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Conference Abstract

A New Method to Access Isotopic Signatures on Preserved Fish Specimens

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Abstract

Isotopic ecology has been widely used to understand spatial connectivity and trophic interactions in marine systems, but comparisons over long time periods are rare. Preserved specimens from museum collections are a potentially valuable source of tissue for isotope analyses, but isotopic signatures are known to be affected by fixatives. Isotopic variation due to fixatives have being studied since the 1980s, with early work addressing zooplankton and increasing interest on fish tissues from the late 1990s. Although there is a general trend of decaying carbon ($\delta^{13}C$) values and small shifts in nitrogen isotopic values ($\delta^{15}N$) with fixation, there is no evident direction for the isotopic shifts of fish muscle due to fixative exposure over the studies. Moreover, most of the effects are seen in the first weeks of fixation and there is generally no subsequent trend over time. A few studies have demonstrated interactions between lipid content and the magnitude of isotopic shift. The aim of the present study is to generate a correction factor for the effects of fixative on isotopic signatures of fish muscle tissue, that incorporates lipid content. Two specimens of *Parapercis colias, Seriolella brama* and *Oncorhynchus tschawytscha* were sampled at five locations along their dorsal musculature, at three time periods:

1. fresh,
2. after one month preserved in formalin and
3. after three months fixed in either ethanol or isopropanol (one specimen each).

All samples were analysed for C:N ratio, $\Delta^{13}C$ and $\Delta^{15}N$. Isotopic changes due to formalin fixation were significantly affected by the factor SPECIES, but not sample LOCATION. Lipid content was positively correlated with C:N ratio (r^2=0.83) and had a significant effect on $\delta^{13}C$ after treatments, but not on $\delta^{15}N$. There was no difference between samples preserved in ethanol and isopropanol. After the 4 month experiment, 91 % of the variation of $\delta^{13}C$ and 96% of the variation in $\delta^{15}N$ were explained by a mixed model including the isotopic signature and C:N ratio (as a proxy for lipid content) from the preserved specimens. This new approach can be applied to uncover ecological shifts over time and create baselines of already impacted ecosystems. Isotopic signatures of preserved *Nemadactylus macropterus* prior to 1970 were analysed and compared with fresh samples from the Otago region, showing a decrease in trophic level and a shift to a more pelagic food web over time.

Keywords

Isotopic ecology, fixative effects, hitorical specimens data, trophic dynamic shift, collection access

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