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Standardized measurements, landmarks, and meristic counts for cypriniform fishes

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Abstract

Standardized measurements and landmarks for traditional morphometrics, landmark-based (partial truss) measurements, and geometric morphometrics for Cypriniformes are described. Standardized meristic counts also are described.

Key words: Morphology, fishes

Introduction

In order to standardize as much as possible how data are taken for the All Cypriniformes Species Inventory, three morphometric schemes and one set of meristic counts are proposed. The three morphometrics are: Geometric Morphometric Landmarks (GM), Landmark-Based Morphometric Analysis (LBM), based on a partial truss configuration (Strauss & Bookstein 1982), and Traditional Morphometrics (TM), based on Hubbs & Lagler (1964). Landmarks are shared between GM and LBM, and some are shared with TM. The difference between LBM and TM is that some (e.g., Strauss & Bookstein 1982) suggest that measurements not taken between homologous landmarks (as in some TM) are not comparable across taxa. Most recent cyprinid descriptions use TM, and it is not recommended to deviate from this; however, because many cyprinids are laterally compressed, the coordinate data from GM can easily be converted to measurements, and these measurements will not have much distortion because many cypriniforms are relatively flat. Thus, the LBM method can be used on photographs, and lengths can be calculated on coordinate data using the Pythagorean theorem shown below; 1 and 2 represent the two different landmarks and c is the measurement desired.

$$a^2 + b^2 = c^2$$

$$a = \Delta x = x_1 - x_2; b = \Delta y = y_1 - y_2$$

$$c = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

It is recommend that the measurements presented herein be thought of as a minimal set of measurements for any cypriniform description, and authors may wish to add measurements and landmarks as needed. Some landmarks (e.g., barbel placement) will be valid only on those species with barbels, and only landmark numbers for the maxillary barbels are presented. Any additional measurements or landmarks should be placed at the end of the ones listed below.