Latest news in genetic and isotopes

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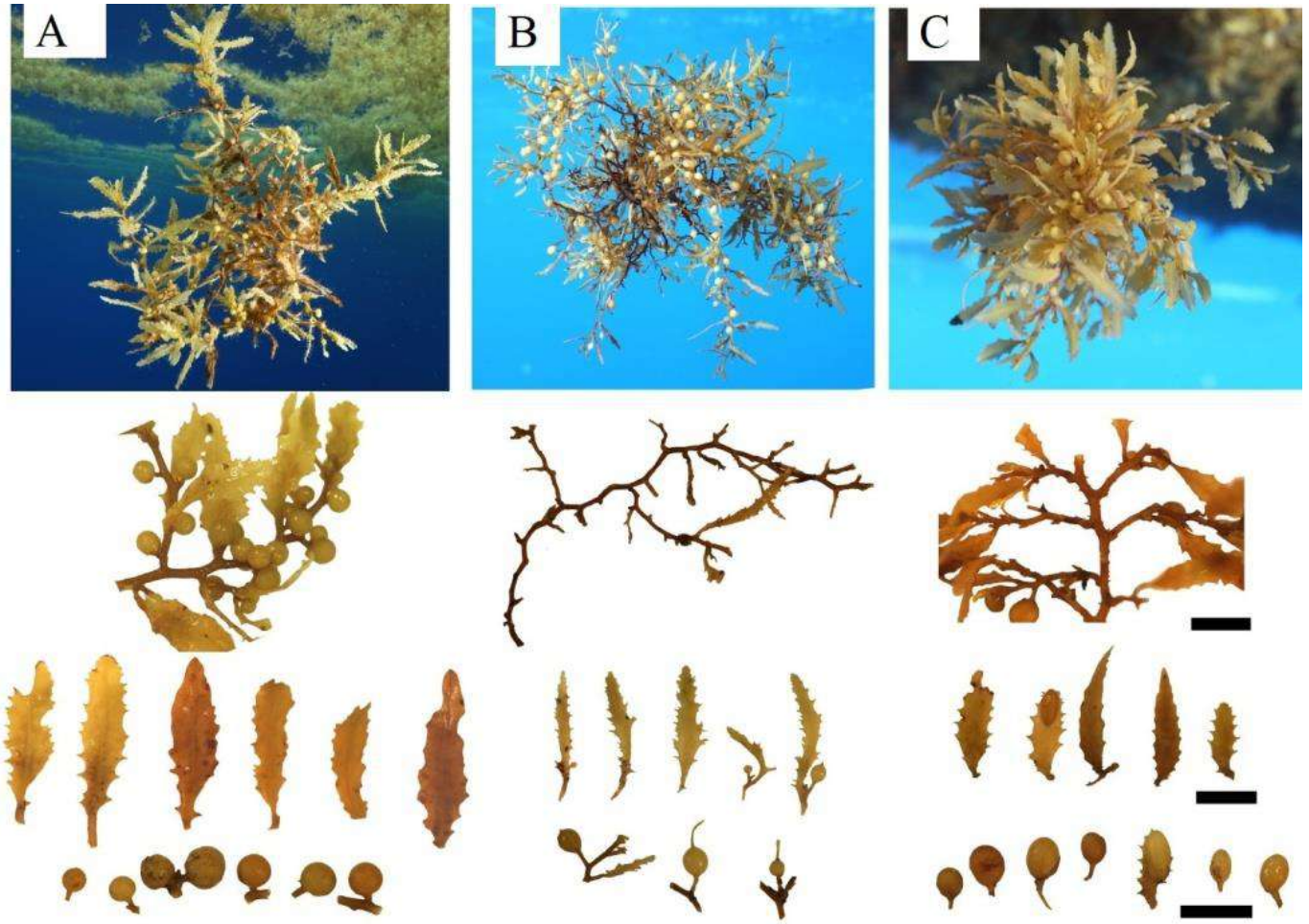
1.Identification
Lastest news

3 morphotypes found in all the North Atlantic Ocean and since 2011 they form the Great Atlantic Sargassum Belt



Sargassum natans VIII *Sargassum natans* I *Sargassum fluitans* III

Sample collection

264 Holopelagic *Sargassum* specimens were collected in 2017 +**135** *Sargassum* samples collected from 2015 to 2019 by Sea Education Association (SEA) for genetic analysis. All vouchers are kept at SEA and MIO

Morphological analysis

264 individuals analysed ; **20 characters** observed and measured. nMDS and Permanova was performed. We used S17 Bray-Curtis similarity distance.

Phylogenetic analysis

3 mitochondrial markers (cox3, mt16S rRNA gene and nad6 gene) were used to examine genetic difference among the 3 morphotypes (for more details see Dibner *et al.*, 2022)

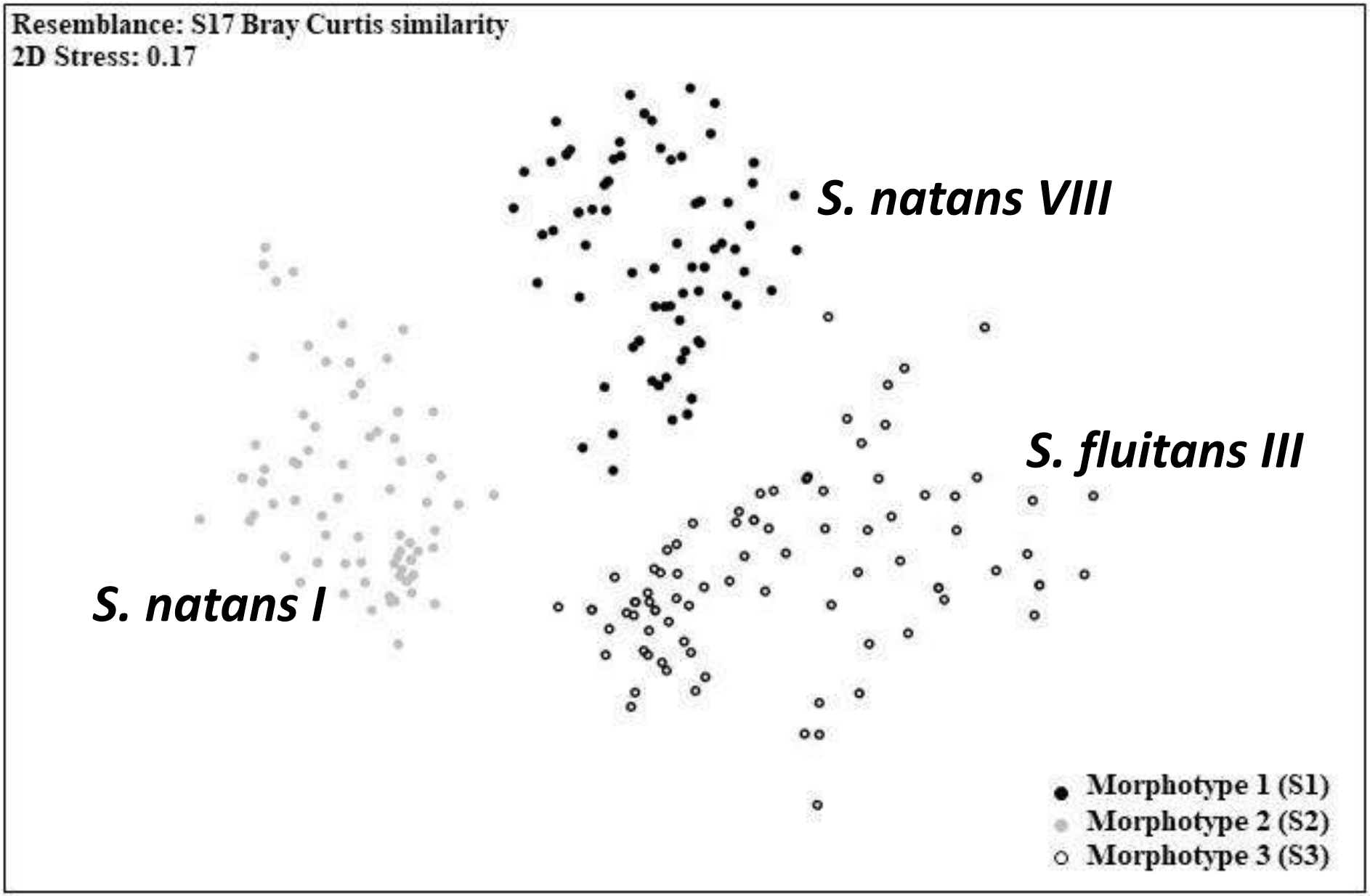
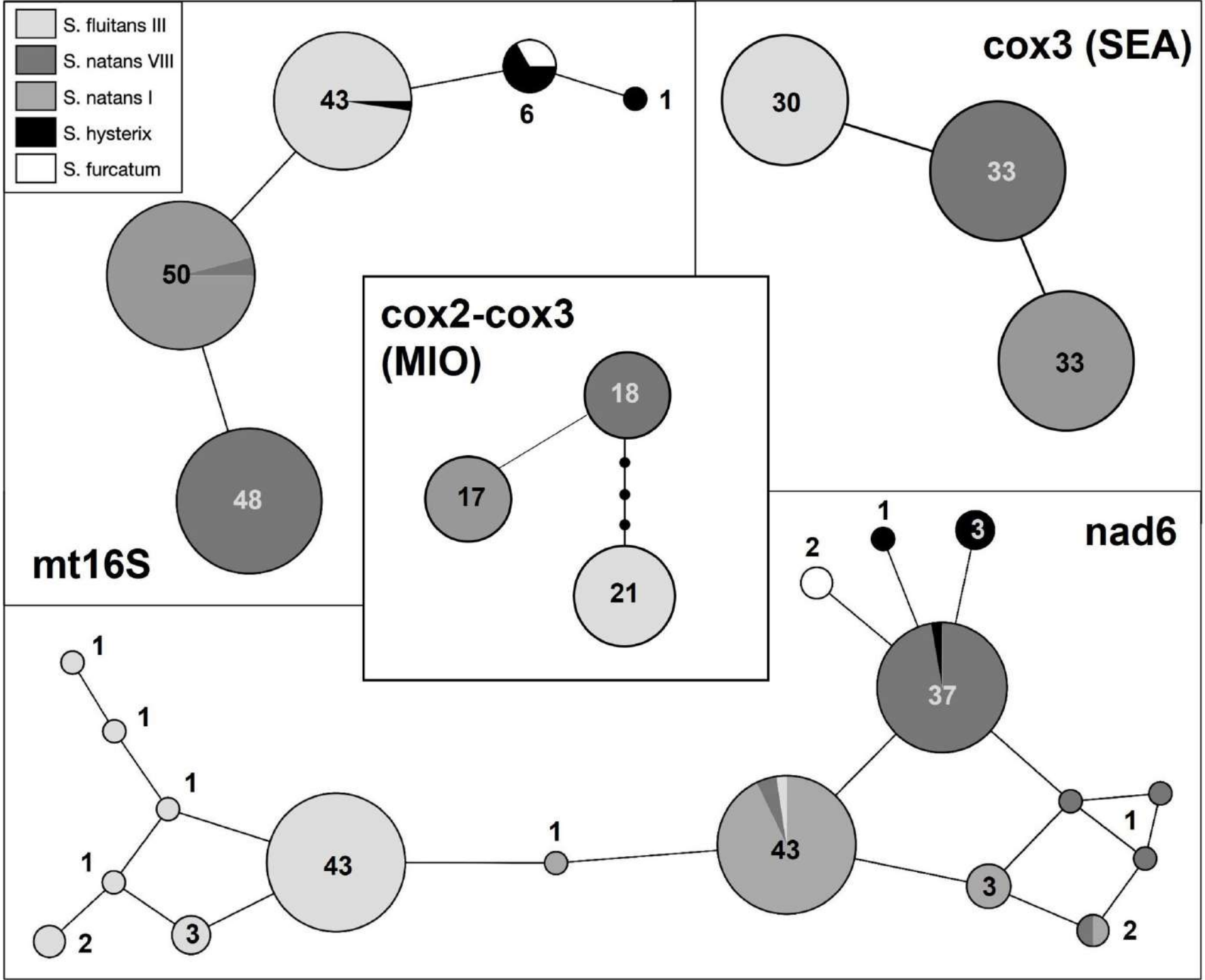

Resemblance: S17 Bray Curtis similarity
2D Stress: 0.17
S. natans VIII
S. fluitans III
S. natans I
Morphotype 1 (S1)
Morphotype 2 (S2)
Morphotype 3 (S3)

Table 1. Permutation multivariate analysis of variance (PERMANOVA) and Pair-Wise test, based on the morphological characters of pelagic specimens of *Sargassum* collected during the two 2017 campaigns (after a square root transformation of the data, and using S17 Bray Curtis similarity).

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Morphotype	2	77756	38878	175.73	0.001	998
Residual	252	55752	221.24			
Total	254	1.3351E5				

Groups	t	P(perm)	Unique perms	P(MC)
S. natans VIII, S. natans I	14.306	0.001	999	0.001
S. natans VIII, S. fluitans, III	10.59	0.001	999	0.001
S. natans I, S. fluitans, III	14.93	0.001	999	0.001


S. fluitans III
S. natans VIII
S. natans I
S. hysterix
S. furcatum
mt16S
43
6
1
50
48
cox2-cox3
(MIO)
18
17
21
cox3 (SEA)
30
33
33
nad6
1
3
2
37
1
1
1
1
1
43
1
43
1
3
2
3
2

Usually same morphology and genetic difference = cryptic species

Here the contrary ! Probably due to the clonal aspect = plasticity but not “à mémoire de forme”

2. What is the influence of the morphotype and the location on the C and N isotopic ratio in the pelagic Sargassum?

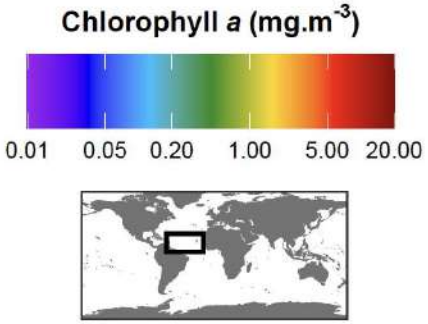
Sampling campaigns

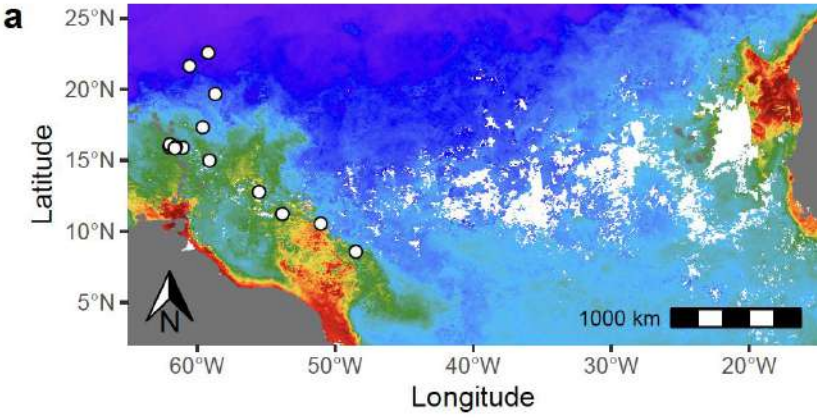
10th June-11th July 2017

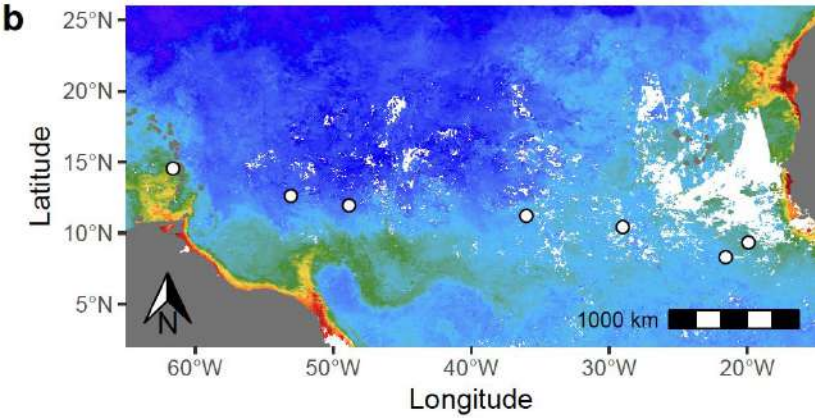
13 locations sampled
3 specimens/morphotype

22nd September – 20th October 2017

7 locations sampled
3 specimens/morphotype



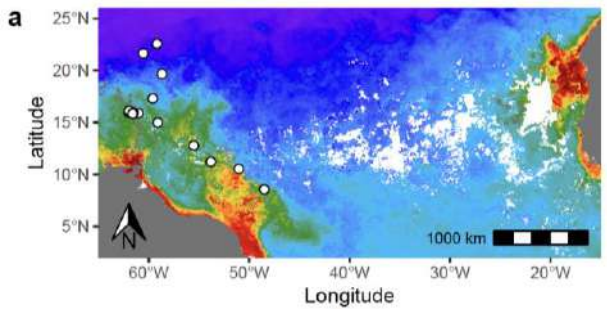




181 samples were freeze-dried and then ground

⇒For each sample, a sub-sample (~2 mg) was encapsulated in a tin capsule
⇒ analyzed with an elemental analyzer (Flash EA 2000, Thermo Scientific, Milan, Italy) coupled to a mass spectrometer (Delta V+ with a conflo IV interface, Thermo Scientific, Bremen, Germany) at the Ocean Spectrometry Center (Plouzané, France)

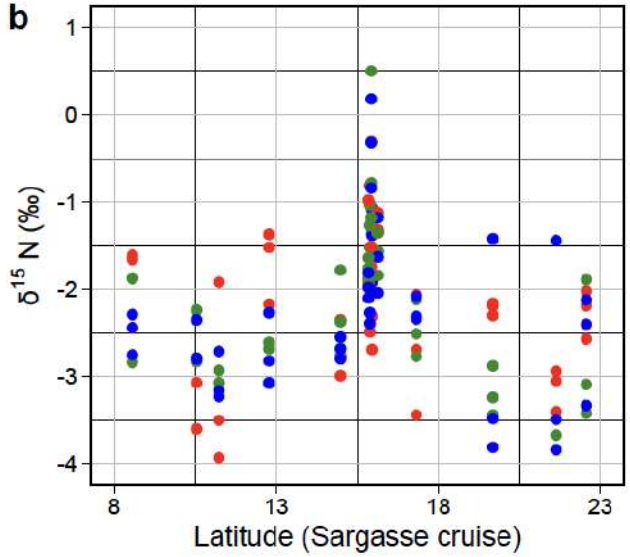
$\delta^{15}N$



Sargassum natans VIII

Sargassum natans I

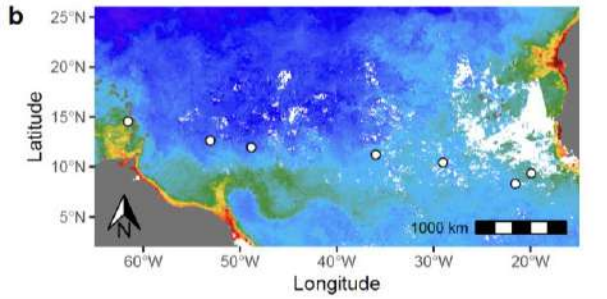
Sargassum fluitans III



Neither the latitude nor the morphotype influence $\delta^{15}N$

Ancova **$\delta^{15}N$ (‰)**

	df	F	P
Morphotype	2,118	0.120	0.887
Latitude	1,118	0.670	0.415
Morphotype:Latitude	2,118	0.112	0.894

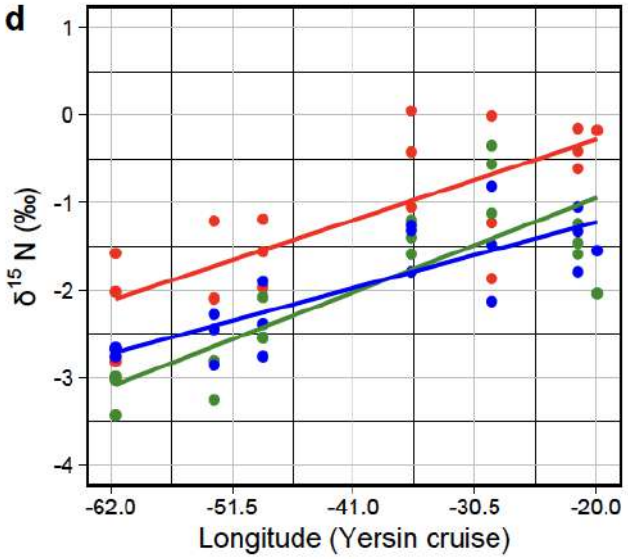


$\delta^{15}N$

Sargassum natans VIII

Sargassum natans I

Sargassum fluitans III



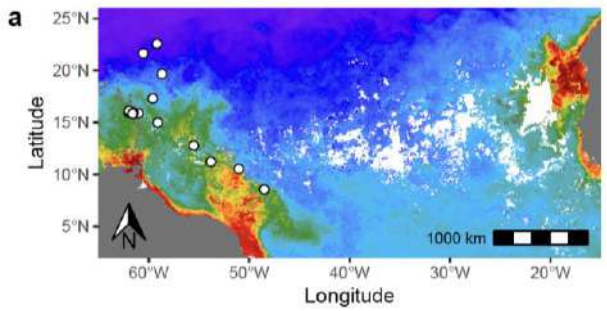
Influence of the longitude on $\delta^{15}N$

Decrease of $\delta^{15}N$ from East to West

No influence of the morphotype

$\delta^{15}N$ (‰)

	df	F	P
Morphotype	2,51	2.635	0.081
Longitude	1,51	**91.572**	**< 0.001**
Morphotype:Longitude	2,51	0.960	0.390

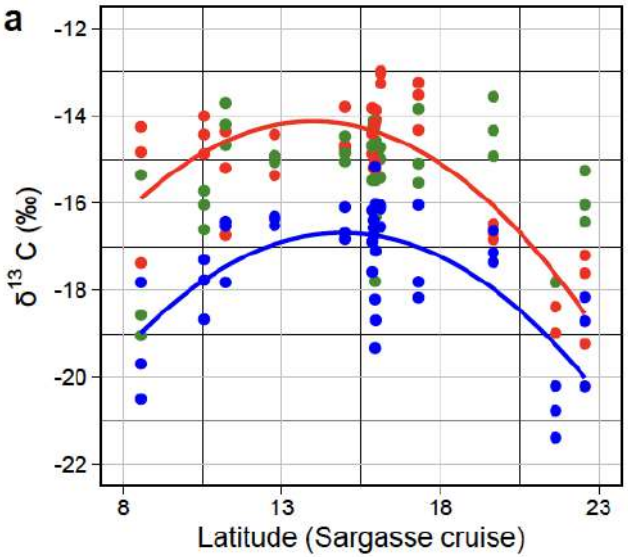


$\delta^{13}C$

Sargassum natans VIII

Sargassum natans I

Sargassum fluitans III



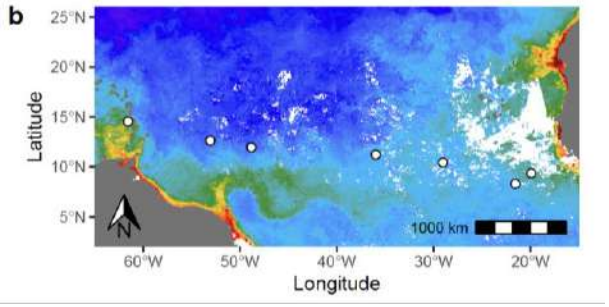
Influence of the latitude and the morphotype on $\delta^{13}C$

$\delta^{13}C$ is lower within *S. fluitans* III than in both *S. natans*

Maximum at 16 °C near the lesser Antillas

Ancova **$\delta^{13}C$ (‰)**

	df	F	P
Morphotype	2,118	**41.031**	**< 0.001**
Latitude	1,118	**12.034**	**< 0.001**
Morphotype:Latitude	2,118	**5.941**	**0.003**

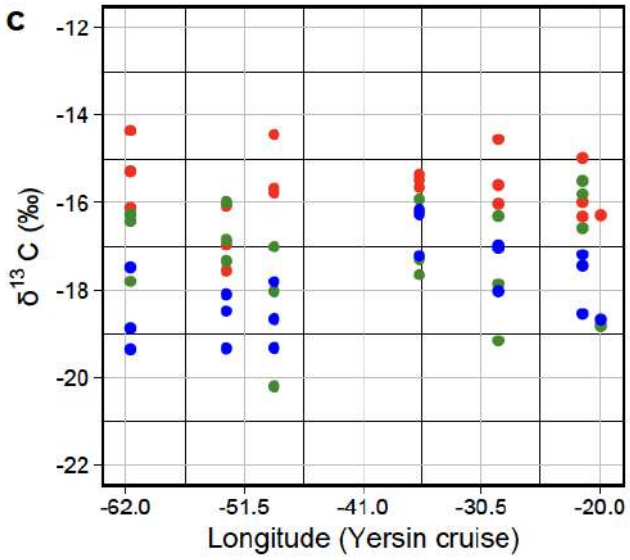


$\delta^{13}C$

Sargassum natans VIII

Sargassum natans I

Sargassum fluitans III



Neither the latitude nor the morphotype influence $\delta^{13}C$

$\delta^{13}C$ (‰)

	df	F	P
Morphotype	2,51	1.121	0.245
Longitude	1,51	1.382	0.334
Morphotype:Longitude	2,51	1.002	0.374

$\delta^{13}C$

- $\delta^{13}C$ in aquatic plants may be related to the carbon source used for photosynthesis
- $\delta^{13}C < -30$ ‰ exclusively use CO_2 which is low in C_{13} ($\delta^{13}C = -7.8$ ‰)
- $\delta^{13}C > -10$ ‰ exclusively use HCO_3^- ions enriched in C_{13} ($\delta^{13}C = 0$ ‰)
- -30 ‰ $< \delta^{13}C < -10$ ‰ could use both CO_2 & HCO_3^-

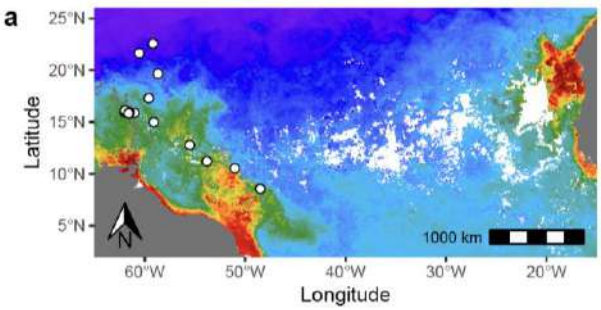
(Raven *et al.*, 2022)

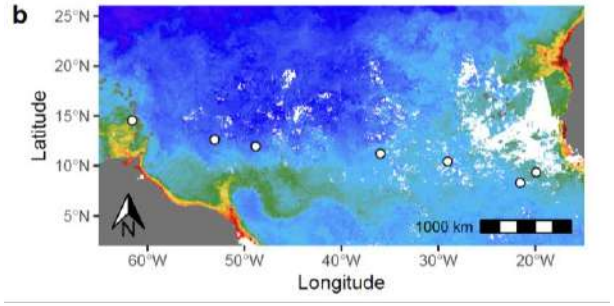
-21 ‰ $< \delta^{13}C < -11$ ‰ in holopelagic Sargassum

⇒**Switch in C source**

⇒**High $\delta^{13}C$ values may indicate an higher use of HCO_3^-**

⇒ **depletion of CO_2 in the algal boundary layer when strong growth (higher around the Caribbean, and lower offshore)**





⇒**water movement, within raft CO_2 is rapidly depleted**

$\delta^{15}N$

- $\delta^{15}N$ in aquatic plants is related to the source of nitrogen
- positive $\delta^{15}N$ - N from up-welling, coastal origin
- negative $\delta^{15}N$ – N from animal excretion
- very negative $\delta^{15}N$ – N_2 fixed from diazotrophy

(Montoya *et al.*, 2008)

$-4‰ < \delta^{15}N < 0.5‰$ in holopelagic Sargassum

⇒Dominance of diazotrophy (cf. Matéo's talk)

but also uptake of N

⇒from the associated fauna

⇒from up-welling

⇒from coastal water run-off

⇒N is never a factor of limitation