Chemical data (photometry) at Lake Stechlin 1970-2020

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Data origin Data were collected by IGB (Uta Mallok, Marén Lentz).

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 The cooling water was withdrawn from neighbouring Lake Nehmitz (North basin) and discharged into Lake Stechlin at an average temperature of approximately 10 °C above the ambient surface water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 1970-2020

Sampling method

Samples were taken at the deepest site of the lake (69.5 m) in the main basin (53°9'19.5"N, 13°1'52.9"E), from 1985 onwards as well in the West basin (53°9'15.1"N, 13°0'30.5"E) and in the South basin (53°8'37.0"N, 13°1'14.9"E), and between 1994 and 2018 as well at the inlet of Lake Dagow (Dagowsee). The temporal resolution varied over time. In the main basin, fortnightly samples have usually been taken from May to September. Outside this period monthly results are almost always available. The temporal resolution at the other sites is irregular. The spatial resolution was oriented according to thermal stratification patterns. 2-3 separate samples were taken and afterwards pooled representing the situation of the upper mixed layer (epilimnion). Several other samples were collected but not mixed in order to reflect the situation in the deeper waters (metalimnion and hypolimnion).

- Total phosphorus (TP), soluble reactive phosphorus (SRP), total nitrogen (TN), nitrite (NO2), nitrate (NO3), ammonium (NH4), soluble calcium (Ca), aluminium (Al), iron (Fe) and silicate (Si) were determined photometric following standardized protocols or methods outlined in the user manual of the respective instrument. Dissolved components were estimated after filtration of the sample through a 0.45 µm membrane. TP and TN were measured after wet digestion of unfiltered subsamples in an autoclave (potassium peroxodisulfate, TP 30 min., 134 °C; TN 40 min., 121 °C).
  - TP, SRP: Foss FIAstar 5000 Analyzer, Foss Analytical AB, Höganäs, Sweden; Water quality, determination of orthophosphate and total phosphorus contents by flow analysis (FIA and CFA) - Part 1: Method by flow injection analysis (FIA) (ISO 15681-1:2003)
  - TN, NO2, NO3, NH4: Foss FIAstar 5000 Analyzer, Foss Analytical AB, Höganäs, Sweden; Water quality, determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analysis (CFA and FIA) and spectrometric detection (ISO 13395:1996)
  - Ca: Foss FIAstar 5000 Analyzer, Foss Analytical AB, Höganäs, Sweden; Determination of dissolved calcium in water by FIAstar, Application note 5261, Foss Analytical AB, Höganäs, Sweden, 2003
  - Al: FIAcompact, Bestimmung des gesamten gelösten Aluminiums im Wasser. Arbeitsanleitung, Medizin- und Labortechnik GmbH, Dresden, Deutschland 2004
  - Fe: FIAcompact, Medizin- und Labortechnik GmbH, Dresden, Deutschland 2004, German standard methods for the examination of water, waste water and sludge; cations (group E); determination of iron (E 1), DIN 38404-1:1983-05
  - Si: Foss FIAstar 5000 Analyzer, Foss Analytical AB, Höganäs, Sweden; Water quality, determination of soluble silicates by flow analysis (FIA and CFA) ISO 16264:2002
- Total inorganic carbon (TIC) and non-purgeable organic carbon (NPOC) were estimated

using an unfiltered sample following the methods suggested in the user manual, SHIMADZU, TOC analyser VCPH/ASI-V, Kyoto, Japan

- Calcium carbonate ($CaCO_3$) was determined by filtering aliquots through membranes (cellulose acetate, pore size 0.45 µm, Sartorius, Göttingen) which were stored in a desiccator until further analysis. Samples were then dissolved in 10 % hydrochloric acid and the released CO_2 was measured using an infrared gas analyser (Infralyt 50 Saxon, Junkalor, Dessau, Germany; see Proft 1984). To recalculate from CO_2-C into $CaCO_3$ a factor of 8.3 was used.
- Alkalinity was ascertained titrimetric, Titrando 888, Metronom, Filderstadt, Germany). Water quality, determination of alkalinity - Part 1: Determination of total and composite alkalinity (ISO 9963-1:1994)
- Chlorophyll a was measured photometric, Hitachi spectrophotometer U-2900; German standard methods for the examination of water, waste water and sludge; test methods using water organisms (group L); determination of chlorophyll a in surface water (L 16), DIN 38412-16:1985-12. Available in this dataset are mostly values that were rounded to the units digit; a higher precision may be available upon request.

Parameters

- `date` – date of measurement [`YYYY-MM-DD`]
- `depth` – depth of measurement [m]
- `tp` – total phosphorus [mg L^{-1}]
- `srp` – soluble reactive phosphorus [mg L^{-1}]
- `tn` – total nitrogen [mg L^{-1}]
- `no2` – nitrite [mg L^{-1}]
- `no3` – nitrate [mg L^{-1}]
- `nh4` – ammonium [mg L^{-1}]
- `ca` – soluble calcium [mg L^{-1}]
- `al` – aluminium [mg L^{-1}]
- `fe` – iron [mg L^{-1}]
- `si` – silicate [mg L^{-1}]
- `npoc` – non-purgeable organic carbon [mg L^{-1}]
- `ic` – total inorganic carbon [mg L^{-1}]
- `doc` – dissolved organic carbon [mg L^{-1}]
- `caco3` – calcium carbonate [mg L^{-1}]

- `chla` – chlorophyll a [μg L^{-1}]
- `alkalinity` – alkalinity [mval L^{-1}]
- `site` – measurement site
- `comment` – comments

References

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Change log

- 2020/2021 Silke R. Schmidt: Chla values should be exchanged: a higher accuracy is available in raw data, however, values were roundet to the units digits.