SPATIAL AND TEMPORAL VARIATION IN $\delta^{13}C$ AND $\delta^{15}N$ ISOTOPES OF ICHTHYOPLANKTON IN THE SEA OF CHILOÉ (Northern Patagonia)

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Introduction

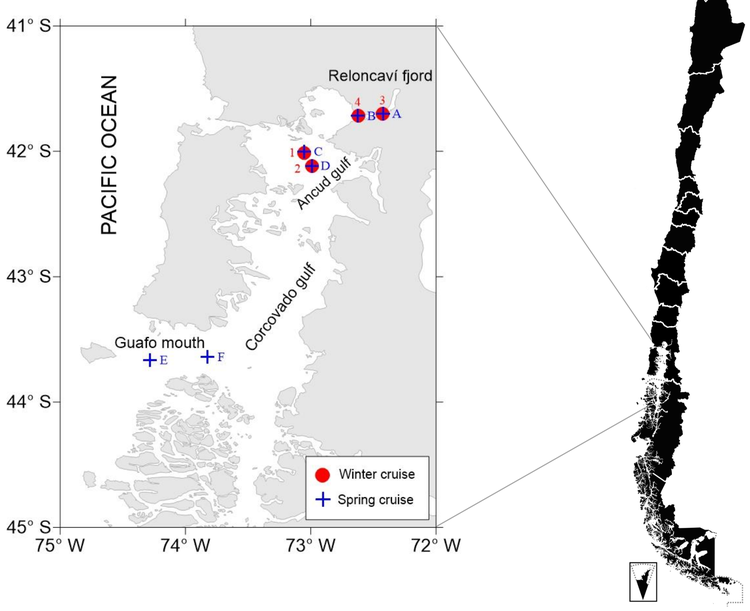
The structure of the zooplankton community is seasonally modulated by primary production (PP), higher in spring than in winter, and by the dominant type of food web (microbial *vs*. classic) in the inner Sea of Chiloé (ISC). Seasonal changes in freshwater discharges from rivers and ice-melting might modify the organic carbon isotopic signature of the plankton assimilated by both ichthyoplankton and eggs of reproductive fish in this nursery area. We hypothesized that: a) particulate organic carbon (POM) is less enriched in $\delta^{13}C$ at inshore areas in winter than spring, as there is a lower terrigenous discharge; b) there are seasonal differences in the $\delta^{15}N$ signal due to the microbial and classical food web alternation.

Goals & Methods

Results of combined C and N stable isotope analysis on fish larvae and eggs are presented here in order to examine 1.) organic matter sources, 2.) isotopic niche width and 3.) potential trophic partitioning between fish larval groups.

SAMPLING

- Ichthyoplankton was collected at inshore (Reloncaví fjord, Ancud gulf) and offshore (Guafo mouth) sites using a Tucker trawl (300 µm mesh size) during two cruises (late winter and spring) .
- Dried and homogenized fish samples, and also acidified samples of POM, were analyzed at UC Davis Analytical Laboratory. Lipid content was corrected when the C:N ratio was lower than 3.5[1].



STATISTICS

- Spatial and temporal mean variations in $\delta^{13}C$ and $\delta^{15}N$ were tested via ANOVA.
- Bayesian inference was used to calculate the standard area of ellipses that represent the isotopic niche of fish predators using the R-package 'SIBER'[2].

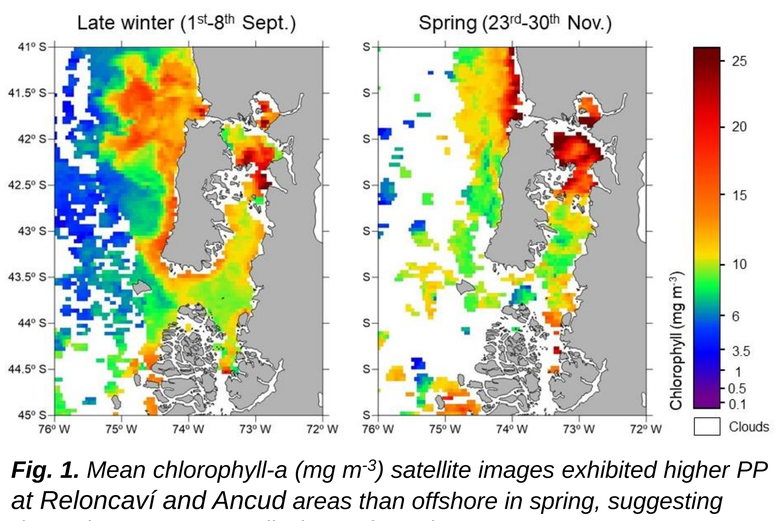


Fig. 1. *Mean chlorophyll-a (mg m^{-3}) satellite images exhibited higher PP at Reloncaví and Ancud areas than offshore in spring, suggesting dependence on matter discharge from rivers.* http://oceancolor.gsfc.nasa.gov/

Results

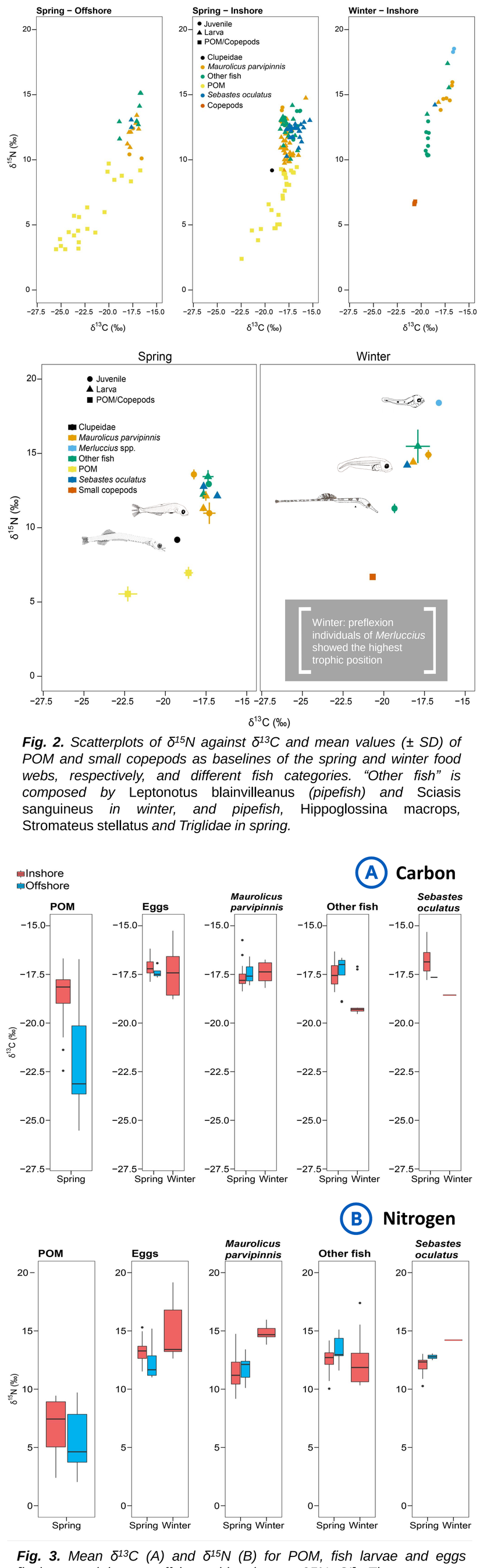


Fig. 2. *Scatterplots of $\delta^{15}N$ against $\delta^{13}C$ and mean values (± SD) of POM and small copepods as baselines of the spring and winter food webs, respectively, and different fish categories. "Other fish" is composed by* Leptonotus blainvilleanus *(pipefish) and* Sciasis sanguineus *in winter, and pipefish,* Hippoglossina macrops*,* Stromateus stellatus *and Triglidae in spring.*

Fig. 3. *Mean $\delta^{13}C$ (A) and $\delta^{15}N$ (B) for POM, fish larvae and eggs [inshore: red boxes; offshore: blue boxes; 95% CI]. There were no seasonal or spatial differences in $\delta^{13}C$ for POM, fish eggs and larvae, but offshore POM was more depleted in organic carbon. Fish eggs showed high $\delta^{15}N$ from adult female diet. Post-hoc comparisons ($\delta^{15}N$) exhibited intraspecific differences in M. parvipinnis between winter and spring.*

Results

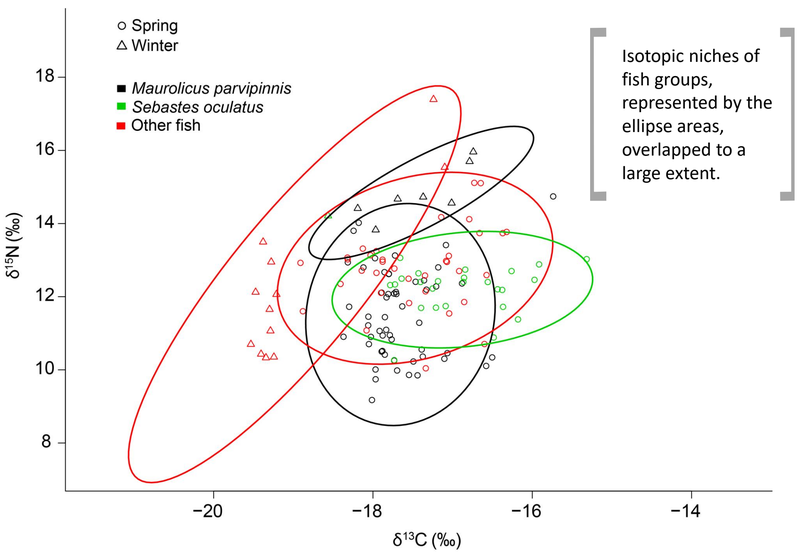


Fig. 4. *95 % confidence ellipses denote significant isotopic niche for each group.*

Discussion

- **CARBON SOURCE:** The inshore area of Ancud was characterized with $\delta^{13}C$ POM-values that ranged from −17.5 ‰ to −23 ‰ **(Fig. 2)**, inferring a dominance of the oceanic carbon production[3]. Towards the open waters (Guafo mouth), $\delta^{13}C$ values even decreased (−20.5 ‰ to −25 ‰) in late spring, and C:N ratios were low at both sites (inshore: 4-7; offshore: 3-6). The allochthonous terrestrial matter does not exert high influence, being more retained near the fjords and river mouths. As in previous studies[4, 5], more enriched organic carbon values, rather at inshore than offshore waters, could be related to phytoplankton bloom events during spring, when dissolved inorganic carbon is massively used for carboxylation and less involved in the photosynthetic isotope fractionation.
- **TROPHIC STRUCTURE:** Higher $\delta^{15}N$ values might be reflecting more N-enriched marine source in winter. $\delta^{15}N$ range was wider in late winter than spring: *M. parvipinnis* and *S. oculatus* displayed higher mean $\delta^{15}N$ values in winter **(Fig. 3)**. Mean $\delta^{15}N$ values were higher for "other fish" in winter due to the fact that species composition for this group was more varied and accounted with other carnivorous species in spring, while *L. blainvilleanus* was dominant in the winter group (feeds on organisms inhabiting algal-beds).
- **ISOTOPIC NICHE:** Winter individuals of *L. blainvilleanus* (red-triangle points corresponding to "other fish") and *M. parvipinnis* partially occupied different isotopic niches. Also *S. oculatus* showed a completely segregated isotope niche in spring from *M. parvipinnis* in winter, the former with lower $\delta^{15}N$ values **(Fig. 4).**

References

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Aknowledgements

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