Quantitative Methods

CALCULATING BODY MASS FOR NOTOUNGULATES USING HEAD-BODY LENGTH BASED ON A WIDE RANGE OF MODERN MAMMALS BEYOND UNGULATES

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Several major mammal clades are included within the informal moniker South American native ungulates (SANUs). SANUs lack extant representatives and have no close relatives with similar body plans, which has made reconstructing many aspects of their paleoecology challenging. This is particularly the case for notoungulates, the most diverse and speciose SANU group; notoungulate skulls, dentitions, and limb bones are quite atypical compared to modern ungulates, and this raises doubts about using modern ungulate models and equations to determine diet, body mass (BM), and other notoungulate attributes. Head-body length (HBL) is highly correlated with BM in extant mammals and has been recommended for estimating BM in extinct mammals lacking close modern analogs. Of course, a major constraint in this approach is that it requires knowledge of the complete skeleton of an extinct species. Relatively few complete skeletons are known for notoungulates, but those that are known hold promise for helping gauge the accuracy of BM estimates based on other, more limited skeletal elements.
We created a dataset of HBL and BM values for 354 extant terrestrial, non-volant mammals of 20 orders, including only mammals >500 g (the range likely spanned by most notoungulates). A representative size range of each order was included to avoid over-sampling particularly species-rich groups. From this dataset, we calculated a regression equation of BM on HBL to estimate notoungulate BM, with results as follows: *Protypotherium australe* (4.2 kg; 53 cm), *Interatherium robustum* (1.4 kg; 36 cm), *Pachyrukhos moyani* (0.92 kg; 31 cm), *Thomashuxleya externa* (87 kg; 150 cm), *Homalodotherium cunninghami* (170 kg; 190 cm), *Adinotherium ovinum* (37 kg; 110 cm), and *Nesodon imbricatus* (140 kg; 180 cm). Percent prediction error was 51%. In general, these HBL-based BM estimates are lower than those based on cranial measurements that use modern ungulates as analogs. This suggests that: (1) broader taxonomic samples of extant mammals should be used in comparative datasets; and/or (2) craniodental morphologies of notoungulates may be so distinct from those of extant mammals that they result in misleading BM estimates. Certain limb bones, such as the astragalus, seem to be accurate indicators of BM based on comparisons with HBL-based estimates.

Marine Mammals

TAXONOMIC REVISION OF THE PACIFIC RECORD OF THE SQUALODONTIDAE (CETACEA, ODONTOCETI)

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The Squalodontidae is a historic family of fossil odontocetes that is now recognized as a 'wastebasket taxon' for fragmentary fossils of heterodont cetaceans. As a result, the Squalodontidae are in need of taxonomic revision so that the family can be placed in an accurate phylogenetic context. Historically, squalodontids were thought to be characterized by triangular cheek teeth featuring heavily ornamented crowns and short ridges that extend towards the apex of the crown (the cristae rugosae of earlier authors). Currently, only three genera within the Squalodontidae are known from partial or nearly complete skulls: *Phoberodon*, *Eosqualodon*, and *Squalodon*. Of these genera, diagnostic material is restricted to the Atlantic Ocean. In the Pacific realm, there are two named genera reported from New Zealand: *Austrosqualodon*, a mandibular fragment with no associated teeth; and *Tangaroasaurus*, a mandibular fragment with a few associated teeth. Neither *Austrosqualodon* nor *Tangaroasaurus* have enough material preserved to be considered diagnostic and previous authors have considered *Austrosqualodon* a nomen dubium. Other Pacific records of the Squalodontidae include finds from Japan, Australia, Chile, the west coast of North America, and Costa Rica. None of these fossils are identified to species level, and most are diagnosed as *Squalodon* sp. or Squalodontidae indet. Here, we evaluate the fossil record of the Squalodontidae in the Pacific Ocean with the goal of refining the taxonomy and biogeography of the Squalodontidae. Pending further work extracting phylogenetic signals from heterodont cetacean teeth that may enable us to diagnose teeth to a family level, we conclude that 'squalodont' fossils of the Pacific should be considered Odontoceti incertae sedis. As a result, the Squalodontidae appear restricted to the north and south Atlantic.

Mesozoic & Early Cenozoic Mammalian Evolution

TOOTH ERUPTION AND MORPHOLOGY IN EARLY MAMMALS: A JUVENILE DRYOLESTOID SKULL FROM THE LATE CRETAEOUS OF SOUTH AMERICA.