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

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1. Introduction

Stable isotope analyses of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) are a common tool to investigate marine food webs functioning

Organisms stored in museums sampled during past periods with environmental conditions different from today

→ Possibility to use them for stable isotope analyses to study past food webs?

→ Does preservation method alter stable isotope ratios? No study on sea stars

Objective: To investigate the influence of preservation methods on C and N stable isotope ratios in sea stars

2. Material and methods

n = 20 sea stars (*Marthasterias glacialis*)

Analysis of stable isotope ratios in dissected tegument:

- One arm: **t0 = 0 month** (drying and immediate grinding)

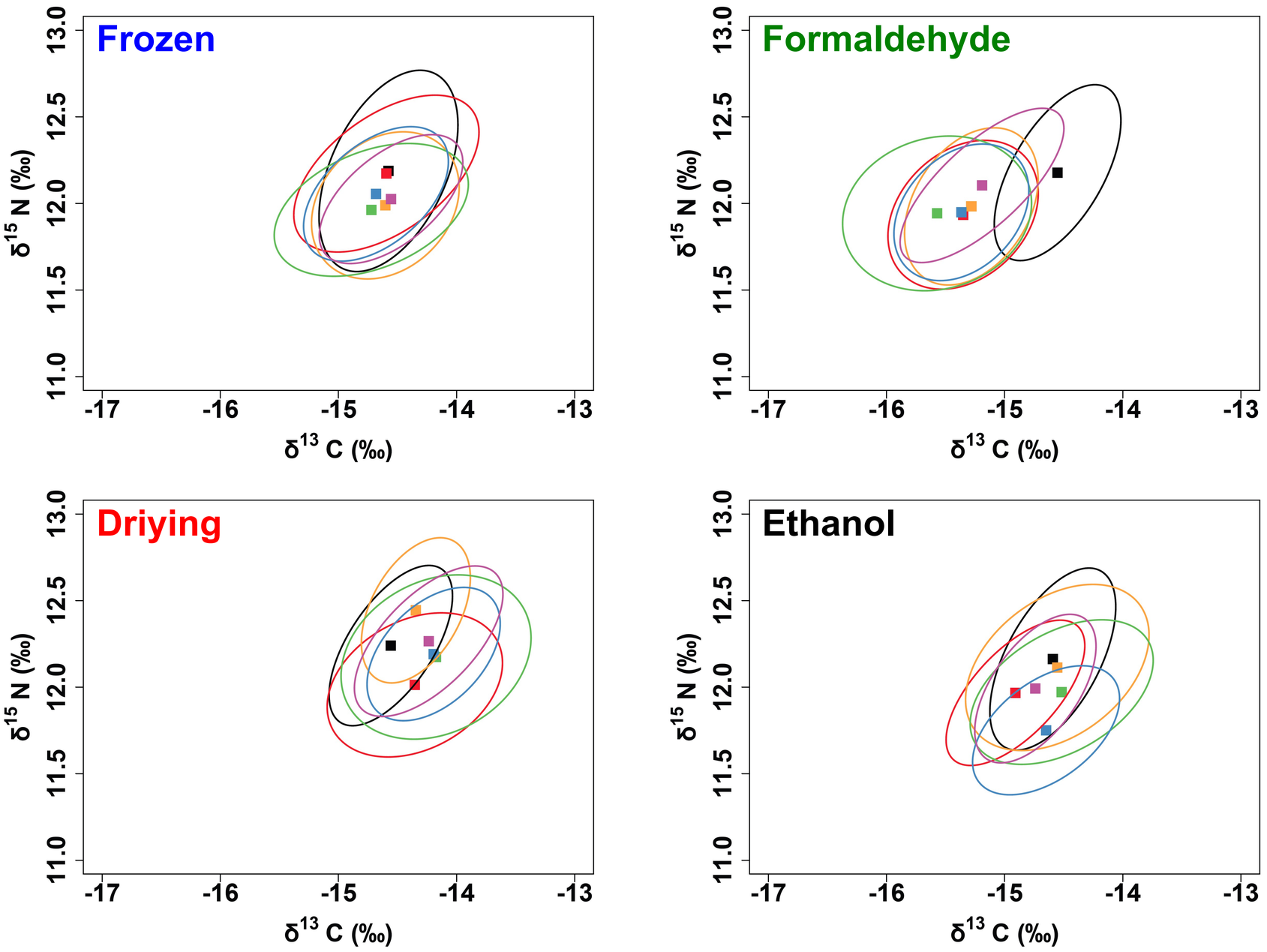
- Other arms: **preservation treatments** (**freezing** at –28°C, 3.7% **formaldehyde**, 99.8% **ethanol**, **drying**)

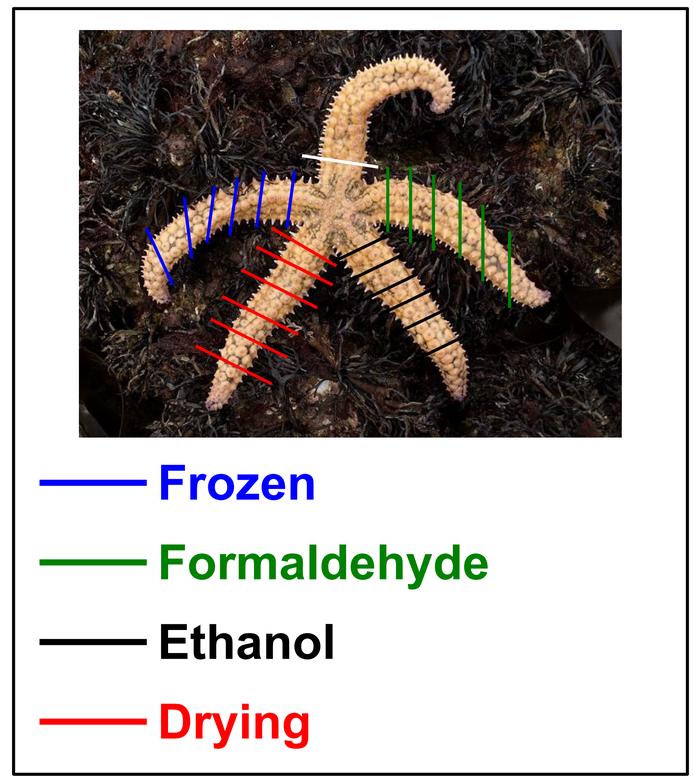
- Arms sections randomly assigned to **time** of grinding and analysis (1 to 12 months)

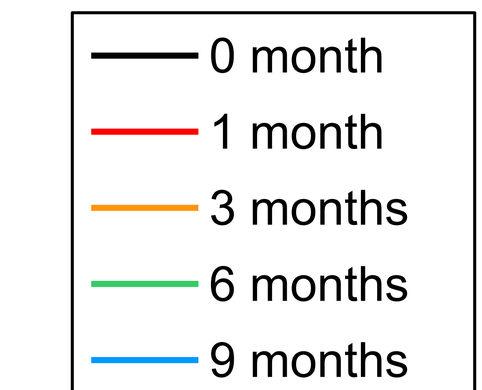
Comparison to t0 of mean stable isotope ratios and isotopic niche (proxy of trophic niche) areas of preserved samples

Estimation of the overlap between t0 and preserved samples

3. Results







Evolution of $\delta^{13}C$ and $\delta^{15}N$ mean values (‰, squares) and isotopic niche (ellipses) during 12 months of preservation

Formaldehyde: **immediate decrease and then stability** of $\delta^{13}C$ values (-0,8 ± 0,5 ‰)
→ very low overlap between t0 and preserved samples

No $\delta^{13}C$ values significantly different from the control for the other methods; **No** significant nor consistent pattern for **changes of $\delta^{15}N$ values**
→ yet, sufficient to reduce the overlap between t0 and preserved samples

No significant change of isotopic niche area except at 6 months for samples preserved in ethanol

4. Discussion

Non-consistent pattern of changes of stable isotope values and reduced overlap → variation of isotopic ratios in individual sea stars, minor preservation-induced variation or analytical error

Formaldehyde: Possibility to use **a same correction factor for $\delta^{13}C$** no matter how long samples have been preserved

Conclusions:

- Samples stored **frozen**, in **ethanol** or **dried** may be used to study past trophic ecology of sea stars.

- Samples stored in **formaldehyde** may be used after using a correction factor.

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