Seasonal sampling and stable isotopes use to delineate seagrass phytodetritus macrofauna trophic ecology: baseline variation or actual diet change?

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What is « exported macrophytodetritus accumulation »?

Posidonia oceanica

seagrass

Macro-algae

P.oceanica dead leaves

Micro-organisms

P.oceanica living leaves

« Dead leaves litter »

50-90 %

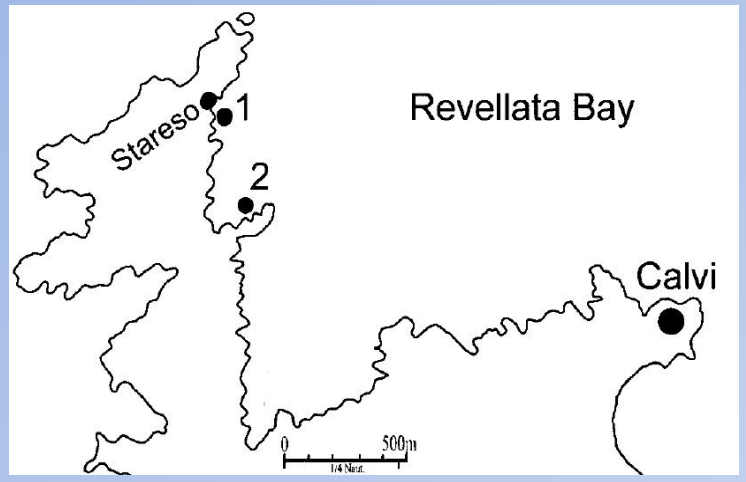
exported

Aim?

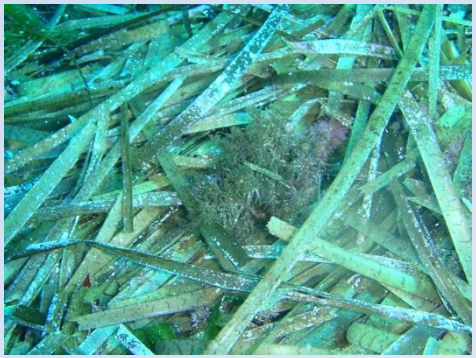
Aim of the study :

- Determine if the vagile macrofauna community experiences spatio-temporal changes of its isotopic composition
- Determine whether these variations are due to real diet modifications, or only due to isotopic baseline shifts.

Sampling techniques



- Sampling in August 11, November 11, March 12 and June 12
- 2 different sites (10m depth)
- Litter + macrofauna

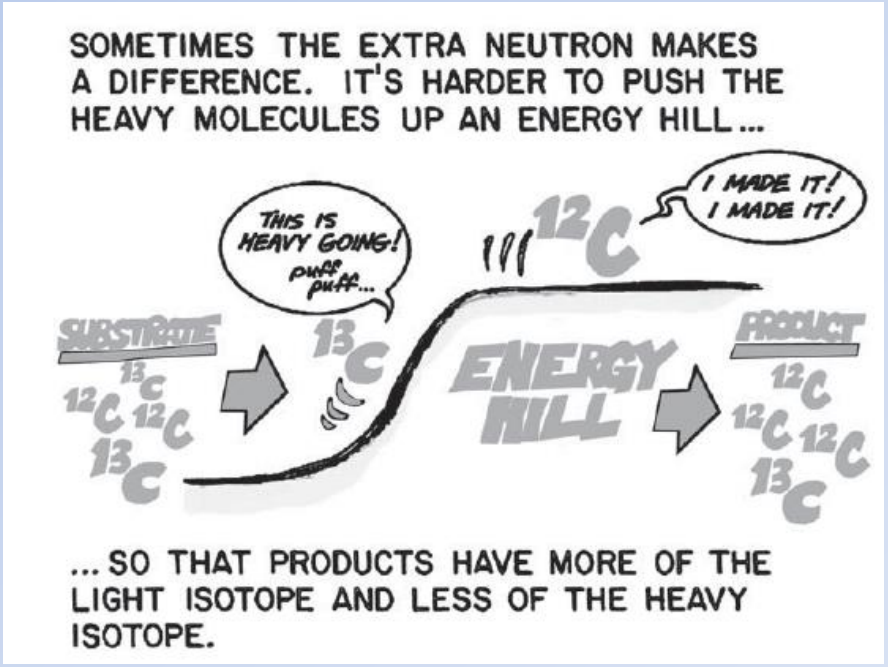


Why use N and C “stable isotopes”?

^{12}C	^{13}C	^{14}C
12.00000	13.00335	14.0
98.89%	1.11%	$t_{1/2}$ = 5715yrs
Stable	Stable	Radioactive Cosmogenic/ anthropogenic

^{14}N	^{15}N
14.00307	15.0001
99.63%	0.37%
Stable	Stable

➔ “Fractionation”



➔ Differences between food webs components

Why use N and C “stable isotopes”?

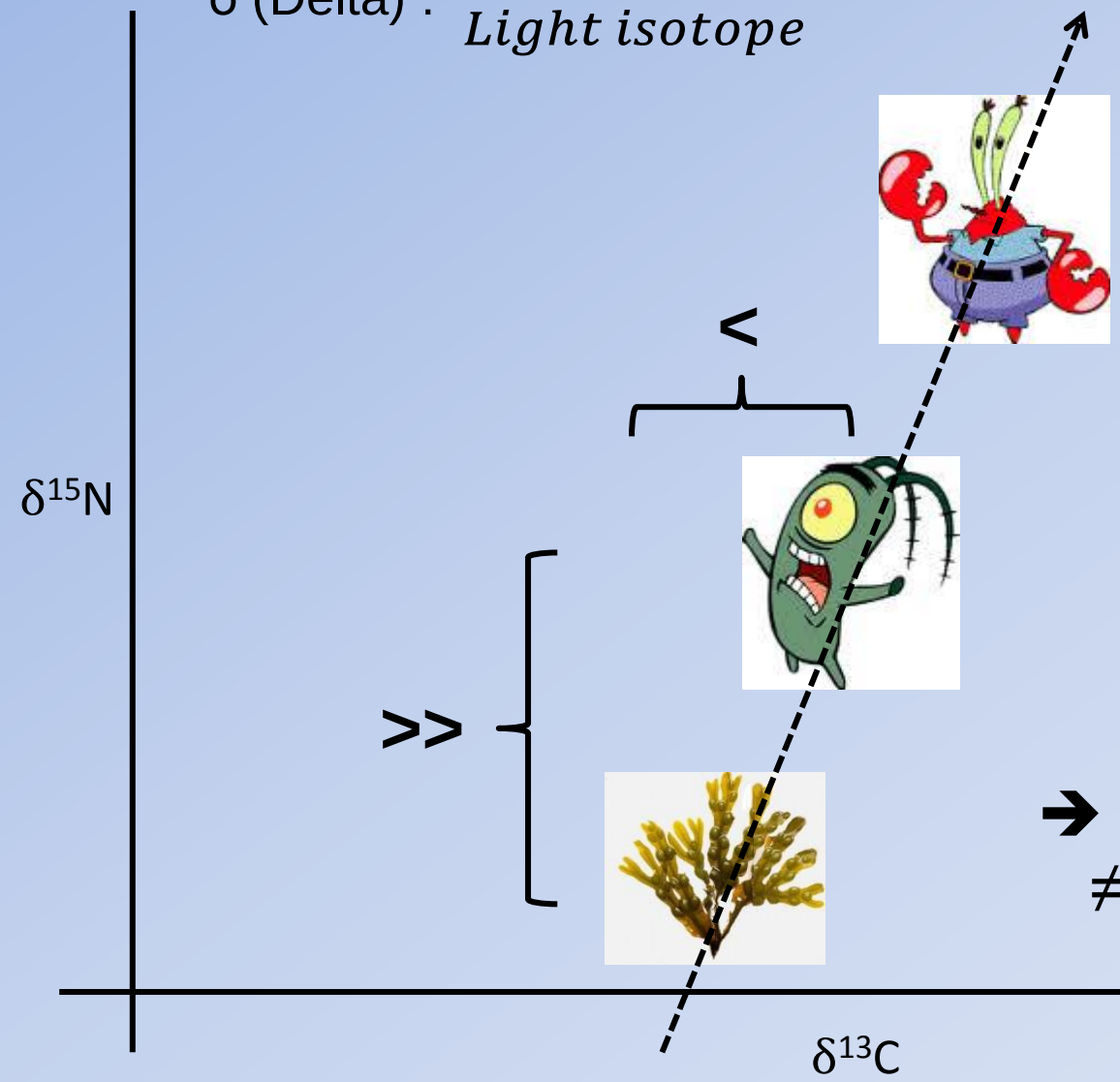
➔ Main rule in isotopic ecology :

“You are what you eat, plus (or minus) a few permill…” (DeNiro & Epstein 1976)

Why use N and C “stable isotopes”?

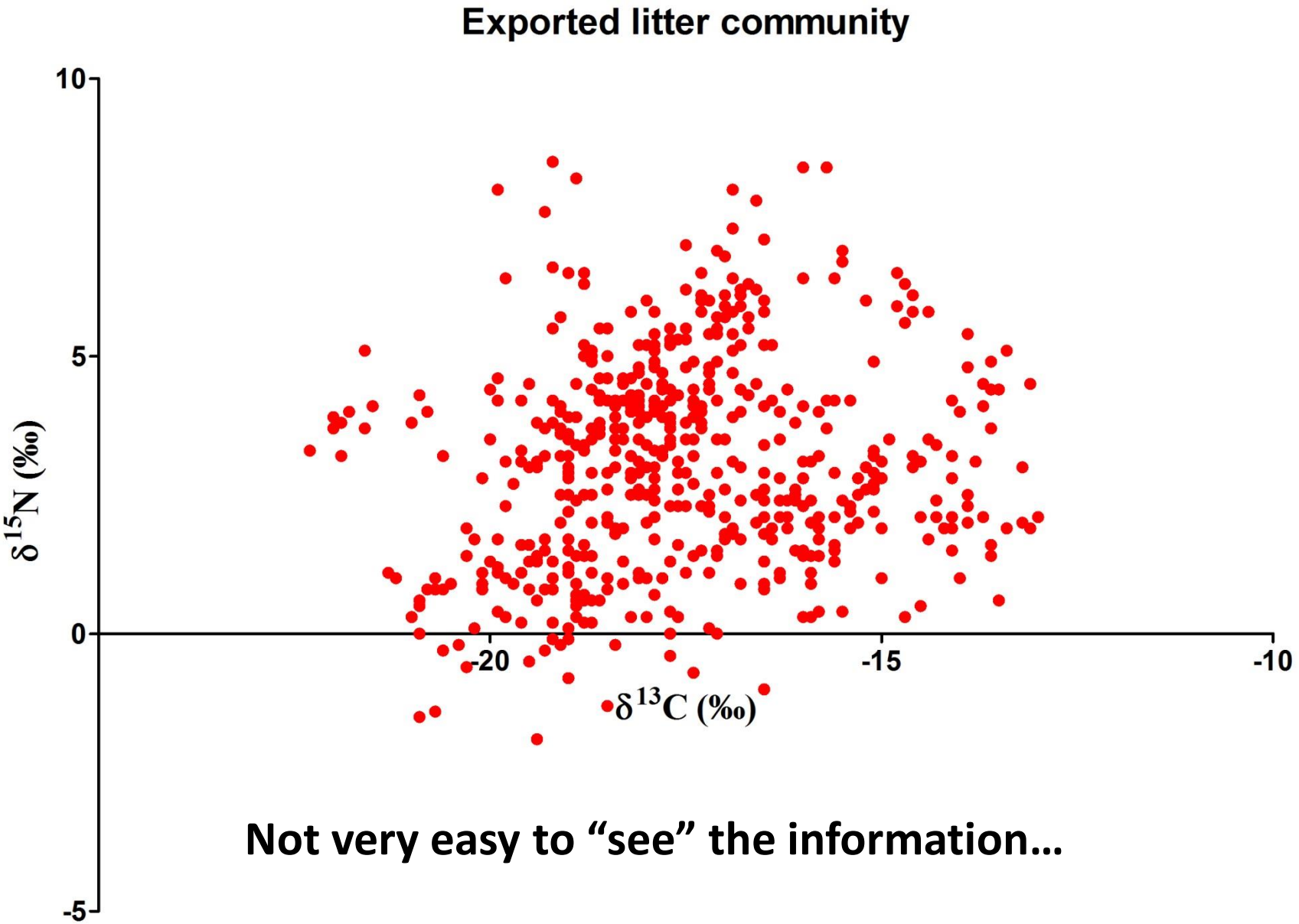
δ (Delta) : $\frac{Heavy\ isotope}{Light\ isotope}$

- **$^{13}C/^{12}C$** = food marker
- **$^{15}N/^{14}N$** = trophic level/ food marker



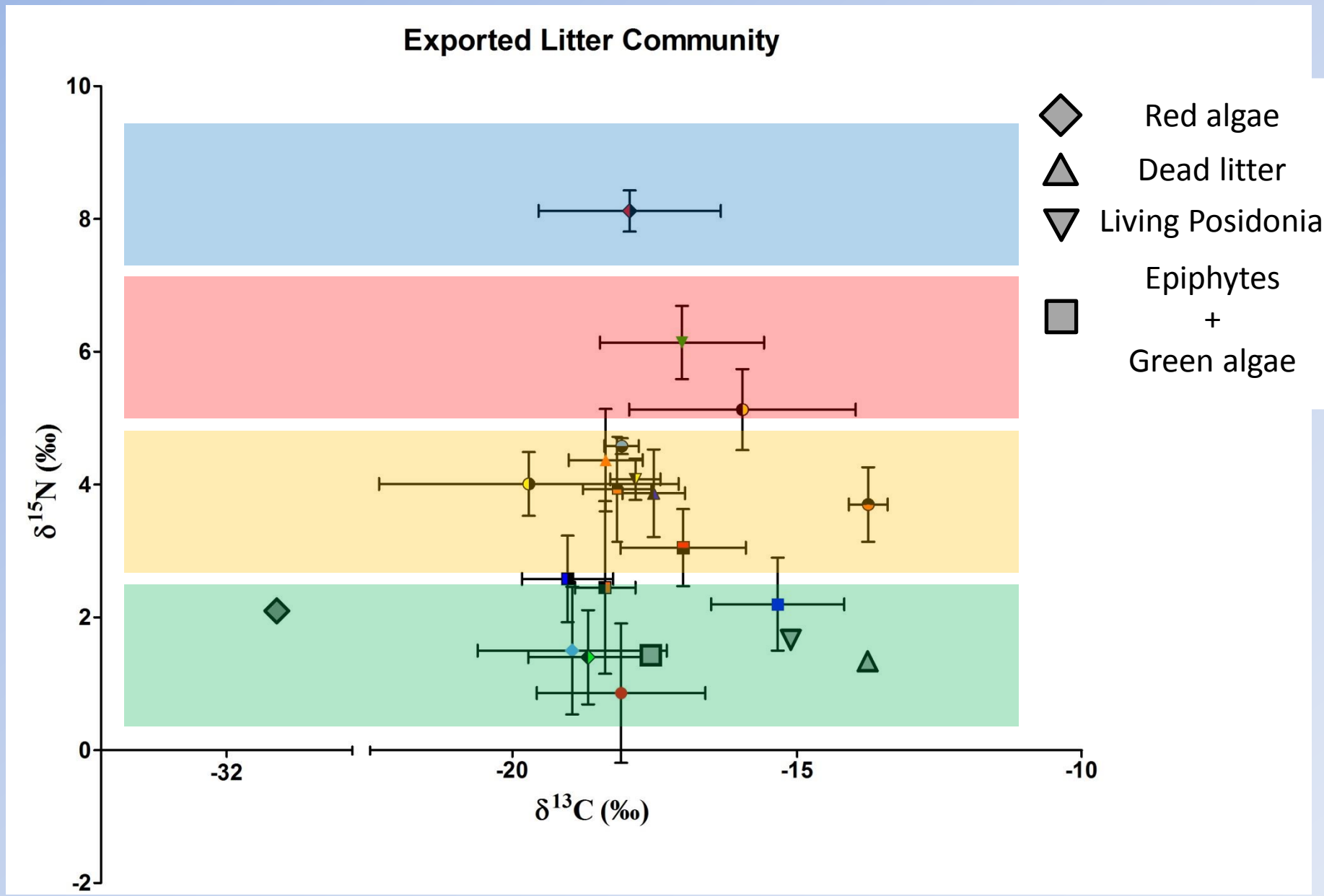
➔ Food source composition ≠ consumer composition

Results : the global community



Not very easy to “see” the information…

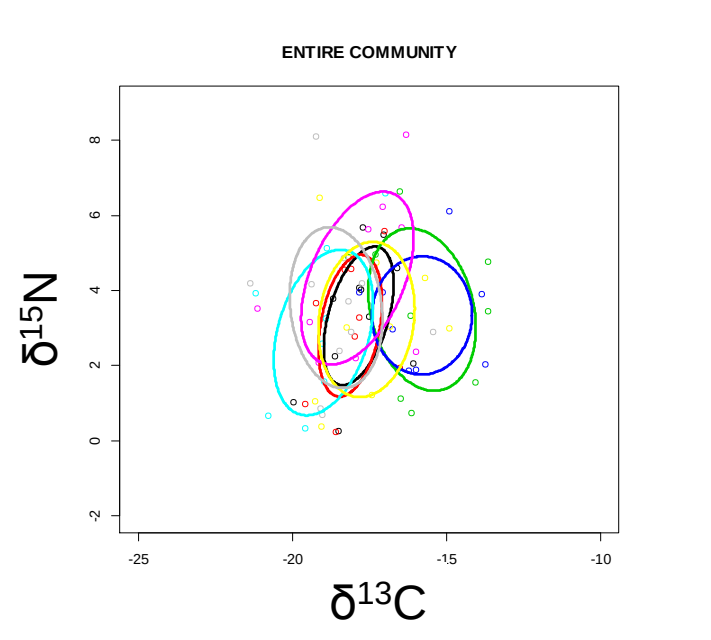
Results : the global community



SIBER model

Good to give the position, shape and are of “isotopic niches” of different species inside a community, or of an entire community

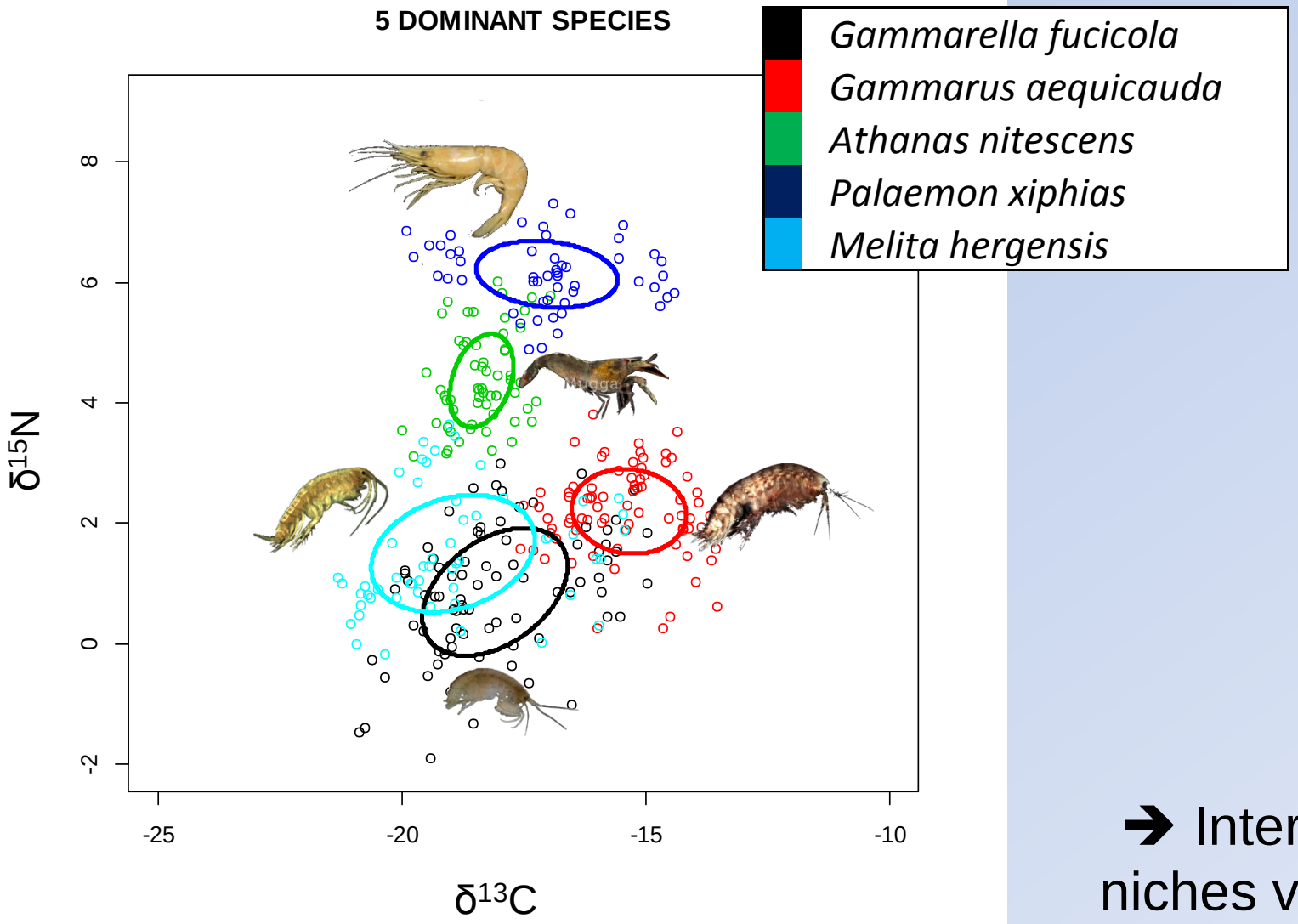
Less sensitive to sample size than Layman metrics
➔ good for our use



- Standard ellipses areas
- Comparison of ares
- Measure of overlap

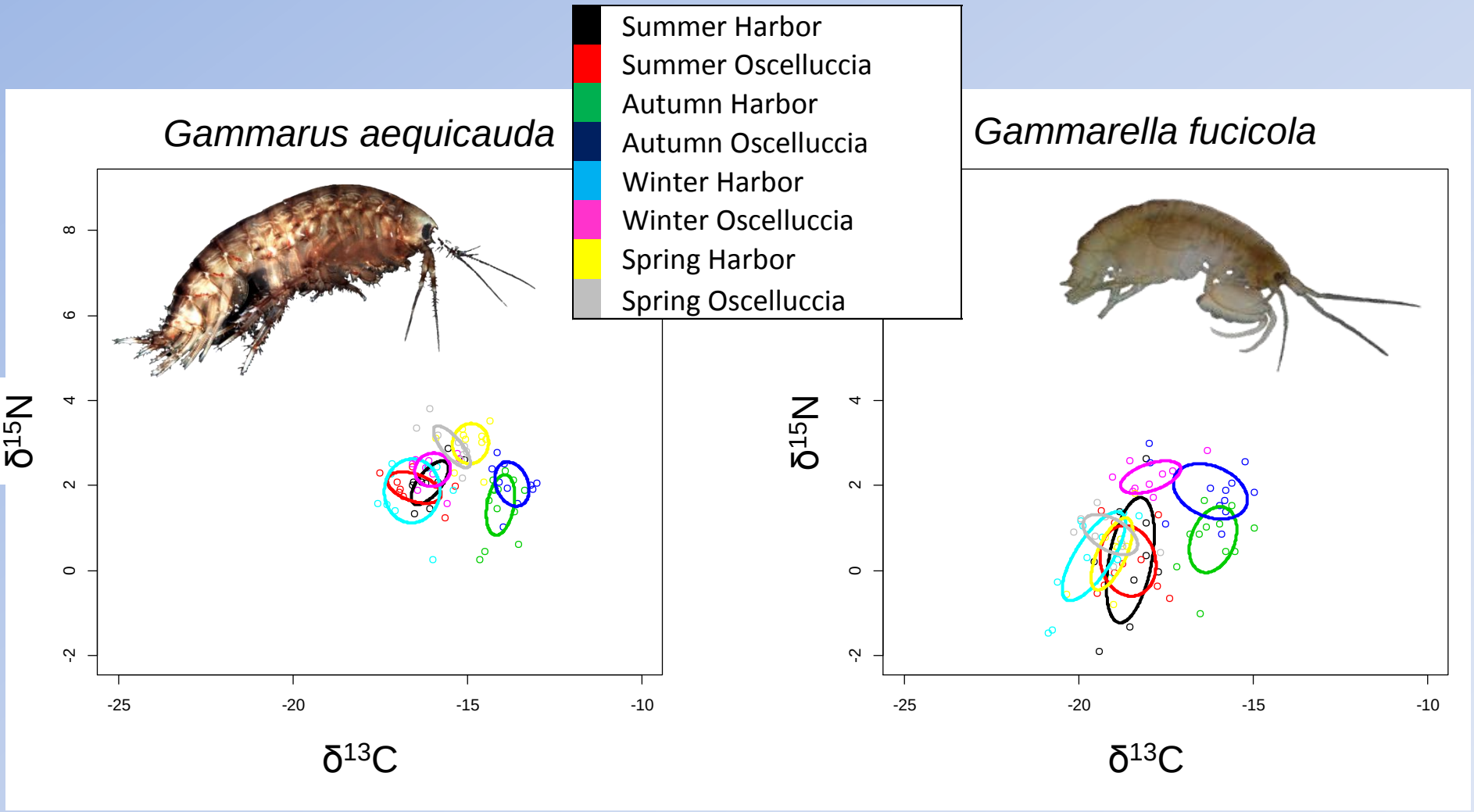
…

Results : SIBER model run



➔ Interspecific niches variations

Results : SIBER model run



➔ Spatio-temporal intraspecific level niche variations

Okay BUT…

But… are these differences reflecting a diet change, or only a food sources basline shift?

SIAR Bayesian mixing model

Reality : always different potential food sources

Need to solve the question

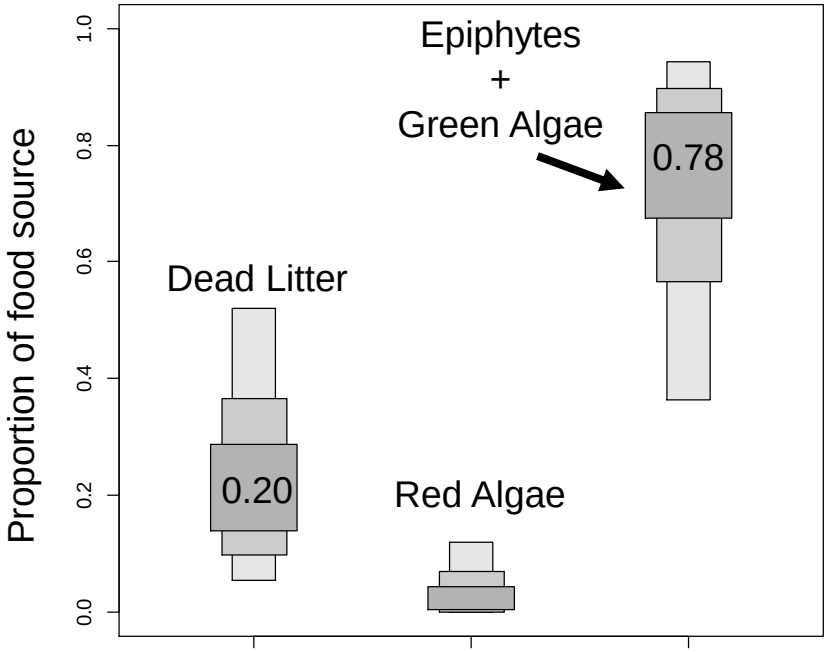
➔ Mixing models ➔ SIAR

$\delta^{15}N$

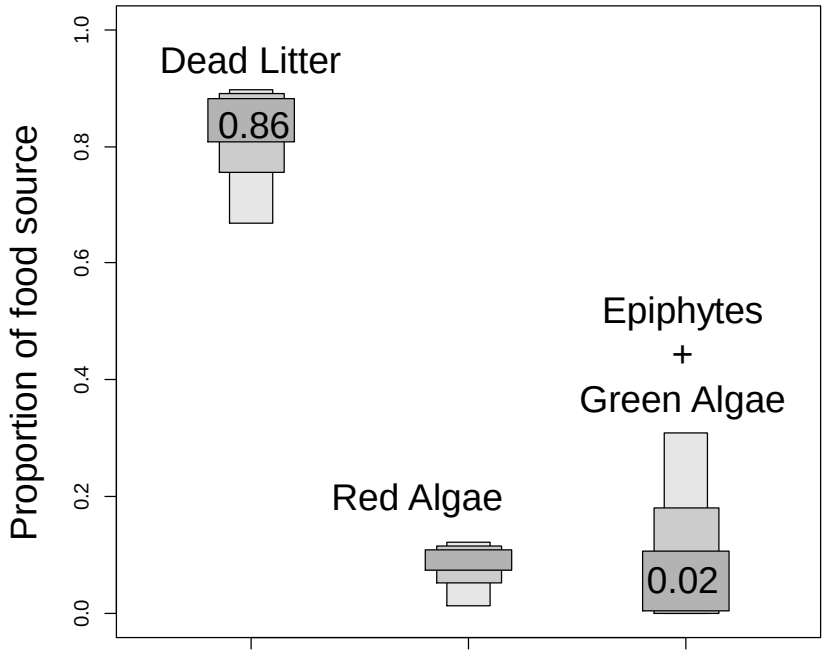
$\delta^{13}C$

SIAR mixing model run

Gammarus aequicauda, **summer**, site 1



Gammarus aequicauda, **autumn**, site 1



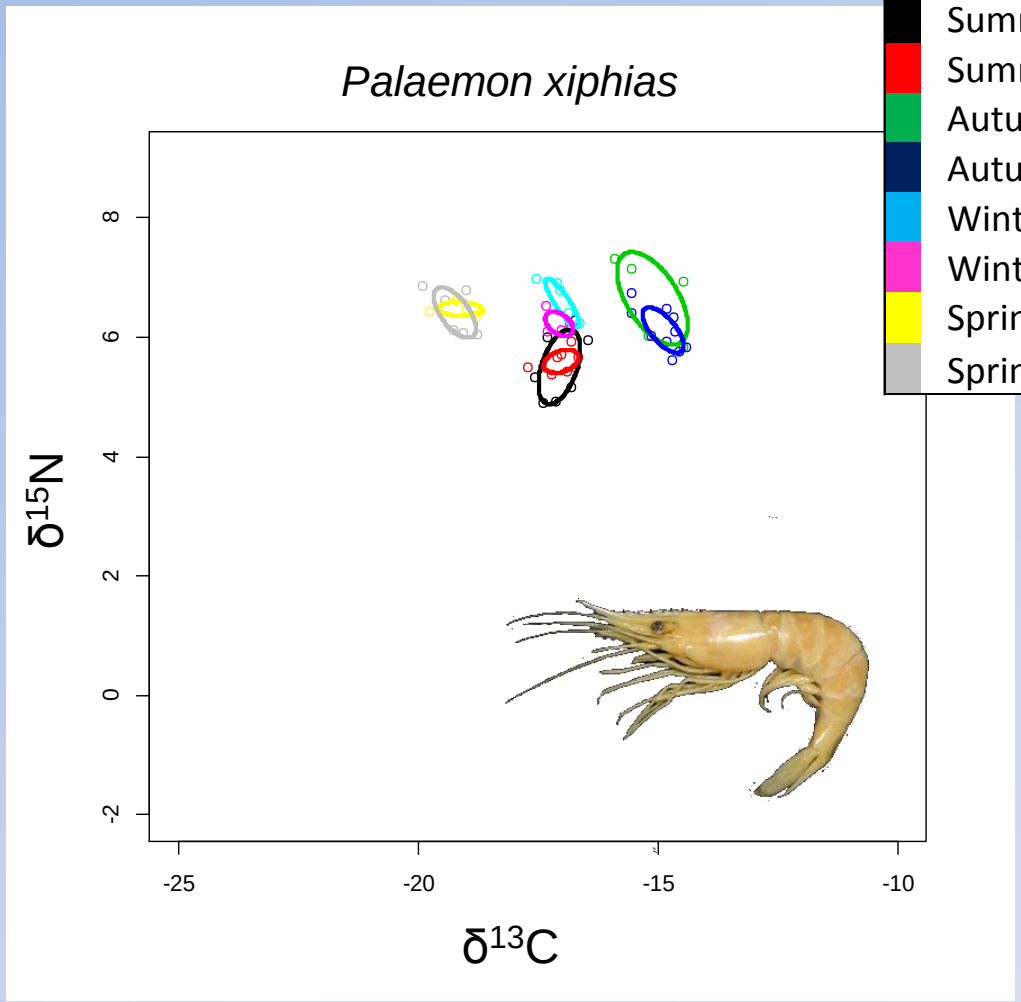
➔ Drastic changes even if the model takes baseline variations into account

Real diet change independently of food sources isotopic composition!

SIAR mixing model run

Okay for one species but… is it the case for all the community?

Obviously not ➔ each species reacts differently to litter dynamic conditions



Same intraspecific niche variations…

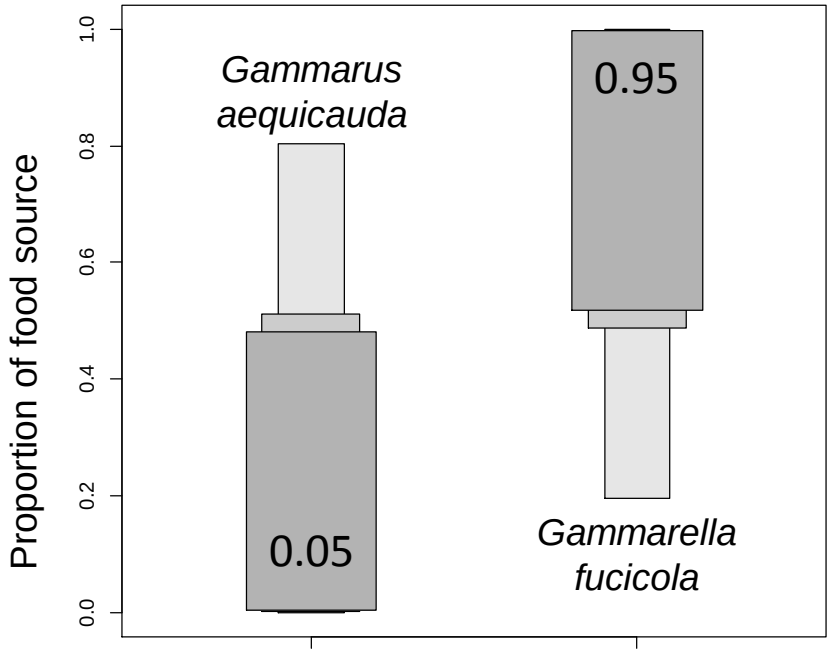
BUT…

SIAR mixing model run

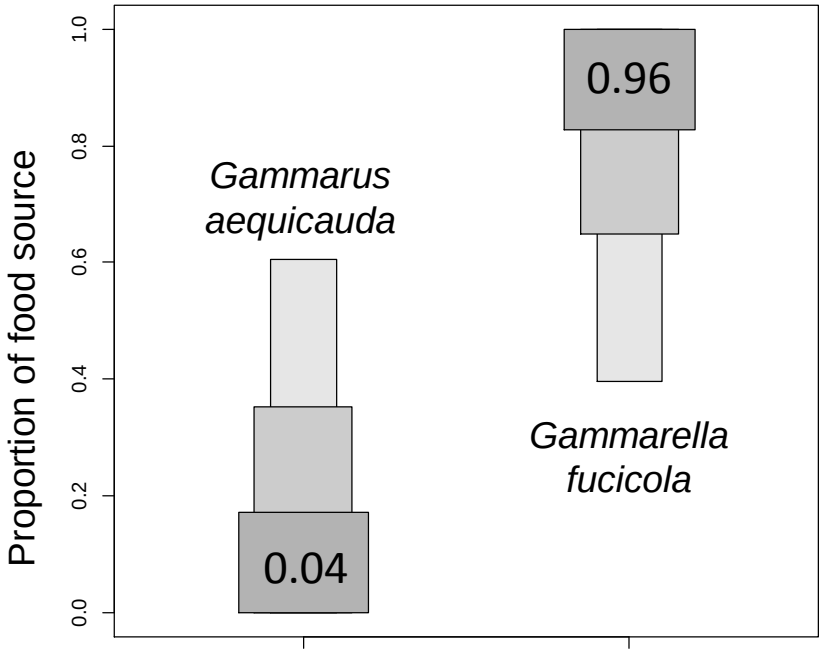
➔ Uncertainty differs, but no apparent change of the diet

Predatory shrimp ➔ eats the same preys➔ diet of preys differ ➔ indirect effect

Palaemon xiphias, **summer**, site 1



Palaemon xiphias, **autumn**, site 1



Take home message

- Mixing models like **SIAR** and **SIBER** are powerful tools for trophic ecologists
IF PROPERLY USED

- Exported litter macrofauna ➔ isotopic niches modification at **community**, **specific**, and **intraspecific** level

- Niche variations may be related to real and important **diet modifications**

BUT…

- Need to work at a specific level

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