Influence of environmental conditions on Antarctic Notothenioid trophic ecology in a context of climate change

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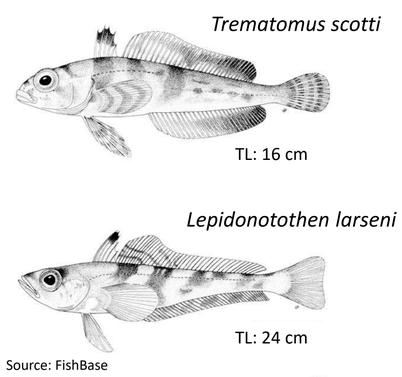
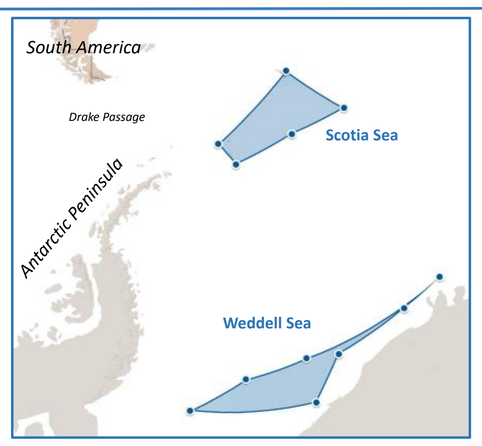
Introduction & methods

- Southern Ocean (SO) undergoes major **environmental modifications** (changes in sea ice cover, temperature, pH, …).
- **Icefishes** (Notothenioidei) living in the SO can exploit various ecological niches and are an important component of food webs.
- *Lepidonotothen* and *Trematomus* are two widespread genera in SO.

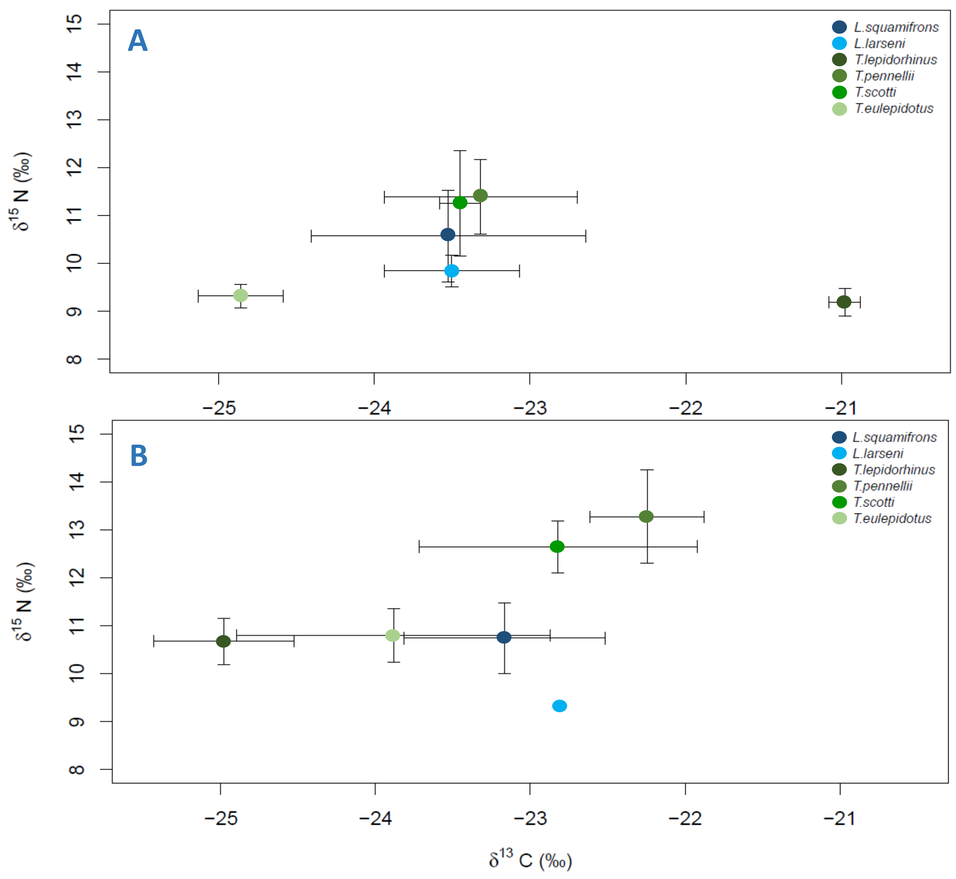
How will these two widespread genera of icefishes react to environmental changes in SO? Will it influence their trophic ecology, and notably resources partitioning?





- 94 individuals (6 species) of *Lepidonotothen* and *Trematomus* were sampling in Weddell and Scotia seas during RV Polarstern campaigns of 2002-04 and 2015-16.
- Carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable **isotope ratios** in muscles were measured and isotopic niches (proxies of realized ecological niches) were modelled using SIBER (Stable Isotope Bayesian Ellipses in R; Jackson *et al.*, 2011. J. Anim. Ecol. 80: 595-602).

Results



1) Temporal variation of isotopic composition in 2002/2004 (A) and in 2015/2016 (B)

- Large variability in isotopic composition among these 6 species:

	2002/2004	*2015/2016*
$\delta^{13}C$ (‰)	-20.9 to -24.8	-22.2 to -24.9
$\delta^{15}N$ (‰)	9.1 to 11.3	9.3 to 13.2

- Temporal variation of the isotopic composition depends on the considered species:

Lepidonotothen squamifrons

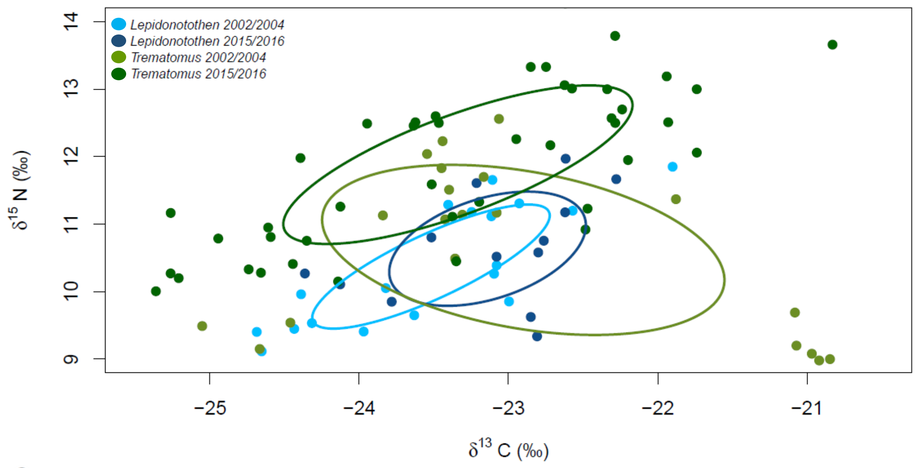
	2002/2004		*2015/2016*
$\delta^{13}C$ (‰)	-23.5	=	-23.1
$\delta^{15}N$ (‰)	10.5	=	10.7

Trematomus lepidorhinus

	2002/2004		*2015/2016*
$\delta^{13}C$ (‰)	-20.9	↘	-24.9
$\delta^{15}N$ (‰)	9.1	↗	10.6

2) Temporal evolution of isotopic niches

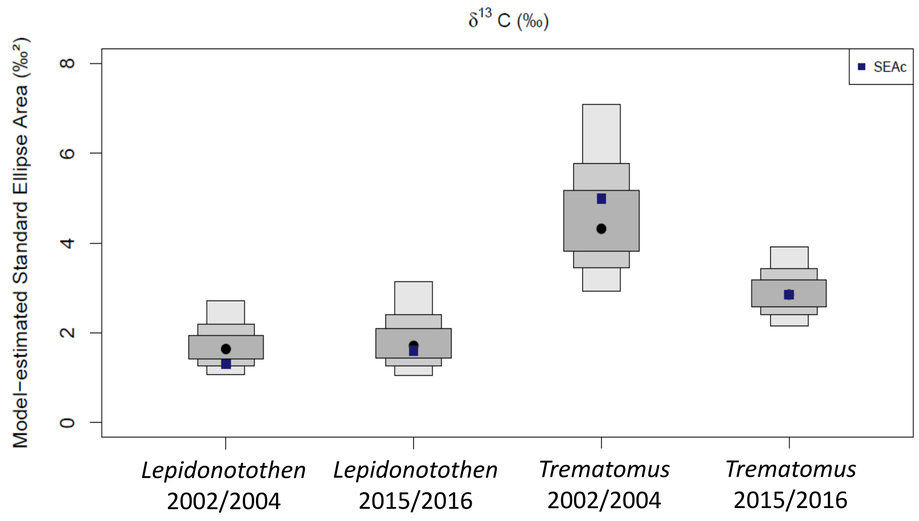
- Overlap of isotopic niches for the 2002/2004 campaigns: *Lepidonotothen* niche is entirely included in that of *Trematomus*.
- Niches are completely separated in 2015/2016.



3) Model-estimated Standard Ellipse Area (SEA)

According to Bayesian modelling of SEAc (proxy of the realized ecological niche width; 10^5 posterior draws):

- *Trematomus:* SEA 2002/2004 > SEA 2015/2016 in 96.3% of model estimates.
- *Lepidonotothen*: SEA 2002/2004 = SEA 2015/2016.
- 2002-2004: SEA *Trematomus* > SEA *Lepidonotothen* in 99.9% of model estimates.
- 2015-2016: SEA *Trematomus* = SEA *Lepidonotothen.*



Discussion and perspectives

1. Broad distribution of these Antarctic Notothenioid species in the isotopic space: they exploit a **wide array of resources**, especially *Trematomus* species.
2. Species-dependant temporal evolution of the isotopic niches: taxon-specific **ecological plasticity** in response to environmental change and/or to prey availability in SO?
3. Decrease of the amounts of resources exploited by *Trematomus* species over time and of the overlap between niches of the two genera: evidence of **past competition**?
4. These results should be complemented with a stomach content analysis and to use mixing models (including isotopic composition of potential prey) to better identify possible changes in icefish trophic ecology.

Acknowledgments

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