Effects of fluid preservation on sea star stable isotope composition: How useful can museum collections be for trophic ecology studies?

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Stable isotope analyses (SIA) of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) are a common tool to investigate the trophic ecology of marine organisms. After field sampling, animal tissues are usually preserved frozen or dried before subsequent analysis. However, museum samples, or samples not initially collected for SIA, are often fixed in preservative solutions. These preservation methods may alter stable isotope ratios in tissues and these effects should be quantified. Here, we investigated long-term effects (1, 3, 6, 9 and 12 months) of four preservation methods (freezing, alcohol, formaldehyde, drying) on $\delta^{13}C$ and $\delta^{15}N$ values of sea stars. In particular, we tried to assess the influence of preservation on the isotopic niches. We observed that only formaldehyde preservation significantly affected $\delta^{13}C$ values, leading to strong reduction of the overlap between the isotopic niche of the fresh samples and those of the preserved samples. A correction factor was designed to manage this issue. $\delta^{15}N$ values changed across time for all methods except freezing but this may be the result of a higher intra-individual variability of $\delta^{15}N$ values. Bayesian estimations of the standard ellipse areas (SEA_B) of preserved and fresh samples were not significantly different, except for the samples preserved 6 months in alcohol. These two results lead to reduction of the overlap between the isotopic niche of the fresh samples and those of the preserved samples across time. These preliminary results suggest that samples stored during one year in preservative fluids may be used for SIA. Future results will determine whether this can be generalised to sea stars preserved for a longer time, such as those in museum collections.

Keywords: stable isotopes; sea star; preservation