Stable isotopes reveal effects of environmental changes on ecological niches of Iphimediidae amphipods

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Context, objectives & methods

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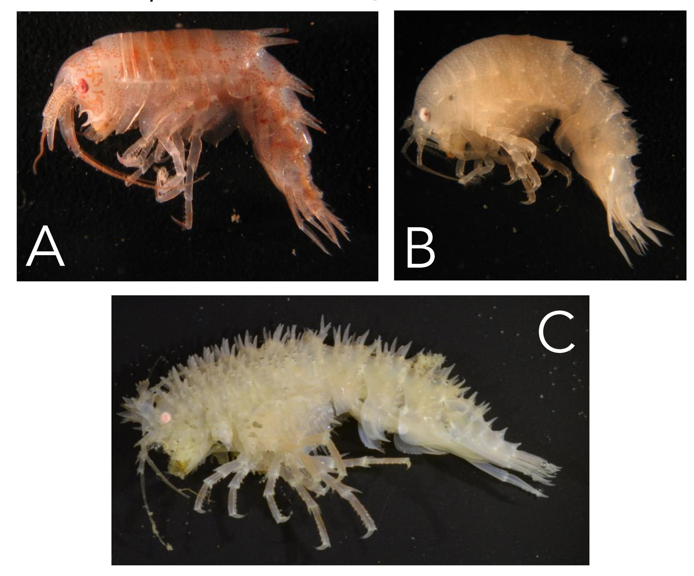
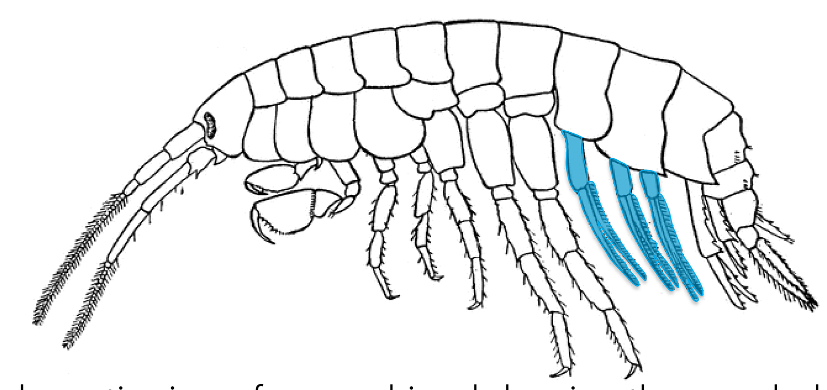
- Climate change has contrasted effects on Antarctica. West Antarctic Peninsula (WAP): T° ➚ and sea ice cover ➘. Adélie Land (AL): T° ➔➘ and sea ice cover ➔➚.
- How will benthic invertebrates react to such changes? When faced with environmental changes, organisms are expected to have some intrinsic ability to adapt through ecological plasticity.
- Here: assessment of ecological plasticity of Iphimediidae amphipods (widely distributed family with important ecological diversity) using stable isotopes of carbon and nitrogen.
- Museum specimens (19 species, 248 individuals) sampled in WAP and AL between 2006 and 2013 were dissected to extract pleopods without damaging the rest of the animal. Carbon ($\delta^{13}C$, ‰) and nitrogen ($\delta^{15}N$, ‰) stable isotope ratios in pleopods were measured by CF-EA-IRMS at University of Liège.
- Data were explored through isotopic niche (proxy of realized ecological niche) modelling using SIBER (Stable Isotope Bayesian Ellipses in R; Jackson *et al.* (2011) J. Anim. Ecol. 80: 595-602).

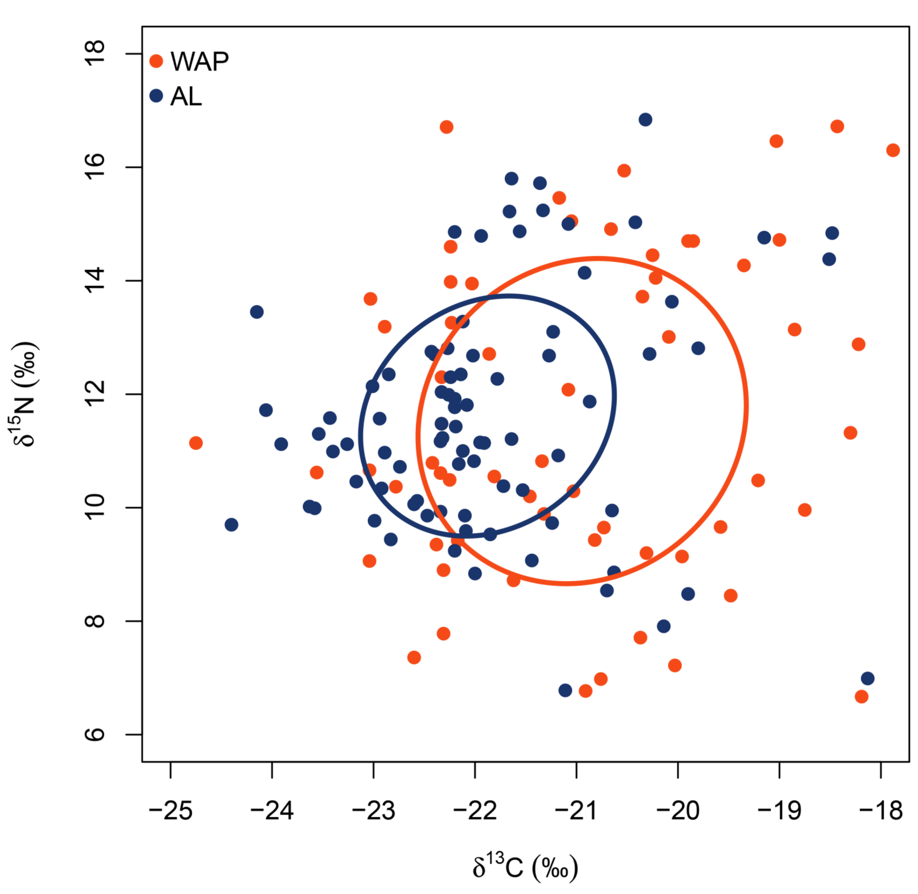
▼ Some of the studied species. A: *Gnathiphimedia sexdentata* (total length 20 mm). B: *Echiniphimedia echinata* (TL 35 mm). C: *Echniphimedia hodgsoni* (TL 35 mm).

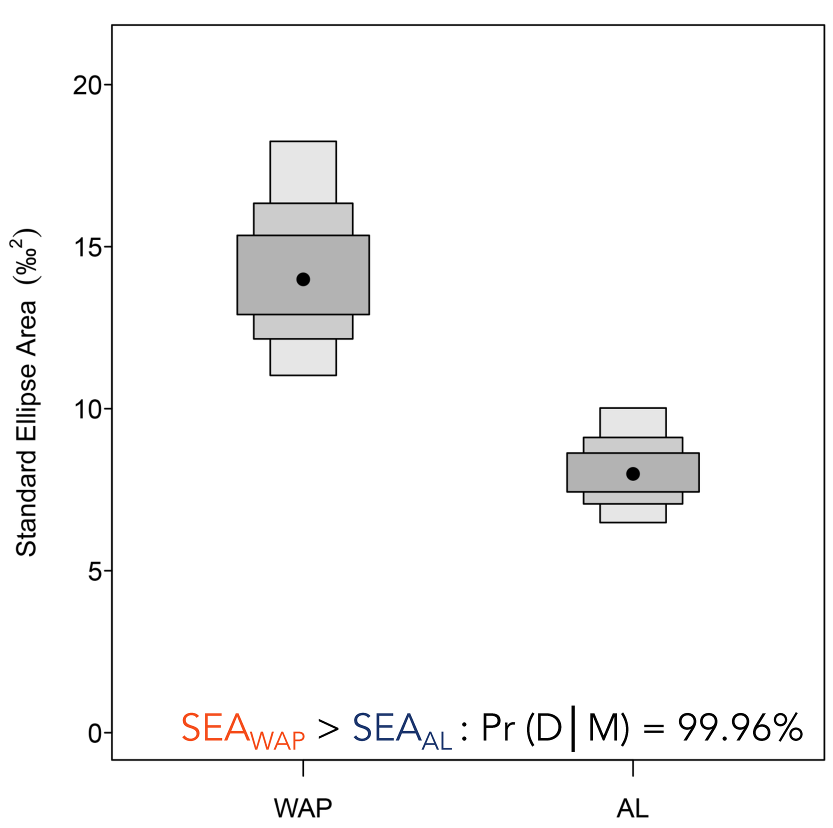




▲ Schematic view of an amphipod showing the sampled body parts (in blue).

Results & discussion



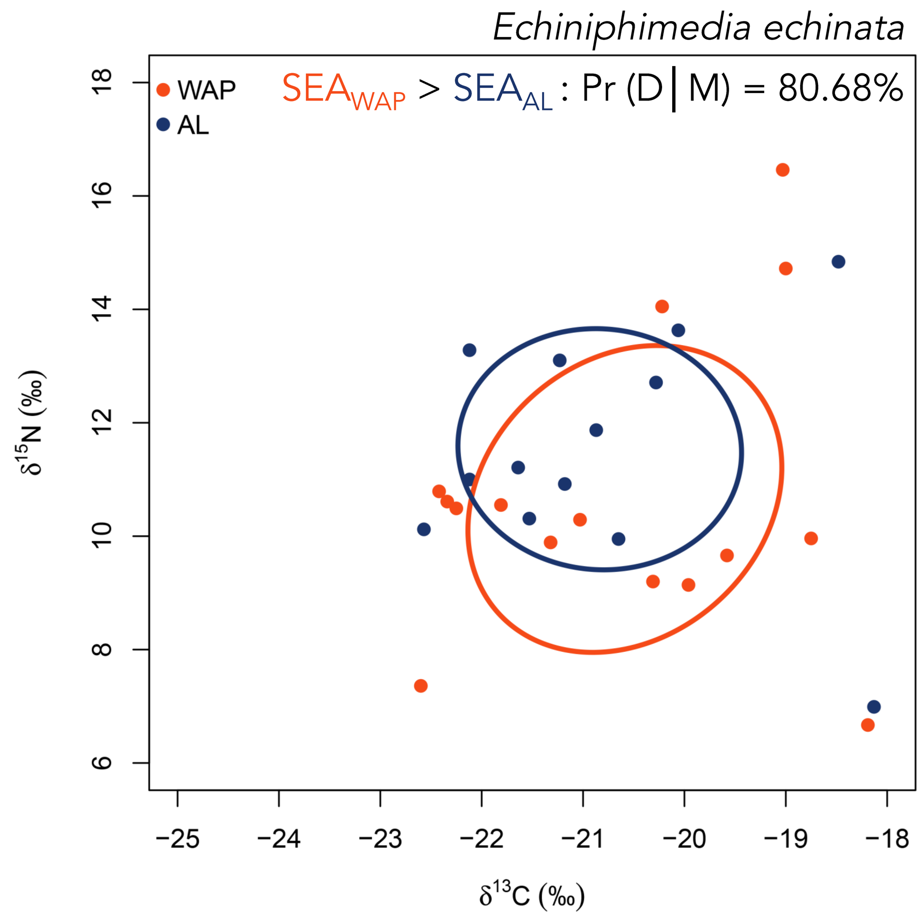


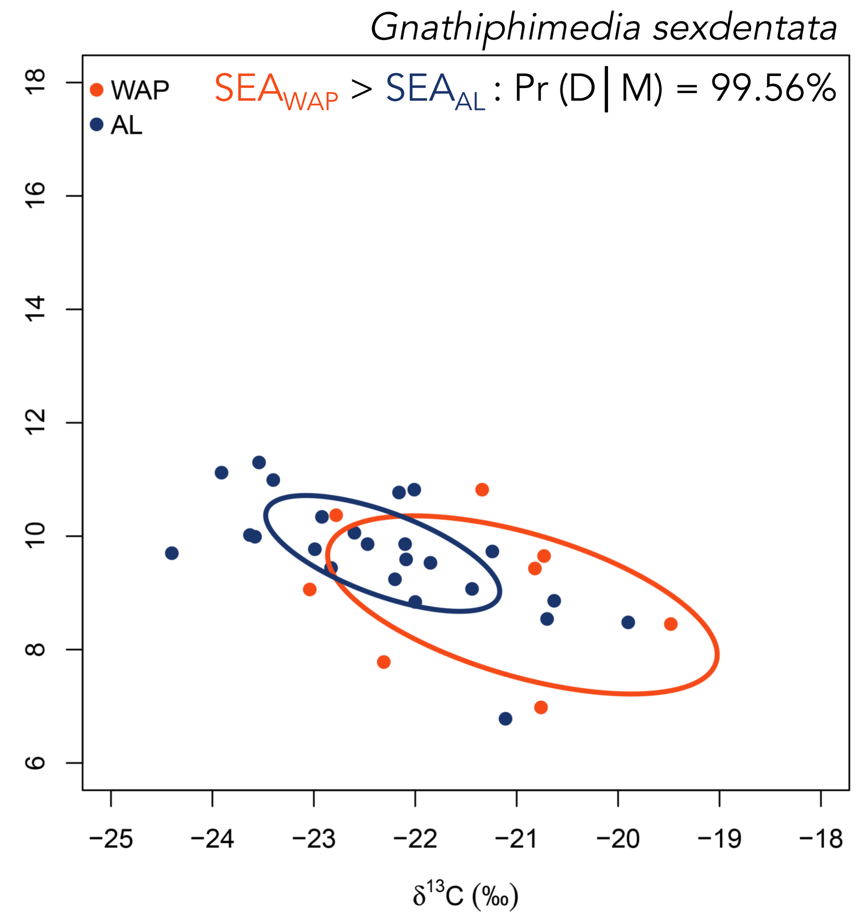
◀ 1) Global assemblage niche size

- Comparison of isotopic niches built using all individuals belonging to species found in both areas ($N_{species}$ = 11, $N_{individuals}$ = 62 for WAP and 83 for AL)
- Isotopic niche is wider in WAP than in AL ➔ Iphimediidae assemblage exploit more food and/or habitat resources in the WAP area

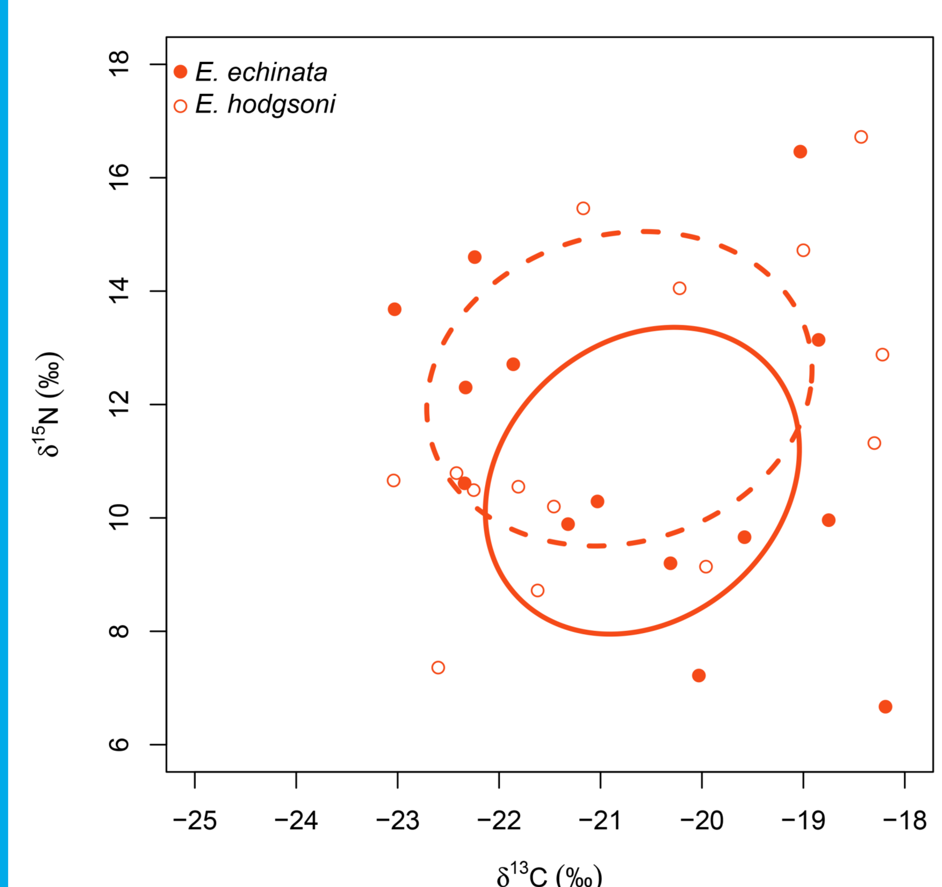
▼ 2) Species-specific trends

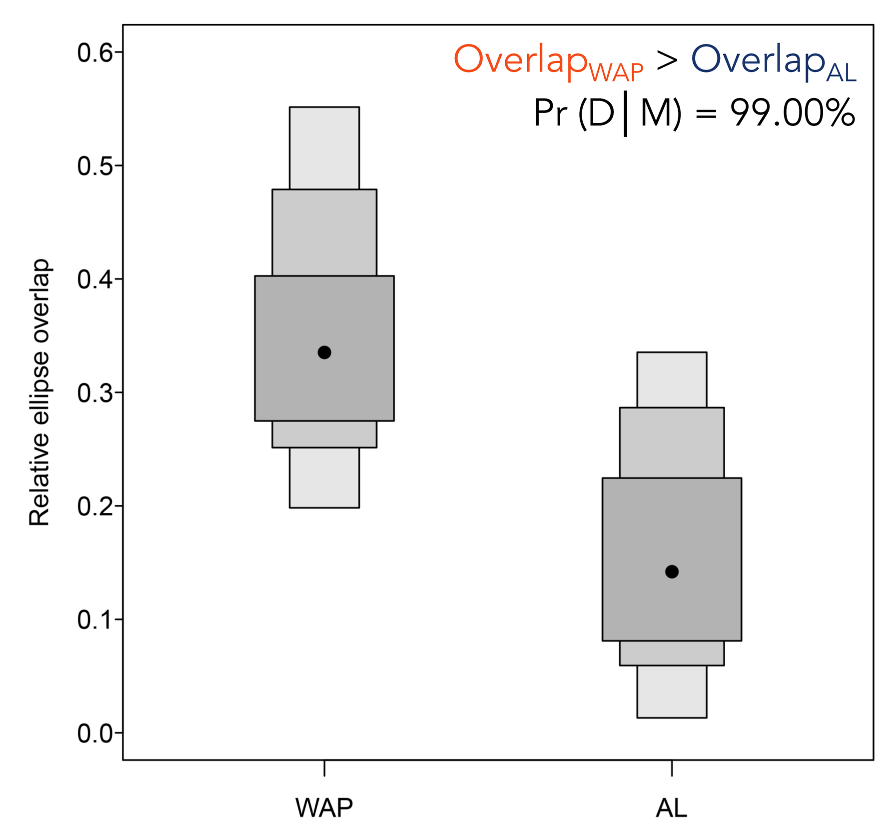
- Species-level niches are also larger in WAP for some taxa (*e.g. G. sexdentata*, right), but others have similar width in both areas (*e.g. E. echinata*, left) ➔ Different Iphimediidae species show different degrees of ecological plasticity.
- Differences in ellipse shape are also clear ➔ Drivers of ecological plasticity are likely to differ among species

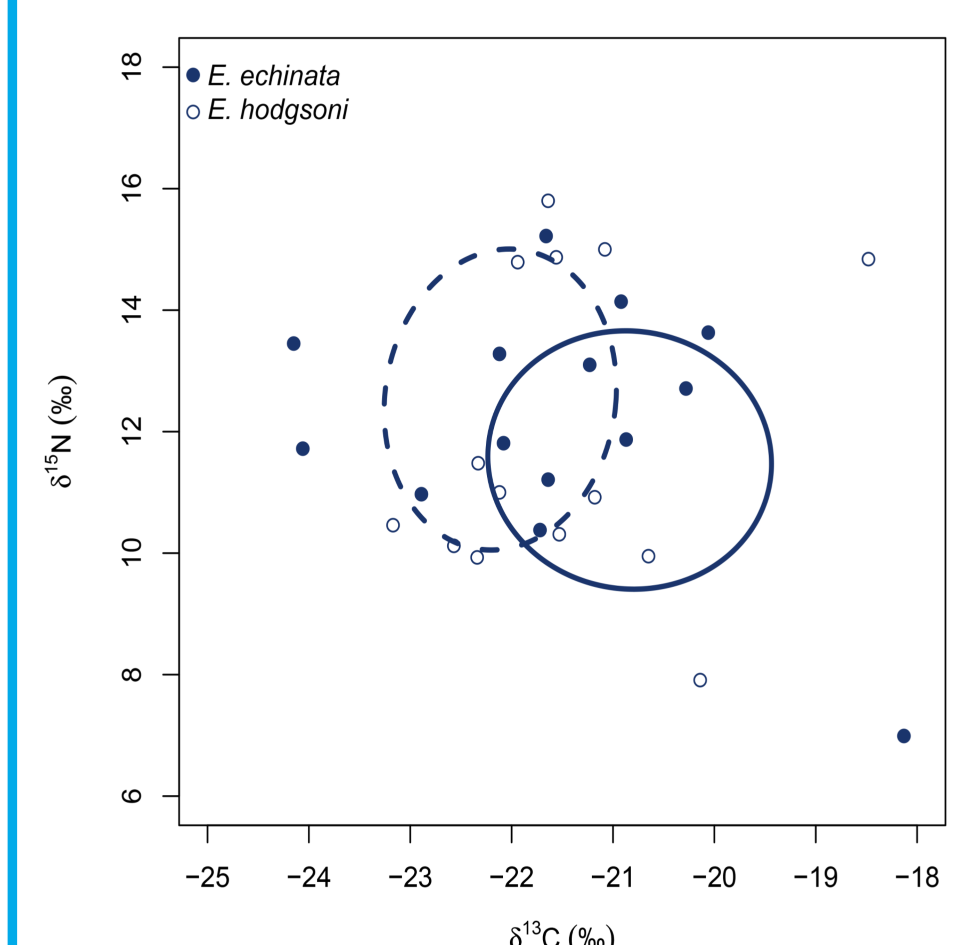




▼ 3) Niche overlap between congeneric species







Niche overlap between morphologically similar and closely related (congeneric) species is higher in the WAP area

🡣

Risks of competition for resources could be higher in WAP than in AL

Conclusions & perspectives

- The widely different environmental conditions encountered by animals in the studied areas clearly influence their ecology.
- Niche width and overlap tend to be higher in WAP. Strong environmental changes in these region might reinforce those trends, which might lead to competition and perturb amphipod assemblage structure
- Future questions: Relative importance of habitat vs. food as drivers of ecological plasticity? Influence of cryptic speciation on niche parameters?

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