

Research on 3-D Modeling of Beaks of cuttlefish *Sepia pharaonic*

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Abstract

Based on the analysis of morphological characteristics of the beak of the cuttlefish *Sepia pharaonic*, computer graphics technology and state of art 3-D modeling technology were used to reconstruct the 3-D model of the beak. The light reflection principle of a 45° prism was used to obtain a beak image containing five isometric views from different angles after one shot. Then the software Photoshop CC was applied to extract the external outline of the beak from the image respectively, and the reference gallery was established. The ZBrush 2020 software had been applied to sculpting the beaks as realistic as possible before these digital 3-D assets were printed as an existing object. These printed models were compared with their prototype beaks and that of big fin reef squid to verify their accuracy. It required enough learning cost to manipulate the state-of-art 3-D constructed software like ZBrush. However, once a standardized model of the beak has been built, it's easy to refine and apply to species of cephalopod from different types of habitat (pelagic, benthic, and demersal). The models can be obtained quickly with lower cost compared with present underwater photogrammetry and/or micro-CT scanning and have sufficient precision for quantitative interspecific morphological analyses. The research can provide new ideas and lay a foundation for the comparative morphology analysis of the beak of different species, and also provides convenience for marine biology visualization, and/or digital multimedia development.

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