Supporting Information

Cole et al. 10.1073/pnas.1012807108

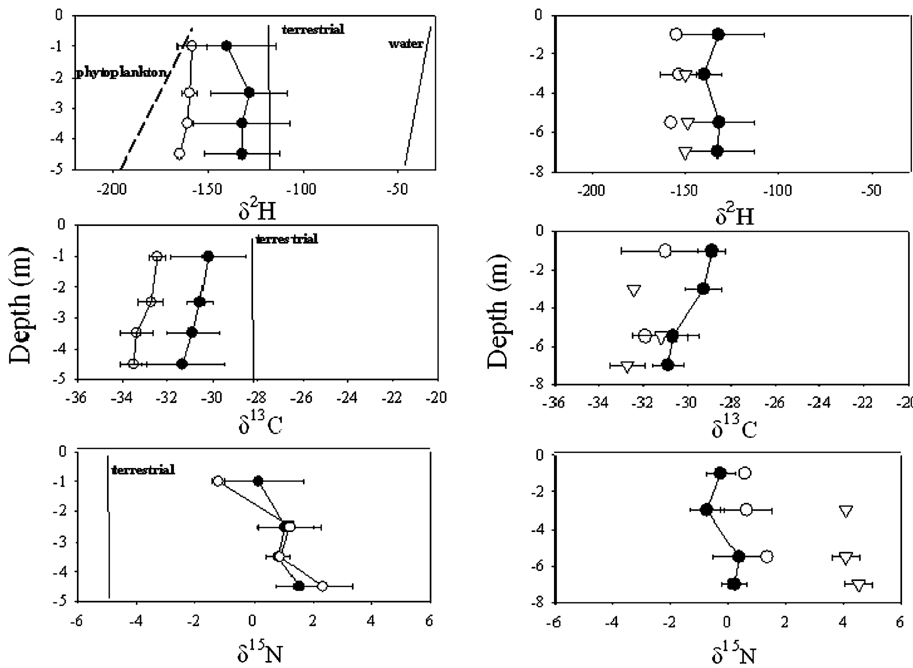

Fig. S1. Isotopic profiles of POM (filled circles) of zooplankton (open symbols) in Paul (*Left*) and Crampton (*Right*) lakes. In Paul L., only *Daphnia* (open circles) is shown because *Daphnia* and *Holopedium* were indistinguishable at this scale. In Crampton L., *Holopedium* (open circles) and *Leptodiaptomus* (▽) are both shown. Error bars at each represent the temporal SD of samples taken four times during 2009. In Paul L., both zooplankton taxa were measured at all depths on all four dates. In Crampton L., we did not measure both taxa at all depths or on all dates because in some cases, taxa were too rare to obtain sufficient mass for isotope analyses. Thus, samples without SD are from single measures. The approximate position of terrestrial isotope values is shown for each isotope; the approximate value for the δ^2H of phytoplankton is shown in *Upper*.

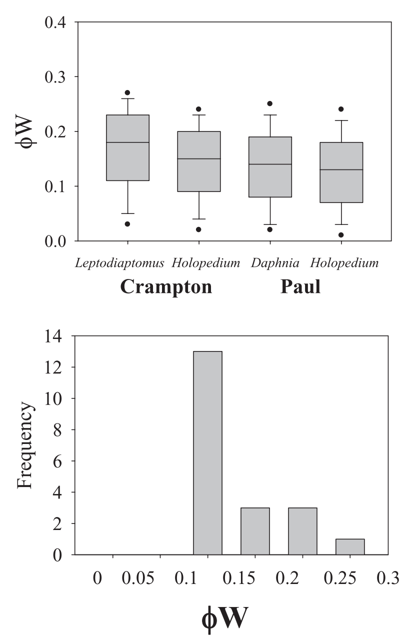

Fig. S2. Results of fitting dietary water in IsoSource. *Upper* shows the distributions of dietary water, fitted by IsoSource in models that included all three isotopes (C, N, and H) and four end members as possible sources (terrestrial, surface phytoplankton, deep phytoplankton, and benthic algae). *Lower* shows the distribution of the mean values of dietary water, fitted by IsoSource, for all of the three isotope models shown in Fig. 3.

Table S1. Reported values of allochthony for zooplankton in freshwater systems

Reference	ϕT zooplankton	System	Approach	Support
Qualitative estimates				
del Giorgio and France (1)	Allochthony low	Canadian lakes	Ambient ^{13}C	No
Sobczak et al. (2)	Allochthony low	San Joaquin River	Mass balance	No
Karlsson et al. (3)	Allochthony high for Cladocerans	15 subarctic lakes	Ambient ^{15}N	Yes
Perga et al. (4)	Allochthony high for copepods; for *Daphnia* low	Lake Annecy, France	Fatty acid biomarkers	Yes
Quantitative estimates				
Meili et al. (5)	≈40% cladocerans 25 ± 20% *Eudiaptomus*	Humic Lake, Sweden	Ambient ^{13}C	Yes
Jones et al. (6)	≈50%, copepods, cladocerans.	Loch Ness, Scotland	Ambient ^{13}C, ^{15}N	Yes
Cole et al. (7, 8)	<10%	Two small Wisconsin lakes-experimentally fertilized	Whole lake ^{13}C addition	No
Karlsson et al. (9)	9–77%; mean of 53%	15 subarctic lakes	Ambient ^{13}C with model	Yes
Carpenter et al. (10)	22–73% (across lakes and 3 models)	3 humic lakes Wisconsin, not fertilized	"Whole" lake ^{13}C addition	Yes
Matthews and Mazumder (11)	*Holopedium* 40–50%; *Leptodiaptomus* 15–40%; *Epsichura* 50–60%	Council L., BC, Canada.	Ambient ^{13}C; ^{15}N and experiments	Yes
Pace et al. (12)	2% *Leptodiaptomus*; 30% *Holopedium*	30-ha clear water Wisconsin lake	Whole lake ^{13}C addition and model	Yes
Taipale et al. (13)	29–53%	Shallow Finnish lake	Whole lake ^{13}C addition and model	Yes
Mohammed and Taylor (14)	9–23%	27 Ontario lakes	Ambient ^{13}C and regression model	Yes
Berggren et al. (15)	23% (7–45% depending on model run)	L. Ortrasket, large, boreal lake (7.3 km^2)	Microbial model	Yes
Caraco et al. (16)	21–57%	Hudson River	Ambient ^{14}C with ^{2}H, ^{13}C and ^{15}N	Yes

The table is divided into two parts: Qualitative estimates and Quantitative estimates, and then ordered chronologically. "Qualitative" means that the author provided some written assessment of allochthony as large or small but did not report a numerical value. "Support" means that either the qualitative or quantitative results of the study support (Yes) or do not support (No) the hypothesis that zooplankton are subsidized by terrestrial organic matter.

1. del Giorgio PA, France RL (1996) Ecosystem-specific patterns in the relationship between zooplankton and POM or microplankton delta C-13. *Limnol Oceanogr* 41:359–365.
2. Sobczak WV, Cloern JE, Jassby AD, Müller-Solger AB (2002) Bioavailability of organic matter in a highly disturbed estuary: The role of detrital and algal resources. *Proc Natl Acad Sci USA* 99:8101–8105.
3. Karlsson J, Jonsson A, Meili M, Jansson M (2004) delta N-15 of zooplankton species subarctic lakes in northern Sweden: Effects in s of diet and trophic fractionation. *Freshw Biol* 49: 526–534.
4. Perga ME, Bec A, Anneville O (2009) Origins of carbon sustaining the growth of whitefish *Coregonus lavaretus* early larval stages in Lake Annecy: Insights from fatty-acid biomarkers. *J Fish Biol* 74:2–17.
5. Meili M, et al. (1996) Sources and partitioning of organic matter in a pelagic microbial food web inferred from the isotopic composition δ^{13} C and δ^{15} N) of zooplankton species. *Arch Hydrobiol Spec Issues Advanc Limnol* 48:53–61.
6. Jones RI, Grey J, Sleep D, Quarmby C (1998) An assessment, using stable isotopes, of the importance of allochthonous organic carbon source to the pelagic food web in Loch Ness. *Proc Biol Sci* 265:105–111.
7. Cole JJ, Carpenter SR, Kitchell JF, Pace ML (2002) Pathways of organic carbon utilization in small lakes: Results from a whole-lake C-13 addition and coupled model. *Limnol Oceanogr* 47: 1664–1675.
8. Cole JJ, et al. (2006) Differential support of lake food webs by three types of terrestrial organic carbon. *Ecol Lett* 9:558–568.
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13. Taipale S, Kankaala P, Tiirola M, Jones RI (2008) Whole-lake dissolved inorganic 13C additions reveal seasonal shifts in zooplankton diet. *Ecology* 89:463–474.
14. Mohamed MN, Taylor WD (2009) Relative contribution of autochthonous and allochthonous carbon to limnetic zooplankton: A new cross-system approach. *Fund Appl Limnol* 175: 113–124.
15. Berggren M, et al. (2010) Lake secondary production fueled by rapid transfer of low molecular weight organic carbon from terrestrial sources to aquatic consumers. *Ecol Lett* 13: 870–880.
16. Caraco N, Bauer JE, Cole JJ, Petsch S, Raymond P (2010) Millennial-aged organic carbon subsidies to a modern river food web. *Ecology* 91:2385–2393.

Table S2. Limnologic conditions in Paul and Crampton Lakes, Vilas County, WI

Measurement	Paul Lake	Crampton Lake
Lake area, ha	1.7	25.7
Watershed area, ha	7.9	52.8
Color (A440)	1.5	0.6
Depth to 1% light, m	4.8	8
DOC (mg of C·liter^{-1}; upper mixed layer)	4.3	3.7
POC (mg of C·liter^{-1}; upper mixed layer)	0.49	0.63
Mean depth, m	3.7	4.9
Z_{mix}	≈4	≈7
Z_{oxic}	≈5	Whole water column

Color is a measure of light absorption at 400 nM. DOC, dissolved organic C; POC, particulate organic C. Z_{mix} is the depth of the upper mixed layer; Z_{oxic} is the depth at which anoxic water starts. Paul Lake is entirely feed by ground water and Crampton mostly so, except for an intermittent stream. The watersheds of both lakes are entirely forested and undeveloped; watershed areas from Cardille et al. (1). For both lakes, the terrestrial C can enter these lakes as DOC in groundwater, as Aeolian-transported POC, and POC can be formed in the lake from DOC by flocculation.

1. Cardille JA, et al. (2007) Carbon and water cycling in lake-rich landscapes: Landscape connections, lake hydrology, and biogeochemistry. *J Geophys Res-Biogeo* 112:G202031.

Table S3. Isotopic signatures of terrestrial and aquatic primary producers used as end members in the mixing models

Type	Lake	δ^{13}C (SD) *n*	δ^{15}N (SD) *n*	δ^{2}H (SD) *n*	Method	Symbol
Terrestrial vegetation	Both	−29.2 (1.5) 81	−4.6 (0.6) 81	−129.5 (15.2) 81	Direct measurement (8 dominant tree species) these watersheds	T
Benthic algae	Paul	−28.4 (4.6) 6	+2.4 (4.7) 6	−180.0 (18.0) 6	Direct measurement on tiles colonized with benthic algae in situ	L
Benthic algae	Crampton	−29.4 (3.1) 6	−0.2 (1.5) 6	−186 (15.2) 6	As with Paul	L
Phytoplankton	Paul	−31.3 (2.2) 12	+1.8 (1.7) 12	−198 (8.3) 12	Dilution regrowth for δ^2H, algebra for δ ^{13}C and δ^{15}N on POM, (*Methods*)	P
Phytoplankton	Crampton	−28.8 (0.8) 12	+0.08 (2.3) 12	−195 (8.2) 12	As with Paul	P
Deep Phytoplankton	Paul	−32.3 (2.4) 4	+3.5 (2.9) 4	−212 (8.3) 4	Use ε_H from phytoplankton and water at depth, algebra with POM for C and N	D
Deep phytoplankton	Crampton	−31.3 (0.7) 4	1.1 (1.7) 4	−200 (8.2) 4	As with Paul	D
Methane-oxidizing bacteria	Paul	−60	1.8	−200	Speculative. Based on 41	CH_4
Methane-oxidizing bacteria	Crampton	−60	0.08	−200	Speculative. Based on 41	CH_4

The terrestrial end members represent averages of leaves of the dominant trees in these watersheds and were measured directly. Benthic algal isotopes were obtained by deploying clean tiles for 1–2 wk in each lake and sampling the algae that grew there and measured directly. Phytoplankton isotopes were obtained by a unique method. Using dilution regrowth experiments in each lake, we obtained the δ^2H of phytoplankton. The contrast between the δ^2H of phytoplankton and the water it grew in (ε_{H},) was large, and nearly identical (between 150 and 160 del units) between the lakes and in other systems so far studied (1–4). Unlike the case for C, there is no known physiological effect on ε_H of bulk organic matter from either growth rate or cell size. Thus, it is possible to predict the δ^2H of phytoplankton from that of water in principal under any growth conditions. Using the measured δ^2H of water at each depth and time, we calculated the δ^2H of phytoplankton by using the mean ε_H. We assume that POM is a mixture of phytoplankton and terrestrial material. Because we have measured values of the δ^2H, δ^{13}C, and δ^{15}N of terrestrial material, we can solve algebraically for the ^{13}C and ^{15}N of phytoplankton. Solving Eq. **1** for ϕ_T gives us the fraction of POM that is terrestrial. We can then solve Eq. **2** for the δ^{13}C (or a similar equation for δ^{15}N) of phytoplankton. Eq. **1**: $\delta^2H_{POM} = \phi_T \times \delta^2H_T + (1 - \phi_T)\ \delta^2H_P$ (all are knowns except ϕ_T) Eq. **2**: $\delta^{13}C_{POM} = \phi_T \times \delta^{13}C_T + (1 - \phi_T) \times \delta^{13}C_P$ (now all are knowns except $\delta^{13}C_P$), where the subscripts "POM" and "P" denote particulate organic matter and phytoplankton, respectively, and ϕ_T is the fraction of POM that is terrestrial.

1. Caraco N, Bauer JE, Cole JJ, Petsch S, Raymond P (2010) Millennial-aged organic carbon subsidies to a modern river food web. *Ecology* 91:2385–2393.
2. Doucett RR, Marks JC, Blinn DW, Caron M, Hungate BA (2007) Measuring terrestrial subsidies to aquatic food webs using stable isotopes of hydrogen. *Ecology* 88:1587–1592.
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4. Solomon CT, et al. (2009) The influence of environmental water on the hydrogen stable isotope ratio in aquatic consumers. *Oecologia* 161:313–324.