

Interannual variability in the relationship between *in situ* primary productivity and chitinase-based crustacean productivity in a temperate fjord

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Accurate measurements of both primary and secondary productivity are required when examining energy transfer from phytoplankton to zooplankton. Although estimates of primary productivity are readily available, estimates of secondary productivity remain relatively rare. Here, we examined the relationship between primary and secondary (crustacean) productivity over two years in Saanich Inlet, British Columbia, Canada, to determine how temporal variations in primary productivity influence crustacean production rates and trophic transfer efficiency (TTE). Primary productivity was measured via the ¹³C tracer method, while the crustacean moulting enzyme chitinase was used to estimate community-level crustacean productivity. Peak primary productivity occurred much earlier in 2010 (late April; 9.17 g C m⁻² d⁻¹) than in 2011 (mid-June; 5.01 g C m⁻² d⁻¹) due to a higher abundance of diatoms. The initial peak in crustacean productivity occurred only one week earlier in 2010 than in 2011. Crustacean productivity ranged between 0.01 and 0.65 g C m⁻² d⁻¹ over both sampling years. Average TTE was 14% and 8% in 2010 and 2011, respectively, indicating that the earlier peak in primary productivity in 2010 resulted in more efficient energy transfer from phytoplankton to zooplankton throughout the year compared to 2011. Results from this study highlight the need for incorporating routine field estimates of crustacean productivity into oceanographic studies with the same resolution as primary productivity measurements. Together, these estimates will be critical in terms of investigating the impact of a potential increase in the occurrence of mismatches between lower and higher trophic levels in predicted future warming scenarios.

Keywords: Chitinase, secondary production, crustaceans, productivity, trophic transfer efficiency

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