

Reading the Shark's Barcode

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Shark sclerochronology is an emerging field that is critical for the conservation of these threatened species. Effective elasmobranch management requires robust age and growth estimates, as well as insights into life history, habitat use, and diet. While the use of trace elements and isotopes to infer growth patterns is well-established in teleost otolith studies, its application to elasmobranch vertebrae remains in its early stages. This study presents a novel approach by integrating elemental and isotopic analyses to enhance age estimation and life history reconstructions in sharks. We applied laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) to analyse vertebral elemental profiles (≈ 15 elements) along individual growth transects. Additionally, we characterised radiogenic strontium isotopic ratios ($^{87}\text{Sr}/^{86}\text{Sr}$) using LA-MC-ICP-MS and assessed carbon-to-nitrogen (C:N) ratios within ageing structures to reconstruct life history trajectories. 85 shark vertebrae from 15 species (e.g., Tiger, Hammerhead, Oceanic Whitetip, Mako, Thresher and Blacktip Reef Shark) have been investigated. Isotopic and trace element differences between pelagic, coastal, and riverine species are observed. We are analysing data to identify differences in sex, ontology, and provenance. Unexpectedly high amounts of metals such as Cu, Zn, and Pb are found, showing cyclic variations along the growth axis of the vertebrae. This may be due to sharks' relatively high trophic level in their marine ecosystems. As such, sharks could record the chemical and temporal evolution of these systems. The composite reconstruction of elemental and isotopic profiles provides the most robust life history reconstruction available to date. Our results demonstrate that these techniques can effectively trace ontogenetic movements and trophic shifts, supporting element-environment relationships and opening new avenues for age validation in elasmobranchs.