Instructions for Bovid Ecomorphology Files (v. Aug06)

David DeGusta (degusta@stanford.edu)
Department of Anthropological Sciences
Building 360, 450 Serra Mall
Stanford University
Stanford, CA 94305-2117 USA
www.stanford.edu/~degusta

Purpose

This document provides instructions for generating habitat predictions, body weight estimates, and tribal affiliations from bovid astragali and phalanges using the four bovid ecomorphology discriminant function files provided on my website (AST Discrim, PPX Discrim, IPX Discrim, DPX Discrim) and the JMP statistics program. Explanations are also provided for the raw data files containing the specimen measurements (AST Data, PPX Data, IPX Data, DPX Data). This document does not cover the conceptual or empirical basis of these methods, or the means by which the data was gathered. Users are urged to read the two associated publications (references below) for that information.

Status and Use of Methods and Data

These methods are published (DeGusta and Vrba, 2003, 2005) and, as such, may be used in any way by any one. The raw data may also be used by anyone without restriction, though I would appreciate the chance to read and comment on any use of it prior to publication (this is optional). Naturally, for both the methods and the raw data, the corresponding publications should be cited as appropriate:

DeGusta D, Vrba E (2003) A method for inferring paleohabitats from the functional morphology of bovid astragali. Journal of Archaeological Science 30:1009-1022.

DeGusta D, Vrba E (2005) Methods for inferring paleohabitats from the functional morphology of bovid phalanges. Journal of Archaeological Science 32:1099-1113.

Technical Support

I will endeavor to answer questions and assist people using these methods and data by providing e-mail technical support (degusta@stanford.edu). I would also appreciate suggestions and feedback.

File Format

The discriminant function files ("DISCRIM") are in JMP version 5.0 for Macintosh. They should work on other (non-Macintosh) platforms in exactly the same way, but you will need the JMP program (www.jmp.com). JMP and Microsoft Excel can open each others files, but the formulas and calculations done within JMP are not carried over to Excel, so you cannot calculate the discriminant functions using Excel. The ability to move between Excel and JMP is primarily useful for importing data to JMP (if you have it in Excel format) or outputting JMP data into Excel format (if you prefer dealing with the data in Excel).

The raw data files ("DATA") are provided in JMP (.jmp), Microsoft Excel (.xls), and tab-separated text (.txt) formats.

Raw Data

The data files contain the primary data for each specimen: taxonomic identification, measurements, habitat classification, and mean body weight. There are four files, one for each element (AST Data, PPX Data, IPX Data, DPX data). These files do not contain the discriminant functions. For the discriminant functions, see the DISCRIM files (described below).

In the raw data files, the subfamily and tribal taxonomy follows that of Gentry (1992, Mammal Review 22:1-32). The specimens are sorted taxonomically. The species, and subspecific, identifications are as per the American Museum of Natural History catalog. The mean body weights were generated from the ranges in Kingdon (1982, East African Mammals, Academic Press). Note that these are combined sex means, and so are very rough approximations (further disclaimers given in DeGusta and Vrba, 2003). The habitat classifications are F = forest, H = heavy cover, L = light cover, and O = open. For definitions of these categories, see DeGusta and Vrba (2003) page 1014. The measurements are reported in millimeters, and the abbreviations are the same as used in the DISCRIM files, so see below (or the relevant publications) for their definitions.

General Discriminant Function Procedure

Open the appropriate JMP file (AST DISCRIM for astragali, PPX DISCRIM for proximal phalanges, IPX DISCRIM for intermediate phalanges, DPX DISCRIM for distal phalanges). There is one "example" row and 20 blank rows (denoted by • symbols in most columns). Each row represents one specimen. Additional rows can be added using the "Add Rows..." command under the "Rows" menu, or deleted using "Delete Rows" command in the same menu. For each of your specimens, enter the specimen number and measurements in the appropriate columns (see below for details). Once a measurement has been entered in each column, the predictions (habitat preference, body weight, and taxonomic tribe) will automatically appear in the appropriate columns. In addition, the probabilities of the specimen belonging to each of the habitat categories, and to each of the taxonomic tribes, also appear automatically.

There are several "hidden" columns which have various underlying calculations that are used to produce the predictions and probabilities. They are unlikely to be of interest, but can be accessed by clicking on them in the left-hand frame (where they are always visible and denoted with a black mask icon) and then using the "Hide/Unhide" command in the "Columns" menu.

Every "visible" column in each of the four files is listed and briefly described in the following sections (organized by file).

File Name

AST Discrim.jmp

Element

Astragalus

Reference

DeGusta D, Vrba E (2003) A method for inferring paleohabitats from the functional morphology of bovid astragali. Journal of Archaeological Science 30:1009-1022.

Columns

Specimen Number: Enter the specimen label. This field is not used for any calculations, so it can be anything.

LL: Enter the lateral length of the astragalus in mm. This is the maximum proximal-distal dimension of the lateral surface taken parallel to the main proximal-distal axis of the astragalus. See Figure 2b in DeGusta and Vrba (2003).

LI: Enter the intermediate length of the astragalus in mm. This is the minimum proximal-distal dimension of the astragalus, taken parallel to the main proximal-distal axis of the bone. See Figure 2C in DeGusta and Vrba (2003).

LM: Enter the medial length of the astragalus in mm. This is the maximum proximal-distal dimension of the medial surface taken parallel to the main proximal-distal axis of the specimen. See Figure 2A in DeGusta and Vrba (2003).

WI: Enter the intermediate width of the astragalus in mm. This is the minimum medial-lateral dimension on the anterior surface in the area of the junction between the proximal and distal articular regions. Any projections or tubercles are included. See Figure 2C in DeGusta and Vrba (2003).

WD: Enter the distal width of the astragalus in mm. This is the medial-lateral dimension of the distal end at its distal-most point. See Figure 2C in DeGusta and Vrba (2003).

TP: Enter the proximal thickness of the astragalus in mm. This is the anterior-posterior dimension of the proximal end of the lateral surface. See Figure 2B in DeGusta and Vrba (2003).

TI: Enter the intermediate thickness of the astragalus in mm. This is the minimum anterior-posterior dimension of the lateral surface in the area of the junction between the proximal and distal articular regions. See Figure 2B in DeGusta and Vrba (2003).

TD: Enter the distal thickness of the astragalus in mm. This is the anterior-posterior dimension of the distal end of the lateral surface. See Figure 2B in DeGusta and Vrba (2003).

Predicted Body Wt (kg): The predicted body weight of the individual in kilograms, using the regression equation described in Appendix A.2 of DeGusta and Vrba (2003).

Predicted Habitat: The predicted habitat preference category of the specimen. F = forest, H = heavy cover, L = light cover, and O = open. For definitions of these categories, see DeGusta and Vrba (2003) page 1014.

Forest %: The probability that the specimen belongs to the forest habitat preference category.

Heavy Cover%: The probability that the specimen belongs to the heavy cover habitat preference category.

Light Cover %: The probability that the specimen belongs to the light cover habitat preference category.

Open %: The probability that the specimen belongs to the open habitat preference category.

Predicted Tribe: The predicted taxonomic affiliation of the specimen, at the tribal level.

Aepycerotini %: The probability that the specimen belongs the Aepycerotini tribe.

Alcelaphini %: The probability that the specimen belongs the Alcelaphini tribe.

Antilopini %: The probability that the specimen belongs the Antilopini tribe.

Cephalophini %: The probability that the specimen belongs the Cephalophini tribe.

Hippotragini %: The probability that the specimen belongs the Hippotragini tribe.

Neotragini %: The probability that the specimen belongs the Neotragini tribe.

Reduncini %: The probability that the specimen belongs the Reduncini tribe.

Tragelaphini %: The probability that the specimen belongs the Tragelaphini tribe.

File Name

PPX Discrim.jmp

Element

Proximal Phalanx

Reference

DeGusta D, Vrba E (2005) Methods for inferring paleohabitats from the functional morphology of bovid phalanges. Journal of Archaeological Science 32:1099-1113.

Columns

Specimen Number: Enter the specimen label. This field is not used for any calculations, so it can be anything.

LM: Enter the midline length of the phalanx in mm. This is the minimum proximal-distal dimension along the dorsal midline. See Figure 1 in DeGusta and Vrba (2005).

WP: Enter the proximal width of the phalanx in mm. This is the maximum medial-lateral dimension of the proximal end taken perpendicular to its major proximal-distal axis. See Figure 1 in DeGusta and Vrba (2005).

WI: Enter the intermediate width of the phalanx in mm. This is the medial-lateral dimension of the shaft at midshaft. See Figure 1 in DeGusta and Vrba (2005).

WD: Enter the distal width of the phalanx in mm. This is the maximum medial-lateral dimension of the distal articular end, taken perpendicular to its major proximal-distal axis. See Figure 1 in DeGusta and Vrba (2005).

HP: Enter the proximal height of the phalanx in mm. This is the midline dorsal-ventral dimension of the proximal articular end, taken perpendicular to its major proximal-distal axis. See Figure 1 in DeGusta and Vrba (2005).

HI: Enter the intermediate height of the phalanx in mm. This is the midline dorsal-ventral dimension of the shaft at midshaft. See Figure 1 in DeGusta and Vrba (2005).

HD: Enter the distal height of the phalanx in mm. This is the midline dorsal-ventral dimension just proximal to the distal articular surface. See Figure 1 in DeGusta and Vrba (2005).

Predicted Body Wt (kg): The predicted body weight of the individual in kilograms, using the regression equation described in the Appendix of DeGusta and Vrba (2005).

Predicted Habitat: The predicted habitat preference category of the specimen. F = forest, H = heavy cover, L = light cover, and O = open. For definitions of these categories, see DeGusta and Vrba (2003) page 1014.

Forest %: The probability that the specimen belongs to the forest habitat preference category.

Heavy Cover%: The probability that the specimen belongs to the heavy cover habitat preference category.

Light Cover %: The probability that the specimen belongs to the light cover habitat preference category.

Open %: The probability that the specimen belongs to the open habitat preference category.

Predicted Tribe: The predicted taxonomic affiliation of the specimen, at the tribal level.

Aepycerotini %: The probability that the specimen belongs the Aepycerotini tribe.

Alcelaphini %: The probability that the specimen belongs the Alcelaphini tribe.

Antilopini %: The probability that the specimen belongs the Antilopini tribe.

Cephalophini %: The probability that the specimen belongs the Cephalophini tribe.

Hippotragini %: The probability that the specimen belongs the Hippotragini tribe.

Neotragini %: The probability that the specimen belongs the Neotragini tribe.

Reduncini %: The probability that the specimen belongs the Reduncini tribe.

Tragelaphini %: The probability that the specimen belongs the Tragelaphini tribe.

File Name

IPX Discrim.jmp

Element

Intermediate Phalanx

Reference

DeGusta D, Vrba E (2005) Methods for inferring paleohabitats from the functional morphology of bovid phalanges. Journal of Archaeological Science 32:1099-1113.

Columns

Specimen Number: Enter the specimen label. This field is not used for any calculations, so it can be anything.

LS: Enter the superior length of the phalanx in mm. This is the proximal-distal dimension of the dorsal surface measured along the midline. See Figure 2 in DeGusta and Vrba (2005).

LI: Enter the inferior length of the phalanx in mm. This is the proximal-distal dimension of the ventral surface measured along the midline. See Figure 2 in DeGusta and Vrba (2005).

WP: Enter the proximal width of the phalanx in mm. This is the maximum medial-lateral dimension of the proximal end taken perpendicular to its major proximal-distal axis. See Figure 2 in DeGusta and Vrba (2005).

WD: Enter the distal width of the phalanx in mm. This is the maximum medial-lateral dimension of the distal end taken perpendicular to its major proximal-distal axis. See Figure 2 in DeGusta and Vrba (2005).

HL: Enter the proximal-lateral height of the phalanx in mm. This is the dorsal-ventral dimension of the lateral portion of the proximal articular facet, measured from the most ventral point to the most dorsal point. See Figure 2 in DeGusta and Vrba (2005).

HM: Enter the proximal-medial height of the phalanx in mm. This is the dorsal-ventral dimension of the medial portion of the proximal articular facet, measured from the most ventral point to the most dorsal point. See Figure 2 in DeGusta and Vrba (2005).

HD: Enter the distal height of the phalanx in mm. This is the dorsal-ventral dimension of the distal end measured just proximal to the distal articular surface. See Figure 2 in DeGusta and Vrba (2005).

Predicted Body Wt (kg): The predicted body weight of the individual in kilograms, using the regression equation described in the Appendix of DeGusta and Vrba (2005).

Predicted Habitat: The predicted habitat preference category of the specimen. F = forest, H = heavy cover, L = light cover, and O = open. For definitions of these categories, see DeGusta and Vrba (2003) page 1014.

Forest %: The probability that the specimen belongs to the forest habitat preference category.

Heavy Cover%: The probability that the specimen belongs to the heavy cover habitat preference category.

Light Cover %: The probability that the specimen belongs to the light cover habitat preference category.

Open %: The probability that the specimen belongs to the open habitat preference category.

Predicted Tribe: The predicted taxonomic affiliation of the specimen, at the tribal level.

Aepycerotini %: The probability that the specimen belongs the Aepycerotini tribe.

Alcelaphini %: The probability that the specimen belongs the Alcelaphini tribe.

Antilopini %: The probability that the specimen belongs the Antilopini tribe.

Cephalophini %: The probability that the specimen belongs the Cephalophini tribe.

Hippotragini %: The probability that the specimen belongs the Hippotragini tribe.

Neotragini %: The probability that the specimen belongs the Neotragini tribe.

Reduncini %: The probability that the specimen belongs the Reduncini tribe.

Tragelaphini %: The probability that the specimen belongs the Tragelaphini tribe.

File Name

DPX Discrim.jmp

Element

Distal Phalanx

Reference

DeGusta D, Vrba E (2005) Methods for inferring paleohabitats from the functional morphology of bovid phalanges. Journal of Archaeological Science 32:1099-1113.

Columns

Specimen Number: Enter the specimen label. This field is not used for any calculations, so it can be anything.

LS: Enter the superior length of the phalanx in mm. This is the proximal-distal dimension of the dorsal surface. See Figure 3 in DeGusta and Vrba (2005).

LI: Enter the inferior length of the phalanx in mm. This is the proximal-distal dimension of the ventral surface measured along the midline. See Figure 3 in DeGusta and Vrba (2005).

WB: Enter the basal width of the phalanx in mm. This is the maximum medial-lateral dimension taken at the ventral base of the proximal articular facet. See Figure 3 in DeGusta and Vrba (2005).

HA: Enter the articular facet height of the phalanx in mm. This is the dorsal-ventral dimension of the proximal articular facet. See Figure 3 in DeGusta and Vrba (2005).

HT: Enter the total height of the phalanx in mm. This is the maximum dorsal-ventral dimension of the proximal end. See Figure 3 in DeGusta and Vrba (2005).

Predicted Body Wt (kg): The predicted body weight of the individual in kilograms, using the regression equation described in the Appendix of DeGusta and Vrba (2005).

Predicted Habitat: The predicted habitat preference category of the specimen. F = forest, H = heavy cover, L = light cover, and O = open. For definitions of these categories, see DeGusta and Vrba (2003) page 1014.

Forest %: The probability that the specimen belongs to the forest habitat preference category.

Heavy Cover%: The probability that the specimen belongs to the heavy cover habitat preference category.

Light Cover %: The probability that the specimen belongs to the light cover habitat preference category.

Open %: The probability that the specimen belongs to the open habitat preference category.

Predicted Tribe: The predicted taxonomic affiliation of the specimen, at the tribal level.

Aepycerotini %: The probability that the specimen belongs the Aepycerotini tribe.

Alcelaphini %: The probability that the specimen belongs the Alcelaphini tribe.

Antilopini %: The probability that the specimen belongs the Antilopini tribe.

Cephalophini %: The probability that the specimen belongs the Cephalophini tribe.

Hippotragini %: The probability that the specimen belongs the Hippotragini tribe.

Neotragini %: The probability that the specimen belongs the Neotragini tribe.

Reduncini %: The probability that the specimen belongs the Reduncini tribe.

Tragelaphini %: The probability that the specimen belongs the Tragelaphini tribe.