

Effects of fluid preservation on sea star stable isotope compositions: Can museum collections be used for trophic ecology studies?

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1. Introduction

Stable isotope analyses of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) 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 treatment alter stable isotope ratios? No study on sea stars

Objective: To investigate the influence of preservation treatments on C and N stable isotope ratios in *Marthasterias glacialis*

2. Material and methods

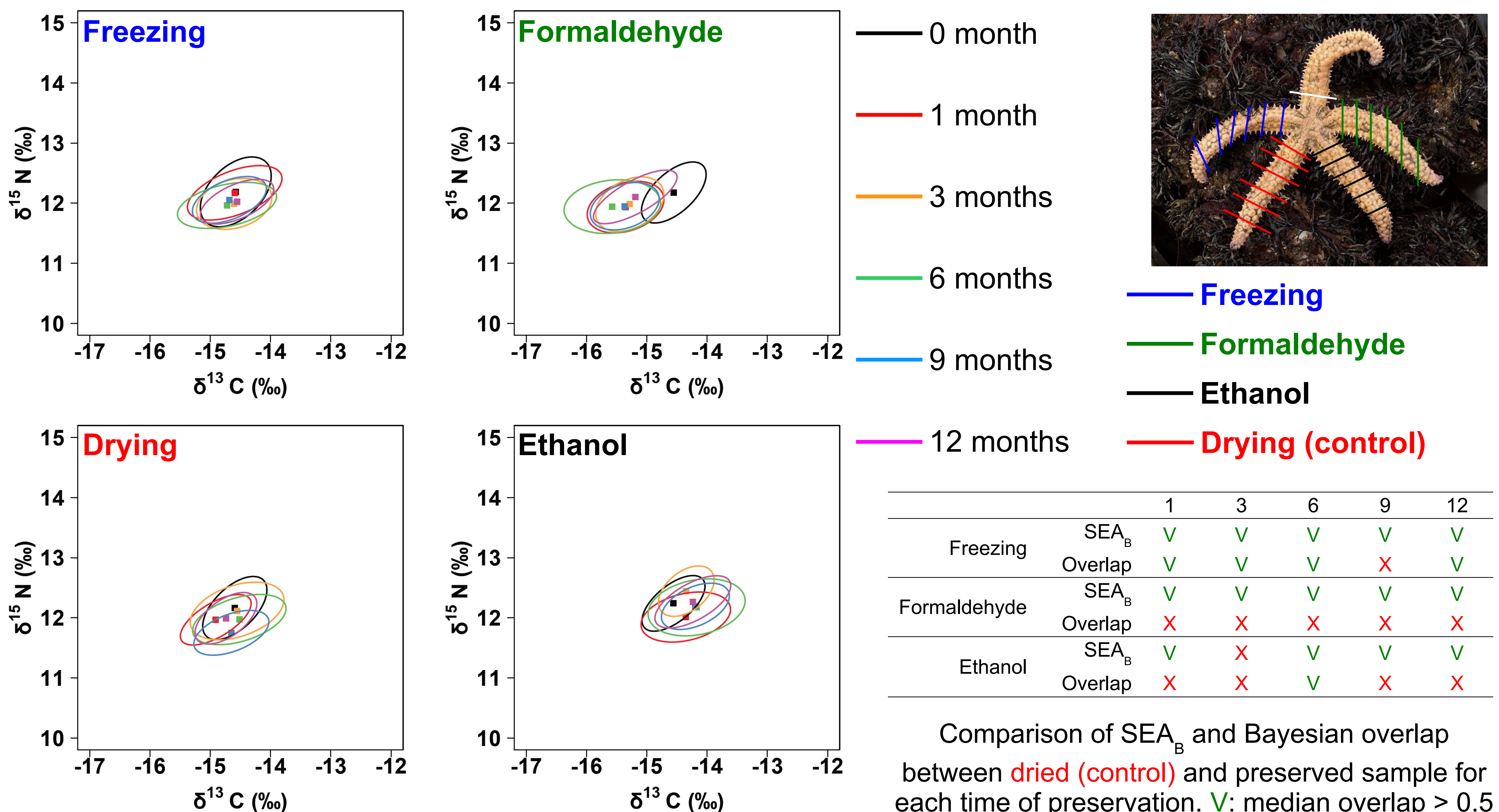
Analysis of stable isotope ratios in dissected tegument of 20 sea stars:

- One arm: **t0 = 0 month** (drying and immediate grinding)
- Other arms: **preservation treatments = freezing** at -28°C , 3.7% **formaldehyde**, 99.8% **ethanol**, **drying (control)**
- Arms sections randomly assigned to **time** of grinding and analysis (1 to 12 months)

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

Estimation of the overlap between t0 and preserved samples

3. Results



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

		1	3	6	9	12
Freezing	SEA_B	V	V	V	V	V
	Overlap	V	V	V	X	V
Formaldehyde	SEA_B	V	V	V	V	V
	Overlap	X	X	X	X	X
Ethanol	SEA_B	V	X	V	V	V
	Overlap	X	X	V	X	X

Comparison of SEA_B and Bayesian overlap between **dried (control)** and preserved sample for each time of preservation. V: median overlap > 0.5 or SEA_B not significantly different, X: median overlap < 0.5 or SEA_B significantly different

Formaldehyde: immediate decrease and then stability of $\delta^{13}\text{C}$ values (-0.8 ± 0.5 ‰)

→ very low overlap between t0 and preserved samples

for the other treatments, **no $\delta^{13}\text{C}$ values significantly different** from the control; **No** significant nor consistent pattern for **changes of $\delta^{15}\text{N}$ values**

→ yet, sufficient to reduce the overlap between t0 and preserved samples

For all treatments, **no significant change from t0 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 $\delta^{13}\text{C}$** no matter how long samples have been preserved

Take home message: Can museum collections be used for trophic ecology studies?

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

- **Yes**, but samples stored in **formaldehyde** may be used **after using a correction factor**.