

SPATIAL-TEMPORAL STUDY ON STABLE ISOTOPE SIGNATURES IN EPIFAUNA AND SYNGNATHID FISHES FROM CÍES ARCHIPELAGO (ATLANTIC ISLANDS NATIONAL PARK, NW SPAIN)

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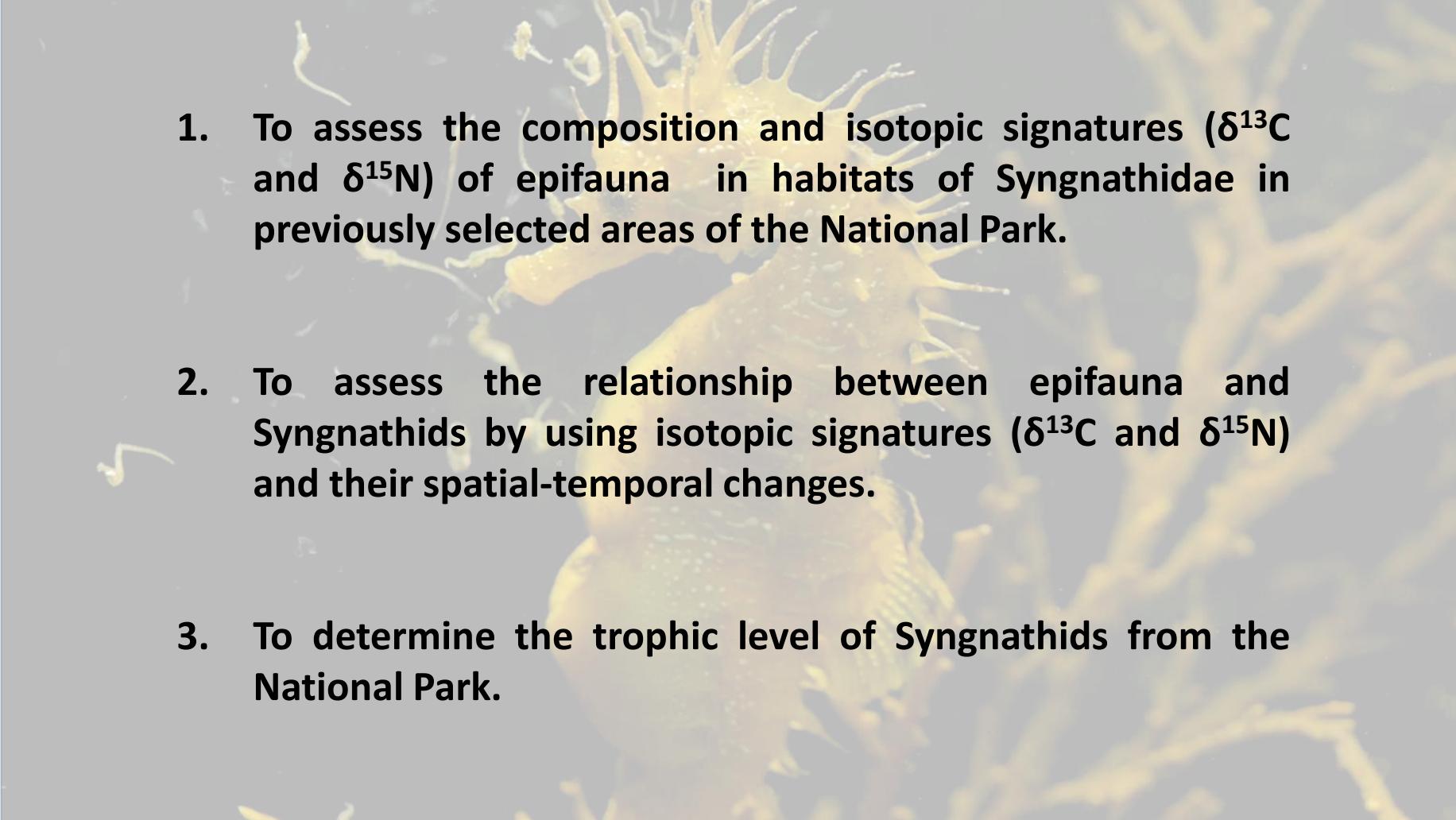
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Specific objectives

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- 1. To assess the composition and isotopic signatures ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) of epifauna in habitats of Syngnathidae in previously selected areas of the National Park.**
 - 2. To assess the relationship between epifauna and Syngnathids by using isotopic signatures ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) and their spatial-temporal changes.**
 - 3. To determine the trophic level of Syngnathids from the National Park.**



Stable isotope analysis - SIA

The central conjecture of SIA in trophic ecology is perhaps best represented by the observation “**You are what you eat (plus a few per mil)**” (DeNiro & Epstein 1976)

SIA $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ integrate dietary components and provide an average of an organism's preferred diet.

Provides info about trophic interactions of fish in aquatic food – webs

- $\delta^{15}\text{N}$ is used to define the trophic levels (**TL**) of organism

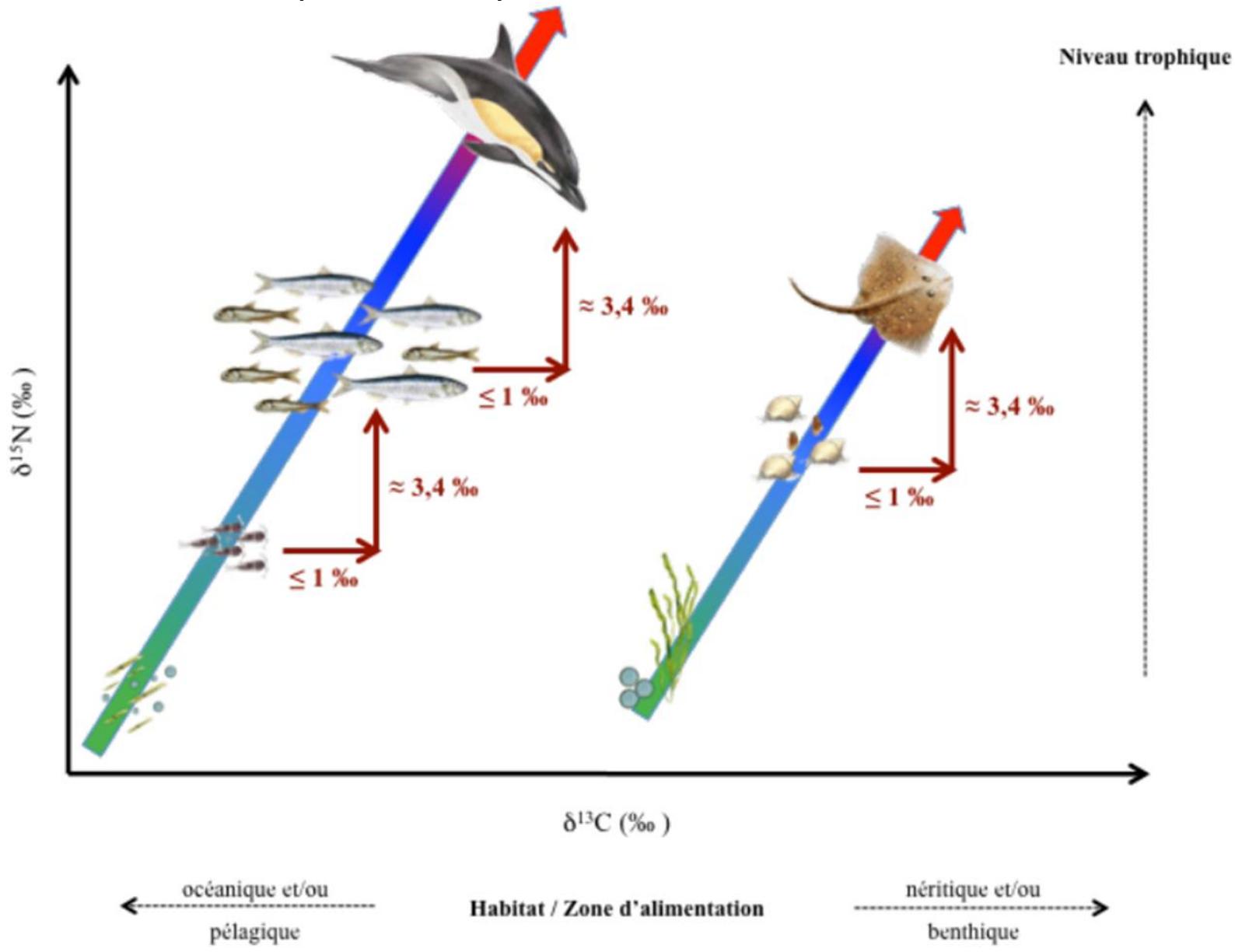
Tl	Trophic class
5	Top predator
4	Secondary consumer
3	Secondary consumer
2	Primary consumer
1	Primary producer

- $\delta^{13}\text{C}$ acts as indicator of sources of production (marine or terrestrial)
- Enrichment factor: 3.4‰ $\delta^{15}\text{N}$ and ~ 1‰ $\delta^{13}\text{C}$.

Syngnathid fishes



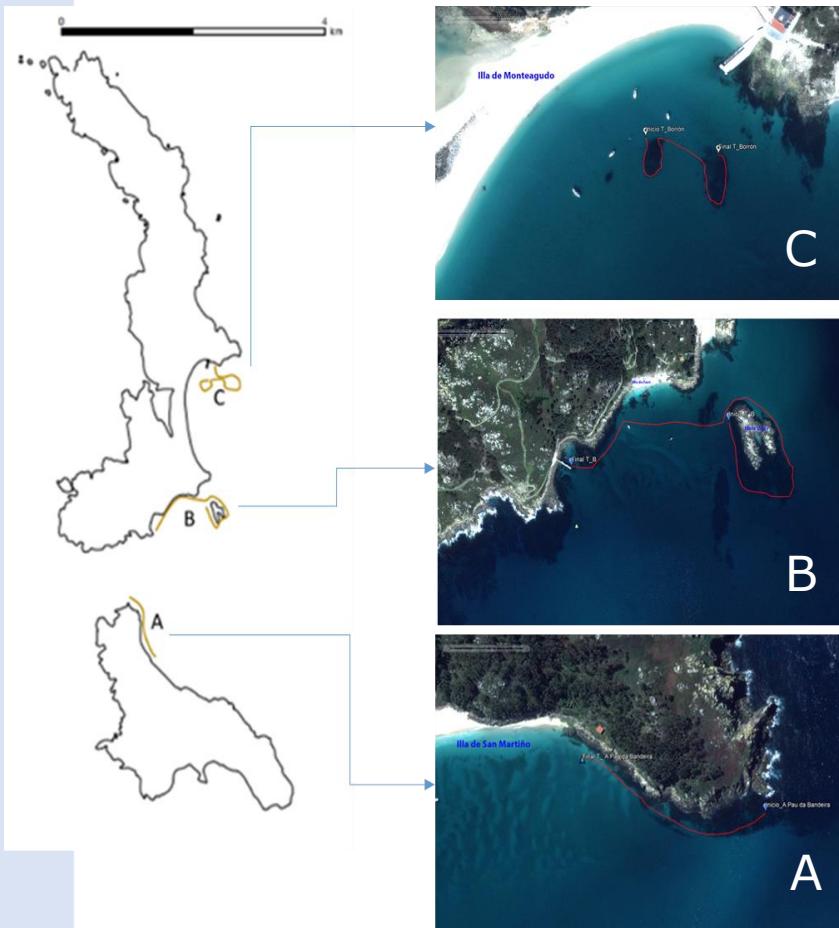
Stable isotope analysis - SIA



(Chouvelon 2011)



The sampling areas



COMMUNITY TYPE

	CORCOD	CORCES	LAMCOD	CYSCOR
CYSCOR	 <i>Corallina officinalis</i>	 <i>Corallina officinalis</i>		 <i>Corallina officinalis</i>
CORCOD	 <i>Lithophyllum incrustans</i>	 <i>Lithophyllum incrustans</i>		 <i>Lithophyllum incrustans</i>
CORCES				
LAMCOD	 <i>Codium tomentosum</i>	 <i>Codium tomentosum</i>	 <i>Codium tomentosum</i>	
CORCOD				
CORCES				
	 <i>Chondracanthus acicularis</i>			
		 <i>Laminaria ochroleuca</i>		
			 <i>Cystoseira bacata</i>	

Methods – 2017 samplings



Epifauna sampling



Syngnathid sampling



Methods – SIA

- Method (Valladares & Planas 2012)



- Flow mass spectrometry (**CF IRMS**)

$$\delta^{13}\text{C} / \delta^{15}\text{N} = \left(\frac{R_{sample}}{R_{standard}} - 1 \right) * 1000$$

- Trophic position

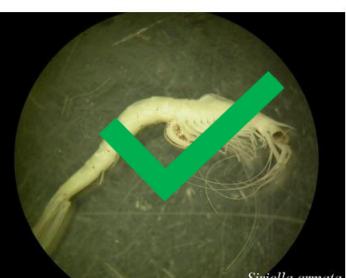
$$TL = \frac{(\delta^{15}\text{N}_{consumer} - \delta^{15}\text{N}_{base})}{3.4} + \lambda$$

λ : trophic position of the organism used to estimate $\delta^{15}\text{N}_{base}$



Results – Epifauna

✓ 84 OTUS reported – 24 selected (>2% abundance) for SIA



Results – Epifauna

✓ 24 selected (>2% abundance) for SIA

TAXA	OTUS	TL	Abbr.	$\delta^{15}\text{N}$	$\delta^{13}\text{C}$
FILTER FEEDING					
Bivalvia	<i>F. Mytilidae</i>	2,12	F_Myt	5,93±0,29	-18,36±0,92
Bivalvia	<i>Irus irus</i>	2,15	Irus	6,05±0,51	-17,70±0,79
Bivalvia	other bivalvia	2	O_bival	5,52±0,45	-18,16±0,89
GRAZER					
Copepoda	<i>O. Harpacticoida</i>	2,39	O_Harp	6,86±0,5	-19,67±2,75
Isopoda	<i>Cymodoce truncata</i>	2,34	Cym	6,68±0,84	-13,80±1
Isopoda	<i>Dynamene bidentata</i>	2,31	Dyna	6,60±0,86	-13,73±1,32
Gastropoda	<i>Elysia spp.</i>	2,58	Elysia	7,49±0,5	-18,21±1,51
Gastropoda	<i>Peringia ulvae</i>	2,59	Pering	7,54±0,5	-15,12±0,65
Gastropoda	<i>Calliostoma zizyphinum</i>	2,55	Calliost	7,41±1,52	-16,63±1,35
DETR./SUSPEN.					
Amphipoda	<i>Corophium spp.</i>	2,25	Corop	6,40±0,41	-18,14±1,57
Gastropoda	<i>Tricolia pullus</i>	2,41	Tricol	6,91±0,72	-15,11±2,75
Holothuroidea	<i>Aslia lefevrei</i>	2,37	Aslia	6,80±0,53	-13,72±1,77
Decapoda	<i>Porcellana platycheles</i>	2,38	Porc	6,81±0,32	-16,65±1,61
Ophiuroidea	<i>Amphipholis squamata</i>	2,52	A_squa	7,29±0,49	-11,05±4,02
OMNIVOROUS					
Amphipoda	<i>Caprella acanthifera</i>	2,32	Capr	6,62±0,27	-18,28±1,93
Amphipoda	<i>Amphilochus manudens</i>	2,51	Am_man	7,28±0,7	-17,69±1,38
Amphipoda	<i>Apherusa spp.</i>	2,31	Aphe	6,59±0,43	-17,47±0,87
Decapoda	<i>Hippolyte varians</i>	2,88	Hipp	8,54±0,5	-17,58±1,3
Polychaeta	<i>F. Nereididae</i>	2,72	F_Nerei	7,96±0,7	-22,33±1,21
PREDATOR					
Misidacea	<i>Siriella armata</i>	3,31	Sirie	10,00±0,6	-17,90±0,76
Pycnogonida	<i>Endeis spp.</i>	2,88	Endeis	8,53±0,4	-19,39±0,51
Polychaeta	<i>F. Polynoidae</i>	3,07	F_Polyn	9,18±0,48	-18,44±0,89
Platyhelminthes	<i>Stylochoplana maculata</i>	2,72	Styloch	7,98±0,4	-17,76±0,95
InfraC. Teleostei	InfraC. Teleostei	3,13	InO_Teleos	9,36	-16,78



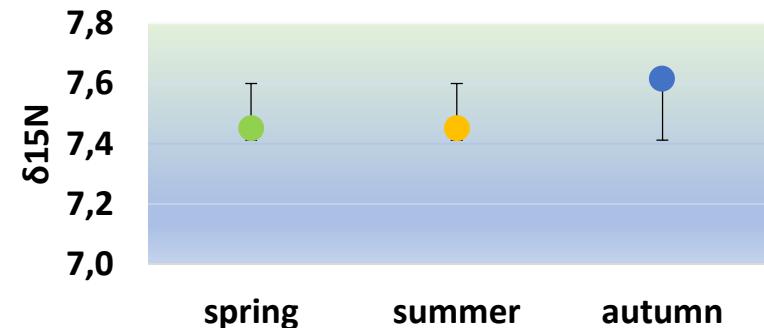
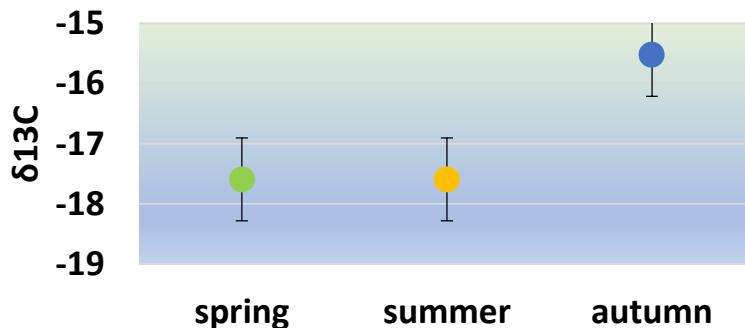
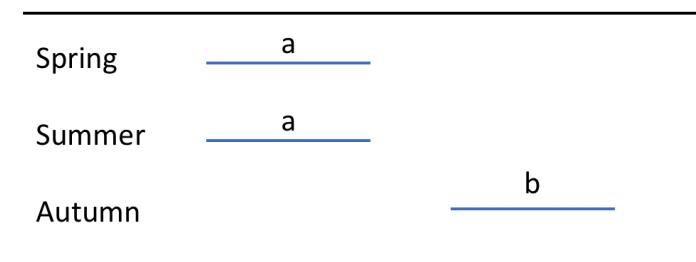
Results – Epifauna

✓ 24 selected (>2% abundance) for SIA

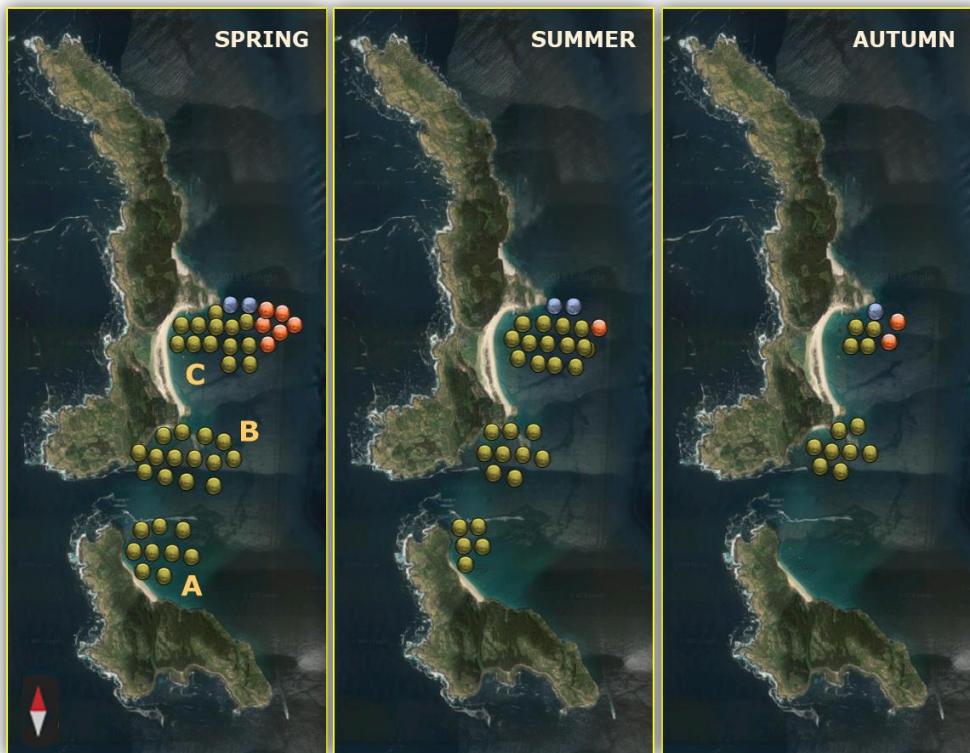
✓ Significant relationship ($P=0.017$) between $\delta^{13}\text{C}$ and **season**. (RSS = 1329,442)

✓ Significant relationship ($P=0.002$) between $\delta^{15}\text{N}$ and **season**. (RSS = 93,466)

✗ No significant relationship ($P>0.05$) between $\delta^{13}\text{C}$ / $\delta^{15}\text{N}$ and **area**.



Results – Syngnathid fishes



Species (5-12 m depth)

- *Syngnathus acus*
(n=74, 5 ♀ 23 ♂)



- *Hippocampus guttulatus*
(n=9, 5 ♀ 4 ♂)



- *Entelurus aequoreus*
(n=5, 4 ♀ 1 ♂)



Results – Syngnathid fishes - Factors

FACTORS CONSIDERED IN DATA ANALYSIS:

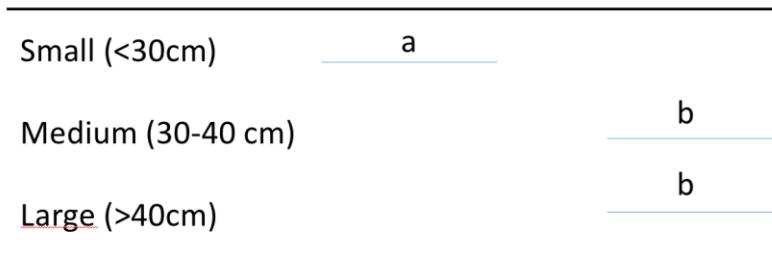
- **Size**
- **Season (spring, summer, autumn)**
- **Area (A, B, C)**
- **Gender (female, male)**
- **Sexual status (immature female, ovigerous female, immature male, pregnant male)**



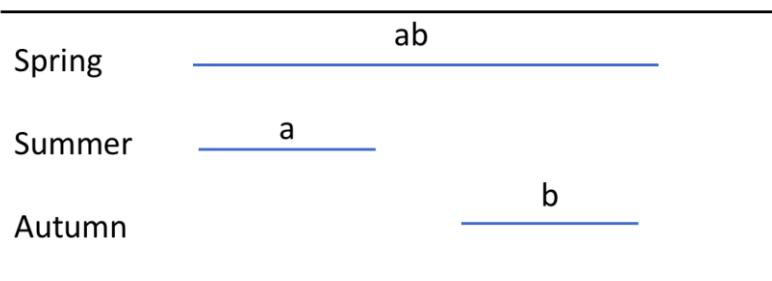
Results –Syngnathid fishes - $\delta^{13}\text{C}$

S. acus

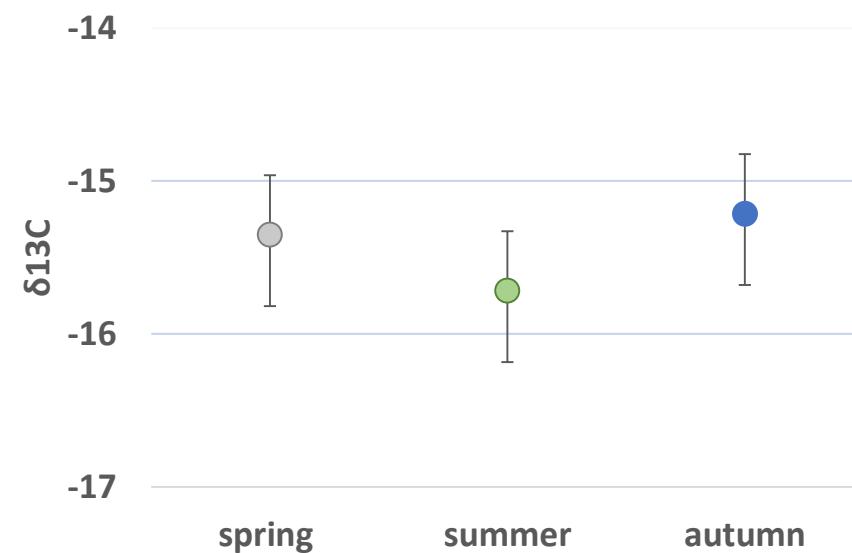
✓ Significant relationship ($P<0.001$) between $\delta^{13}\text{C}$ and size.



✓ Significant relationship ($P=0.04$) between $\delta^{13}\text{C}$ and season.



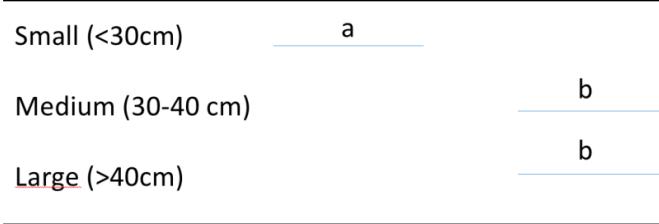
✗ No significant relationship ($P>0.05$) between $\delta^{13}\text{C}$ and area, sexual status or among factor interactions.



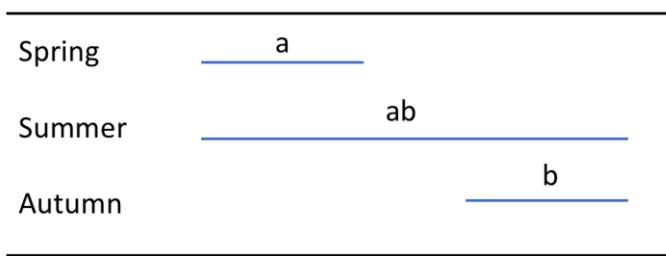
Results – Syngnathid fishes - $\delta^{15}\text{N}$

S. acus

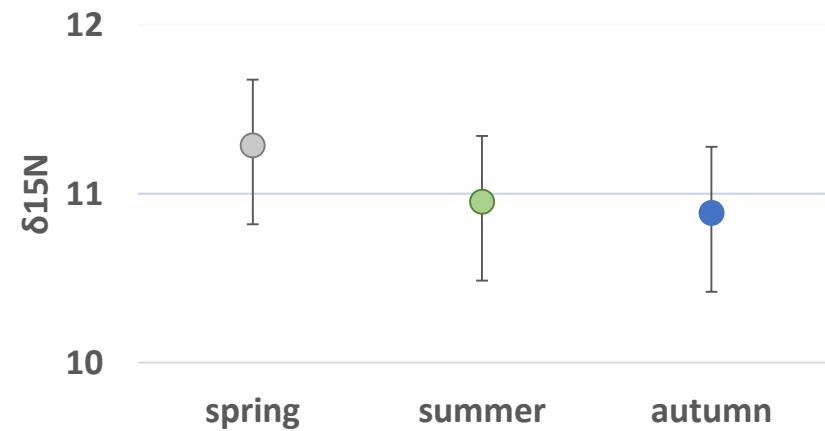
✓ Significant relationship ($P=0.001$) between $\delta^{15}\text{N}$ and **size**.



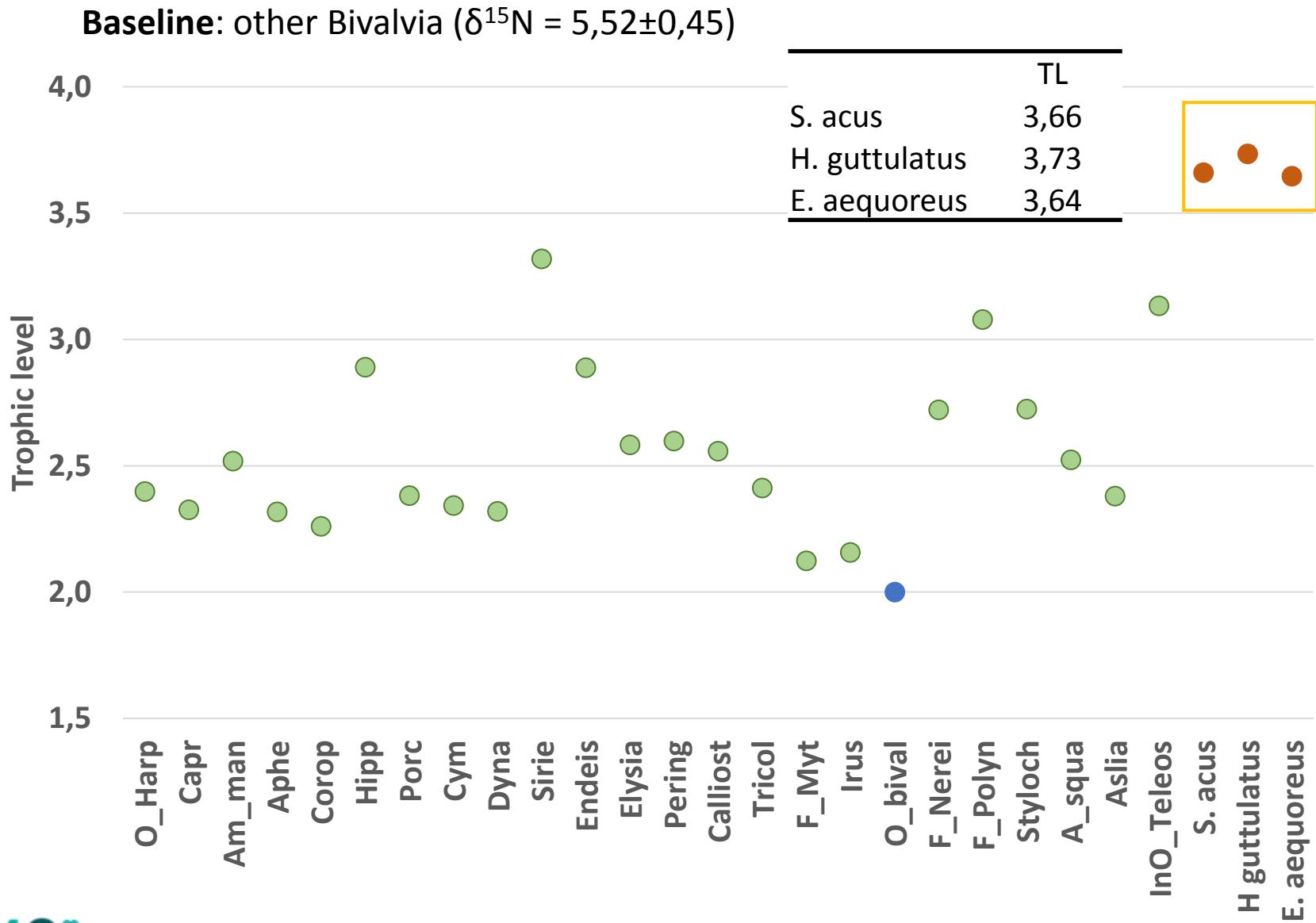
✓ Significant relationship ($P=0.04$) between $\delta^{15}\text{N}$ and **season**.



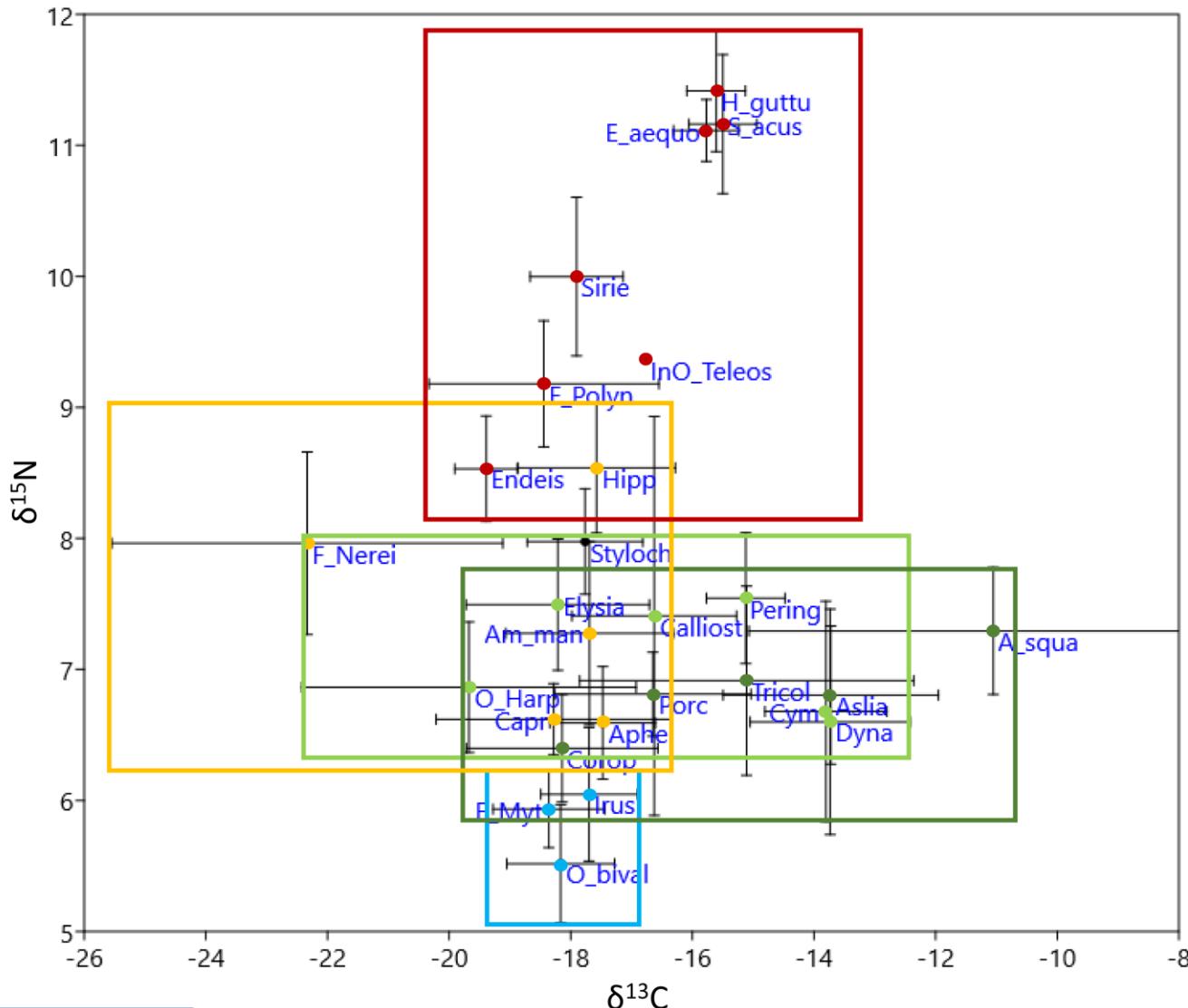
✗ No significant relationship ($P>0.05$) between $\delta^{15}\text{N}$ and area, sexual status or among factor interactions.



Results – trophic features



Results – trophic features



filter feeding
grazer
omnivorous
predator



Conclusions

- We have determined the trophic level (3 - 4) of Syngnathid fishes in Cies Archipelago.
- The $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ analysis suggest that small size (<30cm) *S. acus* diet is clearly different from the others.
- Statistical analysis reveals seasonal differences in the levels of both isotopes in *S. acus*, but not among zones or gender.
- The $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values in autumn epifauna are significantly different from the rest of year.
- The next step is to use the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ data in Bayesian inference.



Thank you!

