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Environmental perturbation effects on baseline $\delta^{15}\text{N}$ values and zooplankton trophic flexibility in the southern California Current Ecosystem

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ABSTRACT: Nitrogen isotopic compositions of zooplankton in the California Current Ecosystem (CCE) are known to vary over inter-annual scales of climate variability, but the extent to which those changes are driven by variations in baseline phytoplankton $\delta^{15}\text{N}$ values vs. zooplankton trophic position (TP) is poorly resolved. We use field samples collected during a large natural environmental perturbation, the 1998 – 1999 alternation between El Niño and La Niña states, to test the ability of large dominant CCE zooplankton *Euphausia pacifica* and *Calanus pacificus* to alter their TPs in response to environmental variability. To distinguish trophic changes from variations of $\delta^{15}\text{N}$ values at the base of the food web, the zooplankton were assayed by Compound Specific Isotope Analysis of Amino Acids (CSIA-AA). Linear mixed-effect models were developed to utilize data from all amino acids (AAs), providing greater statistical power than the typical CSIA-AA approach of using only phenylalanine and glutamic acid. We confirm a significant ^{15}N enrichment of $\sim 2\%$ at the base of the food web for all AAs and all zooplankton groups during the 1998 El Niño. This baseline enrichment in ^{15}N has been speculated to occur during El Niño events but never conclusively shown. We also demonstrate a significantly elevated TP, implying increased carnivory during 1998, for *E. pacifica* while *C. pacificus* did not alter their TP between years. Lastly, TPs calculated from the standard CSIA-AA equation with laboratory-derived constants gave unrealistically low estimates, suggesting an assessment of these variables in situ is needed for an accurate application in natural systems.

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