

Theme 9 Technological Developments

for the back-ground intensities at an acceleration voltage of 15 kV with the aragonite standards. In these conditions, it is possible to obtain precise measurements of Sr/Ca ratios at 10 µm intervals along a transect from the primordium to the edge of the otolith with an error less than 0.05 wt% at the concentrations of Sr between the actual detection limit of 0.03 and 0.80 wt%, as these have been found to discriminate between marine and fresh waters.

Otolith Morphological Characteristics of Juvenile Bluefin Tuna Using Image Analysis Techniques

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Some otolith morphological characteristics of bluefin tuna, *Thunnus thynnus*, were studied using image analysis techniques and the relationships between otolith dimensions and fish size and age, as estimated from whole otoliths increment counting, were examined.

During 1998–2000, otoliths of 82 juvenile bluefin tuna ranging in fork length from 8.5 to 55.5 cm were collected in the Mediterranean Sea. Whole otolith length, width, area and perimeter, and two shape indices circularity and rectangularity, were extracted for each pair of sagittae. Otoliths were aged after immersion in Methylbenzoate by counting the daily increments and the estimated ages ranged from 15 to 113 days. Since no statistically significant differences between left and right otolith morphometrics were found, only one otolith from each fish was used for otolith-fish size and age correlations. Logarithmic transformation was applied to all variables tested, before any statistical procedure was applied. Statistically significant relationships were observed between otoliths measurements and fish fork length when a linear regression was applied. Among the variables, otolith area was the one that showed the highest correlation with FL, followed by otolith length and perimeter whereas otolith circularity exhibited the lowest correlation. A moderate strong statistically significant relationship was observed for the variables tested and the age of the fish, with the otolith area and perimeter having the highest correlation with age and circularity having the lowest.

Annulus 1.0: Advanced Software for Fish Calcified Structure Analysis

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In January 2001, the Chippewas of Nawash Fisheries Assessment Program, and the Axelrod Institute of Ichthyology (University of Guelph) began building a facility for the analysis of fish calcified structures for the purpose of age and growth estimation. We began with an intensive review of the scientific literature and a thorough investigation of digital image analysis software in search of technology that would satisfy our processing requirements. We found that, while much of the required hardware technology is currently available, the software components have not been bundled into a single application that enables user-friendly, semi-automated, and statistically-rigorous analyses. Perhaps most importantly, none of the commercially-available software products (generalized or specialized) provided tools in support of statistical analysis and interpretation of age estimation data. As such the Chippewas of Nawash and the University of Guelph have set out to develop a specialized, user-friendly software for semi-automated age and growth analysis of fish calcified structures.

Some of the key features of Annulus 1.0 include:

1. Semi-automation
2. Reduced subjectivity
3. Analysis of precision
4. Analysis of sample size
5. Ability to account for influences of growth through edge analysis
6. Reduced subjectivity in implementing the fish birthday rule
7. Blind image presentation reduces analyst bias
8. Reference collection is a powerful means of quality control
9. Provide a fully documented, fully supported, product to the user in terms of data summary reports and images with associated tags and data.