Inter-seasonal carbon dynamics of oligotrophic, subalpine Lake Lunz, Austria

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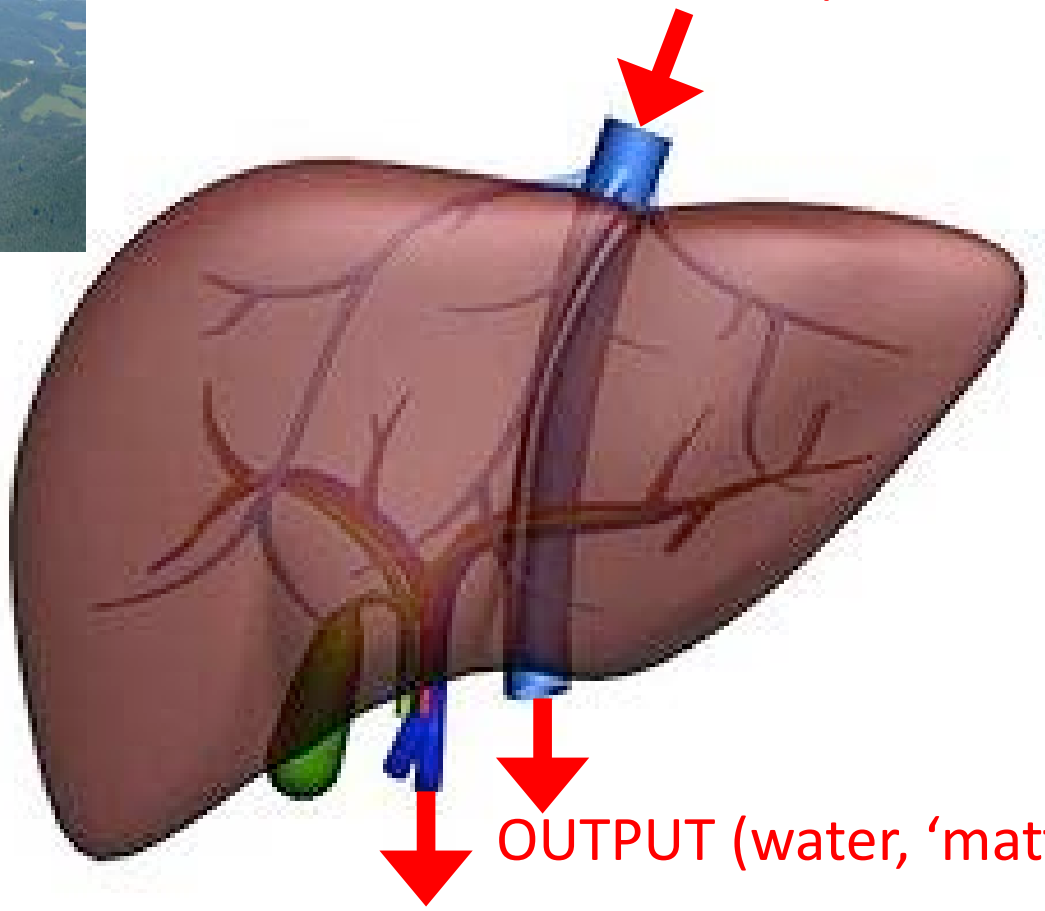
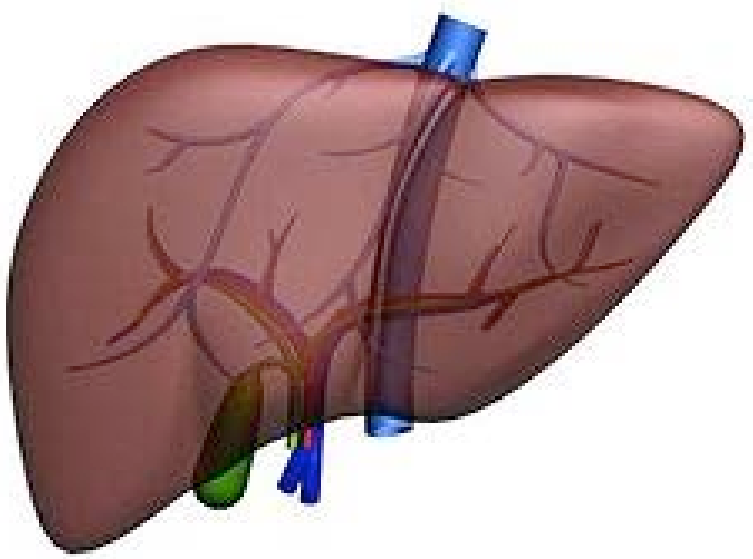
Lake as an organ in the landscape



General questions:

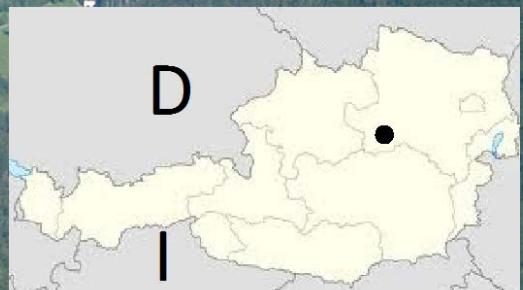
- What is the role of a lake in transforming organic matter in a landscape?
- How do lakes modify organic matter (POM and DOM) over time?
- How do different organic matter sources in lakes perform over time?



http://docmed.tv.vitanet.de

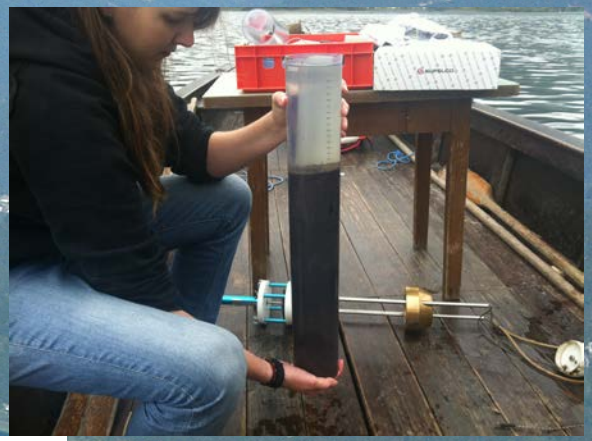
Objectives:

- Determine carbon (POC and DOC) quantity and biochemical quality in lake in- and outflow over time,
- Assess carbon sources in lake in- and outflow, and,
- Determine carbon source retention in lake sediments



- CO_2 (Eddy covariance)

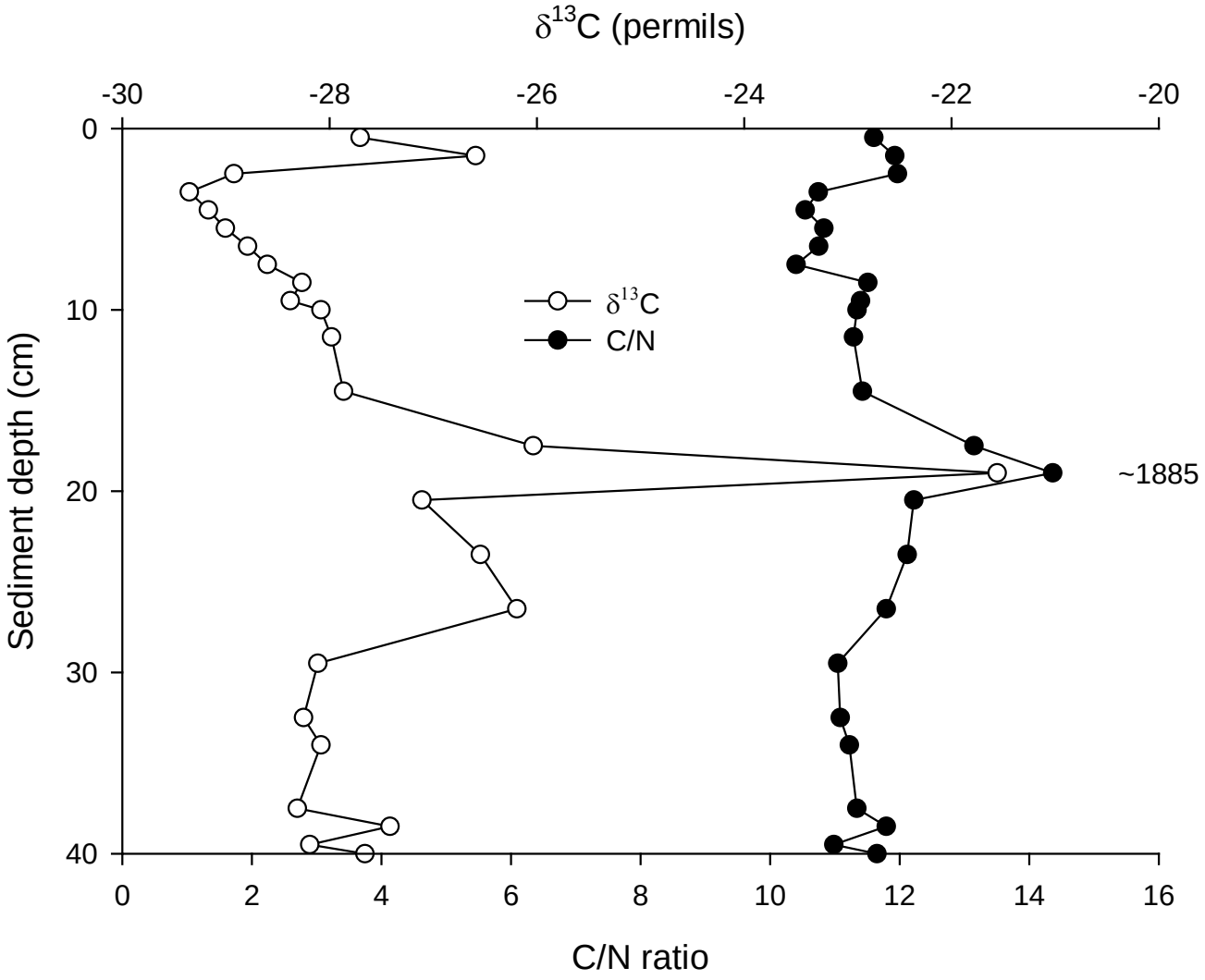
- DOM (<0.2 um)
- POM (0.2-30 um)



- Sediments
- Traps

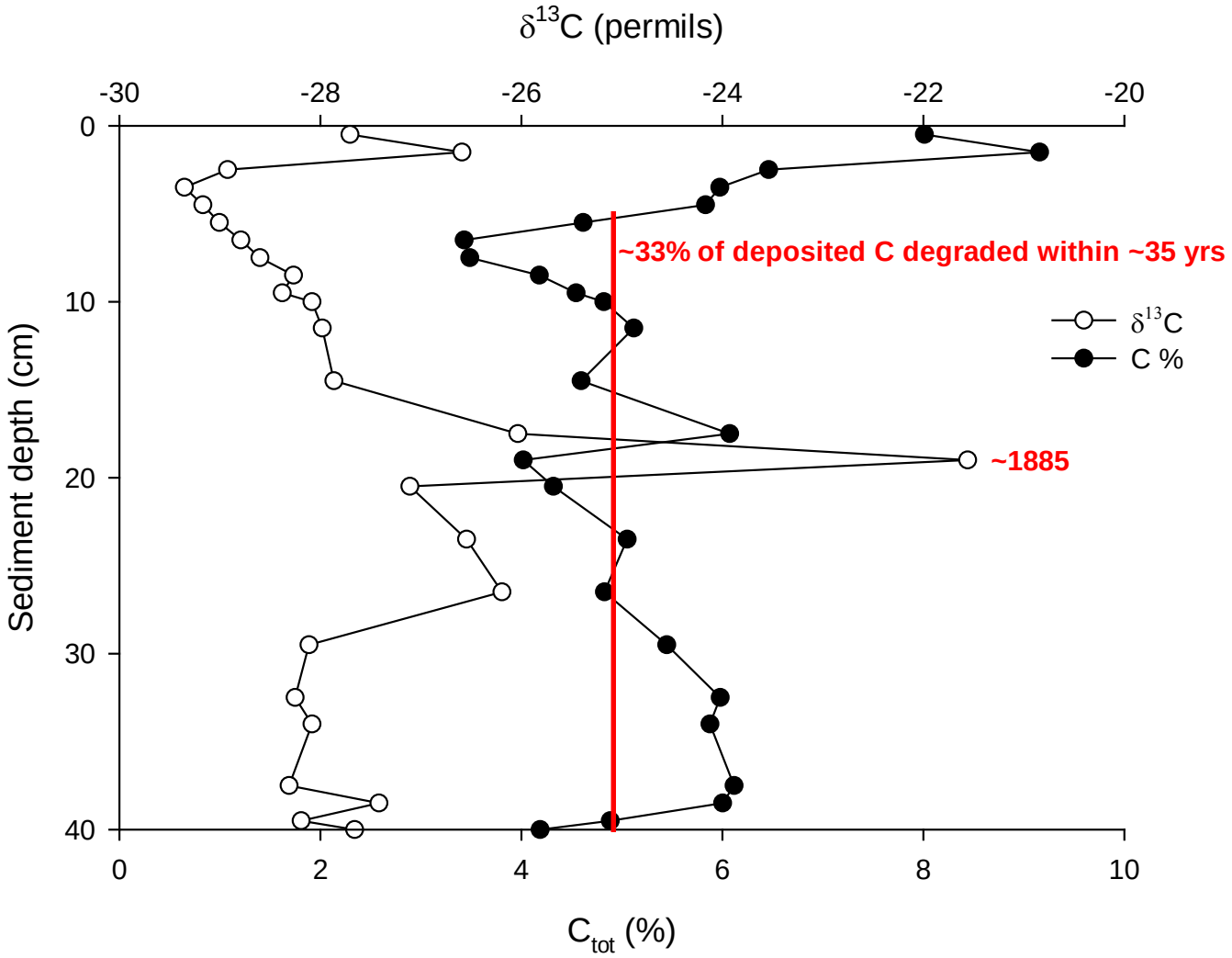
- DOM (<0.2 um)
- POM (0.2-30 um)

Sediments – 0.144 cm yr^{-1} sedimentation rate (^{210}Pb)



Hollaus et al. (in prep.)

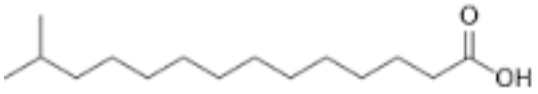
Sediments – rapid downcore carbon degradation



Hollaus et al. (in prep.)

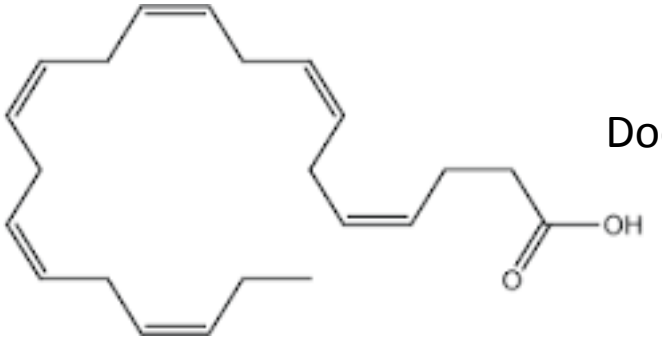
Organic matter sources – fatty acids as biomarkers

Bacterial fatty acids
(odd and branched-chain)



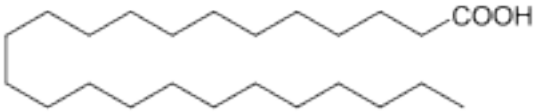
Isopentadecanoic acid (iso-15:0)

Algal fatty acids
(PUFA)



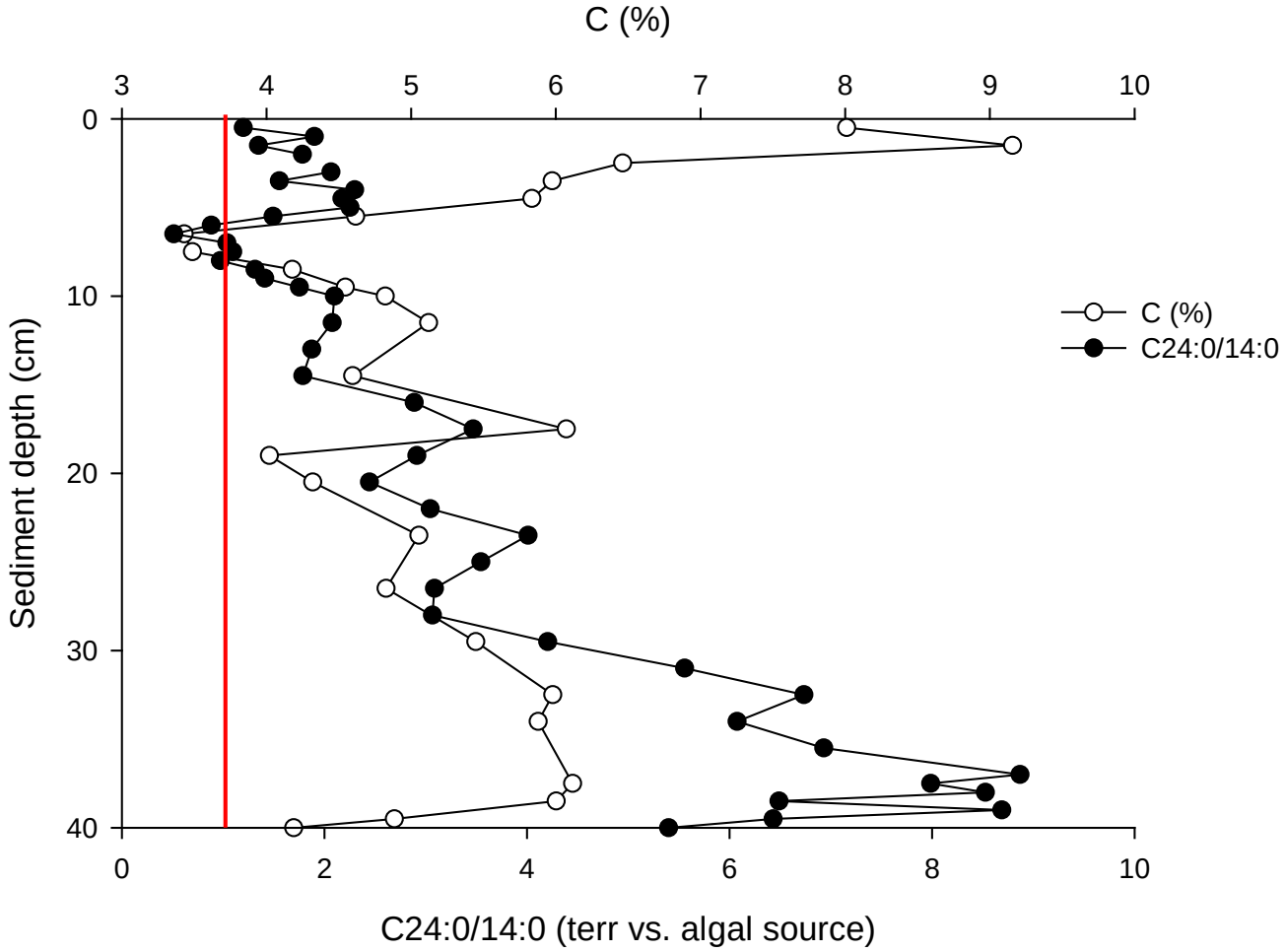
Docosahexaenoic acid (22:6n-3)

Terrestrial fatty acids
(long-chain; >22C)



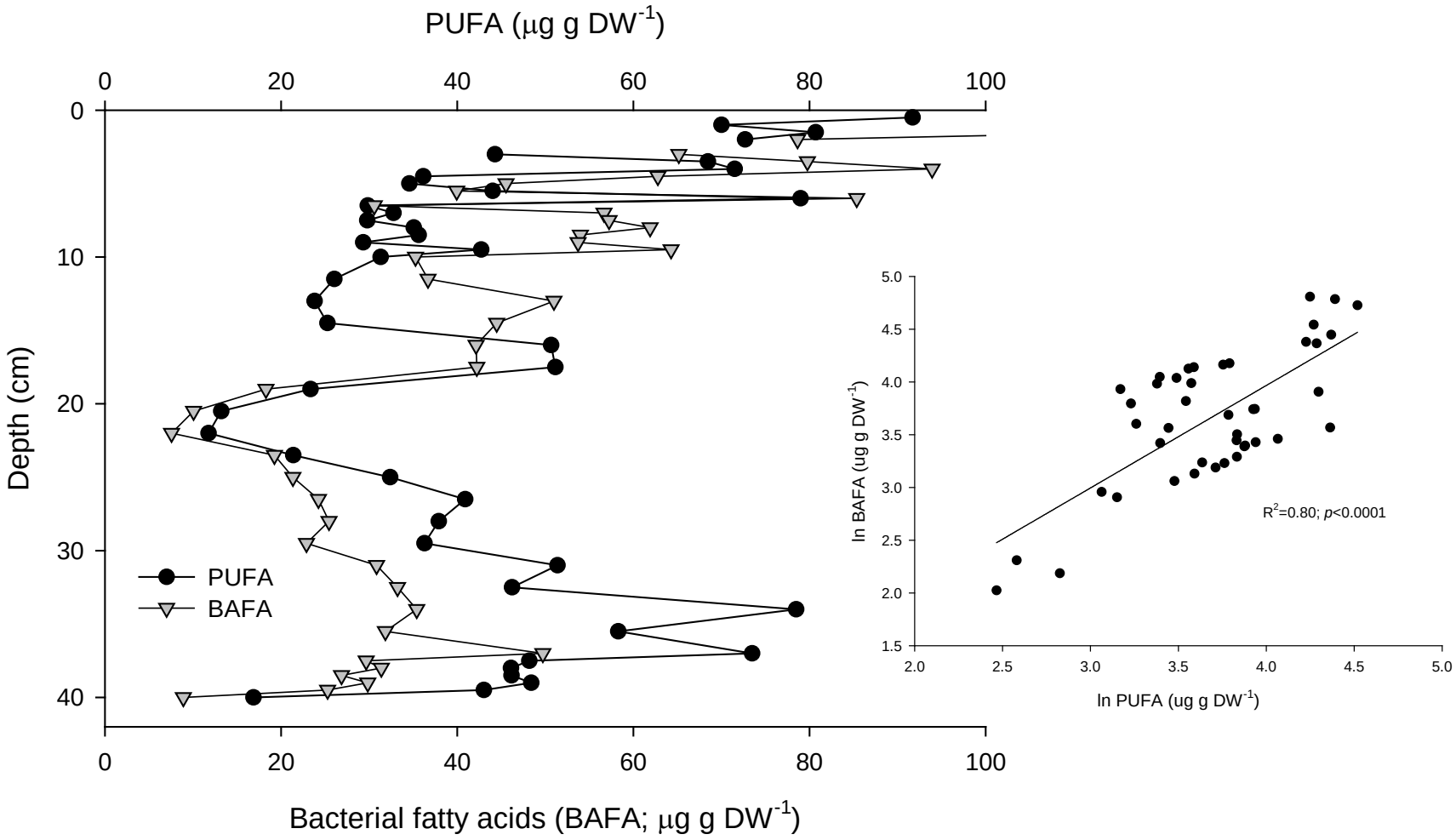
Lignoceric acid (24:0)

Sediments – mostly terrestrial organic matter



Hollaus et al. (in prep.)

Sediments – bacterial biomarkers track labile (algal) matter

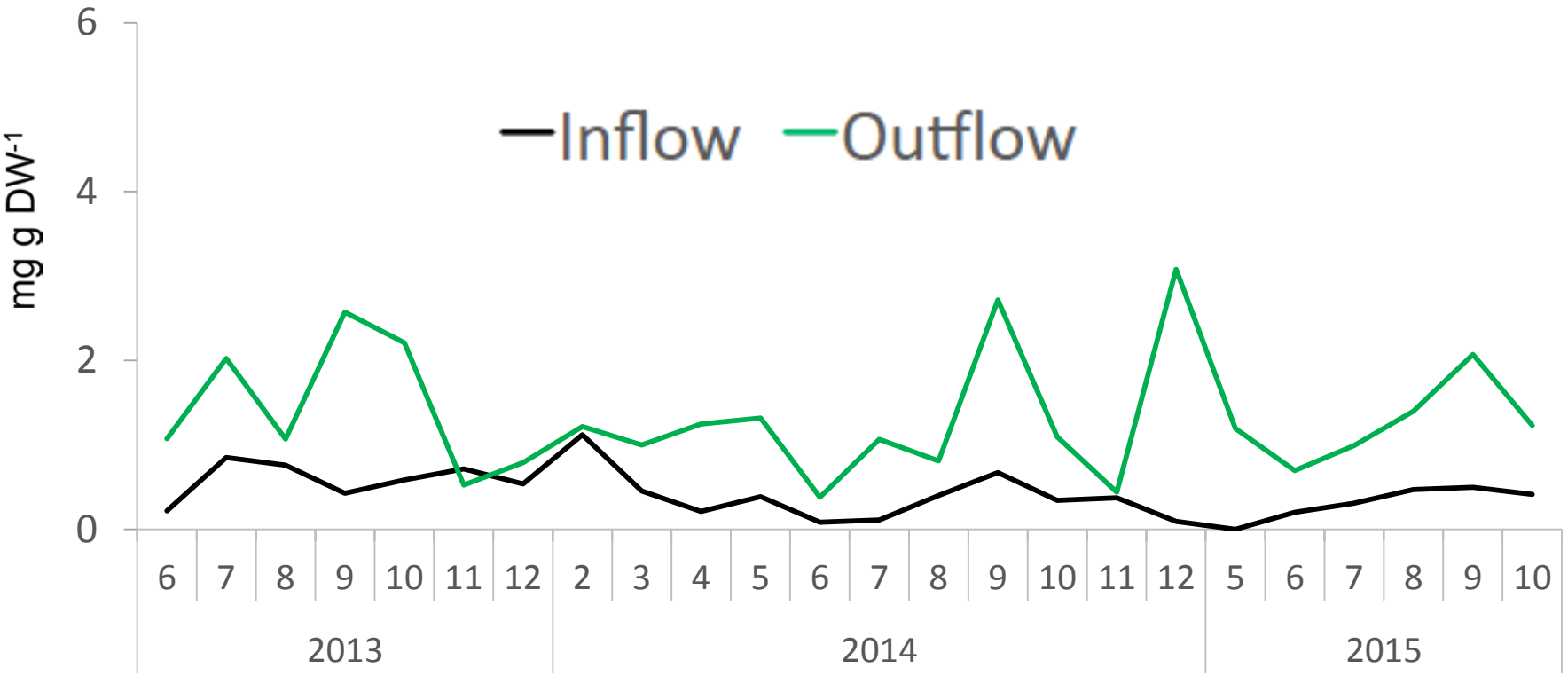


Hollaus et al. (in prep.)

POC sources in lake inflow vs outflow (2013-2015)

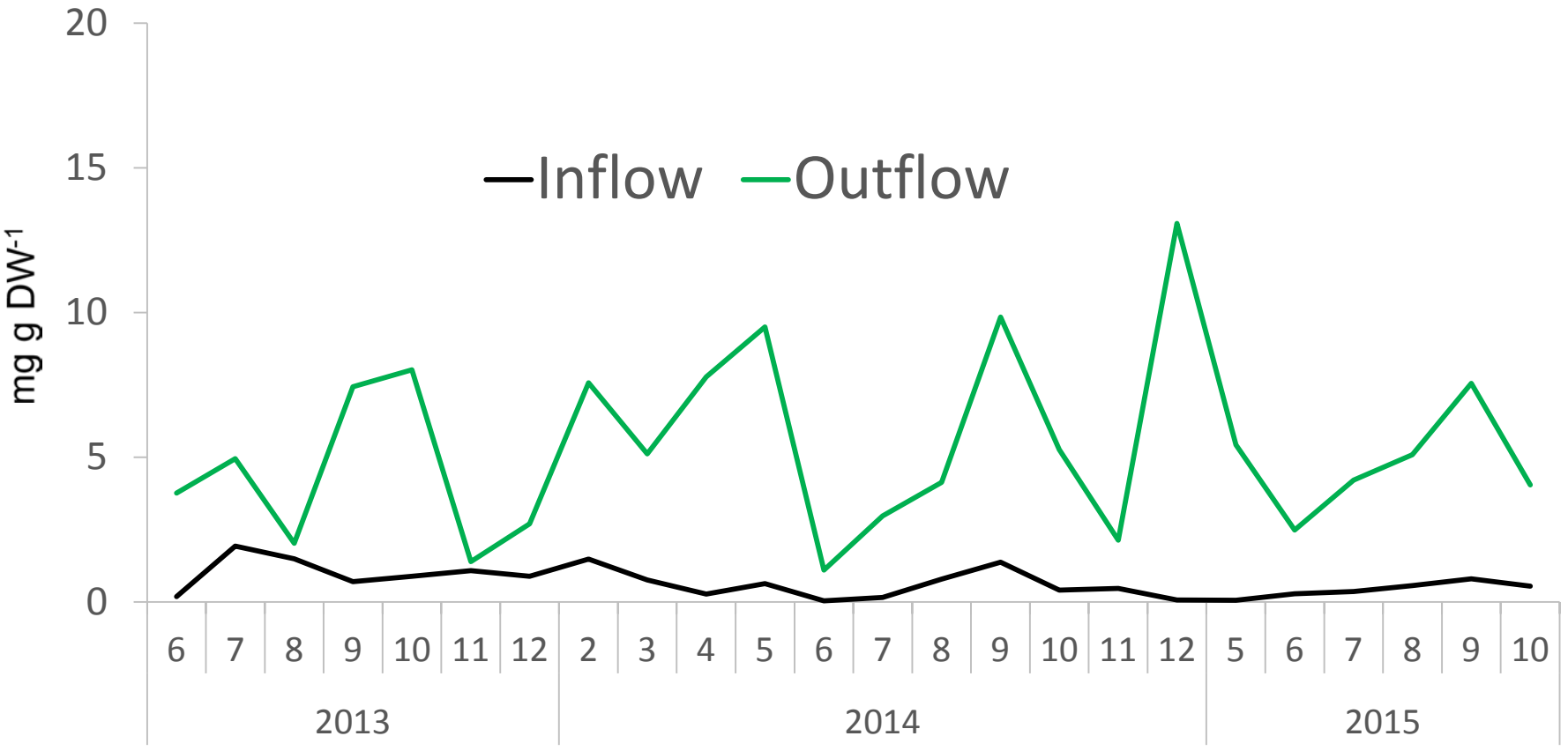
Khan et al. (in prep.)

Bacterial fatty acids (inflow and outflow) in POM



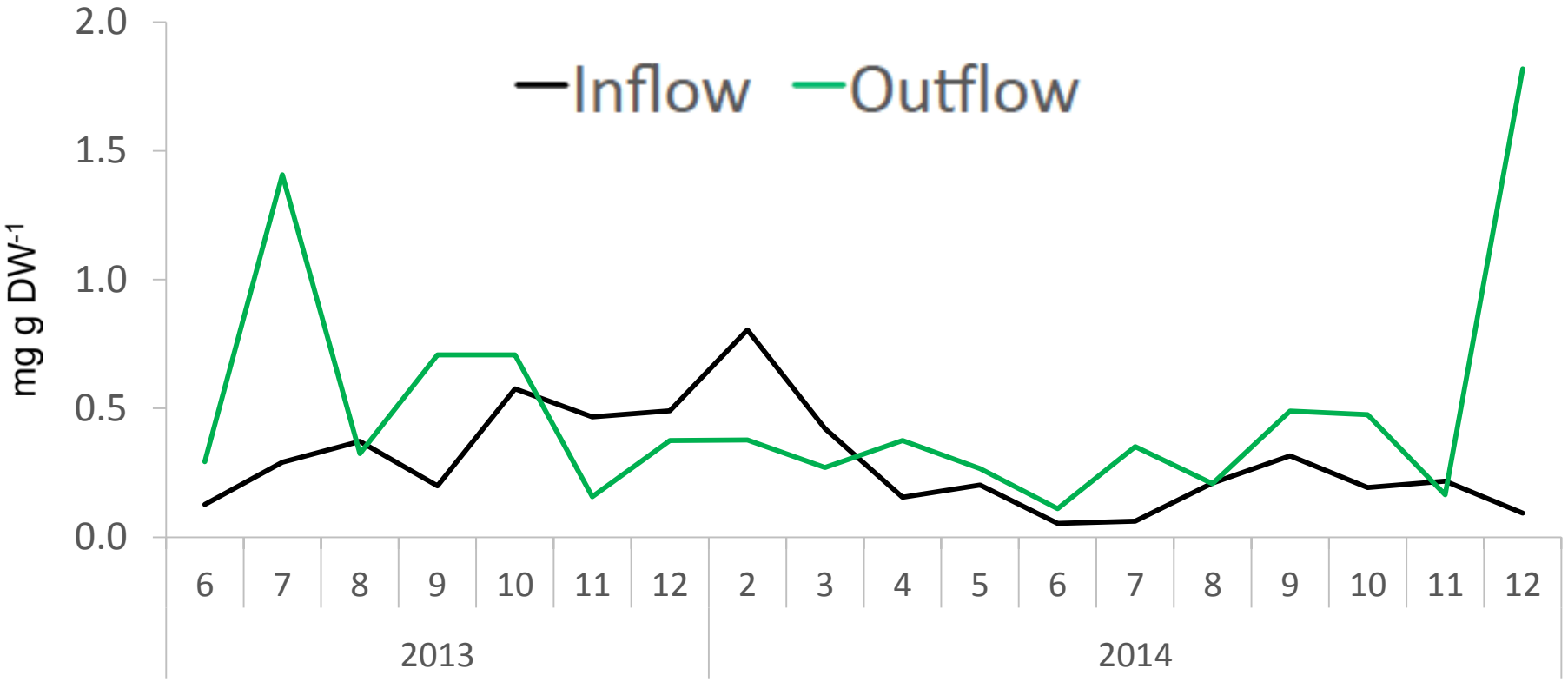
Khan et al. (in prep.)

Algal fatty acids (PUFA; inflow and outflow) in POM



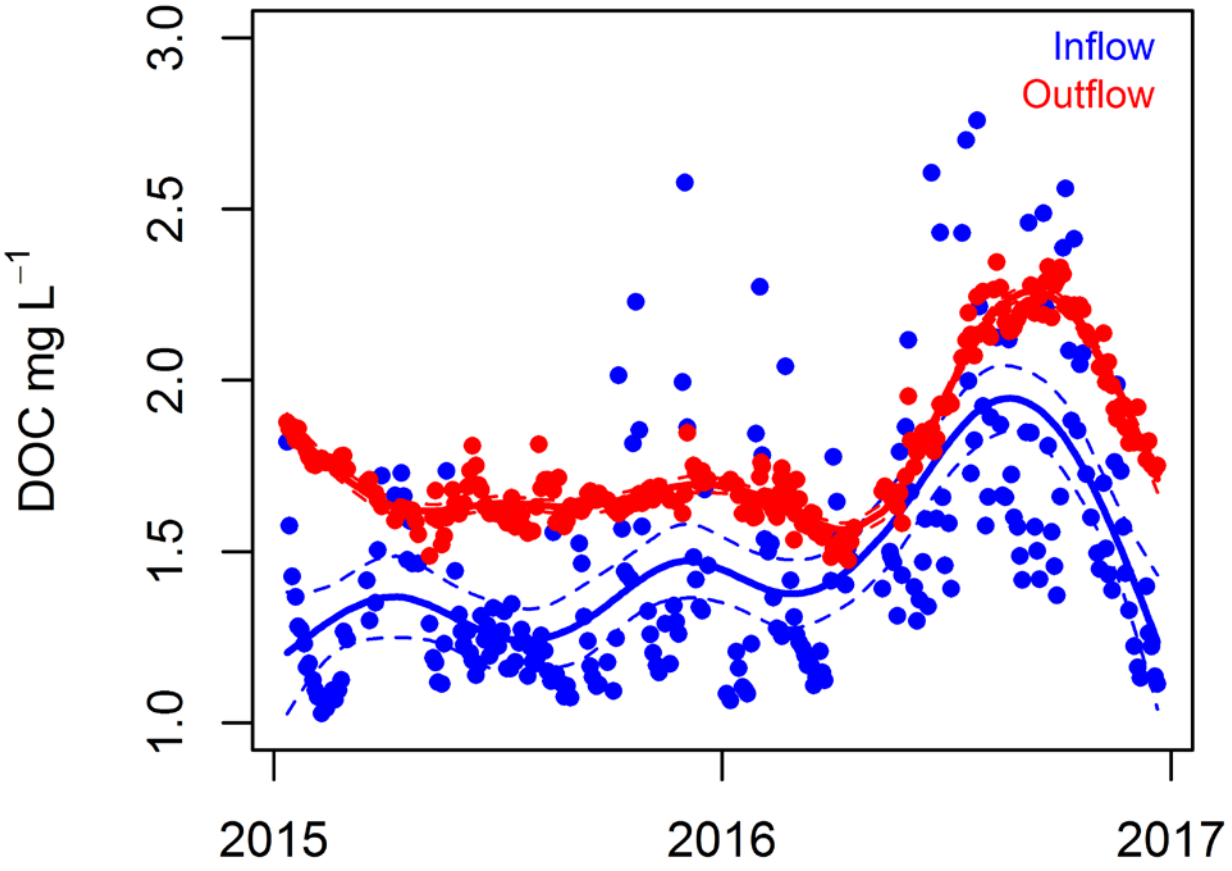
Khan et al. (in prep.)

Terrestrial fatty acids (inflow and outflow) in POM



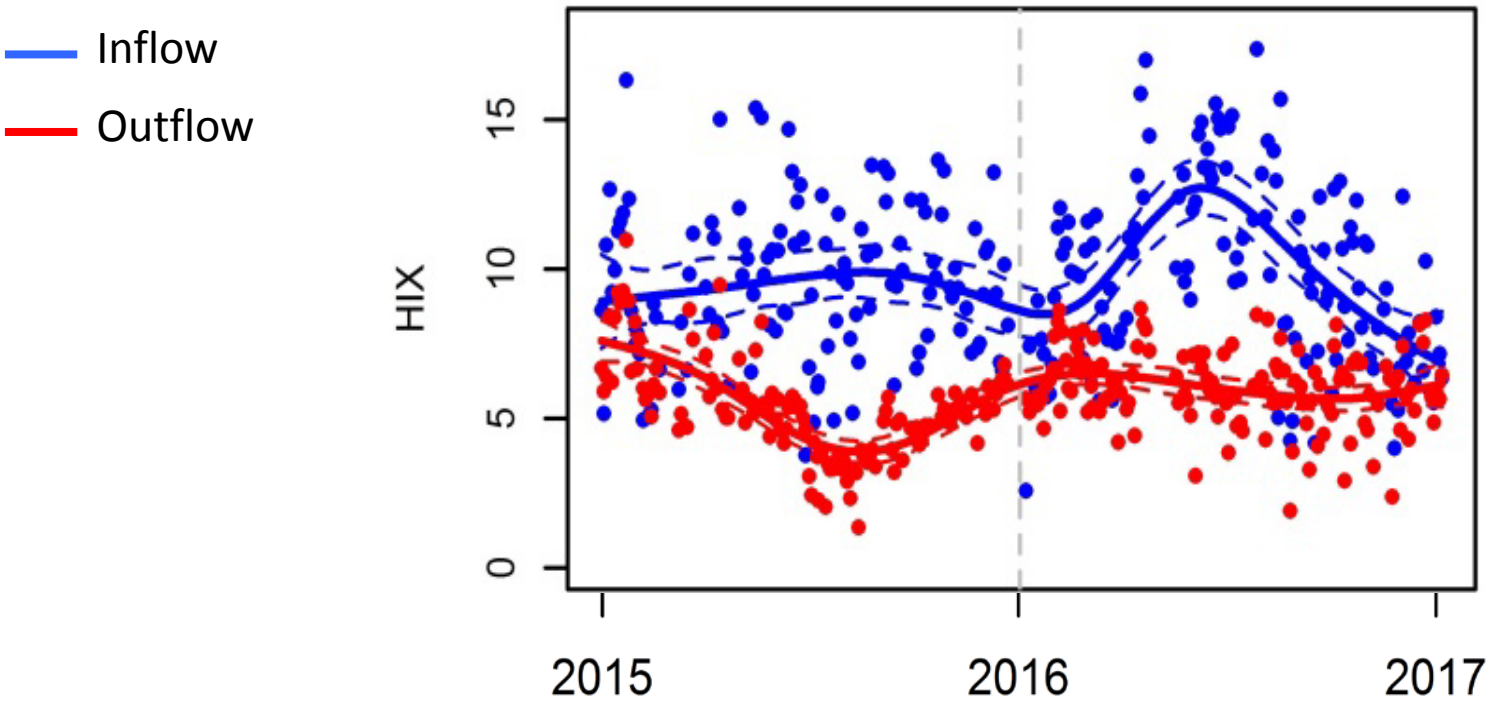
Khan et al. (in prep.)

Dissolved organic carbon – quantity and optical analysis



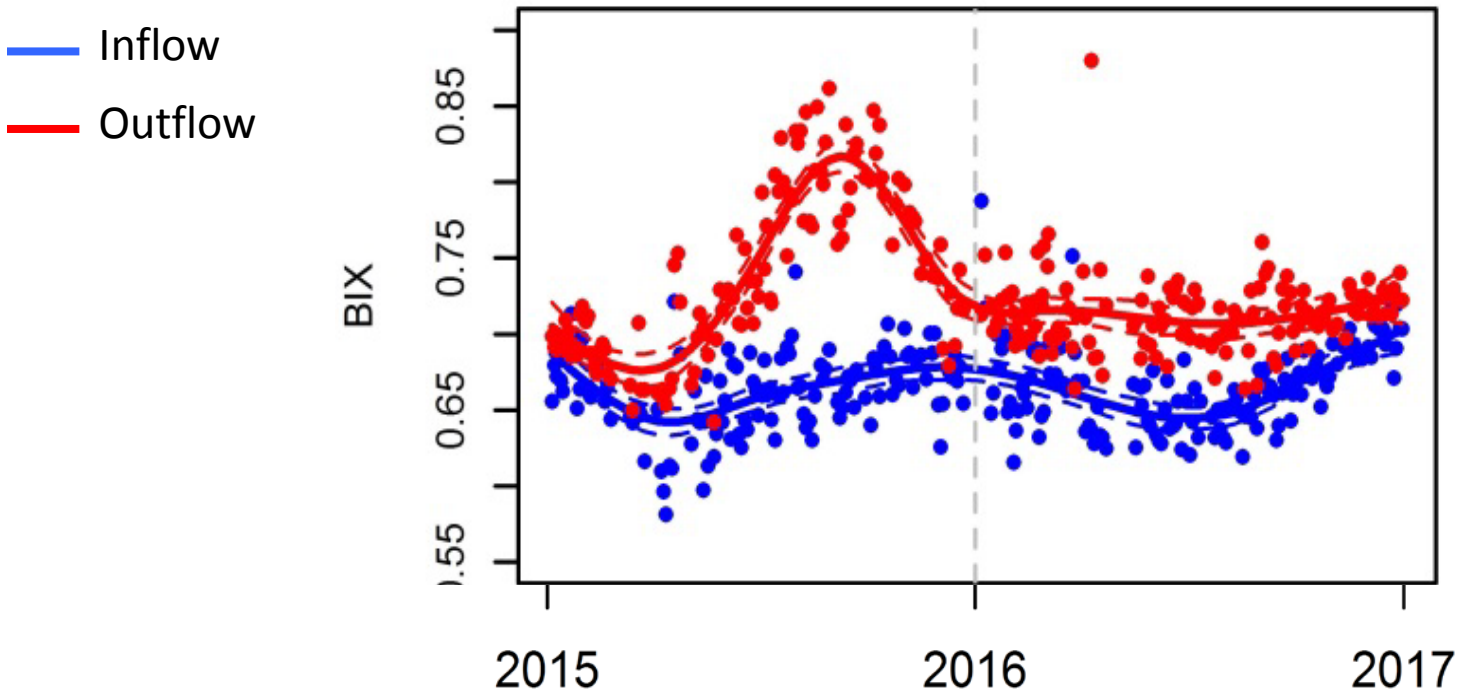
Ejarque et al. (in prep.)

HIX: Humification index (Zsolnay 2003)



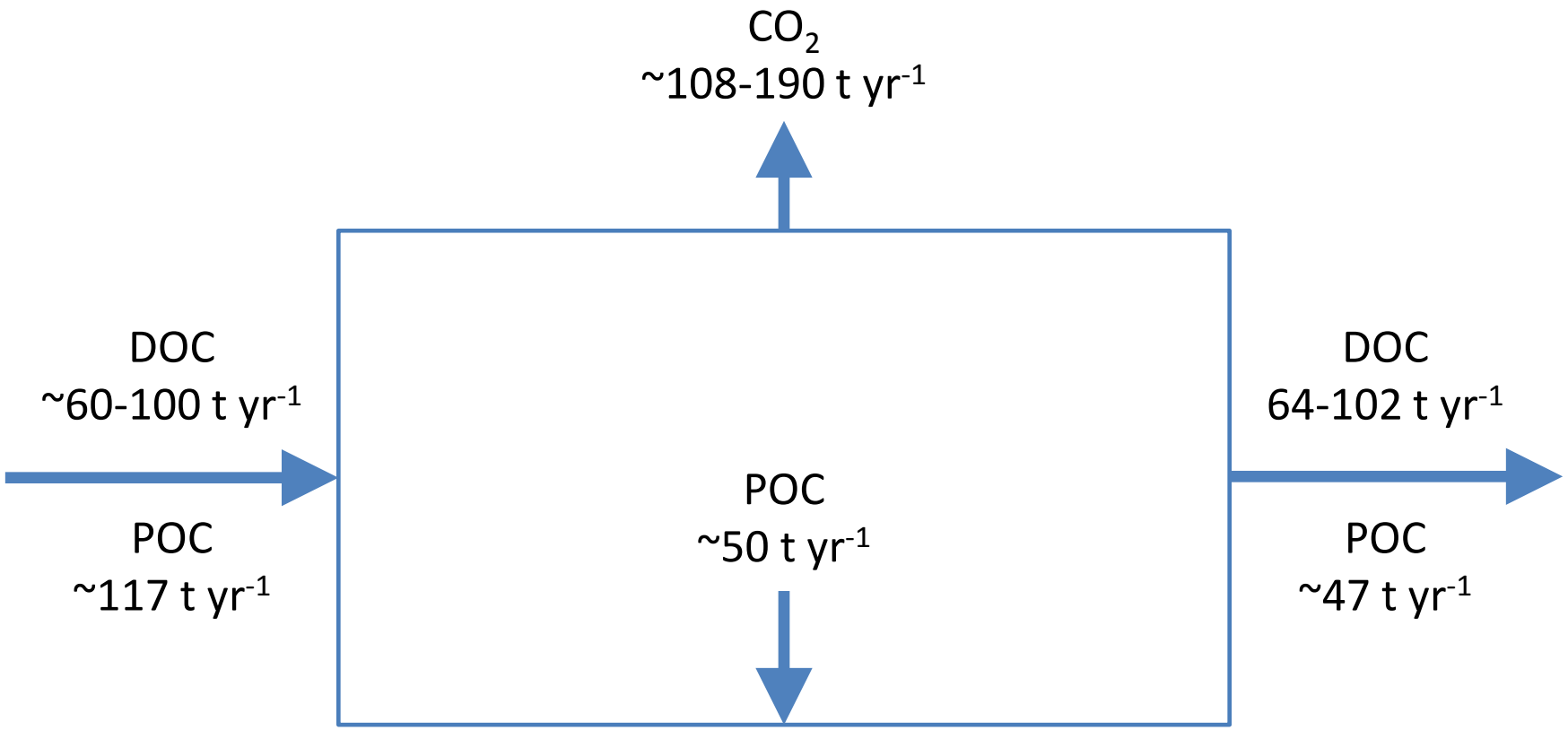
Ejarque et al. (in prep.)

Biological index: autotrophic origin (Huguet et al. 2009)



Ejarque et al. (in prep.)

Where does all the carbon go?

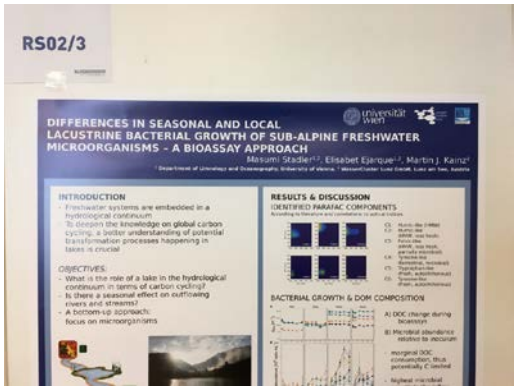


Conclusions and implications

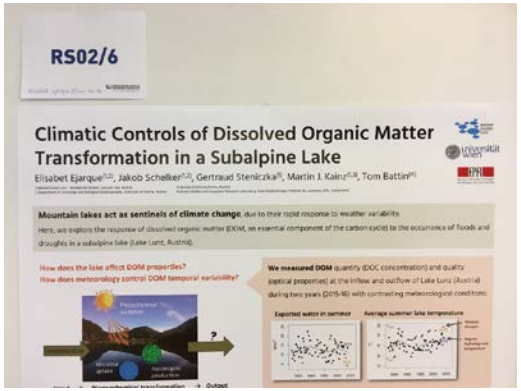
Oligotrophic, deep, sub-alpine Lake Lunz (et al.?)

- clearly acts as an **organic matter upgrader,**
- discharges **more labile** than recalcitrant OM, and,
- is a **source of DOC, but a temporary sink of POC**

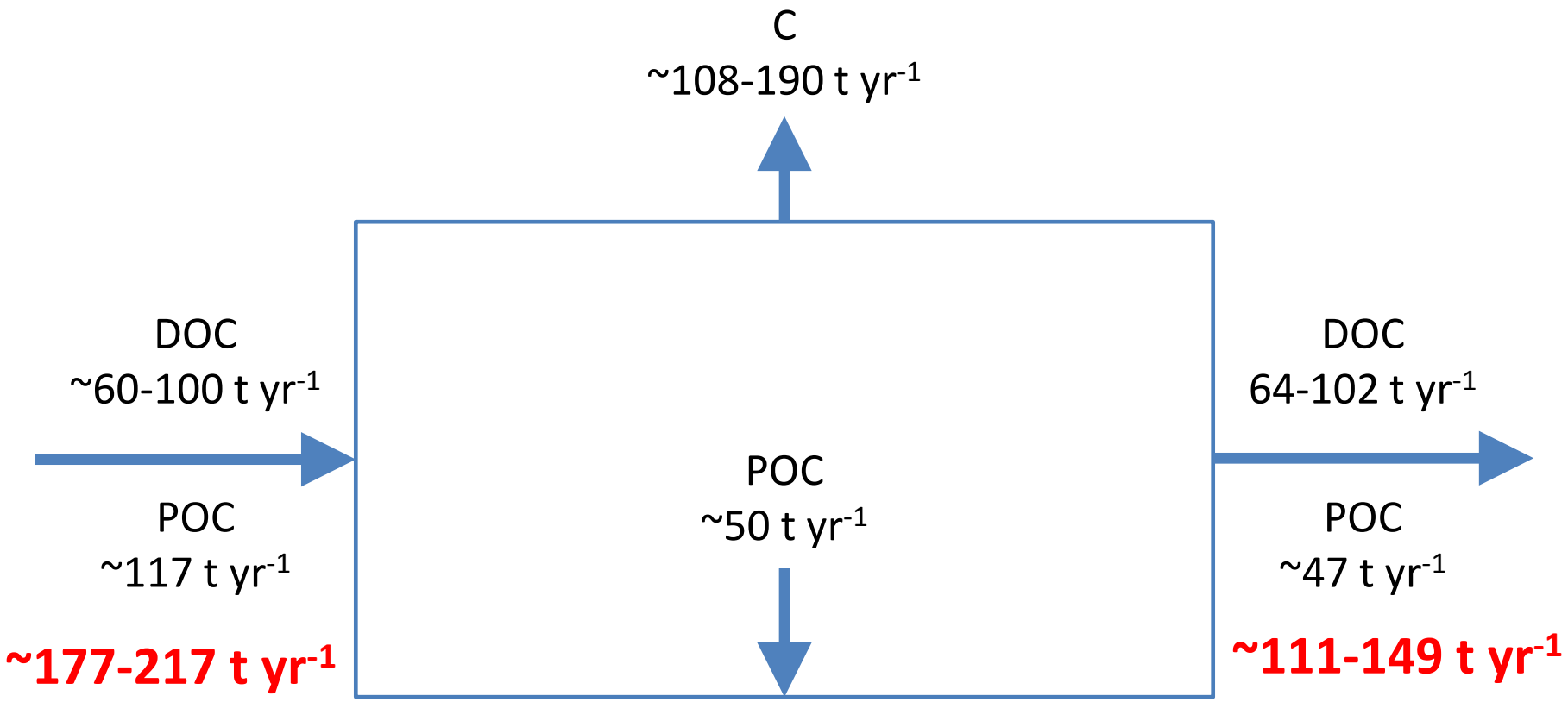
RS02/3
Stadler



RS02/6
Ejarque



Where does all the carbon go? – a preliminary view



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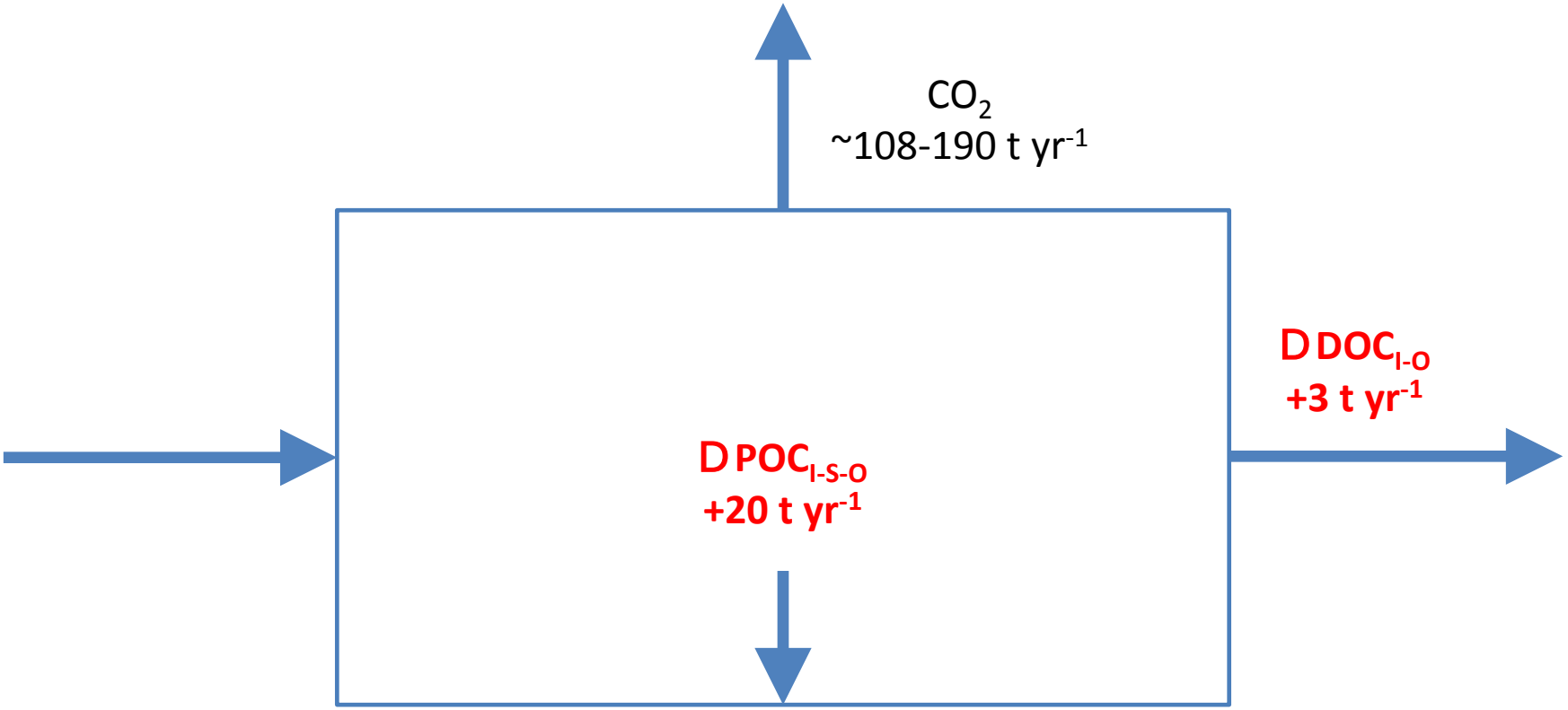
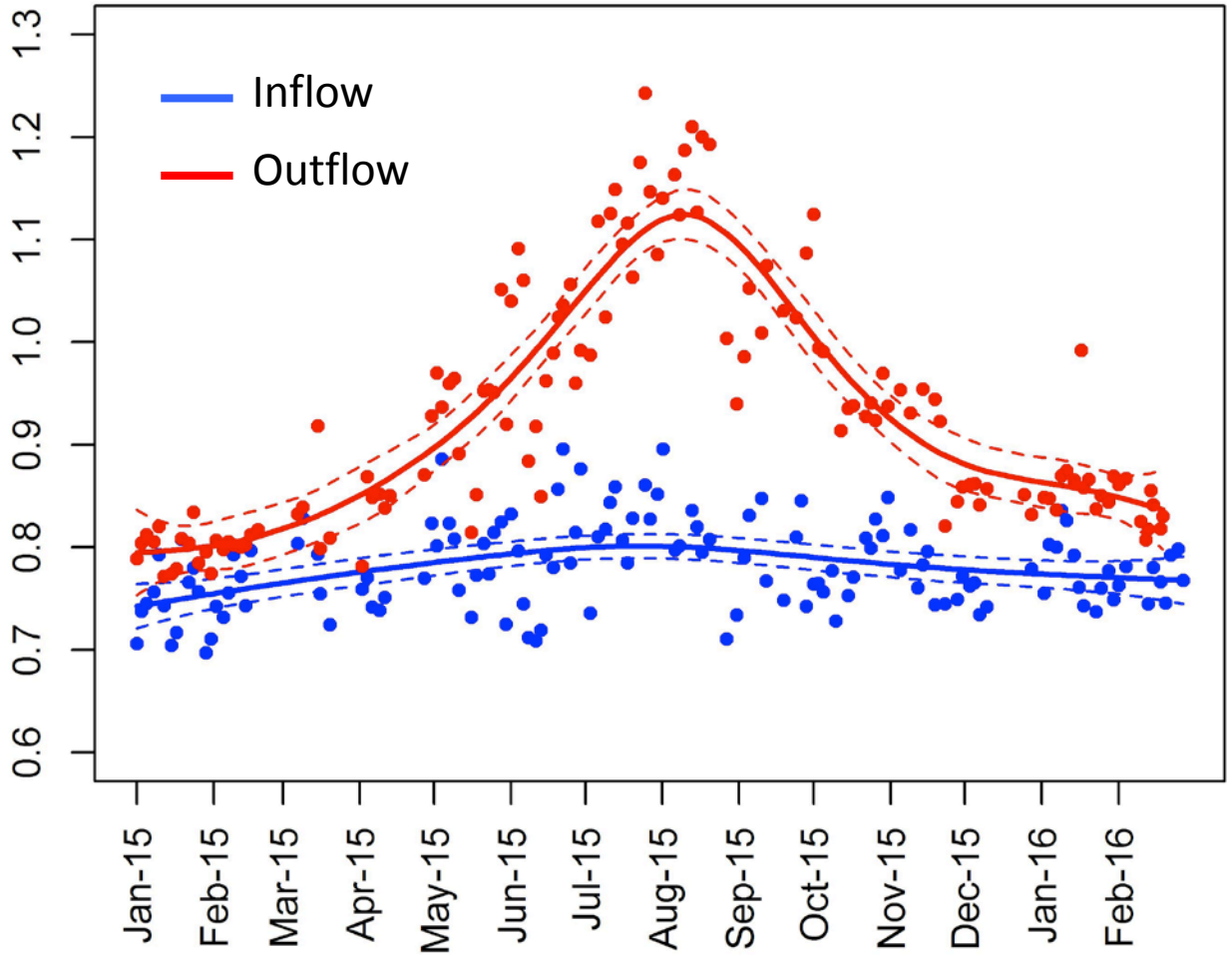
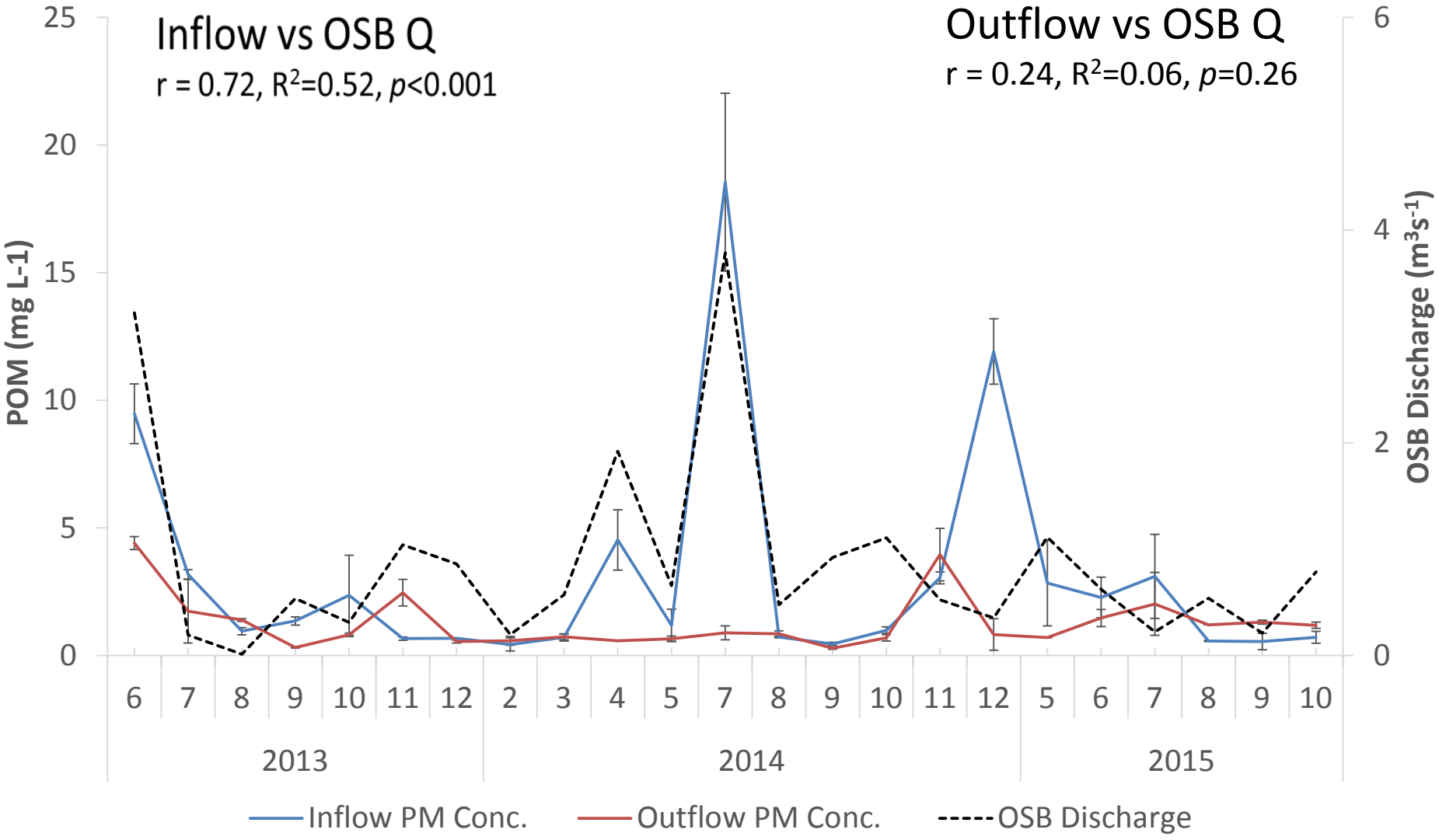


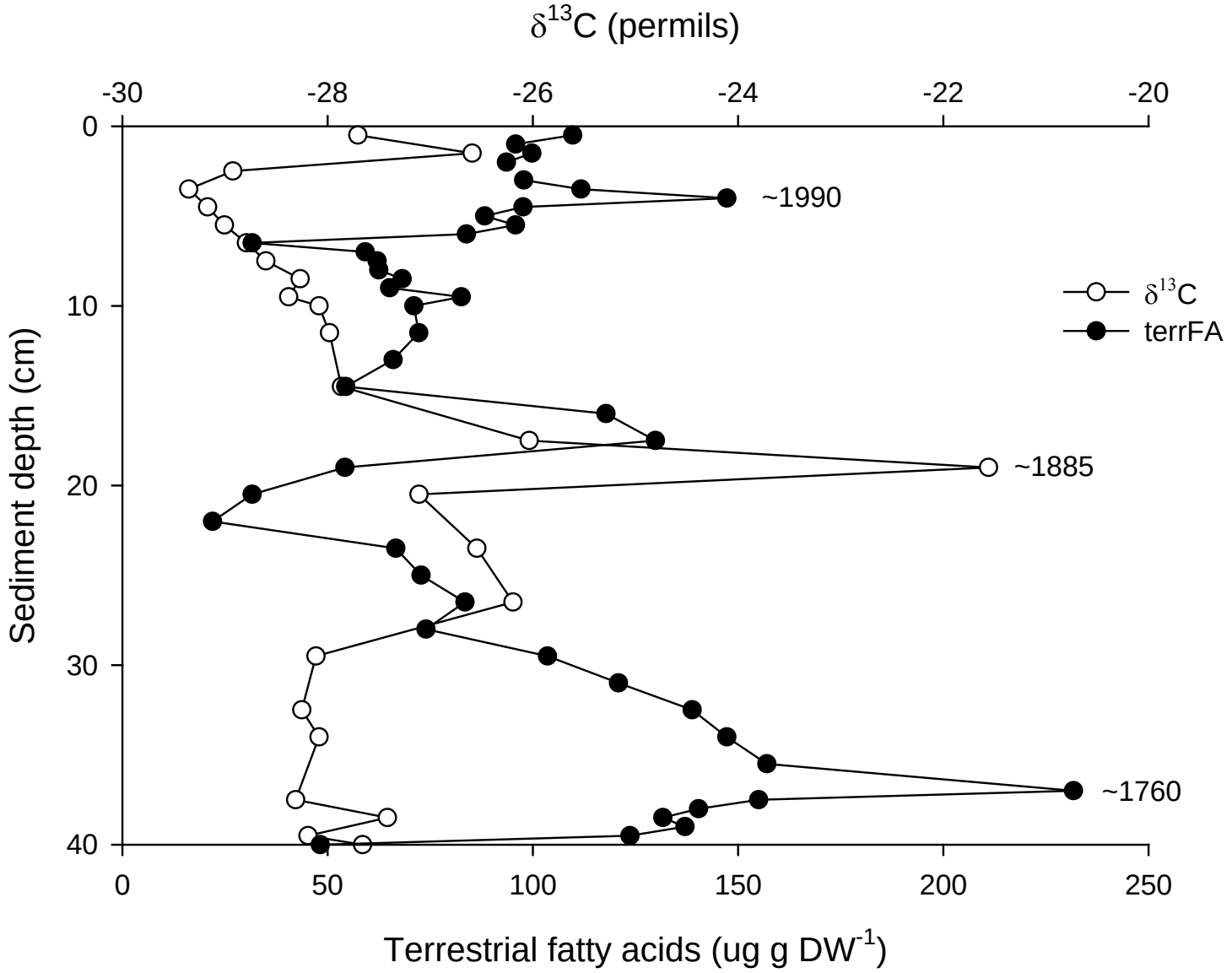
Spectral slope ratio: inverse molecular weight, thus the higher the number, the lower the MW (Helms et al. 2008)



POM in inflow/outflow vs lake inflow (2013-15)



Sediments – bacterial biomarkers track labile (algal) matter



	2015	2016
Inputs	60,405 kg	100,350 kg
Outputs	64,374 kg	102,051 kg
ΔDOC (out-in)	+ 3,969 kg	+1,701 kg
	+ 6.57 %	+1.70 %

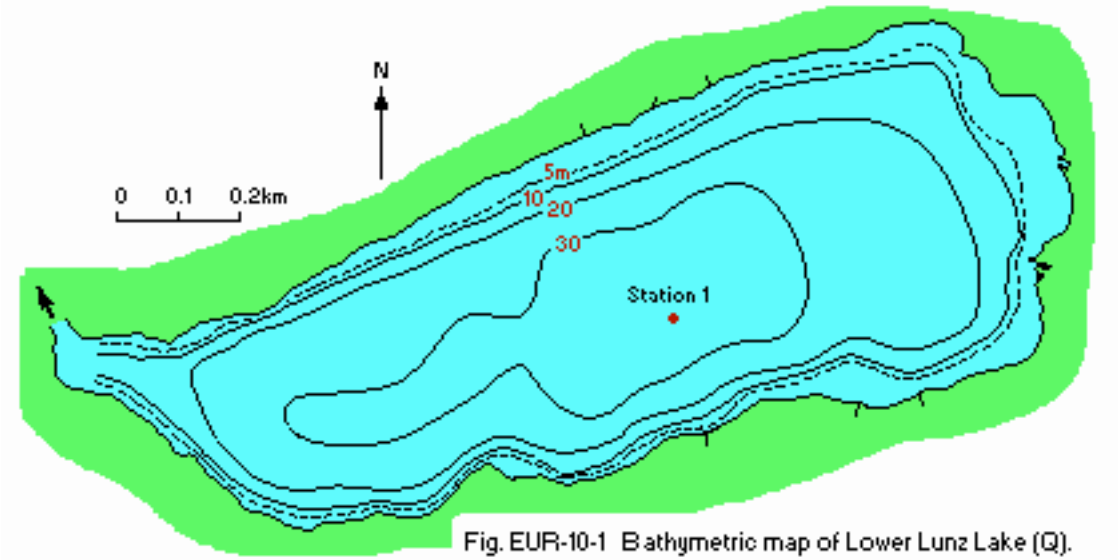


Fig. EUR-10-1 Bathymetric map of Lower Lunz Lake (Q).

POM in lake inflow vs outflow (2013-15)