

Terrestrial support of pelagic consumers: patterns and variability revealed by a multilake study

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SUMMARY

1. Lake food webs can be supported by primary production from within the lake, organic matter imported from the catchment or some mixture of these two sources. Generalisations about food-web subsidies to lake ecosystems are often based on data from only a few ecosystems and therefore do not consider the potential variability of subsidies among diverse ecosystems in a landscape.
2. We measured the variation among lake ecosystems in terrestrial (allochthonous) utilisation by pelagic consumers and developed models to describe the variability. Stable isotope ratios of hydrogen and carbon were measured for *Chaoborus* spp. and crustacean zooplankton taxa in 40 lakes to quantify consumer allochthonous resource use (allochthony).
3. The median fraction of consumer allochthony estimated using a two-source Bayesian mixing model varied between 4 and 82% (mean among all lakes = 36%) for *Chaoborus* sp. among lakes and between 1 and 76% in a more limited sample of crustacean zooplankton consumers. The degree of allochthonous resource use increased linearly with the availability of allochthonous resources.
4. Terrestrial support of *Chaoborus* was correlated (using best fitting relationships) with covariates for lake organic matter sources including dissolved inorganic carbon, total phosphorus, chlorophyll α , colour and catchment area. However, the most parsimonious model was an inverse relationship between lake surface area and consumer allochthony, indicating that allochthonous subsidies are more important in smaller than larger systems. Given the preponderance of small waterbodies, allochthonous subsidies are important in a large number of lake ecosystems.

Keywords: food webs, lakes, pelagic, stable isotopes, zooplankton