

Chemical data (spectrophotometry) at Lake Dagow 1971-2024

Version 2026-05-05

Authors

Kiel Christine, Schmidt Silke, Woodhouse Jason, Gonsiorczyk Thomas, Wollrab Sabine, Beyer Ute, Degebrodt Monika, Degebrodt Roman, Kasprzak Peter, Lentz Maren, Mallok Uta, Roßberg Reingard, Sachtleben Michael, Casper Peter, Gessner Mark, Grossart Hans-Peter, Koschel Rainer

Data management Thomas Gonsiorczyk, Sadia Khalid, Sabine Wollrab

Contact person Sabine Wollrab (sabine.wollrab@igb-berlin.de)

Data responsibility Christine Kiel (christine.kiel@igb-berlin.de)

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

Rights of usage Data are made available under the Creative Commons Attribution License CC By 4.0: <https://creativecommons.org/licenses/by/4.0/>

Data

Sampling site

Lake Dagow (53° 9' 4" N, 13° 3' 14" E) lies in a long glacial channel that stretches from the eastern bay of Lake Stechlin to Lake Röblin near Fürstenberg (Lehmann 1974). It was formed by melting of a dead ice block, lying within the melt water channel (Casper 1985). The lake has an area of 24 ha and a maximum depth of 8.5 meters. The water level is 60.1 m above sea level. With an average depth of 4.95 m, the volume of Lake Dagow is 11.89×10^5 m³. The catchment area of the lake covers approximately 7 km². A drainage ditch from the Tradenrinne flows into the lake from the northwest, but it has dried up since about 1990. In years with high water levels, Lake Dagow drains above ground through a wetland (with the former Little Lake Dagow) into the eastern bay of Lake Stechlin. The water retention time is about 3-5 years. The shoreline of Lake Dagow is 2.5 km long. The village of Neuglobsow borders its shore in the southeast, and the village of Dagow is located on the west shore.

Lake Dagow was strongly polluted by carp and duck breeding in the sixties (Koschel et al. 1990). Between 1965-1969 the PO₄-P loading was 1,04 g m⁻² yr⁻¹. In the 1970s, various measures were taken to improve the water quality of Lake Dagow: carp and duck breeding was stopped in 1970, the discharge of oxidation ponds was ended in 1972, a central sewage system was installed in Neuglobsow and sewage treatment outside the catchment area was constructed in 1980-1985, and a withdrawal of hypolimnetic water was performed in 1986/87. As a result of these measures, the PO₄-P load was reduced to 0.15 g m⁻² yr⁻¹. Today, Lake Dagow has largely recovered from the pollution it suffered in the past.

In the 1990s, Lake Dagow was the subject of intensive research into pelagic calcite precipitation in hard water lakes (Koschel et al. 1987, 1990). In 1994, an enclosure test facility was installed on Lake Dagow, where preliminary tests on artificially induced calcite precipitation for the restoration of eutrophicated hard water lakes were conducted (Dittrich et al. 1997). Later, studies on food chain manipulation were also conducted at the facility (Rychla et al. 2014). In recent years, Lake Dagow has been the subject of intensive research into the release of greenhouse gases CO₂ and CH₄ (Casper et al 2009, Martinez-Cruz et al 2020).

Time span 1971-2024

Sampling site

Since 1971, water samples for chemical analysis have been taken from the central basin at the deepest point of the lake (9.0 m, 53°9'1.76"N, 13°3'3.93"E). The sampling frequency has varied over the years: in 1971 and from 1978 to 1997, samples were taken monthly at times (up to every two weeks in summer). From 1998 to 2008, only 10 samples were taken in total, and since 2009, sampling has been carried out 3 to 6 times per year. From 1970 to 1990, water samples were taken from the surface mixing layer using a 1- or 2-liter Ruttner sampler; since 1991, a 2.6- or 3.5-liter Limnos water sampler (Limnos Oy, Turku, Finland) has been used. In the epilimnion, a composite sample was taken from water depths of 0 m and 2.5 m. If the epilimnion was deep enough, an additional sample was taken from a depth of 5 m and mixed with this composite sample. In the hypolimnion, a sample was always taken from a water depth of 7.5 m.

Details of the analytical methods are as follows:

- TP, SRP: Spectrophotometry
 - Before 1992, manual spectrophotometric analysis as described in Vogler 1965, 1966a,b, Mothes 1974, Mothes 1981
 - From 1992 to December 2005, flow-injection analysis with spectrophotometric detection: FIAstar (Tecator AB, Höganäs, Sweden) Application Note 60/83, ASN 60-03/83 (Determination of orthophosphate in water by flow injection analysis) and ASN 60-04/83 (Determination of total phosphate in water by flow injection analysis)
 - From January 2006 to December 2014, flow-injection analysis with spectrophotometric detection: FIAcompact (Medizin- und Labortechnik GmbH, Dresden, Germany). Arbeitsanleitung Orthophosphat in Wasser/ Abwasser/ Bodenextrakten, fotometrisch über Phosphomolybdat und Reduktion zu Molybdänblau, 2005, based on DIN EN ISO 15681-1
 - Since January 2015 flow-injection analysis with spectrophotometric detection FIAstar 5000 Analyzer (Foss Analytical AB, Höganäs, Sweden). Application Notes 5240 (Determination of ortho-phosphate in water by FIAstar 5000) and 5241 (Determination of total phosphorus in water by FIAstar 5000) according to ISO 15681-1.

- TN, NO₂⁻, NO₃⁻, NH₄⁺: Spectrophotometry
 - Before 1992, flow stream analysis as described in Vogler 1975a,b, which was conducted by Wasserwirtschaftsdirektion Havel, Potsdam, German Democratic Republic (Mothes 1981)
 - From 1992 till October 2009, flow-injection analysis with spectrophotometric detection: FIAstar (Tecator AB, Höganäs, Sweden) Application Note 62/83, ASN 110-01/92 (Determination of the sum of nitrate and nitrite in water by flow injection analysis) and ASN 110-03/92 (Determination of total nitrogen in water by flow injection analysis); and Application Note 50/84, ASN 151-01/92 (Determination of ammonia nitrogen in water by flow injection analysis according to DIN 38406 (E23))
 - Since November 2009 flow-injection analysis with spectrophotometric detection FIAstar 5000 Analyzer (Foss Analytical AB, Höganäs, Sweden). Application Notes 5201 (Determination of the sum of nitrate and nitrite in water by FIAstar 5000) according to ISO 13395-1996, Application Note 5202 (Determination of total oxidized nitrogen in water by FIAstar 5000) according to ISO 11905 and ISO 13395, and Application Note 550 (Determination of ammonium in water by FIAstar 5000) according to ISO 11732.
- Ca²⁺: Spectrophotometry,
 - 1992-10/2009, flow-injection analysis with spectrophotometric detection: FIAstar (Tecator AB, Höganäs, Sweden) Application Note 48/83, ASN 48-03/84 (Determination of calcium in water by flow injection analysis)
 - since 11/2009 flow-injection analysis with spectrophotometric detection FIAstar 5000 Analyzer (Foss Analytical AB, Höganäs, Sweden). Application Note 5261 (Determination of dissolved calcium in water by FIAstar 5000) according to DIN 38406-3
- Al: Spectrophotometry, FIAcompact (Medizin- und Labortechnik GmbH, Dresden, Germany). Arbeitsanleitung Gesamt-Aluminium in Wasser/Abwasser, Brenzcatechinviolettmethode, 2004, based on APHA 3500-Al and ISO 10566
- Fe: Spectrophotometry,
 - From 1996 until August 2005, flow-injection analysis with spectrophotometric detection: FIAstar (Tecator AB, Höganäs, Sweden) Application Note ASN 72-01/84 (Determination of iron in water by flow injection analysis (TPTZ method))
 - Since September 2005, flow-injection analysis with spectrophotometric detection: FIAcompact (Medizin- und Labortechnik GmbH, Dresden, Germany). Arbeitsanleitung Gesamt-Eisen/Eisen (II) in Wasser/Abwasser, Labormethode für FIAcompact, Laboranleitung für FIAcompact, 2004, based on DIN 38406 Part 1 with ferrozine used instead of ortho-phenanthroline
- Si: Spectrophotometry,
 - Before 1992, flow stream analysis as described in Vogler (1975c), which was conducted by Wasserwirtschaftsdirektion Havel, Potsdam, German Democratic Republic (Mothes 1981)
 - 1992-2009, flow-injection analysis with spectrophotometric detection: FIAstar (Tecator AB, Höganäs, Sweden) Application Short Note 4/92 (Determination of silica

in water by flow injection analysis)

- since 2009 flow-injection analysis with spectrophotometric detection FIAstar 5000 Analyzer (Foss Analytical AB, Höganäs, Sweden). Application Note 5240 (Determination of silicate in water by FIAstar 5000) according to ISO 16264
- TIC and NPOC: catalytic oxidation, nondispersive infrared sensor (NDIR), quantification of CO₂ released at high temperature from unfiltered water samples before and after acidification following the procedures described in the user manual.
 - Between 1994 and October 2007, TOC-5000/5050 Analyzer, (Shimadzu, Kyoto, Japan)
 - From November 2007 to November 2009, multi N/C 3100 Analyzer (Analytik Jena, Jena, Germany)
 - Between December 2009 and 2018, TOC-VCPH Analyzer (Shimadzu, Kyoto, Japan)
 - Between 2019 and 2020, TOC-LCPH Analyzer (Shimadzu Kyoto, Japan)
- DOC: catalytic oxidation, NDIR, TOC Analyzer (Shimadzu VCPH analyzer, Kyoto, Japan), determination of CO₂ release from pre-filtered (0.45 µm pore size, filters as described above) water samples, following the methods described in the user manual.
- CaCO₃: infrared gas analyzer (Infralyt 50 Saxon, Junkalor, Dessau, Germany) (Proft 1984, Lenz 2018), determination of CO₂ released from dry filtration ((0.45 µm pore size, filters as described above)) residue of water samples after dissolution in 10% hydrochloric acid. CO₂-C was converted to CaCO₃ by applying a multiplication factor of 8.3, according to the stoichiometry of CaCO₃.
- Alkalinity: Titrimetry,
 - Before 1991: Manual titrimetric analysis with methylorange or phenolphthalein (Legler 1986)
 - 1991-2010: Titroprocessor 686 (Metrohm, Filderstadt, Germany), titration to pH 4.3, according to ISO 9963-1:1994
 - Since 2011: Titrando 888 (Metrohm, Filderstadt, Germany), titration to pH 4.3, according to ISO 9963-1:1994
- Chl a: Spectrophotometry after overnight extraction in 90% acetone modified from references Strickland & Parsons (1968), Kasprzak et al. (2008), using membrane filters (ME 28, 47 mm 1.2µm pore size, Whatman, Little Chalfont, United Kingdom). Before 1997, data were rounded to the nearest integer (µg L⁻¹), thereafter to the nearest 0.1 µg L⁻¹
 - Until 2008, Lambda 2 spectrophotometer (Perkin Elmer, Waltham, MA, USA)
 - Since 2009, U-2900 spectrophotometer (Hitachi, Tokyo, Japan)

Parameters

- lake – sampled lake
- site – measurement site
- 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}]
- tic – total inorganic carbon [mg L^{-1}]
- doc – dissolved organic carbon [mg L^{-1}]
- caco3 – calcium carbonate [mg L^{-1}]
- chla – chlorophyll a [$\mu\text{g L}^{-1}$]
- alkalinity – alkalinity [mmol L^{-1}]
- observer – Person responsible for collecting the data
- comment – comments
- comment_eng – English translation of original German comments given in column “comment”

References

Casper, P., Albino, M. F., & Adams, D. D. (2009). Diffusive fluxes of CH_4 and CO_2 across the water-air interface in the eutrophic Lake Dagow, northeast Germany. *SIL Proceedings, 1922-2010*, 30(6), 874–877. <https://doi.org/10.1080/03680770.2009.11902261>

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

Dittrich, M., Dittrich, T., Sieber, I. & Koschel, R., 1997: A balance analysis of phosphorus elimination by artificial calcite precipitation in a stratified hardwater lake. *Wat. Res.* 31(2): 237-248.

Kasprzak, P., Padisák, J., Koschel, R., Krienitz, L. & Gervais, F. Chlorophyll a concentration across a trophic gradient of lakes: An estimator of phytoplankton biomass? *Limnologica* 38, 327-338 (2008).

- Koschel, R., Giering, B., Kasprzak, P., Proft, G. & Raidt, H., 1990: Changes of calcite precipitation and trophic conditions in two stratified hardwater lakes of the Baltic Lake District of the GDR. *Verh. Internat. Verein. Limnol.* 24: 140-145.
- Koschel, R., Proft, G. & Raidt, H., 1987: Autochthone Kalkfällung in Hartwasserseen der Mecklenburger Seenplatte. *Limnologica* 18: 317 - 338.
- Legler, C., Breitig, G., Steppuhn, G., Vobach, V. (eds.). *Ausgewählte Methoden der Wasseruntersuchung. Band I: Chemische, physikalisch-chemische und physikalische Methoden.* Gustav Fischer Verlag, Jena, Germany (1986).
- Lehmann, E., 1974: *Das Rheinsberg-Fürstenberger Seengebiet. Werte unserer Heimat, Band 25.* Berlin: Akademie-Verlag. (1974).
- Martinez-Cruz, K., Sepulveda-Jauregui, A., Greene, S., Fuchs, A., Rodriguez, M., Pansch, N., ... Casper, P. (2020). Diel variation of CH₄ and CO₂ dynamics in two contrasting temperate lakes. *Inland Waters*, 10(3), 333–347.
<https://doi.org/10.1080/20442041.2020.1728178>
- Mothes, G. Phosphatbestimmungen im Pelagial des Stechlinsees (1970-1971). *Limnologica* 9, 157-169 (1974).
- Mothes, G. Physikalische und chemische Parameter der Wasserbeschaffenheit des Stechlinseegebietes. *Limnologica* 13, 1-53 (1981).
- Rychła, A. Gonsioreczyk, T., Hupfer, M. & Kasprzak, P., 2014: Impact of epilimnetic phosphorus supply and food web structure on phosphorus binding forms in settling material and sediments in a thermally stratified lake. *Limnologica* 46: 116-123.
- Strickland, J. D. H., Parsons, I. R. *A practical handbook of seawater analysis.* Fisheries Research Canada 167, 207-211 (1968).
- Vogler, P. Analysenautomation in Wasserlaboratorien mit flow-stream-Automaten. I. Einsatzgebiete, Anwendungsgrenzen und Nutzen von flow-stream-Automaten in Wasserlaboratorien. *Acta hydrochim. hydrobiol.* 3, 133-144 (1975a).
- Vogler, P. Analysenautomation in Wasserlaboratorien mit flow-stream-Automaten. III. Die kombinierte automatische Bestimmung von Ammonium und Gesamtsalzgehalt in Wässern. *Acta hydrochim. hydrobiol.* 3, 307-326 (1975b).
- Vogler, P. Analysenautomation in Wasserlaboratorien mit flow-stream-Automaten. Teil 6. Die automatische Bestimmung von Nitrit und Nitrat im Wasser. *Acta hydrochim. hydrobiol.* 4, 227-238 (1976b).
58. Vogler, P. Analysenautomation in Wasserlaboratorien mit flow-stream-Automaten. II. Die kombinierte automatische Bestimmung von Orthophosphat und Orthosilikat in Wässern. *Acta hydrochim. hydrobiol.* 3, 145-158 (1975c).
- Vogler, P. Probleme der Phosphatanalytik in der Limnologie und ein neues Verfahren zur Bestimmung von gelöstem Orthophosphat neben kondensierten Phosphaten und organischen Phosphorsäureestern. *Internat. Rev. Ges. Hydrobiol.* 50, 33-48 (1965).
- Vogler, P. Zur Analytik der Phosphorverbindungen in Gewässern. *Limnologica* 4, 437-444 (1966b).

Vogler, P. Zur Analytik kondensierter Phosphate und organischer Phosphate bei limnologischen Untersuchungen. *Internat. Rev. Ges. Hydrobiol.* 51, 775-785 (1966a).