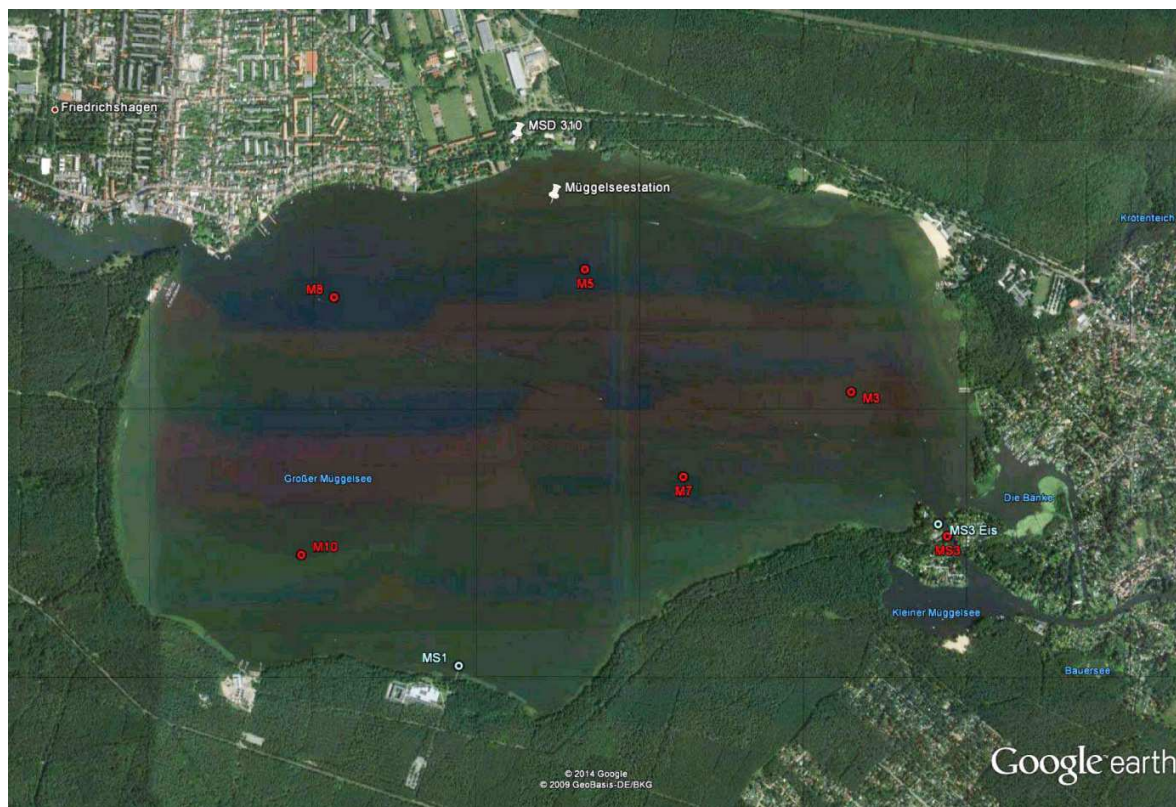




Sampling of Lake Müggelsee (Berlin, Germany) within the long-term ecological research programme of the IGB: Metadata description

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Study site description: Müggelsee (area 7.3 km², mean depth 4.9m, maximum depth 8.0 m) is a shallow, polymictic, and eutrophic lake lying to the southeast of Berlin, Germany. It is situated between maritime and continental climatic zones, characterized by high intra- and interannual weather variability. The lake has an average retention time of 6 – 8 weeks. Further physiographical and limnological characteristics are described by Driescher et al. (1993).



Google earth

Meilen 1
km 2



Figure 1: Google Earth Map of Lake Müggelsee: The sampling stations are depicted in red letters. Sample stations during periods of ice cover are depicted in white letters.

Lake Müggelsee is one of our prime case study sites within the long-term ecological research programme of the IGB. The lake is affected by global climate change along with a change in trophic state in the early 1990ties. The lake experienced a reduction in external nutrient loading by more than 50% in both total phosphorus (TP) and total nitrogen (TN) loading from the hypereutrophic period (19979-1990) to the eutrophic period (Köhler et al. 2005). An ice cover is usually developed during winter. However, ice cover duration has declined following a trend towards milder winters. Summer surface water temperatures increased by 0.52 °C per decade between 1976 and 2013. The lake is usually mixed during summer- but builds up thermal stratification during times of high air temperatures and calm wind conditions. The number of days, when the lake stratifies during summer has increased along with the warming trend the lake has experienced (Wagner & Adrian 2009).

Sampling protocol: The lake is sampled at weekly intervals during the growing season and at biweekly intervals during periods with ice cover. Between 1979 and 1986, phytoplankton samples were drawn weekly (in winter biweekly) at the deepest section of the lake (M7 in Table 1; integrated from 0.5, 4, and 7m). Between 1979 and 1986, zooplankton samples were sampled biweekly at the deepest point of the lake (M7, Table 1, Figure 1) at 1m intervals from the surface to the bottom. A detailed description of the sampling strategy is given in Driescher et al. (1993).

Since 1987, integrated samples were collected weekly at five different lake stations (see description below). We assume that change in the sampling strategy did not cause a significant bias in the plankton series, as analysis of synchronous zooplankton counts in 1987 (n-15) revealed no significant differences (Wilcoxon-Mann-Whitney: $p>0.1$). Moreover, Schellenberger and Stellmacher (1986) found that seston concentrations were quasihomogeneously distributed across the lake.

Coordinates of sampling stations

(A)

Sampling stations	Coordinates North	Coordinates East
M5	52°26.610`	013°39.142`
M3	52°26.308`	013°40.217`
MS3	52°25.953`	013°40.603`
M7	52°26.099`	013°39.539`
M10	52°25.907`	013°37.967`
M8	52°26.541`	013°38.129`

(B)

Sampling stations	Coordinates North	Coordinates East
MS3 bei Eis	52°25.983`	013°40.566`
MS1 bei Eis	52°25.634`	013°38.633`

Table 1: Locations of the Müggelsee sampling stations during ice free (A) and ice covered (B) periods.

Sampling stations		M5	M3	MS3	MS3 During ice	M7	MS1 During ice	M10	M8
Epilimnion	0.5m	X		X	10l	X	30l	X	X

	1.5m	X	X	X		X		X	X
	2.5m	X				X			X
	3.5m	X				X			X
Hypo-limnion	4.5m	X				X		X	
	5.5m	X				X			
	7.0m					X/X			

Table 2: Depth specific sampling profiles at the different lake stations in Lake Müggelsee depicted by X: During thermal stratification an additional sample is taken at 7m (X) for chemical analysis.

Sampling depths at each sampling station are depicted by (X) in Table 2. At each sampling location 5 liter of lake water are sampled via a transparent Hydro Bios Universal Water Sampler (see picture Figure 2). For accuracy the sampler is lowered via a winch equipped with a depth measurement device.

Integration of samples: The integrated samples derive from samples taken at the differed sampling stations and water depths (Table 2). In Table 3 the sample integration scheme is summarized for ice free and ice covered periods, and for thermally stratified and non stratified periods. MPO stands for the upper 0-4m; MPU stand for the lower 5-7 m. Sample number in table x is for internal use only. Coordinates of the different measuring stations are depicted in table 1. During thermally un-stratified conditions all samples are integrated into one sample (MPS in Table 3). During periods of thermal stratification samples from the upper 0-4 m depths and the lower 5-7 m depth are separated. The 4m water depths basically relates to the location of the thermocline. We consider the lake thermally stratified if oxygen concentrations decline by more than 20% between 2m and 5m water depth. During periods of thermal stratification an additional sample is taken at M7 above the sediment for chemical analysis. Samples at 'MS'3 and 'MS3 Ice' are routinely taken.

Thermal regime / Ice cover		Sample acronym	Sample number	Sample stations
No ice	Thermally stratified	M7	202	M7
		MPO	206	M3, M5, M7, M8, M10
		MPU	207	M3, M5, M10
	mixed	MS3	203	MS3
Ice cover		MPS	208	M3, M5, M7, M8, M10
		MS3 Ice	204	MS3
		MS1 Ice	201	MS1

Table 3: Overview of sample description for sample taken during thermally mixed and stratified conditions and during ice free and ice covered periods. MPO: Mixed epilimnetic sample, 0-4m; MPU: mixed hypolimnetic sampl, 5-7m; MPS: sample during non-stratified conditions (mixed; 0-7m). Sample number for internal use only.

In situ measurements: Depths profiles at 0.5 -1m intervals are taken (MS3 and M7) for water temperature (°C); conductivity (µS/sec); pH; oxygen (mg/Liter and % saturation), chlorophyll *a* fluorescence (µg/Liter); depth of the measuring location using a YSI 6600 V2 4 probe.

Secchi depth: Secchi depth readings are performed at station MS3 and M7 using a 25cm diameter white Secchi disk.



Figure 2: Hydro Bios Universal Water Sampler

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