Rates of bacterial protein production at Lake Stechlin 2003-2020

Version 2021-11-24

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Data origin Data were collected by IGB from 2003-03-28 onwards (Elke Mach).

Data

Sampling site

Lake Stechlin is a deep, dimictic, formerly oligotrophic clear-water lake that has been undergoing eutrophication since at least the early 2000s and especially since 2010. The lake is located in a nature reserve approximately 80 km north of Berlin, Germany (53°9‘5.6“N, 13°1‘34.2“E) at 59 m altitude. The lake has a maximum depth of 69.5 m, a mean depth of 23.3 m, a surface area of 4.3 km^2 and a volume of 96.9 x 10^6 m^3. The lake basin was formed during the last continental glaciation ca. 12,000 years ago and is today situated at the transition between temperate maritime and temperate continental climate (Fraedrich et al. 2001). The catchment has a size of 12.6 km^2 and is almost completely covered by managed forest (95%). The main species is Scots pine (*Pinus sylvestris*), although beech (*Fagus sylvatica*) is the dominant tree species along the shoreline. Non-forested areas are the site of a former nuclear power plant and a small village (Neuglobsow with about 300 residents but more during the summer tourist season), whose wastewater is diverted to a different catchment. The shoreline is largely undeveloped with no notable infrastructure except on the properties of a fisherman, the Federal German Environment Agency and the Leibniz Institute of Freshwater Ecology and Inland Fisheries. The seepage lake is mainly fed by precipitation and groundwater, resulting in a theoretical water retention time of more than 40 years (Koschel 1995, Holzbecher et al. 1999). There are no river inflows except for occasional discharge from a small stream channel that is dry in most years. The water level of Lake Stechlin is regulated. From 1966 to 1990, the lake received a total of about 300,000 m^3 d^{-1} of cooling water from the nearby nuclear power plant. The cooling water was withdrawn from neighbouring Upper Lake Nehmitz

and discharged into Lake Stechlin at an average temperature of approximately 10 °C above the ambient surface water temperature. This resulted in an average increase in water temperature by 1-2 °C during the power plant operation (1966-1990). For more information, see Casper (1985), Koschel and Casper (1986), Casper and Koschel (1995), Koschel and Adams (2003) and Kirillin et al. (2013).

Time span 2003-2020

Sampling method

Samples were taken monthly at the deepest site of the lake (69.5 m) usually in two and sometimes three depths: one in the mixed upper layer in a mixed water sample taken in depths between 0 m and 10 m depending on epilimnion depth, one in the hypolimnion in 40 m depth, and sometimes one in the metalimnion. From May to September fortnightly samples have sometimes been taken.

Rates of bacterial protein production (BPP) were determined by incorporation of 14[C]-leucine (14C-Leu, Simon and Azam, 1989). Triplicates and a formalin-killed control were incubated with 14C-Leu (1.15×10^{10} Bq $mmol^{-1}$, Amersham, England) at a final concentration of 50 nmol l^{-1}, which ensured saturation of uptake systems of both free and particle-associated bacteria. Incubation was performed in the dark at in situ temperature (4-25°C) for 1 h. After fixation with 2% formalin, samples were filtered onto 5.0 µm (attached) and 0.2 µm (total isotope incorporation) nitrocellulose filters (Sartorius, Germany) and extracted with ice-cold 5% trichloroacetic acid (TCA) for 5 min. Thereafter, filters were rinsed twice with ice-cold 5% TCA, once with ethanol (96% v/v), and dissolved with ethylacetate for measurement by liquid scintillation counting. Standard deviation of triplicate measurements was usually $<$15%. BPP of free bacteria was calculated by subtraction of attached BPP from total BPP. The amount of incorporated 14C-Leu was converted into BPP by using an intracellular isotope dilution factor of 2. A conversion factor of 0.86 was used to convert the protein produced into carbon (Simon and Azam, 1989). The protocol was modified after Allgaier et al. 2008 including the separation between free-living and particle-associated bacteria (see above).

Parameters

- `date` – date of measurement [`YYYY-MM-DD`]
- `depth` – depth of measurement [m]
- `leucine` – type of leucine that was used when processing the samples
- `light/dark` – indication whether measurements were performed at light or dark conditions
- `BPP-C_particle_hour` – particle-associated bacterial production [µg $l^{-1}h^{-1}$]
- `BPP-C_particle_day` – particle-associated bacterial production [µg $l^{-1}d^{-1}$]
- `BPP-C_water_hour` – free water bacterial production [µg $l^{-1}h^{-1}$]
- `BPP-C_water_day` – free water bacterial production [µg $l^{-1}d^{-1}$]

- BPP-C_total_hour – total bacterial production [µg $l^{-1}h^{-1}$]
- BPP-C_total_day – total bacterial production [µg $l^{-1}d^{-1}$]
- comment_raw – comments in the raw data by technician
- comment_dm – comments by the data manager

References

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Change log

- 2020/2021 Silke R. Schmidt: Data were compiled from raw data files from single measurement dates. Values from beginning until end of 2010 were corrected with factor 0.86, which was not included in the raw data. Negative values were deleted.