

How many bones does a wisent have?

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Abstract: The literature on the European bison skeleton was analyzed. Because the literature contained discrepancies in the reported number of caudal vertebrae, seven skeletons in natural history exhibits were examined, revealing striking differences in the number of caudal vertebrae. It was then decided to re-examine 12 tails, each containing 14 vertebrae. Our study showed that the European bison has 200 bones.

Keywords: wisent, *Bison bonasus*, skeleton

Introduction

The title question was asked by an elementary school student during a meeting held as part of a cultural and educational event. This seemingly simple question perplexed the adult participants. The general structure of the wisent skeleton is widely known: the bones of the head; the spine – vertebrae (cervical, thoracic, lumbar, sacral, coccygeal); ribs; and the bones of the shoulder and pelvic girdles and the limbs. Identifying the parts of a wisent skeleton is also straightforward for those with a general biology education (especially naturalists, breeders, foresters, and veterinarians). This stems from knowledge of mammalian anatomy, especially that of large artiodactyls (bovids). However, there are subtle differences that distinguish this species' skeleton from the skeletal systems of other members of this family. The first in-depth study of the European bison's skeletal anatomy, by Karol Henryk Bojanus, was published in 1827 by the Akademia Leopoldinum (text in Latin). This meticulous work served as a reference point for other anatomical analyses

for many years. However, no newer studies on the European bison's skeletal structure were published for a long time. Primary works on the European bison skeleton did not appear until the 1960s. Three articles were published at that time, authored by scientists from the Warsaw University of Life Sciences (SGGW) (Empel 1962; Empel & Roskosz 1963; Roskosz 1962). They conducted in-depth morphological and morphometric studies, whose conclusions indicated differences in the bone structure of the European bison compared to domestic cattle. They demonstrated that although the basic quantitative pattern in the vertebral column is 7 cervical vertebrae, 14 thoracic vertebrae, 5 lumbar vertebrae, and 5 sacral vertebrae (Roskosz 1962), sporadic shifts may occur in the thoracic, lumbar, and sacral sections. Roskosz (1962) also noted relative instability in the number of caudal vertebrae, ranging from 13 to 16.

To answer the elementary school student's question, an analysis was conducted to determine the number of bones in the European bison.

Material and Methods

This study was based on iconographic sources, primarily published materials. This analysis prompted us to review exhibitions displaying European bison skeletons (Faculty of Veterinary Medicine, Warsaw University of Life Sciences; Forest Culture Center in Gołuchów; and Pszczyna Village Farmstead). A total of seven skeletons were assessed. Because this assessment revealed differences in the number of caudal vertebrae, we decided to examine 12 European bison tails collected from individuals of both sexes, culled in the Bieszczady Mountains due to thelasis. The prepared tails were macerated, and the vertebrae were then counted.

Results

The illustration in Bojanus's work (1825) clearly shows 18 caudal vertebrae, while the other vertebral segments were adapted to the standard for European bison (Roskosz, 1962). Similarly, evaluation of the skeletons showed that the pattern for the four cranial segments (cervical, thoracic, lumbar, and sacral) is consistent with the species, while the number of caudal vertebrae ranges from seven to eleven. Examination of the tails of twelve European bison from Bieszczady revealed fourteen vertebrae in each case.

Summary

Attempting to enumerate the bones of the European bison proved to be a tedious task. Searching source materials did not yield a clear answer. Examination of various materials, including diagrams, source texts, and skeletons presented in natural history exhibits, revealed differences that required clarification, primarily regarding the caudal vertebrae. The results of our work allowed us to determine that the European bison possesses two hundred bones (Tabl. 1).

In the skeleton, we distinguish the axial and peripheral skeleton. The axial skeleton comprises the skull bones, the spine with the sacrum, and the tail vertebrae. The axial skeleton protects the brain, spinal cord, and thoracic organs (heart and lungs). The peripheral skeleton comprises the forelimb bones (pectoral bones) and the pelvic bones, along with the bones of the pelvic girdle (pelvis).

Table 1. Specification of European bison skeleton with number of bones

Cranium (neurocranium) (5 even, 4 unpaired)	14
frontal bone	1
occipital bone	1
parietal bones	2
sphenoid bone	1
ethmoid bone	1
temporal bones	2
auditory ossicles (malleus, incus, stapes)	6
Face bones (7 even, 1 unpaired)	15
maxilla	2
lacrimal bone	2
zygomatic bone	2
palatine bone	2
nasal bone	2
nasal conchae	2
vomer	1
mandible	2
Spinal column – vertebrae	45
cervical vertebrae	7
thoracic vertebrae	14
lumbar vertebrae	5
sacral vertebrae (fused) – sacrum	5
caudal vertebrae	14

Thorax	28
ribs – 14 pairs	28
+ sternum (cartilaginous/ossifies in older individuals)	
Bones of the thoracic limb (left and right)	54
scapula	2
humerus	2
radius & ulna (fused)	4
carpal bones – upper and lower rows of 4 bones each	8
III&IV metacarpal bones (fused)	14
phalanges bones of digits (proximal phalanx [I], middle phalanx, [II], distal phalanx [III])	12
sesamoid bones	12
Pelvis & bones of pelvic limbs (left and right)	44
pelvis (ilium, ischium, pubis – fused)	6
femur	2
patella	2
tibia + fibula	4
tarsal bone (talus, calcaneus & bones of the proximal & distal rows III & IV metatarsal bone (fused)	14
phalanges bones of digits (proximal phalanx [I], middle phalanx, [II], distal phalanx [III])	16
Total	200



Figure 1. Profile of wisent skeleton (photo from the collection of the Museum of Osteology, Department of Morphological Sciences, WULS).

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Ile kości ma żubr

Streszczenie: Przeanalizowano literaturę traktującą o szkielecie żubra. Ponieważ w piśmiennictwie występowały niezgodności w liczbie kręgów ogonowych, oceniono 7 szkieletów w ekspozycjach przyrodniczych. Niestety analiza zbiorów nie rozwiązała wątpliwości, gdyż stwierdzono rażące różnice w liczbie kręgów ogonowych. Zdecydowano się na nowo wypreparować 12 ogonów od osobników eliminowanych, w każdym stwierdzono jednakową liczbę kręgów równą. Badanie nasze pozwoliło na stwierdzenie, iż żubr ma 200 kości.
