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Editorial

Section 4: Otolith composition

Significant advances in the field of otolith chemistry are reported in this section, reflecting both the rapidly growing interest and the very recent start to this field. A total of 34 presentations were made, covering a gamut of interests. Almost all presentations reported applications and innovations that used otolith composition as a tool to answer questions not readily answered with more traditional techniques. Based on the results presented, some aspects of otolith chemistry have already proven to be very effective tools, having progressed well beyond the initial descriptive phase. Further improvements and applications appear inevitable.

Six major themes emerged from the oral and poster presentations. These can be summarized as follows:

1. *Use of Sr:Ca ratios as indicators of salinity history.* Many researchers presented Sr:Ca transects which left little doubt that migrations between freshwater, estuaries and saltwater had been accurately recorded. As a tool for reconstructing the chronology of diadromous migrations, otolith Sr:Ca ratios appear to be among the best available. In contrast, the use of Sr:Ca ratios for reconstructing temperature history was not reported.
2. *Age validations of long-lived fishes.* Radiochemical dating and bomb radiocarbon methods for validating the annulus-based age interpretations of long-lived fishes have become accepted approaches, yielding reliable results. Improvements in the precision of radiochemical ages were also reported, thus narrowing the range of alternative ages. Nevertheless, the point was made that radiochemical dating is best used to differentiate between widely disparate age interpretations.
3. *Elemental fingerprints as natural tags, not genetic identifiers.* Several presentations reported excellent discrimination among groups of fish based on the trace element and isotopic composition of their whole otoliths. As a natural tag for tracking movements over short periods of time, the elemental fingerprint would appear to be ideal. However, the evidence presented did not support the idea that the fingerprint was a proxy for genetic identity, or that the fingerprint of a given stock would necessarily remain stable over many years.
4. *Reconstruction of metabolic and temperature history.* Excellent progress was reported in the application of stable isotopes of carbon and oxygen as indicators of the fish's metabolic and temperature history, respectively. In particular, oxygen stable isotopes appear to provide unambiguous records of temperature history, especially where the isotopic composition of the water is known.
5. *Archaeology and palaeoclimatology.* Several presentations provided convincing reconstructions of palaeoclimate, based only on the elemental and isotopic composition of otoliths collected at archaeological sites. In many respects, otoliths in freshwater sites have begun to fill the role served by corals in marine locales as long-term indicators of climate history.
6. *Technological advancements.* Technological advancements were apparent in many of the presentations, ranging from the use of isotope dilution ICPMS in elemental assays to the use of TIMS for radium assays. However, the most obvious advancements were apparent in methods for high-resolution sampling of the otolith along a transect.

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Computer-controlled microsamplers used in stable isotope assays provided excellent spatial resolution for physical samples, while beam-based techniques such as the proton microprobe and laser ablation ICPMS have greatly increased sensitivity and resolution over that which was possible only a few years ago.

In general, there were some obvious differences between this session on Otolith Composition and that held at the first Otolith Symposium in 1993. Problems and findings which were purely descriptive or preliminary in 1993 are now considered routine; included in this category are approaches such as the use of Sr:Ca ratios for reconstructing salinity history, the use of ICPMS for determining the elemental fingerprint of whole otoliths, the use of bomb radiocarbon and ^{210}Pb:^{226}Ra ratios for the age validation of long-lived fishes, and the use of microsamplers, laser ablation ICPMS and proton microprobes for analyzing otolith composition along a transect. In contrast, some approaches which looked promising in 1993 have not met initial expectations. Examples of this include the use of Sr:Ca ratios as temperature proxies and the use of otolith elemental composition as a broad-scale pollution indicator. As more information is collected on the mechanisms underlying the incorporation of elements and isotopes into the otolith, and in light of recent rapid improvements in technology, the list of accomplishments in the 2003 session on Otolith Composition is likely to be quite different again.

S.E. Campana*
Marine Fish Division
Bedford Institute of Oceanography
PO Box 1006, Dartmouth, NS
Canada B2Y 4A2

W.-N. Tzeng
Dept. of Zoology, College of Science
National Taiwan University Taipei
Taiwan 106, PR China
Republic of chaina

*Corresponding author.