

Automatic landmark selection of otolith shape contour using the wavelet transform modulus maxima

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Otolith shape has been used in recent years as natural tags in automatic taxon identification of fish species, essentially in feeding ecology, paleontology and archeology. Two main groups of shape analysis have been used, contour analysis and homologous points (landmarks) analysis. One of the major challenges of otolith morphology research is developing objective landmark selection methods to better develop systematic studies. In this article, a multiresolution analysis, specifically the discrete Wavelet Transform Modulus Maxima (WTMM) method, is presented for the automatic extraction of otolith shape features. Wavelet-based analysis has advantages over traditional Fourier-based methods since it has the ability to quantify sharp transitions of the signal and establish its precise location. The suitability of the technique for this purpose has been tested through the use of an assorted set of otolith images belonging to the AFORO database (<http://aforo.cmima.csic.es>). Based on a Cartesian codification of the two-dimensional representation of its outline contour, the most discriminating points at different scales of observation have been determined in two sets of groups. First, a group which includes otoliths having very differentiated contours and second, a group based in the Family Myctophidae. The results exemplify the usefulness of the WTMM method as a new promising tool in automatic otolith landmark selection. Achieving this type of multiresolution shape descriptors points out the importance of keep on developing new advanced otolith classification systems which could be based on a combination of different extracted descriptors (morphological, multiscale, etc.).