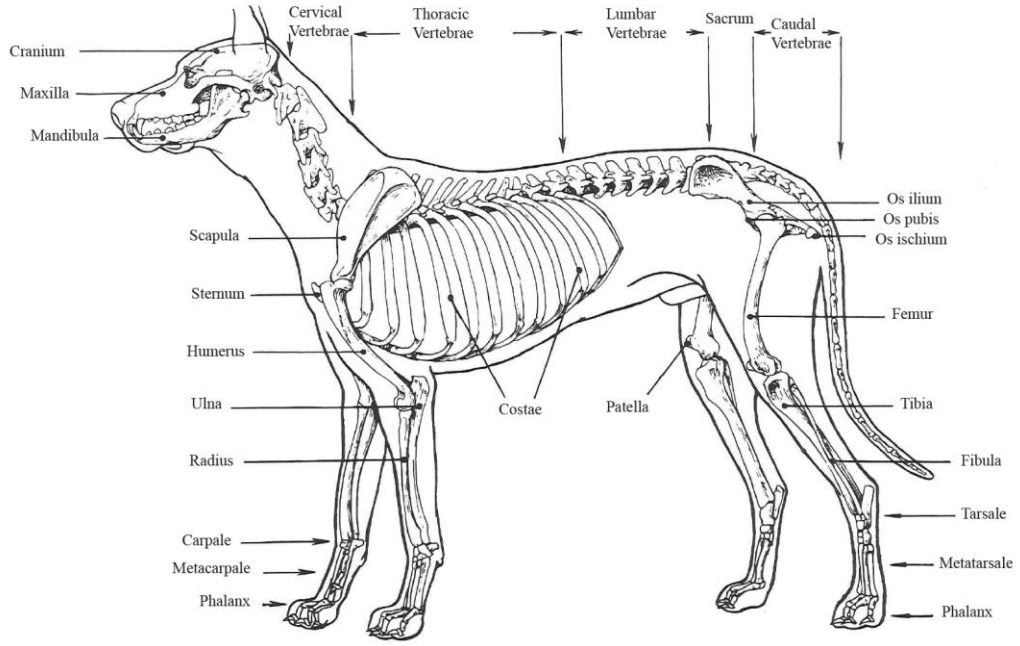
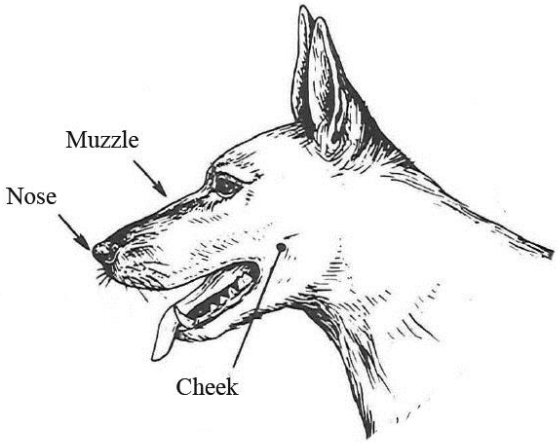


Fig 3.2 Names of the different facial areas on the dog, edited from Barone (1999:28).



3.3 Measurements

All the bones have been measured at points that are being defined by von den Driesch (1976) and Duerst (1930) with a Mitutoyo ABSOLUTE 573 digital sliding caliper or a non-digital cranium clipper in mm, to the nearest of 0.1mm. The bones have been weighed with an Acculab Econ digital scale in grams.

Different cranial ratios and indices have been used to identify morphological groups. Some of these have previously been defined by Harcourt (1974), some have not been previously defined.

Cranium

On complete skulls, a total of 36 craniometric measurements were carried out (Figures 3.3-4). In case of damaged skulls- wherever possible the bilateral symmetry in the anatomy was used to calculate the measurements of missing lateral structures. To compare the similarity between skulls, four cranial indices were, in accordance with recommendations given by Harcourt (1974), and Alpak *et al*. (2004.

Fig 3.3 Craniometric measurements defined by Von den Driesch (1976).
(Left) Dorsal view: Acrokranium (A), Ectorbitale (Ect), Entorbitale (Ent), Nasion (N), Posthion (P), Frontal midpoint (F), Zygion (Zy), 1. Skull length (Acrokranion-Prosthion), 7. Upper neurocranium length (Akrokranion-Frontal midpoint), 8. Viscerocranium lengh (Nasion-Posthion), 9. Facial length (Frontal midpoint-Prosthion), 12. Snouth length (Oral Orbit border-Prosthion), 29. Greatest neurocranium breadth (Euryon-Euryon), 30. Zygomatic breadth (Zygion-Zygion), 31. Least breadth of skull (Frontostenion-Frontostenion), 32. Frontal breadth (Ectorbitale-Ectorbitale), 33. Least breath between the orbits (Entorbitale-Entorbitale).
(Right) Ventral view: Basion (B), Otion (Ot), Prosthion (P), Palatinoorale (Po), Staphylion (St), Synsphenion (S), 2. Condylobasal length (Aboral border of occipital condyles-Prosthion), 3. Basal length (Basion-Prosthion), 4. Basicranial axis (Basion-Synsphenion), 5. Basifacial axis (Synsphenion-Prosthion), 13. Median palatal lengh (Staphylion-Prosthion), 14. Lengh of palatine (Staphylion-Palatinoorale), 15. Length of cheektooth row, 16. Length of molar row, 17. Length of premolar row, 18. Length of the carnassial, 22. Greatest diameter of the auditory bulla, 23. Greatest mastoid breadth (Otion-Otion), 24. Breadth dorsal to the external auditory meatus, 35. Least palatal breadth, 36. Breadth at the canine alveoli. Drawings edited from Von den Driesch (1976).

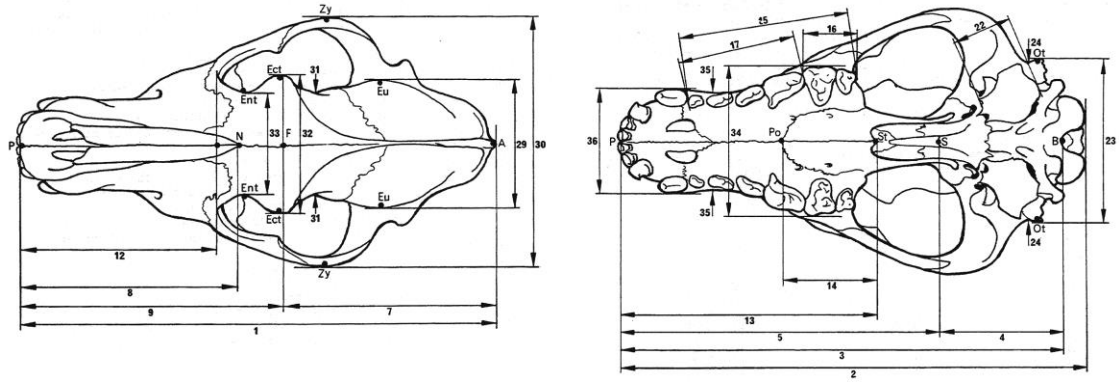
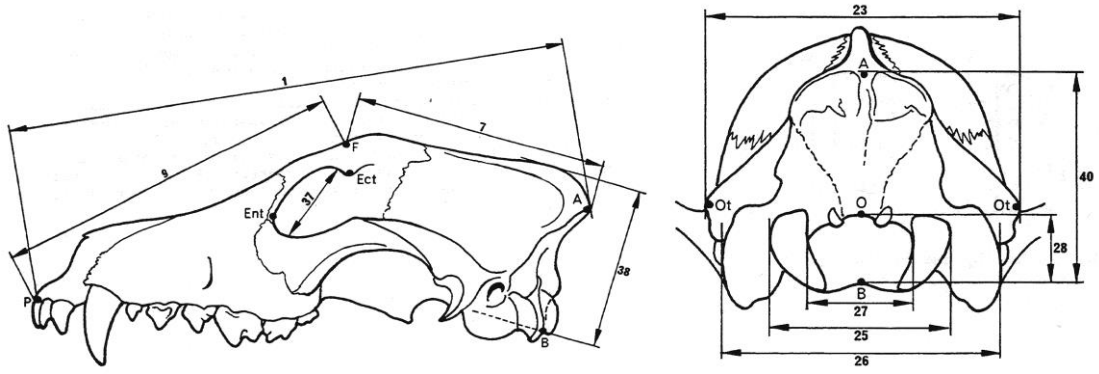


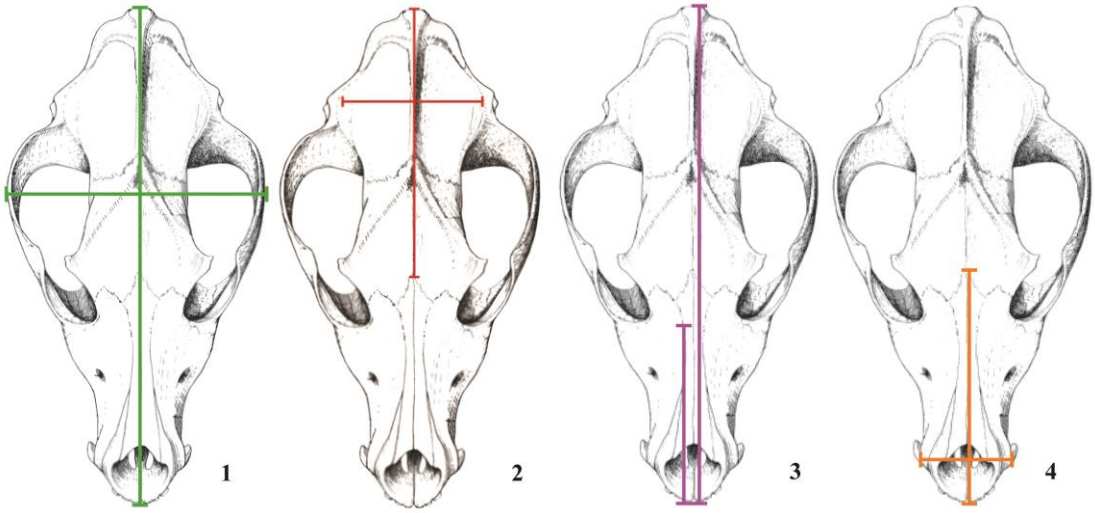
Fig 3.4 Cranometric measurements continued.
(Left) Lateral view: Acrokranion (A), Basion (B), Ectorbitale (Ect), Entorbitale (Ent), Frontal midpoint (F), Posthion (P), 1. Skull length (Acrokranion-Prosthion), 7. Upper neurocranium length (Akrokranion-Frontal midpoint), 9. Facial length (Frontal midpoint-Prosthion), 37. Greatest inner height of the orbit. 38. Skull height (Basioccipital-Highest elevation of the sagittal crest).
(Right) Caudal view: 23. Greatest mastoid breadth (Ostion-Ostion), 25. Greatest breadth of the occipital condyles, 26. Greatest breadth paraoccipital processes, 27. Greatest breadth of the foramen magnum, 28. Height of the foramen magnum (Basion-Opisthion), 40. Height of the occipital triangle (Akrokranion-Basion). Drawings edited from Von den Driesch (1976).



Domestic dog morphology differs more in size and shape than any other species of mammal (Ervynck, 2013; Evans 2013). Especially the skull shows distinct variation in regard to its form and size, and its shape is considered the most important criterion in determining the standard breeds of dogs (Alpak *et al.*, 2004). The skull's indices and ratios have been used for the past century to identify or define morphological types in many studies (Alpak *et al.*, 2004; Brehm *et al*., 1985; Detry & Cardoso, 2010; Drake & Klingenberg, 2008, 2010; Germonpré *et al*. 2009; Hidaka *et al*., 1997; Wagner, 1930)

The calculated ratios and indices (Figure 3.5) of the skull used in this study are: 1. Skull index (SI): Maximum zygomatic width × 100 / Skull length; 2. Cranial index (CI): Greatest neurocranium breadth × 100 / Neurocranium length; 3. Muzzle index (MI): Muzzle length × 100 / Skull length; 4. Muzzle width index (MWI): Maximum canine aveolic width × 100 / Viscerocranial length.

Fig 3.5 Illustration of the calculated cranial ratios and indices. Dorsal view. (1) Skull index, (2) Cranial index, (3) Muzzle index, (4) Muzzle width index. Drawings edited from Evans (2013)



There are three commonly used terms to designate head shapes (Evans, 2013) from the so-called Cephalic Index (Alpak *et al.*, 2004; Harcourt, 1974), which illustrate the ratio between the maximum width of the skull and its maximum length of the neuro-cranium (see skull 2 in figure 3.5). These terms are: dolichocephalic, mesaticephalic, and brachycephalic.

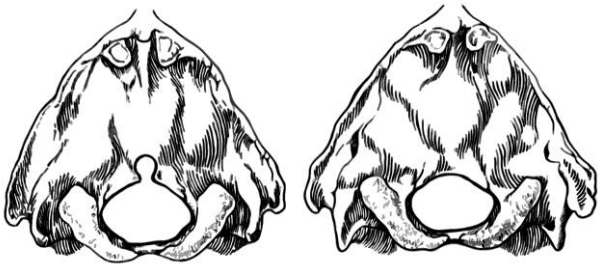
Dolichocephalic (long-headed); the breadth of the skull is less than 75% of the length. Brachycephalic (short-headed); the breadth of the skull is more than 81% of

the length. And mesaticephalic (medium-head); is everything in between Dolicho– and Brachycephalic, normally between 75-81% of the length (Sission, 1975).

The cephalic index is simply the classification of the cephalic ratio. The cephalic ratio is not the same as the craniofacial ratio, which is defined as the measurements of the cranium as compared to the measurements of the face or muzzle. Many papers have confused the cephalic ratio with the craniofacial ratio or the skull index, causing many breeds to be placed into classifications of the cephalic index in which they do not belong, *i.e*. brachycephalic means 'short head' and not 'short face'. Therefore a brachycephalic dog indicates a dog with a short head or short skull, not a short-muzzled dog.

According to Evans (2013:88) a keyhole-shaped notch may be present dorsally in the foramen magnum at the occipital bone (Figure 3.6). This feature is common in the brachycephalic toy breeds and mongrel mesaticephalic dogs (Watson, 1981). In this study, the shape of the foramen magnum has been recorded as one of the cranial measurements.

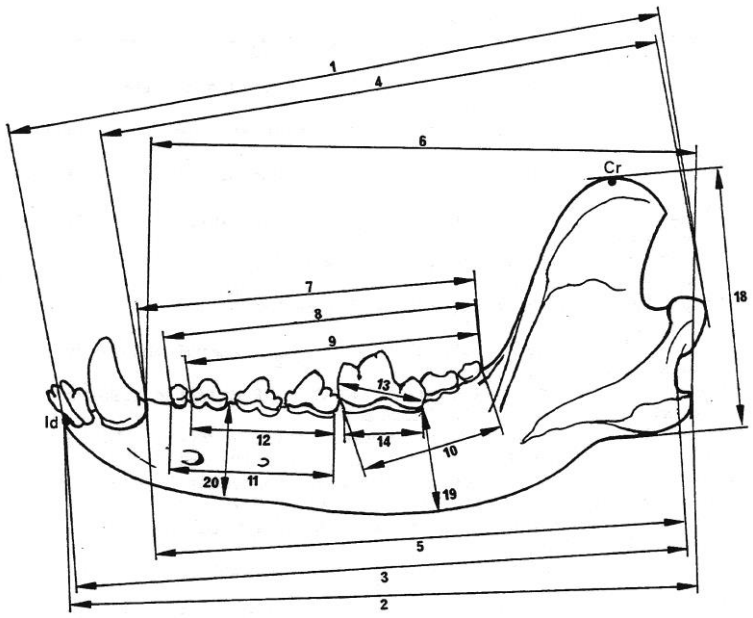
Fig 3.6 Shape of the foramen magnum (caudal view). (Left) shape of a keyhole, (Right) normal oval shape. Drawings edited from Evans (2013).



Mandibula

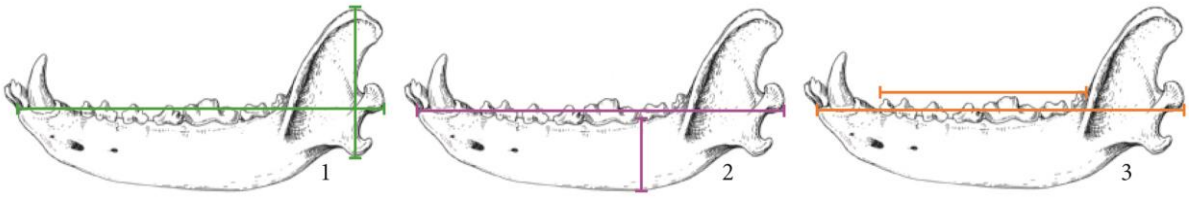
A total of 19 metric measurements were carried out on the mandibula (Figure 3.7). The mandibular indices used to compare the different shape and sizes of the mandibular, have been created by this student for this study (Figure 3.8).

Fig 3.7. Mandibular measurements defined by Von den Driesch (1976).
Lateral view: (Id) Infradentale, (Cr) Coronion.1. Total length (Condyle process-Infradentale), 2. Length (Angular process-Infradentale), 3. Length between the condyle process and angular process-Infradentale, 4. Length (Condyle process-Aboral border of canine alveolus), 5. Length from angular process-aboral border of the canine alveolus, 6. Length (Angular process-aboral border of the canine alveolus), 7. Length (Aboral border M_3- aboral border of the canine alveolus), 8. Length of cheektooth row M3-P1, 9. Length of cheektooth row M_3-P_2, 10. Length of molar row, 11. Length of premolar row P_1-P_4, 12. Length of premolar row P_2-P_4, 13. Length and bread of the carnassial, 14. Length of the carnassial alveolus, 18. Height of the vertical ramus (Basal point of angular process-Coronion), 19 Height of the mandible behind M_1, 20. Height of the mandibule between P_2 and P_3, 21. Height (length) of the canine. Drawings edited from Von den Driesch (1976)



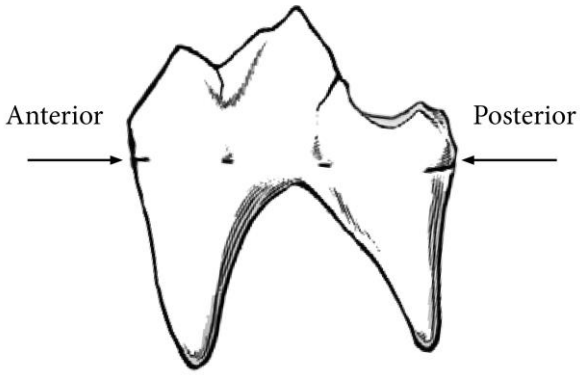
The calculated ratios and indices of the mandibula used in this study are: 1. Coronion index (CoI): Height of the vertical ramus × 100 / maximum length of the corpus mandibularis; 2. Corpus mandibularis index (CMI): Height of the mandible × 100 / Maximum length of the corpus mandibularis; 3. Cheektooth index (CtI): Length of the cheektooth row × 100 / Maximum length of the corpus mandibularis.

Fig 3.8 Mandibular indices (lateral view).
(1) Coronion index, (2) Corpus mandibularis index, (3) Cheektooth index. Drawings edited from Evans (2013).



Where possible the canine teeth were taken from the jaw and the total length have been measured. The fourth premolar in the maxilla (*upper jaw*) and the carnassial (first molar) in the lower jaw were measured at the cingulum (in the anterior-posterior plane) (Figure 3.9).

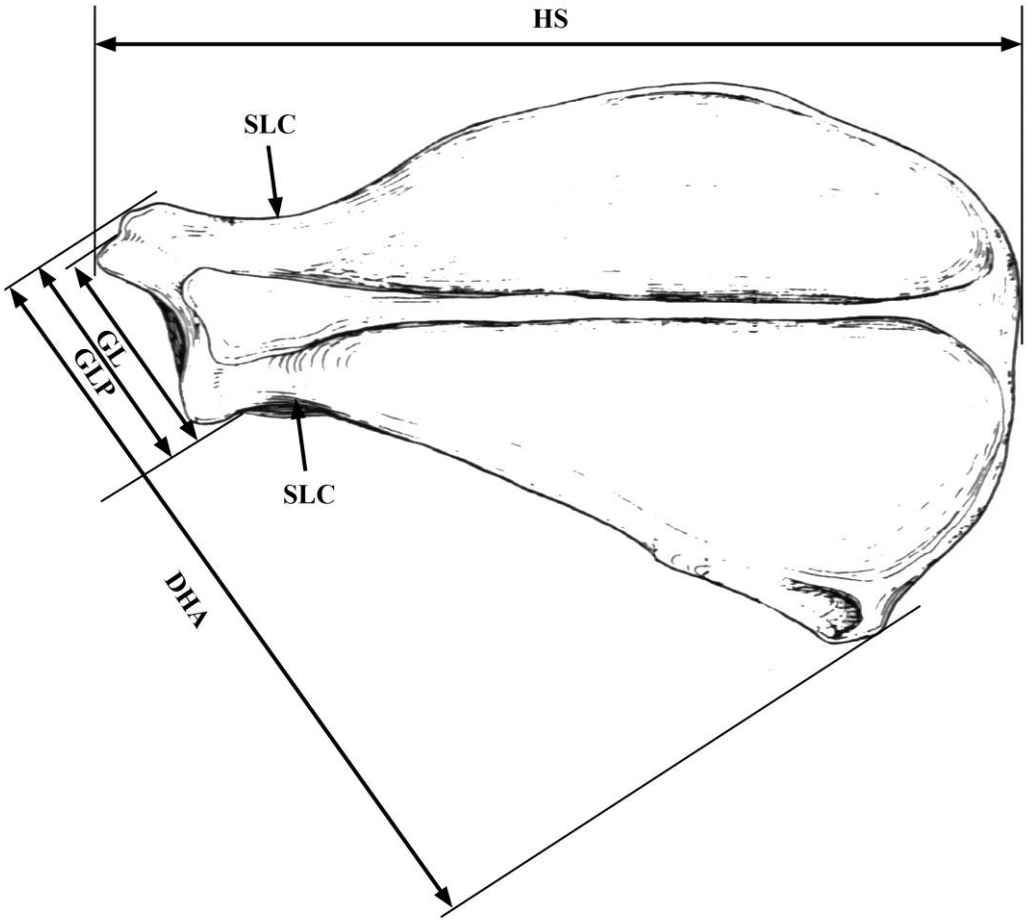
Fig 3.9 Carnassial (the first molar in the mandibula). Drawing by Knoest, J.J.T.



Scapula

A total of 6 metric measurements were carried out on the scapula for (Figure 3.10).

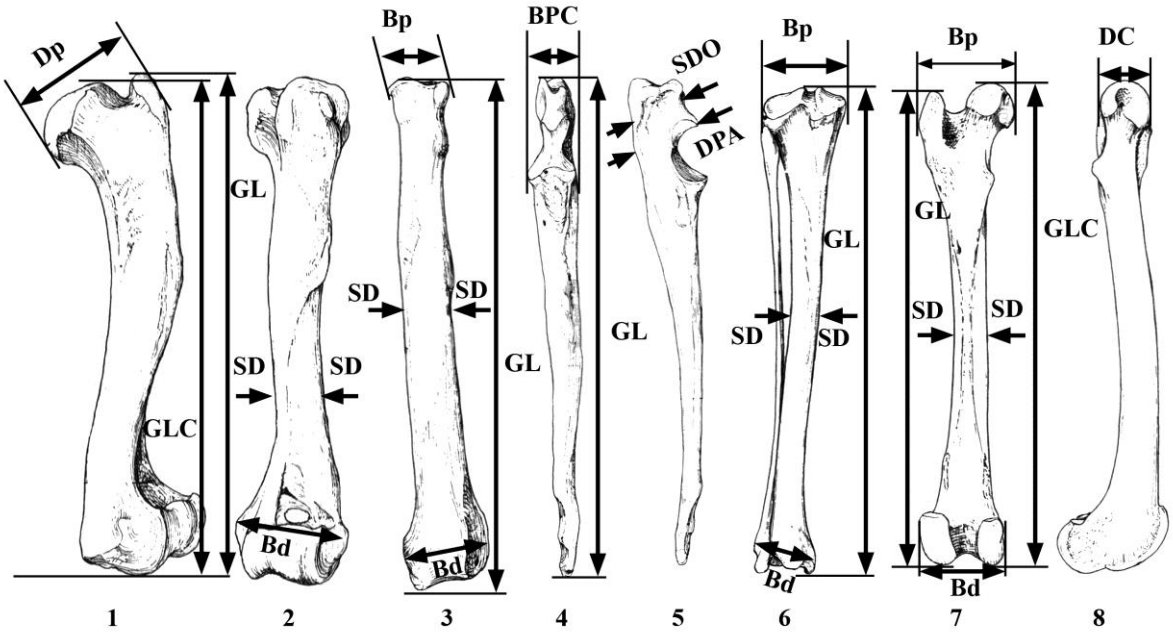
Fig 3.10. Scapular measurements defined by Von den Driesch (1976).
(HS) Longest height along the spine, (DHA) Diagonal height from most distal point to the thoracic angle, (SLC) Smallest length of the Collum scapulae, (GLP) Greatest length of the Processus articularis, (LG) Length of the glenoid cavity, (BG) Breadth of the glenoid cavity (not in figure). Drawing modified from Evans (2013). Drawing edited from Evans (2013).



Long bones

The long bones that have been measured are the Humerus, Radius, Ulna, Femur and the Tibia. A total of 23 measurements have been registered (Figure 3.11).

Fig 3.11. Long bones measurements defined by Von den Driesch (1976).
(1) Humerus: left side, medial view. (GL) Greatest length, (GLC) Greatest length from caput, (Dp) Depth of proximal end. **(2) Humerus**: left side, cranial view. (SD) Smallest breadth of diaphysis, (Bd) Greatest breadth distal end. **(3) Radius**: left side, dorsal view. (GL) Greatest length, (Bp) Greatest breadth proximal end, (SD) Smallest breadth diaphysis, (Bd) Greatest breadth distal end. **(4) Ulna**: left side, dorsal view. (GL) Greatest length, (BPC) Greatest breadth across coronoid process. **(5) Ulna**: left side, medial view. (SDO) Smallest depth of the olecranon, (DPA) depth across the Processus anconaeus. (6) Tibia: left side, caudal view. (GL) greatest length, (Bp) greatest breadth proximal end, (SD) Smallest breadth of diaphysis, (Bd) Greatest breadth distal end. (7) Femur: (GL) Greatest length, (GLC) Greatest length from caput femoris, (Bp) Greatest breadth proximal end, (DC) Depth of the caput femoris, (SD) Smallest breadth diaphysis, (Bd) Greatest breadth distal end. Drawings are modified from Evans (2013).



The measurements that have been used in analysis are the greatest length of all the long bones, the greatest breadths at the proximal and distal ends and the smallest breadth of the diaphyses. Only the greatest length has been used in analysis for the Ulna in this study.

3.4 Data recording

For this thesis, I have created special worksheets in order to make the process of recording important information from each bone easier and more efficient (see Appendix γ). Each bone type has its own worksheet. One worksheet is used per individual bone.

Each sheet has a section where administrative information about the bone can be filled out as well as the condition of the bone, i.e. weight, whether it is complete, fully grown, or has been damaged. The sheets have drawings of the respective bone types, composited and edit from Barone (1999), Evans (2013) and sketches made by this student (Knoest, J.J.T). Each drawing is seen from–either or all–cranial, caudal, lateral, medial, dorsal and ventral points of view. The drawings represent an average size dog, as they are used in biology and veterinarian anatomy books. The pathological and mechanical traits can be drawn into these images of the bone, which helps the researcher later to quickly go over the recorded data and pull up any bones that stood out.

Different points of measurements have been displayed and can be filled out, as well as extra points of measurements taken by the researcher as he or she sees fit. Again these help the researcher to be more efficient in transferring the data to a digital database.

Finally the abbreviations of all the points of measurement are located on the back of each schedule. Figures 3.12-13 are an example of such a schedule.

I have found that the use of these schedules greatly increased the speed at which the material could be identified, and studied. It will also increase the speed at which the recorded measurements can be transferred to the computer. The physical papers, and the scanned documents will most likely improve the transference of the data to other researchers, making it easier and quicker to work through the material and being able to select bones that stand out or are important to further research.

Fig 3.12 (front) Example schedule of the Humerus made by Knoest, J.J.T., for the simplification of data recording of osteological material.

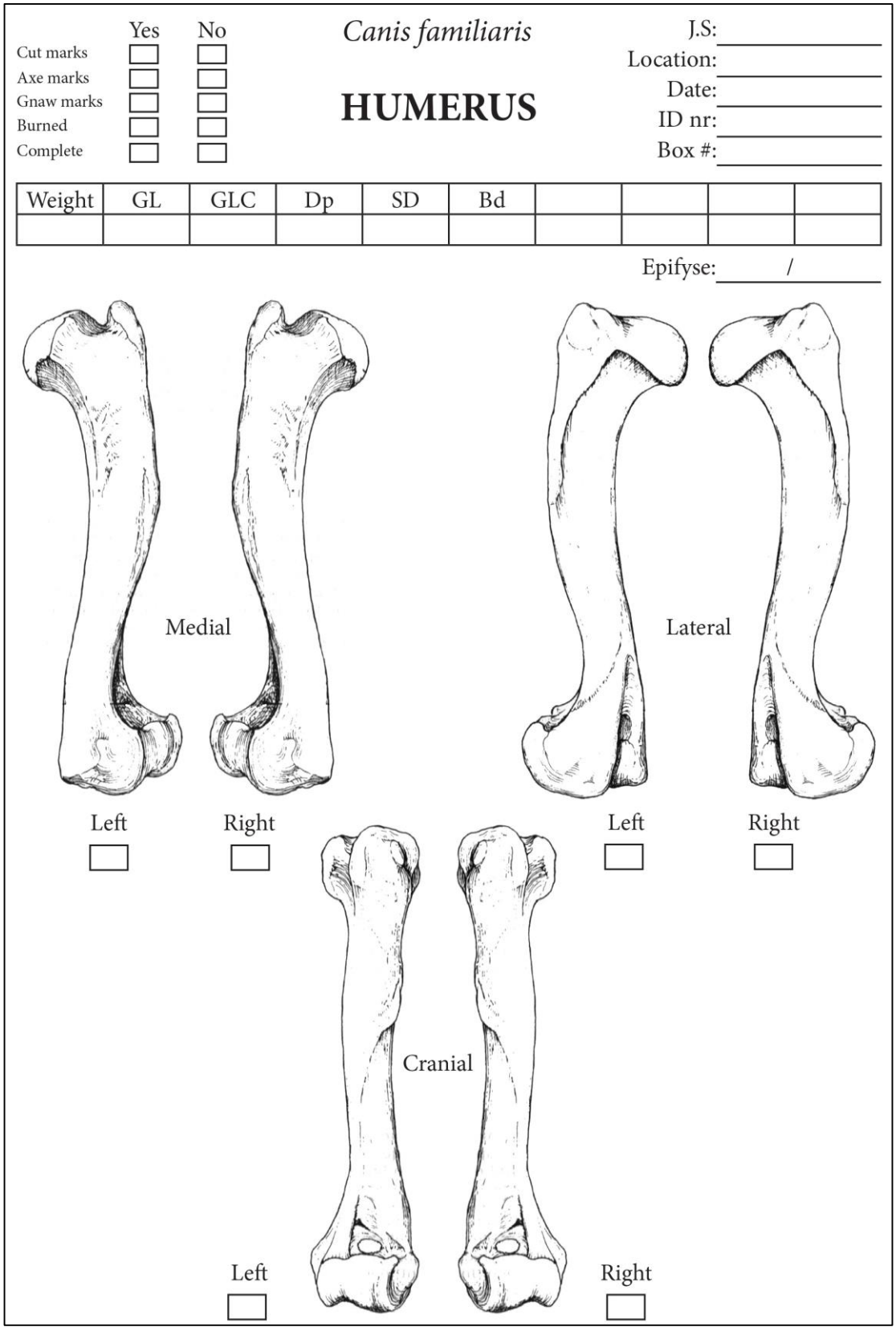


Fig 3.13 (Back) Example schedule of the Humerus made by Knoest, J.J.T., for the simplification of data recording of osteological material. Explanation of the abbreviations used on the front.

Humerus:

GL)	– Greatest length
GLC)	– Greatest length from caput
Dp)	– Depth of the proximal end
SD)	– Smallest breadth of diaphysis
Bd)	– Greatest breadth of the distal end

An estimation of the shoulder height has been calculated based on the length of the Humerus, Radus, Ulna, Femur, Tibia and indexes given by Harcourt (1974), Onar & Belli (2005).

Humerus	(3.43 × tl) – 26.54	Femur	(3.14 × tl) – 12.96
Radius	(3.18 × tl) + 19.51	Tibia	(2.92 × tl) + 9.41
Ulna	(2.78 × tl) + 6.21		

*tl = total length of the bone

However, these estimates cannot be used reliably on immature individuals – that is bones with missing or unfused epiphysis. They also do not differentiate between races that have different ratios between the different parts of the limbs, and they can't be used accurately to calculate the height of dogs with extremely small or bowed limbs (Hufthammer, 1994; Vellanoweth, 2008). These formulas will be used only to give a rough indication of shoulder height.

3.5 Age determination

When possible, age has been determined on the basis of the degree of ossification of the diaphysis and epiphyses in the long bones (Barone, 1999, Moyes, 2008, Reitz, 2008), as well as the tooth eruption, state of the incisors, coloring of the molars and the degree of fusion of the cranial sutures. Bones from juvenile dogs with loose or missing epiphysis have been omitted from this thesis. This is because analyzing these bones would have required more knowledge on the development of different dog races, which is not the focus of this study.

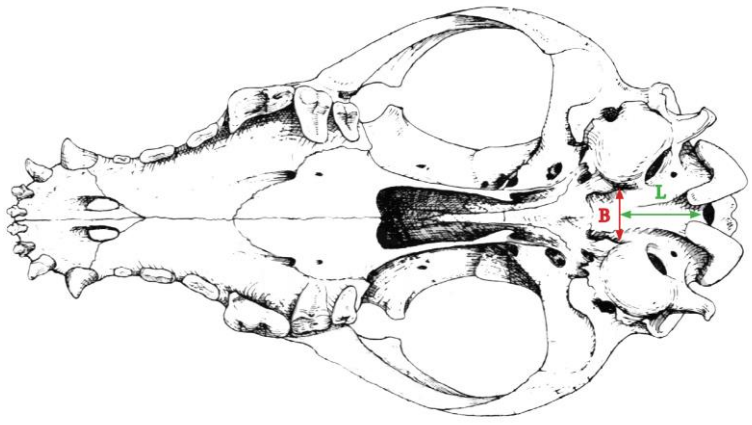
Coefficient of variance tests of modern comparative material (both dog and wolf) has shown that if juveniles are included in a group, the analysis will show that the group is heterogeneous even though all the individuals belong to the same breed. When juvenile individuals were not included in the analysis, the group would be homogeneous. This is because a juvenile dog is still growing in size, and some features in the skull and face are not fully grown yet, and may therefore display different features from its adult version.

3.6 Gender determination

Male dog have a baculum (*penile bone*), and when present their sex can be easily identified. However baculum are very rarely found in sub-fossil assemblages. The baculum is a non-appendicular bone and might be easily separated from the carcass through weathering and/or by scavengers. Sometimes they are missing due to dog being skinned, they are removed as they follow the skin (Hufthammer, correspondence).

Trouth *et al*. (1977), have devised a morphometric index for determining the sex of a dog–besides determining the presence or absence of a baculum–based on the form of the skull. Measuring the basioccipital region between the basion, to a line joining the medial points of the two tympanooccipital fissures (cited in Evans 2013) will give the two measurements used in the formula. The formula to the sex index is: (Breadth x 100)/Length. If this is less than 123 the individual is Male. If it's more than 136 the individual is Female. If the index is between 123 and 136 the individual is either juvenile or castrated. Where breadth (B) is the distance between the two tympanooccipital fissures at their most lateral points, and the length (L) is the distance from the basion to the midpoint of the line between the two most medial points of the tympanooccipital fissures as displayed in figure 3.14. When the gender resulted in juvenile or castrated, these specimens were considered to be castrated dogs because of the state of the cranial sutures and tooth eruption, and they have been included in the morphometric analyses.

Fig 3.14. The points of measurements for the gender formula by Trouth et al. (1977) (ventral view). Modified from Evans (2013).



Most of the pelvis bones in the assemblages were available were not fused at the symphysis, therefore conventional means of determining the sex of the dog; by looking at the apertura pelvis caudalis that is formed by the ilium, the pubis and os sacrum (Evans, 2013), could not be done.

3.7 Statistical analysis

For statistical computation the statistical program ‘R’ and ‘Rstudio’ have been used, simple statistics and creation of graphs have been done in ‘Microsoft Excel’. Statistics such as F-test (Sokal & Rohlf, 1969), and the Coefficient of Variation (Simpson, Roe & Lewontin, 1960) have been used. All tests have a rejection level of 0.05 where $p<0.05$ means there is a significant difference, with $p<0.01$ as the highest significant difference.

4. Results

4.1 Description of individuals in the material

A total of 437 individuals could be been calculated for the 778 bones that were used in the analyses (Tables 4.1-2).

Table 4.1 The minimum number of individuals (MNI) for the adult, juvenile or unknown age groups. As well as the percentage each group and each JS represents in the total.

Commune	Museum number (JS)	MNI Adult	Juvenile	Unknown	Sum	%
Trondheim	92	1	1		2	0.4
	632	4			4	0.9
	765	2	1		3	0.7
	845	4	2	1	7	1.5
Bergen	152	1			1	0.2
	355	1			1	0.2
	375	4			4	0.9
	380	7			7	1.5
	386	1			1	0.2
	387	3			3	0.7
	397	263	69	18	350	76.6
	401		3		3	0.7
	406	6	1	2	9	2.0
	492	2	1	1	4	0.9
	529	2	1	1	4	0.9
	540	10	1	2	13	2.8
	1442	6		1	7	1.5
Stavanger	519	3	1	6	10	2.2
	1398	2	1		3	0.7
	1518			1	1	0.2
Tønsberg	159	1			1	0.2
	644	1			1	0.2
	664	1		1	2	0.4
	694	1			1	0.2
Oslo	599	2			2	0.4
	702	3	2	3	8	1.8
	768	2			2	0.4
	809	1	1	1	3	0.7
Sum		334	85	38	437	100
%		73.1	18.6	8.3	100	

Museum number (JS) 92 Søndre gate 5 (Trondheim): one adult that was represented by more than one bone.

Museum number (JS) 632 Televerkstomten (Trondheim): one adult that was represented by more than one bone.
Museum number (JS) 845 Erkebispegården (Trondheim): one individual that was ≥ 8 < 12-15 months old that was represented by more than one bone.

Museum number (JS) 397 Bryggen (Bergen): six adults, one individual that was ≥ 9-10 months old and two individuals that were ≥ 7-10 months old that were represented by more than one bone.
Museum number (JS) 540 Bryggen (Bergen): three adults (one of which could be identified as female) that were represented by more than one bone.
Museum number (JS) 540 Bryggen (Bergen): one adult that was represented by more than one bone.

Museum number (JS) 519 Skagen 3 (Stavanger): one adult that was represented by more than one bone.

Museum number (JS) 702 Gamlebyen, Nordrefelt 2 (Oslo): one individual that was ≥ 10-12 < 15 months old that was represented by more than one bone.
Museum number (JS) 768 Kanslergaten. 10 (Oslo): one adult that was represented by more than one bone.

Table 4.2
Total minimum number of individuals per town.

Location	Minimum number of individuals
Trondheim	16
Bergen	407
Stavanger	14
Tønsberg	5
Oslo	15

4.2 Cranium

Out of a total of 107 cranial elements and complete skulls, 37 skulls were complete or complete enough to be used in morphometric analysis: of which 1 was excavated from Tønsberg, 34 from Bergen, 1 from Trondheim, and 1 from Oslo. Because of the low numbers of skulls from Tønsberg, Trondheim and Oslo, all the medieval skulls will be grouped together in the analysis.

The ratios and indices of the medieval skulls have been recorded in table 4.3. The *Graph ID* numbers given to them in the table is to clarify the graphs. Their mean, standard deviation, minimum and maximum values and their coefficient of variance have been displayed in table 4.4.

Table 4.3 Skull indices and ratios in all complete medieval dog skulls in this study.
Dolichocephalic (long headed), Mesaticephalic (medium headed), Brachycephalic (short headed).
SI=Skull index, CI= Cranial index, MI=Muzzle index, MWI=Muzzle width index.
** Dogs with a keyhole shaped foramen magnum. – Missing data, due to a missing measuring point.

Commune	Museum number (JS)	Archaeological ID	Graph ID	Skull Type	SI	CI	MI	MWI	Skull length
Tønsberg	644	USB/A 194	36	Dolicho-	54.67	57.57	41.69	39.59	189.5
	355		1	Mesa-	61.40	80.17	37.69	43.22	110.1
	375	3030	28	Mesa-	61.87	77.34	40.19	39.75	116.7
	375	3030	3	Dolicho-	54.34	58.79	43.68	37.21	186.8
	380	11106	10	Brachy-	39.09	116.89	38.28	43.65	123.3
	380	10402	13	Brachy-	38.27	102.28	41.46	40.37	141.1
	380	10410	8**	Brachy-	36.72	108.79	39.42	40.69	144.6
	380	10404	4**		36.73		39.32	42.53	150.3
	380	10107	32	Dolicho-	55.58	63.66	42.24	36.07	160.5
	380	10040	18	Dolicho-	55.20	55.47	43.43	41.88	212.3
	386	B565	23	Brachy-	30.52	105.05	41.94	41.57	174.3
	397	20014	30		57.96		41.53	36.49	154.6
	397	18202	20	Dolicho-	53.38	66.10	41.67	38.15	159.6
	397	21888	17		51.90		44.14	34.74	168.8
	397	20253	14	Dolicho-	20.38	53.71	43.64	38.58	194.3
Bergen	406	21287	19		61.12		41.40	39.54	126.8
	406	19325	24		58.16		39.14	42.22	136.7
	406	20433	22	Dolicho-	59.64	69.57	39.38	42.68	142.7
	406	22064	16	Dolicho-	58.60	66.05	42.15	36.20	145.9
	406	21644	7	Dolicho-	58.03	62.89	39.78	41.87	155.6
	406	21350	12		54.51		45.74	43.90	160.7
	406	20433	29**	Dolicho-	55.76	59.04	42.04	37.28	172.7
	406	21546	9	Dolicho-	55.65	61.07	43.04	39.64	175.2
	406	20825	6	Dolicho-	58.90	59.70	43.18	41.36	187.6
	540	81396	21**		62.62		34.48	45.08	113.7
	540	79893	15	Mesa-	59.85	75.35	40.84	40.47	144.7
	540	79893	27	Dolicho-	56.94	60.00	42.03	38.86	154.9
	540	80759/01	25	Dolicho-	53.25	63.14	43.39	38.35	172.4
	540	80251	11	Dolicho-	57.48	61.76	39.78	39.21	175.7
	540	81197	2**	Dolicho-	57.25	57.74	42.08	35.29	180.6

	1442	77777	34		41.54		37.97	43.86	125.9
	1442	55816	26	Brachy-	28.48	103.70	44.03	34.64	180.1
	1442	45261	33	Brachy-	29.74	108.79	43.98	38.31	196.7
	1442	44932	31	Brachy-	28.49	101.42	43.96	35.22	212.7
	1442	45248	5**	Brachy-	25.67	99.28	43.68	32.25	250.9
Trondheim	92		37	Dolicho-	53.84	64.00	41.73	38.31	194.1
Oslo	599		35	Brachy-	33.48	108.31	42.97	34.50	162.2

Table 4.4 Descriptive statistical data of the medieval dog cranium.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance values of all skull indices and ratios.
SI=Skull index, CI=Cranial index, MI=Muzzle index, MWI=Muzzle width index.
*Values lower than 10 indicate that these ratios and indices belong to individuals from a homogenous group, and that there is little variety between the measured structures.

	SI	CI	MI	MWI	Skull Length
N	37	29	37	37	37
Mean (μ)	56.24	76.81	41.54	39.29	39.29
SD (σ)	6.07	21.00	2.29	3.15	3.15
Min.	26.81	53.71	34.48	32.25	32.25
Max	63.14	116.89	45.74	45.08	45.08
Cv	10.80	27.34	5.50*	8.01 *	8.01*

Not every measurement that has been used for the medieval bones were taken on the skulls on the recent comparative skeletal material. Therefore, only the skull index, muzzle index and muzzle width index are used for comparison and are displayed in table 4.4. For dog breeds that were represented by 5 individuals or more only minimum, maximum and average value are shown. These were: the Buhund, Elkhound, Greyhound and Lundehund. Their mean, standard deviation, minimum and maximum values and their coefficient of variance have been displayed in table 4.5. The cranial indices and ratios of the modern wolf are shown in tables 4.6-8.

Table 4.5 Skull indices and ratios of modern comparative dog breeds.
SI=Skull index, MI=Muzzle index, MWI=Muzzle width index.
– Missing data, due to a missing measuring point.

Dog Breed	ID	SI	MI	MWI	Skull Length
Big Engelsk Guarddog	30	51.36	42.93	35.89	227.8
Boxer	17	66.63	39.14	43.30	175.0
Buhund	15	58.80	42.07	39.43	162.9
Buhund	10	55.49	39.73	36.74	153.7
Buhund	18	61.26	42.94	40.26	177.8
Bulldog	11	79.08	30.78	59.94	158.2
Bulldog	14	75.05	31.30	68.23	162.3
Dachshund	9	61.01	39.19	41.66	152.6
Dalmatian	12	61.75	38.38	41.37	160.0
Eldre Svensk Støver	27	52.02	42.88	41.59	205.7
Elkhound	20	56.10	43.88	38.37	184.9
Elkhound	16	53.68	41.47	36.55	166.2
Elkhound	24	62.70	50.06	39.58	202.0
Finnehund	21	57.19	41.74	41.51	187.1
Finnehund	22	57.00	42.84	–	187.2
Foxterrier	6	59.29	39.35	42.48	132.9
Foxterrier	7	57.88	41.55	36.73	138.4
Greyhound	23	50.37	45.84	33.12	201.7
Greyhound	13	45.73	44.83	30.57	161.2
Greyhound	28	53.22	48.43	35.01	221.5
Harehund	25	51.60	41.04	37.18	202.0
Litle Silkpoodle	3	63.35	35.86	42.70	125.5
Lundehund	5	59.09	38.68	43.15	129.4
Lundehund	1	56.04	37.17	40.28	107.6
Lundehund	8	63.09	40.34	46.43	140.8
Mops	2	82.43	30.14	77.35	113.8
Russian Greyhound	31	40.79	48.39	27.47	242.0
Scottish Sheep Dog	29	46.94	45.68	28.45	222.0
Whippet	4	54.31	39.42	43.34	127.6
Wired Haired Poodle	19	53.17	41.80	43.80	183.0
Unknown	26	–	42.84	37.95	204.5

Table 4.6 Descriptive statistical data of the cranium of modern comparative dog breeds.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance values of all skull indices and ratios.
SI=Skull index, MI=Muzzle index, MWI=Muzzle width index.

	SI	MI	MWI	Skull Length
N	30	31	30	31
Mean (μ)	8.21	40.99	41.68	171.52
SD (σ)	9.02	4.71	10.39	35.17
Min.	40.79	30.14	27.47	107.60
Max	82.43	50.06	77.35	242.00
Cv	15.50	11.48	24.94	20.51

Table 4.7 Skull indices and ratios of modern comparative wolf.
SI=Skull index, MI=Muzzle index, MWI=Muzzle width index.

Museum ID.	Graph ID	SI	MI	MWI	Skull Length
B.2600	1	59.83	47.01	37.73	235.50
B.10	2	54.82	41.13	41.18	241.70
	3	56.52	43.77	38.96	242.40
BM.437	4	56.29	42.58	37.87	267.70
BM.3542	5	53.58	43.75	35.50	269.50
	6	56.57	41.92	39.85	272.40

Table 4.8 Descriptive statistical data of the cranium of modern wolf.
N is the total number of specimens, mean, ± SD, min, max and coefficient of variance values of all skull indices and ratios.
SI=Skull index, MI=Muzzle index, MWI=Muzzle width index.
*Values lower than 10 indicate that these ratios and indices belong to individuals from a homogenous group, and that there is little variety between the measured structures.

	SI	MI	MWI	Skull Length
N	6	6	6	6
Mean (μ)	49.09	38.02	33.87	219.31
SD (σ)	2.11	2.06	1.96	16.67
Min.	53.58	41.13	35.50	235.50
Max	59.83	47.01	41.18	272.40
Cv	4.29*	5.42*	5.79*	7.60

The Cranial indices and ratios illustrate that there are significant differences between the medieval dog skulls and the dog skulls of the modern collection (table 4.9). The skull length is not significantly different between the medieval bones and the modern material ($F = 1.37$, $p < 0.01$). However, there is a significant difference between the skull index ($F = 3.92$, $p < 0.01$), muzzle index ($F = 4.49$, $p < 0.01$) and also for the muzzle width index ($F = 11.24$, $p < 0.01$).

Table 4.9 F-test for variance between the cranial ratios and indices between the medieval material and the modern dog and modern wolf comparative material. *$p < 0.01$, ^{NS} Not significant

Assemblages		Medieval bones from the Middle Ages			
	Indices	SI	MI	MWI	Skull length
Modern dog	F-Test	3.92*	4.49*	11.24*	1.37^{NS}
Modern wolf	F-Test	8.32^{NS}	1.23^{NS}	2.58^{NS}	3.35^{NS}

Previous studies (Wagner 1930; Stockhaus 1965; Wendt 1978; Harcourt 1974) have found the dogs in the Viking and early medieval period to have relatively long muzzles, and that in comparison, dogs from the Anglo-Saxon period (AD 500-1100) have less variation on the shape of their skulls. A previous study by Hufthammer (1994:227) on dogs from Bryggen has shown that although the skulls were relatively long and narrow, there were a few individuals from Bryggen that had much broader and shorter muzzles than the majority of dogs from that assemblage. Figures 4.1-4 illustrate the indices from the bones displayed in tables 4.3, 4.5 and table 4.7.

Figure 4.1 shows that although the majority of skulls are long and narrow, it is possible to discern different groups within the material from Bergen. The two skulls from Tønsberg (skull no.36) and Trondheim (skull no.37) as well as skulls no.21, 23 and 24 from Bergen is quite similar in both size and shape. They most likely belong to the same type of dog. Whereas the one skull from Oslo (skull no .35) has an average muzzle in length but is relative broad and is relatively short. Individuals 23, 26, 31 and 33 from Bryggen have similar shaped skulls.

This shows that geographically the same dog types that were kept in Tønsberg, Trondheim and Oslo were also kept in Bergen.

Fig 4.1 The skull–, muzzle length and muzzle width indices for 37 crania of the medieval dog skulls. Trondheim is grey, Bergen is black, Tønsberg is purple and Oslo is green. The numbers for each graph is referring to the site number (upper) and skull number (lower) respectively.

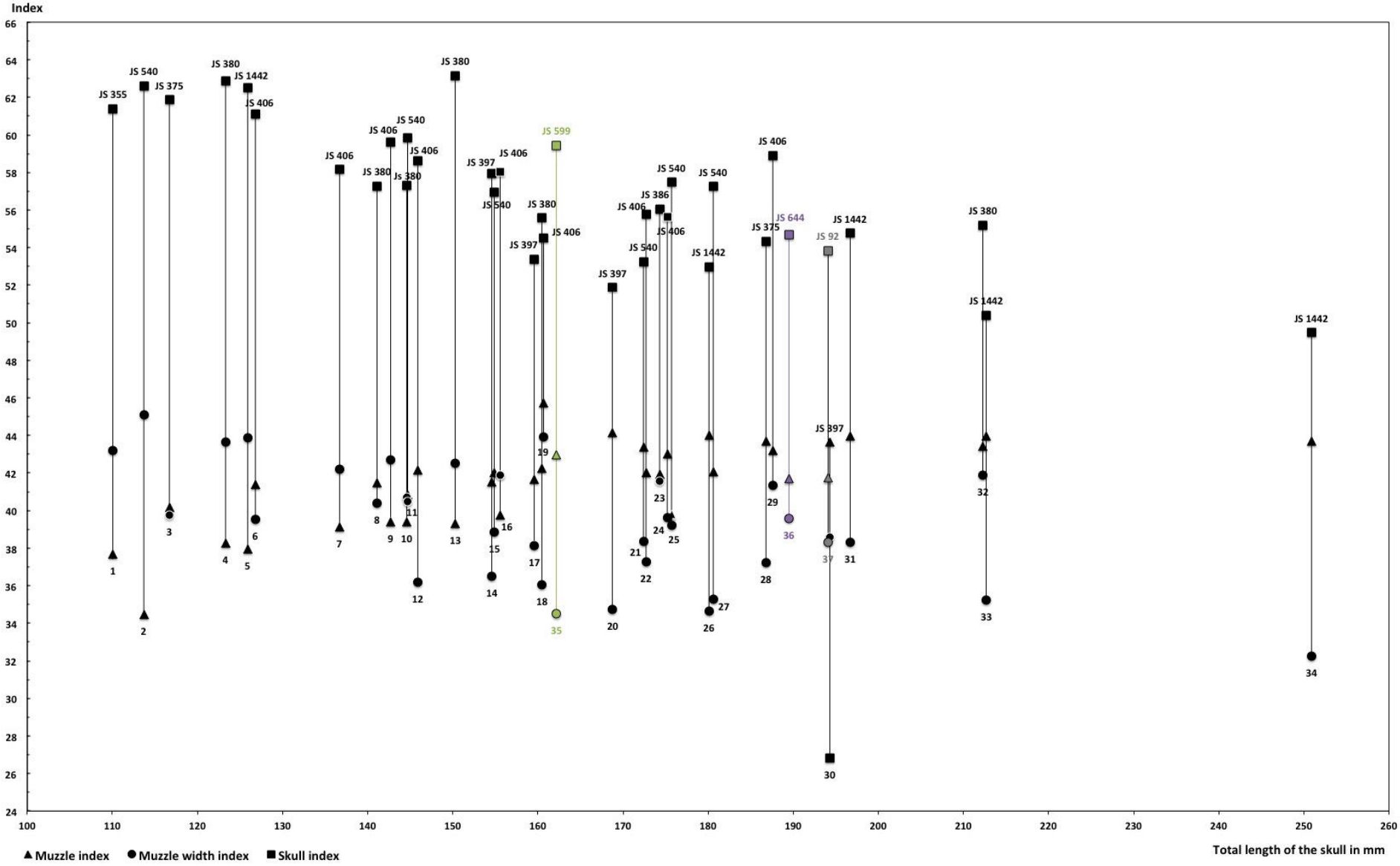


Fig 4.2 The skull–, muzzle length and muzzle width indices for the 31 crania of modern dogs and 6 crania of modern wolf. Modern dog is navy blue, and modern wolf is red. The numbers for each graph is referring to the skull number (lower).

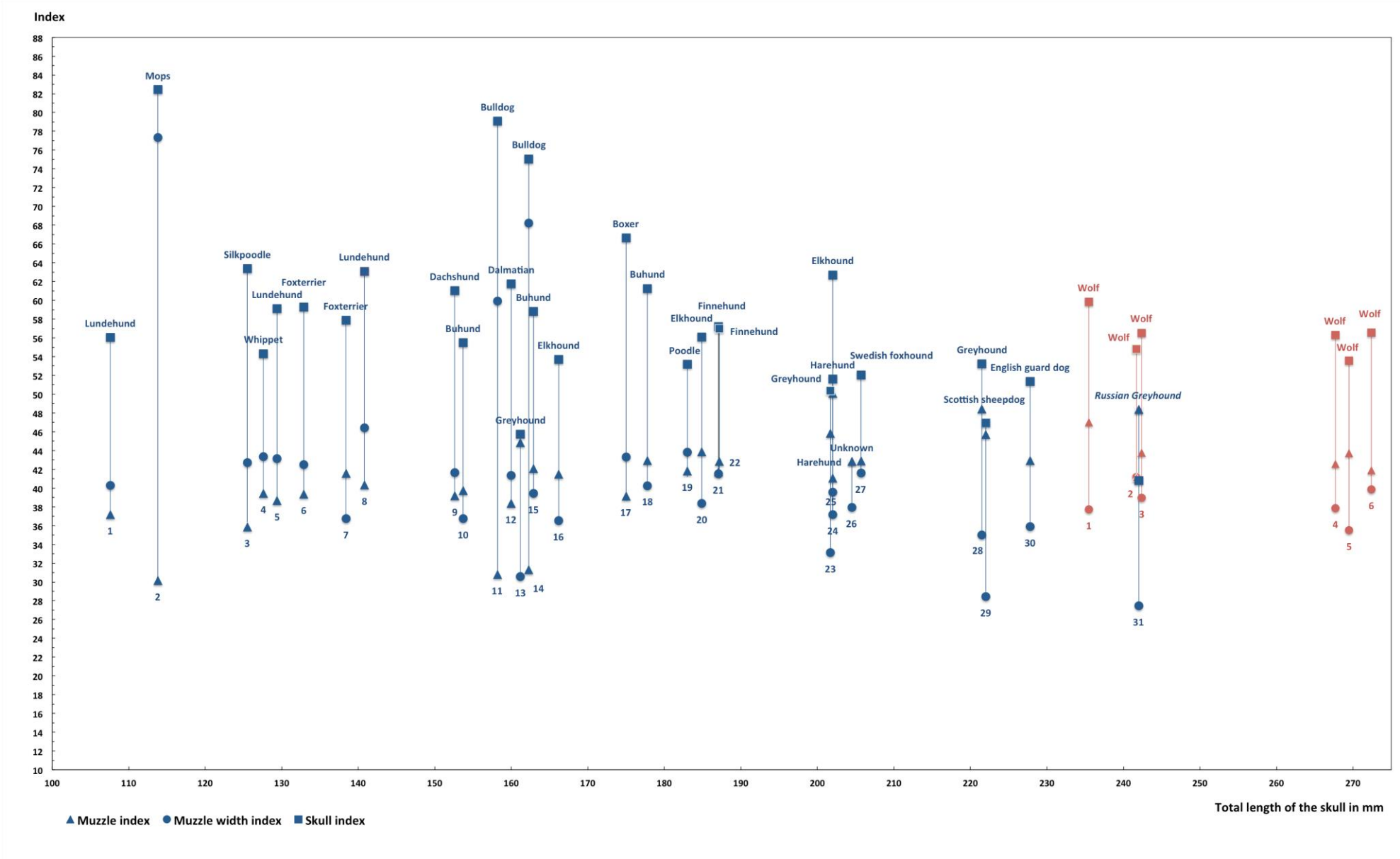


Fig 4.3 The skull–, muzzle length and muzzle width indices for the 37 crania of the medieval dogs, the 31 crania from modern dogs and 6 crania from modern wolf. The medieval dog bones are black, the modern dog bones are navy blue, and modern wolf bones are red. The numbers for each graph is referring to the skull number (lower).

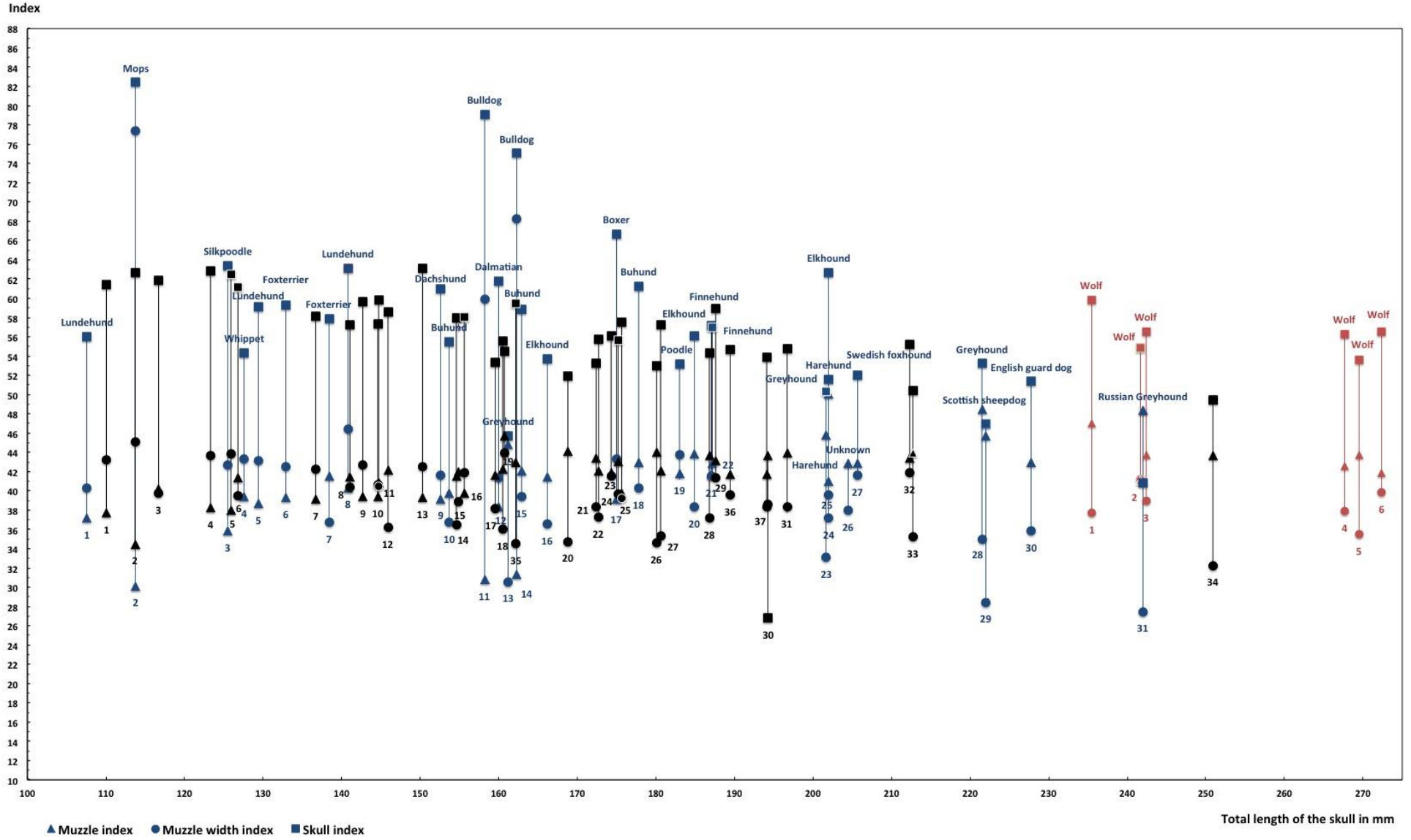


Fig 4.4 Scatterplot with regression lines for the skull indices for the 37 crania of the medieval dog skulls.

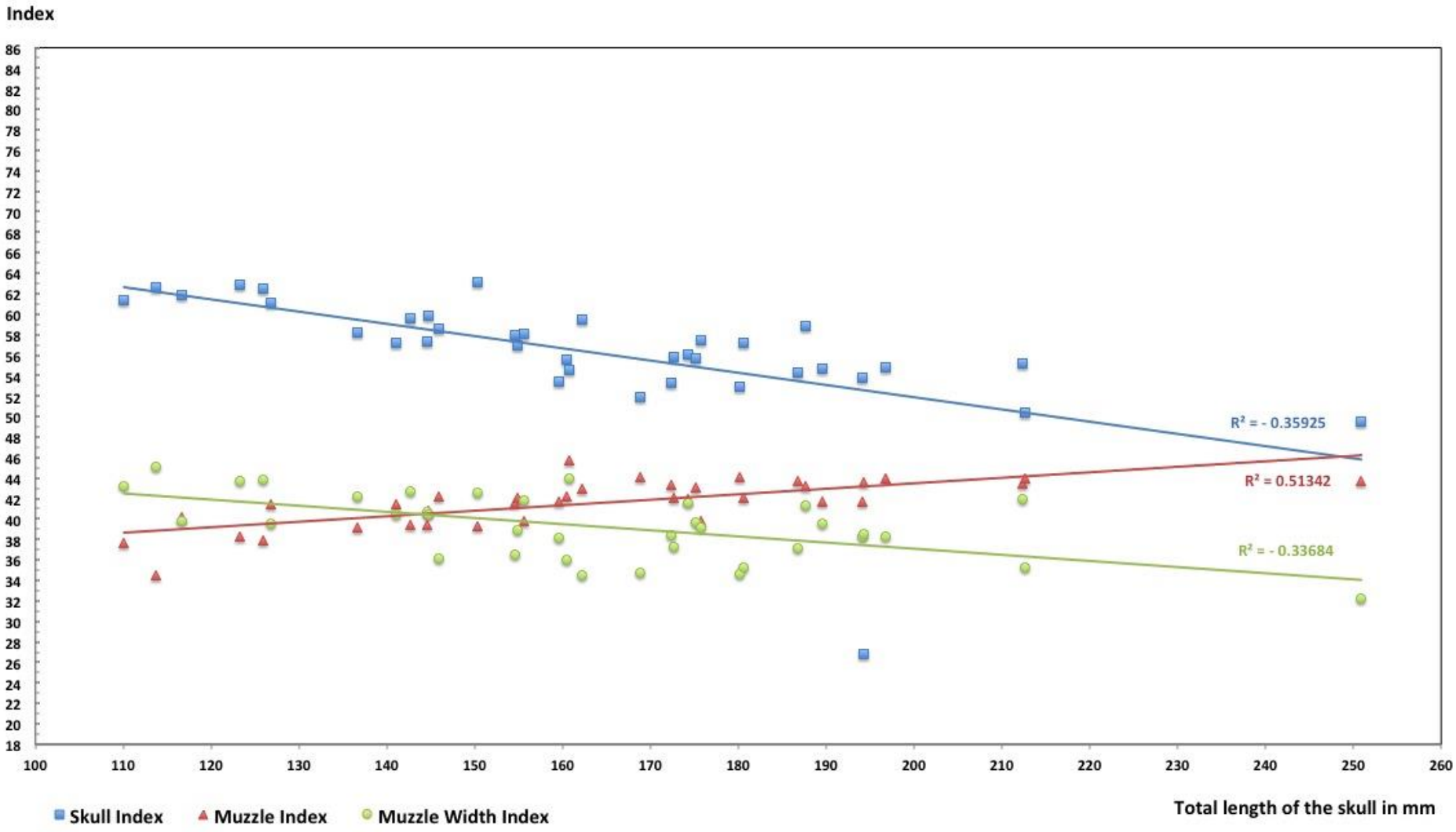
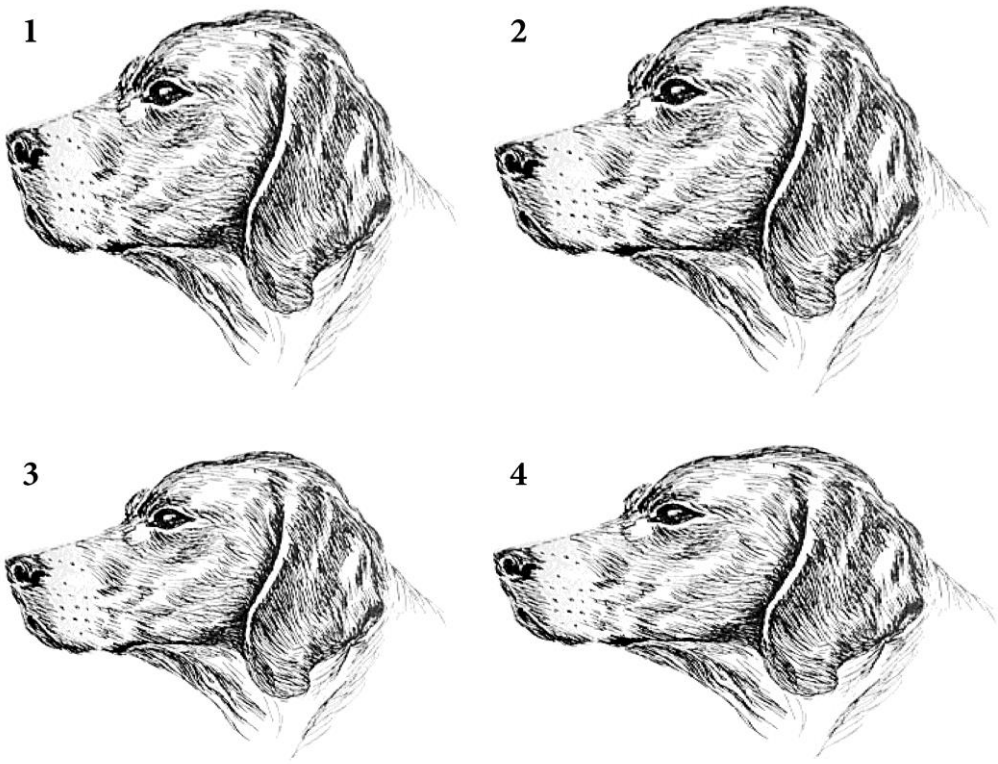


Figure 4.3 shows that with regard to the total size of the skulls, the dogs of the Middle Ages had skulls that are similar to the modern breeds, with the exception of a few extreme modern breeds. Figure 4.4 shows that the longer the total length of the skull gets, the longer and narrower the muzzle gets.

The medieval skulls can roughly be placed into four types (Figure 4.5): (1) Dogs with a short skull and a short muzzle. (2) Dogs with a relatively average skull and muzzle. (3) Dogs with a relatively long skull and average muzzle. (4) Dogs with a long skull and a long muzzle.

Fig 4.5 General shapes of medieval dog skulls. (1) Short skull short muzzle. (2) Average skull average muzzle. (3) Long skull average muzzle. (4) Long skull long muzzle.
- NB! The coat and ears on these dog profiles are made up by the student. These drawings are made to illustration the shape and size of the cranium and muzzle in the four groups.



The medieval cranial bones have been compared to the modern material (see table 4.10) or has been given a general description.

Table 4.10 Morphology of the medieval dogs and their resemblance to modern dogs.
(1) Short skull short muzzle. (2) Average skull average muzzle. (3) Long skull average muzzle. (4) Long skull long muzzle. – Doesn't resemble any modern dog breed.

Individual	General shape of the skull	Modern breeds they are resembling
1	1	Lundehund, poodle
2	1	Lundehund, poodle
3	1	Foxterrier
4	2	Lundehund, poodle
5	2	Lundehund, poodle
6	2	Foxterrier
7	3	Lundehund, poodle
8	3	Buhund
9	2	Lundehund, poodle
10	2	Buhund
11	3	Buhund
12	3	Foxterrier
13	2	Dachshund
14	3	Buhund
15	3	Buhund
16	3	Dachshund
17	4	Buhund
18	4	Buhund
19	4	–
20	4	Elkhound
21	4	Elkhound, Buhund
22	3	Elkhound, Buhund
23	3	–
24	3	Finnehund
25	3	Elkhound, Buhund
26	4	Elkhound
27	3	Elkhound
28	4	Elkhound
29	4	Finnehund
30	4	–
31	3	Elkhound
32	4	Swedish foxhound
33	4	English guard dog
34	4	Greyhound, Wolf
35	2	Elkhound
36	4	Finnehund
37	4	Elkhound

4.3 Mandibula

50 mandibles out of the 117 included in the medieval material were complete enough to be used for analysis (Tables 4.11-12). The majority of specimens are from Bergen. Trondheim, Stavanger, Tønsberg and Oslo are only represented by one mandibula each.

Table 4.11 Mandibular length, indices and ratios of medieval bones.
CoI=Coronion index, CtI=Cheektooth index, CMI=Corpus mandibularis index.

Commune	Museum number (JS)	Archaeological ID	Graph ID	CoI	CtI	CMI	Mandibula Length
Trondheim	92		38	42.66	50.87	17.57	131.5
	529	72392	1	35.11	59.70	16.22	78.9
	540	81396	2	36.35	60.59	15.91	81.7
	702		3	34.18	58.48	14.08	83.1
	397	21876	4	39.44	61.02	16.82	86.2
	1442	77777	5	42.62	53.22	19.13	91.5
	397	21876	6	37.76	57.07	16.24	94.8
	397	21886	7	36.50	55.80	15.72	94.8
	397	20251	8	39.62	54.69	14.86	94.9
	406	19325	9	39.36	55.91	15.11	97.3
	397		11	38.98	56.79	16.63	101.6
	397	19675	12	38.12	56.74	15.32	103.1
	397	22780	13	37.99	56.65	15.60	104.5
	397	21119	14	38.29	54.66	17.40	106.3
	397	20012	15	39.66	53.13	17.12	106.9
	397	21121	16	40.00	54.39	17.85	107.0
	397	21880	17	35.87	54.37	14.96	107.6
	397	20247	18	38.25	56.59	14.93	108.5
	397	21119	19	36.41	55.08	16.01	109.3
	397	20249	20	38.53	58.57	17.32	110.3
	397	22775	21	38.38	53.87	15.67	112.3
Bergen	397	22722	22	40.16	51.15	14.98	112.8
	397	19673	23	39.22	54.95	17.14	113.2
	397	18202	24	37.02	55.19	14.79	115.6
	397	18202	25	37.22	55.35	13.99	115.8
	397	20260	26	36.30	53.85	16.01	116.8
	380	1017	27	36.86	55.20	15.19	117.2
	397	20257	28	40.02	55.50	14.81	118.2
	397	22780	29	38.73	54.34	15.28	121.1
	397	21891	30	36.04	55.03	15.42	123.2
	397	21894	32	38.59	55.06	15.92	124.4
	397	20249	33	39.95	52.53	16.93	126.4
	397	20253	35	36.50	54.32	16.89	128.5
	397	21882	36	35.04	54.40	14.46	130.7
	397	21890	37	37.86	54.27	15.04	131.0
	397	19673	39	38.76	49.81	18.40	132.1
	397	20012	40	36.71	54.08	15.48	132.4
	397	20253	41	36.86	54.65	15.92	133.2
	540	81355	42	39.34	52.93	17.04	133.2
	397	21560	43	40.01	52.98	16.43	135.7
	397	21103	44	37.44	50.60	15.02	140.5
	397	22780	45	38.98	50.43	16.43	140.6

	397	20260	46	37.81	54.28	16.04	141.5
	397	20249	47	37.17	51.99	17.64	148.5
	397	22573	48	38.81	52.05	16.89	151.0
	492	69564	49	39.50	49.74	16.90	156.2
	540	81355	50	38.24	52.83	16.60	164.5
Stavanger	519		34	42.80	54.07	16.59	127.8
Tønsberg	159		31	38.35	54.69	16.34	123.6
Oslo	702	21877	10	37.91	57.55	14.51	101.3

Table 4.12 Descriptive statistical data of the medieval mandibles.
N is the total number of specimens, Mean, ± SD, min, max and coefficient of variance values of the CoI=Coronion index, CtI=Cheektooth index, CMI=Corpus mandibularis index.
*Values lower than 10 indicate that these ratios and indices belong to individuals from a homogenous group, and that there is little variety between the measured structures.

	CoI	CtI	CMI	Mandibula Length
N	50	50	50	50
Mean (μ)	38.25	54.64	16.07	117.38
SD (σ)	1.61	2.02	1.05	16.68
Min.	34.18	49.74	13.99	78.90
Max	42.80	61.02	19.13	164.50
Cv	4.22*	3.69*	6.56*	14.21

The coefficient of variance for the Coronion index, the cheektooth index and the corpus mandibularis index are all lower than 10, indicating that there is very little differences between these individuals. However, with a Cv of 14.21, there is a large difference in the size of the mandibles.

Table 4.13-16 display the calculated mandibular indices for the modern dog breeds and modern wolf. The breeds Buhund, Lundehund, Elkhund and Greyhound are represented by individuals with the lowest and highest total length, as well as the average of the total population of these breeds in the material.

Table 4.13 Mandibular indices and ratios of the modern dog breeds.
CoI=Coronion index, CtI=Cheektooth index, CMI=Corpus mandibularis index
[3]Average from 3 individuals, [5]Average from 5 individuals, [6]Average from 6 individuals

Dog Breed	CoI	CtI	CMI	Mandibula Length
Bulldog	46.60	49.93	15.63	138.2
Mops	40.65	44.65	15.03	92.5
Finnehund	39.61	51.60	15.19	137.6
Scottish Sheep Dog	38.73	52.47	15.36	166.0
Big Engelsk Guarddog	38.55	49.04	15.60	166.0
Harehund	36.59	52.01	14.96	151.7
Foxterrier	35.96	55.16	14.20	97.9
Foxterrier	36.05	57.37	12.87	101.8
Eldre Svensk Støver	37.76	50.64	16.67	156.0

Wired Haired Poodle	38.69	53.38	15.93	136.2
Dalmatian	36.25	46.51	14.47	118.9
Boxer	38.21	49.13	15.90	132.7
Bulldog	46.15	46.23	17.68	126.1
Dachshund	40.74	57.16	15.98	113.9
Finnehund	39.18	50.84	15.85	136.3
Russian Greyhound	34.45	53.17	13.89	178.5
Lundehund	33.00	54.09	12.37	93.00
Lundehund	34.02	55.67	13.09	99.36
Lundehund[6]	35.05	56.79	14.51	105.40
Buhund	36.32	53.63	14.01	112.10
Buhund	37.95	54.34	15.95	120.30
Buhund[5]	40.19	55.21	22.24	129.40
Elkhund	38.61	50.50	15.12	128.90
Elkhund	40.08	52.86	15.43	140.18
Elkhund[3]	41.59	54.77	15.81	151.50
Greyhound	34.48	50.06	11.97	123.60
Greyhound	37.07	51.80	14.23	152.72
Greyhound[3]	39.85	53.32	15.82	174.00

Table 4.14 Descriptive statistical data of the mandibula of the modern dog breeds.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance. CoI=Coronion index, CtI=Cheektooth index, CMI=Corpus mandibularis index.
*Values lower than 10 indicate that these ratios and indices belong to individuals from a homogenous group, and that there is little variety between the measured structures.

	CoI	CtI	CMI	Mandibula Length
N	28	28	28	28
Mean (μ)	38.30	52.22	15.21	131.46
SD (σ)	3.19	3.25	1.89	24.54
Min.	33.00	44.65	11.97	92.50
Max	46.60	57.37	22.24	178.50
Cv	8.33*	6.22*	12.42	18.67

The coronion index and the cheektooth index both have a coefficient of variance less than 10, making them low in variance. The corpus mandibularis index and mandibular length have a Cv larger than 10. The ratio of the length of the tooth row against the total length of the mandibula is consistently similar across all groups of dogs.

Table 4.15 Mandibular indices and ratios of the modern wolf.
CoI=Coronion index, CtI=Cheektooth index, CMI=Corpus mandibularis inde

Museum ID.	CoI	CtI	CMI	Mandibula Length
	38.37	52.21	16.10	172.0
BM.437	42.40	51.56	15.98	179.0
BM.3542	37.90	52.02	16.24	193.4
B.8616	39.37	50.59	18.56	196.1
	43.87	50.38	17.00	196.5

Table 4.16 Descriptive statistical data of the mandibula of the modern wolf.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance. CoI=Coronion index, CtI=Cheektooth index, CMI=Corpus mandibularis index.
*Values lower than 10 indicate that these ratios and indices belong to individuals from a homogenous group, and that there is little variety between the measured structures.

	CoI	CtI	CMI	Mandibula Length
N	5	5	5	5
Mean (μ)	40.38	51.35	16.78	187.40
SD (σ)	2.62	0.83	1.07	11.21
Min.	37.90	50.38	15.98	172.00
Max	43.87	52.21	18.56	196.50
Cv	6.49*	1.61*	6.41*	5.98

All indices of the modern wolf have a coefficient of variance of less than 10, making it a homogeneous group, which is as expected.

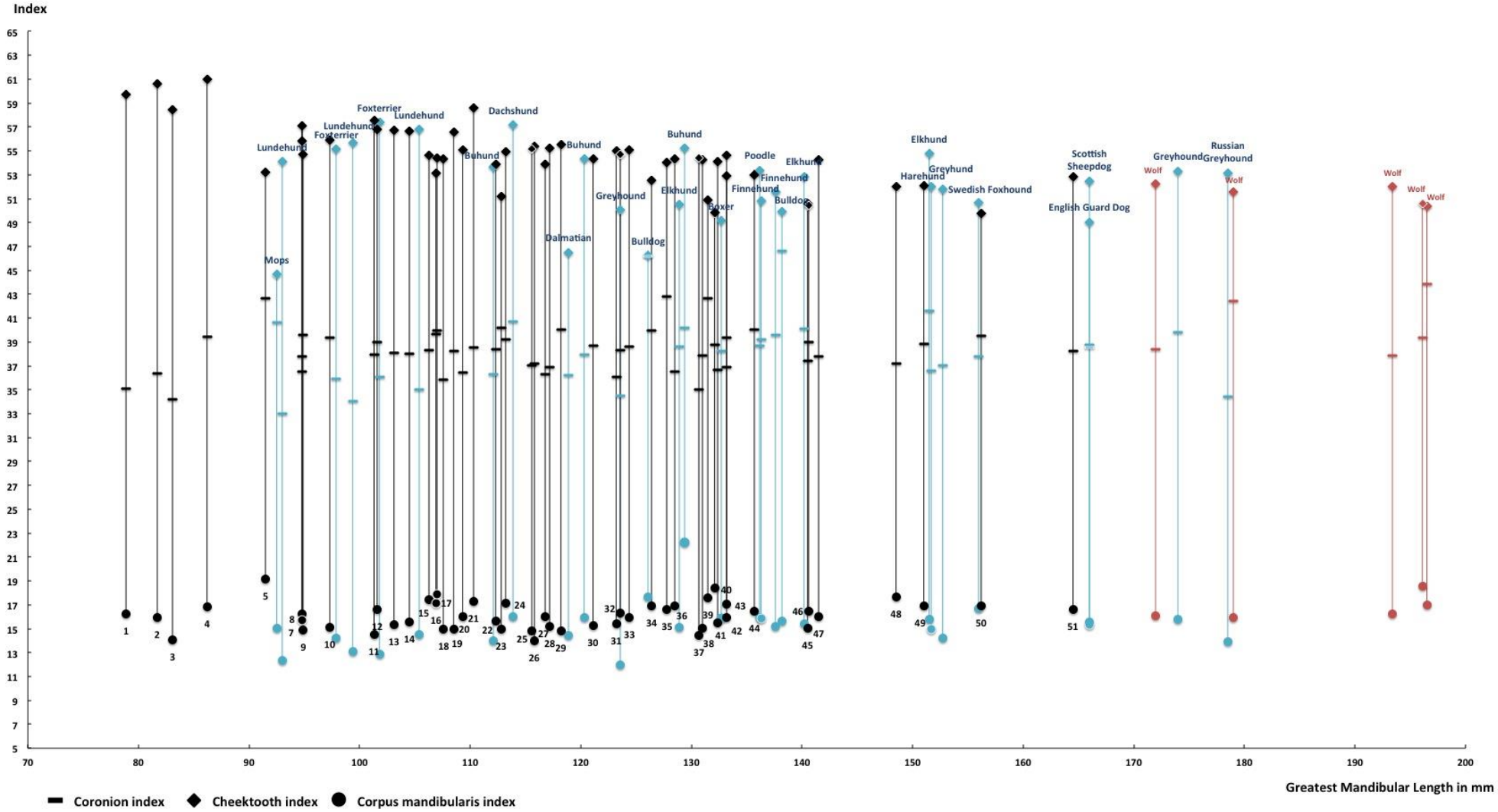
After comparing the mandibular indices and ratios of the medieval material with those of the modern comparative material for significant variances, significant differences between the medieval bones and the modern comparative material have been identified (Table 4.17).

Table 4.17 F-test for variance between the mandibular ratios and indices between the medieval material and the modern dog and modern wolf comparative material. *$p < 0.01$, ^{NS} not significant

Assemblages		Medieval bones from the Middle Ages			
	Indices	CoI	CtI	CMI	Mandibula length
Modern dog	F-Test	3.06*	1.67^{NS}	2.82*	1.57^{NS}
Modern wolf	F-Test	2.06^{NS}	9.21^{NS}	1.09^{NS}	3.06^{NS}

Table 4.17 shows that although there are a few significant differences between the coronion and corpus mandibularis indexes in the mandibular of the medieval dogs and the modern dogs, there are no differences in the cheektooth index or the general size of the mandibula. Figure 4.6 shows the distribution of the mandibular indices in the medieval material against the modern material.

Fig 4.6 The coronion, cheektooth and corpus mandibularis indices for the 50 mandibulae of the medieval medieval material, the mandibulae of the modern dogs and 5 mandibulae of modern wolf. The medieval material is black, the modern material is blue, modern wolf is red. The numbers for each graph is referring to the graph IDs.



4.4 Dentition

Intensive breeding may produce abnormal dentition (Ackerman, 2011:39-45). Few dogs from the medieval material had abnormal dentition that could only be explained through breeding. Only one cranium from Bergen had teeth that were growing in right angles to the jawline. Fifty two out of 117 mandibulae had their carnassial present. The majority of the mandibulae comes from Bergen. The measurements, their mean, standard deviation, minimum and maximum values and their coefficient of variance have been displayed in tables 4.18-21.

Table 4.18 Measurements of the 52 carnassials in the medieval material.

Town	Museum number (JS)	Archaeological ID	Length of the tooth row	Length of the carnassial
Trondheim	92		72.1	20.2
Bergen	397	20006	49.2	17.0
	397	21890	50.2	16.6
	540	81396	50.8	15.4
	397	20008	53.0	17.8
	397	21876	53.6	16.2
	1442	77777	54.2	14.7
	397	21886	55.1	16.4
	406	19325	57.6	16.3
	529	72382	57.7	17.9
	397	22907	60.5	18.2
	397	22283	61.7	17.2
	397	19675	62.7	16.9
	397	20504	62.9	18.4
	397	20247	64.5	20.2
	397	22775	64.5	19.3
	397	21119	65.3	17.5
	397	20003	65.5	18.7
	540	81328	66.2	18.3
	397	18202	66.6	16.4
	397	20249	66.6	19.3
	397	21121	67.1	20.4
	397	19673	67.5	17.6
	397	21111	68.2	20.3
	380	1017	68.3	19.1
	397	18202	68.4	17.5
	397	20257	69.2	19.5
	397	20249	70.3	20.1
	397	19675	70.4	20.0
	397	21891	71.1	18.8
	397	19673	71.5	19.3
	397	20249	71.5	20.0
	540	79330	72.2	20.6
	397	21894	72.8	19.4
	397	20506	74.6	20.3
	397	21121	76.5	19.6
	540	81355	76.5	20.7

	397	22780	77.7	19.8
	397	21560	78.0	22.3
	397	20260	82.4	20.0
	397	20249	82.8	22.4
	397	22573	85.8	21.5
	492	69564	87.0	19.4
	540	81355	94.6	23.9
Stavanger	519		72.9	19.0
	519		72.2	19.6
	519		70.1	18.9
	519		52.6	16.4
Tønsberg	159		71.6	20.2
Oslo	702		61.7	14.7
	702		51.8	16.0
	702		50.6	15.7

Table 4.19 Descriptive statistical data of the medieval bones carnassials and length of tooth row. N is the total number of specimens, mean, ± SD, min, max and coefficient of variance.

	Length of the tooth row	Length of the carnassial
N	52	52
Mean (μ)	67.08	18.69
SD (σ)	10.22	1.99
Min.	49.20	14.70
Max	94.60	23.90
Cv	15.23	10.67

Table 4.20 Measurements of 46 length of tooth row and carnassials of the modern dog breeds.

Museum ID	Type	Length of the tooth row	Length of the carnassial
H.036	Mops	44.9	15.5
H.044	Litle Silkpoodle	52.2	14.9
H.409	Lundehund	54.3	16.1
H.343	Lundehund	54.4	16.7
H.079	Whippet	54.9	15.4
H.332	Lundehund	55.5	17.0
H.340	Lundehund	56.0	17.9
H.410	Lundehund	57.9	16.6
H.180	Foxterrier	58.3	17.9
H.411	Lundehund	60.3	18.1
H.222	Bulldog	60.8	20.7
H.333	Lundehund	60.8	17.7
H.181	Foxterrier	61.2	17.5
H.334	Lundehund	62.5	18.1
H.291	Buhund	64.4	17.5
H.504	Buhund	66.3	18.8
H.202	Dalmatian	66.6	18.8
H.233	Dachshund	67.9	18.4
H.490	Buhund	70.0	18.9
H.399	Buhund	71.0	19.3
H.035	Bulldog	71.2	20.7

H.221	Boxer	72.4	21.1
H.167	Greyhound	72.6	17.7
H.439	Buhund	73.2	20.8
H.487	Buhund	73.4	19.5
H.440	Buhund	74.1	21.1
H.067	Elkhund	76.0	19.3
H.056	Finnehund	77.9	21.0
H.201	Wired Haired Poodle	77.9	19.4
H.239	Finnehund	78.1	19.6
H.090	Elkhund	78.2	21.0
H.073	Elkhound	78.7	20.5
H.074	Elkhund	80.0	20.3
H.244	Elkhund	80.4	22.0
	–	81.3	20.3
H.077	Elkhund	82.3	21.5
H.166	Greyhound	83.2	20.9
H.223	–	83.7	24.1
H.108	Greyhound	84.9	21.3
H.146	Harehund	85.6	21.8
H.145	Engelsk Guard Dog	88.8	21.5
H.183	Swedish Foxhound	89.3	20.9
H.034	Greyhound	91.3	22.9
H.144	Scottish Sheepdog	92.1	22.0
H.219	Greyhound	97.0	21.7
H.422	Russian Greyhound	102.0	23.4

Table 4.21 Descriptive statistical data of the tooth row and carnassials of the modern dog breeds. N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.

	Length of the tooth row	Length of the carnassial
N	46	46
Mean (μ)	72.30	19.52
SD (σ)	13.10	2.19
Min.	44.90	14.90
Max	102.00	24.10
Cv	18.12	11.23

An F-test for variance between the medieval bones and the modern comparative material has been performed (Table 4.22).

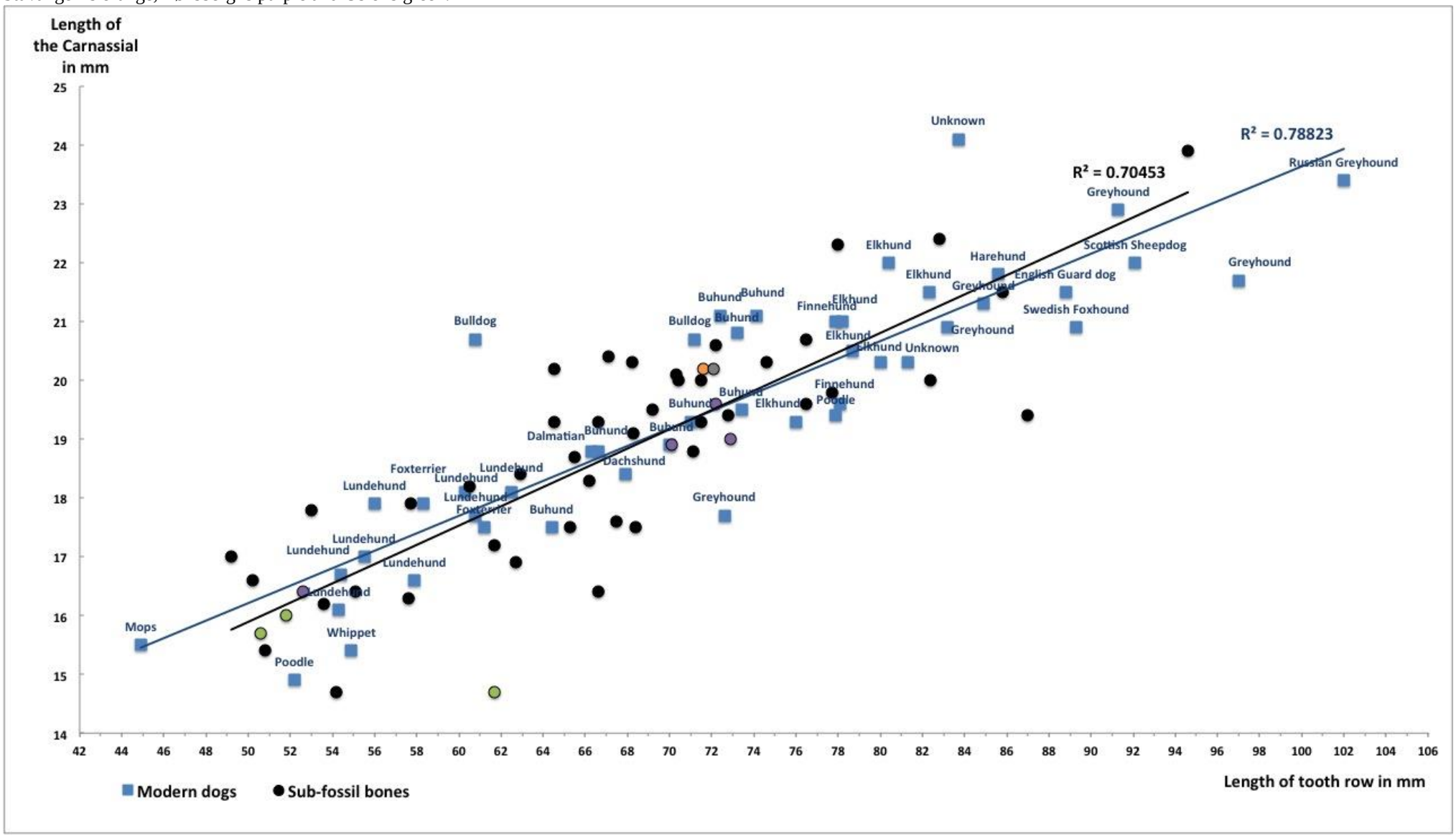
Table 4.22 F-test for variance of the carnassial and tooth row between the medieval material and the comparative modern dog bones. ^{NS} Not significant

Assemblages	Medieval material from the Middle Ages		
	Length	Tooth row	Carnassial
Modern dog	F-Test	1.58^{NS}	1.14^{NS}

The F-test shows that there is no significant variation between the tooth size of the medieval bones and the modern dog breeds. There is also no significant difference between their tooth row lengths.

Figure 4.7 illustrates the distribution of the carnassial length against the length of the tooth row in the mandibula. As can be seen in the scatterplot, both the size of the carnassial as the size of the tooth row of the mandibular in both the medieval dogs as well as the modern dogs is very similar. Both regression lines are very similar for the medieval bones (R^2=0.70) and the modern dog breeds (R^2=0.79).

Fig 4.7 Scatterplot of the distribution of carnassial length against length of the tooth row of modern dog breeds compared to the medieval samples. Trondheim is grey, Bergen is black, Stavanger is orange, Tønsberg is purple and Oslo is green.



4.5 Scapula

Out of the 56 scapulae that were present in the material, 28 were complete. Table 4.23 display the measurements of the scapulae of the medieval bones, and table 4.24 the statistical analysis. The measurements of the modern dog breeds and modern wolfs and their statistical analysis are displayed in tables 4.25-28. Part of the modern material comes from Wagner (1930). The measurements for each dog breed from Wagner's study have been recorded by its average. A scatterplot (see figure 4.8) illustrates the increase of column width and glenoid cavity length (articular surface) as the total length of the scapula increases. Out of 28 measureable scapulae twenty seven are from Bergen and only one from Trondheim. Therefore, it is not possible to say anything about geographic variation.

Table 4.23 Measurements of the 28 complete scapulae of the medieval bones. HS=Height Scapula, SLC=Smallest length of the column, LG=Length of the glenoid cavity.

Commune	Museum number (JS)	Archaeological ID	Graph ID	HS	SLC	LG
Trondheim	845	N115990	26	138.6	25.4	26.1
	397	20013	1	66.4	12.1	13.8
	397	21898	2	80.3	15.8	14.9
	397	19640	3	88.8	20.5	18.8
	397	21894	4	89.9	12.8	15.2
	397	22732	5	89.9	15.4	15.9
	397	21106	6	90.5	12.7	15.2
	397	21876	7	92.4	17.1	18.0
	397	21104	8	94.1	14.6	16.1
	397	21106	9	94.4	14.7	16.1
	397	20254	10	97.2	15.3	17.4
	397	22788	11	101.0	16.3	19.7
	397	20254	12	103.7	20.7	19.2
	397	20257	13	104.4	16.0	17.2
Bergen	397	22731	14	104.6	19.8	18.2
	397	22050	15	107.4	16.8	18.7
	397	22907	16	108.2	16.7	17.3
	397	22734	17	109.7	21.2	22.8
	397	20006	18	111.0	19.3	19.2
	397	21109	19	111.0	18.4	20.5
	397	21109	20	116.3	19.3	19.7
	397	21106	21	119.8	20.3	20.2
	397	23167	22	121.5	18.6	19.5
	397	20006	23	126.2	21.4	18.9
	397	22046	24	127.0	22.4	23.0
	397	20257	27	147.1	26.4	24.8
	397	20257	28	147.8	27.2	26.0
	540	81355	25	136.4	21.3	21.5

Table 4.24 Descriptive statistical data of the scapulae of the medieval bones.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.
HS=Height Scapula, SLC=Smallest length of the column, LG=Length of the glenoid cavity.

	HS	SLC	LG
N	28	28	28
Mean (μ)	108.06	18.52	19.07
SD (σ)	19.83	3.96	3.24
Min.	66.40	12.10	13.80
Max	147.80	27.20	26.10
Cv	18.35	21.36	17.02

All the measurements have a coefficient of variance that is larger than 10, making the material heterogeneous. And this indicates that the material consists of different groups.

Table 4.25 Measurements of the scapula of the modern dog breeds. HS=Height of scapula, SLC=Smallest length of the column, LG=Length of the glenoid cavity. *Average values displayed.

Dog Breed	Museum ID	Graph ID	HS	SLC	LG
Dwarf Pinscher		1	66.0	10.0	13.0
Pekingese*		2	78.0	15.0	17.5
Lundehund*		3	88.8	15.6	16.8
Whippet*		4	93.0	16.5	19.5
Dachshund*		5	76.8	18.8	22.0
Foxterrier*		6	99.2	18.8	20.1
Buhund*		7	116.8	21.2	21.7
Schnauzer*		8	109.0	22.3	24.1
Norwegian Harehund*		9	115.8	22.5	24.4
Finnehund	H.239	10	127.1	23.2	24.3
Elkhound*		11	132.0	24.3	25.5
Bulldog*		12	121.3	25.0	24.8
Poodle		13	134.0	27.0	28.0
Greyhound	H.108	14	160.1	27.2	30.6
Dingo		15	123.0	28.0	26.0
Setter*		16	141.4	28.8	28.8
Scottish Sheep Dog	H.144	17	165.0	28.9	30.2
Barsoi		18	154.0	29.0	31.0
Pointer*		19	145.0	29.0	29.7
Boxer*		20	133.4	30.9	28.9
Russian Greyhound	H.422	21	195.0	31.1	35.7
Dobermann-Pinsher*		22	138.3	31.7	32.0
German Shepherd*		23	149.9	35.1	33.8
Bernhardiner		24	166.0	40.0	36.0
Irish Wolfhund		25	184.0	43.0	43.0

Table 4.26 Descriptive statistical data of the scapulae of the modern dog breeds.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.
HS=Height Scapula, SLC=Smallest length of the column, LG=Length of the glenoid cavity.

	HS	SLC	LG
N	25	25	25
Mean (μ)	128.52	25.72	26.69
SD (σ)	14.57	6.81	5.24
Min.	66.00	10.00	13.00
Max	195.00	43.00	43.00
Cv	11.34	26.49	19.65

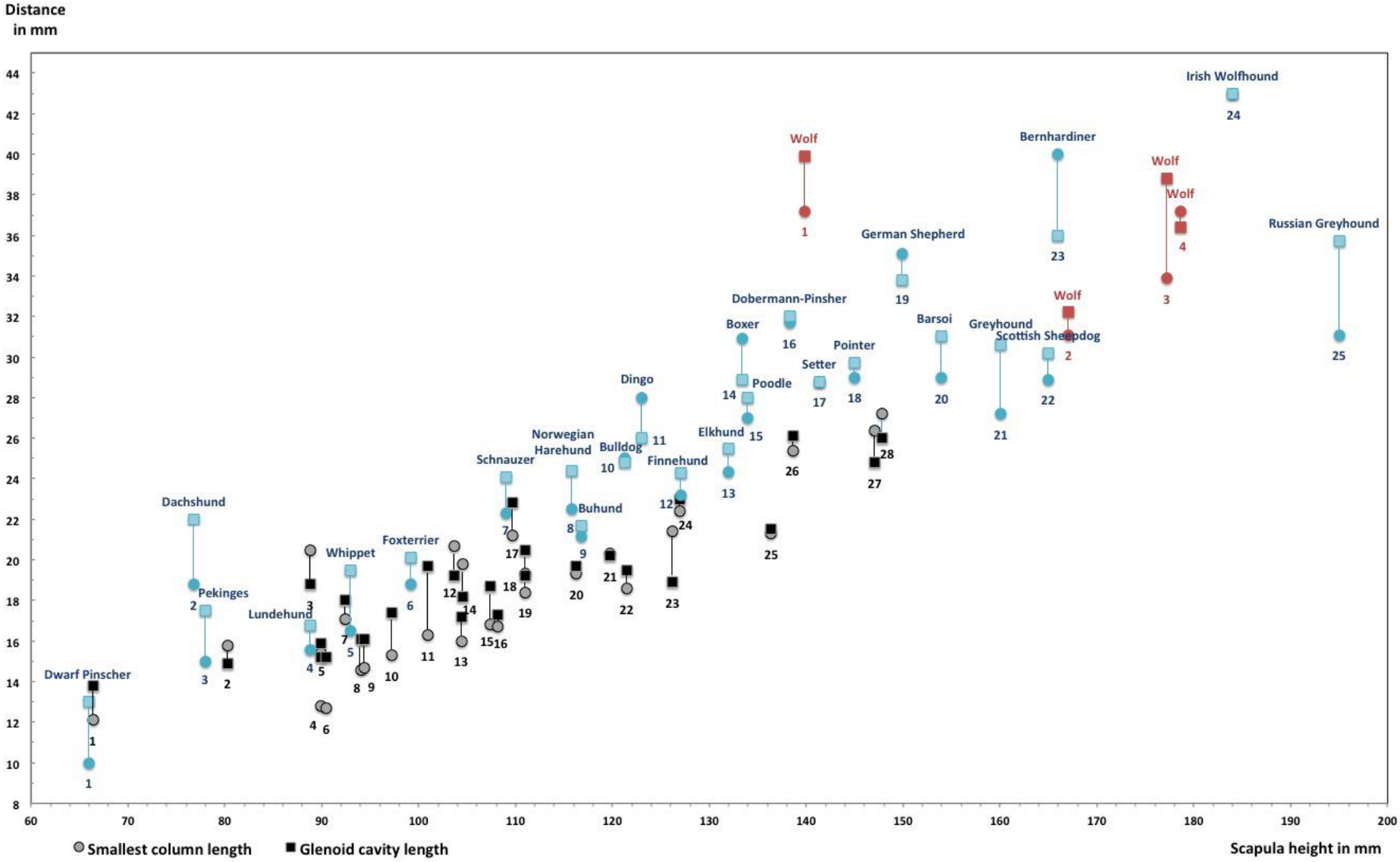
Table 4.27 Measurements of the scapula of the modern wolf. HS=Height of scapula, SLC=Smallest length of the column, LG=Length of the glenoid cavity.

Museum ID	Graph ID	HS	SLC	LG
B.2	178.7	36.4	37.2	1.02
B.10	167.1	32.2	31.1	0.97
	139.9	39.9	37.2	0.93
	177.2	38.8	33.9	0.87

Table 4.28 Descriptive statistical data of the scapulae of the modern wolf.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.
HS=Height Scapula, SLC=Smallest length of the column, LG=Length of the glenoid cavity
*Values lower than 10 indicate that these ratios and indices belong to individuals from a homogenous group, and that there is little variety between the measured structures.

	HS	SLC	LG
N	4	4	4
Mean (μ)	165.73	36.83	34.85
SD (σ)	17.97	3.41	2.94
Min.	139.90	32.20	31.10
Max	178.70	39.90	37.20
Cv	10.84	9.27*	8.45*

Fig 4.8 Scatterplot of the column width and glenoid cavity length (articular surface) against the total length of the scapula. Medieval material is black, modern dog breeds are blue, modern wolf is red. The numbers for each graph is referring to the graph IDs.



There is a significant variation between the total length of the scapula of the medieval bones and the modern bones ($F = 2.81$, $p < 0.001$). There is also a significant difference between the column width ($F = 3.81$, $p < 0.001$) and length of the glenoid cavity ($F = 4.41$, $p < 0.001$). The medieval dog has smaller and narrower shoulder blades than the dog breeds we have today.

The small Dachshund types of dogs have scapulae that have a pronounced column and articular surface and a bent fossa (Wagner, 1930:92-93; Hufthammer, 1994). Larger dogs have a narrower column with a much straighter fossa (Evans, 2013:127-129). There are no individuals in the medieval material that display the morphology of the modern Dachshund. Individual 1, 2 and 3 have slightly curved scapulae, with a strongly developed column and glenoid cavity. These dogs resemble the modern Dwarf Pinscher more in shape and size than the modern Dachshund.

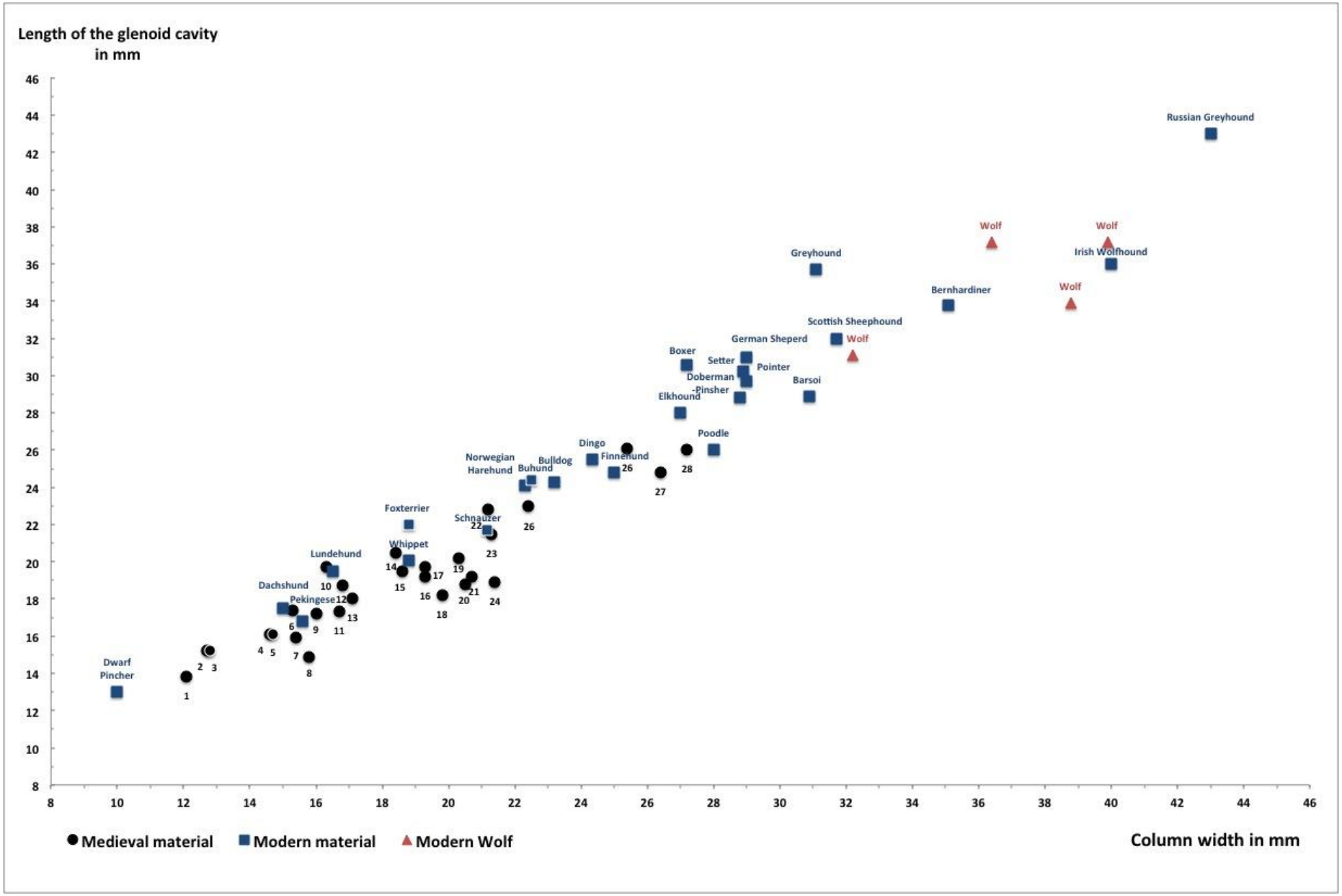
None of the medieval scapulae resemble those of the modern wolf scapula in size. Three types of scapulae can be identified in the medieval assemblage. Those with a column that is smaller than the glenoid cavity, those with a column that is the same size as the glenoid cavity and those with a column larger than the glenoid cavity (Table 4.29).

Table 4.29. Distribution of different shape of scapula of the medieval bones.

Type of Scapula	Graph ID
Column smaller than the glenoid cavity	1, 4, 6, 7, 8, 9, 10, 11, 13, 15, 16, 17, 18, 19, 22, 24, 26
Column same size as the glenoid cavity	5, 20, 21, 25
Column larger than the glenoid cavity	2, 3, 12, 14, 23, 27, 28

The modern material show the same variation. The main difference between the medieval dogs and the modern dogs is that the scapulae of the medieval dogs are smaller and more slender. However, as the size increases, they do get more pronounced, similar to that of the modern breeds. Figure 4.9 displays the size of the column against the size of the glenoid cavity of the medieval bones and modern material from tables 4.23, 4.25 and 4.27.

Fig 4.9 Scapula column width against length of the glenoid cavity of the modern dog breeds, modern wolf and medieval bones.



The length of the glenoid cavity–the actual surface where the scapula articulates with the humerus–is only slightly smaller in the medieval dog compared to the modern dog breeds. The majority of the material resembles the small and middle size modern dog breeds. Individuals 1-6 are very similar in size to the modern Dwarf Pinscher and modern Dachshund. The group levels out somewhat around 18mm column width. Then there is a small group that seems to decrease in clenoid cavity length, as the column grows larger.

Individuals 26, 27 and 28 resemble larger dogs such as the Elkhound and Buhund. The size of the medieval scapula increases at the same rate as the modern material: the larger the column width, the larger the glenoid cavity.

F-test for variance between the medieval bones and the modern comparative material has been performed (Table 4.30).

Table 4.30 F-test for variance of the scapula between the medieval material and the modern comparative material (both dog and wolf). *$p < 0.01$, ^{NS} Not significant

Material	Medieval material from the Middle Ages			
	Length	HS	SLC	LG
Modern dog	F-Test	2.81*	3.81*	4.41*
Modern wolf	F-Test	1.22^{NS}	1.34^{NS}	1.21^{NS}

There are significant differences in size, and shape between the scapulae of the medieval dogs and those of modern dog breeds.

4.6 Long bones

Out of 512 long bones that were measured, originating from both the front limb and the hind limb, 146 bones were complete and were used in osteometric analysis. Fragmented bones that only had one or both epiphyses present are recorded in appendix α, but have not been displayed in the graphs. For the humerus and the radius, the bones of only 8 modern breeds were available for measurement. Because the measurements are so few, they are displayed in appendix β rather than in the text.

Hufthammer (1994) has recorded three groups of dogs according to the shape of the long bones: those with straight limbs, those with bowed limbs comparable to modern dachshund, and those comparable to modern dwarf pincher. Judged visually, there are three groups of dogs that can be differentiated in the assemblages. Those with short bowed long bones, those with short straight bones and those with long straight bones. I have not come across any dogs that have large bowed bones.

A source of error in this paper is that although this bowed shape in the bones has been noticed, it has not been actively recorded for each and every long bone. And therefore, I don`t have sufficient data to make a distribution analysis or tests of significance for “bowed bones”.

For the ulna there were no modern bones measured that can be used for comparison

Humerus

Twenty three complete humeri are measured and the results displayed in table 4.31. And their statistical analysis in table 4.32. A scatterplot, with the depth of the proximal end against the total length of the Humerus for the medieval dogs, the modern comparative dogs and modern wolf is displayed in figure 4.16. And a scatterplot of the smallest breadth of the diaphysis against the total length of the Humerus for the medieval elements is displayed in figure 4.17.

Table 4.31 Measurements of the humerus of the medieval dog bones. GL=Greatest length, Dp=Depth of the proximal end, SD=Smallest breadth of diaphysis.

Town	Museum number (JS)	Archaeological ID	GL	Dp	SD
Trondheim	92		131.2	41.0	13.1
	92		131.8	40.8	13.4
Bergen	397	20260	98.5	27.6	8.7
	397	21876	104.9	30.6	9.1
	397	22043	109.1	26.4	7.4
	397	20254	112.6	26.9	8.0
	397	21108	115.9	26.6	7.3
	397	21109	116.4	26.5	7.3
	397	20252	118.1	28.9	7.8
	397	20249	119.9	36.6	11.5
	397	21112	120.6	27.3	7.3
	397	22904	120.7	28.2	9.8
	397	22904	127.2	29.2	8.8
	397	22772	127.7	30.1	8.4
	397	20504	131.7	30.0	9.0
	397	22050	141.4	34.0	11.3
	397	21114	141.7	33.5	10.8
	397	22046	144.2	35.3	11.5
	397	20254	152.2	24.9	10.1
	397	20255	158.3	35.2	11.6
Stavanger	1398	12198	160.8	39.2	10.8
Oslo	599		107.1	27.7	9.2
	599		107.1	27.4	8.9

Table 4.32 Descriptive statistical data of the medieval humeri.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.
GL=Greatest length, Dp=Depth of the proximal end, SD=Smallest breadth of diaphysis.

	GL	Dp	SD
N	23	23	23
Mean (μ)	126.05	31.04	9.61
SD (σ)	17.30	4.90	1.84
Min.	98.5	24.9	7.3
Max	160.8	41.0	13.4
Cv	13.73	15.77	19.16

Fig 4.16 Depth of the proximal end of the humerus against its total length of the modern dog breeds and modern wolf and the medieval bones.. Trondheim is grey, Bergen is black, Stavanger is orange and Oslo is green.

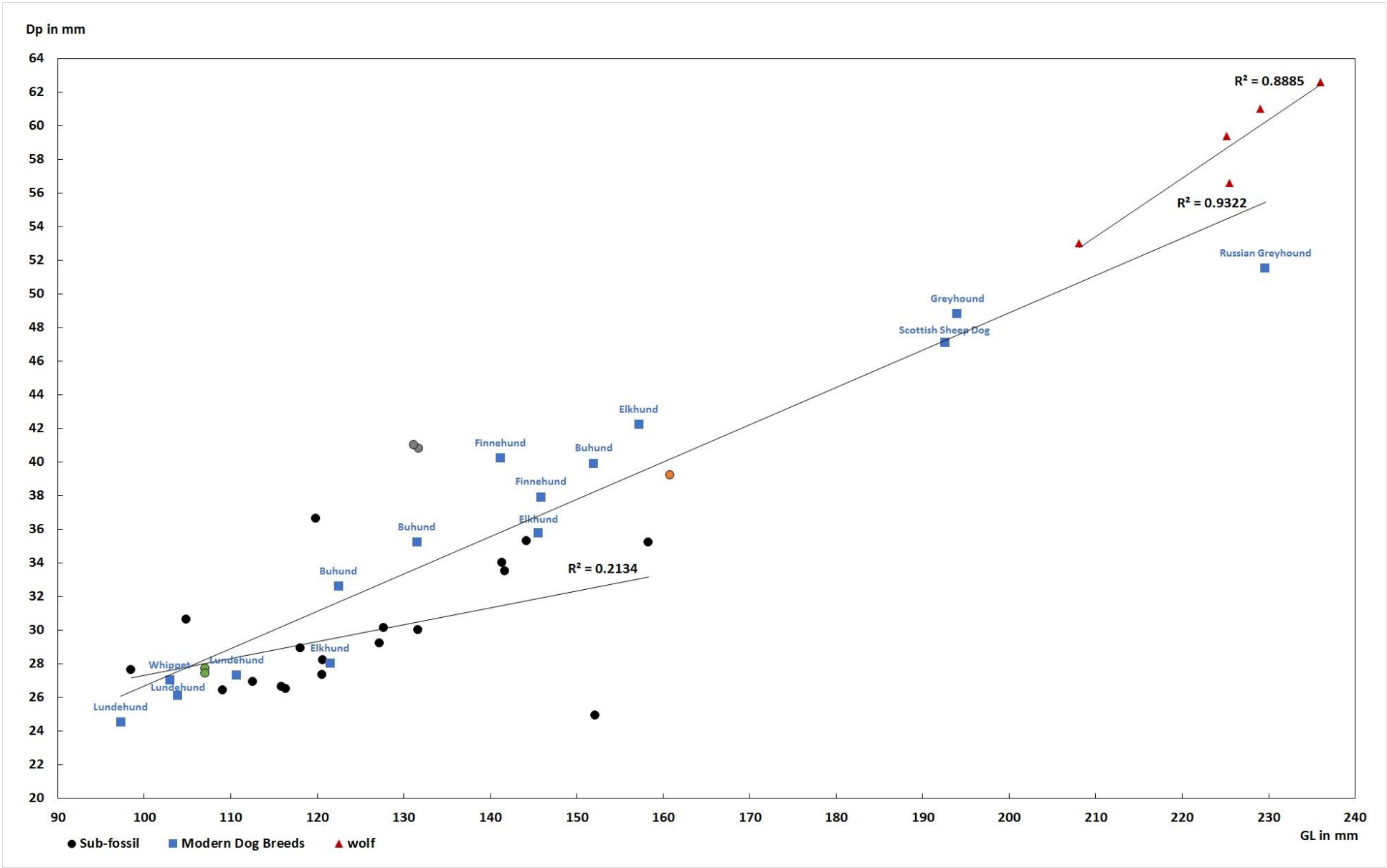
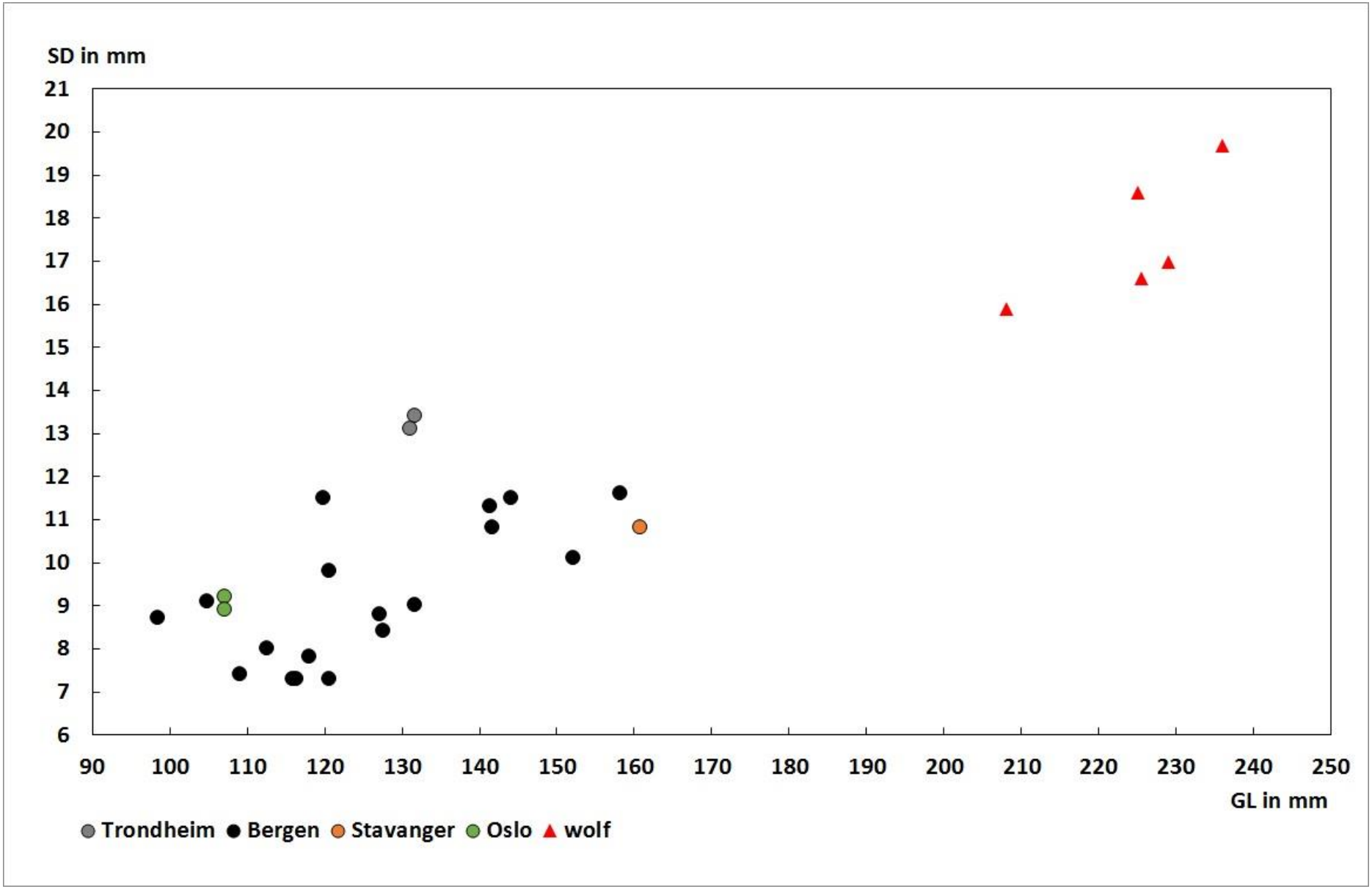


Fig 4.17 Smallest breadth of the diaphysis against the total length of humerus of the medieval bones: Trondheim is grey, Bergen is black, Stavanger is orange and Oslo is green.



Radius

A total of 37 complete radii are measured and used in statistical analysis (Tables 4.33-34). A scatterplot, with the breadth of the proximal epiphysis against the total length of the radius for the medieval dogs, the modern comparative dogs and modern wolf is displayed in figure 4.18. And a scatterplot of the smallest breadth of the diaphysis against the total length of the radius for the medieval bones is displayed in figure 4.19.

Table 4.33 Measurements of the radius of the medieval dog bones. GL=Greatest length, Bp=Breadth of the proximal end, SD=Smallest breadth of diaphysis.

Towns	Museum number (JS)	Archaeological ID	GL	Bp	SD
Trondheim	632	N49151	128.3	12.8	9.3
	845	N115992	128.3	15.1	11.3
Bergen	387	15818	146.0	16.4	9.7
	397	21115	93.6	11.7	7.9
	397	20008	97.7	10.2	66.6
	397	21112	99.8	13.8	10.0
	397	20504	103.3	9.9	6.7
	397	21104	105.7	15.9	13.2
	397	22056	115.6	12.3	7.4
	397	21109	116.0	12.1	8.1
	397	21108	116.9	12.4	8.0
	397	20252	118.2	12.4	8.0
	397	21562	125.2	12.6	8.1
	397	21880	127.9	14.0	8.4
	397	21870	129.1	13.7	8.7
	397	20504	130.4	12.6	9.4
	397	22043	131.8	12.7	9.0
	397	21872	133.1	12.9	8.6
	397	18207	140.8	14.6	10.1
	397	22050	141.0	14.9	10.6
	397	22572	141.5	14.1	9.8
	397	21114	141.8	14.7	10.3
	397	22773	142.9	14.0	9.3
	397	22776	143.5	13.6	9.3
	397	22772	145.8	14.1	9.2
	397	21880	149.9	14.7	10.3
	397	22046	150.2	16.1	12.0
	397	20255	158.4	16.3	11.9
	397	22731	158.9	16.5	10.3
	492	69564	123.1	12.6	8.8
	529	71922	85.4	11.5	9.2
Stavanger	519		103.8	13.2	9.1
	1398	12198	93.9	10.4	8.4
	1398	S.12198	107.5	11.6	14.5
Tønsberg	644	USB/A 240	172.9	17.1	12.2

Oslo	599	101.9	12.7	8.7
	702	118.8	11.5	7.7

Table 4.34 Descriptive statistical data of the radii of the medieval bones.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.
GL=Greatest length, Bp=Breadth of the proximal end, SD=Smallest breadth of diaphysis.

	GL	Dp	SD
N	37	37	37
Mean (μ)	126.19	13.45	11.08
SD (σ)	21.02	1.82	9.52
Min.	85.4	9.9	6.7
Max	172.9	17.1	66.6
Cv	16.66	13.54	85.92

Fig 4.18 Breadth of the proximal end of the radius against its total length of the modern dog breeds, modern wolf and medieval bones. Trondheim is grey, Bergen is black, Stavanger is orange, Tønsberg is orange and Oslo is green.

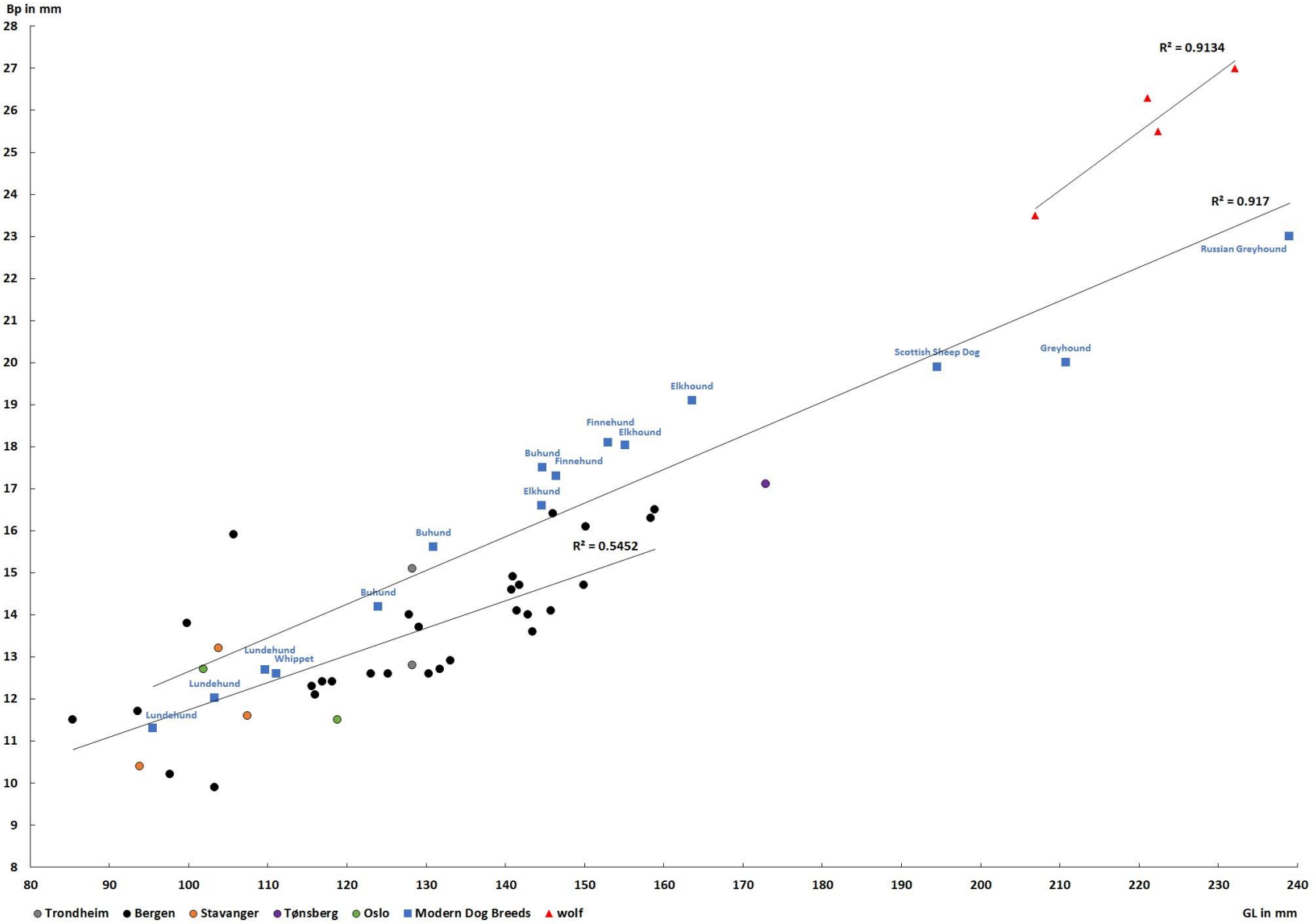
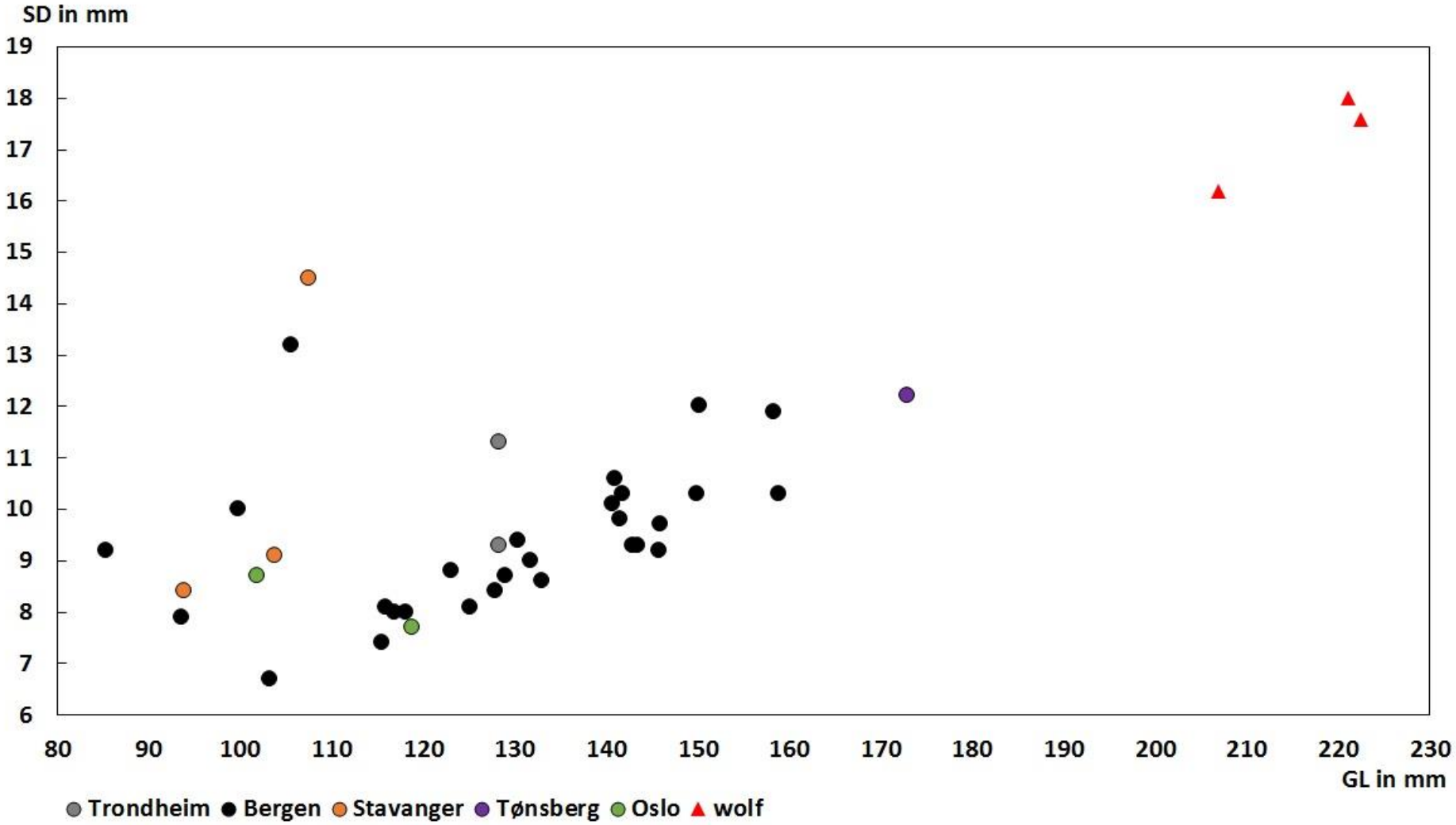


Fig 4.19 Smallest breadth of the diaphysis against the total length of the radii of the medieval bones: Trondheim is grey, Bergen is black, Stavanger is orange, Tønsberg is orange and Oslo is green.



Ulna

A total of 23 complete ulnae have been measured and their total length (GL) and their depth across the processus anconaeus (DPA) have been used in statistical analysis (Tables 4.35-36). A scatterplot, with the DPA against the total length of the radius for the medieval dogs, the modern comparative dogs and modern wolf is displayed in figure 4.20. The ulnae of only 4 modern dog breeds were available for measurement.

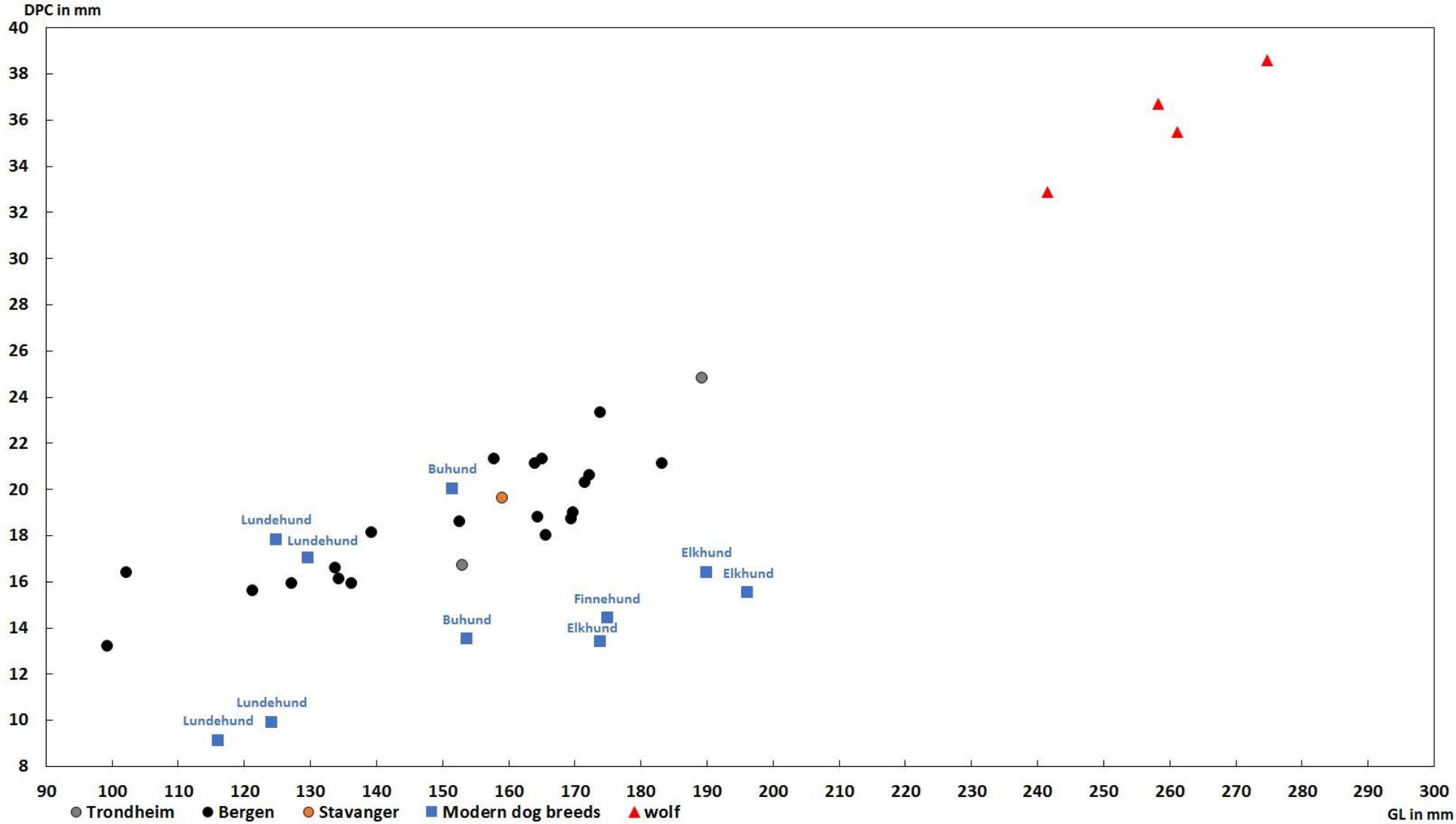
Table 4.35 Measurements of the ulna of the medieval dog bones. GL=Greatest length, DPA=Depth across the processus anconaeus.

town	Museum number (JS)	Archaeological ID	GL	DPA
Trondheim	632	49152	153.0	16.7
	845	N115990	189.3	24.8
Bergen	397	20260	99.4	13.2
	397	22047	102.2	16.4
	540	81317	121.4	15.6
	397	21560	127.2	15.9
	397	21117	133.9	16.6
	397	21119	134.4	16.1
	397	21875	136.3	15.9
	397	21870	139.3	18.1
	397	20504	152.6	18.6
	397	20504	157.9	21.3
	397	22050	164.0	21.1
	397	22725	164.4	18.8
	397	21114	165.1	21.3
	397	21109	165.7	18.0
	397	22776	169.6	18.7
	397	22722	169.8	19.0
	397	19352	171.6	20.3
	397	21893	172.3	20.6
	397	22046	173.9	23.3
	397	22722	183.3	21.1
Stavanger	519		159.1	19.6

Table 4.36 Descriptive statistical data of the radii of the medieval bones.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.
GL=Greatest length, DPA=Depth across the processus anconaeus.

	GL	Dp
N	23	23
Mean (μ)	152.42	18.74
SD (σ)	24.17	2.76
Min.	99.40	13.20
Max	189.30	24.80
Cv	15.86	14.72

Fig 4.20 Scatterplot of the depth across the processus anconaeus against the total length of the ulnae of the medieval bones: Trondheim is grey, Bergen is black and Stavanger is orange



Femur

A total of 25 complete femurs are measured and their total length and their proximal breadth have been used in statistical analysis (Tables 4.37-38). A scatterplot, with the SD against the total length of the femur for the medieval dogs and modern wolf is displayed in figure 4.21.

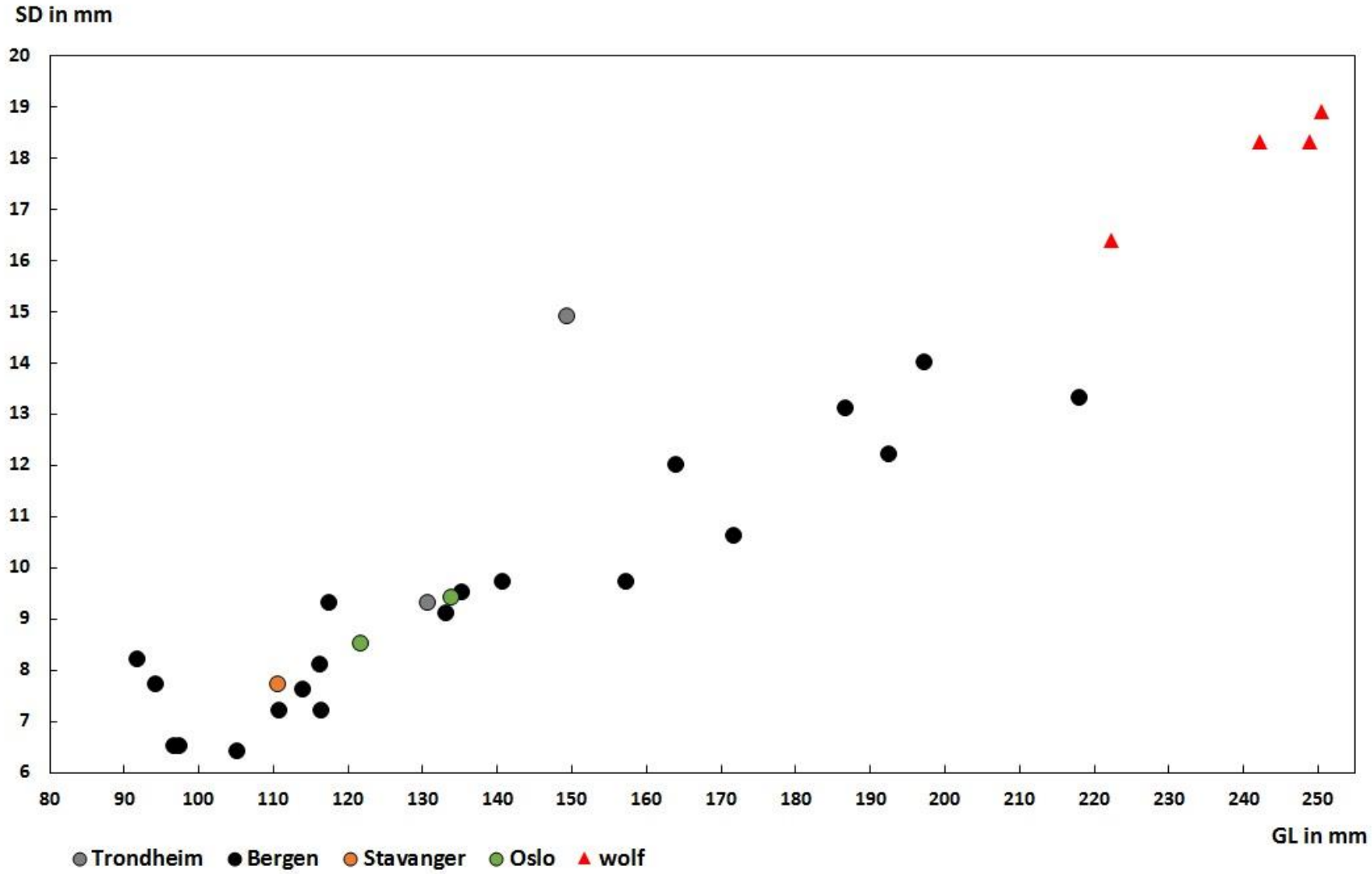
Table 4.37 Measurements of the femur of the medieval dog bones. GL=Greatest length, Bp=Breadth of the proximal end, SD=Smallest breadth of diaphysis.

Town	Museum number (JS)	Archaeological ID	GL	Bp	SD
Trondheim	92		149.5	37.7	14.9
	845	119946	130.8	26.4	9.3
Bergen	397	20013	94.3	23.6	7.7
	397	22772	96.8	19.8	6.5
	397	22905	97.6	19.9	6.5
	397	20257	105.2	19.8	6.4
	397	21892	110.9	24.0	7.2
	397	21099	114.0	23.5	7.6
	397	22776	116.4	23.3	8.1
	397	22782	116.5	24.3	7.2
	397	19671	117.5	24.8	9.3
	397	22905	133.2	26.5	9.1
	397	22772	135.3	28.6	9.5
	397	21104	140.9	26.9	9.7
	397	21112	157.4	32.5	9.7
	397	21114	171.8	33.0	10.6
	397	22729	186.7	37.2	13.1
	397	18203	192.6	37.9	12.2
	397	23166	218.2	42.9	13.3
	529	71919	91.8	22.6	8.2
	529	71917	197.4	41.8	14.0
	540	81355	164.1	35.2	12.0
Stavanger	519		110.7	23.0	7.7
Oslo	599		134.0	12.6	9.4
	768	K78	121.9	24.1	8.5

Table 4.38 Descriptive statistical data of the femur of the medieval bones.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.
GL=Greatest length, Bp=Breadth of the proximal end, SD=Smallest breadth of diaphysis.

	GL	Bp	SD
N	25	25	25
Mean (μ)	136.22	27.68	9.51
SD (σ)	35.23	7.63	2.46
Min.	91.8	12.6	6.4
Max	218.2	42.9	14.9
Cv	25.86	27.58	25.84

Fig 4.21 Scatterplot of the smallest breadth of the diaphysis of the femur against the total length of the modern wolf and the medieval bones. Trondheim is grey, Bergen is black, Stavanger is orange and Oslo is green.



Part of the modern data comes from Wagner (1930). The measurements for each dog breed presented by more than 2 individuals in Wagner's study have been recorded by the smallest, largest and the average value (Table 4.39). The descriptive statistical analysis is displayed in table 4.40.

Table 4.39 Measurements of the femur of the modern dog breeds. GL=Greatest Length, Bp= Breadth of the proximal end. *Average values displayed.

Dog Breed	Graph ID	GL	Bp
Dwarf Pinscher	1	83.0	19.0
Dwarf Pinscher	2	84.0	19.0
Pekingese	3	95.0	24.0
Dachshund	4	96.0	33.0
Pekingese*	5	96.5	25.3
Dachshund	6	97.0	32.0
Pekingese	7	98.0	26.0
Lundehund	8	109.7	23.1
Foxterrier	9	115.0	26.0
Lundehund*	10	116.4	24.8
Whippet	11	118.2	24.1
Whippet*	12	124.0	26.0
Lundehund	13	125.0	26.5
Foxterrier	14	127.5	29.0
Whippet	15	133.2	28.8
Buhund	16	136.8	31.2
Elkhund	17	138.1	29.3
Schnauzer	18	140.0	33.0
Norwegian Harehound	19	143.0	32.0
Whippet	20	143.0	31.0
Foxterrier	21	145.0	35.0
Buhund*	22	145.4	33.5
Bulldog	23	151.0	37.0
Schnauzer*	24	151.8	35.4
Bulldog*	25	154.4	38.6
Bulldog	26	158.0	40.0
Norwegian Harehound*	27	158.1	37.0
Finnehund	28	159.0	37.3
Schnauzer	29	159.0	37.0
Finnehund	30	159.7	37.7
Buhund	31	161.5	36.6
Elkhund	32	161.9	36.4
Boxer	33	165.0	40.0
Norwegian Harehound	34	166.0	40.0
Elkhund	35	176.2	39.4
Poodle	36	181.0	41.0
Poodle	37	181.0	42.0
Boxer*	38	181.5	43.5
Setter	39	182.0	39.0
Dingo	40	185.0	40.0
Dingo	41	186.0	40.0
Pointer	42	194.0	42.0

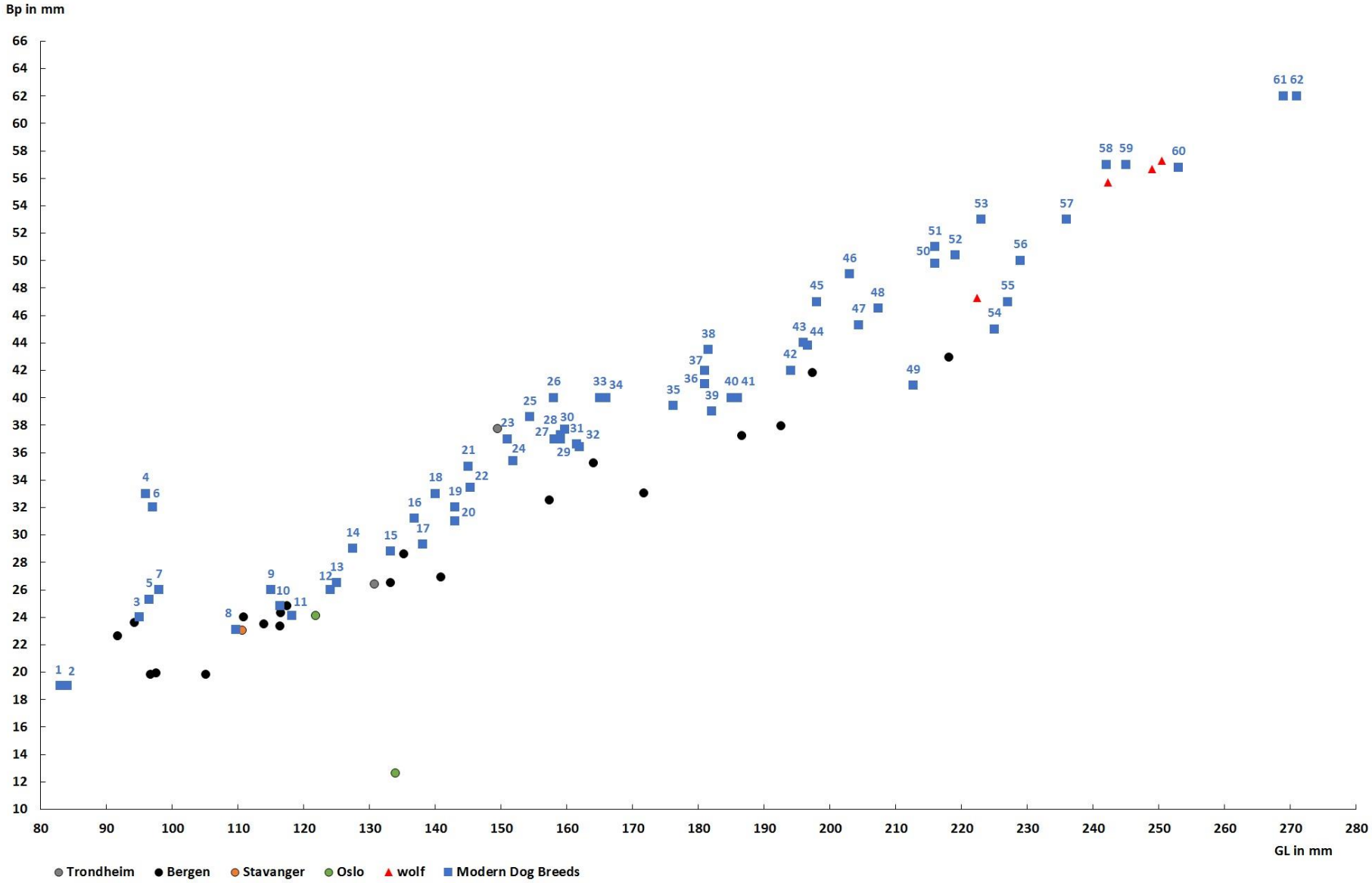
Dobermann-Pinscher	43	196.0	44.0
Setter	44	196.6	43.8
German Shepherd	45	198.0	47.0
Boxer	46	203.0	49.0
Pointer*	47	204.4	45.3
Dobermann-Pinscher*	48	207.3	46.5
Scottish Sheep Dog	49	212.7	40.9
Greyhound	50	216.0	49.8
Pointer	51	216.0	51.0
German Shepherd	52	219.1	50.4
Setter	53	223.0	53.0
Barsoi	54	225.0	45.0
Barsoi	55	227.0	47.0
Dobermann-Pinscher	56	229.0	50.0
German Shepherd	57	236.0	53.0
Bernhardiner	58	242.0	57.0
Bernhardiner	59	245.0	57.0
Russian Greyhound	60	253.0	56.8
Irish Wolfhund	61	269.0	62.0
Irish Wolfhund	62	271.0	62.0

Table 4.40 Descriptive statistical data of the femur of modern dog breeds.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.
GL=Greatest length, Bp=Breadth of the proximal end.

	GL	Bp
N	62	62
Mean (μ)	168.89	38.74
SD (σ)	47.81	10.41
Min.	83.0	19.0
Max	271.0	62.0
Cv	28.31	26.88

A scatterplot, with the Bp against the total length of the femur for the medieval dogs, the modern comparative dogs and modern wolf is displayed in figure 4.22.

Fig 4.22 Scatterplot of the breadth of the proximal end of the femur against the total length of the modern dog breeds, modern wolf and the medieval bones. Trondheim is grey, Bergen is black, Stavanger is orange and Oslo is green. The numbers for each graph represent their graph ID.



Tibia

A total of 56 complete tibiae are measured and their total length and their proximal breadth have been used in statistical analysis (Tables 4.41-42). A scatterplot, with the SD against the total length of the tibiae for the medieval dogs and modern wolf is displayed in figure 4.23.

Table 4.41 Measurements of the tibia of the medieval dog bones. GL=Greatest length, Bp=Breadth of the proximal end, SD=Smallest breadth of diaphysis.

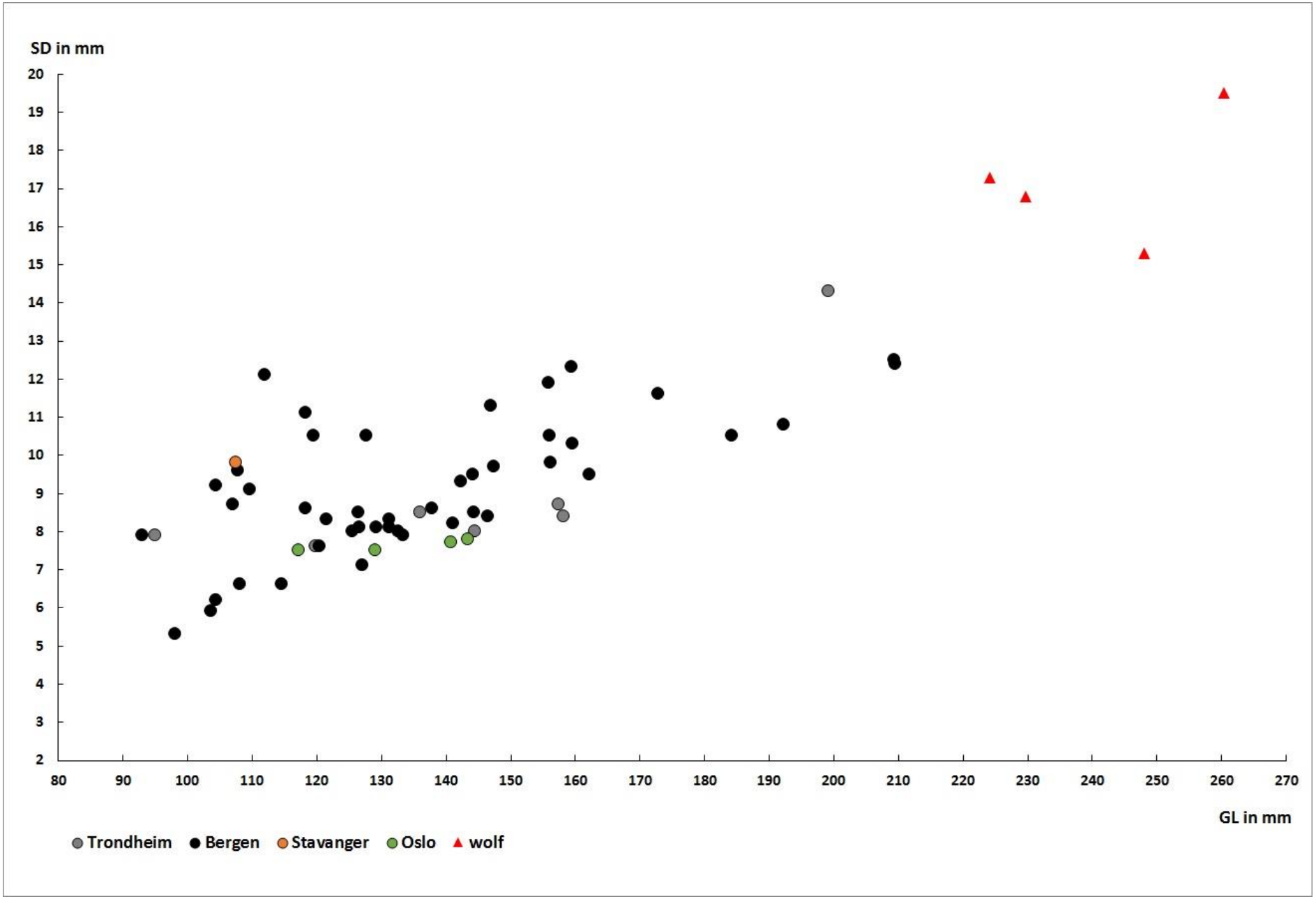
Town	Museum number (JS)	Archaeological ID	GL	Bp	SD
Trondheim	632	N49969	119.9	24.0	7.6
	632	49566	136.1	22.6	8.5
	632	N49822	199.2	36.2	14.3
	765	95926	157.5	24.4	8.7
	765	N95926	158.2	23.4	8.4
	845	N121371	95.1	20.4	7.9
	845	N121476	144.5	22.2	8.0
Bergen	397	20013	93.0	21.5	7.9
	387	15818	118.3	21.7	8.6
	397	22772	103.7	19.3	5.9
	397	22905	104.4	18.9	6.2
	397	22280	104.5	29.0	9.2
	397	20253	107.0	23.9	8.7
	397	20506	107.9	23.8	9.6
	397	20504	108.1	19.7	6.6
	397	19351	109.7	24.4	9.1
	397		112.0	27.3	12.1
	397	22278	114.7	19.2	6.6
	397	22732	118.4	29.7	11.1
	397	20009	119.6	27.2	10.5
	397	21115	120.5	20.9	7.6
	397	20252	121.5	21.5	8.3
	397	21888	125.6	22.6	8.0
	397	20249	126.5	23.2	8.5
	397	20504	126.7	21.6	8.1
	397	22285	127.1	25.6	7.1
	397	22782	127.7	28.2	10.5
	397	21109	129.2	22.6	8.1
	397	21898	131.3	22.9	8.1
	397	21898	131.3	23.3	8.3
	397	22054	132.7	23.0	8.0
	397	21559	133.5	22.2	7.9
	397	20261	137.9	24.1	8.6
	397	21112	141.2	25.6	8.2
	397	21898	142.4	23.8	9.3
	397	18256	144.2	25.9	9.5
	397	22283	144.4	24.5	8.5
	397	19682	146.6	22.3	8.4
	397	19673	147.0	29.2	11.3

	397	21561	147.5	22.7	9.7
	397	22905	156.0	29.2	11.9
	397	22050	156.2	29.7	9.8
	397	20249	159.4	28.9	12.3
	397	19675	159.7	28.2	10.3
	397	20247	162.2	28.5	9.5
	397	19685	184.3	31.3	10.5
	397	21112	192.3	31.9	10.8
	397	20257	209.4	35.5	12.5
	397	20254	209.5	35.0	12.4
	529	72382	172.9	37.1	11.6
	540	79559	156.1	27.5	10.5
Stavanger	519		107.5	23.6	9.8
Oslo	599		143.4	23.6	7.8
	702		140.8	21.8	7.7
	768	K78	129.1	124.9	7.5
	809	5217	117.3	20.0	7.5

Table 4.42 Descriptive statistical data of the tibia of the medieval bones.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.
GL=Greatest length, Bp=Breadth of the proximal end, SD=Smallest breadth of diaphysis.

	GL	Bp	SD
N	56	56	56
Mean (μ)	137.01	26.99	9.11
SD (σ)	27.07	14.02	1.76
Min.	93.0	18.9	5.9
Max	209.5	124.9	14.3
Cv	19.76	51.96	19.32

Fig 4.23 Scatterplot of the smallest breadth of the diaphysis of the tibia against the total length of the modern wolf and the medieval bones and modern wolf. Trondheim is grey, Bergen is black, Stavanger is orange and Oslo is green.



Part of the modern material comes from Wagner (1930). The measurements for each dog breed presented by more than 2 individuals from Wagner's study have been recorded by the smallest value, the largest and the average (Table 4.43). The descriptive statistical analysis is displayed in table 4.44.

Table 4.43 Measurements of the tibia of the modern dog breeds. GL=Greatest Length, Bp= Breadth of the proximal end. *Average values displayed.

Dog Breed	Graph ID	GL	Bp
Dachshund	1	79.0	27.0
Dachshund*	2	80.0	28.8
Dachshund	3	82.0	31.0
Pekingese	4	85.0	21.0
Pekingese*	5	89.0	22.5
Dwarf Pinscher	6	90.0	19.0
Dwarf Pinscher*	7	90.0	19.0
Pekingese	8	93.0	24.0
Lundehund	9	107.9	22.4
Foxterrier	10	112.0	24.0
Lundehund*	11	115.4	23.9
Lundehund	12	122.5	25.9
Whippet	13	130.4	22.4
Foxterrier*	14	130.5	27.2
Whippet*	15	136.0	24.0
Norwegian Harehund	16	137.0	31.0
Buhund	17	139.5	28.7
Foxterrier	18	147.0	31.0
Whippet	19	147.7	26.0
Buhund*	20	148.2	31.9
Bulldog	21	153.0	32.0
Schnauzer	22	155.0	31.0
Bulldog*	23	156.5	33.2
Schnauzer	24	157.7	33.7
Norwegian Harehund*	25	158.4	34.4
Schnauzer	26	160.0	34.0
Whippet	27	160.0	28.0
Bulldog	28	161.0	34.0
Elkhund	29	162.0	33.6
Finnehund	30	162.1	32.8
Buhund	31	163.0	34.8
Finnehund	32	167.9	34.7
Boxer	33	170.0	35.0
Norwegian Harehund	34	170.0	36.0
Elkhund*	35	171.8	35.0
Elkhund	36	180.0	36.9
Dingo	37	182.0	35.0
Dingo	38	182.0	35.0
Boxer	39	186.8	38.1
Setter	40	189.0	37.0
Poodle	41	192.0	37.0
Poodle	42	193.0	36.0

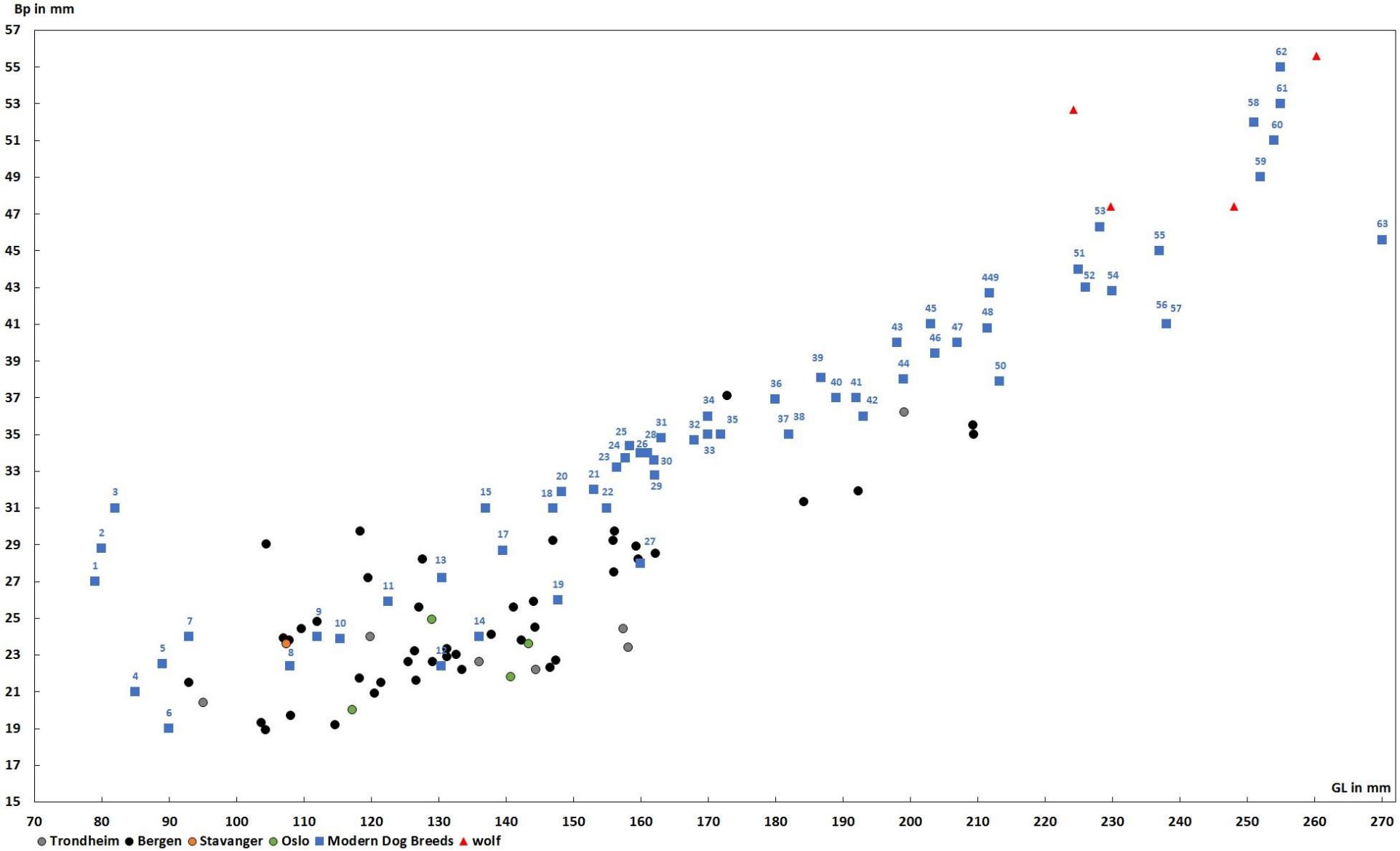
Doberman-Pinscher	43	198.0	40.0
Pointer	44	199.0	38.0
German Shepherd	45	203.0	41.0
Setter	46	203.7	39.4
Boxer	47	207.0	40.0
Pointer*	48	211.4	40.8
Doberman-Pinscher*	49	211.8	42.7
Scottish Sheep Dog	50	213.3	37.9
Pointer	51	225.0	44.0
Setter	52	226.0	43.0
German Shepherd	53	228.1	46.3
Greyhound	54	230.0	42.8
Doberman-Pinscher	55	237.0	45.0
Russian Wolfhound	56	238.0	41.0
Russian Wolfhound*	57	238.0	41.0
St. Bernard	58	251.0	52.0
German Shepherd	59	252.0	49.0
St. Bernard	60	254.0	51.0
Irish Wolfhund	61	255.0	55.0
Irish Wolfhund	62	255.0	53.0
Russian Greyhound	63	270.0	45.6

Table 4.44 Descriptive statistical data of the tibia of modern dog breeds.
N being the total number of specimens, mean, ± SD, min, max and coefficient of variance.
GL=Greatest length, Bp=Breadth of the proximal end.

	GL	Bp
N	63	63
Mean (μ)	171.46	34.86
SD (σ)	51.19	8.52
Min.	79.0	19.0
Max	270.0	55.0
Cv	29.86	24.44

A scatterplot, with the Bp against the total length of the tibia for the medieval dogs, the modern comparative dogs and modern wolf is displayed in figure 4.24.

Fig 4.24 Scatterplot of the breadth of the proximal end of the tibia against the total length of the modern dog breeds, modern wolf and medieval bones,. Trondheim is grey, Bergen is black, Stavanger is orange and Oslo is green. Numbers for each graph represent their graph ID.



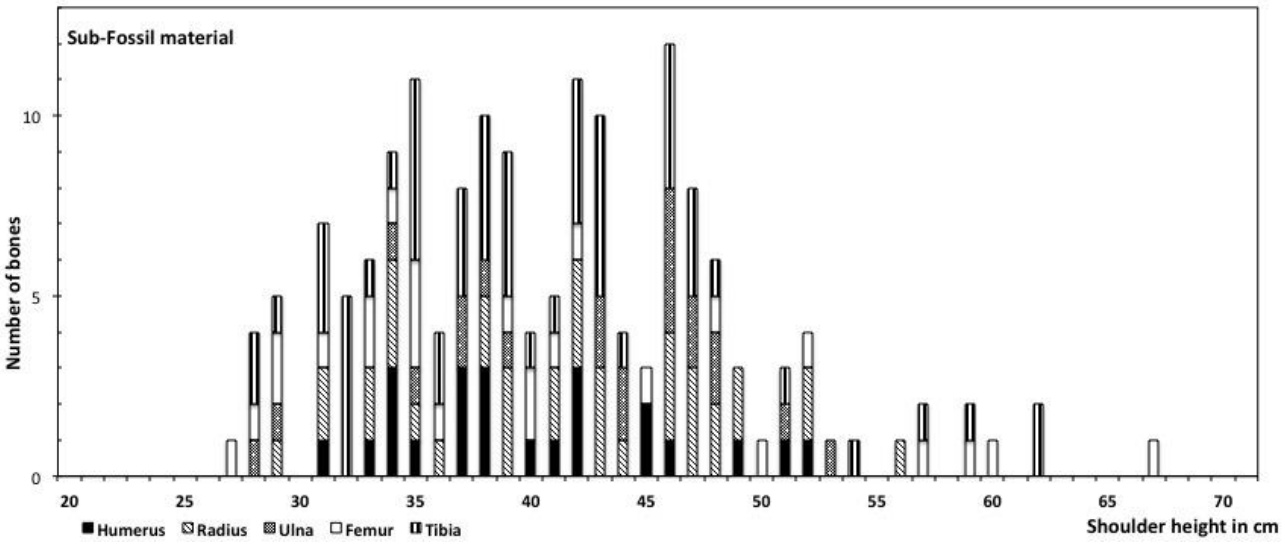
4.7 Shoulder height - size

Based on the total length of the long bones; Humerus, radius, ulna, femur and tibia. Figure 4.10 illustrates the rough shoulder height of the Medieval dogs in Norway (Table 4.45). In this figure all the locations have been combined. Figures 4.11-15 display the shoulder height per town. The majority of complete, measurable long bones are from Bergen.

Table 4.45 Shoulder height (cm) of medieval dogs from different towns. Calculated from total length of long bones according to Harcourt (1974).

	Humerus	42	42						
	Radius	42	42						
Trondheim	Ulna	43	53						
	Femur	39							
	Tibia	28	35	40	43	46	47	59	
	Humerus	31	33	34	35	37	37	37	38
		38	38	40	41	42	45	45	46
		49	51						
	Radius	29	31	33	33	34	35	38	38
		39	39	41	41	42	43	43	43
		44	46	46	46	47	47	47	48
		48	49	49	52	52			
	Ulna	28	29	34	35	37	37	38	39
		43	44	46	46	46	46	47	47
Bergen		48	48	48	51				
	Femur	27	28	29	29	31	33	34	35
		35	35	40	41	42	48	50	52
		57	59	60	67				
	Tibia	28	29	31	31	31	32	32	32
		32	33	34	35	35	35	36	36
		37	37	37	38	38	38	39	39
		39	39	41	42	42	43	43	43
		43	44	46	46	46	47	47	48
		51	54	57	62	62			
	Humerus	52							
	Radius	31	34	36					
Stavanger	Ulna	44							
	Femur	33							
	Tibia	32							
	Humerus	(no complete bones present)							
	Radius	56							
Tønsberg	Ulna	(no complete bones present)							
	Femur	(no complete bones present)							
	Tibia	(no complete bones present)							
	Humerus	34	34						
	Radius	34	39						
Oslo	Ulna	(no complete bones present)							
	Femur	40	36						
	Tibia	42	35	38	42				

Fig 4.10 Shoulder height of the medieval bones based on the different long bones.



The majority of the shoulder heights lie within the range of 30-50cm. Many modern races fall within the interval of 35-55cm (Hufthammer, 1994:219). Although there are some larger individuals that lie within the 55-63cm range, they are very few. There is also a group of very small dogs, with a shoulder height of less than 30cm. Over all, the medieval dogs vary greatly in their height at the shoulder, that is – in size.

The distribution of shoulder height is significantly different between Bergen and Oslo ($F = 6.08$, $p < 0.001$) and between Oslo and Trondheim ($F = 5.13$, $p < 0.001$).

Fig 4.11 Shoulder height based on the different long bones of the medieval dogs in Trondheim

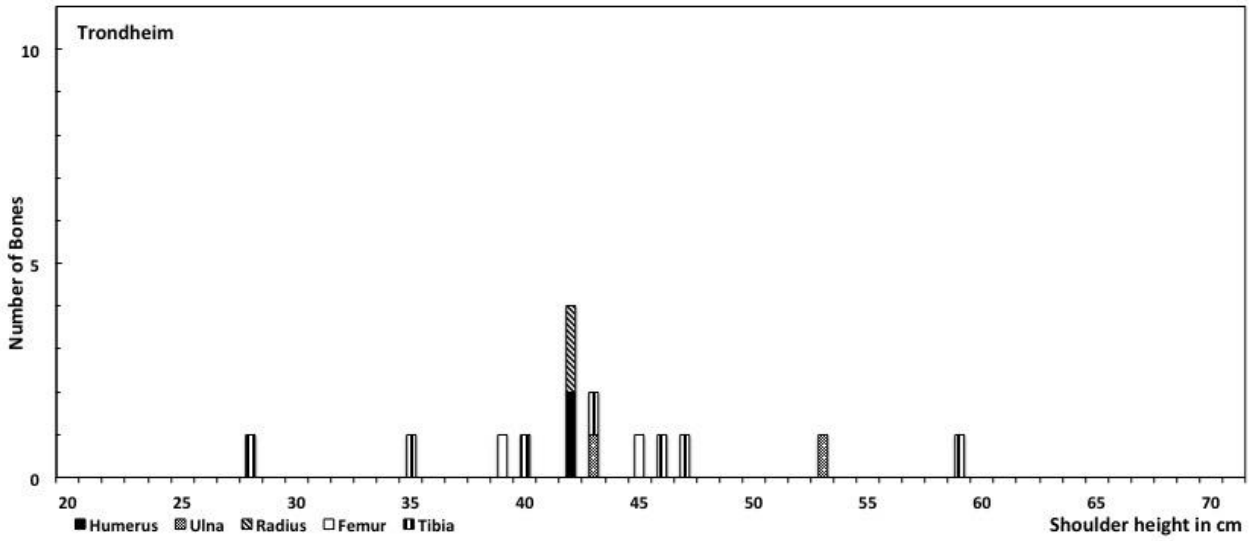


Fig 4.12 Shoulder height based on the different long bones of the medieval dogs in Bergen.

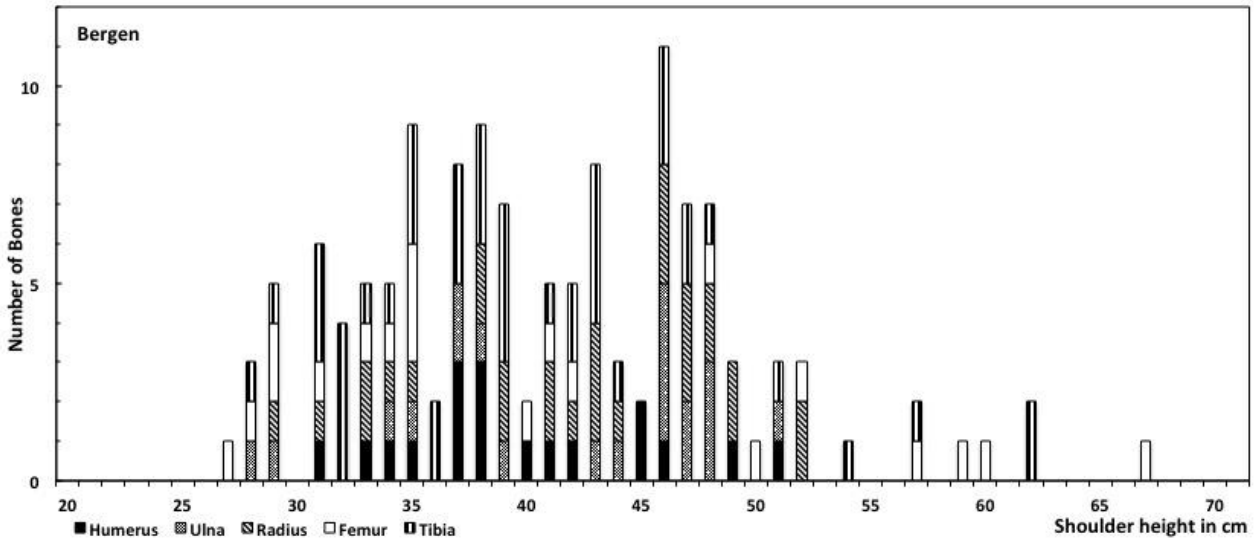


Fig 4.13 Shoulder height based on the different long bones of the medieval dogs in Stavanger

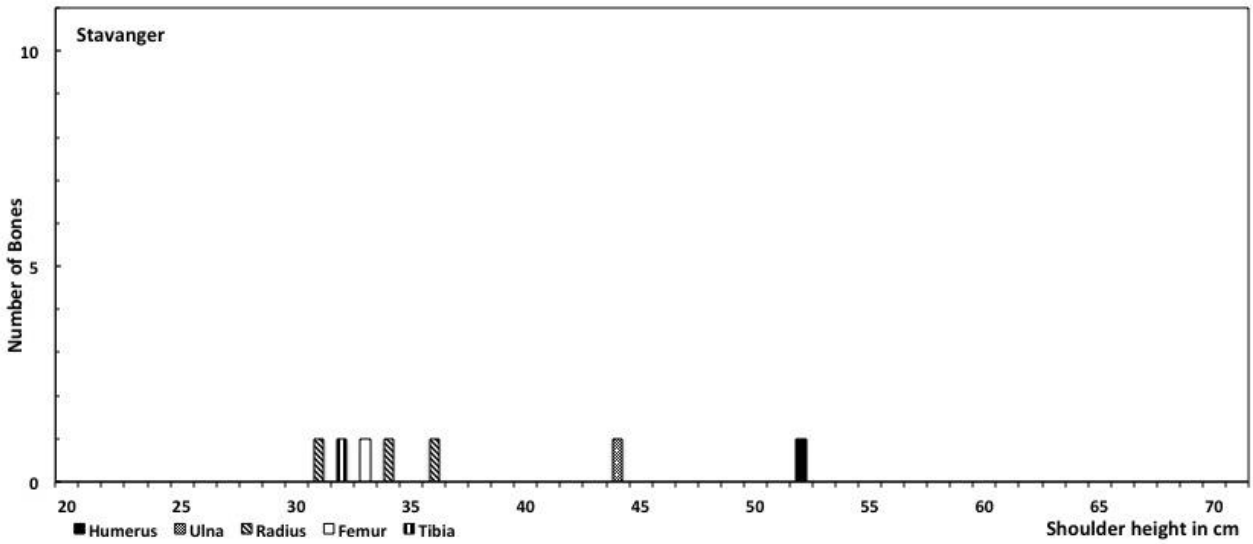


Fig 4.14 Shoulder height based on the different long bones of the medieval dogs in Tønsberg.

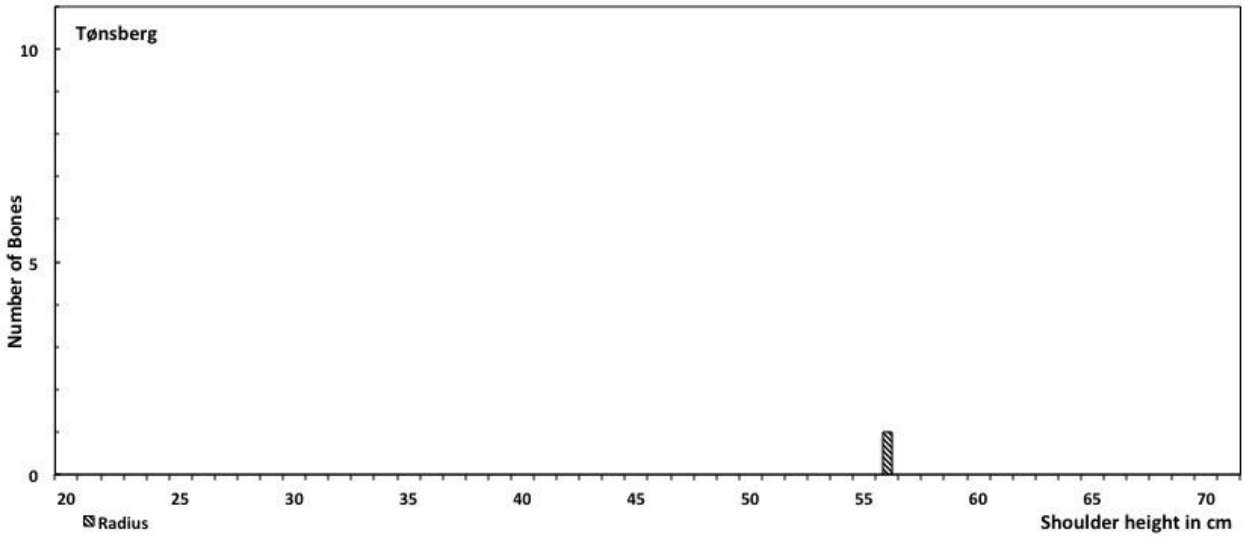
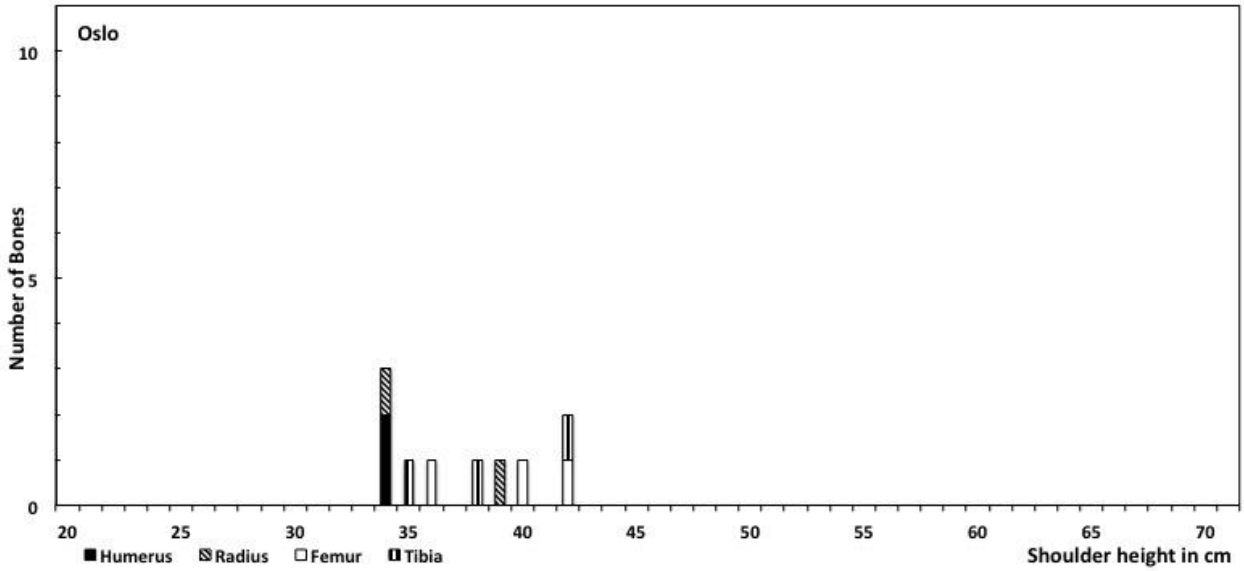


Fig 4.15 Shoulder height based on the different long bones of the medieval dogs in Oslo.



Bergen has a very large variation in height at the shoulder. The individuals from Oslo are of average height, and the individuals from Stavanger are small with one larger than average individual. The shoulder height in Trondheim resembles a normal distribution, with a very small individual and a very large individual, the bulk of individuals at an average height. There is only one individual from Tønsberg and it is larger than averag.

4.8 Age distribution

The juveniles that were identified through the gender determination formula from Trout *et al*. (1977) were considered to be castrated males, rather than juveniles. Therefore those skulls have been counted as castrated adults. Based on the eruption of permanent teeth, 54 of the crania were adults. Knife marks marks and blunt force trauma show that 32 were butchered and/or skinned. One skull was clearly a juvenile, and show signs of butchering from cutting marks. Twenty crania were damaged to such a degree that the maxilla (*upper jaw*) wasn't present.

There are 21 juvenile dogs less than 24 weeks old, based on teeth eruption in the mandibles in the medieval assemblages, 5 of which were either butchered or skinned. And there are 60 dogs that are more than 24 weeks old. Fourteen out of these 60 show signs of having been either butchered or skinned.

The age distribution based on the fusion of epiphysis of the long bones are displayed in table 4.46, as well as the amount of bones that had either axe or knife marks on them.

Table 4.46 Fused and unfused epiphyses in the different long bones. Single unattached epiphyses have not been included. For complete bones, the state of the fusion at the two ends is given separately. The age has been given according to Barone (1999:76). The amount of bones with axe or knife marks has been included.

Bone type		Epiphysis fused	Age	Axe or knife marks	Age	Epiphysis Not fused	Axe or knife marks
Scapula	Proximal	39	≥ 5-8 Months	18	< 5-8 Months	4	0
Humerus	Proximal	28	≥ 12-15 Months	7	< 12 Months	38	6
	Distal	86	≥ 7-8 Months	36	< 7 Months	16	3
Radius	Proximal	73	≥ 9-10 Months	17	< 9 Months	12	3
	Distal	46	≥ 10-12 Months	5	< 10 Months	13	1
Ulna	Proximal	76	≥ 7-8 Months	29	< 7 Months	4	0
	Distal	29	≥ 9-12 Months	8	< 9 Months	5	0
Femur	Proximal	38	≥ 9-12 Months	14	< 9-12 Months	5	1
	Distal	58	≥ 9-12 Months	25	< 9-12 Months	9	2
Tibia	Proximal	86	≥ 10-12 Months	27	< 9-10 Months	36	7
	Distal	68	≥ 10-12 Months	14	< 9-10 Months	31	4
	Total	627		200		173	27

Based on the numbers in table 4.46; 31.9% of all the adult dogs have been butchered and/or skinned. 15.6% of all the juvenile dogs have been butchered and/or skinned 28.4% of all the dog bones that had at least one epiphysis present (fused or unfused) has been butchered and/or skinned.

5 Discussion and Conclusion

5.1 Cranium

The cranial ratios and indices and their low coefficient of variance values suggest that the muzzle itself, both in length and width, is very similar between the individual dogs in the Middle Ages. The skull index and the cranial index as well as the skull length show more variety, and indicate that there are several types of dogs in the assemblages. This tells also that these are the parts of the skull that are more plastic, and change more over time and between different breeds/types than other parts. The length and width of the muzzle as well as the length of the jaw compared to the total length of the skull seem to be very similar between the dog breeds and changes very little.

The plasticity of the skull is very extreme in some cases. All the values of the cranial ratios and indices of the modern dog breeds have a coefficient of variance of more than 10.An indication on that they do not belong to the same group.

The skull index of the medieval dogs are much more uniform than those of the modern dogs.

None of the ratios or indices of the modern dog breeds that are displayed in table 4.1.1d are homogenous. The closest value to being homogenous is the muzzle index with Cv=11.48. This indicates that all the modern dog breeds that have muzzles that are physiologically different from each other. This is as expected. The fact that the muzzle index of the medieval dog bones are homogenous is very significant. It shows that different types of dogs carried the same cranial traits.

Based on figure 4.1, all the types of skulls that were found in Oslo, Trondheim and Tønsberg were also found in Bergen.

Both the modern dogs as well as the modern wolves show that today there is a certain amount of variance amongst individuals of the same group, both in size and shape. Whether or not this is also the case with the medieval dog is hard to say. Without a complete skeleton it is difficult to categorize bones into a specific group.

There is variation of skull sizes between the excavations at Bryggen in Bergen. Hufthammer (1994) has recorded that the material from Bryggen dates from 1170 AD to 1476 AD. Because there is a lot of variation in the assemblage in shape and size of the crania within individual excavations, and there are a lot of similarities between excavations, it is most likely that all the morphotypes that are present in the assemblages have been present throughout this time.

The excavation from Bryggen, JS 1442 has shown the greatest variety in skulls, of which the largest one resembles the modern wolf in size. Though appears to be having a narrower head, making it unlikely to be a wolf. However, without having osteological material of *Canis lupus* from this time period, we can't be certain that this is in fact the case.

The unknown dog from JS 1442 with ID number 30, seems to have an extreme narrow skull, this might be a measuring error as a result of a slightly compressed skull as it has been laying in the ground. The skull itself has extensive damage in both the muzzle and zygions.

The majority of the sub fossil skull index is similar to that of the modern wolf. However, the total length of the skull is half that of the modern wolf, therefore it's not likely that these dogs would be any closer to the wolf than the modern dog breeds are.

Out of the 37 crania, 6 had a keyhole-shaped notch on their foramen magnum. All six crania are from Bergen. Being in the group with the smallest and broadest crania in the material, as well as being brachycephalic, dogs 2, 4 and 5 could have been "toy" dogs. Based on Evans` (2013) explanation of the keyhole in modern dogs, dogs 8, 21 and 29 all have an average size cranium, which could indicate that they are mongrels.

5.2 Mandibula

The diversity between the mandibulae of the sub-fossil material and the modern material is very low. The sub-fossil bones are just as diverse–or lack thereof– as the modern dog breeds. When looking at the cranium, there was a lot of variation in the shape and size. When it comes to the mandibula, the variation is not as large.

All the indices, including the total size of the mandibula had a coefficient of variance of less than 10 between the sub-fossil bones and modern wolf. The modern dog

breeds were a little more diverse, but the length and height of the ramus, as well as the height of the corpus mandibularis were homogeneous. This makes the lower jaw much more uniform across the different groups and breeds of dogs than the skull itself.

Table 4.15 shows that although there are similarities between the medieval dogs and the modern dogs, there are also differences. All the indices and ratios of the mandibles of the medieval dogs were showing signs of being homogeneous. Whereas in modern dogs, the corpus of the lower jaw is showing greater variety amongst the different modern groups (Cv 12.42). The total size of the mandibular was showing only slightly less variety amongst the medieval dogs (Cv 14.21) than in the modern dogs (Cv 18.67).

5.3 Dentition

It might seem as if extreme physiological traits in dogs only occur after a long time of breeding or intensive breeding. The purebred health problems (Ackerman, 2011; the purebred paradox.html) such as: hip problems in the German shepherd, eye problems in the Husky, dogs that die very young such as the Great Dane are present today because of earlier breeding. However, it is possible, as explained by Evans (2013) that extreme traits can already occur in the first generation of offspring. Abnormal dentition size could be the result of a larger dog mating with a small dog, giving the offspring a jaw that is too small for its teeth. It can also be the result of a lasting trait that has come into the DNA, giving the offspring from two equal size parent dogs a jaw that is too small for its teeth. However, in general, large dogs have large teeth, small dogs have small teeth. As shown in this thesis, most mandibles had teeth that were properly sized according to the size of the tooth row. If teeth were changing shape and size in a lower rate than the jaw, we should be finding large jaws, with relatively small teeth, and vice versa. However in the sub-fossil material there were only a few individuals with abnormal dentition.

Teeth were missing in many of the skulls. When a dog loses a tooth, the alveolus in the jaw closes up completely over time (Evans, 2013). Therefore it is hard

to say whether the missing teeth in the sub-fossil mandibula are the result of natural occurring loss of teeth, or whether this missing tooth is a characteristic trait for a certain type of dog (Ackerman, 2011:39-45). Dogs with common oligodontia (abnormal number of teeth) are *i.e.*, Bedlington terrier, Belgian tervuren, Border terrier, Borzoi, Doberman Pinscher, German Shepherd and Jack Russell terrier to name but a few. Whether or not the teeth that were absent from the sub-fossil bones were the result of genetics or natural occurring losses, the majority of carnassials (M_1) were homogenous with the comparative material.

As figure 4.7 illustrates: the size of the M_1 compared to the size of the tooth row-which corresponds with the CtI-is incredibly linear in both the medieval dog as well as in modern dog breeds. This shows that the relation between the size of the tooth and the size of the lower jaw has not changed significantly since the middle ages.

5.4 Scapula

Overall, the scapulae of the medieval dog are smaller and more slender than those of modern dog breeds. Some individuals are similar to modern breeds in their ratios. But none of the sub-fossil bones seem to be exactly the same in both ratio and size as the modern material.

It is known that there were several groups of dogs during the Middle Ages (Hufthammer, 1994). The material in this thesis supports that claim, as the diversity in shoulder height is large. However, the dogs in this study represent almost all sizes, from very small to large. There are a few modern breeds that are smaller and also much larger, but in general the material shows great diversity. There are no clear-cut groups with large size and/or shape differences.

5.5 Long bones

Because the ossification process occurs several times faster in small dogs than it does in big dogs (Barone, 1999) it is relevant to measure the total size of juvenile bones when it comes to determining the dog's breed. If a breed is large, it is likely that

juveniles of that breed are already larger than adult small dogs. Barone (1999), Habermehl (1975), Evans (2013) and other osteological textbooks use an average ossification time span to cover for this difference.

The age of death of a specimen may be misinterpreted if age is based on ossification alone, without looking at the size. A small radius with fused epiphyses *i.e.*, will be categorized as an adult, while a large radius with unfused epiphyses will be categorized as a juvenile, even though both bones could be the same age. Further research into the ossification periods of the long bones of modern dog breeds is needed on this matter.

All the long bones had coefficient of variation values larger than 10 for each measurement in the descriptive statistical analyses. It is clear that the medieval dog consists out of several types of dogs. The humerus of the medieval dog has a smaller caput humerus than most modern breeds. One dog had an exceptionally narrow caput humerus, at a total length of 152 mm. There are 5 humeri that are exceptionally broad in their caput, as their total length increases (GL between 98-131 mm) which is larger than the recorded modern breeds with the same total length.

There are four medieval radii that are rather short but also rather wide in their proximal epiphysis, wider than modern dog breeds. The rest of the assemblages seems to follow a similar regression line as the modern bones, but are narrower in their epiphysis than the modern dog breeds. The shorter the radius the more variation there is in the breadth of the proximal epiphysis. The diaphysis shows a similar variation. There are a few very broad diaphysis where the total length is relatively short, and the longer the radius gets, the thinner and more consistent the diaphysis gets.

The depth of the processus anconaeus of the ulna in the medieval dog, is relatively broad compared to the few modern breeds that were available. The medieval dogs seemed to be right on the same regression line as the modern wolf when it comes to the morphology of the ulna.

The femur shows the same image as the humerus and radius do. The medieval dog is narrower in its proximal epiphysis than our modern comparative dogs. Yet it follows a similar regression line and the variation is similar to modern dog breeds.

There is a distinct group of short and thick tibiae. These tibiae somewhat resemble the modern dachshund but are still a lot more slender. Overall the tibiae from the middle ages are more slender in their proximal epiphysis than the tibiae of modern dogs. However, shorter tibiae show more variation in thickness than longer tibiae.

Increased contact between different populations of dogs can cause bone types to become uniform in shape and size.

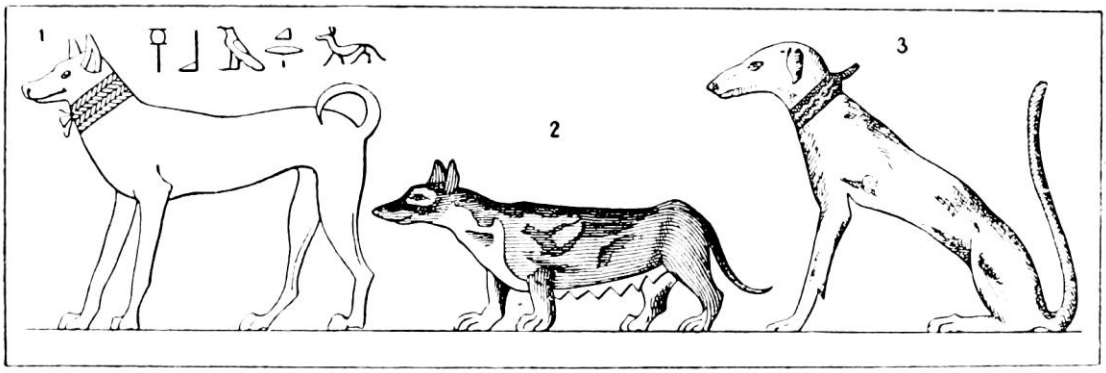
Wagner (1930), Stockhaus (1965) and Wendt (1978) found in their studies that dogs in the Viking and early medieval period in Germany had more variation in their shape than what Harcourt (1974) found in the Anglo-Saxon period (AD 500-1100) in Britain. The lack of variation could be a result of more contact and travel between societies. Since dogs are very plastic, even the first-generation hybrids of purebred parents can exhibit bizarre combinations of body characteristics (Evans, 2013:3; Stockard, 1941). On a short time scale, this will lead to an increase in variety in the shape and size of the dogs, but in the long run this will lead to more uniform groups.

5.6 Shoulder height

The distribution of the shoulder height for dogs in the Middle Ages is comparable to the average dog size we have today, though more towards the smaller end. There were a few small dogs present in the material, as well as a few large ones. Though the majority of the shoulder heights were of average height.

Dogs with significantly shorter legs than the greyhound-like dog (Figure 5.1) were already present in Egypt around 3200 BC (Wilkinson *et al*., 1878:99).

Fig. 5.1 Different types of Egyptian dogs. Dog number 2 resembles a short legged molosser-type dog. Image from Wilkinson et al., (1878:99).



There were a few humeri in the assemblages that were slightly bend, however, because I didn`t actively recorded this, I can not say for sure if these bones resemble those of the modern dachshund. This is something that further study could take a closer look at.

The majority of the medieval dog`s estimated shoulder heights lay within the average height of 35-55cm. However, there were dogs that were below and above this average, with the majority of the dogs leaning towards the shorter end of the average.

There were “average” size dogs as well as very large, and very small dogs in the middle ages. And the diversity of the dogs was already formidable. IN comparison to the modern dog breeds we find in Norway today, the medieval dog were in general slimmer and with fewer extreme features. Given the time period, exceptionally large dogs might have been more rare than average and small dogs. As large dogs require a lot more food, they might have been a much more expensive. Trophy dogs might have also been buried with more care, and therefore harder to find during an excavation.

Bibliography

Ackerman, L., (2011). *The Genetic Connection. A Guide to Health Problems in Purebred Dogs*. (American Animal Hospital Association Press. Second edition)

Alpak, H., Mutus, R. & Onar. V., (2004). Correlation analysis of the skull and long bone measurements of the dog. *Annals of Anatomy*. 186: pp. 323–330.

Barone, R., (2000). *Anatomie comparé des mammifères domestiques*. Tome 1. *Ostéologie*. (Editions Vigot, 4e édition)

Brehm, H., Loeffier, K. & Komeyli, H., (1985) Skull shape in the Dog. *Anatomia Histologia Embryologia*. 14**(4)**: pp. 324-331.

Brinkmann, A., (1920) Canidenstudien *Videnskabelige Meddelese, Dansk Naturhistorisk Forening*, 72, 1-43

Detry, C. & Cardoso, J.L., (2010). On some remains of dog (Canis familiaris) from the Mesolithic shell-middens of Muge, Portugal. *Journal of Archaeological Science*. 37: pp. 2762–2774.

Drake, A.G. & Klingenberg, C.P., (2008). The Pace of Morphological Change: Historical Transformation of Skull Shape in St. Bernard Dogs. *Proceedings: Biological Sciences*. 275: pp. 71–76.

Drake, A.G. & Klingenberg, C.P., (2010). Large-Scale Diversification of Skull Shape in Domestic Dogs: Disparity and Modularity. *The American Naturalist*. 175**(3)**: pp. 289–301.

Duerst, J. U., (1926). Vergleichende Untersuchungsmetoden am Skelett bei Säugern, *Handbuch der Biologischen Arbeitsmetoden,* Abt 7, Metoden der verleichenden morphologischen Forschung, Heft 2, 125-530

Ervynck, A., (2013). Archeologie laat de dieren spreken. *Tijdschrift voor Geschiedenis*. 125**(4)**: pp. 476–487.

Evans, H.E., (2013). *Miller's Anatomy of the Dog*. (Saunders: Philadelphia, first edition 1964, 4th ed)

Germonpré, et al., (2009). Fossil dogs and wolves from Palaeolithic sites in Belgium, the Ukraine and Russia: osteometry, ancient DNA and stable isotopes. *Journal of Archaeological Science*. 36: pp. 473–490.

Harcourt, R.A., (1974). The Dog in Prehistoric and Early Historic Britain. *Journal of Archaeological Science*. 1: 151–175.

Hewson-Hughes, A.K. et al., (2012). Geometric analysis of macronutrient selection in breeds of the domestic dog, *Canis lupus familiaris*. *Behavioural Ecolog*. 10: pp. 923–304.

Hidaka. S. et al., (1998). Morphology and Morphometry of Skulls of Raccoon Dogs, *Nyctereutes procyonoides* and Badgers, *Meles meles*. *Journal of Veterinary Medical Science.* 60**(2)**: pp. 161-167.

Hufthammer, A.K., (1994). The dog bones from Bryggen. *The Bryggen Papers*. 5: pp. 209–286.

Hufthammer, A.K. (2014). Old Bones. Osteoarchaeology in Norway: Yesterday, Today and Tomorrow. *Norwegian Institute for Cultural Heritage Research: 54-63*

Imsen, S., (2003). Ecclesia Nidrosiensis 1153–1537. Søkelys på Nidaroskirkens of Nidarosprovinsens historie. *Senter for middelalderstudier*, NTNU. Trondheim: TapirAkademisk Forlag. p.417

Lie, R. W., (1980). Minimum numbers of individuals from osteological samples, *Norwegian Archaeological Review*, 13: 24-30

- (1988a). En Oversikt over Norges Faunahistorie. *Naturen*: 225-232

Kerswell, K.J. et al., (2009). The relationship of adult morphology and early social signaling of the domestic dog (*Canis familiaris*). *Behavioural Processes*. 81: pp. 376–382.

Moyes, C. D. and Schulte, P. M., (2008). *Principles of Animal Physiology*. (New York: Pearson. Second edition) ch. 14.

Onar, V. & Belli, O., (2005). Estimation of shoulder height from long bone measurements on dogs unearthed from the Van-Yoncatepe early Iron Age necropolis in Easter Anatolia. *Revue Méd Vét*. 156**(1)**: pp. 53–60.

Onar, V. et al., (2001). Skull typology of adult male Kangal dogs. *Anatomia Histologia Embryologia*. 30**(1)**: pp. 41-48

Reitz, E. J. & Wing, E. S., (2008). Zooarchaeology. (Cambridge: Cambridge University Press, Second Edition)

Sandvik, P.U. (2000). The vegetarian component of a late medieval diet. An example from Erkebispegården – The Archbishop's Palace in Trondheim, Norway. *AmS-Skrifter*, 16: 85-92.

Sisson, S., (1975). Carnivore Osteology. In: *Sisson and Grossman's The Anatomy of the Domestic Animals*. (Saunders: Philadelphia London Toronto, Vol 2, 5th ed). pp. 1427-1503.

Simpson, G. G., Roe, A. & Lewontin, R. C. (1960). *Quantitative Zoology*. (Harcourt, New York, Chicago, San Fransisco, Atlanta)

Sokal, R. R. & Rohlf, F. J., (1980). *Biometry*. (San Fransisco)

Stockard, C.R., (1941). *The genetic and endocrinic basis for differences in form and behavior*. (Philadelphia: The Winstar Institute of Anatomy and Biology) pp. 1–804

Stockhaus, K., (1965). Metrische Untersuchungen an Schädeln von Wölfen und hunden. *Zeitschrift für Zoologische Systematik und Evolutionsforschung*, Frankfurt-am-Main, 3: 157-258

Studer, T.H., (1901). *Die prähistorischen Hunde*, (dissertation for the Swiss Paleontological Society, Zürich)

Trouth, C.O. *et al*., (177). Analysis of the sexual dimorphism in the basioccipital portion of the dog`s skull. Cell Tissues Organs. 98**(4)**:pp1-5

Vallanoweth, et al., (2008). A double dog burial from San Nicolas Island, California, USA: osteology, context, and significance. *Journal of Archaeological Science*. 35: 3111–3123.

Von den Driesch, A., (1976). *A guide to the measurement of animal bones from archaeological sites*. (Harvard University: Boston)

Wagner, K., (1930) *Rezente Hunderassen. Eine osteologische untersuchung*. (Oslo, Antropologische abteilung)

Wang, X. & Tedford, R.H., (2008). *Dogs. Their Fossil Relatives & Evolutionary History* (New York. Columbia University Press)

Watson A.G., Evans A.E., de Lahunta A.,(1986) Gross morphology of the composite occipito-atlas-axis joint cavity in the dog, *Zbl Vet Med C Anat Histol Embryol* 15:139-146

Wendt, W., (1978). Untersuchungen an Skelettresten von Hunden. *Ausgrabungen in Haithabu*. Neumünster, 3.

Wilkingson et al., 1878., *The manners and customs of the ancient Egyptians* (London: Albemarle street. Harvard University. Vol 2). 554

Internet

http://www.humanesociety.org/news/magazines/2010/05-06/the_purebred_paradox.html (20 Nov 2015)

Titel page image of dog:
http://hippie.nu/~unicorn/tut/img/basics/animalanatomy/canine-skeleton.jpeg
(downloaded 21-04-2013)

Fig 2.1 Photo of Norway map:
http://www.123rf.com/photo_11451115_political-map-of-norway-with-the-several-counties.html 28 Sep 2015

Image of dog head:
https://img1.etsystatic.com/008/0/5490994/il_570xN.366018479_6llt.jpg 06 Oct 2015

Fig 5.1. Egyptian dogs image
https://en.wikipedia.org/wiki/Tesem#/media/File:PSM_V39_D830_Dogs_from_the_egyptian_monument.jpg (18 Oct 2015)

Fig 3.9
Drawing of Carnassial
Made by J.J.T. Knoest (02 Aug 2015)

APPENDIX A

1 MEASUREMENTS OF THE CRANIA (after von den Driesch, 1976)

1 Total length: *Akrokranion – Prosthion*
2 Condylobasal length: *Occipital condyles – Prosthion*
3 Basal length: *Basion – Prosthion*
4 Basicranial axis: *Basion – Synsphenion*
5 Basifacial axis: *Synsphenion – Prosthion*
6 Neurocranium length: *Basion – Nasion*
7 Upper neurocranium length: *Akrokranion – Frontal midpoint*
8 Viscerocranium length: *Nasion – Prosthion*
9 Facial length: *Frontal midpoint – Prosthion*
12 "Snout" length: *Orbits – Prosthion*
13 Median palatal length: *Staphylion – Prosthion*
14 Palatine length: *Staphylion – Palatinoorale*
15 Length of cheektooth row
16 Length of the molar row
17 Length of the premolar row
18 Carnassial length at cingulum
23 Greatest mastoid breath: *Otion – Otion*
24 Breadth dorsal to external auditory meatus
25 Greatest breadth of the occipital condyles
26 Greatest breath of the bases of the paraoccipital processes
27 Greatest breadth of the foramen magnum
28 Height foramen magnum: *Basion – Opisthion*
30 Zygomatic breadth: *Zygion – Zygion*
31 Least breadth of skull: *aboral of supraorbital processes*
32 Frontal breadth: Ectorbitale – Ectorbitale
33 Least breadth orbits: *Entorbitale – Entorbitale*
34 Greatest palatal breadth: *Outer borders of the alveoli*
35 Least palatal breadth: Behind the canines
36 Breadth at the canine alveoli
37 Greatest inner height of the orbit
38 Skull height: *Skull basis – Sagittal crest*

40 Height occipital triangle: *Akrokranion – Basion*

41 Height (length) of the canine taken out of jaw

Table 1. Crania

Points of measurements							
JS	ID	1	2	3	4	5	6
92		194.1	175.8	166.2	47.1	120.4	95.0
152					58.2		119.0
355		110.1	103.4	97.2	28.5	68.8	60.5
375	3030						
375	3030	116.7	106.8	102.8	31.7	71.6	64.0
375	3030	186.8	177.3	168.7	48.1	121.1	99.0
375	3504				35.3		76.0
380	10040	212.3	196.7	187.6	49.6	138.2	112.5
380	10107	160.5	147.3	140.6	38.9	101.9	82.0
380	10402	141.1	133.8	127.1	37.6	89.5	79.0
380	10404	150.3				96.8	
380	10405				35.5		76.0
380	10410	144.6	137.6	131.6	35.9	95.3	76.2
380	11106	123.3	113.4	107.6	33.1	74.4	66.3
386	B565	174.3	168.4	159.4	45.5	114.3	93.0
387	14999						91.0
397	18202	159.6	150.0	141.6	36.9	104.5	82.0
397	18259						
397	19347						
397	19671						
397	20008						
397	20014	154.6	142.9	136.5	34.6	103.1	79.0
397	20249						
397	20249						
397	20249						
397	20251						
397	20253	194.3	181.7	173.2	44.6	130.2	97.0
397	20504						
397	20506						
397	20506						
397	21098						
397	21102						
397	21105						
397	21107						
397	21111						
397	21562						
397	21876				32.4		67.5
397	21888	168.8					
397	21891						
397	21894						
397	21894						
397	21894						
397	22053						
397	22278						
397	22278						
397	22282						
397	22283						
397	22283						
397	22284						
397	22727						
397	22782						
406	19325	136.7	127.0	120.6	32.9	87.2	74.8
406	20433	142.7	131.7	125.2	36.3	89.7	76.9

(**table 1**. contd)

Points of measurements							
JS	ID	1	2	3	4	5	6
406	20825	187.6	176.5	168.1	50.9	117.4	99.0
406	21287	126.8				81.9	
406	21350	160.7					
406	21546	175.2		155.7	41.9	114.4	93.5
406	21644	155.6	147.9	139.8	37.3	101.7	79.5
406	22064	145.9	135.7	127.0	36.0	91.1	76.0
492	69564						
492	69564						
492	69564						
540	78893						62.5
540	79893	154.9	148.1	140.6	41.0	99.6	83.5
540	79893	144.7	134.8	127.9	33.3	94.3	71.0
540	80251	175.7	169.1	159.0	43.1	115.9	91.0
540	80251				43.5		
540	81197	180.6	171.5	162.8	46.0	117.0	93.0
540	81317						
540	81328	161.0		145.6			
540	81396	113.7					
540	79488/01				43.7		92.0
540	80688/01						
540	80759/01	172.4	161.5	152.3	42.9	112.1	92.5
599		162.2	159.0	150.9	42.5	108.6	89.0
644	USB/A 194	189.5	179.2	169.9	49.0	122.0	97.1
664							
809	5132						
1442	42337					115.1	
1442	44932	212.7	198.8	190.0	52.7	137.0	105.7
1442	45248	250.9	237.7	225.0	60.4	164.4	125.0
1442	45261	196.7	182.6	172.4	48.2	124.8	99.0
1442	55816	180.1	166.1	159.0	44.0	116.6	92.0
1442	77777	125.9				79.8	
1442	77920				52.4		110.0
1518							

Table 1. Crania

Points of measurements		7	8	9	12	13	14
JS	ID						
92		97.6	95.8	108.9	81.0	94.6	31.0
152		108.8					
355		57.3	51.6	62.6	41.5	54.6	19.8
375	3030		99.0	116.6	82.5		
375	3030	60.1	56.6	66.7	46.9	57.8	17.1
375	3030	88.9	91.9	108.2	81.6	97.3	35.5
375	3504	75.3					22.1
380	10040	103.5	101.0	124.1	92.2	107.8	34.5
380	10107	78.3	79.3	92.6	67.8	77.7	27.3
380	10402	69.4	69.6	83.7	58.5	70.0	25.3
380	10404	74.4	74.3	83.8	59.1	72.0	23.4
380	10405						
380	10410	68.7	69.3	83.3	57.0	74.0	27.1
380	11106	63.8	59.1	67.7	47.2	59.3	18.2
386	B565	82.8	84.2	99.2	73.1	87.5	29.5
387	14999						
397	18202	74.3	76.8	92.2	66.5	80.6	26.4
397	18259		70.6	84.8	53.8		
397	19347						
397	19671		79.2	92.8	66.2	78.0	26.4
397	20008						
397	20014	72.6	79.2	92.4	64.2	79.8	27.1
397	20249						
397	20249						
397	20249					86.6	27.3
397	20251		64.6	78.7	49.6	66.0	23.1
397	20253	90.3	95.9	113.9	84.8	95.4	29.8
397	20504						
397	20506						
397	20506						
397	21098					70.1	
397	21102						
397	21105						
397	21107						
397	21111						
397	21562	82.9					
397	21876	58.7					
397	21888	79.0	85.2	101.6	74.5	85.3	28.3
397	21891						
397	21894						
397	21894						
397	21894		83.1	97.0	71.5	84.5	29.8
397	22053						
397	22278						
397	22278		63.9	73.8	62.1		
397	22282						
397	22283						
397	22283						24.5
397	22284						
397	22727						
397	22782						
406	19325	67.8	63.0	81.2	53.5	70.5	22.7
406	20433	73.8	66.3	81.0	56.2	71.0	22.5

(**table 1**. contd)

Points of measurements		7	8	9	12	13	14
JS	ID						
406	20825	81.6	84.5	98.5	72.6	88.2	28.6
406	21287	88.6	89.7	109.8	81.0	91.7	33.8
406	21350	64.1	60.7	69.3	52.5	65.9	20.6
406	21546	79.5	83.6	97.9	73.5	83.7	35.3
406	21644	84.4	84.5	102.3	75.4	88.6	31.1
406	22064	73.8	72.6	87.7	61.9	79.4	26.8
492	69564	79.9	75.7	88.9	61.5	67.3	20.1
492	69564						
492	69564						34.5
540	78893		67.3	79.2	53.6	70.3	24.6
540	79893	68.2					
540	79893	70.0	75.4	95.0	65.1	77.1	26.7
540	80251	73.2	68.7	83.0	59.1	73.6	24.5
540	80251	82.3	86.2	102.7	69.9	88.2	28.5
540	81197	85.4					
540	81317	82.8	91.8	108.1	76.0	88.2	28.9
540	81328				66.5		51.1
540	81396		76.7	88.5		78.3	26.2
540	79488/01	60.2	50.8	62.5	39.2	59.5	20.1
540	80688/01	82.8				32.9	
540	80759/01		70.7	83.5	59.8	71.1	24.3
599		85.6	86.3	105.1	74.8	85.3	27.8
644	USB/A 194	75.5	82.9	93.6	69.7	82.9	27.9
664		88.1	93.7	109.6	79.0	96.6	34.2
809	5132						
1442	42337						
1442	44932					92.6	33.6
1442	45248	98.4	107.9	125.5	93.5	107.8	40.1
1442	45261	117.0	126.5	146.5	109.6	128.5	45.4
1442	55816	95.6	95.8	113.8	86.5	93.1	31.4
1442	77777	83.4	89.2	106.9	79.3	90.6	29.5
1442	77920	64.2	57.0	69.7	47.8	66.0	21.7
1518		99.7					

Table 1. Crania

Points of measurements		15	16	17	18	22	23
JS	ID						
92		63.5	20.1	50.3	18.7	22.2	66.9
152						26.8	76.6
355		41.8	13.9	30.9	14.4	14.3	40.4
375	3030						
375	3030	43.0	13.9	29.7	13.7	15.1	40.4
375	3030	71.0	18.6	55.3	17.9	20.1	60.9
375	3504		17.4	38.0	15.5	15.9	51.2
380	10040	73.1	20.5	53.6	20.2	23.0	71.5
380	10107	57.9	16.3	39.5	16.9	18.8	53.8
380	10402	52.6	15.4	37.0	16.2	17.1	50.2
380	10404	56.3	15.2	42.7	17.0		52.6
380	10405					17.7	48.4
380	10410	54.4	15.9	40.9	16.1	17.6	48.1
380	11106	43.2	14.8	32.3		15.6	46.2
386	B565	62.4	18.5	46.7	17.0	21.2	60.7
387	14999						
397	18202	63.5	21.8	51.2	14.6	24.0	54.9
397	18259	51.4	18.1	39.7			
397	19347					17.7	48.1
397	19671	57.1	17.0	43.8	15.7		
397	20008	48.4	13.0	37.2	15.8		
397	20014	55.6	15.2	44.7	16.4	18.3	53.8
397	20249			44.5	17.7		
397	20249	63.5	17.0	46.2	17.2		
397	20249	64.2	17.5	46.5	17.9		
397	20251	47.2	14.4	35.6	14.7		
397	20253	69.5	18.6	52.9	17.0	19.5	61.4
397	20504	53.2	15.5	39.8			
397	20506		17.8	16.4			
397	20506	65.8	18.6	48.1	18.3		
397	21098	51.2	17.0	38.5	15.7		
397	21102	52.9	15.0	39.1	16.0		
397	21105						
397	21107		14.9		16.2		
397	21111	54.6	14.9	27.4	15.0		
397	21562		16.0	46.5	16.9	19.6	54.9
397	21876					16.7	46.0
397	21888	62.3	17.4	47.3	17.4		
397	21891	60.7	16.7	46.5	17.6		
397	21894					17.2	
397	21894						
397	21894	63.2	17.8	45.9	17.1		
397	22053						
397	22278	41.1	16.6	24.0	11.0		
397	22278	46.8	14.3	35.4	14.2	16.5	
397	22282		16.8		15.7		
397	22283					21.2	
397	22283	58.3	15.7	42.0	14.9	20.0	
397	22284	51.5	15.7	41.4	16.1		
397	22727			51.4	19.6		
397	22782			42.3	15.9		
406	19325	46.5	15.2	36.8		17.1	49.5
406	20433	50.2	16.3	37.6	15.3	16.8	50.9

(**table 1**. contd)

Points of measurements		15	16	17	18	22	23
JS	ID						
406	20825	50.7	16.8	37.8	15.3	21.2	57.9
406	21287	71.9	24.9	56.6	18.8	29.6	62.6
406	21350	52.0	18.8	41.7	14.3	21.2	
406	21546	66.1	30.4	51.0	27.0		
406	21644	61.3	17.6	46.7	17.0	20.4	59.0
406	22064	62.8	22.4	50.5	17.4	27.1	54.3
492	69564	50.5	18.0	37.4	14.3	18.7	54.4
492	69564						
492	69564				18.2		
540	78893	16.4					
540	79893					15.3	
540	79893	56.1	16.1	43.7	17.8	17.5	53.8
540	80251	54.4	16.7	40.9	14.6	19.8	52.6
540	80251	60.8	16.9	45.1	16.3	23.2	58.8
540	81197					19.9	64.0
540	81317	63.4	17.3	49.0	18.1	21.2	63.0
540	81328	56.6	15.4	43.8	16.2		
540	81396	58.0	15.3	43.5	15.5	19.6	53.8
540	79488/01	43.0	12.4	33.4		17.0	
540	80688/01	64.2	16.8	51.3	17.4	20.8	60.8
540	80759/01	54.5	14.9	41.5	16.3	18.7	
599		63.5	18.3	48.4		19.9	60.4
644	USB/A 194	60.6	15.9	42.7	17.0	20.4	56.0
664		70.5	19.3	51.2	18.2	22.8	68.0
809	5132			47.1	17.1		
1442	42337						
1442	44932	65.7	17.7	48.8	18.4		
1442	45248	76.7	19.6	58.5	17.0	23.5	69.3
1442	45261	90.5	18.7	63.7	18.9	25.3	79.0
1442	55816	67.6	18.6	49.7	18.3	20.9	67.5
1442	77777	64.2	18.3	44.5	17.0	18.4	62.6
1442	77920	43.4	7.3	32.4	12.7	16.1	45.3
1518						25.7	75.2

Table 1. Crania

Points of measurements		24	25	26	27	28	29
JS	ID						
92		67.7	38.3	51.8	17.6	13.2	60.8
152		76.9	46.3	62.5	22.6	15.4	76.9
355		41.5	22.1	28.0	13.0	12.6	48.5
375	3030						
375	3030	44.0	23.3	29.4	14.0	15.7	49.5
375	3030	59.9	34.8	45.9	17.7	13.7	58.2
375	3504	52.3	29.1	37.2	15.6	14.1	52.5
380	10040	69.8	40.3	56.5	21.2	14.8	62.4
380	10107	53.6	29.3	44.0	15.0	19.4	52.2
380	10402	51.7	27.2	37.3	14.6	16.2	80.8
380	10404	54.2					94.9
380	10405	48.5	28.6	40.5	14.0	15.2	52.6
380	10410	49.1	30.5	37.4	17.6	15.5	82.9
380	11106	46.2	24.7	34.7	14.0	15.3	77.5
386	B565	57.7	34.0	47.3	18.8	12.8	97.7
387	14999	58.2	35.6		17.6	14.1	58.1
397	18202	53.9	30.3	41.1	17.2	14.4	54.2
397	18259						
397	19347	49.0	26.8	36.8	14.5	16.3	
397	19671						
397	20008						
397	20014	53.8	30.0	40.1	16.3	12.0	
397	20249						
397	20249						
397	20249						
397	20251						
397	20253	59.2	35.5	48.0	18.7	13.5	52.1
397	20504						
397	20506						
397	20506						
397	21098						
397	21102						
397	21105						
397	21107						
397	21111						
397	21562	54.8					57.0
397	21876	45.1	25.3	35.8	14.0	12.8	46.6
397	21888						52.4
397	21891						
397	21894						
397	21894		34.0		17.9	14.0	
397	21894						
397	22053						
397	22278						
397	22278						48.6
397	22282						
397	22283						
397	22283						
397	22284						
397	22727						
397	22782						
406	19325	47.6	28.0	37.0	14.9	11.2	
406	20433		30.4		15.9	18.2	53.5

(**table 1**. contd)

Points of measurements		24	25	26	27	28	29
JS	ID						
406	20825	55.9	32.5	45.4	16.5	13.1	53.9
406	21287	62.3	37.3	49.1	16.6	13.0	59.1
406	21350						52.5
406	21546						57.7
406	21644	60.2					57.1
406	22064	54.6	32.0	44.1	16.7	14.9	50.0
492	69564	53.8	30.6	40.1	16.4	12.4	50.2
492	69564						
492	69564						
540	78893						
540	79893		28.3	35.8	15.3	14.5	49.1
540	79893	52.4	32.0	39.5	17.0	13.8	50.1
540	80251	53.2	29.9	39.9	15.4	11.8	53.5
540	80251	59.0	35.2	48.0	18.3	13.4	56.2
540	81197	60.9	36.0	47.1	17.7	14.9	54.4
540	81317	63.6	34.2	51.2	18.0	14.0	53.7
540	81328						
540	81396	54.5	31.5	41.8	16.0	12.9	54.3
540	79488/01						50.0
540	80688/01	61.3	33.7	48.6	17.5	13.9	57.0
540	80759/01						
599		61.7	34.4	46.4	18.1	14.5	58.4
644	USB/A 194	55.8	32.8	44.2	18.4	14.1	96.4
664		65.8	38.4	51.8	19.6	14.9	55.9
809	5132						
1442	42337						
1442	44932						
1442	45248	67.2	39.3	53.9	20.2	15.1	107.2
1442	45261	76.0	45.1	65.4	20.3	16.9	124.1
1442	55816	68.2	37.5	53.1	19.2	14.8	107.7
1442	77777	61.0	35.4	45.7	19.3	13.8	95.4
1442	77920	48.5					78.7
1518		72.0	42.1	56.2	20.3	15.5	99.9

Table 1. Crania

Points of measurements		30	31	32	33	34	35
JS	ID						
92		104.5	39.7	55.8	39.2	67.2	35.8
152		120.1	39.2	54.8	46.0		
355		67.6	33.9	35.3	23.2	43.5	20.8
375	3030						
375	3030	72.2	30.5	33.5	22.9	41.6	19.9
375	3030	101.5	34.2	51.4	36.3	62.0	32.1
375	3504	83.1	36.5	46.0	29.9	53.4	27.4
380	10040	117.2	39.2	52.5	40.6	67.9	38.9
380	10107	89.2	40.3	45.6	30.3	53.9	25.4
380	10402	54.0	35.2	38.7	26.4	51.0	27.3
380	10404	55.2	36.0	43.0	29.9	55.1	29.1
380	10405	72.6	34.0	35.5	23.7		
380	10410	53.1	33.7	40.1	26.4	51.5	27.4
380	11106	48.2	33.0	39.4	25.4	48.9	24.3
386	B565	53.2	33.7	47.5	30.7	60.9	32.6
387	14999		36.0				
397	18202	85.2	33.4	39.3	27.6	55.7	38.4
397	18259		30.2	37.6			
397	19347						
397	19671			41.4	29.0	59.5	30.2
397	20008						
397	20014	89.6			27.9	51.7	28.5
397	20249						
397	20249						
397	20249	101.4				34.0	31.6
397	20251		41.2	46.1	27.9	45.6	22.7
397	20253	39.6				62.6	36.5
397	20504						
397	20506						
397	20506						
397	21098	76.4				53.4	26.6
397	21102						
397	21105		35.8	38.8	26.8		
397	21107						
397	21111					59.4	26.6
397	21562	91.8	31.2	40.6	29.7	58.4	30.6
397	21876		31.8	33.4	22.7		
397	21888	87.6	37.6	49.3	32.2	56.6	27.6
397	21891						
397	21894						
397	21894						
397	21894	91.4	28.9	37.9	26.8	58.4	30.2
397	22053		23.2				
397	22278						
397	22278	77.8	31.8			50.6	26.8
397	22282		33.6	46.0			
397	22283						
397	22283					52.8	27.4
397	22284						
397	22727						
397	22782					59.3	29.6
406	19325	79.5			25.8	44.9	24.9
406	20433	85.1	35.3	37.8	24.9	50.9	26.9

(**table 1**. contd)

Points of measurements		30	31	32	33	34	35
JS	ID						
406	20825	96.3	34.6	44.9	30.3	58.4	31.1
406	21287	110.5	41.4	52.2	36.9	70.0	41.5
406	21350	77.5	33.0	38.0	24.7	53.1	30.1
406	21546	87.6	44.7	47.9	35.8	58.0	35.1
406	21644	97.5	36.2	48.6	35.2	59.8	32.7
406	22064	90.3	34.3	44.6	29.3	60.3	34.0
492	69564	85.5	29.1	39.0	27.5	50.0	26.8
492	69564						
492	69564						
540	78893		30.1	38.8	25.3		2.6
540	79893	69.0	34.0	36.9	24.9		
540	79893	88.2	33.3		29.0		28.6
540	80251	86.6	37.5		29.7	51.2	27.1
540	80251	101.0	32.7	46.8	30.3	59.1	33.0
540	81197	100.8	37.0	50.4	34.3		
540	81317	103.4	36.0	35.0		64.4	31.4
540	81328					55.4	27.8
540	81396	82.0	32.0	40.9	29.4	55.4	26.8
540	79488/01	71.2	38.1	39.2	24.3	43.9	22.3
540	80688/01	96.4	35.5		32.8	60.6	32.1
540	80759/01	79.5	29.8	38.4	26.5	50.6	26.0
599		91.8	40.9	48.3	35.5	57.7	32.3
644	USB/A 194	54.3	34.3	41.3	29.9	56.5	27.1
664		103.6	36.4	56.0	35.5	64.9	34.2
809	5132						
1442	42337						34.5
1442	44932					61.2	33.4
1442	45248	60.6	39.6	57.4	41.1	68.0	35.6
1442	45261	64.4	40.9	71.1	50.3	75.7	39.7
1442	55816	58.5	39.5	59.9	38.0	65.2	34.4
1442	77777	51.3	34.1	41.8	30.1	57.9	30.3
1442	77920	52.3	32.4	34.8	25.4	48.5	24.9
1518		58.4	43.1	52.9	36.8		

Table 1. Crania

Points of measurements		36	37	38	40	41
JS	ID					
92		36.7	28.1	58.7	43.7	
152				70.3	50.9	
355		22.3	22.0	43.7	28.7	
375	3030					
375	3030	22.5	22.6	43.8	28.5	
375	3030	34.2	29.2	56.2	42.0	
375	3504		32.7	45.3	39.0	
380	10040	42.3	31.2	61.7	48.3	54.2
380	10107	28.6	25.7	52.8	40.1	
380	10402	28.1	23.0	44.7	32.6	
380	10404	31.6	27.3			31.5
380	10405			45.8	33.9	
380	10410	28.2	26.6	47.5	35.0	
380	11106	25.8	23.7	43.1	31.1	
386	B565	35.0	29.0	56.3	41.4	
387	14999		42.2	38.5		
397	18202	29.3	27.0	47.3	37.3	
397	18259		23.6			
397	19347					
397	19671	31.7	25.2			
397	20008					
397	20014	28.9	27.7	49.9	36.2	
397	20249					35.8
397	20249					35.6
397	20249	57.0				37.2
397	20251	25.4	23.8			
397	20253	37.0	29.0	56.1	43.1	43.8
397	20504					
397	20506					
397	20506					
397	21098	27.8				33.6
397	21102					
397	21105					
397	21107		24.6			
397	21111	29.4	24.8			
397	21562		26.2			
397	21876			42.7	33.3	
397	21888	29.6	26.4			
397	21891		27.1			
397	21894					
397	21894					
397	21894	32.3	28.4			
397	22053					
397	22278					
397	22278	27.1	37.8	26.4		
397	22282		25.8			
397	22283					
397	22283	30.4	26.9			
397	22284					
397	22727					
397	22782	31.0				
406	19325	26.6	25.5	44.2	33.1	
406	20433	28.3	26.7	46.3	34.7	

(**table 1**. contd)

Points of measurements		36	37	38	40	41
JS	ID					
406	20825	31.5	28.3	59.1	39.4	35.0
406	21287	37.1	29.2	55.3	45.0	
406	21350	24.0	23.6			
406	21546	36.7	33.9			
406	21644	33.5	27.8	51.4	40.5	
406	22064	30.4	26.3	48.4	40.7	
492	69564	27.4	25.8	48.3	37.3	
492	69564	38.8				
492	69564					
540	78893					
540	79893			42.1	32.0	
540	79893	29.3		50.3	37.7	
540	80251	27.8	25.6	44.6	36.3	
540	80251	33.8	30.0	57.2	42.4	
540	81197			56.8	43.8	
540	81317	32.4		55.8	41.3	
540	81328	29.8				
540	81396	30.2	27.3	50.1	36.1	
540	79488/01	22.9	21.9			
540	80688/01	28.6	52.8	42.6		
540	80759/01	27.8	25.0			
599		33.1	27.6		41.9	
644	USB/A 194	28.6	27.3	53.5	38.6	40.8
664		37.1	29.7	62.2	48.1	
809	5132					37.0
1442	42337	34.3				32.7
1442	44932	34.9	28.2			
1442	45248	38.0	30.9	53.0	47.1	41.1
1442	45261	40.8	34.3	67.1	54.4	46.5
1442	55816	36.7	28.7	57.6	47.8	
1442	77777	30.9	28.4	56.2	43.9	
1442	77920	25.0	25.0			
1518				58.7	47.1	

2 MEASUREMENTS OF THE MANDIBULA (after von den Driesch, 1976)

1 Total length: *Condyle process – Infradentale*

2 Length: *Angular process – Infradentale*

3 Length from indentation between condyle process and angular process – Infradentale

4 Length: *Condyle process – Aboral border of canine alveolus*

5 Length from indentation between condyle process and angular process – Aboral border of Canine alveolus

6 Length: *Angular process – Aboral border of canine alveolus*

7 Length: *Aboral border of alveolus M_3 – Aboral border of canine alveolus*

8 Length of cheektooth row, M_3–P_1, measured along the alveoli

9 Length of cheektooth row, M_3–P_2, measured along the alveoli

10 Length of the molar row, measured along the alveoli

11 Length of the premolar row, P_1–P_4, measured along the alveoli

12 Length of the premolar row, P_2–P_4, measured along the alveoli

13 Length and breadth of the carnassial, measured at the cingulum

14 Length of the carnassial alveolus

17 Greatest thickness of the body of jaw (below M_1)

18 Height of the vertical ramus: *Basal point of the angular process – Coronion*

19 Height of the mandible behind M_1

20 Height of the mandible between P_2 and P_3

21 Height (length) of the canine taken out of jaw

Table 2. Mandibula

Points of Measurement		1	2	3	4	5	6
JS	ID						
92		131.5	131.6	124.3	112.2	108.2	112.5
159		123.6	118.4	115.6	108.0	100.0	102.8
380	1017	117.2	115.6	111.7	102.3	96.4	100.4
397	18202	115.8	115.7	111.1	97.5	94.7	100.1
397	18202	115.6	116.2	110.9	101.0	96.0	101.7
397	18258				83.6	80.2	83.1
397	19673	113.2	114.2	109.4	98.2	95.5	100.7
397	19673	132.1	130.0	126.8	113.3	108.3	111.9
397	19675	117.6		114.6	103.1	100.3	
397	19675	103.1	101.9	99.7	89.8	87.1	89.9
397	19675						
397	20003	120.7	121.6	115.9	104.5	99.7	105.4
397	20006						
397	20006	114.0	115.0	110.9	98.3	95.3	99.9
397	20006	86.3	85.8	82.6	72.4	69.3	71.9
397	20008	97.6	97.2	92.7	84.0	78.7	82.0
397	20008						
397	20012	106.9	107.9	103.5	89.7	87.6	91.7
397	20012	75.7					
397	20012	132.4	132.4	127.3	112.6	109.3	114.0
397	20013		16.7				102.1
397	20247	108.5	107.7	103.5	93.2	89.0	93.0
397	20248						
397	20249	126.4	129.1	121.4	110.3	105.9	112.2
397	20249						
397	20249	110.3	111.1	108.2	93.2	91.8	95.3
397	20249	148.5	147.0	140.6	128.4	122.8	128.9
397	20251	94.9	95.7	90.6	80.6	77.0	81.6
397	20253	133.2	132.9	128.1	114.6	109.1	114.8
397	20253	128.5	128.3	124.7	107.9	107.0	110.1
397	20253						
397	20253				124.1	118.9	119.4
397	20257	118.2	118.8	114.3	101.6	98.0	103.4
397	20260	116.8	116.3	110.8	100.8	95.1	100.4
397	20260	141.5	140.4	136.2	123.1	117.7	121.7
397	20504	108.5	109.9	104.2	93.1	90.8	96.4
397	20506	132.0		125.8	114.3	109.4	
397	20506						
397	21098	129.9	130.6	125.8	109.5	108.5	112.9
397	21098	101.6	102.5	98.8	86.7	83.8	78.4
397	21103	140.5	140.8	135.3	123.7	118.8	124.2
397	21109						
397	21111		118.3	112.4		94.9	102.0
397	21114						
397	21114						
397	21114						
397	21115						
397	21119	106.3	106.8	101.8	90.0	87.0	92.7
397	21119	109.3			95.7		
397	21120	79.6	80.5	76.7	66.2	64.3	67.9
397	21121	107.0	107.3	102.0	90.4	87.1	82.0
397	21121		132.2				115.0
397	21121						

(**table 2**. contd)

Points of Measurement		1	2	3	4	5	6
JS	ID						
397	21559						
397	21560	135.7	137.0	131.2	118.1	113.3	119.9
397	21565						
397	21872	94.0	92.0	89.9	81.8	78.3	79.8
397	21876	86.2	87.0	84.2	78.3	75.7	79.0
397	21876	94.8	95.5	90.9	79.6	76.5	81.3
397	21876						
397	21877	100.9	98.4	97.0	89.4	85.9	87.1
397	21880	107.6	109.4	104.5	92.0	89.4	94.3
397	21882	130.7	131.1	127.1	111.9	108.8	112.2
397	21882	88.2	87.2	82.9	74.8	70.2	74.6
397	21886	94.8	92.7	89.1	80.1	74.9	78.4
397	21890	86.2	86.6	81.7	71.9	67.9	72.4
397	21890	131.0	131.5	126.5	113.3	108.4	113.6
397	21891	123.2	124.0	118.8	106.3	102.7	107.3
397	21894	124.4	125.1	121.0	105.9	103.0	107.6
397	22056	97.0			84.6		
397	22278	78.8	75.6	75.9	66.9	64.8	65.3
397	22283	107.6	105.8	103.3	95.0	90.2	93.6
397	22285		105.6	103.9		92.9	94.3
397	22572						
397	22573	151.0	150.7	142.8	135.9	127.6	135.1
397	22722	112.8	113.2	107.7	94.7	91.2	96.1
397	22775	112.3	112.8	107.9	94.4	91.6	96.7
397	22780	140.6	139.9	133.7	121.3	115.3	122.2
397	22780	121.1	123.5	117.1	104.3	101.0	107.8
397	22780	104.5	100.9	99.1	91.3	86.3	87.5
397	22907	111.1	110.9	105.6	97.6	91.7	96.9
401	25724	129.3	129.5	124.5	111.5	106.4	111.7
401	25727	117.5	114.2	112.0	102.5	97.7	99.3
401	25727	117.5	113.8	12.5	102.5	98.1	99.3
406	19325	97.3	99.3	96.5	81.8	80.4	84.8
492	69564						
492	69564						
492	69564				89.6	86.5	
492	69564	156.2	155.5	145.9	138.6	129.6	138.7
519							
519							
519		117.1		112.3	101.9	98.0	
519							
519					54.6	52.9	53.3
519							
519		127.8	129.5	124.5	112.0	110.6	116.2
519		91.9	90.2	87.8	78.5	74.9	77.6
519							
529	72382	113.0	113.2	108.1	98.1	92.8	98.8
529	72392	78.9	75.7	74.1	68.9	64.4	65.7
540	79330	129.8	131.9	126.3	113.3	109.2	114.9
540	81328	117.5		12.4	104.4	99.5	
540	81355	164.5	167.0	159.7	142.7	139.5	148.3
540	81355	133.2	134.2	126.6	116.2	111.0	118.3
540	81396	81.7	82.8	79.6	69.0	67.1	70.5
702					71.1	68.0	

(**table 2**. contd)

Points of Measurement		1	2	3	4	5	6
JS	ID						
702		101.3	101.0	97.2	90.7	86.6	90.7
702		83.1	82.2	79.5	70.9	67.7	70.4
809	5137	125.3	126.3	121.2	109.3	105.5	111.2
845	120072						
845	121511				140.3	135.6	139.6
845	137484						
845	138376			166.8		145.1	
845	138378						
1398	S.12198						
1398	S.12198					81.5	
1442	77777	91.5	90.1	86.4	79.6	75.2	78.8

(**table 2**. contd)

Points of Measurement		7	8	9	10	11	12
JS	ID						
92		72.1	66.9	62.0	28.7	37.4	32.6
159		71.6	67.6	63.8	32.1	36.6	30.6
380	1017	68.3	64.7	61.0	31.2	34.5	30.1
397	18202	66.6	64.1	59.3	229.5	33.2	29.0
397	18202	68.4	63.8	59.9	30.1	34.4	30.3
397	18258	60.2	57.6	55.4	31.3	32.5	29.6
397	19673	67.5	62.2	57.8	28.6	33.4	28.9
397	19673	71.5	65.8	62.0	32.0	35.8	31.7
397	19675	70.4		60.5	29.7		30.9
397	19675	62.7	58.5	54.5	28.7	34.0	27.4
397	19675						
397	20003	65.5		58.2	26.9		31.0
397	20006	48.9	48.0	44.8	21.3	27.0	23.7
397	20006	65.0	61.6	55.2	30.2	32.7	25.6
397	20006	49.2	47.9	44.7	22.2	27.6	24.4
397	20008	53.0	50.3	43.4	23.3	28.1	23.6
397	20008						
397	20012	62.3	56.8	53.1	26.4	31.0	27.2
397	20012				22.2		
397	20012	76.8	71.6	67.1	32.6	38.9	33.2
397	20013					35.6	30.8
397	20247	64.5	61.4		30.6	32.4	
397	20248				20.3		
397	20249	71.5	66.4	61.2	32.3	35.2	30.2
397	20249	70.3	66.2	61.8	31.6	33.9	29.8
397	20249	66.6	64.6	61.5	31.2	34.1	29.8
397	20249	82.8	77.2	72.5	36.0	40.4	35.8
397	20251	54.0	51.9	48.2	24.4	28.0	24.2
397	20253	77.9	72.8		32.9	39.8	
397	20253	73.9	69.8	65.7	32.8	37.6	33.2
397	20253				32.1		
397	20253	81.7	76.2	71.6	35.6	42.0	36.7
397	20257	69.2	65.6	60.8	31.4	36.0	30.5
397	20260	68.4	62.9	58.7	28.2	34.2	30.6
397	20260	82.4	76.8	70.7	35.5	42.0	36.5
397	20504	62.9	58.6	55.5	29.5	29.7	26.1
397	20506	74.6	68.8	63.0	33.9	35.7	30.8
397	20506				29.6		
397	21098	74.1		64.9	33.2		31.7
397	21098	60.2	57.7	53.2	27.9	30.5	26.2
397	21103	79.3	71.1	66.6	33.6	37.9	32.5
397	21109		64.6	60.7	32.1	33.5	29.6
397	21111	68.2	65.1	61.0	32.2	34.4	29.9
397	21114						
397	21114						
397	21114					32.3	28.9
397	21115				23.2		
397	21119	62.1	58.1	53.7	29.2	29.4	24.9
397	21119	65.3	60.2	56.3	29.1	32.3	27.6
397	21120	46.0		38.2	21.9		20.5
397	21121	61.3	58.2		28.4		
397	21121	76.5	70.7	65.7	32.6	39.1	34.3
397	21121	67.1	63.9	59.9	32.0	31.7	28.2

(**table 2**. contd)

Points of Measurement		7	8	9	10	11	12
JS	ID						
397	21559						
397	21560	78.0	71.9	67.3	35.2	38.5	33.6
397	21565					29.4	26.8
397	21872	57.7	54.0	48.8	25.0	29.8	24.8
397	21876	53.6	52.6	49.0	25.6	27.5	24.8
397	21876	57.2	54.1	50.5	25.8	28.1	25.0
397	21876						
397	21877					36.2	28.8
397	21880	62.2	58.5	54.7	27.8	30.3	26.3
397	21882	75.8	71.1	66.2	33.2	38.4	33.0
397	21882	49.8	47.5	44.2	22.1	25.4	21.9
397	21886	55.1	52.9	49.2	25.1	27.8	23.7
397	21890	50.2	48.2	43.5	23.3	26.6	21.9
397	21890	76.1	71.1	66.6	32.7	38.7	33.9
397	21891	71.1	67.8	63.0	31.3	36.6	31.8
397	21894	72.8	68.5	63.5	31.7	36.6	31.7
397	22056					33.2	26.0
397	22278					17.4	14.5
397	22283	61.7		53.3	23.6		30.0
397	22285	69.2	62.5	60.4	34.6	30.5	27.6
397	22572		62.4		32.7	29.4	
397	22573	85.8	78.6	73.1	36.4	42.8	37.0
397	22722	64.8	57.7		30.6	32.2	
397	22775	64.5	60.5	57.0	29.8	31.7	28.4
397	22780	77.7	70.9	66.3	34.7	36.0	31.0
397	22780	70.8	65.8	61.8	31.9	35.0	30.4
397	22780	61.8	59.2	54.4	26.9	32.6	28.5
397	22907	60.5	56.1	52.6	25.0	30.9	27.9
401	25724	68.7	64.8	61.8	29.1	37.7	33.1
401	25727	67.7	65.1	58.4	28.3	37.6	29.0
401	25727	67.8	65.1	57.5	27.5	36.4	30.3
406	19325	57.6	54.4	49.8	27.8	27.3	23.3
492	69564					31.4	27.2
492	69564		72.5	70.4	34.6	42.5	36.1
492	69564	61.9	58.5	54.8	28.1	31.3	27.0
492	69564	87.0	77.7	71.8	37.1	42.3	36.0
519		71.5	68.0	61.4	32.4	36.4	13.4
519		70.1	65.3	61.7	30.1	35.4	30.5
519		61.4	58.3	53.9	28.1	32.9	27.7
519			53.0	50.6	25.8	30.1	25.8
519						15.0	13.3
519		72.2	67.5	62.8	31.7	54.8	50.1
519		72.9	69.1	66.9	36.5	36.3	31.0
519		52.6	49.2	44.9	23.2	26.6	22.9
519					32.7		
529	72382	57.7	58.2	53.4	23.6	33.5	29.7
529	72392	50.4	47.1	45.3			
540	79330	72.2	67.6	62.7	29.3	39.1	34.5
540	81328	66.2	61.5	50.9	28.5	34.6	22.8
540	81355	94.6	86.9	81.4	40.8	45.5	40.4
540	81355	76.5	70.5	67.0	35.6	38.0	32.4
540	81396	50.8	49.5	46.2	24.8	26.2	22.8
702		51.8	48.7	45.3	25.8	23.8	20.1

(**table 2**. contd)

Points of Measurement		7	8	9	10	11	12
JS	ID						
702		61.7	58.3	54.8	24.9	32.9	29.0
702		50.6	48.6	44.8	25.2	24.3	20.7
809	5137	75.0	69.6	65.4	31.8	37.5	33.1
845	120072						
845	121511	98.7	94.2	86.0	48.3	49.5	40.6
845	137484						43.9
845	138376	99.2	93.5	86.0	47.1	49.5	41.7
845	138378					51.8	43.6
1398	S.12198					33.0	28.5
1398	S.12198	59.4	55.0	54.4	28.1	30.1	26.9
1442	77777	54.2	48.7	44.2	23.5	27.2	22.5

(**table 2**. contd)

Points of Measurement		13	14	17	18	19	20	21
JS	ID							
92		20.2	19.6	10.5	56.1	23.1	18.5	37.5
159		20.2	19.5	10.3	47.4	20.2	15.3	
380	1017	19.1	18.2	8.6	43.2	17.8	16.4	
397	18202	16.4	15.5	9.1	43.1	16.2	13.5	
397	18202	17.5	15.7	9.0	42.8	17.1	13.7	
397	18258		18.9	9.8	31.7	14.3	13.1	
397	19673	17.6	16.7	9.0	44.4	19.4	15.7	
397	19673	19.3	18.1	9.3	51.2	24.3	18.0	29.6
397	19675	20.0	18.8	10.2		17.4	15.8	
397	19675	16.9	16.4	8.1	39.3	15.8	13.2	
397	19675					24.0		
397	20003	18.7	17.5	8.9	47.2	17.8	14.7	
397	20006		16.0	7.6		15.1	11.8	
397	20006		17.8	9.1		19.2	15.4	
397	20006	17.0	16.4	7.5	31.7	15.1	11.9	27.7
397	20008	17.8	17.2	8.0	37.5	15.8	13.4	
397	20008					19.7		
397	20012		15.3	8.4	42.4	18.3	16.0	
397	20012					11.8	10.7	
397	20012		18.3	9.9	48.6	20.5	16.8	37.2
397	20013		23.4	11.9		17.8	17.1	
397	20247	20.2	18.7	7.8	41.5	16.2	13.5	
397	20248					9.0		
397	20249	20.0	18.8	10.8	50.5	21.4	19.0	34.6
397	20249	20.1	18.9	10.1	46.9	23.0	17.0	
397	20249	19.3	18.7	9.8	42.5	19.1	16.1	33.5
397	20249	22.4	22.1	12.3	55.2	26.2	19.7	38.9
397	20251		15.2	7.5	37.6	14.1	12.1	
397	20253		18.5	10.3	49.1	21.2	16.8	
397	20253		19.7	9.8	46.9	21.7	17.4	
397	20253	19.9	19.2	10.3		18.7		
397	20253		19.5	10.6	53.9	23.2	17.3	
397	20257	19.5	18.3	10.1	47.3	17.5	15.7	32.3
397	20260		16.9	10.0	42.4	18.7	15.6	
397	20260	20.0	19.3	10.4	53.5	22.7	19.1	34.5
397	20504	18.4	17.7	9.4	43.0	17.9	15.3	
397	20506	20.3	19.4	10.9		23.0	16.4	35.1
397	20506	19.4	19.1	9.3	44.2			
397	21098		17.6	10.6	48.2	18.8	17.3	
397	21098		16.4	8.4	39.6	16.9	14.4	
397	21103		20.3	10.7	52.6	21.1	19.1	32.9
397	21109		18.4	9.0		19.1	16.3	
397	21111	20.3	19.1	9.6		18.8	16.4	31.8
397	21114					16.9		
397	21114					24.0		
397	21114						14.4	
397	21115	17.0	16.4	8.0	35.6	14.8		
397	21119		17.1	8.8	40.7	18.5	15.0	
397	21119	17.5	15.7	9.4	39.8	17.5	15.0	
397	21120		13.4	6.7	29.1	12.9	10.7	
397	21121		16.4	9.3	42.8	19.1	14.2	
397	21121	19.6	19.2	10.3		21.4	16.9	40.7
397	21121	20.4	18.7	10.4		19.8	17.8	36.6

(**table 2**. contd)

Points of Measurement		13	14	17	18	19	20	21
JS	ID							
397	21559							29.3
397	21560	22.3	20.8	11.6	54.3	22.3	19.8	38.5
397	21565						13.3	
397	21872		17.5	8.9	32.2	14.3	13.9	
397	21876	16.2	14.4	7.3	34.0	14.5	12.8	
397	21876		15.5	7.9	35.8	15.4	13.5	
397	21876				57.5			
397	21877					18.7	16.6	
397	21880		16.9	8.7	38.6	16.1	15.4	
397	21882		18.5	9.7	45.8	18.9	16.5	
397	21882		14.6	21.2	32.9	13.7	12.2	
397	21886	16.4	15.1	7.9	34.6	14.9	12.0	
397	21890	16.6	16.4	7.1	34.1	15.1	11.2	23.6
397	21890		17.8	9.6	49.6	19.7	16.7	
397	21891	18.8	18.0	9.1	44.4	19.0	17.4	
397	21894	19.4	18.2	10.2	48.0	19.8	15.5	32.4
397	22056			8.4			14.6	
397	22278	12.0	10.6	6.2	25.0	12.3	12.1	
397	22283	17.2	16.5	9.1	37.9	16.5	13.7	32.3
397	22285		20.4	10.6		17.4	15.7	28.5
397	22572	20.2	18.9	10.5		21.8		
397	22573	21.5	20.4	10.7	58.6	25.5	18.2	
397	22722		18.2	9.0	45.3	16.9	14.8	
397	22775	19.3	18.3	9.5	43.1	17.6	15.2	
397	22780	19.8	19.0	11.5	54.8	23.1	19.5	
397	22780		17.4	9.4	46.9	18.5	14.4	
397	22780		15.3	6.7	39.7	16.3	12.8	
397	22907	18.2	16.9	9.1	42.2	17.2	15.2	
401	25724		20.5	11.1		20.9	17.5	
401	25727		20.2	10.3	41.4	18.9	16.7	29.5
401	25727		19.6	10.5	41.3	19.2	17.1	
406	19325	16.3	14.2	8.5	38.3	14.7	13.8	
492	69564						14.9	
492	69564	20.8	18.7	12.0		26.3	19.5	
492	69564		18.8	8.3	39.9	15.6	14.7	33.6
492	69564	19.4	18.3	11.6	61.7	26.4	20.2	
519			18.9	9.1		17.9	15.6	
519		18.9	17.2	10.4		20.9	18.2	
519			18.8	10.0	43.8	20.5	17.1	
519		15.2				14.1	12.1	
519		10.9			21.1	10.8	9.5	
519		19.6	18.5	10.9	19.1	17.4		
519		19.0	18.5	10.1	54.7	21.2	18.1	
519		16.4	16.0	8.1	35.1	14.7	12.9	
519			20.2	8.9	35.1	17.4	14.7	
529	72382	17.9	15.8	8.8	42.3	17.9	14.5	
529	72392			6.5	27.7	12.8	20.1	
540	79330	20.6	20.0	10.5	52.2	19.4	18.4	39.0
540	81328	18.3	17.5	9.9		20.6	14.8	
540	81355	23.9	22.7	13.0	62.9	27.3	21.7	37.7
540	81355	20.7	20.1	10.8	52.4	22.7	18.8	
540	81396	15.4	15.2	6.9	29.7	13.0	11.4	19.2
702		16.0	14.8	7.3		12.3	11.7	

(**table 2**. contd)

Points of Measurement		13	14	17	18	19	20	21
JS	ID							
702		14.7	14.0	6.9	38.4	14.7	12.0	
702		15.7	14.7	7.2	28.4	11.7	11.8	27.7
809	5137		18.7	9.8	45.9		16.2	36.0
845	120072							
845	121511		29.0	15.4		33.2	26.0	
845	137484	27.7	26.5	15.2		37.7		
845	138376		28.6	12.9		28.8	24.0	
845	138378	28.5	26.8					
1398	S.12198	15.5	13.6	7.3		14.7	13.2	
1398	S.12198		16.5	7.7	36.8	15.8	12.2	
1442	77777	14.7	14.1	8.0	39.0	17.5	12.4	

3 MEASUREMENTS OF SCAPULA (after von den Driesch, 1976)

HS	Height along the spine
DHA	Diagonal height: from most distal point of the scapula to the thoracic angle
SLC	Smallest length of the Collum scapulae
GLP	Greatest length of the Processus articularis (glenoid process)
LG	Length of the glenoid cavity (include cranial lip)
BG	Greatest breadth of the glenoid cavity

Table 3. Scapula

Points of Measurement		HS	DHA	SLC	GLP	LG	BG
JS	ID						
397	19640	88.8	86.7	20.5	24.5	18.8	13.7
397	19671		102.9	16.1	21.4	17.1	13.1
397	19690			19.9	22.7		12.2
397	20006	111.0	105.6	19.3	23.6	19.2	14.7
397	20006	126.2	115.9	21.4	23.9	18.9	14.8
397	20008						
397	20013	66.4	63.4	12.1	16.7	13.8	10.4
397	20246			18.7	23.4	18.5	14.6
397	20246			19.8			
397	20254			16.1	21.4	16.2	12.6
397	20254	103.7	99.0	20.7	25.2	19.2	15.3
397	20254	97.2	92.1	15.3	20.6	17.4	13.0
397	20257	104.4	97.3	16.0	20.1	17.2	12.3
397	20257						
397	20257	147.8	137.2	27.2	31.0	26.0	18.5
397	20257	147.1	137.2	26.4	30.7	24.8	17.1
397	20503						18.6
397	21101	125.4	108.6		24.2	18.4	14.9
397	21104	94.1	87.8	14.6	19.4	16.1	12.0
397	21106	94.4	86.6	14.7	19.1	16.1	11.8
397	21106	90.5	85.1	12.7	17.6	15.2	11.3
397	21106	119.8	103.5	20.3	24.4	20.2	15.8
397	21109	111.0	107.2	18.4	24.4	20.5	14.4
397	21109	116.3	110.6	19.3	23.7	19.7	13.4
397	21116			16.2			
397	21565			26.2	30.0	24.0	18.7
397	21876	92.4	90.1	17.1	21.3	18.0	12.8
397	21881						
397	21882						
397	21894	89.9	84.0	12.8	17.5	15.2	11.2
397	21898	80.3	79.2	15.8	18.1	14.9	11.0
397	22046	127.0	118.4	22.4	26.9	23.0	16.9
397	22046						
397	22050						
397	22050	107.4	97.8	16.8	21.8	18.7	13.4
397	22282						
397	22282						
397	22731	104.6	98.3	19.8	25.0	18.2	14.9
397	22732	89.9	86.8	15.4	19.7	15.9	11.9
397	22734	109.7	105.8	21.2	27.1	22.8	16.7
397	22772	90.7	88.7	25.1	26.3		
397	22787						
397	22788						
397	22788	101.0	97.1	16.3	21.5	19.7	13.2
397	22904		86.1	17.4	21.6	17.7	13.0
397	22907	108.2	102.3	16.7	20.8	17.3	13.5
397	23166			22.4			
397	23167	121.5	114.8	18.6	23.8	19.5	13.8
540	81355	136.4	124.2	21.3	27.6	21.5	16.2
702	5066			24.0	28.4	23.6	19.7
809	5184			17.7	19.1	15.0	11.6
845	115838			21.7	27.7	24.0	16.8
845	N115990	138.6	126.3	25.4	31.2	26.1	19.2
845	N120023			28.3	32.2	26.5	19.9
1398	S.12198					15.1	

4 MEASUREMENTS OF THE HUMERUS (after von den Driesch, 1976)

GL	Greatest length
GLC	Greatest length from caput
DP	Depth of the proximal end
SD	Smallest breadth of diaphysis
Bd	Greatest breadth of the distal end

Table 4. Humerus

Points of Measurement		GL	GLC	Dp	SD	Bd
JS	ID					
92		131.8	125.9	40.8	13.4	33.0
92		131.2	126.8	41.0	13.1	33.0
397	19347				11.3	30.0
397	19348				8.2	20.9
397	19348				7.6	21.5
397	19351		156.7	40.1	11.1	28.8
397	19681				7.4	20.0
397	19689					31.4
397	19690			29.5	9.5	24.7
397	19690			28.0	8.5	25.7
397	19693				14.4	33.3
397	20011	122.6			7.8	23.7
397	20013	72.9			7.8	19.8
397	20013				8.8	23.4
397	20246		101.9		11.6	28.1
397	20246				9.6	26.4
397	20249				9.4	24.2
397	20249	119.9	115.0	36.6	11.5	27.5
397	20249					33.1
397	20249	99.7			10.0	25.0
397	20249	93.0			9.1	24.6
397	20252	96.0			8.6	25.3
397	20252	118.1	114.6	28.9	7.8	21.9
397	20253		127.1	9.7	25.6	
397	20253				11.3	29.3
397	20254				13.5	33.7
397	20254	152.2		24.9	10.1	25.7
397	20254	71.7			7.0	19.5
397	20254	112.6	110.0	26.9	8.0	21.2
397	20255				6.3	19.0
397	20255	158.3	153.7	35.2	11.6	27.7
397	20256					35.5
397	20257			40.2		
397	20257	122.0			7.9	23.4
397	20257				13.0	33.6
397	20258			34.5		
397	20258	102.0			7.0	21.3
397	20258	125.1			9.4	28.0
397	20260	98.5	94.2	27.6	8.7	20.7
397	20504	131.7	128.5	30.0	9.0	25.0
397	20505	132.4			8.3	24.8
397	21098			24.0	8.0	21.3
397	21098				8.9	24.0
397	21098				10.9	31.6
397	21100				12.5	28.8
397	21101					24.1
397	21102				8.7	
397	21108	115.9	114.6	26.6	7.3	21.9
397	21109					
397	21109	116.4	114.4	26.5	7.3	21.2
397	21112				8.9	27.0
397	21112	120.6	117.3	27.3	7.3	21.3
397	21114					
397	21114					34.2
397	21114	141.7	138.7	33.5	10.8	27.5

(**table 4**. contd)

Points of Measurement JS	ID	GL	GLC	Dp	SD	Bd
397	21116				7.4	19.0
397	21560				7.3	20.2
397	21565				7.1	13.8
397	21565					33.9
397	21565					23.1
397	21876	115.4			9.0	25.2
397	21876	104.9	102.3	30.6	9.1	25.9
397	21880	111.6			8.0	22.5
397	21884			32.2		
397	21890					
397	21890					31.3
397	21892	133.2		20.4	10.5	25.4
397	21894			29.3	9.8	26.4
397	21897					26.8
397	22043				7.5	
397	22043					25.0
397	22043	109.1	105.8	26.4	7.4	20.4
397	22046	144.2	140.3	35.3	11.5	28.5
397	22049	88.2			8.4	22.9
397	22050	141.4	138.2	34.0	11.3	28.0
397	22051				7.5	
397	22281	118.2			8.0	20.7
397	22283	99.1			6.1	18.6
397	22721					23.9
397	22730				12.4	
397	22733				7.7	19.9
397	22772	127.7	124.3	30.1	8.4	23.9
397	22787					28.9
397	22788				11.6	29.1
397	22904	120.7	117.2	28.2	9.8	22.6
397	22904	127.2	123.6	29.2	8.8	22.2
397	22906					24.2
397	22980		123.0		9.2	26.5
401	25723				9.2	34.1
401	25723	98.0			9.1	
519					8.5	16.8
519					7.9	20.7
529	72392				6.8	14.0
599		107.1	103.9	27.7	9.2	22.8
599		107.1	103.7	27.4	8.9	23.2
599						22.9
632	10977					31.0
644	USB/A 195				11.5	30.2
694	TV1349				9.7	
702	5042			37.7	10.4	
702	5066					22.2
702		158.7			12.0	33.1
765	95938	124.1			7.4	20.1
809	5184		131.8		7.9	22.8
845	117645				8.2	
845	118515			28.5		
845	N120130	113.3			6.9	19.3
845	N120130	112.6			6.8	18.5
845	N120222					
1398	12198	160.8	155.2	39.2	10.8	29.2

5 MEASUREMENTS OF THE RADIUS (after von den Driesch, 1976)

GL	Greatest length
Bp	Greatest breadth of the proximal end
SD	Smallest breadth of diaphysis
Bd	Greatest breadth of the distal end

Table 5. Radius

Points of Measurement		GL	Bp	SD	Bd
JS	ID				
387	15818	146.0	16.4	9.7	
397	18207	140.8	14.6	10.1	17.2
397	19676		16.5	12.6	
397	19688		12.4	8.0	
397	19689		18.2	11.3	
397	19691		15.0	10.2	
397	20008	97.7	10.2	66.6	13.1
397	20011				17.7
397	20011	104.4	10.9	6.8	14.3
397	20013		19.4		21.1
397	20246		14.8	10.5	
397	20246	94.7	15.9	10.9	20.6
397	20249				14.5
397	20249				14.4
397	20249		14.6		
397	20249				18.3
397	20252		18.3	12.7	
397	20252	118.2	12.4	8.0	16.2
397	20253		13.9	9.1	
397	20253		18.0		
397	20254		19.2	13.3	
397	20254		15.1	11.5	
397	20255	158.4	16.3	11.9	21.5
397	20257		18.7	12.8	
397	20258	148.7	18.3	11.4	25.8
397	20258		20.6		
397	20504		13.9		
397	20504	130.4	12.6	9.4	17.9
397	20504	129.8	14.6	10.0	20.6
397	20504	103.3	9.9	6.7	13.1
397	20504	97.6	15.6	8.9	18.4
397	20506		15.1	10.5	
397	21098	89.8	12.9	7.6	17.1
397	21104	105.7	15.9	13.2	21.8
397	21107		14.3	8.6	
397	21108	116.9	12.4	8.0	15.9
397	21109	116.0	12.1	8.1	15.9
397	21112	99.8	13.8	10.0	17.7
397	21114				25.6
397	21114		19.6		
397	21114				
397	21114		17.7	13.1	
397	21114		18.7		
397	21114	141.8	14.7	10.3	18.5
397	21115		19.3		
397	21115	93.6	11.7	7.9	15.2
397	21117	110.4	13.2	9.5	18.9
397	21119		18.1		
397	21562	125.2	12.6	8.1	15.9
397	21563		20.3		
397	21565	130.3	16.3	10.8	21.8
397	21565		13.2	8.8	
397	21566		14.2		

(table 5 contd)

Points of Measurement		GL	Bp	SD	Bd
JS	ID				
397	21870	129.1	13.7	8.7	18.2
397	21872	133.1	12.9	8.6	17.3
397	21872		13.9		
397	21880	149.9	14.7	10.3	18.7
397	21880	127.9	14.0	8.4	18.0
397	21886		13.1	9.5	
397	22043	131.8	12.7	9.0	17.6
397	22046	150.2	16.1	12.0	20.8
397	22047		15.3		
397	22050	141.0	14.9	10.6	19.0
397	22056	115.6	12.3	7.4	15.6
397	22283	112.6	16.5	9.2	22.6
397	22572	141.5	14.1	9.8	18.8
397	22724			9.3	17.9
397	22731	158.9	16.5	10.3	21.2
397	22772	145.8	14.1	9.2	18.4
397	22773	142.9	14.0	9.3	18.8
397	22776		15.7		
397	22776	143.5	13.6	9.3	17.6
397	22781		15.2	10.3	
397	22782		14.7	9.7	
397			16.0	13.1	
492	69564	123.1	12.6	8.8	16.2
519			16.1		
519			13.0	9.5	
519		103.8	13.2	9.1	17.2
519				9.8	
519				13.0	
519		101.4	10.8	7.4	13.6
519			14.1	10.4	
529	71922	85.4	11.5	9.2	14.9
529	72388			12.2	22.8
540	79489		23.0		
599		101.9	12.7	8.7	16.2
599			16.8	11.1	
632	49566		11.0		
632	N49151	128.3	12.8	9.3	16.6
644	USB/A 240	172.9	17.1	12.2	22.4
702					
702		118.8	11.5	7.7	15.8
809	5137				17.1
809	5184	119.2	10.6	7.6	
845	115686			7.8	16.4
845	N115992	128.3	15.1	11.3	21.2
845	N120130		13.6		
845	N120222		12.0		
1398	12198	93.9	10.4	8.4	13.1
1398	S.12198	107.5	11.6	14.5	7.7

6 MEASUREMENTS OF THE ULNA (after von den Driesch, 1976)

GL	Greatest length
DPA	Depth across the Processus anconaeus
SDO	Smallest depth of the olecranon
BPC	Greatest breadth across the coronoid process

Table 6. Ulna

Points of Measurement		GL	DPA	SDO	BPC
JS	ID				
397	123	103.4	18.1	14.6	12.6
397	2046		20.0	17.7	13.4
397	19351		14.9	12.9	8.2
397	19351		19.1	16.4	12.9
397	19352	171.6	20.3	17.7	12.8
397	19689		23.1	20.0	16.0
397	20005		16.0	14.3	12.6
397	20008	101.7	16.1	16.9	14.3
397	20012		16.0	13.3	11.3
397	20013		18.3	15.7	13.1
397	20246	165.6	20.0	17.8	15.0
397	20249				
397	20249		20.5	17.9	13.3
397	20249		21.9	19.0	15.7
397	20249				
397	20249		20.5	17.9	13.3
397	20249		21.9	19.0	15.7
397	20252	105.1			14.5
397	20252				
397	20254		27.1	23.4	19.0
397	20257		20.8	17.8	14.9
397	20257		27.6	24.5	19.2
397	20260	99.4	13.2	11.6	10.0
397	20504	157.9	21.3	17.5	13.3
397	20504	152.6	18.6	16.5	12.6
397	21098	100.5	18.7	15.9	12.1
397	21098	141.3	16.3	15.0	12.5
397	21100		17.1	15.1	12.7
397	21103		22.5	17.9	13.8
397	21107		17.2	15.5	13.2
397	21109	165.7	18.0	15.4	13.2
397	21110	149.6	21.2	19.0	15.3
397	21114	165.1	21.3	19.3	15.1
397	21114		26.6	22.6	18.4
397	21114		27.0	23.7	18.1
397	21117	133.9	16.6	13.9	11.5
397	21119	134.4	16.1	14.2	10.2
397	21560	127.2	15.9	14.0	11.7
397	21562		16.1	14.7	11.8
397	21563				20.6
397	21565	151.2	23.0	19.9	15.2
397	21870	139.3	18.1	15.2	11.6
397	21875	136.3	15.9	14.2	11.6
397	21880		19.3	17.4	13.7
397	21893	172.3	20.6	17.2	14.6
397	21897		19.7	16.1	13.4
397	21898		22.5	18.2	14.7
397	22046	173.9	23.3	19.3	16.2
397	22047	102.2	16.4	14.5	10.7
397	22048		22.1	19.2	15.1
397	22050	164.0	21.1	19.0	15.5
397	22283	125.8	24.0		16.2
397	22722	169.8	19.0	16.3	12.8

(table 6. contd)

Points of Measurement		GL	DPA	SDO	BPC
JS	ID				
397	22722	183.3	21.1	18.3	15.6
397	22723		29.1	25.0	19.5
397	22724		20.1	17.7	15.0
397	22725	164.4	18.8	16.7	13.6
397	22776	169.6	18.7	15.9	12.9
397	22779		21.2	18.5	15.2
397	22779		22.1	19.2	15.6
397	22780	112.3	18.7	15.4	11.9
397	22781		21.0	17.7	15.2
397	22787		17.7	15.7	13.4
397	22787		22.5	21.1	17.3
397	22904		18.1	16.1	12.6
397	22904	145.4	20.0	17.4	14.2
492	69564		17.0	14.8	11.2
519			17.3	14.7	12.1
519		159.1	19.6	17.7	14.5
519			18.0	14.7	11.2
540	79489			27.2	
540	81317	121.4	15.6	13.8	10.0
632	10977		23.6	19.5	17.7
632	49152	153.0	16.7	14.8	10.9
632	49595		23.0	19.9	16.0
632	492101		26.1	24.2	17.1
664			22.2	16.5	13.5
702	5042		22.5	19.0	16.0
768					
845	N115990	189.3	24.8	21.5	17.8
845	N120130				
845	N120130		15.1	13.1	9.8
1398	12198		9.7	15.1	9.2
1398	12198		13.3	18.7	12.0

7 MEASUREMENTS OF THE FEMUR (after von den Driesch, 1976)

GL	Greatest length
GLC	Greatest length from Caput femoris
Bp	Greatest breadth of the proximal end
DC	Greatest depth of the Caput femoris
SD	Smallest breadth of diaphysis
Bd	Greatest breadth of the distal end

Table 7. Femur

Points of Measurement		GL	GLC	Bp	DC	SD	Bd
JS	ID						
92		149.5	142.7	37.7	18.4	14.9	31.4
397	18203	192.6	192.6	37.9	17.7	12.2	32.8
397	19671	117.5	117.5	24.8	11.5	9.3	20.3
397	19690						21.6
397	19690						29.8
397	19692					7.9	19.3
397	20011						21.6
397	20011					11.2	29.4
397	20013	94.3	91.3	23.6	10.6	7.7	20.6
397	20253						
397	20254	76.3				6.9	16.9
397	20254					8.1	19.8
397	20257	105.2	105.2	19.8	9.7	6.4	16.9
397	20257						32.4
397	20257			31.5	14.5		
397	20257						22.5
397	20257						21.1
397	20257					9.5	24.1
397	21098			25.0	11.8		
397	21099	114.0	114.0	23.5	11.1	7.6	19.4
397	21104	140.9	14.9	26.9	13.6	9.7	23.7
397	21107						24.8
397	21109						24.0
397	21109						
397	21109			26.5	12.6		
397	21109						21.7
397	21109						20.8
397	21109						21.9
397	21112	157.4	157.4	32.5	16.3	9.7	27.7
397	21114						26.2
397	21114	171.8	171.8	33.0	16.9	10.6	27.6
397	21117						30.7
397	21564						24.9
397	21565	100.6		22.8		8.7	17.8
397	21565					7.6	
397	21566						18.2
397	21872						24.9
397	21876						
397	21876					10.6	
397	21876						
397	21876						
397	21888						26.3
397	21892					8.5	14.5
397	21892	110.9	110.9	24.0	11.2	7.2	19.0
397	21896					13.8	
397	21897						31.8
397	22050					13.3	24.6
397	22050			30.6	14.3		
397	22050					8.7	24.2
397	22054			25.3	12.4		
397	22278					9.7	16.4
397	22281						
397	22721						

(table 7. contd)

Points of Measurement		GL	GLC	Bp	DC	SD	Bd
JS	ID						
397	22729	186.7	186.7	37.2	17.7	13.1	31.2
397	22732					8.6	16.7
397	22772			34.4	15.3		
397	22772	96.8	96.8	19.8	9.4	6.5	18.5
397	22772	135.3	135.3	28.6	14.3	9.5	23.1
397	22776	116.4	115.7	23.3	11.0	8.1	20.2
397	22782	116.5	116.5	24.3	12.0	7.2	20.2
397	22904			26.4	12.5		
397	22905						28.3
397	22905	97.6	97.6	19.9	9.3	6.5	18.3
397	22905	133.2	133.2	26.5	13.0	9.1	22.4
397	23166	218.2	218.2	42.9	19.5	13.3	35.8
492	69564						21.4
519				33.0	15.3		
519		110.7	110.7	23.0	11.4	7.7	20.1
519						7.5	16.5
529	71914						25.9
529	71917	197.4	197.4	41.8	20.7	14.0	36.2
529	71919	91.8	91.8	22.6	10.9	8.2	20.9
529	72392					3.8	
540	81355	164.1	164.1	35.2	17.5	12.0	28.9
540	81396					13.0	33.8
599		134.0	134.0	12.6	12.7	9.4	22.0
632	49152			36.9	17.8	12.1	
702	5004						
768	K78	121.9	121.4	24.1	11.9	8.5	22.6
809	5195				16.7		
809	5278						22.3
845	114738						21.7
845	119946	130.8	130.8	26.4	12.4	9.3	22.5

8 MEASUREMENTS OF THE TIBIA (after von den Driesch, 1976)

GL	Greatest length
Bp	Greatest breadth of the proximal end
SD	Smallest breadth of diaphysis
Bd	Greatest breadth of the distal end

Table 8. Tibia

Points of Measurement		GL	Bp	SD	Bd
387	15818	118.3	21.7	8.6	13.8
397	18256	144.2	25.9	9.5	17.5
397	19349	83.2	20.9	7.8	15.4
397	19351	109.7	24.4	9.1	17.0
397	19669		25.3	8.8	
397	19673	147.0	29.2	11.3	18.5
397	19675	159.7	28.2	10.3	18.2
397	19682	146.6	22.3	8.4	16.6
397	19685	184.3	31.3	10.5	20.9
397	19690		23.9		
397	19693		33.7		
397	19693		33.9		
397	20006			9.4	18.1
397	20009	119.6	27.2	10.5	18.4
397	20013	93.0	21.5	7.9	13.5
397	20246		21.7		
397	20247	162.2	28.5	9.5	19.3
397	20249				13.8
397	20249	113.4	19.7	8.2	13.6
397	20249	113.4	19.7	8.2	13.6
397	20249		28.7		
397	20249	126.5	23.2	8.5	15.2
397	20249	159.4	28.9	12.3	22.7
397	20249		34.3		
397	20249	120.7		8.2	14.8
397	20252	98.1		5.3	12.1
397	20252	121.5	21.5	8.3	14.5
397	20252	113.8	24.1	11.6	19.2
397	20252	119.5	26.5	11.1	19.1
397	20253		24.6	8.8	
397	20253		27.2	13.5	
397	20253	129.9	28.0	13.2	21.7
397	20253	107.0	23.9	8.7	16.0
397	20254	209.5	35.0	12.4	22.7
397	20254		21.4	7.8	
397	20255		20.3		
397	20257	209.4	35.5	12.5	23.0
397	20257		22.6		
397	20257		34.7	12.4	
397	20257		23.2		
397	20258	129.9	21.6	8.8	16.5
397	20260		20.4		
397	20261	137.9	24.1	8.6	15.3
397	20504	126.7	21.6	8.1	14.0
397	20504	108.1	19.7	6.6	12.6
397	20506	107.9	23.8	9.6	15.9
397	21099				23.9
397	21101	128.8	23.2	10.7	18.1
397	21101	144.3	23.0	9.9	17.2
397	21107	141.5	23.3	9.5	17.9
397	21109	129.2	22.6	8.1	14.8
397	21109				15.1
397	21109		27.3		

(t**able 8.** contd)

Points of Measurement		GL	Bp	SD	Bd
397	21109		38.1		
397	21109		23.2		
397	21109	95.1	22.0	8.7	16.1
397	21112	192.3	31.9	10.8	20.8
397	21112	141.2	25.6	8.2	
397	21114		26.9		
397	21115				15.6
397	21115	120.5	20.9	7.6	14.6
397	21121	112.9	17.4	7.1	13.9
397	21559	133.5	22.2	7.9	14.6
397	21561	147.5	22.7	9.7	17.9
397	21561	155.8	22.8	10.5	18.3
397	21562	105.9	19.5	7.3	13.7
397	21565	71.1	15.9	6.9	11.4
397	21565	109.2	20.9	8.2	16.7
397	21878	129.6	22.1	8.4	15.5
397	21880	142.9	25.7	8.9	18.3
397	21881	72.0	20.5	9.0	16.0
397	21882	113.3	19.9	8.1	13.9
397	21888	125.6	22.6	8.0	15.2
397	21892	101.3	18.8	7.7	14.2
397	21897		34.1		
397	21898	131.3	22.9	8.1	15.3
397	21898	142.4	23.8	9.3	15.6
397	21898	131.3	23.3	8.3	15.4
397	22044				19.1
397	22044	135.6	21.4	9.6	16.5
397	22048		16.6	6.4	
397	22048		27.8		
397	22050			13.6	
397	22050	156.2	29.7	9.8	19.4
397	22050		25.5	8.6	
397	22054	132.7	23.0	8.0	14.6
397	22056		25.3		
397	22278	57.1	20.7	8.9	16.6
397	22278	114.7	19.2	6.6	12.7
397	22280	104.5	29.0	9.2	18.4
397	22283	144.4	24.5	8.5	14.9
397	22283	167.6	29.3	10.2	19.5
397	22285	127.1	25.6	7.1	16.4
397	22287	136.7	22.5	9.0	16.8
397	22573		27.9	9.5	
397	22732		29.4		
397	22732	118.4	29.7	11.1	19.1
397	22772	103.7	19.3	5.9	12.1
397	22776				17.6
397	22782		28.2		
397	22782	127.7	28.2	10.5	18.5
397	22904		26.3		
397	22905	156.0	29.2	11.9	18.9
397	22905	104.4	18.9	6.2	12.1
397	22979		24.8	8.0	
397		112.0	27.3	12.1	18.4

(t**able 8.** contd)

Points of Measurement		GL	Bp	SD	Bd
519					19.3
519		107.5	23.6	9.8	14.9
529	72382	172.9	37.1	11.6	23.2
529	72392	84.9	12.1	6.8	9.4
540	79559	156.1	27.5	10.5	18.0
540	81251		30.2	11.7	
599		143.4	23.6	7.8	14.7
632	49366		19.4		
632	49566	136.1	22.6	8.5	13.4
632	N49822	199.2	36.2	14.3	24.3
632	N49968		26.1	9.2	
632	N49969	119.9	24.0	7.6	15.0
694	TV1349			9.2	17.5
702	5004		19.7		
702	5004				14.7
702				13.3	21.9
702		140.8	21.8	7.7	14.2
765	82540	73.8	20.3	10.3	15.3
765	95926	157.5	24.4	8.7	16.1
765	95938	132.2	19.0	7.5	15.2
765	N95926	158.2	23.4	8.4	16.9
768	K78	129.1	124.9	7.5	14.4
809	5217	117.3	20.0	7.5	14.8
809	5278		24.7	8.7	
845	N118174			6.9	
845	N121371	95.1	20.4	7.9	13.8
845	N121476	144.5	22.2	8.0	15.7

THE OSTEOLOGICAL MATERIAL OF MODERN DOGS

APPENDIX B

1 MEASUREMENTS OF THE CRANIA (after von den Driesch, 1976)

1 Total length: *Akrokranion – Prosthion*
2 Condylobasal length: *Occipital condyles – Prosthion*
3 Basal length: *Basion – Prosthion*
4 Basicranial axis: *Basion – Synsphenion*
5 Basifacial axis: *Synsphenion – Prosthion*
6 Neurocranium length: *Basion – Nasion*
7 Upper neurocranium length: *Akrokranion – Frontal midpoint*
8 Viscerocranium length: *Nasion – Prosthion*
9 Facial length: *Frontal midpoint – Prosthion*
12 "Snout" length: *Orbits – Prosthion*
13 Median palatal length: *Staphylion – Prosthion*
14 Palatine length: *Staphylion – Palatinoorale*
18 Carnassial length at cingulum
23 Greatest mastoid breath: *Otion – Otion*
24 Breadth dorsal to external auditory meatus
25 Greatest breadth of the occipital condyles
26 Greatest breath of the bases of the paraoccipital processes
27 Greatest breadth of the foramen magnum
28 Height foramen magnum: *Basion – Opisthion*
30 Zygomatic breadth: *Zygion – Zygion*
31 Least breadth of skull: *aboral of supraorbital processes*
32 Frontal breadth: Ectorbitale – Ectorbitale
33 Least breadth orbits: *Entorbitale – Entorbitale*
36 Breadth at the canine alveoli
37 Greatest inner height of the orbit
38 Skull height: *Skull basis – Sagittal crest*
40 Height occipital triangle: *Akrokranion – Basion*
41 Height (length) of the canine taken out of jaw

Table 1. Crania

Points of Measurement Breed	1	2	3	4	5	6
Greyhound	221.5	210.8	200.0	53.8	147.2	110.3
Bulldog	158.2	142.5	135.3	48.8	86.5	97.5
Mops	113.8	109.5	102.5	34.2	68.3	71.2
Litle Silkpoodle	125.5	113.7	107.7	34.9	73.2	68.0
Finnehund	187.1	174.5	165.2	48.7	116.5	97.6
Black Dyrehund	178.0	170.0	157.0	43.3	113.7	94.2
Elkhound	188.2	157.8	166.2	44.5	121.7	96.5
Grey Elkhound	–	–	–	–	–	–
Grey Elkhound	202.0	191.5	181.5	50.0	131.5	104.0
Whippet	127.6	118.0	112.1	32.7	79.4	69.0
Grey Dyrehund	190.0	176.1	162.0	45.3	116.7	95.0
Greyhound	206.9	202.3	189.1	52.3	136.8	108.5
Scottish Sheep Dog	222.0	212.3	201.9	53.7	148.2	110.5
Big Engelsk Guarddog	227.8	215.0	197.5	54.0	143.5	114.0
Harehund	202.0	183.0	178.1	51.5	126.6	104.0
Greyhound	–	–	–	–	127.6	–
Greyhound	161.2	158.0	148.9	40.6	107.7	87.0
Foxterrier	132.9	127.6	119.8	36.4	84.6	72.2
Foxterrier	138.4	131.0	122.7	37.8	87.7	75.0
Eldre Svensk Støver	205.7	198.0	184.5	53.6	131.1	106.0
Wired Haired Poodle	183.0	177.2	166.9	52.9	114.0	98.5
Dalmatian	160.0	153.9	142.8	43.3	99.5	86.5
Greyhound	217.2	225.1	212.2	67.7	144.5	119.0
Boxer	175.0	169.7	159.8	52.7	101.1	100.0
Bulldog	162.3	141.8	134.0	45.5	88.5	91.0
–	204.5	193.9	182.5	53.0	129.5	108.0
Dachshund	152.6	143.4	134.8	37.2	97.6	79.0
Finnehund	187.2	174.0	163.7	46.0	117.7	–
Grey Dyrehund	–	–	–	–	–	–
Grey Dyrehund	166.2	175.8	169.2	44.7	124.5	95.5
Norwegian Sheep dog	153.7	141.7	133.4	40.8	92.6	85.2
Lundehund	99.1	91.3	85.0	28.4	57.3	–
Lundehund	101.6	95.8	88.7	28.9	59.9	–
Lundehund	107.6	102.6	95.5	30.3	65.8	–
Lundehund	114.5	106.9	101.8	32.6	69.8	–
Lundehund	122.8	115.1	106.7	33.6	73.0	–
Lundehund	130.0	122.7	113.7	36.0	77.6	–
Lundehund	129.6	122.2	112.8	36.4	76.4	–
Lundehund	140.4	131.5	122.3	40.1	82.1	–
Lundehund	140.8	132.2	122.2	38.4	83.7	–
Lundehund	130.9	123.1	113.2	36.6	76.6	–
Lundehund	129.2	121.4	114.3	36.7	78.8	–
Lundehund	124.2	117.8	110.0	34.5	78.5	–
Buhund	164.0	156.0	147.3	44.9	102.4	–
Lundehund	126.4	119.7	111.6	35.2	76.3	–
Lundehund	132.1	127.5	119.3	36.5	82.7	–
Lundehund	132.2	126.8	116.7	36.5	80.1	–
Russian Greyhound	242.0	232.0	217.0	90.0	127.0	123.0
Buhund	163.0	156.0	150.0	39.6	110.0	–
Buhund	166.5	155.5	148.2	42.2	106.0	–
Buhund	177.8	168.0	157.5	49.0	108.5	–
Buhund	158.3	151.8	143.6	41.3	102.2	–
Buhund	157.0	148.4	140.5	40.2	100.3	–

– = measurement could not be taken

(**table 1**. contd)

Points of Measurement Breed	7	8	9	12	13	14
Greyhound	101.0	113.9	131.1	99.3	112.3	39.0
Bulldog	94.5	71.9	79.0	48.7	71.0	26.1
Mops	68.4	44.6	56.0	34.3	57.4	18.9
Litle Silkpoodle	67.4	56.2	67.5	45.0	61.4	19.2
Finnehund	89.7	94.2	105.8	78.1	93.3	–
Black Dyrehund	83.2	89.2	102.5	75.7	89.5	29.2
Elkhound	90.4	96.2	107.9	79.6	94.2	33.2
Grey Elkhound	93.8	95.6	114.3	–	90.7	27.4
Grey Elkhound	96.1	104.5	115.1	86.9	99.3	33.7
Whippet	63.9	58.6	75.1	50.3	66.7	22.0
Grey Dyrehund	91.6	99.6	107.2	78.8	89.7	41.8
Greyhound	92.3	107.3	126.6	93.6	104.5	33.9
Scottish Sheep Dog	100.9	120.9	134.1	101.4	110.0	39.4
Big Engelsk Guarddog	112.3	115.9	127.4	97.8	111.4	39.8
Harehund	94.8	93.6	115.5	82.9	104.4	35.7
Greyhound	–	97.5	112.0	86.4	95.7	31.0
Greyhound	74.6	83.4	97.1	72.3	86.8	30.8
Foxterrier	64.1	63.8	76.6	52.3	97.3	19.4
Foxterrier	65.3	68.6	84.1	57.5	69.3	19.5
Eldre Svensk Støver	91.2	96.9	122.7	88.2	104.0	–
Wired Haired Poodle	87.9	86.3	104.0	76.5	89.2	34.1
Dalmatian	81.0	77.6	87.3	61.4	80.1	26.1
Greyhound	108.5	118.5	138.1	105.2	116.3	42.9
Boxer	88.1	83.6	98.8	68.5	88.3	30.4
Bulldog	92.1	72.4	87.1	50.8	71.3	28.5
–	98.2	103.3	117.2	87.6	103.9	34.1
Dachshund	78.6	74.9	83.3	59.8	79.4	28.0
Finnehund	92.6	–	106.5	80.2	91.9	–
Grey Dyrehund	–	–	–	–	–	–
Grey Dyrehund	89.0	96.0	109.3	83.2	94.3	31.4
Norwegian Sheep dog	78.5	72.4	87.0	65.9	72.2	24.8
Lundehund	59.3	44.5	53.4	34.5	46.4	15.4
Lundehund	57.9	44.7	53.5	36.5	47.3	15.3
Lundehund	58.4	48.1	60.1	40.0	50.2	15.2
Lundehund	61.4	54.4	62.4	42.6	54.2	15.9
Lundehund	64.8	57.4	67.7	47.5	58.6	17.7
Lundehund	67.9	64.2	74.1	52.1	60.5	19.1
Lundehund	70.7	59.5	68.6	49.3	61.4	17.9
Lundehund	73.7	67.9	74.2	55.2	66.8	19.9
Lundehund	74.0	67.4	76.6	56.8	67.2	21.0
Lundehund	70.7	63.3	71.0	50.7	61.5	19.2
Lundehund	69.7	61.7	69.8	48.4	61.9	19.6
Lundehund	66.5	59.1	69.9	48.6	60.3	18.3
Buhund	77.6	80.6	96.7	70.1	83.2	26.9
Lundehund	66.1	58.7	70.4	48.8	60.8	18.3
Lundehund	69.2	64.9	72.6	50.6	66.3	21.1
Lundehund	70.3	63.1	72.1	50.9	63.8	22.0
Russian Greyhound	109.7	131.8	150.3	117.1	122.3	38.4
Buhund	77.4	84.2	101.5	70.0	83.7	28.3
Buhund	79.0	86.9	99.2	70.4	86.8	29.3
Buhund	87.1	88.0	99.6	73.3	88.6	30.1
Buhund	78.5	78.6	88.8	62.9	78.3	23.6
Buhund	79.6	78.0	89.3	67.0	79.4	27.4

(**table 1**. contd)

Points of Measurement Breed	18	23	24	25	26	27
Greyhound	20.4	70.8	68.1	41.7	56.4	20.0
Bulldog	16.3	68.0	76.0	37.1	56.0	18.2
Mops	13.6	50.6	54.7	27.4	38.3	14.9
Litle Silkpoodle	13.7	44.3	48.6	23.8	33.7	12.5
Finnehund	17.4	61.6	62.5	33.0	47.6	17.0
Black Dyrehund	17.6	58.0	58.7	37.3	45.4	20.7
Elkhound	17.4	63.6	64.4	33.3	49.1	16.9
Grey Elkhound	18.5	–	–	–	–	–
Grey Elkhound	19.7	67.3	67.4	36.1	–	–
Whippet	10.8	47.1	50.1	27.0	34.0	14.4
Grey Dyrehund	19.0	64.5	63.7	36.6	50.0	17.1
Greyhound	17.9	65.7	64.6	38.7	53.0	19.2
Scottish Sheep Dog	19.3	69.5	69.0	41.1	54.7	21.3
Big Engelsk Guarddog	18.2	75.4	72.5	42.2	57.1	21.4
Harehund	18.5	66.6	65.6	–	25.7	19.7
Greyhound	18.8	–	–	–	–	–
Greyhound	14.6	54.0	56.5	32.8	43.4	16.5
Foxterrier	15.4	48.7	50.9	28.5	38.0	16.8
Foxterrier	14.5	47.3	50.3	28.5	37.9	15.0
Eldre Svensk Støver	18.6	71.3	71.2	42.3	55.9	22.8
Wired Haired Poodle	17.1	61.3	62.5	37.2	48.9	17.5
Dalmatian	16.3	57.2	57.4	31.6	43.3	16.3
Greyhound	19.0	67.7	72.1	44.0	56.1	21.6
Boxer	17.6	65.1	67.0	36.3	50.9	18.1
Bulldog	18.6	62.6	74.3	31.8	50.1	15.9
–	21.3	71.9	–	42.3	56.7	19.9
Dachshund	15.6	57.1	59.4	30.6	41.9	16.8
Finnehund	18.6	61.9	62.9	34.3	48.3	18.7
Grey Dyrehund	–	–	–	–	–	–
Grey Dyrehund	18.5	62.0	63.5	33.3	48.3	17.2
Norwegian Sheep dog	15.8	52.5	55.4	29.7	41.3	15.7
Lundehund	–	42.0	43.6	21.9	32.2	11.4
Lundehund	–	41.2	42.8	22.9	31.7	13.0
Lundehund	–	42.5	43.6	23.5	32.0	13.6
Lundehund	13.9	43.6	44.4	24.2	32.1	13.3
Lundehund	14.0	44.1	46.2	24.7	32.6	14.2
Lundehund	15.7	48.7	50.2	25.6	36.5	14.1
Lundehund	15.3	44.7	46.5	25.0	33.2	14.2
Lundehund	15.7	51.0	50.7	27.3	37.2	14.8
Lundehund	15.4	49.6	51.9	26.5	35.7	15.2
Lundehund	15.6	46.6	48.6	25.5	34.2	14.4
Lundehund	14.4	47.4	47.3	25.2	35.0	14.6
Lundehund	14.1	44.1	46.4	24.7	33.1	14.3
Buhund	16.9	52.2	56.1	29.1	40.0	16.0
Lundehund	14.1	43.7	44.9	24.4	32.9	13.5
Lundehund	15.0	48.6	49.9	27.2	35.4	14.7
Lundehund	15.6	49.7	50.3	27.0	35.5	15.2
Russian Greyhound	19.7	69.0	65.0	43.2	58.8	23.7
Buhund	16.1	57.9	49.0	32.5	45.3	18.2
Buhund	18.6	57.4	61.8	31.2	44.8	16.6
Buhund	17.3	61.5	61.6	35.3	47.2	19.5
Buhund	17.0	51.8	55.0	28.2	41.2	16.4
Buhund	16.9	52.3	53.6	31.6	42.0	17.4

(**table 1**. contd)

Points of Measurement Breed	28	30	32	33	36	37
Greyhound	16.0	101.3	36.4	53.3	36.8	37.0
Bulldog	14.8	125.1	45.7	64.8	44.9	43.1
Mops	12.6	93.8	41.2	44.3	29.5	34.5
Litle Silkpoodle	15.5	79.5	33.7	38.2	24.3	24.0
Finnehund	13.3	107.0	38.6	52.6	39.0	39.1
Black Dyrehund	14.7	96.2	32.7	47.3	31.6	32.6
Elkhound	13.5	102.0	38.3	53.8	35.8	37.2
Grey Elkhound	–	–	44.1	64.2	42.5	37.3
Grey Elkhound	–	112.9	39.6	59.8	39.6	40.1
Whippet	17.0	69.3	45.8	41.8	20.7	25.4
Grey Dyrehund	14.6	102.0	32.3	55.0	33.6	37.9
Greyhound	14.2	103.8	39.6	54.8	34.4	32.8
Scottish Sheep Dog	15.4	104.2	39.2	62.2	42.3	34.4
Big Engelsk Guarddog	17.2	117.0	37.2	57.1	43.4	41.6
Harehund	17.5	104.6	35.0	49.0	36.5	34.8
Greyhound	–	101.7	33.8	50.2	36.0	33.1
Greyhound	12.5	84.4	37.4	49.7	34.9	29.2
Foxterrier	16.9	78.8	31.6	38.0	24.4	27.1
Foxterrier	14.9	80.1	36.0	41.5	26.6	25.2
Eldre Svensk Støver	10.9	107.0	40.2	56.1	40.4	40.3
Wired Haired Poodle	13.2	97.3	37.2	57.5	37.9	37.8
Dalmatian	13.9	98.8	36.2	47.3	32.4	32.1
Greyhound	17.2	115.6	36.5	60.5	43.7	39.8
Boxer	14.4	116.6	39.0	58.6	40.2	36.2
Bulldog	16.2	121.8	54.5	68.8	46.0	49.4
–	15.3	–	41.4	54.4	40.1	39.2
Dachshund	11.7	93.1	36.1	43.5	30.8	31.2
Finnehund	15.1	106.7	39.7	55.8	40.7	34.3
Grey Dyrehund	–	–	–	–	–	–
Grey Dyrehund	13.3	104.2	40.8	59.0	41.0	38.0
Norwegian Sheep dog	14.7	88.7	35.1	45.1	31.2	26.6
Lundehund	16.2	59.2	39.5	38.3	22.1	23.0
Lundehund	16.7	58.8	37.1	31.3	21.5	20.7
Lundehund	16.7	60.3	32.4	30.8	21.1	22.2
Lundehund	18.4	67.1	32.6	33.6	23.8	22.1
Lundehund	19.2	72.6	33.8	37.6	26.1	24.0
Lundehund	15.7	71.4	35.3	36.9	26.3	25.5
Lundehund	16.6	75.5	34.3	39.2	37.5	26.1
Lundehund	16.8	82.3	34.8	43.5	30.2	27.7
Lundehund	17.7	80.5	33.5	43.5	29.5	28.5
Lundehund	17.3	76.0	31.0	36.4	25.4	25.5
Lundehund	13.2	76.8	33.7	40.8	27.9	26.0
Lundehund	16.0	75.5	33.3	37.5	27.2	25.1
Buhund	13.3	91.0	34.3	42.4	30.4	32.0
Lundehund	14.9	74.0	34.2	38.5	29.3	26.3
Lundehund	16.3	80.9	37.1	46.3	32.3	26.8
Lundehund	17.8	83.4	35.4	45.8	31.2	29.3
Russian Greyhound	18.4	98.7	39.0	64.7	48.9	36.2
Buhund	13.4	98.7	41.0	54.5	35.7	33.9
Buhund	13.5	102.0	40.0	50.3	35.5	34.7
Buhund	15.4	102.8	42.1	57.5	36.3	34.5
Buhund	15.5	96.3	39.8	52.7	36.0	31.5
Buhund	12.7	91.0	36.8	50.5	35.0	31.3

(**table 1**. contd)

Points of Measurement Breed	38	40	41
Greyhound	67.9	49.9	–
Bulldog	66.0	47.9	–
Mops	52.0	32.6	27.7
Litle Silkpoodle	42.8	33.4	–
Finnehund	64.8	41.1	31.4
Black Dyrehund	58.7	45.0	39.0
Elkhound	62.1	43.1	41.0
Grey Elkhound	–	–	–
Grey Elkhound	62.9	46.4	–
Whippet	–	32.2	–
Grey Dyrehund	67.3	46.8	–
Greyhound	62.8	49.6	43.6
Scottish Sheep Dog	69.2	48.2	–
Big Engelsk Guarddog	73.9	50.0	–
Harehund	61.0	46.6	–
Greyhound	–	–	–
Greyhound	52.9	36.1	–
Foxterrier	48.4	38.0	–
Foxterrier	47.7	35.5	–
Eldre Svensk Støver	66.3	50.1	–
Wired Haired Poodle	60.6	44.5	–
Dalmatian	50.9	38.9	–
Greyhound	72.8	57.1	–
Boxer	59.4	44.1	–
Bulldog	58.9	41.9	–
–	67.8	48.2	–
Dachshund	50.4	36.9	–
Finnehund	63.2	46.2	–
Grey Dyrehund	–	–	–
Grey Dyrehund	56.5	41.1	–
Norwegian Sheep dog	52.3	37.0	–
Lundehund	–	30.1	–
Lundehund	–	31.9	–
Lundehund	–	31.4	–
Lundehund	43.8	32.9	–
Lundehund	44.0	34.3	–
Lundehund	43.5	34.4	–
Lundehund	46.6	34.5	–
Lundehund	50.2	36.3	–
Lundehund	49.2	34.3	–
Lundehund	45.6	33.7	–
Lundehund	44.2	34.6	–
Lundehund	42.6	33.6	–
Buhund	50.5	40.2	–
Lundehund	43.1	33.1	–
Lundehund	45.8	35.3	–
Lundehund	49.7	36.8	–
Russian Greyhound	72.3	47.5	–
Buhund	51.2	39.8	–
Buhund	54.3	37.9	–
Buhund	57.4	44.9	36.5
Buhund	52.1	35.3	33.9
Buhund	25.2	49.6	38.3

2 MEASUREMENTS OF THE MANDIBULA (after von den Driesch, 1976)

1 Total length: *Condyle process – Infradentale*
2 Length: *Angular process – Infradentale*
3 Length from indentation between condyle process and angular process – Infradentale
4 Length: *Condyle process – Aboral border of canine alveolus*
5 Length from indentation between condyle process and angular process – Aboral border of Canine alveolus
6 Length: *Angular process – Aboral border of canine alveolus*
7 Length: *Aboral border of alveolus M_3 – Aboral border of canine alveolus*
8 Length of cheektooth row, M_3–P_1, measured along the alveoli
9 Length of cheektooth row, M_3–P_2, measured along the alveoli
10 Length of the molar row, measured along the alveoli
11 Length of the premolar row, P_1–P_4, measured along the alveoli
12 Length of the premolar row, P_2–P_4, measured along the alveoli
13 Length and breadth of the carnassial, measured at the cingulum
14 Length of the carnassial alveolus
17 Greatest thickness of the body of jaw (below M_1)
18 Height of the vertical ramus: *Basal point of the angular process – Coronion*
19 Height of the mandible behind M_1
20 Height of the mandible between P_2 and P_3
21 Height (length) of the canine taken out of jaw

Table 2. Mandibula

Points of Measurement Breed	1	2	3	4	5	6
Greyhound	165.0	164.3	154.8	144.2	135.0	145.7
Bulldog	138.2	136.9	130.7	117.4	109.9	115.8
Mops	92.5	88.9	85.5	75.5	68.9	72.8
Litle Silkpoodle	90.0	89.3	86.4	77.3	73.6	76.6
Finnehund	137.6	135.1	129.5	117.3	111.1	116.9
Black Dyrehund	128.9	131.0	123.9	113.2	108.0	115.8
Elkhound	140.1	139.7	134.1	120.2	114.4	120.8
Grey Elkhound	–	–	–	–	–	–
Grey Elkhound	151.5	148.9	144.1	134.2	126.1	131.3
Whippet	89.8	87.8	86.3	76.1	72.7	74.7
Grey Dyrehund	138.5	133.1	128.8	118.1	108.6	114.2
Greyhound	156.2	151.2	144.8	136.2	125.7	131.8
Scottish Sheep Dog	166.0	165.4	157.0	146.2	137.5	146.6
Big Engelsk Guarddog	166.0	162.5	153.5	144.0	134.8	143.0
Harehund	151.7	146.6	141.9	134.2	123.2	127.2
Greyhound	144.8	144.1	137.0	126.8	119.1	126.8
Greyhound	123.6	122.4	117.5	106.7	101.4	105.8
Foxterrier	97.9	96.2	92.0	82.8	78.1	82.1
Foxterrier	101.8	100.6	97.0	88.6	82.5	85.9
Eldre Svensk Støver	156.0	154.8	148.3	135.9	128.2	134.6
Wired Haired Poodle	136.2	136.6	129.6	118.8	112.1	120.0
Dalmatian	118.9	116.5	112.3	102.3	97.3	101.3
Greyhound	174.0	172.0	166.8	156.0	149.2	153.9
Boxer	132.7	131.9	127.3	114.9	110.0	114.4
Bulldog	126.1	121.7	116.9	103.4	95.6	99.1
–	151.0	150.0	142.5	128.0	121.9	129.0
Dachshund	113.9	108.6	108.1	96.1	90.4	91.3
Finnehund	136.3	138.3	132.2	118.0	113.4	120.4
Grey Dyrehund	–	–	–	–	–	–
Grey Dyrehund	141.9	140.4	135.6	122.4	115.9	121.4
Norwegian Sheep dog	112.1	110.6	106.5	97.1	92.6	95.6
Lundehund	71.6	67.9	–	62.2	–	57.8
Lundehund	74.5	70.6	71.1	64.0	62.3	62.7
Lundehund	78.8	76.6	75.8	67.9	65.9	66.5
Lundehund	85.6	83.1	82.3	71.3	68.0	68.9
Lundehund	92.2	90.2	88.1	77.4	72.6	74.9
Lundehund	97.9	94.8	93.8	82.7	77.7	79.2
Lundehund	96.5	93.8	91.7	82.5	77.0	79.4
Lundehund	104.1	100.7	99.8	88.0	83.5	85.3
Lundehund	105.4	101.4	100	88.7	83.7	85.8
Lundehund	97.3	94.9	92.5	76.7	76.9	77.3
Lundehund	95.9	93.4	91.3	82.0	77.5	79.5
Lundehund	93.9	90.5	88.5	79.3	73.7	76.4
Buhund	120.0	120.5	115.3	104.5	100.0	104.8
Lundehund	93.0	90.6	88.1	79.2	75.2	76.9
Lundehund	100.6	98.5	96.0	86.2	82.0	84.6
Lundehund	104.1	101.2	98.6	87.9	83.9	86.4
Russian Greyhound	178.5	172.0	168.0	156.6	146.5	151.0
Buhund	125.4	122.6	118.8	107.8	102.7	106.8
Buhund	122.3	118.6	116.4	107.4	99.9	104.4
Buhund	129.4	127.7	123.6	112.8	107.4	111.6
Buhund	118.1	117.4	112.9	103.3	98.1	102.6
Buhund	114.8	113.4	109.1	98.4	94.0	97.4

(**table 2**. contd)

Points of Measurement Breed	7	8	9	10	11	12
Greyhound	91.3	85.6	78.8	39.5	44.1	37.5
Bulldog	71.2	69.0	66.2	33.5	37.0	32.1
Mops	44.9	41.3	36.8	22.3	23.3	16.9
Litle Silkpoodle	52.2	–	46.8	23.8	–	23.8
Finnehund	77.9	71.0	65.3	36.0	34.2	30.5
Black Dyrehund	76.0	70.6	66.5	32.8	37.2	32.9
Elkhound	78.7	75.2	69.8	35.7	40.1	34.6
Grey Elkhound	80.0	–	–	34.8	–	–
Grey Elkhound	82.3	76.5	70.9	34.6	42.3	37.3
Whippet	54.9	52.7	47.0	24.7	27.7	22.5
Grey Dyrehund	78.2	73.3	67.0	36.5	36.4	31.1
Greyhound	84.9	79.3	73.0	35.3	42.8	37.6
Scottish Sheep Dog	92.1	87.1	79.7	39.4	47.7	41.0
Big Engelsk Guarddog	88.8	81.4	74.4	38.0	43.3	36.8
Harehund	85.6	78.9	73.6	35.8	44.6	39.3
Greyhound	83.2	76.7	69.2	36.3	40.8	34.0
Greyhound	72.6	65.9	61.5	30.2	35.2	30.4
Foxterrier	58.3	54.0	50.1	27.5	28.3	25.0
Foxterrier	61.2	58.4	54.5	35.5	32.0	27.9
Eldre Svensk Støver	89.3	79.0	73.4	48.0	42.4	35.5
Wired Haired Poodle	77.9	72.7	–	32.7	40.3	–
Dalmatian	66.6	55.3	55.1	31.4	31.6	25.8
Greyhound	97.0	87.1	77.4	39.5	46.9	37.8
Boxer	72.4	65.2	61.2	31.1	35.9	31.6
Bulldog	60.8	58.3	52.1	34.1	27.6	23.8
–	83.7	–	74.8	41.2	–	35.9
Dachshund	67.9	65.1	59.3	30.9	34.7	30.0
Finnehund	78.1	69.3	65.6	32.9	37.9	33.2
Grey Dyrehund	–	–	–	–	–	–
Grey Dyrehund	80.4	74.4	69.5	35.9	39.3	33.0
Norwegian Sheep dog	64.4	60.9	57.5	28.6	31.6	28.0
Lundehund	28.8	–	–	–	–	–
Lundehund	45.3	44.4	41.3	21.2	25.7	21.6
Lundehund	51.9	50.0	45.3	22.8	27.0	23.7
Lundehund	50.7	49.8	46.8	26.4	18.3	14.7
Lundehund	53.8	51.6	41.7	25.3	17.6	11.4
Lundehund	59.5	51.7	48.3	29.2	28.6	22.7
Lundehund	55.5	54.8	50.0	27.6	21.3	16.2
Lundehund	60.8	58.4	54.1	29.1	20.8	15.7
Lundehund	62.5	59.4	56.2	30.1	–	–
Lundehund	56.0	54.0	50.4	28.6	–	–
Lundehund	56.0	54.7	50.0	25.7	19.6	13.5
Lundehund	54.4	51.5	–	26.7	17.8	–
Buhund	71.0	65.2	60.0	31.1	25.2	29.6
Lundehund	54.3	50.3	–	25.5	16.6	–
Lundehund	57.9	55.6	50.8	27.1	21.0	15.6
Lundehund	60.3	58.7	54.4	29.6	–	–
Russian Greyhound	102.0	94.9	88.5	41.2	52.8	45.8
Buhund	73.2	68	63.3	33	36.4	32.1
Buhund	74.1	66.7	61.9	34.2	35.7	31.9
Buhund	73.4	69.4	63.9	32.6	37.8	31.5
Buhund	70.0	65.2	60.1	31.7	35.5	30.0
Buhund	66.3	62.1	58.0	29.9	32.0	28.5

(**table 2**. contd)

Points of Measurement Breed	13	14	17	18	19	20
Greyhound	22.9	21.5	10.2	62.2	26.1	20.6
Bulldog	20.7	20.0	11.6	64.4	21.6	19.5
Mops	15.5	13.7	8.6	37.6	13.9	13.3
Litle Silkpoodle	14.9	13.7	7.6	33.1	12.4	12.7
Finnehund	21.0	20.2	12.3	54.5	20.9	17.0
Black Dyrehund	19.3	18.6	9.9	53.1	20.0	16.4
Elkhound	20.5	18.6	10.2	55.3	21.3	18.4
Grey Elkhound	20.3	18.4	11.1	–	22.4	18.8
Grey Elkhound	21.5	20.0	11.9	58.5	22.9	20.3
Whippet	15.4	14.5	7.2	31.5	11.2	11.3
Grey Dyrehund	21.0	20.4	12.3	57.6	21.9	18.9
Greyhound	21.3	19.2	10.0	56.0	18.7	16.1
Scottish Sheep Dog	22.0	21.0	11.9	64.3	25.5	19.4
Big Engelsk Guarddog	21.5	19.8	13.2	64.0	25.9	22.8
Harehund	21.8	19.9	11.2	55.5	22.7	18.7
Greyhound	20.9	20.5	10.7	57.7	22.0	17.4
Greyhound	17.7	16.5	8.8	46.3	17.5	13.8
Foxterrier	17.9	16.8	8.0	35.2	13.9	13.6
Foxterrier	17.5	15.4	7.1	36.7	13.1	14.2
Eldre Svensk Støver	20.9	20.5	10.7	58.9	26.0	20.3
Wired Haired Poodle	19.4	18.4	10.2	52.7	21.7	15.3
Dalmatian	18.8	17.5	10.5	43.1	17.2	17.0
Greyhound	21.7	18.8	10.9	60.0	24.4	20.1
Boxer	21.1	20.5	11.1	50.7	21.1	18.4
Bulldog	20.7	19.5	13.3	58.2	22.3	21.6
–	24.1	22.6	14.2	64.0	25.1	20.6
Dachshund	18.4	15.7	8.9	46.4	18.2	14.5
Finnehund	19.6	17.8	11.6	53.4	21.6	18.5
Grey Dyrehund	–	–	–	–	–	–
Grey Dyrehund	22.0	20.9	10.5	56.1	22.0	17.6
Norwegian Sheep dog	17.5	15.9	9.2	42.7	15.7	15.5
Lundehund	–	–	6.0	20.8	12.0	11.7
Lundehund	–	11.2	6.8	20.8	11.5	10.1
Lundehund	–	11.9	7.7	24.1	11.9	11.2
Lundehund	16.2	15.4	7.2	28.2	9.9	10.3
Lundehund	15.6	15.1	7.9	31.1	11.1	10.6
Lundehund	17.7	16.1	8.4	31.7	11.9	12.9
Lundehund	17.0	16.1	7.8	33.7	12.8	12.1
Lundehund	17.7	17.4	9.1	35.5	15.1	13.4
Lundehund	18.1	17.5	8.8	36.9	13.7	13.6
Lundehund	17.9	16.7	8.1	34.1	12.7	11.8
Lundehund	16.4	15.1	7.4	32.8	13.7	12.0
Lundehund	16.7	16.4	7.8	31.1	12.5	11.2
Buhund	19.3	18.8	10.0	45.1	18.0	16.8
Lundehund	16.1	15.6	7.7	31.1	11.5	11.6
Lundehund	16.6	16.3	8.0	33.2	12.6	13.0
Lundehund	18.1	17.6	8.5	34.9	13.2	13.3
Russian Greyhound	23.4	22.6	9.9	61.5	24.8	21.7
Buhund	20.8	18.3	10	46.3	17.9	16.1
Buhund	21.1	20	11	47.5	27.2	34.5
Buhund	19.5	18.3	11.2	52.0	20.0	17.0
Buhund	18.9	17.4	10.3	44.5	17.4	16.8
Buhund	18.8	17.5	10.6	41.7	18.3	15.7

(**table 2**. contd)

Points of Measurement	21
Breed	
Greyhound	–
Bulldog	–
Mops	–
Litle Silkpoodle	–
Finnehund	30.8
Black Dyrehund	–
Elkhound	–
Grey Elkhound	–
Grey Elkhound	–
Whippet	–
Grey Dyrehund	–
Greyhound	41.2
Scottish Sheep Dog	–
Big Engelsk Guarddog	–
Harehund	–
Greyhound	–
Greyhound	–
Foxterrier	–
Foxterrier	–
Eldre Svensk Støver	–
Wired Haired Poodle	–
Dalmatian	–
Greyhound	–
Boxer	–
Bulldog	–
–	39.8
Dachshund	–
Finnehund	–
Grey Dyrehund	–
Grey Dyrehund	–
Norwegian Sheep dog	–
Lundehund	–
Lundehund	–
Lundehund	–
Lundehund	–
Lundehund	–
Lundehund	–
Lundehund	–
Lundehund	–
Lundehund	–
Lundehund	–
Lundehund	–
Lundehund	–
Buhund	–
Lundehund	–
Lundehund	–
Lundehund	–
Russian Greyhound	–
Buhund	31.1
Buhund	31.5
Buhund	35.5
Buhund	31.5
Buhund	26.8

3 MEASUREMENTS OF THE ATLAS (after von den Driesch, 1976)

GB	Greatest breadth over the wings
GL	Greatest length
BFcr	Greatest breadth over the Facies articularis cranialis
BFcd	Greatest breadth over the Facies articularis caudalis
GLF	Greatest length from the Facies articularis cranialis to the Facies articularis caudalis
LAd	Length of the Arcus dorsalis, median
H	Height

Table 3. Atlas

Points of Measurement Breed	GB	GL	BFcr	BFcd	GLF	LAD	H
Greyhound	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
Mops	–	–	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–	–	–
Finnehund	74.5	36.4	36.7	29.9	28.9	15.3	26.2
Black Dyrehund							
Elkhound	76.4	36.8	37.8	30.0	27.1	16.4	26.3
Grey Elkhound	76.9	41.1	36.0	31.5	30.4	17.5	26.8
Grey Elkhound	–	–	–	–	–	–	–
Whippet	–	–	–	–	–	–	–
Grey Dyrehund	79.3	37.0	39.9	32.7	31.2	16.2	24.8
Greyhound	86.0	44.9	42.3	36.4	32.9	16.7	27.1
Scottish Sheep Dog	–	–	–	–	–	–	–
Big Engelsk Guarddog	–	–	–	–	–	–	–
Harehund	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–	–	–
Dalmatian	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Boxer	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–
Dachshund	–	–	–	–	–	–	–
Finnehund	71.5	33.3	37.4	29.2	26.6	13.0	25.2
Grey Dyrehund	80.1	38.0	42.2	30.6	28.9	14.2	27.6
Grey Dyrehund	75.2	35.4	36.4	27.3	26.7	14.2	26.3
Norwegian Sheep dog	63.3	30.3	33.1	27.3	32.7	13.7	21.8
Lundehund	38.3	13.0	24.0	23.8	12.8	6.9	17.8
Lundehund	40.0	16.9	20.3	20.1	16.7	8.0	17.7
Lundehund	42.9	17.9	25.1	21.8	16.9	8.4	17.9
Lundehund	48.5	20.5	26.4	21.1	18.5	9.0	18.6
Lundehund	53.0	22.5	26.9	21.8	18.4	10.0	19.1
Lundehund	52.4	21.6	28.5	24.6	21.1	10.5	20.8
Lundehund	55.7	20.1	28.4	23.4	18.3	9.4	19.5
Lundehund	61.1	24.5	21.2	25.7	30.2	11.1	21.7
Lundehund	60.8	25.3	27.6	24.8	20.8	10.2	20.9
Lundehund	53.8	25.7	28.7	23.4	19.4	8.5	20.3
Lundehund	57.9	24.1	28.0	22.5	20.1	9.4	20.3
Lundehund	54.6	23.3	27.4	21.9	18.3	9.5	18.8
Buhund	64.3	30.5	32.3	25.4	24.0	14.2	23.2
Lundehund	54.8	22.1	26.4	21.2	19.5	9.8	18.9
Lundehund	58.7	23.8	29.3	22.8	20.2	9.5	20.5
Lundehund	60.3	23.0	29.6	23.3	17.0	9.2	21.0
Russian Greyhound	86.1	55.1	47.9	38.8	37.2	21.5	30.4
Buhund	69.8	34.6	29.3	35.4	23.8	12.9	22.3
Buhund	68.7	30.2	34.5	30.9	24.4	12.8	24.9
Buhund	73.1	34.3	39.8	31.1	28.1	14.2	25.6
Buhund	66.7	29.0	30.7	27.8	24.6	11.3	23.3
Buhund	63.7	28.9	34.5	34.4	23.1	10.4	22.6

4 MEASUREMENTS OF THE Axis (after von den Driesch, 1976)

LCDe	Greatest length of the corpus including the dens
LAPa	Greatest length of the arch including Processus articulares caudales
BFcr	Greatest breadth over the Facies articularis cranialis
BFacd	Greatest breadth across the Processus articularis caudalis
SBV	Smalles breadth of the vertebra
BFcd	Greates breadth of the Facies terminalis caudalis
H	Greatest height

Table 4. Axis

Points of Measurement Breed	LCDe	LAPa	BFcr	BFacd	SBV	BFcd	H
Greyhound	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
Mops	–	–	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–	–	–
Finnehund	42.2	50.9	28.1	29.3	39.6	20.7	18.3
Black Dyrehund							
Elkhound	43.5	47.0	28.3	27.9	40.5	22.0	18.3
Grey Elkhound	44.2	54.2	29.1	29.3	43.1	22.6	17.7
Grey Elkhound	–	–	–	–	–	–	–
Whippet	–	–	–	–	–	–	–
Grey Dyrehund	44.8	49.7	31.0	31.1	43.3	22.5	17.8
Greyhound	58.4	68.4	32.9	34.1	38.4	23.2	20.6
Scottish Sheep Dog	–	–	–	–	–	–	–
Big Engelsk Guarddog	–	–	–	–	–	–	–
Harehund	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–	–	–
Dalmatian	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Boxer	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–
Dachshund	–	–	–	–	–	–	–
Finnehund	42.1	43.2	27.9	30.0	38.5	21.6	16.8
Grey Dyrehund	48.7	52.2	29.1	27.8	38.9	20.2	18.6
Grey Dyrehund	43.0	44.7	27.2	25.7	40.3	21.3	17.2
Norwegian Sheep dog	38.4	39.7	24.3	24.1	32.6	16.5	14.1
Lundehund	17.2	16.8	17.4	17.0	18.7	15.7	11.3
Lundehund	NA	20.4	17.2	15.8	17.7	17.3	8.9
Lundehund	23.8	23.8	17.8	16.9	16.1	14.0	10.2
Lundehund	29.9	28.2	18.1	18.2	22.1	14.9	9.6
Lundehund	32.0	30.4	19.2	20.5	24.7	15.6	11.4
Lundehund	31.7	32.8	21.6	20.6	25.5	17.7	12.6
Lundehund	32.0	30.8	20.5	20.1	23.9	15.7	12.0
Lundehund	34.8	35.9	22.9	20.8	28.7	17.7	13.5
Lundehund	33.2	33.8	21.8	20.1	29.2	16.4	12.9
Lundehund	29.7	29.5	20.0	20.8	23.0	15.8	11.7
Lundehund	32.8	32.4	19.8	20.2	24.1	15.9	11.7
Lundehund	30.8	29.6	20.0	19.0	25.5	15.3	11.9
Buhund	37.2	40.4	23.6	27.0	33.6	18.2	15.5
Lundehund	30.4	31.3	19.1	19.6	24.8	13.9	11.6
Lundehund	33.1	33.6	20.4	19.4	27.5	14.9	12.4
Lundehund	23.0	32.6	20.5	19.8	27.4	15.5	12.4
Russian Greyhound	67.9	73.8	36.7	33.3	50.6	25.5	23.7
Buhund	40.3	42.4	27.1	23.6	33.9	19.2	15.2
Buhund	39.4	43.4	28.1	23.6	35.9	20.3	16.3
Buhund	42.0	47.9	28.6	26.6	34.2	20.7	16.5
Buhund	39.7	42.0	24.8	23.0	35.4	19.5	14.5
Buhund	39.1	39.7	24.5	22.6	34.6	18.9	14.8

5-7 MEASUREMENTS OF THE VERTEBRAE (after von den Driesch, 1976)

PL	Physiological length of the body. Facies terminalis cranialis – Facies terminalis caudalis
LAPa	Greatest length of the arch including Processus articulares caudales
BFacr	Greatest breadth across the Processus articularis cranialis (in cervical vertebrae)
BFacd	Greatest breadth across the Processus articularis caudalis (in cervical vertebrae)
BPtr	Greatest breadth across the Processus transversi
BFcr	Greatest breadth of Facies terminalis cranialis
BFcd	Greatest breadth of Facies terminalis caudalis (not measured in thoracic vertebrae)
HFcr	Greatest height of Facies terminalis cranialis
HFcd	Greatest height of Facies terminalis caudalis
HFv	Height Foramen vertebralis
H	Greatest height

Table 5. Cervical Vertebra IV

Points of Measurement Breed	PL	GLPa	BPacr	BPacd	BPtr	BFcr	BFcd
Greyhound	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
Mops	–	–	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–	–	–
Finnehund	24.5	35.0	35.5	31.1	43.4	14.8	15.4
Black Dyrehund	24.8	34.2	32.8	28.9	43.3	13.4	14.9
Elkhound	24.8	35.0	34.8	33.3	45.2	14.5	15.8
Grey Elkhound	25.1	37.9	36.8	34.8	45.9	14.6	16.6
Grey Elkhound	–	–	–	–	–	–	–
Whippet	–	–	–	–	–	–	–
Grey Dyrehund	24.8	35.6	36.7	33.2	44.8	15.4	15.8
Greyhound	33.8	49.8	34.5	33.2	52.7	18.0	19.0
Scottish Sheep Dog	–	–	–	–	–	–	–
Big Engelsk Guarddog	–	–	–	–	–	–	–
Harehund	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–	–	–
Dalmatian	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Boxer	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–
Dachshund	–	–	–	–	–	–	–
Finnehund	28.1	33.0	34.8	33.1	38.6	14.2	15.0
Grey Dyrehund	30.3	37.0	28.0	32.4	49.3	16.1	17.4
Grey Dyrehund	23.9	33.1	33.2	30.9	43.7	14.8	15.5
Norwegian Sheep dog	23.8	31.2	28.4	26.6	35.4	12.0	13.1
Lundehund	6.5	13.3	19.1	18.3	22.0	8.2	10.8
Lundehund	10.6	16.8	17.0	16.8	20.9	8.8	10.2
Lundehund	9.7	17.3	19.3	19.4	22.3	8.3	9.7
Lundehund	17.4	22.9	18.9	19.6	28.7	9.9	9.9
Lundehund	18.1	24.3	20.8	21.8	32.2	10.5	11.2
Lundehund	15.9	24.4	24.0	23.3	28.8	10.8	10.8
Lundehund	20.6	25.2	20.7	20.9	33.0	10.9	11.9
Lundehund	20.7	25.4	21.9	21.9	36.0	12.3	12.3
Lundehund	21.5	24.7	21.2	21.5	37.5	11.6	12.8
Lundehund	19.9	24.7	22.9	23.0	28.5	10.1	10.1
Lundehund	20.9	26.7	22.7	20.5	28.2	11.0	11.0
Lundehund	17.9	23.3	20.9	19.8	27.6	9.9	10.2
Buhund	20.4	29.6	32.0	30.3	34.5	12.2	13.8
Lundehund	19.5	23.9	20.0	19.9	31.7	10.2	11.4
Lundehund	17.3	24.4	19.9	20.9	35.3	10.7	12.0
Lundehund	16.3	24.0	23.4	21.5	28.2	9.6	10.8
Russian Greyhound	31.7	49.0	40.8	39.1	60.1	20.8	21.9
Buhund	20.0	31.3	30.1	27.3	26.9	13.2	14.1
Buhund	22.9	31.5	29.8	28.1	42.3	13.7	15.0
Buhund	29.2	34.5	33.7	28.8	42.0	14.7	15.4
Buhund	25.5	29.6	23.4	27.8	44.7	13.0	13.8
Buhund	22.0	30.1	23.6	25.2	41.5	13.7	14.3

(**table 5.** contd)

Points of Measurement Breed	HFcr	HFcd	HFv	H
Greyhound	–	–	–	–
Bulldog	–	–	–	–
Mops	–	–	–	–
Litle Silkpoodle	–	–	–	–
Finnehund	9.8	15.6	8.1	40.0
Black Dyrehund	9.2	14.0	8.9	32.2
Elkhound	10.9	14.8	8.7	35.3
Grey Elkhound	10.9	14.6	8.0	38.6
Grey Elkhound	–	–	–	–
Whippet	–	–	–	–
Grey Dyrehund	10.4	15.4	7.0	32.8
Greyhound	11.9	18.6	7.7	45.4
Scottish Sheep Dog	–	–	–	–
Big Engelsk Guarddog	–	–	–	–
Harehund	–	–	–	–
Greyhound	–	–	–	–
Greyhound	–	–	–	–
Foxterrier	–	–	–	–
Foxterrier	–	–	–	–
Eldre Svensk Støver	–	–	–	–
Wired Haired Poodle	–	–	–	–
Dalmatian	–	–	–	–
Greyhound	–	–	–	–
Boxer	–	–	–	–
Bulldog	–	–	–	–
–	–	–	–	–
Dachshund	–	–	–	–
Finnehund	8.7	14.9	7.6	34.5
Grey Dyrehund	10.7	14.9	8.7	28.0
Grey Dyrehund	10.7	14.1	8.3	35.7
Norwegian Sheep dog	8.0	12.2	6.7	28.3
Lundehund	7.1	7.1	–	15.9
Lundehund	5.4	5.6	–	13.4
Lundehund	5.7	6.3	–	14.9
Lundehund	5.0	6.6	–	14.4
Lundehund	6.8	7.4	–	17.5
Lundehund	7.7	7.3	–	18.0
Lundehund	7.2	8.3	–	16.3
Lundehund	6.7	10.0	–	17.6
Lundehund	7.7	9.3	–	20.2
Lundehund	8.0	8.5	–	19.8
Lundehund	7.2	8.4	–	16.6
Lundehund	6.7	8.7	–	16.4
Buhund	7.5	12.7	–	28.4
Lundehund	8.1	8.0	–	15.5
Lundehund	7.1	10.1	–	16.8
Lundehund	8.0	10.6	–	25.4
Russian Greyhound	14.0	19.1	8.8	46.4
Buhund	9.3	13.7	–	28.7
Buhund	9.9	13.1	–	28.7
Buhund	10.1	13.8	–	30.7
Buhund	8.8	10.8	–	23.4
Buhund	8.7	10.6	–	19.8

Table 6. Thoracic Vertebra I

Points of Measurement Breed	PL	GLPa	BPacr	BPacd	BFcr	HFcr	HFcd
Greyhound	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
Mops	–	–	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–	–	–
Finnehund	17.5	26.1	28.5	20.6	24.8	12.6	11.3
Black Dyrehund	17.2	24.8	27.1	17.7	23.9	11.6	11.2
Elkhound	17.3	22.4	29.2	16.6	25.5	13.1	11.7
Grey Elkhound	17.1	23.5	27.1	19.6	28.5	12.6	11.1
Grey Elkhound	–	–	–	–	–	–	–
Whippet	–	–	–	–	–	–	–
Grey Dyrehund	18.1	25.2	27.8	19.5	25.9	12.8	11.5
Greyhound	21.9	30.3	32.1	20.7	32.6	15.6	14.1
Scottish Sheep Dog	–	–	–	–	–	–	–
Big Engelsk Guarddog	–	–	–	–	–	–	–
Harehund	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–	–	–
Dalmatian	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Boxer	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–
Dachshund	–	–	–	–	–	–	–
Finnehund	16.0	24.2	27.6	19.3	24.3	10.8	10.8
Grey Dyrehund	19.3	27.7	30.5	18.7	27.3	12.8	12.1
Grey Dyrehund	15.9	24.5	19.3	11.6	22.2	10.2	11.4
Norwegian Sheep dog	14.2	19.3	21.5	16.9	19.6	9.4	9.1
Lundehund	7.4	8.6	9.1	7.7	7.3	6.5	6.2
Lundehund	6.7	11.2	17.8	12.9	8.3	5.9	5.4
Lundehund	6.3	12.6	15.4	9.3	8.0	5.5	5.7
Lundehund	9.1	14.7	15.0	9.5	8.7	7.7	6.6
Lundehund	9.9	10.8	16.6	9.2	8.6	8.0	7.2
Lundehund	8.5	10.5	18.0	9.4	10.5	6.7	7.0
Lundehund	10.5	16.4	17.3	10.3	9.7	7.8	7.8
Lundehund	12.9	17.0	22.0	16.8	11.0	9.1	9.0
Lundehund	11.7	17.6	20.9	15.3	11.3	8.7	8.7
Lundehund	11.4	18.3	20.1	14.5	9.6	8.5	7.9
Lundehund	11.0	17.0	16.8	9.0	8.9	8.2	8.0
Lundehund	10.7	14.7	18.7	13.6	9.1	7.8	7.7
Buhund	12.4	12.2	10.7	9.9	10.4	8.4	8.9
Lundehund	11.7	16.7	17.9	14.4	9.9	8.3	8.1
Lundehund	12.7	12.2	20.6	15.5	10.6	8.5	8.5
Lundehund	11.9	15.7	21.2	15.8	11.0	8.4	8.2
Russian Greyhound	25.1	29.6	27.2	17.7	32.2	15.8	15.4
Buhund	14.30	13.7	10.2	9.2	13.1	9.6	10.2
Buhund	14.2	14.2	22.0	11.0	12.6	10.7	10.7
Buhund	15.7	21.3	26.4	12.6	12.8	12.6	10.2
Buhund	14.2	16.5	18.9	9.2	11.5	10.0	9.1
Buhund	14.6	20.5	23.3	14.6	12.6	9.9	9.1

(**table 6.** contd)

Points of Measurement Breed	HFv	H
Greyhound	–	–
Bulldog	–	–
Mops	–	–
Litle Silkpoodle	–	–
Finnehund	9.0	65.1
Black Dyrehund	8.8	62.2
Elkhound	10.7	66.5
Grey Elkhound	8.9	66.4
Grey Elkhound	–	–
Whippet	–	–
Grey Dyrehund	8.8	70.6
Greyhound	9.5	70.7
Scottish Sheep Dog	–	–
Big Engelsk Guarddog	–	–
Harehund	–	–
Greyhound	–	–
Greyhound	–	–
Foxterrier	–	–
Foxterrier	–	–
Eldre Svensk Støver	–	–
Wired Haired Poodle	–	–
Dalmatian	–	–
Greyhound	–	–
Boxer	–	–
Bulldog	–	–
–	–	–
Dachshund	–	–
Finnehund	9.4	63.2
Grey Dyrehund	9.7	66.2
Grey Dyrehund	9.0	62.5
Norwegian Sheep dog	8.2	56.2
Lundehund	–	26.7
Lundehund	–	30.3
Lundehund	–	31.8
Lundehund	–	38.7
Lundehund	–	41.6
Lundehund	–	41.7
Lundehund	–	44.7
Lundehund	–	49.0
Lundehund	–	47.2
Lundehund	–	41.7
Lundehund	–	47.0
Lundehund	–	43.2
Buhund	–	51.2
Lundehund	–	45.8
Lundehund	–	48.7
Lundehund	–	49.7
Russian Greyhound	10.2	82.3
Buhund	–	53.4
Buhund	–	59.1
Buhund	–	64.2
Buhund	–	56.8
Buhund	–	53.6

Table 7. Lumbar Vertebra V

Points of Measurement Breed	PL	GLPa	BPacr	BPacd	BPtr	BFcr	BFcd
Greyhound	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
Mops	–	–	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–	–	–
Finnehund	24.4	34.8	23.6	17.2	63.5	22.9	25.9
Black Dyrehund	24.1	31.6	21.5	13.5	55.7	19.8	22.7
Elkhound	25.8	35.4	23.9	15.9	62.4	23.4	24.5
Grey Elkhound	27.2	38.2	23.8	13.8	65.0	20.3	24.4
Grey Elkhound	–	–	–	–	–	–	–
Whippet	–	–	–	–	–	–	–
Grey Dyrehund	26.9	38.1	22.3	12.7	61.6	23.0	23.6
Greyhound	33.5	45.2	23.5	11.3	73.8	26.5	28.7
Scottish Sheep Dog	–	–	–	–	–	–	–
Big Engelsk Guarddog	–	–	–	–	–	–	–
Harehund	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–	–	–
Dalmatian	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Boxer	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–
Dachshund	–	–	–	–	–	–	–
Finnehund	24.2	35.0	19.7	12.9	55.3	20.4	21.7
Grey Dyrehund	26.5	37.3	22.7	19.1	66.8	21.6	24.8
Grey Dyrehund	24.5	34.0	22.8	15.0	64.3	19.9	23.1
Norwegian Sheep dog	20.5	28.6	21.4	13.8	43.0	15.3	17.2
Lundehund	10.7	15.6	13.6	11.4	23.8	11.1	14.4
Lundehund	8.5	16.0	15.3	16.7	25.0	12.3	13.9
Lundehund	11.2	20.3	13.5	9.2	23.8	12.2	12.4
Lundehund	15.4	19.7	15.6	15.4	28.3	13.2	14.6
Lundehund	18.0	24.8	15.2	10.4	34.3	13.9	14.2
Lundehund	13.1	22.0	18.4	17.5	35.5	15.0	17.7
Lundehund	19.6	24.9	17.2	11.5	–	14.4	14.8
Lundehund	16.8	23.6	17.5	19.4	43.9	16.6	19.4
Lundehund	18.1	22.6	18.1	19.2	40.2	15.8	18.3
Lundehund	17.5	26.0	16.9	10.2	38.0	13.6	14.9
Lundehund	18.3	23.2	17.6	14.8	39.5	13.7	16.0
Lundehund	15.7	20.9	16.8	16.0	36.4	12.4	16.0
Buhund	22.6	31.2	20.5	12.7	46.4	17.4	20.0
Lundehund	19.1	25.3	16.3	10.7	35.4	13.3	14.5
Lundehund	18.7	26.2	19.9	11.2	35.6	14.8	15.3
Lundehund	16.5	23.2	18.3	17.0	38.8	15.7	16.9
Russian Greyhound	37.5	51.1	31.4	15.1	67.3	29.9	31.5
Buhund	19.0	29.0	15.3	12.2	40.3	18.7	19.3
Buhund	23.3	29.8	16.3	13.7	51.3	19.4	21.3
Buhund	25.5	35.5	21.9	14.0	58.2	20.8	22.7
Buhund	22.2	30.9	14.1	12.2	46.6	18.1	18.9
Buhund	22.5	29.7	21.9	14.0	50.1	18.4	19.1

(**table 7.** contd)

Points of Measurement Breed	HFcr	HFcd	HFv	H
Greyhound	–	–	–	–
Bulldog	–	–	–	–
Mops	–	–	–	–
Litle Silkpoodle	–	–	–	–
Finnehund	13.5	14.1	6.7	42.0
Black Dyrehund	12.7	13.4	7.4	44.6
Elkhound	14.4	13.4	9.2	48.2
Grey Elkhound	14.7	14.8	8.4	49.4
Grey Elkhound	–	–	–	–
Whippet	–	–	–	–
Grey Dyrehund	14.6	14.3	7.2	49.7
Greyhound	17.6	17.2	9.5	57.6
Scottish Sheep Dog	–	–	–	–
Big Engelsk Guarddog	–	–	–	–
Harehund	–	–	–	–
Greyhound	–	–	–	–
Greyhound	–	–	–	–
Foxterrier	–	–	–	–
Foxterrier	–	–	–	–
Eldre Svensk Støver	–	–	–	–
Wired Haired Poodle	–	–	–	–
Dalmatian	–	–	–	–
Greyhound	–	–	–	–
Boxer	–	–	–	–
Bulldog	–	–	–	–
–	–	–	–	–
Dachshund	–	–	–	–
Finnehund	13.9	11.9	6.9	45.1
Grey Dyrehund	13.2	13.5	7.6	47.3
Grey Dyrehund	13.3	12.7	7.5	46.3
Norwegian Sheep dog	10.8	10.0	6.7	35.6
Lundehund	7.0	7.9	–	19.9
Lundehund	7.2	6.0	–	17.6
Lundehund	7.6	6.5	–	20.6
Lundehund	9.2	7.6	–	23.2
Lundehund	9.2	8.5	–	29.4
Lundehund	10.7	9.1	–	24.8
Lundehund	9.8	9.2	–	32.3
Lundehund	11.4	9.2	–	26.4
Lundehund	11.1	9.6	–	25.1
Lundehund	8.9	8.9	–	29.3
Lundehund	10.2	8.1	–	25.7
Lundehund	9.7	8.8	–	26.5
Buhund	12.5	10.7	–	42.9
Lundehund	9.6	9.6	–	31.0
Lundehund	11.1	9.2	–	32.0
Lundehund	10.5	9.8	–	28.9
Russian Greyhound	19.8	19.9	8.7	68.8
Buhund	11.4	11.6	–	39.6
Buhund	14.4	13.2	–	44.8
Buhund	14.5	12.2	–	48.9
Buhund	12.4	11.6	–	40.8
Buhund	11.9	10.3	–	38.6

8 MEASUREMENTS OF OS SACRUM (after von den Driesch, 1976)

GL	Greatest length on the ventral side: from the cranial borders of the wings to the caudoventral border of the body of the last verebra
PL	Physiological length, measured between the centers of the bodies of the most cranial and most caudal vertebrae
GB	Greatest breadth (across the wings)
BFcr	Greatest breadth of Facies terminalis cranialis
HFcr	Greatest height of Facies terminalis cranialis

Table 8. Os Sacrum

Points of Measurement Breed	GL	PL	GB	BFcr	HFcr
Greyhound	–	–	–	–	–
Bulldog	–	–	–	–	–
Mops	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–
Finnehund	36.6	33.5	43.8	26.0	12.4
Black Dyrehund	38.5	34.8	45.9	25.4	10.3
Elkhound	38.0	33.9	41.9	24.0	11.5
Grey Elkhound	45.8	40.5	48.7	25.3	13.7
Grey Elkhound	–	–	–	–	–
Whippet	–	–	–	–	–
Grey Dyrehund	–	–	–	–	–
Greyhound	49.9	44.8	58.4	31.0	15.6
Scottish Sheep Dog	–	–	–	–	–
Big Engelsk Guarddog	–	–	–	–	–
Harehund	–	–	–	–	–
Greyhound	–	–	–	–	–
Greyhound	–	–	–	–	–
Foxterrier	–	–	–	–	–
Foxterrier	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–
Dalmatian	–	–	–	–	–
Greyhound	–	–	–	–	–
Boxer	–	–	–	–	–
Bulldog	–	–	–	–	–
–	–	–	–	–	–
Dachshund	–	–	–	–	–
Finnehund	37.7	34.4	43.7	24.2	10.7
Grey Dyrehund	36.1	36.1	47.1	25.4	12.0
Grey Dyrehund	34.7	32.1	43.8	21.1	11.1
Norwegian Sheep dog	31.5	26.5	32.9	17.6	9.0
Lundehund	–	–	–	–	–
Lundehund	9.2	7.0	23.3	13.7	5.9
Lundehund	–	–	–	–	–
Lundehund	22.5	22.0	24.9	16.8	6.9
Lundehund	24.8	23.3	27.6	15.8	7.1
Lundehund	25.5	24.6	27.4	18.2	8.1
Lundehund	23.2	23.1	28.2	16.0	7.2
Lundehund	25.3	24.9	28.9	16.6	8.1
Lundehund	23.7	28.1	28.2	15.9	6.9
Lundehund	22.2	25.6	26.6	14.8	7.6
Lundehund	23.9	23.5	30.7	16.7	7.5
Lundehund	23.0	22.7	27.1	15.2	8.0
Buhund	33.4	30.7	39.5	23.2	9.9
Lundehund	24.9	22.4	31.9	16.6	7.2
Lundehund	28.3	24.6	29.1	14.9	8.0
Lundehund	27.3	28.8	28.0	16.5	8.0
Russian Greyhound	71.8	66.9	69.1	37.6	18.1
Buhund	29.8	29.6	41.7	23.9	11.1
Buhund	33.4	31.5	44.4	22.7	11.7
Buhund	34.8	35.0	44.2	24.1	11.5
Buhund	32.2	38.3	37.7	20.4	9.3
Buhund	31.1	31.1	35.3	21.2	9.8

9 MEASUREMENTS OF SCAPULA (after von den Driesch, 1976)

HS	Height along the spine
DHA	Diagonal height: from most distal point of the scapula to the thoracic angle
SLC	Smallest length of the Collum scapulae
GLP	Greatest length of the Processus articularis (glenoid process)
LG	Length of the glenoid cavity (include cranial lip)
BG	Greatest breadth of the glenoid cavity

Table 9. Scapula

Points of Measurement Breed	HS	DHA	SLC	GLP	LG	BG
Greyhound	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–
Mops	–	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–	–
Finnehund	128.2	118.1	23.1	29.5	24.7	17.0
Black Dyrehund	124.3	115.4	21.8	28.6	25.4	16.4
Elkhound	123.1	114.6	24.2	29.3	25.2	16.8
Grey Elkhound	136.5	125.3	26.6	33.2	26.2	21.6
Grey Elkhound	–	–	–	–	–	–
Whippet	76.7	73.7	14.1	18.5	17.1	11.9
Grey Dyrehund	136.2	127.4	23.5	30.7	26.3	18.4
Greyhound	160.1	151.2	27.2	37.5	30.6	20.1
Scottish Sheep Dog	165.0	150.1	28.9	34.4	30.2	19.9
Big Engelsk Guarddog	–	–	–	–	–	–
Harehund	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–	–
Dalmatian	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–
Boxer	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–
–	–	–	–	–	–	–
Dachshund	–	–	–	–	–	–
Finnehund	127.1	114.3	23.2	27.1	24.3	16.6
Grey Dyrehund	139.9	125.3	25.6	32.3	24.3	18.0
Grey Dyrehund	–	–	–	–	–	–
Norwegian Sheep dog	105.7	98.9	19.1	23.6	18.7	14.4
Lundehund	47.8	48.4	14.2	15.2	12.5	8.7
Lundehund	56.2	53.7	13.2	15.3	11.2	8.4
Lundehund	63.2	60.2	12.4	15.7	14.2	9.2
Lundehund	75.2	71.3	13.1	17.5	15.4	10.1
Lundehund	84.0	81.2	13.7	18.4	16.3	11.0
Lundehund	82.7	79.1	17.0	20.7	18.4	12.4
Lundehund	89.7	96.0	15.1	19.7	16.7	11.5
Lundehund	92.7	89.8	17.5	21.3	18.4	12.7
Lundehund	93.0	90.3	17.0	21.4	19.1	12.2
Lundehund	86.4	83.3	15.2	19.4	15.6	11.4
Lundehund	87.1	82.2	15.0	14.9	16.9	11.5
Lundehund	83.2	78.9	15.2	18.8	15.1	11.1
Buhund	110.2	103.9	20.7	25.8	21.7	14.3
Lundehund	84.7	80.5	15.1	19.4	16.9	11.8
Lundehund	91.7	87.9	16.7	21.2	16.8	12.0
Lundehund	95.2	82.9	16.0	20.9	18.3	12.5
Russian Greyhound	195.0	184.3	31.1	41.2	35.7	24.3
Buhund	120.6	113.4	20.2	28.0	–	–
Buhund	116.0	103.6	23.1	26.6	20.2	15.9
Buhund	128.7	119.5	24.5	29.8	25.8	17.5
Buhund	112.6	105.9	19.0	25.4	21.7	14.4
Buhund	107.4	99.4	20.6	24.9	22.1	14.5

10 MEASUREMENTS OF THE HUMERUS (after von den Driesch, 1976)

GL	Greatest length
GLC	Greatest length from caput
DP	Depth of the proximal end
SD	Smallest breadth of diaphysis
Bd	Greatest breadth of the distal end

Table 10. Humerus

Points of Measurement Breed	GL	GLC	Dp	SD	Bd
Greyhound	–	–	–	–	–
Bulldog	–	–	–	–	–
Mops	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–
Finnehund	147.3	141.2	40.2	11.3	33.0
Black Dyrehund	149	146.3	39.1	12.3	31.2
Elkhound	163.0	157.2	42.2	12.5	34.0
Grey Elkhound	–	–	–	–	–
Grey Elkhound	–	–	–	–	–
Whippet	104.0	103.0	27.0	6.3	21.7
Grey Dyrehund	153.3	147.1	39.9	12.6	35.3
Greyhound	199.9	194.0	48.8	12.8	38.0
Scottish Sheep Dog	200.5	192.6	47.1	13.9	34.7
Big Engelsk Guarddog	–	–	–	–	–
Harehund	–	–	–	–	–
Greyhound	–	–	–	–	–
Greyhound	–	–	–	–	–
Foxterrier	–	–	–	–	–
Foxterrier	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–
Dalmatian	–	–	–	–	–
Greyhound	–	–	–	–	–
Boxer	–	–	–	–	–
Bulldog	–	–	–	–	–
–	–	–	–	–	–
Dachshund	–	–	–	–	–
Finnehund	149.8	145.9	37.9	11.1	34.4
Grey Dyrehund	161.0	155.8	28.0	13.3	33.8
Grey Dyrehund	–	–	–	–	–
Norwegian Sheep dog	128.5	121.5	29.6	9.4	23.8
Lundehund	69.4	69.4	20.2	6.6	19.3
Lundehund	77.1	76.3	20.1	5.6	19.6
Lundehund	80.6	78.9	19.7	5.9	18.9
Lundehund	97.5	94.6	23.0	6.4	20.5
Lundehund	103.2	98.8	23.4	6.6	20.9
Lundehund	105.0	101.4	26.9	7.9	23.7
Lundehund	108.6	103.6	26.4	8.2	22.6
Lundehund	113.8	110.7	27.3	7.9	24.4
Lundehund	112.1	106.4	27.3	7.9	23.8
Lundehund	106.3	102.4	25.5	7.5	21.9
Lundehund	105.3	101.3	25.2	6.6	21.7
Lundehund	100.9	97.3	24.7	7.2	21.8
Buhund	133.4	126.9	33.3	10.7	27.4
Lundehund	101.3	97.9	24.5	7.0	21.6
Lundehund	108.9	105.5	26.3	7.5	22.6
Lundehund	109.8	107.4	26.6	7.6	19.4
Russian Greyhound	235.0	229.6	51.5	14.8	41.1
Buhund	135.6	136.0	36.0	11.0	30.4
Buhund	129.1	126.8	35.7	12.1	30.5
Buhund	156.0	152.0	39.9	11.7	31.6
Buhund	129.4	125.2	32.6	10.0	25.8
Buhund	127.7	122.5	33.8	10.5	27.3

11 MEASUREMENTS OF THE RADIUS (after von den Driesch, 1976)

GL	Greatest length
Bp	Greatest breadth of the proximal end
SD	Smallest breadth of diaphysis
Bd	Greatest breadth of the distal end

Table 11. Radius

Points of Measurement Breed	GL	Bp	SD	Bd
Greyhound	–	–	–	–
Bulldog	–	–	–	–
Mops	–	–	–	–
Litle Silkpoodle	–	–	–	–
Finnehund	146.4	17.3	11.9	24.0
Black Dyrehund	148.4	16.6	11.2	22.4
Elkhound	144.6	17.6	12.3	25.3
Grey Elkhound	162.0	19.1	12.2	23.6
Grey Elkhound	–	–	–	–
Whippet	111.1	12.6	7.1	16.8
Grey Dyrehund	157.0	18.6	12.8	24.7
Greyhound	210.8	20.0	13.2	29.4
Scottish Sheep Dog	194.5	19.9	14.3	25.2
Big Engelsk Guarddog	–	–	–	–
Harehund	–	–	–	–
Greyhound	–	–	–	–
Greyhound	–	–	–	–
Foxterrier	–	–	–	–
Foxterrier	–	–	–	–
Eldre Svensk Støver	–	–	–	–
Wired Haired Poodle	–	–	–	–
Dalmatian	–	–	–	–
Greyhound	–	–	–	–
Boxer	–	–	–	–
Bulldog	–	–	–	–
–	–	–	–	–
Dachshund	–	–	–	–
Finnehund	153.0	18.1	10.5	22.9
Grey Dyrehund	163.6	18.3	12.4	24.0
Grey Dyrehund	–	–	–	–
Norwegian Sheep dog	124.9	13.6	8.9	17.0
Lundehund	59.3	10.5	6.1	14.2
Lundehund	74.3	9.9	5.1	13.3
Lundehund	77.7	10.4	5.6	14.2
Lundehund	90.2	11.0	6.3	12.9
Lundehund	98.8	11.0	6.6	13.7
Lundehund	102.9	12.8	7.2	16.9
Lundehund	107.0	11.6	7.3	15.0
Lundehund	109.7	12.7	7.4	16.4
Lundehund	108.2	12.5	8.1	17.0
Lundehund	103.3	11.8	7.5	14.4
Lundehund	99.0	12.1	7.0	15.3
Lundehund	96.2	11.3	7.2	13.6
Buhund	133.8	14.7	10.2	19.1
Lundehund	95.5	11.8	6.8	14.4
Lundehund	102.9	11.9	7.5	14.8
Lundehund	103.6	12.6	7.6	16.1
Russian Greyhound	239.0	23.0	15.2	31.5
Buhund	130.8	16.2	10.9	22.7
Buhund	127.7	16.6	11.2	22.3
Buhund	144.7	17.5	11.6	23.4
Buhund	124.5	14.5	9.7	19.3
Buhund	123.9	14.2	9.9	20.5

12 MEASUREMENTS OF THE ULNA (after von den Driesch, 1976)

GL	Greatest length
DPA	Depth across the Processus anconaeus
SDO	Smallest depth of the olecranon
BPC	Greatest breadth across the coronoid process

Table 12. Ulna

Points of Measurement Breed	GL	DPA	SDO	BPC
Greyhound	–	–	–	–
Bulldog	–	–	–	–
Mops	–	–	–	–
Litle Silkpoodle	–	–	–	–
Finnehund	175.0	14.4	21.5	18.0
Black Dyrehund	174.0	13.4	20.5	16.8
Elkhound	178.2	14.8	20.6	19.1
Grey Elkhound	190.0	16.4	23.3	17.3
Grey Elkhound	–	–	–	–
Whippet	128.8	9.7	13.9	11.1
Grey Dyrehund	183.5	14.6	21.4	19.9
Greyhound	244.0	17.0	24.8	20.6
Scottish Sheep Dog	228.5	17.8	24.9	17.1
Big Engelsk Guarddog	–	–	–	–
Harehund	–	–	–	–
Greyhound	–	–	–	–
Greyhound	–	–	–	–
Foxterrier	–	–	–	–
Foxterrier	–	–	–	–
Eldre Svensk Støver	–	–	–	–
Wired Haired Poodle	–	–	–	–
Dalmatian	–	–	–	–
Greyhound	–	–	–	–
Boxer	–	–	–	–
Bulldog	–	–	–	–
–	–	–	–	–
Dachshund	–	–	–	–
Finnehund	175.0	13.4	21.1	18.0
Grey Dyrehund	196.2	15.5	22.3	17.8
Grey Dyrehund	–	–	–	–
Norwegian Sheep dog	146.8	11.0	16.0	12.9
Lundehund	67.3	7.9	11.8	11.0
Lundehund	91.6	7.9	10.2	10.6
Lundehund	95.5	8.0	10.7	10.4
Lundehund	105.3	8.4	11.3	12.1
Lundehund	120.0	9.3	13.4	11.3
Lundehund	112.4	10.1	13.5	13.5
Lundehund	129.5	9.7	13.5	12.8
Lundehund	132.9	10.4	14.8	13.9
Lundehund	129.7	17.0	15.2	12.9
Lundehund	124.3	16.4	13.8	12.1
Lundehund	122.0	8.8	13.1	11.5
Lundehund	116.8	9.1	13.0	12.4
Buhund	153.7	13.5	18.7	13.9
Lundehund	116.1	9.1	12.5	11.7
Lundehund	124.2	9.9	13.9	12.3
Lundehund	124.9	17.8	13.7	13.0
Russian Greyhound	279.0	19.5	27.3	21.0
Buhund	158.2	23.1	18.9	–
Buhund	154.2	24.3	19.8	16.7
Buhund	174.0	24.1	22.6	17.1
Buhund	151.5	20.0	17.3	14.9
Buhund	147.1	12.4	18.1	14.0

13–14 MEASUREMENTS OF THE METACARPUS/TARSUS II (after von den Driesch, 1976)

GL Greatest length

Bd Greatest breadth of the distal end

Table 13. Metacarpus II

Points of Measurement Breed	GL	Bd
Greyhound	–	–
Bulldog	–	–
Mops	–	–
Litle Silkpoodle	–	–
Finnehund	61.6	8.0
Black Dyrehund	63.0	8.5
Elkhound	–	–
Grey Elkhound	57.8	8.0
Grey Elkhound	–	–
Whippet	–	–
Grey Dyrehund	67.5	9.2
Greyhound	79.6	8.2
Scottish Sheep Dog	–	–
Big Engelsk Guarddog	–	–
Harehund	–	–
Greyhound	–	–
Greyhound	–	–
Foxterrier	–	–
Foxterrier	–	–
Eldre Svensk Støver	–	–
Wired Haired Poodle	–	–
Dalmatian	–	–
Greyhound	–	–
Boxer	–	–
Bulldog	–	–
–	–	–
Dachshund	–	–
Finnehund	63.0	8.0
Grey Dyrehund	65.0	8.2
Grey Dyrehund	–	–
Norwegian Sheep dog	48.7	5.0
Lundehund	–	–
Lundehund	30.0	5.0
Lundehund	31.6	5.7
Lundehund	42.2	4.9
Lundehund	41.7	5.7
Lundehund	38.3	7.5
Lundehund	39.7	5.6
Lundehund	42.2	6.3
Lundehund	38.4	6.3
Lundehund	38.4	6.4
Lundehund	37.2	5.9
Lundehund	41.2	5.6
Buhund	51.3	6.2
Lundehund	40.3	5.3
Lundehund	39.2	5.9
Lundehund	40.0	8.1
Russian Greyhound	94.1	10.3
Buhund	49.5	8.7
Buhund	43.8	8.6
Buhund	47.7	9.7
Buhund	46.6	7.7
Buhund	43.4	7.5

Table 14. Metatarsus II

Points of Measurement Breed	GL	Bd
Greyhound	–	–
Bulldog	–	–
Mops	–	–
Litle Silkpoodle	–	–
Finnehund	66.1	9.4
Black Dyrehund	67.7	9.5
Elkhound	–	–
Grey Elkhound	69.7	8.9
Grey Elkhound	–	–
Whippet	–	–
Grey Dyrehund	69.6	9.1
Greyhound	93.9	10.5
Scottish Sheep Dog	–	–
Big Engelsk Guarddog	–	–
Harehund	–	–
Greyhound	–	–
Greyhound	–	–
Foxterrier	–	–
Foxterrier	–	–
Eldre Svensk Støver	–	–
Wired Haired Poodle	–	–
Dalmatian	–	–
Greyhound	–	–
Boxer	–	–
Bulldog	–	–
–	–	–
Dachshund	–	–
Finnehund	64.8	7.2
Grey Dyrehund	74.8	7.8
Grey Dyrehund	–	–
Norwegian Sheep dog	56.3	5.4
Lundehund	–	–
Lundehund	34.0	6.1
Lundehund	37.6	5.3
Lundehund	47.8	5.0
Lundehund	47.4	5.9
Lundehund	45.8	5.4
Lundehund	50.9	5.2
Lundehund	48.0	6.5
Lundehund	47.7	6.6
Lundehund	47.8	6.2
Lundehund	50.0	5.9
Lundehund	46.7	5.6
Buhund	56.7	11.0
Lundehund	44.5	5.2
Lundehund	48.2	6.2
Lundehund	51.7	9.4
Russian Greyhound	105.6	10.9
Buhund	62.8	7.4
Buhund	54.2	7.6
Buhund	67.0	11.4
Buhund	59.5	6.6
Buhund	51.8	7.0

15 MEASUREMENTS OF PELVIS (after von den Driesch, 1976)

GL	Greatest length of one half
LA	Length of the acetabulum including the tip
LAR	Length of the acetabulum on the rim
LS	Length of the symphysis
SH	Smallest height of the shaft of ilium
SB	Smallest breadth of the shaft of ilium
LFo	Inner length of the foramen obturatum
HFo	Inner height of the foramen obturatum
BP	Breadth of Os Pubis
LP	Length of Os Pubis to acetabulum
GBTc	Greatest breadth across the Tubera coxarum
BGA	Greatest breadth across the acetabula
GBTi	Greatest breadth across the Tubera ischiadica
SBI	Smallest breadth across the bodies of the ischia

Table 15. Pelvis

Points of Measurement Breed	GL	LA	LAR	LS	SH	SB	LFo
Greyhound	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
Mops	–	–	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–	–	–
Finnehund	141.1	25.7	19.0	44.4	17.2	9.0	27.8
Black Dyrehund	143.1	25.3	19.1	45.5	16.7	7.5	29.1
Elkhound	131.5	27.0	19.2	39.0	17.5	8.2	26.6
Grey Elkhound	152.5	27.2	20.9	49.1	19.0	9.9	28.0
Grey Elkhound	–	–	–	–	–	–	–
Whippet	–	–	–	–	–	–	–
Grey Dyrehund	147.3	27.4	20.1	46.0	17.9	9.5	27.3
Greyhound	174.8	32.5	23.9	50.9	21.7	9.9	32.3
Scottish Sheep Dog	–	–	–	–	–	–	–
Big Engelsk Guarddog	–	–	–	–	–	–	–
Harehund	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–	–	–
Dalmatian	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Boxer	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–
Dachshund	–	–	–	–	–	–	–
Finnehund	134.9	24.6	18.6	39.7	18.8	8.7	25.8
Grey Dyrehund	146.1	30.4	21.7	47.2	19.2	9.7	29.8
Grey Dyrehund	130.4	25.4	19.8	41.6	17.6	8.2	27.8
Norwegian Sheep dog	121.4	20.9	15.0	34.2	13.8	7.0	22.5
Lundehund	61.6	16.0	11.7	–	10.3	6.4	12.5
Lundehund	68.3	16.2	12.4	–	9.1	4.5	–
Lundehund	71.6	16.4	11.8	21.4	9.4	4.4	14.4
Lundehund	86.2	17.3	11.9	28.3	10.3	4.4	17.1
Lundehund	94.9	17.8	11.8	–	10.6	4.3	18.1
Lundehund	90.8	19.0	14.3	–	12.6	5.9	16.7
Lundehund	96.1	17.9	13.1	–	12.2	5.5	–
Lundehund	106.7	19.1	15.0	31.5	12.8	5.8	18.9
Lundehund	103.2	18.8	14.1	33.0	13.1	6.3	18.3
Lundehund	93.6	18.2	13.2	19.5	11.0	5.0	17.3
Lundehund	98.6	17.4	13.1	31.5	11.9	5.0	17.2
Lundehund	96.3	18.2	12.9	30.9	11.7	5.4	17.6
Buhund	120.5	23.1	17.1	33.7	16.1	7.6	23.5
Lundehund	97.1	16.2	12.1	31.5	12.0	5.2	18.2
Lundehund	104.8	17.7	14.2	33.6	12.7	5.9	18.4
Lundehund	103.9	19.5	14.4	33.9	12.6	5.9	18.5
Russian Greyhound	200.9	33.1	26.9	62.0	25.0	11.3	36.0
Buhund	134.2	18.2	22.0	40.3	16.4	7.7	26.3
Buhund	127.6	22.1	18.0	40.5	16.0	8.5	25.5
Buhund	144.8	26.4	19.0	42.2	16.5	8.8	28.1
Buhund	124.5	20.2	16.2	36.7	14.5	7.4	26.7
Buhund	121.3	23.4	16.3	24.0	14.2	8.2	24.0

(**table 15.** contd)

Points of Measurement Breed	HFo	BP	LP	GBTc	GBA	GBTi	KBI
Greyhound	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
Mops	–	–	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–	–	–
Finnehund	19.6	8.3	21.5	79.5	76.0	93.4	61.4
Black Dyrehund	23.7	6.3	25.2	81.0	74.1	99.1	64.2
Elkhound	22.3	8.1	23.1	–	–	–	–
Grey Elkhound	22.7	9.5	27.1	90.0	78.6	105.7	67.0
Grey Elkhound	–	–	–	–	–	–	–
Whippet	–	–	–	–	–	–	–
Grey Dyrehund	22.1	8.7	23.6	87.3	78.0	102.2	64.6
Greyhound	27.2	9.8	29.6	110.6	88.0	120.2	75.2
Scottish Sheep Dog	–	–	–	–	–	–	–
Big Engelsk Guarddog	–	–	–	–	–	–	–
Harehund	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–	–	–
Dalmatian	–	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–	–
Boxer	–	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–
Dachshund	–	–	–	–	–	–	–
Finnehund	21.6	6.6	28.0	78.1	72.1	93.2	62.3
Grey Dyrehund	22.7	10.5	25.2	79.1	79.4	100.9	66.0
Grey Dyrehund	20.7	5.8	25.9	84.3	78.7	94.0	64.2
Norwegian Sheep dog	16.6	5.7	22.0	59.5	61.8	78.9	51.6
Lundehund	–	–	–	–	–	–	–
Lundehund	–	–	–	–	–	–	–
Lundehund	–	–	–	–	–	–	–
Lundehund	–	–	–	–	–	–	–
Lundehund	–	–	–	–	–	–	–
Lundehund	–	–	–	–	–	–	–
Lundehund	–	–	–	–	–	–	–
Lundehund	–	–	–	–	–	–	–
Lundehund	–	–	–	56.4	52.3	64.2	43.7
Lundehund	–	–	–	–	–	–	–
Lundehund	–	–	–	–	–	–	–
Lundehund	–	–	–	–	–	–	–
Buhund	–	–	–	72.8	68.5	84.5	58.1
Lundehund	–	–	–	53.5	53.5	63.5	45.3
Lundehund	–	–	–	56.2	53.9	69.4	46.6
Lundehund	–	–	–	51.5	49.3	67.4	43.8
Russian Greyhound	28.4	11.9	36.2	135.5	105.5	141.9	89.0
Buhund	–	–	–	77.3	68.0	86.4	55.0
Buhund	–	–	–	74.4	69.2	88.6	57.3
Buhund	–	–	–	88.0	74.9	99.6	65.2
Buhund	–	–	–	68.9	63.8	80.4	52.1
Buhund	–	–	–	70.0	64.8	80.0	56.2

16 MEASUREMENTS OF THE FEMUR (after von den Driesch, 1976)

GL	Greatest length
GLC	Greatest length from Caput femoris
Bp	Greatest breadth of the proximal end
DC	Greatest depth of the Caput femoris
SD	Smallest breadth of diaphysis
Bd	Greatest breadth of the distal end

Table 16. Femur

Points of Measurement Breed	GL	GLC	Bp	DC	SD	Bd
Greyhound	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–
Mops	–	–	–	–	–	–
Litle Silkpoodle	–	–	–	–	–	–
Finnehund	159.0	159.0	37.3	18.0	12.1	31.7
Black Dyrehund	163.5	163.5	36.4	17.6	11.7	30.8
Elkhound	161.0	161.0	37.6	18.4	12.2	31.8
Grey Elkhound	176.2	176.2	39.4	19.9	12.9	33.5
Grey Elkhound	–	–	–	–	–	–
Whippet	118.2	118.2	24.1	13.6	6.8	22.7
Grey Dyrehund	166.9	166.9	37.5	18.3	13.0	33.8
Greyhound	216.0	216.0	49.8	21.5	13.2	37.3
Scottish Sheep Dog	212.7	212.7	40.9	19.8	14.2	38.1
Big Engelsk Guarddog	–	–	–	–	–	–
Harehund	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–
Foxterrier	–	–	–	–	–	–
Eldre Svensk Støver	–	–	–	–	–	–
Wired Haired Poodle	–	–	–	–	–	–
Dalmatian	–	–	–	–	–	–
Greyhound	–	–	–	–	–	–
Boxer	–	–	–	–	–	–
Bulldog	–	–	–	–	–	–
–	–	–	–	–	–	–
Dachshund	–	–	–	–	–	–
Finnehund	159.7	159.7	37.7	17.9	11.9	30.8
Grey Dyrehund	175.0	175.0	39.0	19.0	13.4	33.4
Grey Dyrehund	152.9	152.9	35.7	18.1	11.6	28.9
Norwegian Sheep dog	138.1	138.1	29.3	13.5	9.8	24.0
Lundehund	74.0	74.0	18.2	11.0	7.0	17.5
Lundehund	85.5	85.5	19.0	10.2	6.4	17.3
Lundehund	88.2	88.2	19.1	10.4	6.5	18.1
Lundehund	108.1	108.1	21.6	11.6	7.5	19.8
Lundehund	112.6	112.6	23.0	12.0	7.9	20.7
Lundehund	114.7	114.7	25.2	12.9	8.3	22.7
Lundehund	116.3	116.3	24.9	12.3	9.4	22.2
Lundehund	125.0	125.0	26.2	13.7	9.1	23.2
Lundehund	119.8	119.8	26.5	12.2	9.5	22.2
Lundehund	113.3	113.3	24.0	12.5	8.4	21.9
Lundehund	114.4	114.4	24.6	12.6	8.2	20.4
Lundehund	109.7	10.9.7	23.1	12.4	8.6	21.4
Buhund	142.6	142.6	31.2	16.4	11.2	25.5
Lundehund	110.0	110.0	23.8	12.1	7.9	20.1
Lundehund	119.3	119.3	25.1	13.2	8.9	22.5
Lundehund	117.9	117.0	25.1	13.3	9.0	22.4
Russian Greyhound	253.0	253.0	56.8	25.8	15.0	43.2
Buhund	150.0	150.0	34.5	16.8	11.2	31.2
Buhund	142.7	141.1	34.1	16.5	12.9	30.5
Buhund	161.5	161.5	36.6	17.8	12.3	32.1
Buhund	136.8	136.4	32.5	14.6	10.5	26.6
Buhund	138.6	138.6	31.8	15.5	10.7	27.1

17 MEASUREMENTS OF THE TIBIA (after von den Driesch, 1976)

GL	Greatest length
Bp	Greatest breadth of the proximal end
SD	Smallest breadth of diaphysis
Bd	Greatest breadth of the distal end

Table 17. Tibia

Points of Measurement Breed	GL	Bp	SD	Bd
Greyhound	–	–	–	–
Bulldog	–	–	–	–
Mops	–	–	–	–
Litle Silkpoodle	–	–	–	–
Finnehund	167.9	34.7	12.1	22.2
Black Dyrehund	167.1	33.6	12.1	22.0
Elkhound	162.0	34.3	12.4	23.4
Grey Elkhound	180.0	34.6	12.5	22.6
Grey Elkhound	–	–	–	–
Whippet	130.4	22.4	6.8	15.7
Grey Dyrehund	170.8	35.7	13.7	22.3
Greyhound	230.0	42.8	12.5	28.3
Scottish Sheep Dog	213.3	37.9	14.7	25.0
Big Engelsk Guarddog	–	–	–	–
Harehund	–	–	–	–
Greyhound	–	–	–	–
Greyhound	–	–	–	–
Foxterrier	–	–	–	–
Foxterrier	–	–	–	–
Eldre Svensk Støver	–	–	–	–
Wired Haired Poodle	–	–	–	–
Dalmatian	–	–	–	–
Greyhound	–	–	–	–
Boxer	–	–	–	–
Bulldog	–	–	–	–
–	–	–	–	–
Dachshund	–	–	–	–
Finnehund	162.1	32.8	11.6	21.6
Grey Dyrehund	179.2	36.9	13.2	22.9
Grey Dyrehund	150.4	34.2	10.7	17.8
Norwegian Sheep dog	144.4	25.0	9.5	16.3
Lundehund	70.3	18.4	7.2	14.3
Lundehund	83.5	18.7	5.9	14.3
Lundehund	88.5	19.9	6.3	13.7
Lundehund	108.1	21.5	6.8	17.1
Lundehund	111.0	22.0	7.6	15.1
Lundehund	117.6	24.7	6.8	17.4
Lundehund	116.5	24.4	8.6	16.0
Lundehund	121.4	24.9	8.4	16.2
Lundehund	122.5	25.9	8.7	15.9
Lundehund	112.0	22.8	7.7	15.7
Lundehund	112.4	22.9	7.9	15.2
Lundehund	107.9	22.9	8.2	15.2
Buhund	145.9	28.7	10.5	19.7
Lundehund	108.3	22.4	7.3	14.5
Lundehund	117.5	23.5	8.5	15.5
Lundehund	117.2	24.2	8.2	16.6
Russian Greyhound	270.0	45.6	14.9	30.3
Buhund	152.4	33.5	10.8	22.4
Buhund	146.4	33.7	12.2	23.3
Buhund	163.0	34.8	12.0	24.6
Buhund	139.5	30.5	9.8	19.5
Buhund	142.2	30.0	10.5	18.8

18 MEASUREMENTS OF THE FIBULA (after von den Driesch, 1976)

GL Greatest length

19 MEASUREMENTS OF THE CALCANEUS (after von den Driesch, 1976)

GL Greatest length

GB Greatest breadth

18 MEASUREMENTS OF THE ASTRAGALUS (after von den Driesch, 1976)

GL Greatest length

Table 18. Fibula

Points of Measurement	GL
Breed	
Greyhound	–
Bulldog	–
Mops	–
Litle Silkpoodle	–
Finnehund	159.0
Black Dyrehund	156.0
Elkhound	153.5
Grey Elkhound	169.0
Grey Elkhound	–
Whippet	118.1
Grey Dyrehund	161.0
Greyhound	217.9
Scottish Sheep Dog	202.0
Big Engelsk Guarddog	–
Harehund	–
Greyhound	–
Greyhound	–
Foxterrier	–
Foxterrier	–
Eldre Svensk Støver	–
Wired Haired Poodle	–
Dalmatian	–
Greyhound	–
Boxer	–
Bulldog	–
–	–
Dachshund	–
Finnehund	152.2
Grey Dyrehund	169.8
Grey Dyrehund	–
Norwegian Sheep dog	136.5
Lundehund	–
Lundehund	68.2
Lundehund	74.9
Lundehund	100.1
Lundehund	107.4
Lundehund	100.0
Lundehund	112.6
Lundehund	115.6
Lundehund	114.4
Lundehund	107.5
Lundehund	107.3
Lundehund	103.6
Buhund	138.0
Lundehund	103.4
Lundehund	110.8
Lundehund	111.1
Russian Greyhound	252.1
Buhund	114.1
Buhund	138.5
Buhund	152.7
Buhund	131.8
Buhund	135.6

Table 19. Calcaneus

Points of Measurement	GL	GB
Breed		
Greyhound	–	–
Bulldog	–	–
Mops	–	–
Litle Silkpoodle	–	–
Finnehund	39.1	16.5
Black Dyrehund	42.4	18.1
Elkhound	42.2	16.7
Grey Elkhound	44.0	19.6
Grey Elkhound	–	–
Whippet	–	–
Grey Dyrehund	42.5	17.7
Greyhound	55.7	21.5
Scottish Sheep Dog	–	–
Big Engelsk Guarddog	–	–
Harehund	–	–
Greyhound	–	–
Greyhound	–	–
Foxterrier	–	–
Foxterrier	–	–
Eldre Svensk Støver	–	–
Wired Haired Poodle	–	–
Dalmatian	–	–
Greyhound	–	–
Boxer	–	–
Bulldog	–	–
–	–	–
Dachshund	–	–
Finnehund	41.4	15.8
Grey Dyrehund	43.6	16.9
Grey Dyrehund	–	–
Norwegian Sheep dog	31.8	12.5
Lundehund	25.3	10.9
Lundehund	24.6	9.5
Lundehund	26.8	9.8
Lundehund	28.4	10.3
Lundehund	29.3	10.3
Lundehund	30.5	12.4
Lundehund	30.0	11.5
Lundehund	31.9	12.8
Lundehund	30.8	12.7
Lundehund	29.3	11.6
Lundehund	28.8	11.7
Lundehund	28.6	10.8
Buhund	35.0	13.7
Lundehund	28.1	11.3
Lundehund	29.9	11.8
Lundehund	30.0	13.0
Russian Greyhound	54.0	21.1
Buhund	41.6	16.3
Buhund	40.0	17.5
Buhund	41.9	16.1
Buhund	37.8	16.3
Buhund	35.5	14.7

Table 20. Astragalus

Points of Measurement Breed	GL
Greyhound	–
Bulldog	–
Mops	–
Litle Silkpoodle	–
Finnehund	27.3
Black Dyrehund	27.2
Elkhound	27.4
Grey Elkhound	26.5
Grey Elkhound	–
Whippet	–
Grey Dyrehund	27.2
Greyhound	34.7
Scottish Sheep Dog	–
Big Engelsk Guarddog	–
Harehund	–
Greyhound	–
Greyhound	–
Foxterrier	–
Foxterrier	–
Eldre Svensk Støver	–
Wired Haired Poodle	–
Dalmatian	–
Greyhound	–
Boxer	–
Bulldog	–
–	–
Dachshund	–
Finnehund	26.0
Grey Dyrehund	28.8
Grey Dyrehund	–
Norwegian Sheep dog	20.5
Lundehund	17.1
Lundehund	20.4
Lundehund	20.8
Lundehund	22.0
Lundehund	21.4
Lundehund	20.6
Lundehund	18.8
Lundehund	20.8
Lundehund	20.4
Lundehund	23.5
Lundehund	22.4
Lundehund	19.8
Buhund	22.1
Lundehund	18.2
Lundehund	19.6
Lundehund	18.9
Russian Greyhound	35.4
Buhund	25.2
Buhund	24.5
Buhund	26.7
Buhund	22.0
Buhund	22.3

THE CUSTOM MADE WORKSHEETS

APPENDIX Γ

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

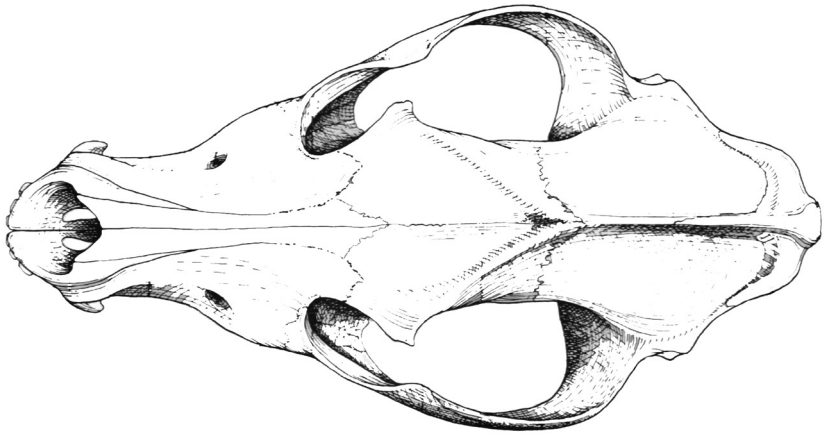
CRANIUM

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

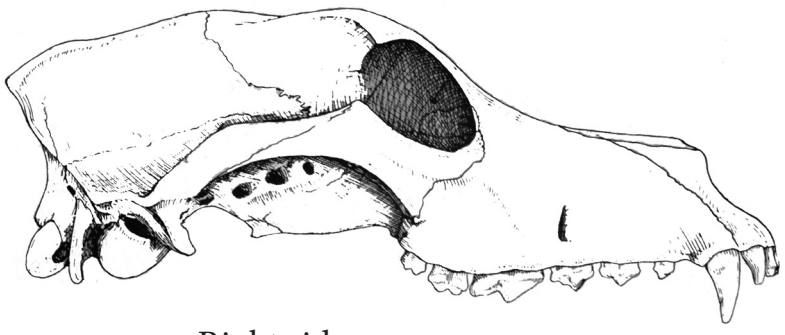
Weight	1	2	3	4	5	6	7	8	9

12	13	14	18	23	24	25	26	27	28

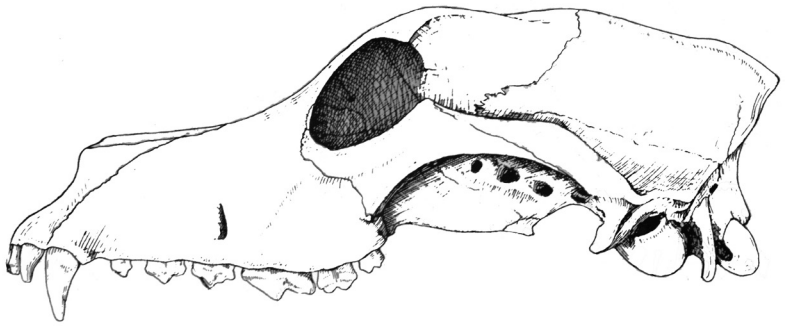
29	30	31	32	33	36	37	38	40	41



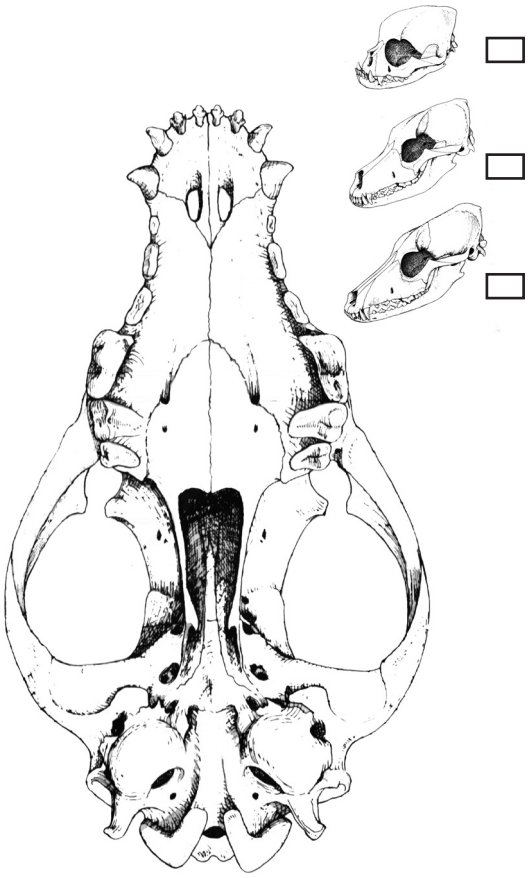
Dorsal



Right side

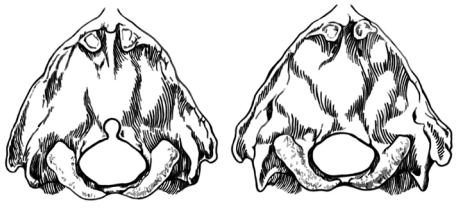


Left side



☐
☐
☐

Ventral



☐ ☐

Dental formula maxilla:

Right side: I /0 C /0 P /0 M /0

Left side: I /0 C /0 P /0 M /0

Cranium:	
1)	– Total length: *Akrokranion – Prosthion*
2)	– Condylobasal length: *Occipital condyles – Prosthion*
3)	– Basal length: *Basion – Prosthion*
4)	– Basicranial axis: *Basion – Synsphenion*
5)	– Basifacial axis: *Synsphenion – Prosthion*
6)	– Neurocranium length: *Basion – Nasion*
7)	– Upper neurocranium length: *Akrokranion – Frontal midpoint*
8)	– Viscerocranium length: *Nasion – Prosthion*
9)	– Facial length: *Frontal midpoint – Prosthion*
12)	– "Snout" length: *Orbits – Prosthion*
13)	– Median palatal length: *Staphylion – Prosthion*
14)	– Palatine length: *Staphylion – Palatinoorale*
15)	– Length of cheektooth row
16)	– Length of the molar row
17)	– Length of the premolar row
18)	– Carnassial length at cingulum
22)	– Greatest diameter of the auditory bulla
23)	– Greatest mastoid breath: *Otion – Otion*
24)	– Breadth dorsal to external auditory meatus
25)	– Greatest breadth of the occipital condyles
26)	– Greatest breath of the bases of the paraoccipital processes
27)	– Greatest breadth of the foramen magnum
28)	– Height foramen magnum: *Basion – Opisthion*
30)	– Zygomatic breadth: *Zygion – Zygion*
31)	– Least breadth of skull: *aboral of supraorbital processes*
32)	– Frontal breadth: Ectorbitale – Ectorbitale
33)	– Least breadth orbits: *Entorbitale – Entorbitale*
34)	– Greatest palatal breadth: *Outer borders of the alveoli*
35)	– Least palatal breadth: *Behind the canines*
36)	– Breadth at the canine alveoli
37)	– Greatest inner height of the orbit
38)	– Skull height: *Skull basis – Sagittal crest*
40)	– Height occipital triangle: *Akrokranion – Basion*
41)	– Height (length) of the canine taken out of jaw
B)	– Breadth between the most lateral parts of the basioccipital fissures
L)	– Length from Basion to line between most medial points of jugular foramen

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

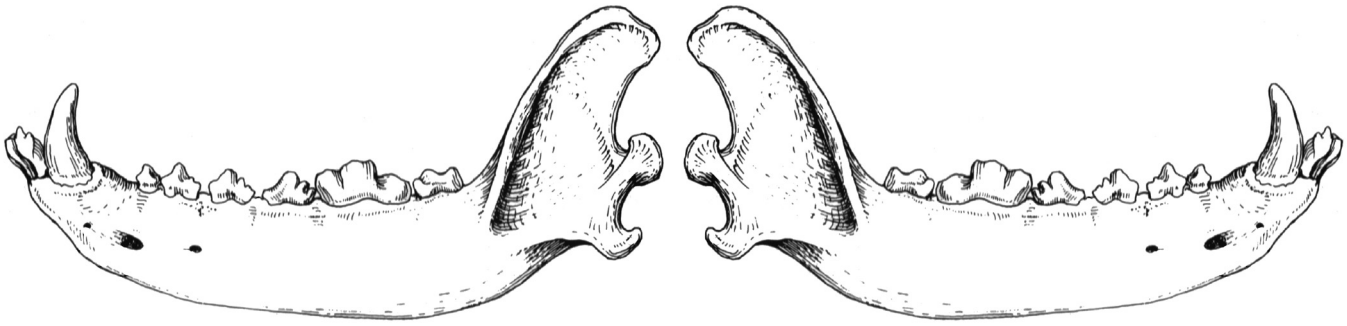
MANDIBULA

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	1	2	3	4	5	6	7	8	9

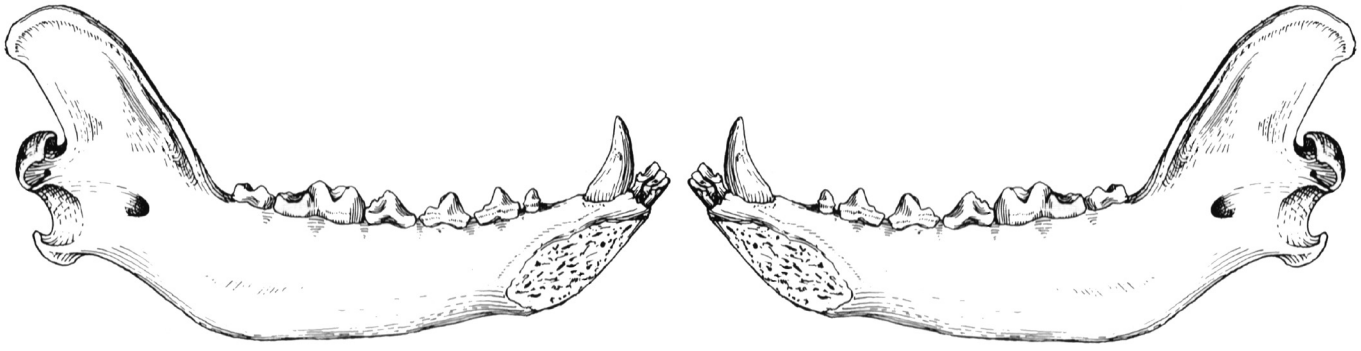
10	11	12	13	14	17	18	19	20	21

Lateral



Left side ☐ Right side ☐

Medial



Left side ☐ Right side ☐

Dental formula mandibula:

Right side: I $^{0}/$ C $^{0}/$ P $^{0}/$ M $^{0}/$

Left side: I $^{0}/$ C $^{0}/$ P $^{0}/$ M $^{0}/$

Mandibula:

1) – Total length: *Condyle process – Infradentale*

2) – Length: *Angular process – Infradentale*

3) – Length from indentation between condyle process and angular process – Infradentale

4) – Length: *Condyle process – Aboral border of canine alveolus*

5) – Length from indentation between condyle process and angular process – Aboral border of Canine alveolus

6) – Length: *Angular process – Aboral border of canine alveolus*

7) – Length: *Aboral border of alveolus M_3 – Aboral border of canine alveolus*

8) – Length of cheektooth row, M_3–P_1, measured along the alveoli

9) – Length of cheektooth row, M_3–P_2, measured along the alveoli

10) – Length of the molar row, measured along the alveoli

11) – Length of the premolar row, P_1–P_4, measured along the alveoli

12) – Length of the premolar row, P_2–P_4, measured along the alveoli

13) – Length and breadth of the carnassial, measured at the cingulum

14) – Length of the carnassial alveolus

17) – Greatest thickness of the body of jaw (below M_1)

18) – Height of the vertical ramus: *Basal point of the angular process – Coronion*

19) – Height of the mandible behind M_1

20) – Height of the mandible between P_2 and P_3

21) – Height (length) of the canine taken out of jaw

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

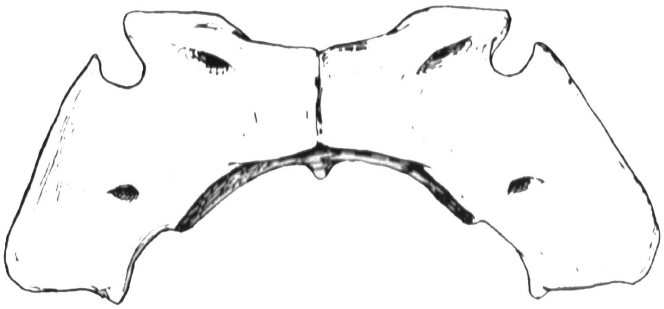
Canis familiaris

ATLAS

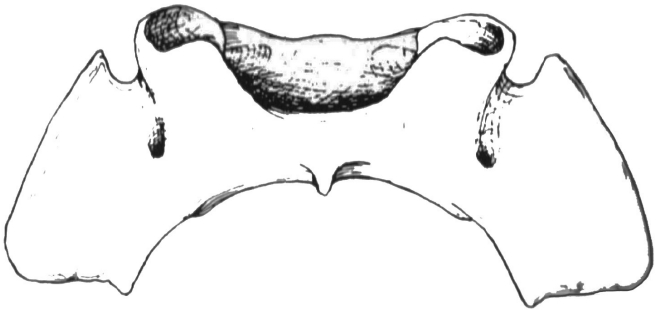
J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GB	GL	BFcr	BFcd	GLF	LAd	H		

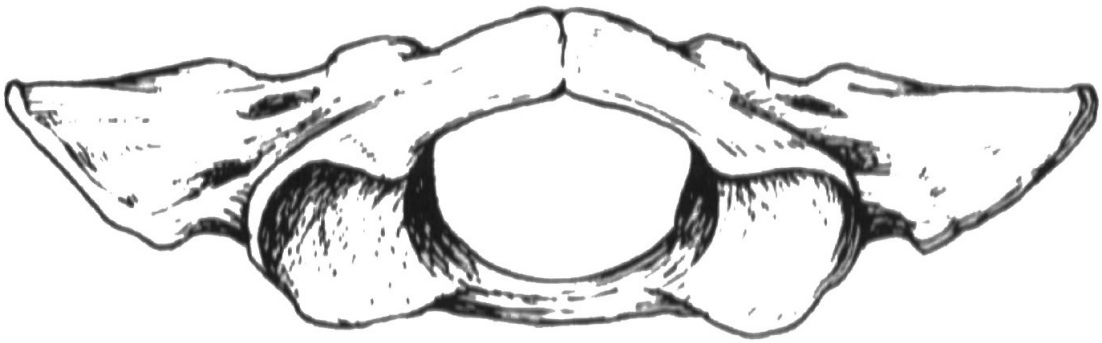
Dorsal



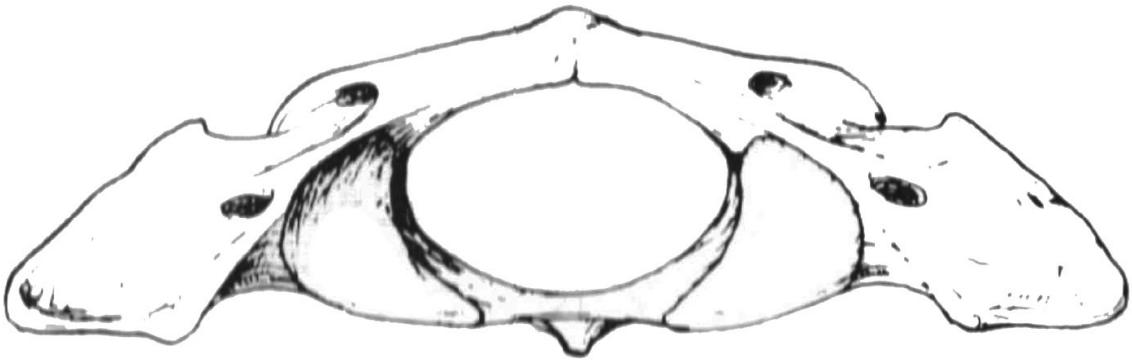
Ventral



Cranial



Caudal



Atlas:	
GB)	– Greatest breadth over the wings
GL)	– Greatest length
BFcr)	– Greatest breadth over the Facies articularis cranialis
BFcd)	– Greatest breadth over the Facies articularis caudalis
GLF)	– Greatest length from the Facies articularis cranialis to the Facies articularis caudalis
LAd)	– Length of the Arcus dorsalis, median
H)	– Height

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

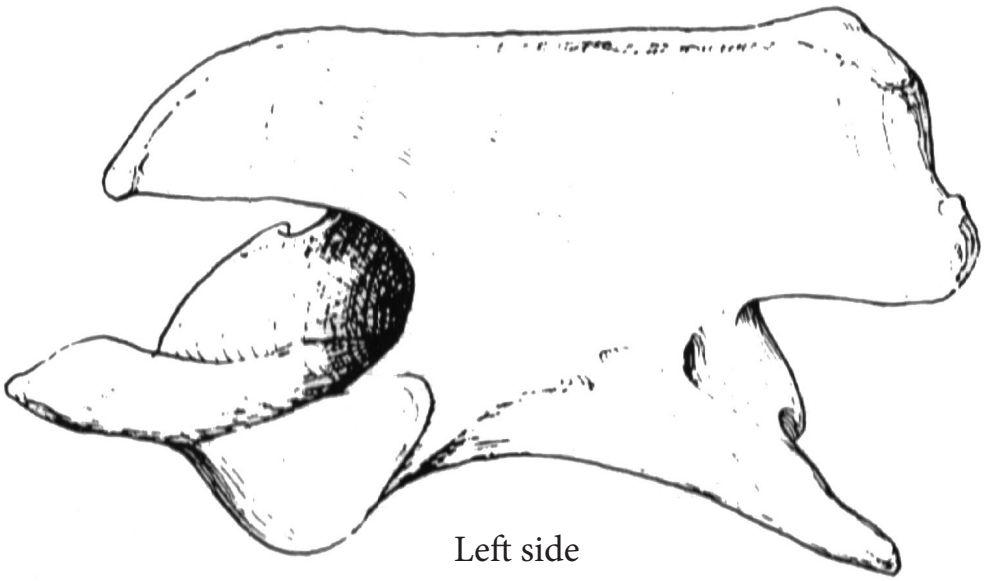
Canis familiaris

AXIS

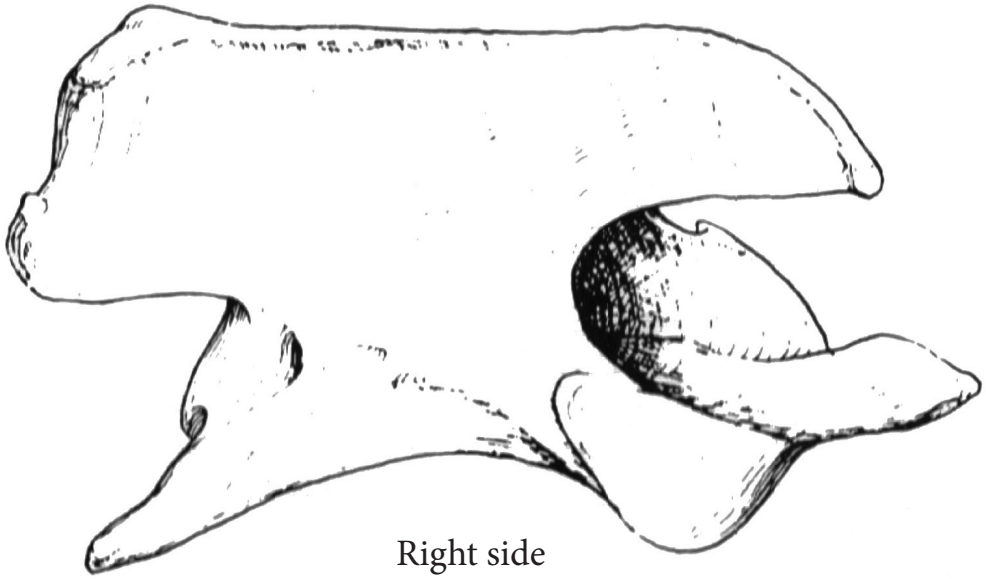
J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	LCDe	LAPa	BFcr	BPacd	SBV	BFcd	H		

Epifyse: ____ / ____



Left side



Right side

Axis:	
LCDe)	**–** Greatest length of the corpus including the dens
LAPa)	**–** Greatest length of the arch including Processus articulares caudales
BFcr)	**–** Greatest breadth over the Facies articularis cranialis
BPacd)	**–** Greatest breadth across the Processus articularis caudalis
SBV)	**–** Smallest breadth of the vertebra
BFcd)	**–** Greatest breadth of the Facies terminalis caudalis
H)	**–** Greatest height

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

CERVICAL V

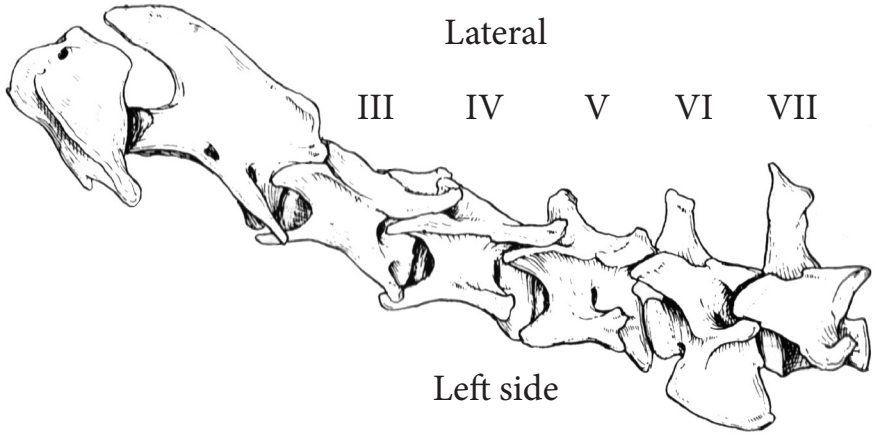
J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

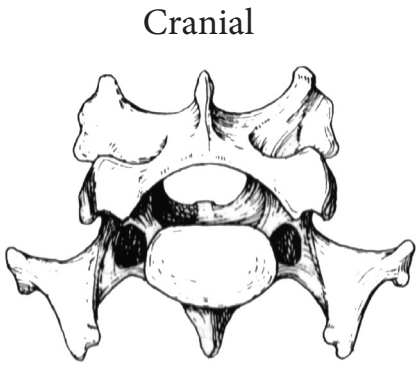
Weight	PL	GLPa	BPacr	BPacd	BPtr	BFcr	BFcd	HFcr	HFcd

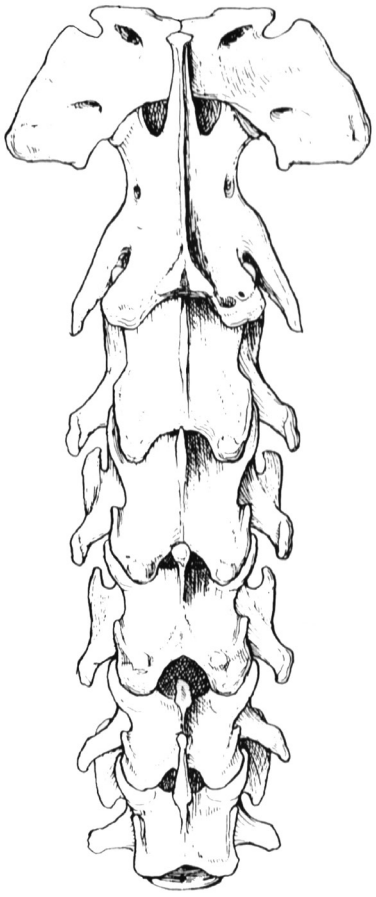
HFv	H								

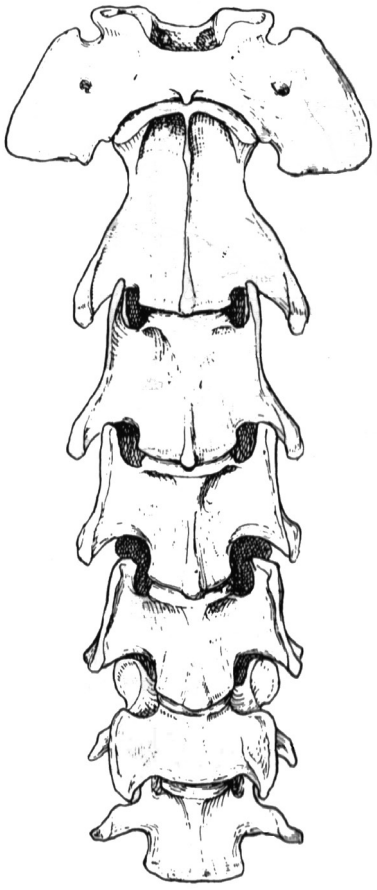
III ☐ IV ☐ V ☐ VII ☐

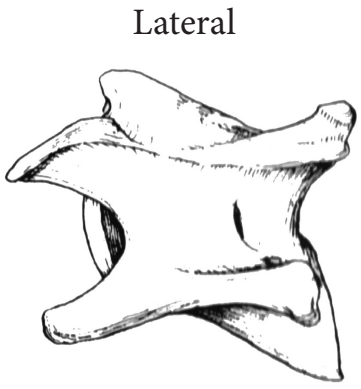
Epifyse: ____ / ____

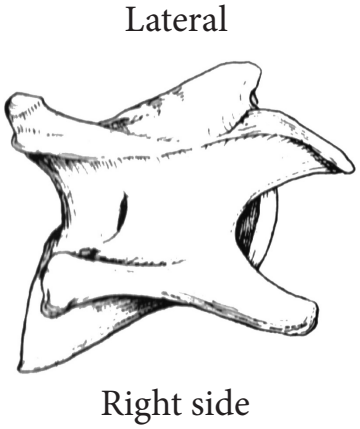












	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

THORACIC V

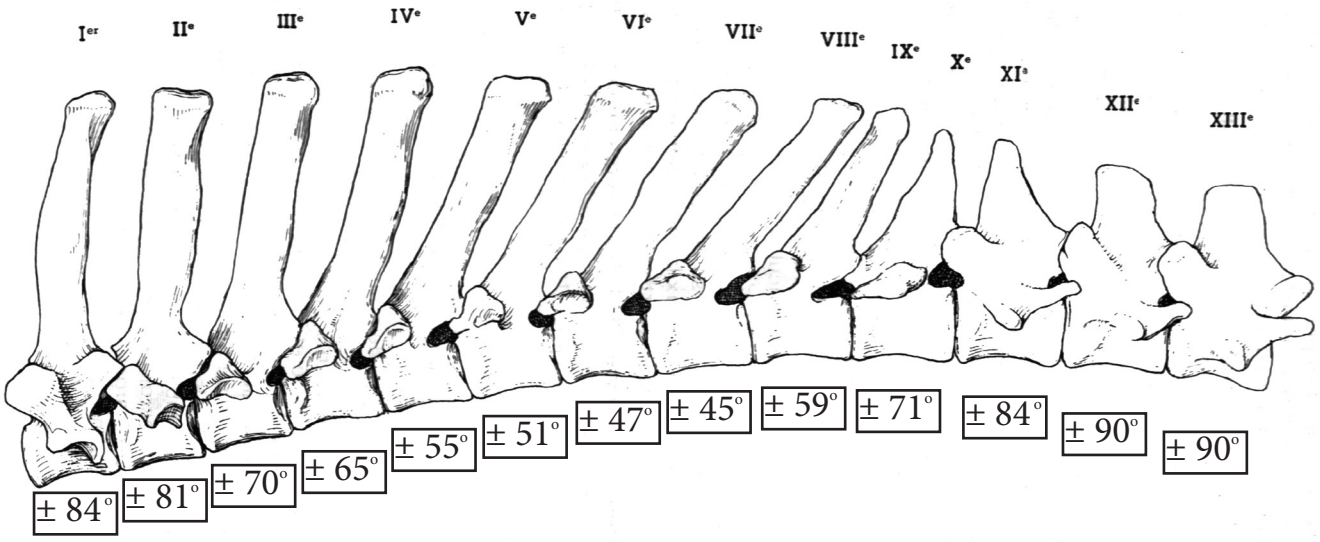
J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	PL	GLPa	BPacr	BPacd	BFcr	BFcd	HFcr	HFcd	HFv

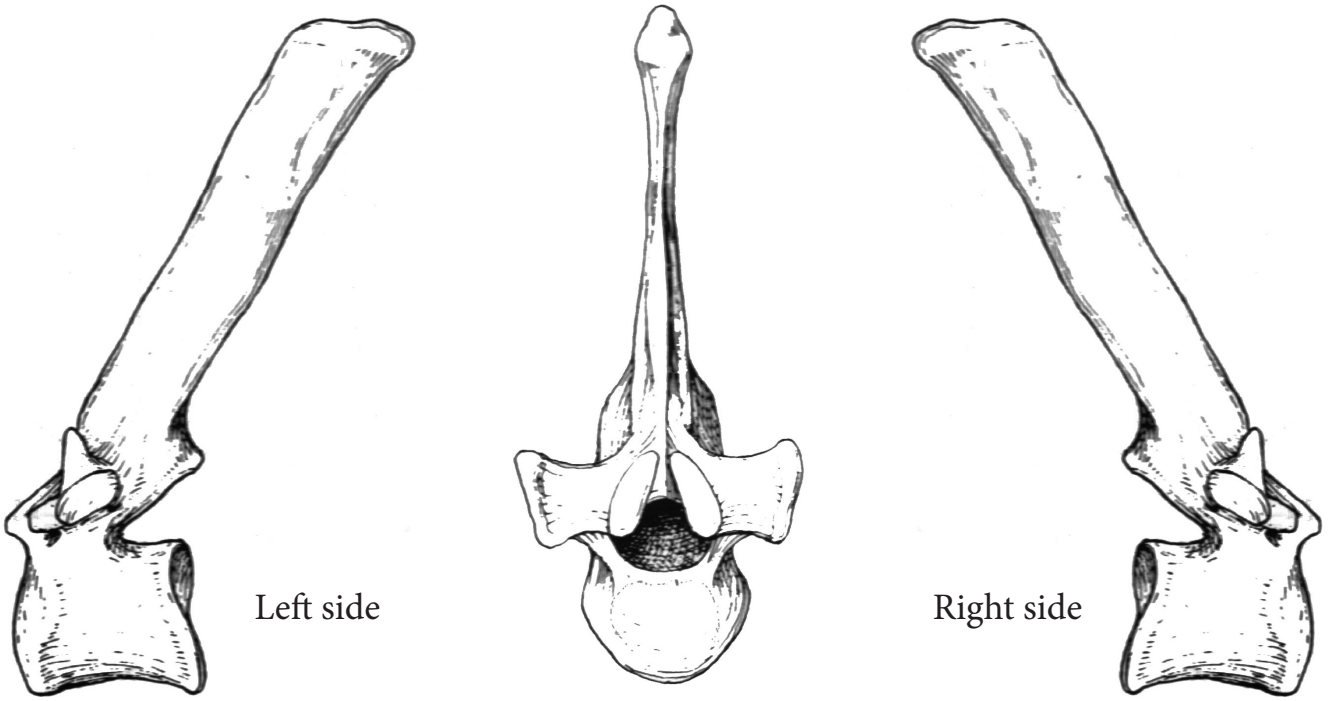
H									

I ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐ VII ☐ VIII ☐ IX ☐ X ☐ XI ☐ XII ☐ XIII ☐

Epifyse: ____/____



Cranial



Left side

Right side

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

LUMBAR V

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

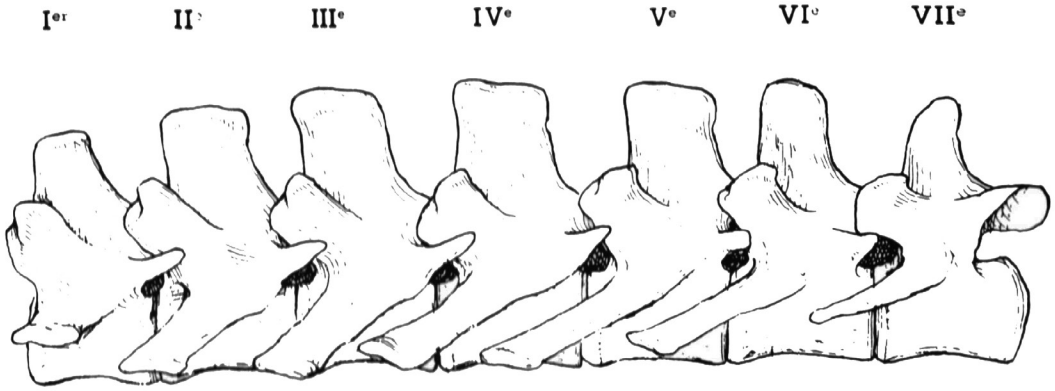
Weight	PL	GLPa	BPacr	BPacd	BPtr	BFcr	BFcd	HFcr	HFcd

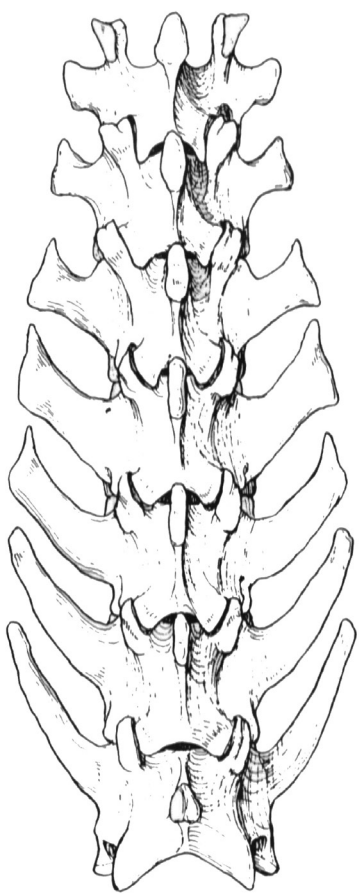
HFv	H								

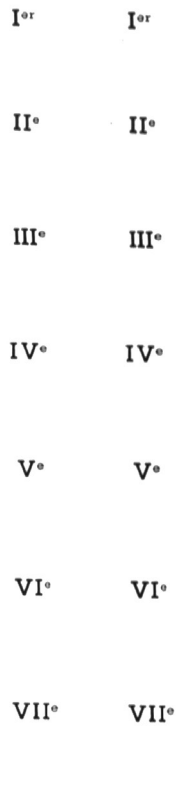
I ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐ VII ☐

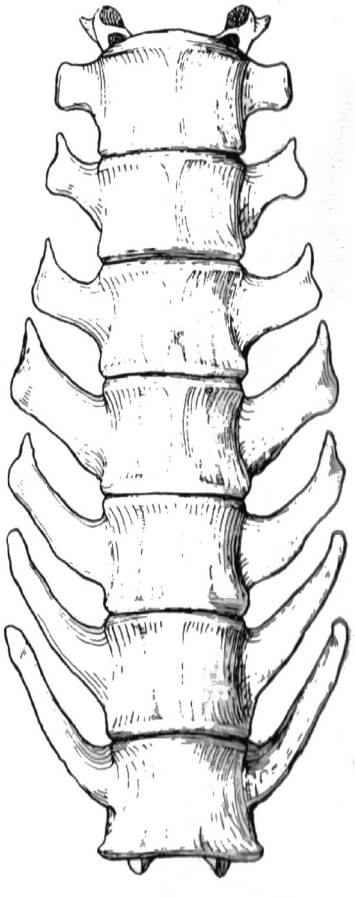
Epifyse: ____ / ____

Left side









Dorsal Ventral

Vertebrae:	
PL)	– Physiological length of the body. Facies terminalis cranialis – Facies terminalis caudalis
GLPa)	– Greatest length from Processus articulares craniales to Processus articularis caudales. (in cervical vertebrae)
BPacr)	– Greatest breadth across the Processus articularis craniales (in cervical vertebrae)
BPacd)	– Greatest breadth across the Processus articularis caudalis (in cervical vertebrae)
BPtr)	– Greatest breadth across the Processus transversi
BFcr)	– Greatest breadth over the Facies articularis cranialis (in thoracic vertebrae including the facets for the heads of the ribs)
BFcd)	– Greatest breadth over the Facies articularis caudalis (in thoracic vertebrae including the facets for the heads of the ribs)
HFv)	– Height Foramen vertebralis
H)	– Greatest height

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

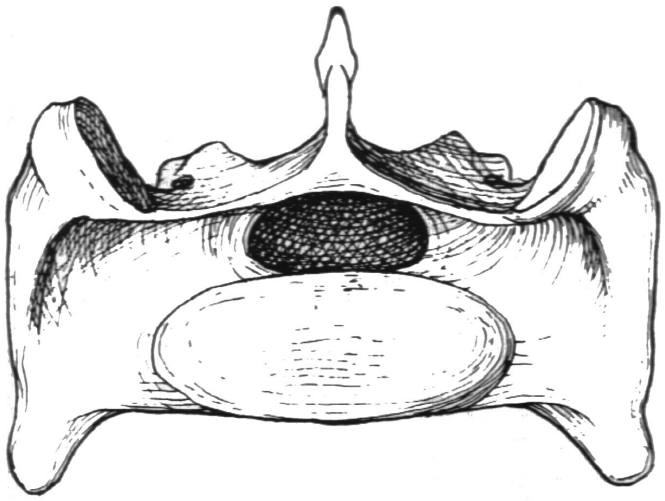
SACRUM

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

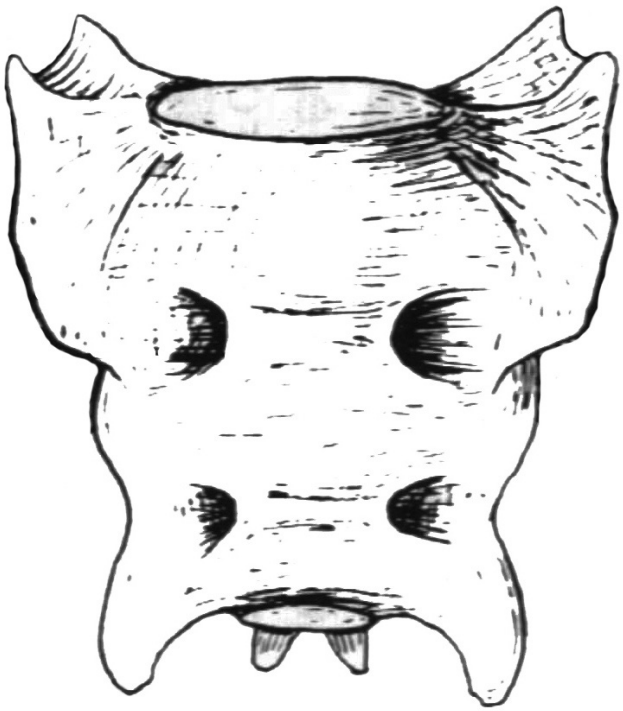
Weight	GL	PL	GB	BFcr	HFcr				

Epifyse: / _____

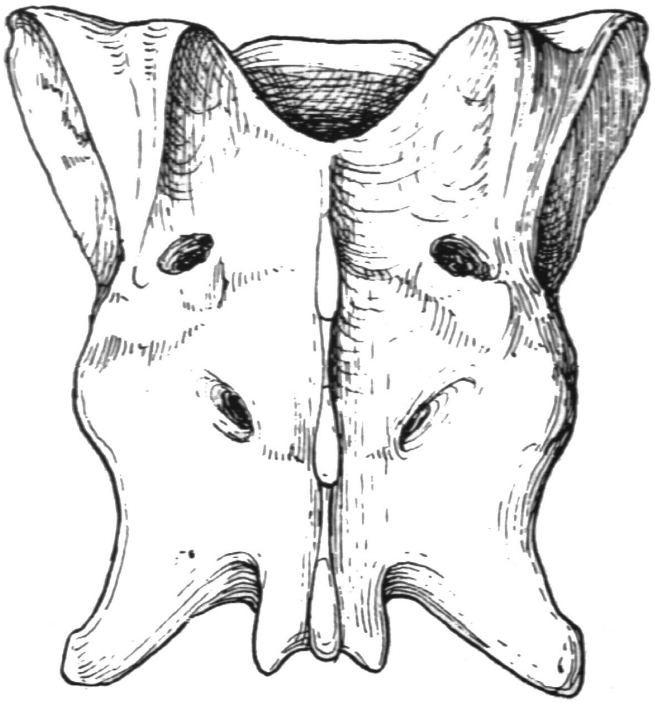
Cranial



Ventral



Dorsal



Sacrum:	
GL)	– Greatest length on the ventral side: from the cranial borders of the wings to the caudoventral border of the body of the last vertebra
PL)	– Physiological length, measured between the centers of the bodies of the most cranial and most caudal vertebrae
GB)	– Greatest breadth (across the wings)
BFcr)	– Greatest breadth of the Facies terminalis cranialis
HFcr)	– Greatest height of the Facies terminalis cranialis

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

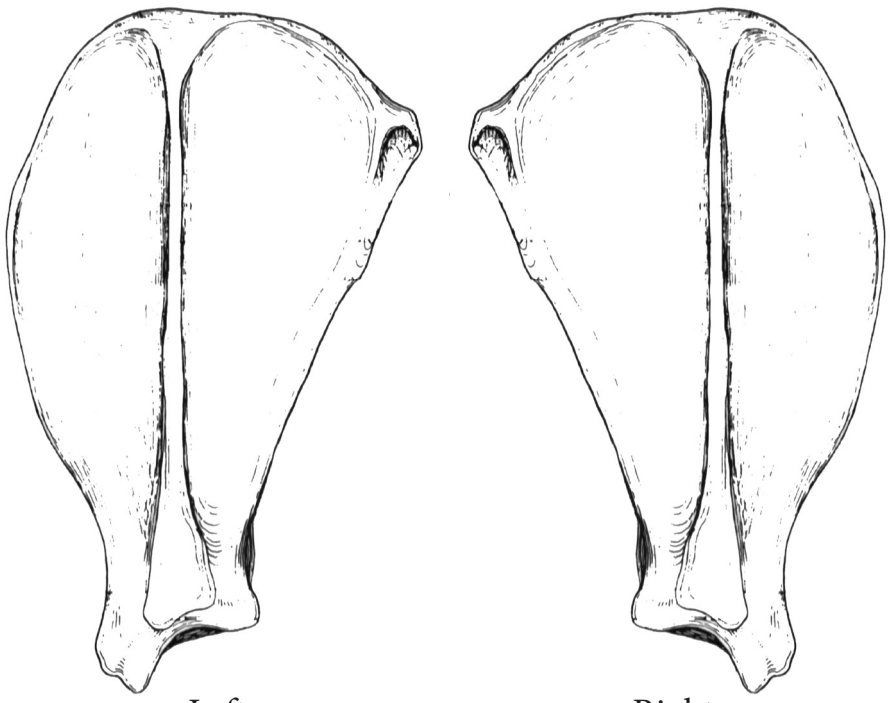
Canis familiaris

SCAPULA

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

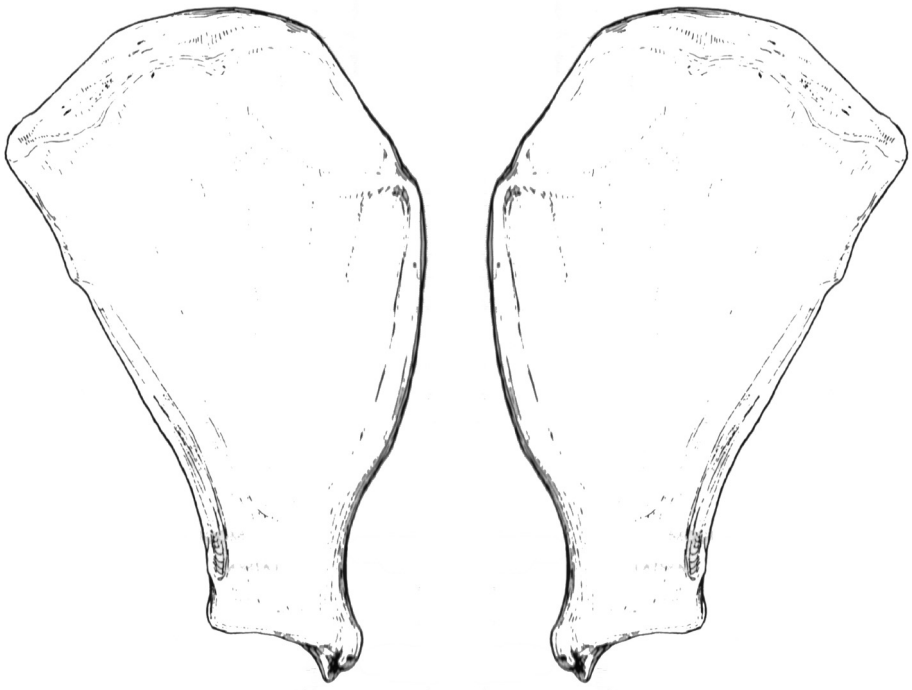
Weight	HS	DHA	SLC	GLP	LG	BG			

Lateral



Left ☐ Right ☐

Medial



Left ☐ Right ☐

Scapula:	
HS)	– Height along the spine
DHA)	– Diagonal height: from most distal point of the scapula to the thoracic angle
SLC)	– Smallest length of the Collum scapulae
GLP)	– Greatest length of the Processus articularis (glenoid process)
LG)	– Length of the glenoid cavity (include cranial lip)
BG)	– Greatest breadth of the glenoid cavity

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

CAUDAL V

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

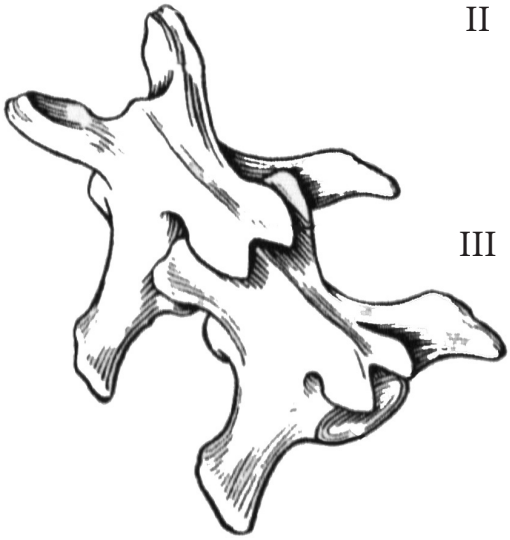
Weight	PL	GLPa	BPacr	BPacd	BPtr	BFcr	BFcd	H	

I ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐ VII ☐ VIII ☐ IX ☐ X ☐ XI ☐ XII ☐ XIII ☐

XIV ☐ XV ☐ XVI ☐ XVII ☐ XVIII ☐ XIX ☐ XX ☐ XXI ☐

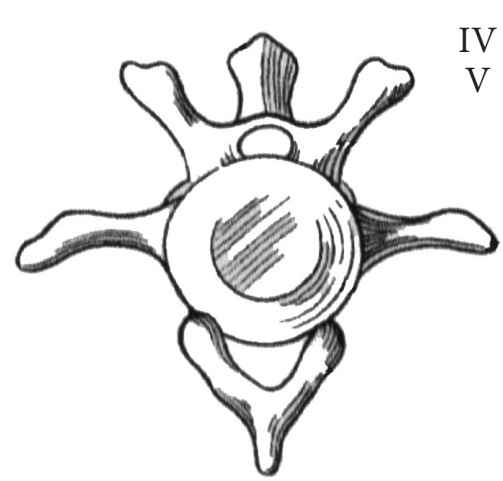
Epifyse: _____ / _____

I



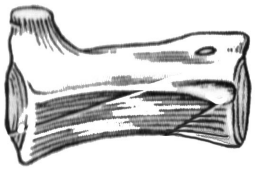
II

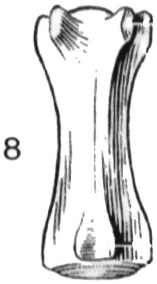
III



IV
V

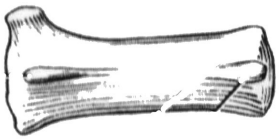
VI
VII

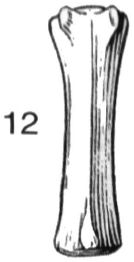




8

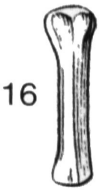
VIII
IX
X
XI





12

XII
XIII
XIV
XV



16

XVI
XVII
XVIII

19
20
21

XIX

XX
XXI

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

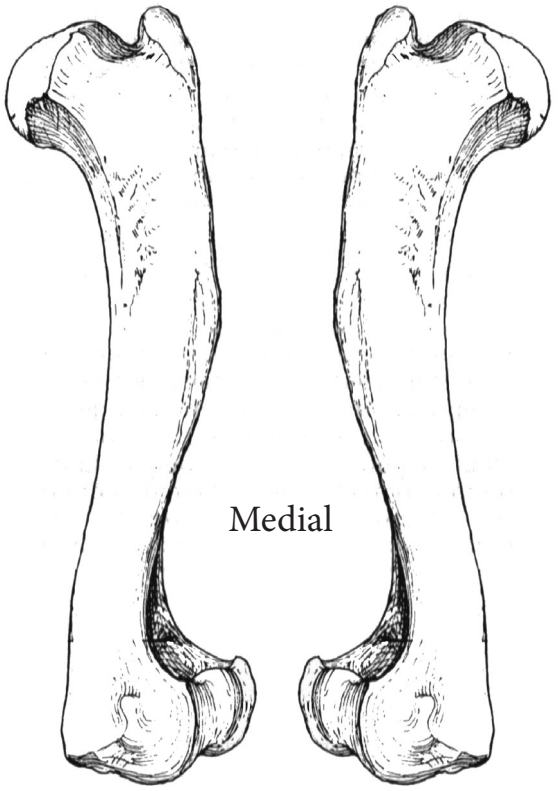
Canis familiaris

HUMERUS

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

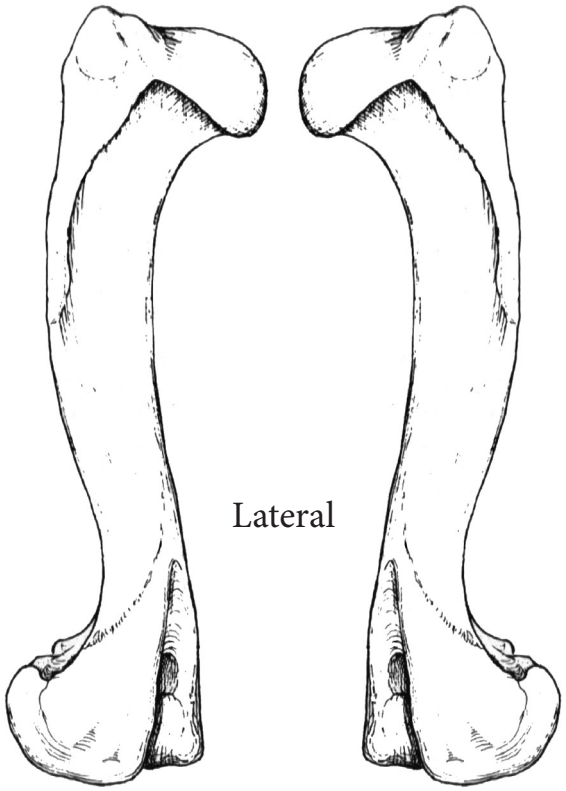
Weight	GL	GLC	Dp	SD	Bd				

Epifyse: /



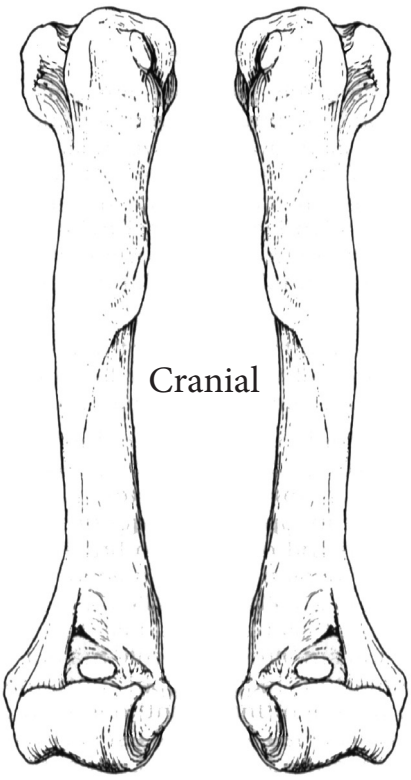
Medial

Left ☐ Right ☐



Lateral

Left ☐ Right ☐



Cranial

Left ☐ Right ☐

Humerus:	
GL)	– Greatest length
GLC)	– Greatest length from caput
Dp)	– Depth of the proximal end
SD)	– Smallest breadth of diaphysis
Bd)	– Greatest breadth of the distal end

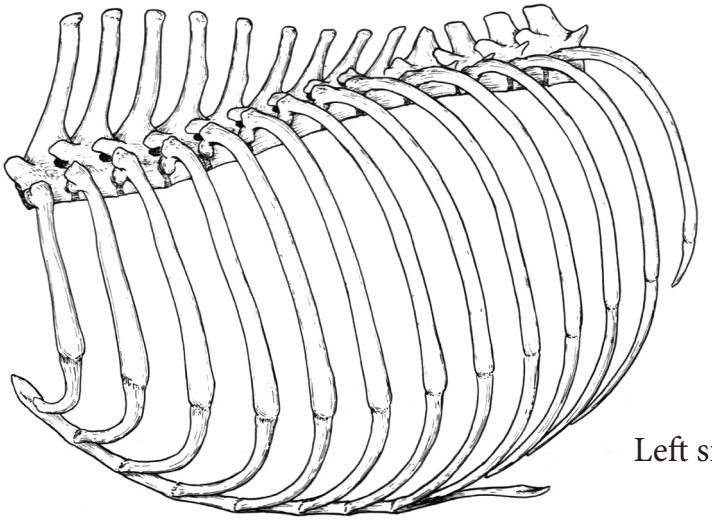
	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐
Individual	_____	

Canis familiaris

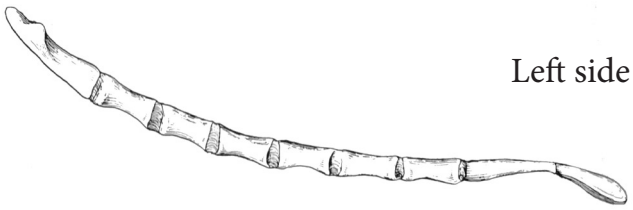
COSTA

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

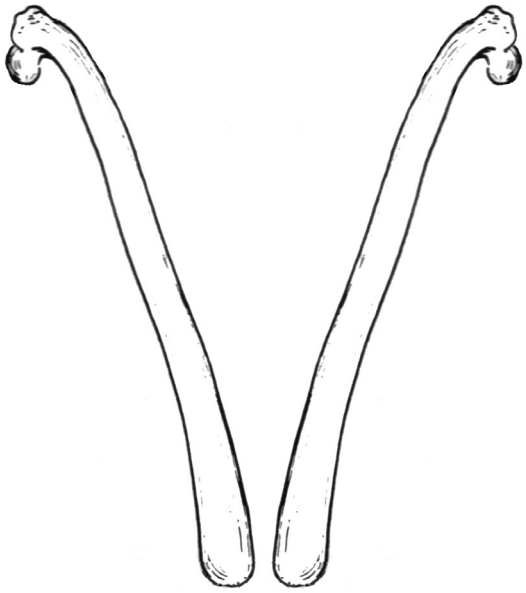
Weight	GL								



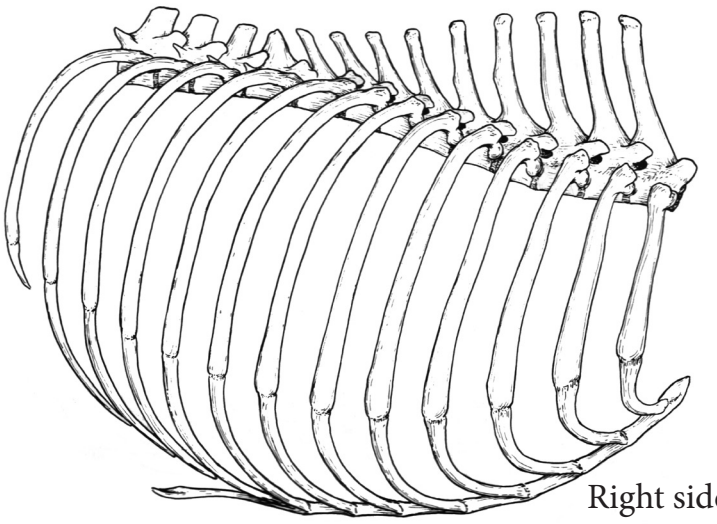
Left side



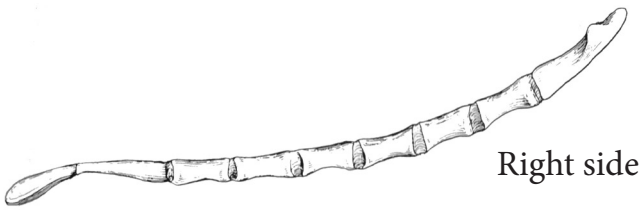
Left side



Left side Right side



Right side



Right side

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

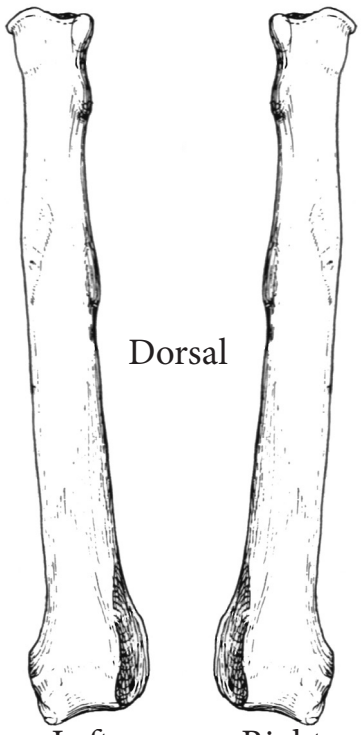
Canis familiaris

RADIUS

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

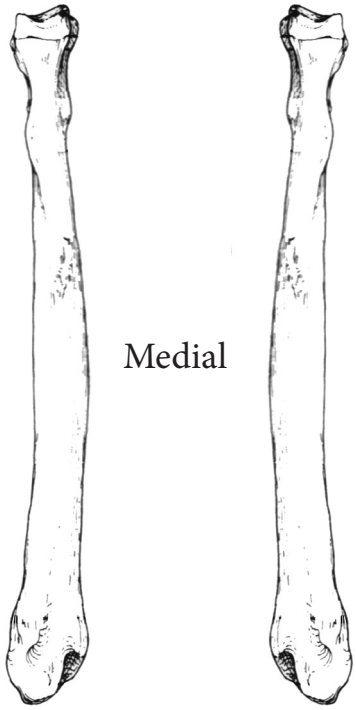
Weight	GL	Bp	SD	Bd					

Epifyse: / _____



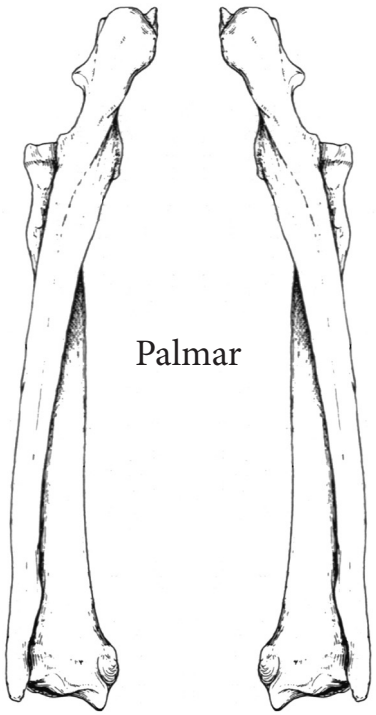
Dorsal

Left ☐ Right ☐



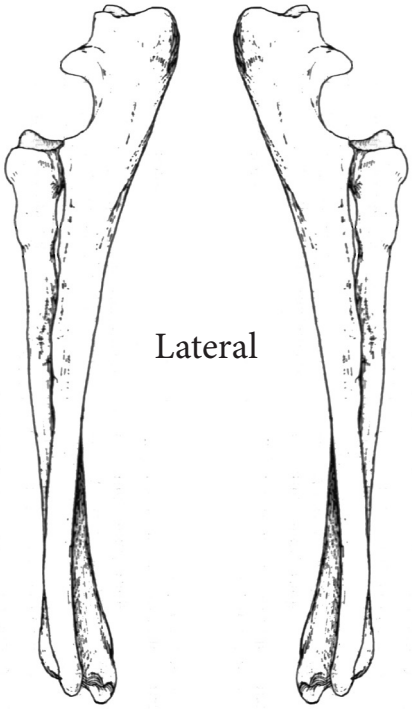
Medial

Left ☐ Right ☐



Palmar

Left ☐ Right ☐



Lateral

Left ☐ Right ☐

Radius:

GL) – Greatest length

Bp) – Greatest breadth of the proximal end

SD) – Smallest breadth of diaphysis

Bd) – Greatest breadth of the distal end

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

ULNA

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GL	DPA	SDO	BPC					

Epifyse: / _____

Left ☐

Dorsal

Right ☐

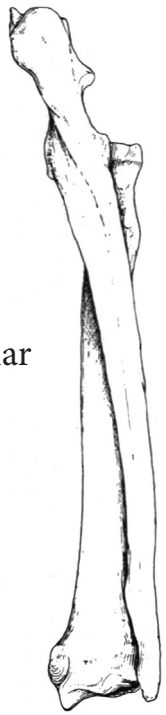
Left ☐

Medial

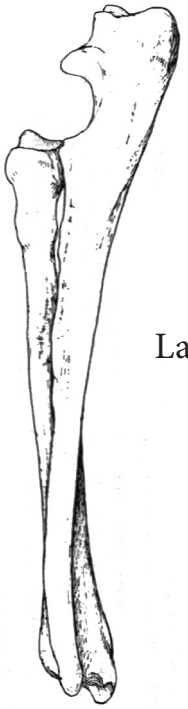
Right ☐

Left ☐

Palmar

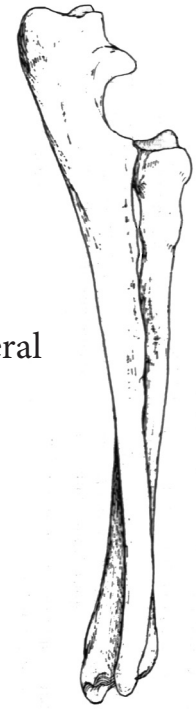


Right ☐



Left ☐

Lateral



Right ☐

Ulna:

GL) **–** Greatest length

DPA) – Depth across the Processus anconaeus

SDO) – Smallest depth of the olecranon

BPC) – Greatest breadth across the coronoid process

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

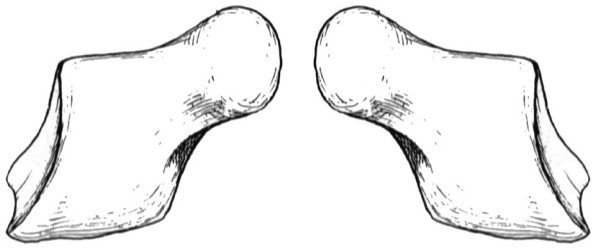
Canis familiaris

CARPALE I

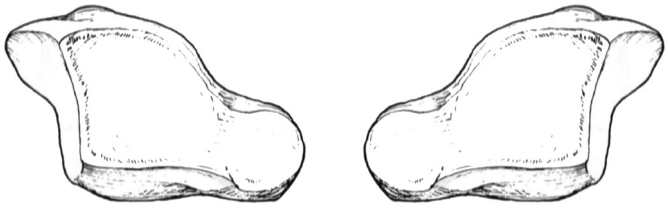
J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GL								

Proximal

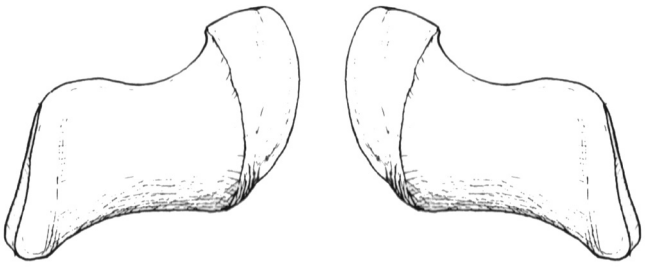


Ulnare
Distal

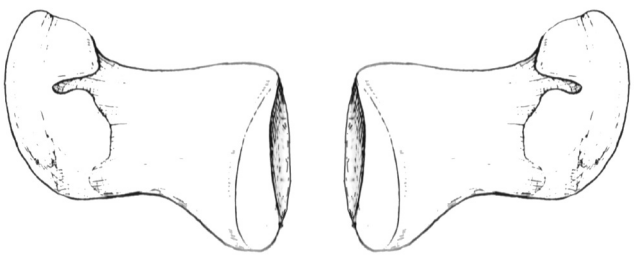


Left ☐ Right ☐

Lateral



Pisiforme
Medial



Left ☐ Right ☐

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

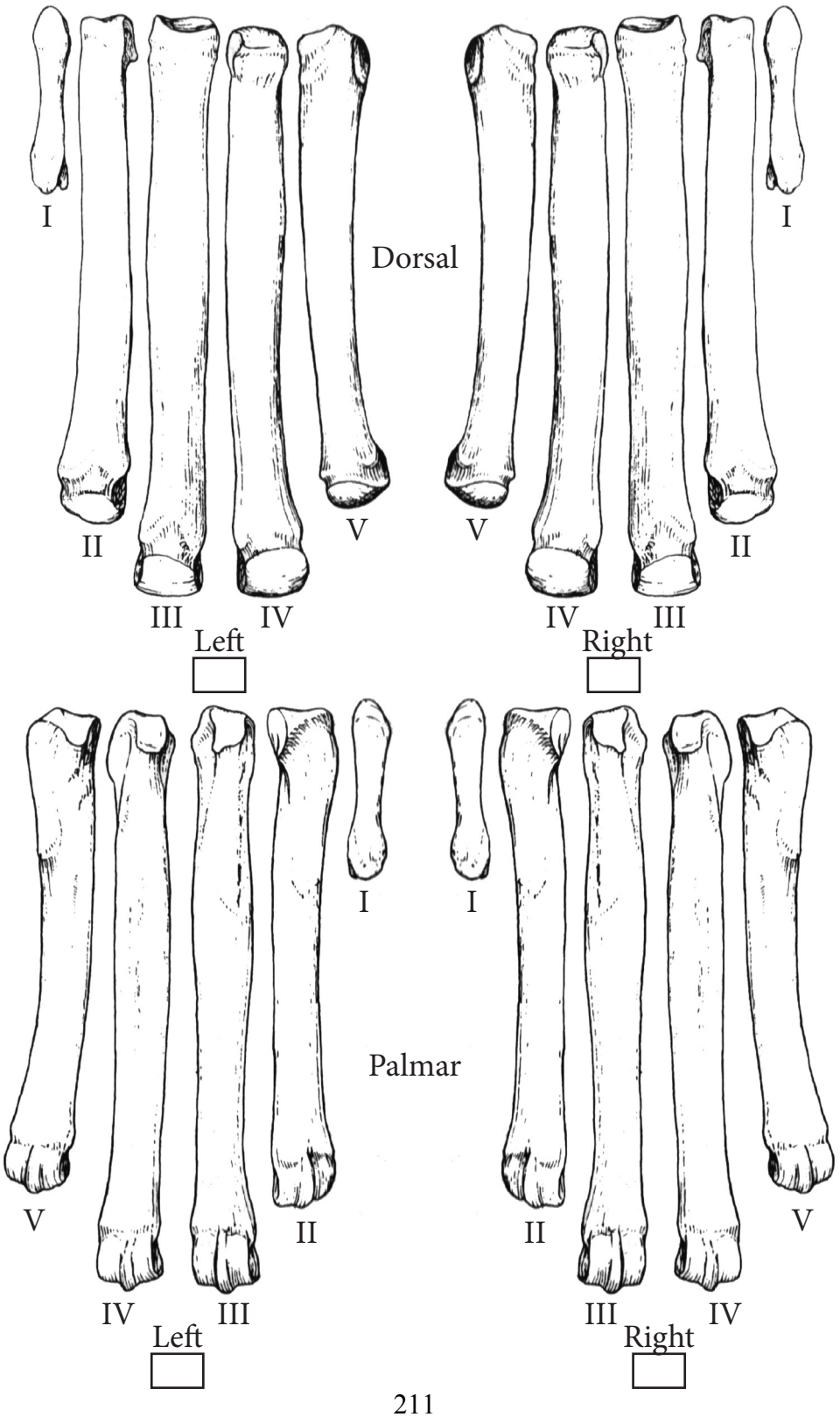
Canis familiaris

METACARPALE

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GL	Bd							

I ☐ II ☐ III ☐ IV ☐ V ☐ Epifyse: / _____



Metacarpus:

GL) **–** Greatest length

Bd) – Greatest breadth of the distal end

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

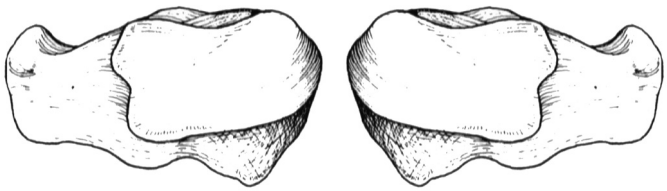
Canis familiaris

CARPALE II

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

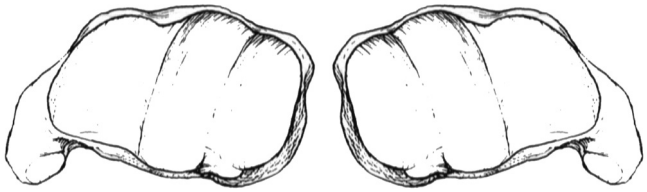
Weight	GL								

Proximal



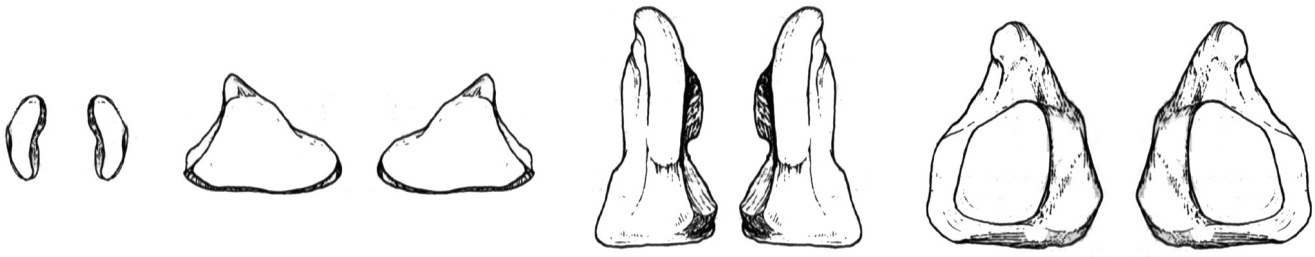
Scapholunatum

Distal



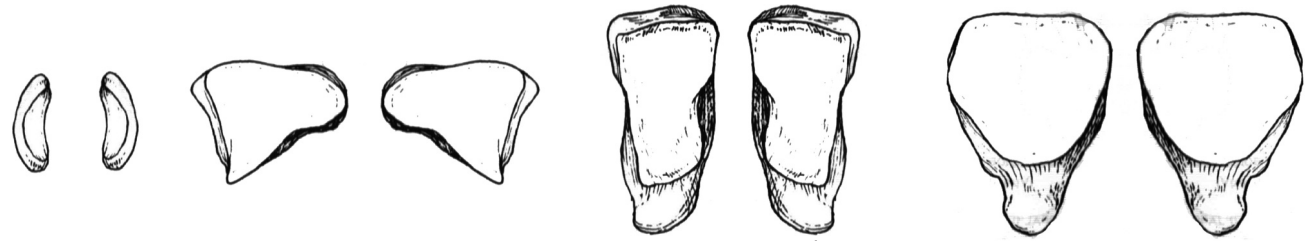
Left ☐ Right ☐

Proximal



Carpale I | Carpale II | Carpale III | Carpale IV

Distal



Left ☐ Right ☐ | Left ☐ | Right ☐ | Left ☐ Right ☐ | Left ☐ Right ☐

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

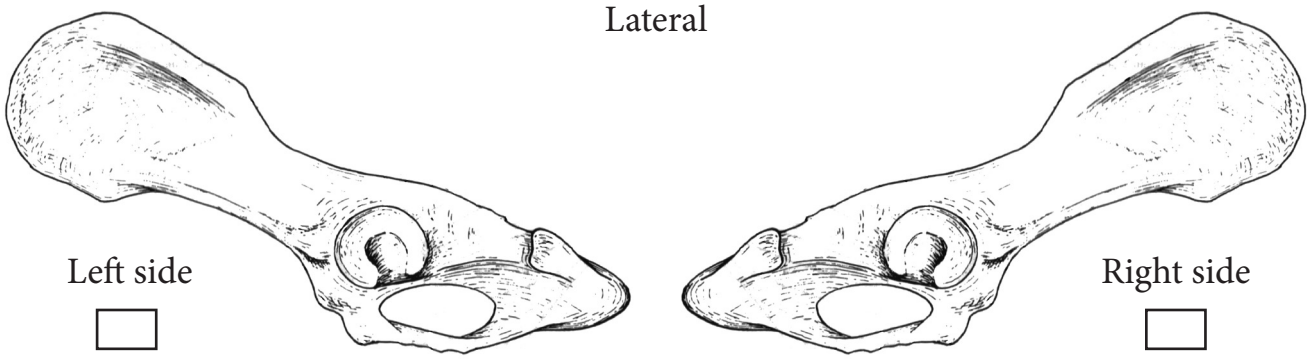
PELVIS

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GL	LA	LAR	LS	SH	SB	LFo	HFo	BP

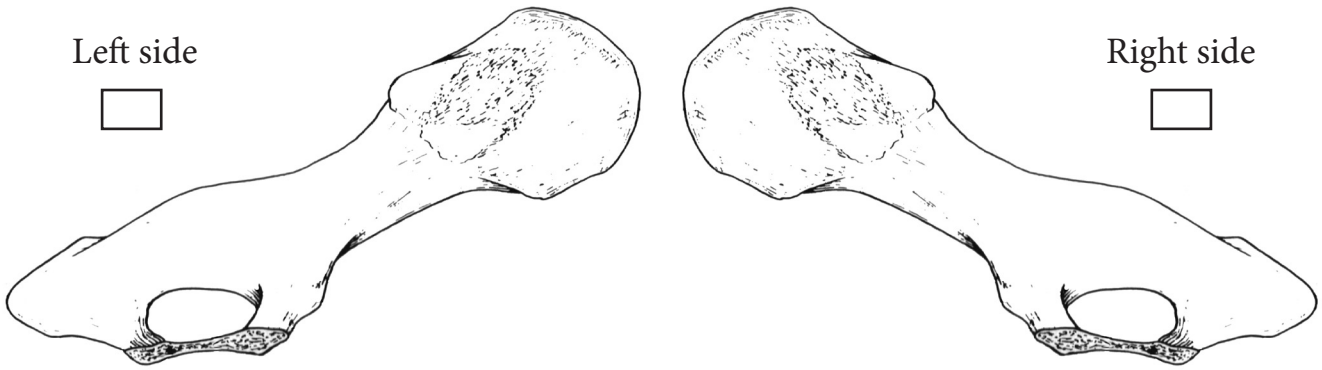
LP	GBTc	GBA	GBTi	SBI					

Lateral

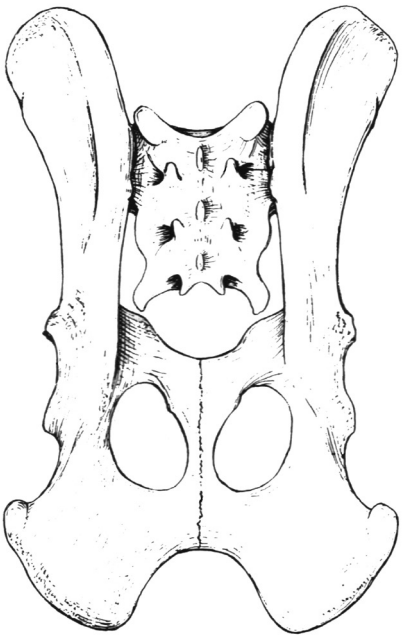


Left side ☐ Right side ☐

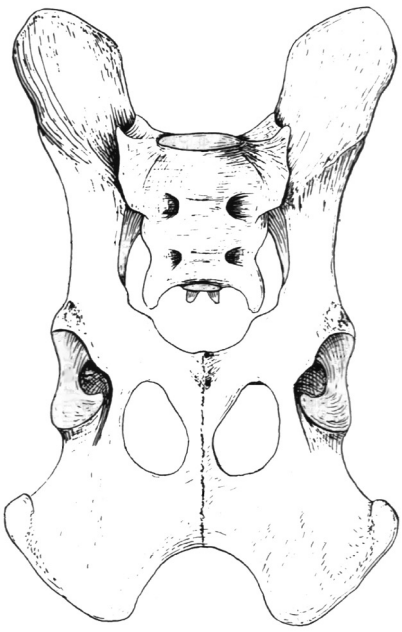
Medial



Left side ☐ Right side ☐



Dorsal



Ventral

Pelvis:	
GL)	– Greatest length of one half
LA)	– Length of the acetabulum including the lip
LAR)	– Length of the acetabulum on the rim
LS)	– Length of the symphysis
SH)	– Smallest height of the shaft of ilium
SB)	– Smallest breadth of the shaft of ilium
LFo)	– Inner length of the foramen obturatum
HFo)	– Inner height of the foramen obturatum
BP)	– Breadth of the Os Pubis
LP)	– Length of the Os Pubis to acetabulum
GBTc)	– Greatest breadth across the Tubera coxarum
GBA)	– Greatest breadth across the acetabula
GBTi)	– Greatest breadth across the Tubera ischiadica
SBI)	– Smallest breadth across the bodies of the ischia

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

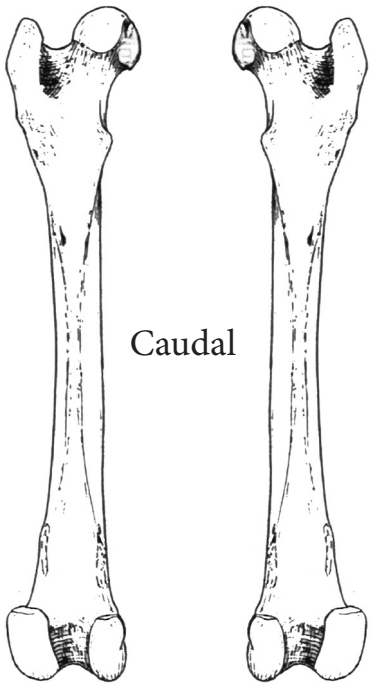
Canis familiaris

FEMUR

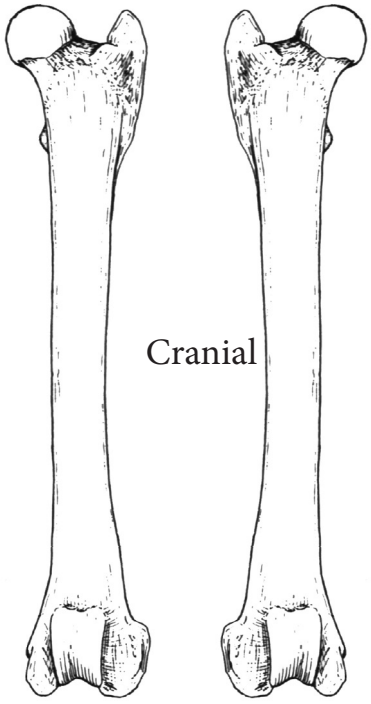
J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GL	GLC	Bp	DC	SD	Bd			

Epifyse: /



Left ☐ Right ☐



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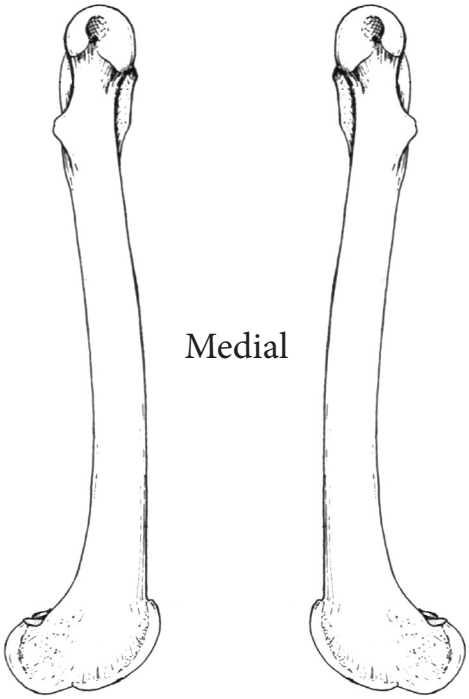
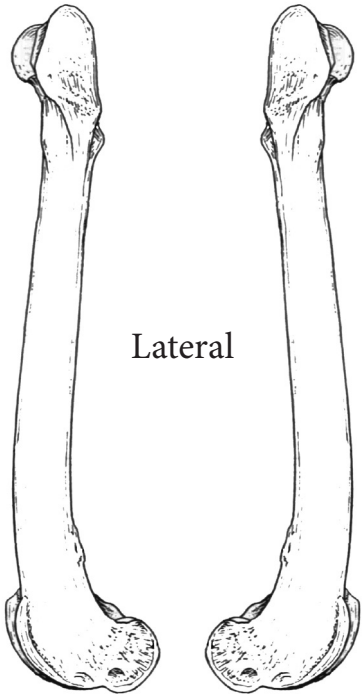


Left ☐ Right ☐



Left ☐ Right ☐

Femur:	
GL)	– Greatest length
GLC)	– Greatest length from caput femoris
Bp)	– Greatest breadth of the proximal end
DC)	– Greatest depth of the Caput femoris
SD)	– Smallest breadth of diaphysis
Bd)	– Greatest breadth of the distal end

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

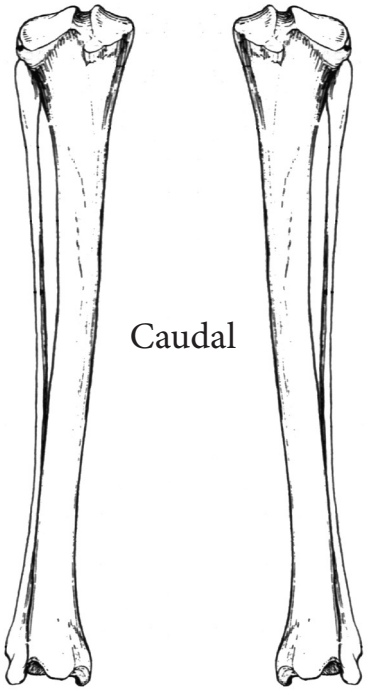
Canis familiaris

TIBIA

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

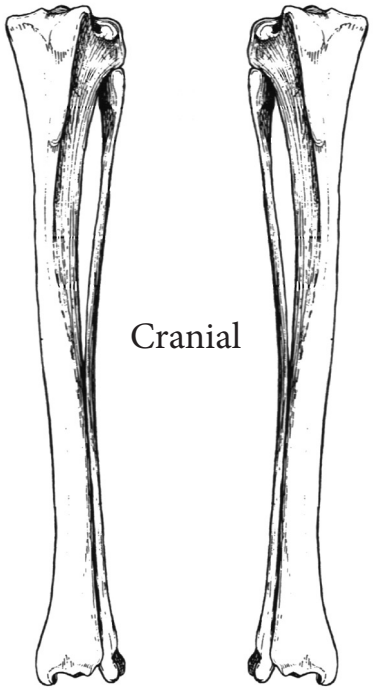
Weight	GL	Bp	SD	Bd					

Epifyse: / _____



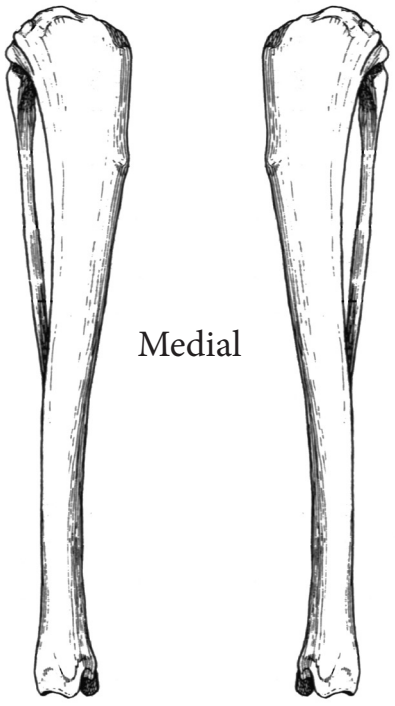
Caudal

Left ☐ Right ☐



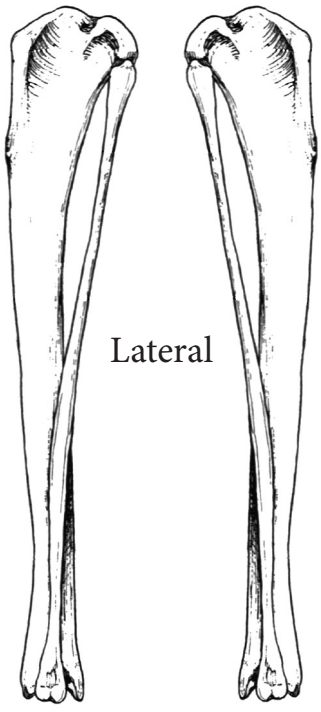
Cranial

Left ☐ Right ☐



Medial

Left ☐ Right ☐



Lateral

Left ☐ Right ☐

Tibia:

GL) – Greatest length

Bp) – Greatest breadth of the proximal end

SD) – Smallest breadth of diaphysis

Bd) – Greatest breadth of the distal end

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

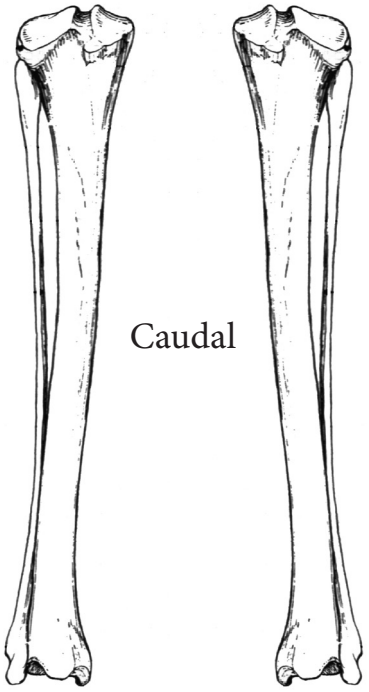
Canis familiaris

FIBULA

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

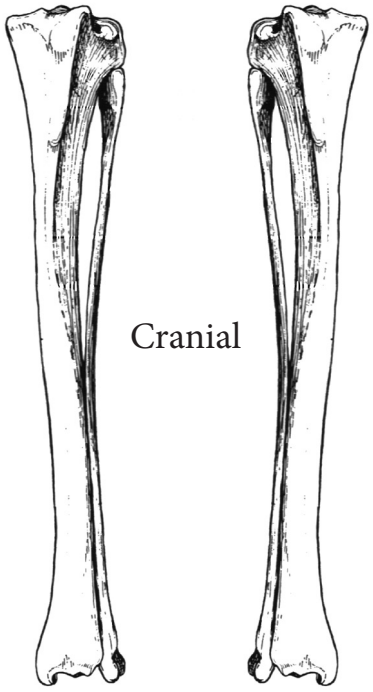
Weight	GL								

Epifyse: / _____



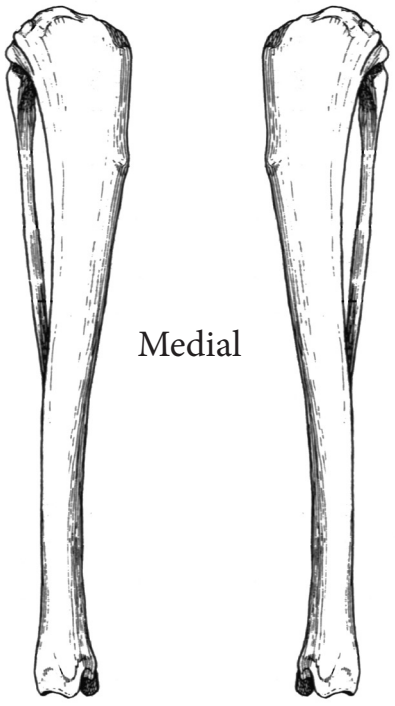
Caudal

Left ☐ Right ☐



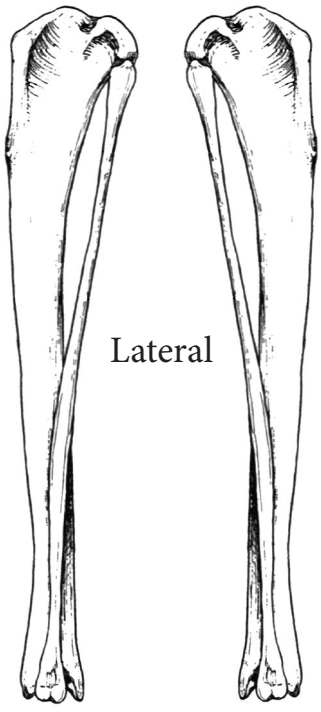
Cranial

Left ☐ Right ☐



Medial

Left ☐ Right ☐



Lateral

Left ☐ Right ☐

Fibula:

GL) – Greatest length

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

PATELLA

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GL	Gb							

Caudal

Cranial

Lateral

Left ☐ Right ☐

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

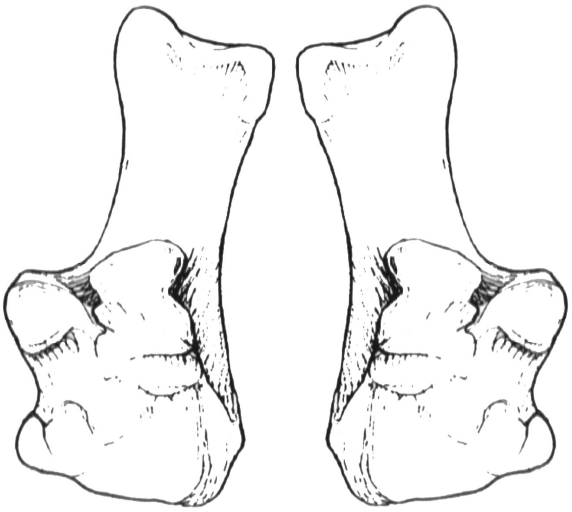
Canis familiaris

CALCANEUM

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

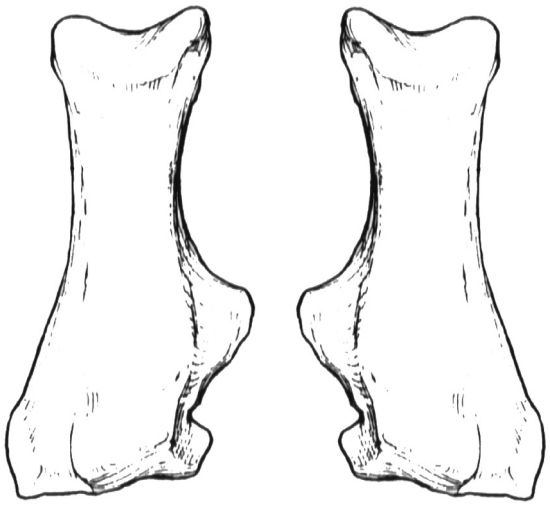
Weight	GL	GB							

Dorsal



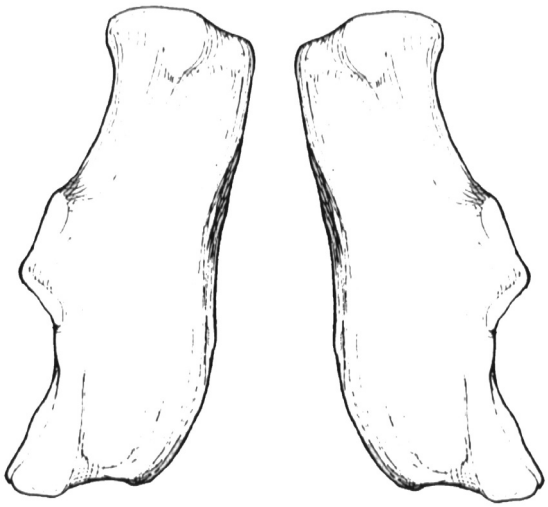
Left ☐ Right ☐

Lateral



Left ☐ Right ☐

Plantar



Left ☐ Right ☐

Calcaneus:

GL) – Greatest length

GB) – Greatest breadth

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

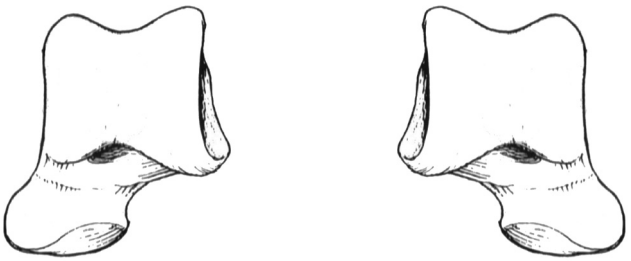
Canis familiaris

TALUS

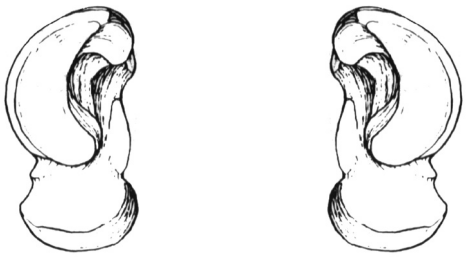
J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GL								

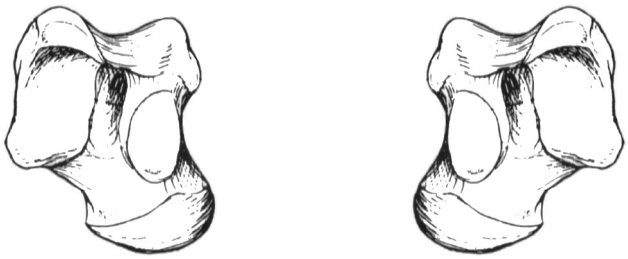
Dorsal



Lateral



Plantar



Left ☐ Right ☐

Astragalus (=talus):

GL) **–** Greatest length

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

TARSALE

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GL								


Dorsal

Tarsale V

Plantar


Left ☐ Right ☐


Proximal

Navicular

Distal


Left ☐ Right ☐

Proximal






Tarsale III Tarsale II Tarsale I

Distal






Left ☐ Right ☐ Left ☐ Right ☐ Left ☐ Right ☐

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

METATARSALE

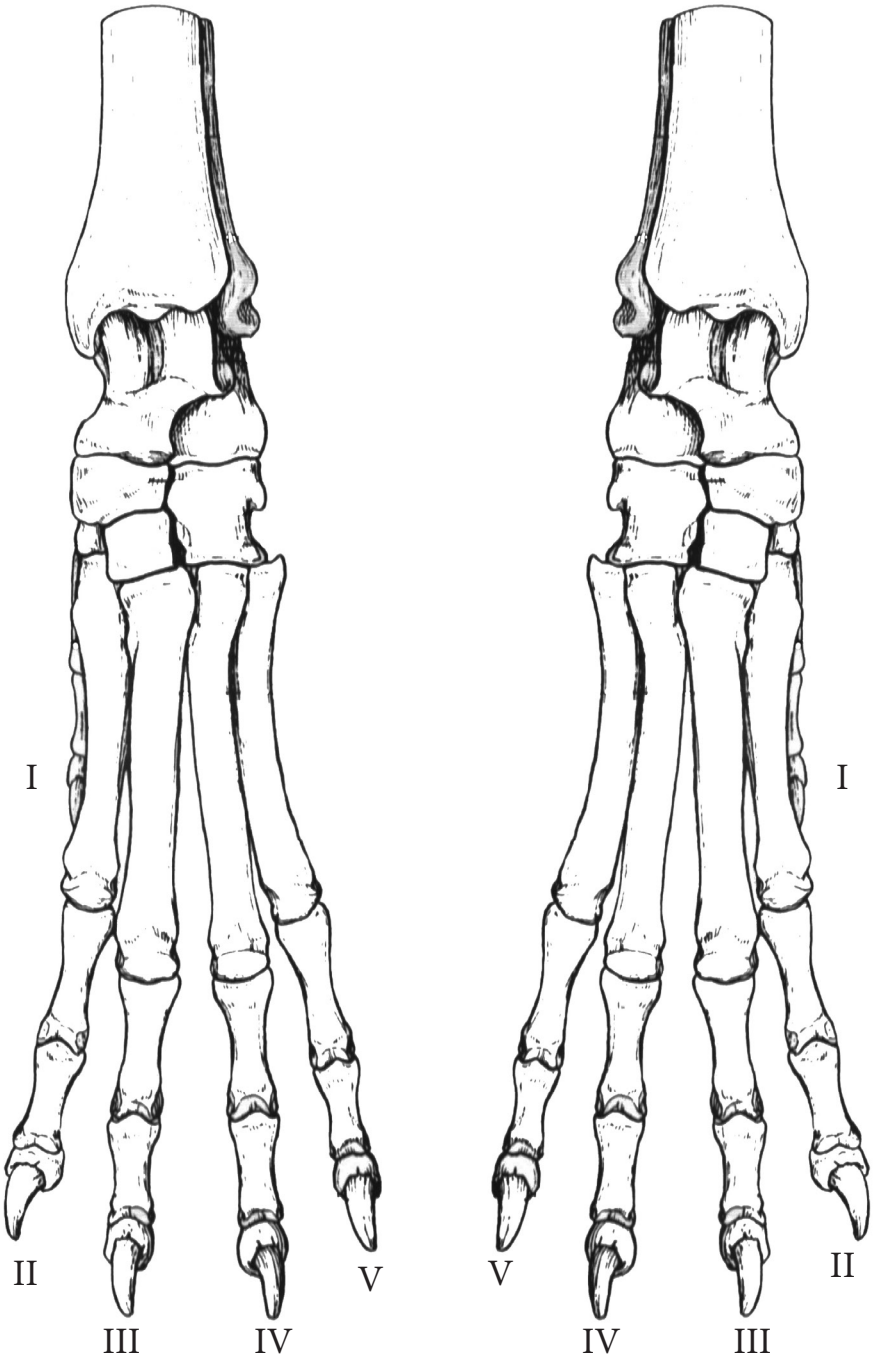
J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GL	Bd							

I ☐ II ☐ III ☐ IV ☐ V ☐

Epifyse: _____ / _____

Dorsal



Metatarsus:

GL) **–** Greatest length

Bd) – Greatest breadth of the distal end

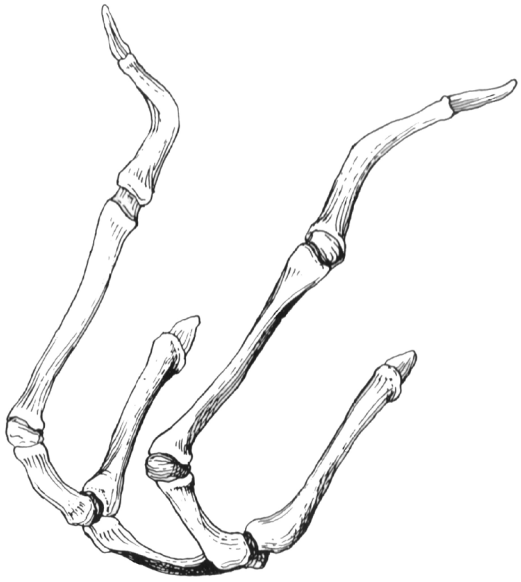
	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐
Individual	_____	

Canis familiaris

HYOIDEUS + BACULUM

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight									



	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

PHALANX

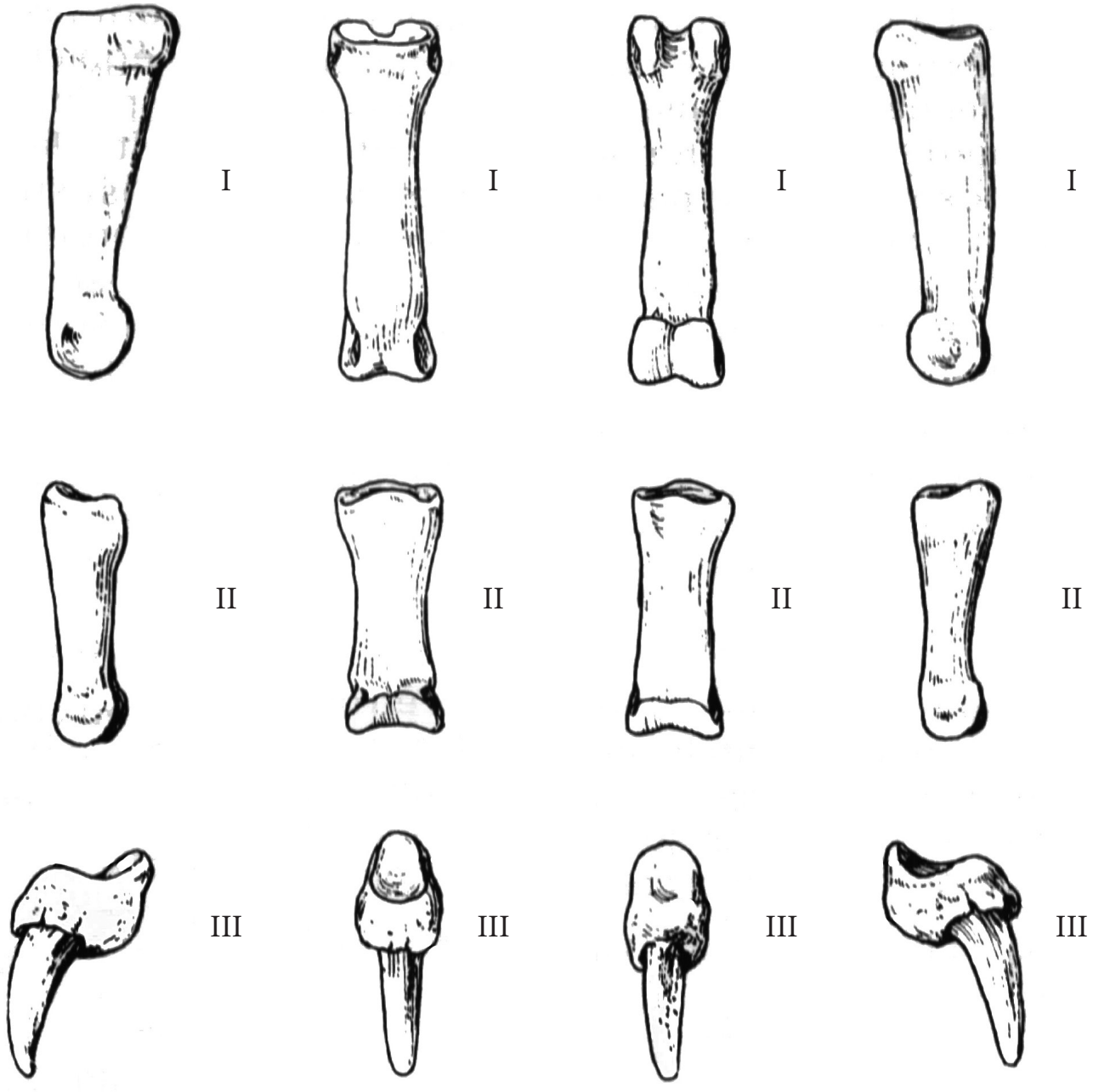
J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight	GL	Bd							

I ☐ II ☐ III ☐

Epifyse: / _____

Abaxial Dorsal Palmar Axial



	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

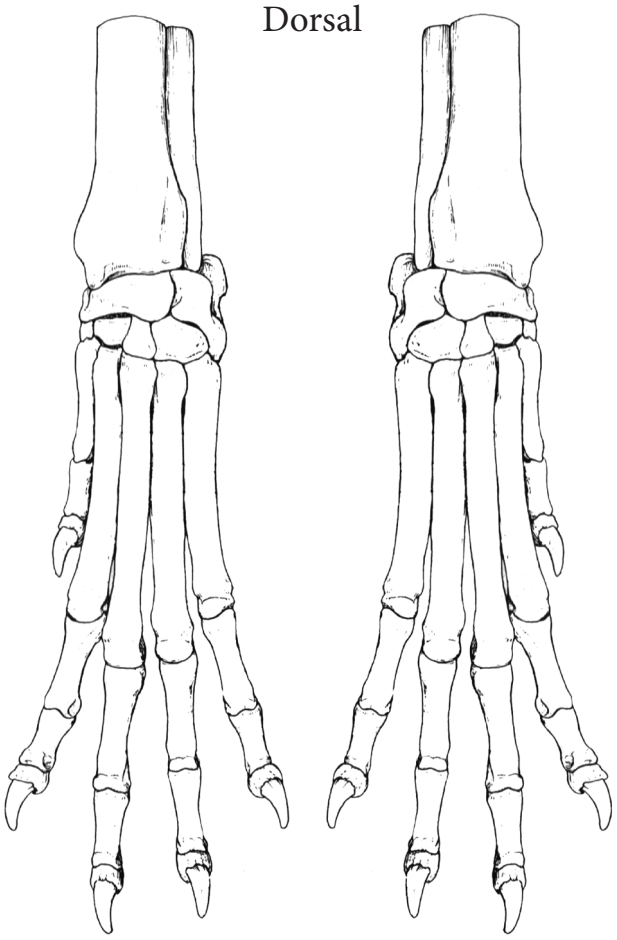
Canis familiaris

FRONT PAW

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

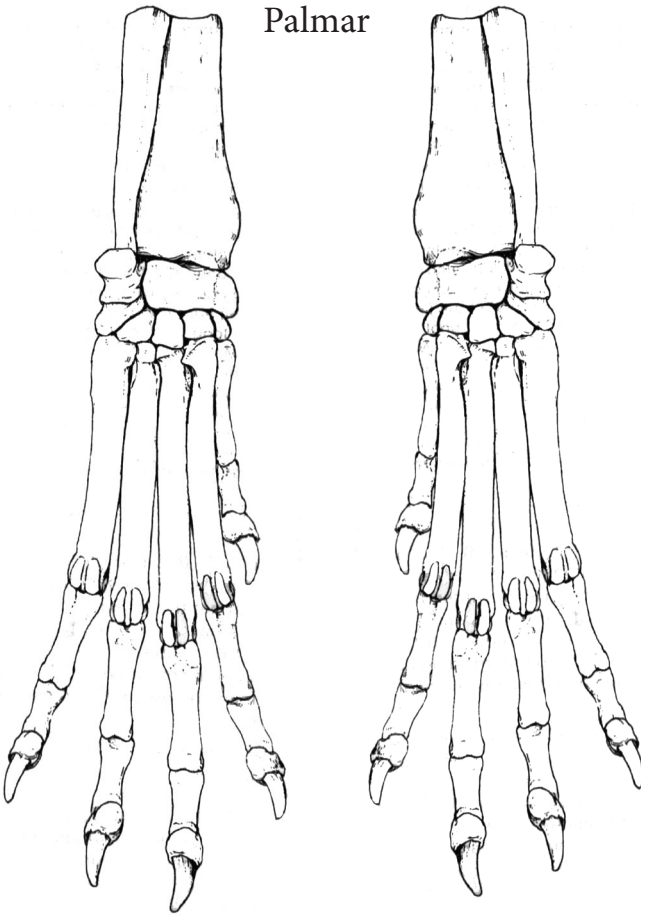
Weight									

Dorsal



Left ☐ Right ☐

Palmar



Left ☐ Right ☐

	Yes	No
Cut marks	☐	☐
Axe marks	☐	☐
Burned	☐	☐
Complete	☐	☐

Individual _____

Canis familiaris

UNKNOWN

J.S: _____
Location: _____
Date: _____
ID nr: _____
Box #: _____

Weight									