FIRST STEPS TOWARDS DEVELOPING A NEW OPEN ACCESS SOFTWARE DESIGNED FOR THE RECOGNITION OF DAILY MICROSTRUCTURES USED IN AGEING FISH

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SUMMARY

Ageing methods for most of the exploited fish species are not validated and consequently age data series often have important gaps and uncertainty manifesting its consequences on age-based fisheries assessment

Amongst the most recognizable otolith microstructures are those corresponding to daily growth increments producing reliable estimates of larval and juvenile growth in an ample number of fish species. From the temporal perspective, otoliths are the only calcified structure that show growth signals at two different scales, the seasonal and daily patterns. Seasonal rings or otolith macrostructure is mostly used to age juvenile and adult individuals while microstructure is typically used in larvae, since the DGI in adult otoliths are numerous and difficult to count. Nonetheless, in several hake species DGI have been counted and measured in juveniles by interpretating daily increments through thin transversal sections of the otolith (50-100 µ). Since these sections can be obtained after a process of otolith resin embedding, section cutting and final polishing, the main handicap lacking today is an appropriate digital tool for counting and measuring otolith DGI widths.

In this communication, the research multidisciplinary team of researchers from the research fields offisheries researchers and engineering proposes the development of a new tool designed to add efficieciency in the cumbersome task of estimating the age of fishes based on DGI analysis. The technique is based on new computer algorithms to interpret the DGI patterns whether in a semi-automatic way, in such a manner that otolith readers are allowed to interact with the system or run in an automatic way when the the technique finds determined types of otolith structural patterns that are considered consistent and reliable. The technique, when registered, will be available to the international scientific community as open access software. Although some image analysis software is available in the market nowadays, even some focusing in otolith image processing, they all show at least two main restrictions: they do not manage 'live' images and also its high price. We present here the first results on the development of this forthcoming software which is expected to resolve the before mentioned limitations.

Larval and adult otoliths measure from some hundred µm to several mm, respectively while DGI widths fluctuates from slightly less than 1 µm increments close to the nucleus in larval otoliths to more than 15 µm in juveniles and adults. In order to discriminate DGI, light microscope magnification varies from x1000 in larvae to x200 in juveniles and adults. As a consequence, most of the times the whole otolith or section cannot be represented on a single image and consequently, several images are needed to construct a sole image where the total otolith size can be measured with the inclusion of most DGI counts. In these cases, the image series should be tiled as a panoramic view or mosaic, where each section superposes with adjacent ones. The first step in the software development has been a superposing routine, identifying automatically common areas between adjacent images. Once a single high quality image is set by otolith at an acceptable magnification some arrangements on contrast, brightness, etc. can be implemented when desired. The next stage is the controlled or semi-automatic counting of DGI along a growth trajectory. Expert readers particular interpretations could be matched to those made automatically and eventually adjust the software reading standards. Finally, DGI counts and measurement data are recorded and also exported to work files, where further analysis could be performed.

As soon as having ready an appropriate and affordable tool to count and measure daily growth increments in an automatic or semi-automatic way, otolith microstructure analysis can have a much more age estimation method that can be extended towards ageing adult fish. Although, in its present form the technique is focused in otolith microstructure analysis, further developments of the initiated software development intends to extend its application to other calcified structures, namely bivalve shells and cephalopod peaks.