Multiparameter probe data at Lake Stechlin 1970-2020

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

Sampling site

Lake Stechlin is a deep, dimictic, formerly oligotrophic clear-water lake that has been undergoing eutrophication since 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. Lake Stechlin 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 (Casper 1985). 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 (KKW Rheinsberg) and the small village of Neuglobsow with about 300 residents (up to 1000 during the tourist season in summer), whose wastewater is diverted to a different catchment. The shoreline is largely undeveloped with no notable infrastructure except on the small beach and the boat rental, 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 The cooling water was withdrawn from neighbouring Lake Nehmitz (North basin) and discharged into Lake Stechlin at an average temperature of approximately 10 °C above the ambient surface water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) and decreased the retention time of Lake Stechlin. 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

Vertical profiles were collected at the deepest point of the Lake Stechlin (69.5 m) situated in the main basin (53°9‘19.5“N, 13°1‘52.9“E), from 1982 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 2009 as well at the inlet of Lake Dagow (Dagowsee). In February to March 2010 multiprobe measurements have been performed in the South basin during an ice-covered period marked as “additional site” as it was not at the exact location of the regular monitoring samplings during ice-free conditions. The temporal resolution varied over time. In the main basin, fortnightly samples have usually been taken from May to September. Outside the stratification period monthly sampling was performed even throughout winter (when possible). The temporal resolution at the other sites is irregular. Measurements were performed at variable depths between 0 m and the deepest point at the respective site at a high spatial resolution (1-5 m). Before 1992, water temperature was measured using the mercury thermometer of the Ruttner sampler (Mothes 1981) and dissolved oxygen concentrations were determined by the Winkler method (Mothes 1981, Legler 1986). From 1992 onwards, multi-parameter probes were used to obtain vertical profiles (1-5 m depth intervals) of temperature, dissolved oxygen, oxygen saturation, pH, specific conductivity, and, from 2013 onwards, turbidity, chlorophyll *a* (chl *a*) and phycocyanin (PC). Hand-held WTW multiprobes (OXI-197, Weilheim, Germany) were used until 2009, and YSI multiprobes (YSI 6600, Yellow Springs, OH, USA) since 2010. Sensors were regularly calibrated in the lab according to the user manuals.

Water transparency was determined as Secchi depth on each sampling occasion. A white disc 30 cm (1970-1991) or 20 cm (1992-2020) in diameter was lowered in the water column until it was no longer visible, then raised, and the depth recorded both when the disc disappeared and when it re-appeared. The mean of both values is reported as Secchi depth. Readings were taken with a bathyscope on the shady side of a boat to reduce the influence of reflections and glittering.

Parameters

- lake – sampled lake
- date – date of measurement [YYYY-MM-DD]

- depth – depth of measurement [m]
- wtemp – water temperature [°C]
- o2 – dissolved oxygen [mg L-1]
- so2 – oxygen saturation [%]
- ph – pH value
- conductivity – electrical conductivity [µS cm^{-1}]
- turbidity – turbidity [NTU]
- chla – chlorophyll a [µg L^{-1}]
- bga_pc – blue-green algae [cells L^{-1}]
- secchi – secchi depth [m]
- site – measurement site
- probe – type of multiparameter probe
- comment – comments
- std_depth – standardized depth (rounded depth value to the integers digit)

References

Casper SJ. 1985: Lake Stechlin. A temperate oligotrophic lake. Dr. W. Junk Publishers, Dordrecht, Boston, Lancaster, 553 pp.

Casper P, Koschel R. 1995: Description of Lake Stechlin. Limnologica 25, 281–284.

Fraedrich K, Gerstengarbe FW, Werner PC. 2001: Climate shifts during the last century. Climate Change 50, 405–17.

Holzbecher E, Nützmann G, Ginzel G. 1999: Water and component mass balances in the catchment of Lake Stechlin. Integrated Methods in Catchment Hydrology - Tracer, Remote Sensing and New Hydrometric Techniques, IAHS Publication 258, 37–44.

Kirillin G, Shatwell T, Kasprzak P. 2013: Consequences of thermal pollution from a nuclear plant on lake temperature and mixing regime. Journal of Hydrology 496, 47-56.

Koschel R, Casper SJ. 1986: Die ökologische Bedeutung des Kernkraftwerkes I der DDR 'Rheinsberg' für den Stechlinsee. Biologische Rundschau 24, 179–195.

Koschel R. 1995: Manipulation of whole-lake ecosystems and long-term limnological observations in the Brandenburg-Mecklenburg Lake District, Germany. Internationale Revue der gesamten Hydrobiologie 80, 507–518.

Koschel R, Adams DD. 2003: An approach to understanding a temperate oligotrophic lowland lake. Archiv für Hydrobiologie Special Issues - Advances in Limnology 58, 1–9.

Mothes G 1981: Physikalische und chemische Parameter der Wasserbeschaffenheit des Stechlinseegebietes. Limnologica 13, 1-53.

Legler C, Breitig G, Steppuhn G, Vobach V. (eds.). 1986: Ausgewählte Methoden der Wasseruntersuchung. Band I: Chemische, physikalisch-chemische und physikalische Methoden. Gustav Fischer Verlag, Jena, Germany.

Change log

- 2020/2021 Silke R. Schmidt: These data are not yet quality-controlled. There are known issues in the data, such as values of 0 instead of NA are values beyond physical limits. Less flawed data are available in the raw data files.
- 2022 Sabine Wollrab/ Jason N. Woodhouse: Quality control, checking and correcting for data beyond physical limits. Additional column with rounded depth measurements was added (column “std_depth”) as from 2010 onwards the exact depth measurements, while in previous years the standard discrete depths were entered from which also water samples were taken (column “depth”).
- 2025 Christine Kiel/ Sabine Wollrab: update on method description, adding more details on different multiprobes used over time. Rights of usage has been updated.