

Whole-lake carbon-13 additions reveal terrestrial support of aquatic food webs

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Ecosystems are supported by organic carbon from two distinct sources. Endogenous carbon is produced by photosynthesis within an ecosystem by autotrophic organisms. Exogenous carbon is produced elsewhere and transported into ecosystems. Consumers may use exogenous carbon with consequent influences on population dynamics, predator–prey relationships and ecosystem processes¹. For example, exogenous inputs provide resources that may enhance consumer abundance beyond levels supported by within-system primary production². Exogenous fluxes of organic carbon to ecosystems are often large, but this material is recalcitrant and difficult to assimilate, in contrast to endogenously produced organic matter, which is used more easily^{3,4}. Here we show, by the experimental manipulation of dissolved inorganic ¹³C in two lakes, that internal primary production is insufficient to support the food webs of these ecosystems. Additions of NaH¹³CO₃ enriched the ¹³C content of dissolved inorganic carbon, particulate organic carbon, zooplankton and fish. Dynamics of ¹³C indicate that 40–55% of particulate organic carbon and 22–50% of zooplankton carbon are derived from terrestrial sources, showing that there is significant subsidy of these ecosystems by organic carbon produced outside their boundaries.