Aquatic Ecosystem Sciences LLC

TECHNICAL MEMORANDUM

Upper Klamath Lake 2015 Data Summary Report

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INTRODUCTION

The Klamath Tribes have been monitoring water quality in Upper Klamath Lake (UKL) since 1990. These data have been described and summarized to varying degrees in a series of reports and manuscripts (e.g., Kann 1998; Kann and Smith 1999; Kann and Welch 2005; Kann 2007 through Kann 2014). The UKL electronic water quality database was previously updated with 2015 data and appropriate quality assurance analyses (*see Excel spreadsheet: Klamath Tribes UKL Water Quality Data 1990-2015_ver_4-26-16.xls*). In addition, several reports provide additional detail and comprehensive analysis of the first 19-20 years of the database (Jassby and Kann 2010; Eldridge et al. 2014). The current 2015 data report is intended to serve as an annual update to the UKL water quality database, including a summary of 2015 data (basic summary statistics and graphical analysis), and limited comparison of inter- annual trends of UKL data collected for the 26 year period between 1990 and 2015.

METHODS

Methods followed the Klamath Tribes established procedures for field collection and laboratory analysis of water quality parameters (see Klamath Tribes 2013a,b for a complete description of these methods). Beginning in 2008 for nutrient parameters and 2009 for Chlorophyll-a (CHL), laboratory analyses transitioned from Aquatic Research, INC. in Seattle WA to the Sprague River Water Quality Laboratory in Chiloquin OR. During the transition period duplicate samples were analyzed by both laboratories to confirm parameter reproducibility. During the 2015 sampling season limnological data (Table 1) were collected approximately biweekly from the end of April through October[1] at 10 standardized stations in UKL and Agency Lake (Figure 1; Figure 2).

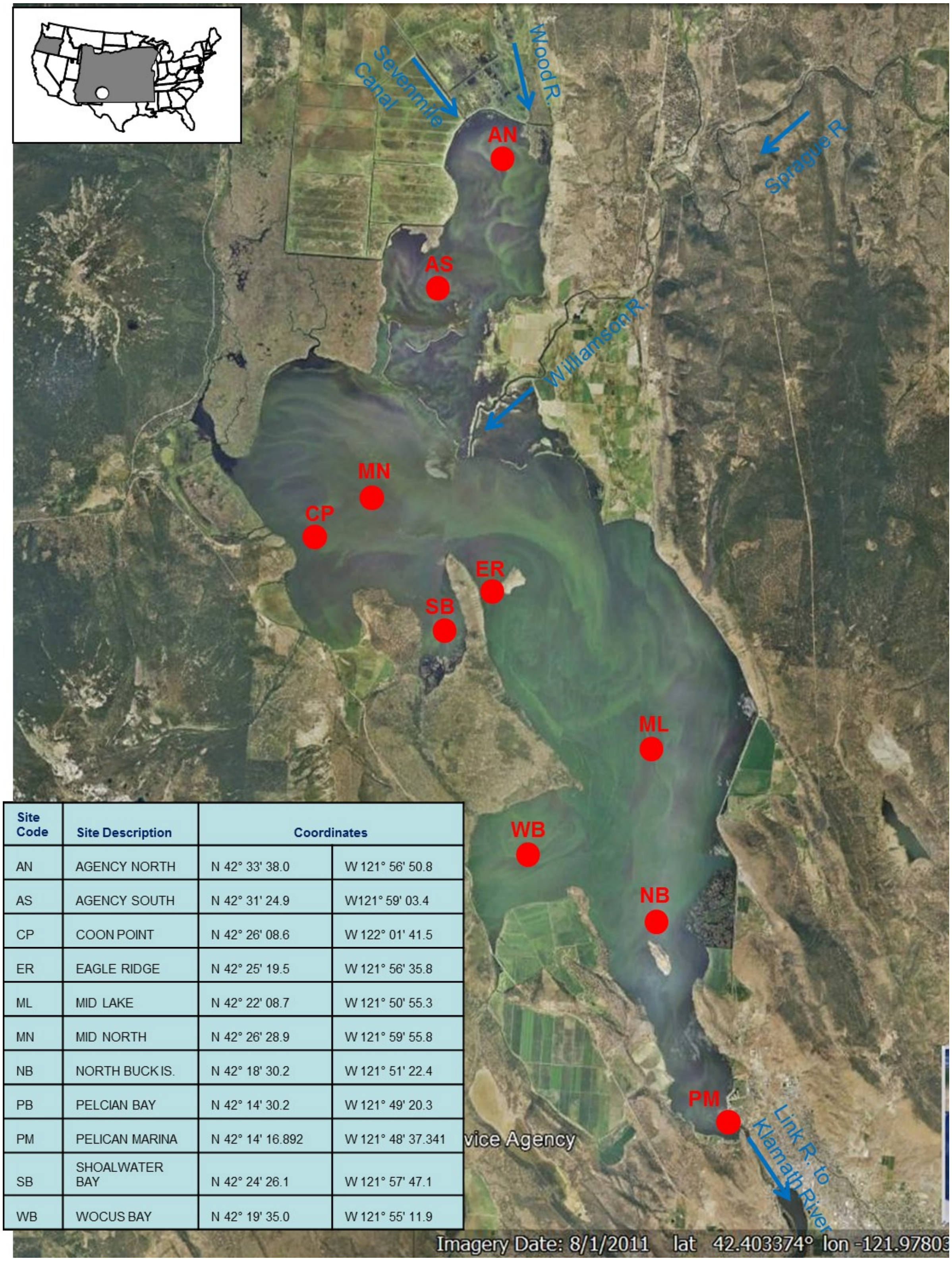
Table 1. Limnological parameters sampled in Upper Klamath Lake, 2015.

Parameter	Abbreviation/ Unit	Profile [a]	Grab [b]
Temperature	T (°C)	X	
Dissolved Oxygen	DO (mg/L)	X	
pH	pH	X	
Specific Conductivity	(µSiemens/cm)	X	
Secchi Transparency	Secchi (m)		
Light (Photosynthetically Active Radiation)	PAR ($uEm^{-2}s^{-1}$)	X	
Total Phosphorus	TP (µg/L)		X
Soluble Reactive phosphorus	SRP (µg/L)		X
Total Nitrogen	TN (µg/L)		X
Ammonia Nitrogen	NH_4-N (µg/L)		X
Nitrate-Nitrite Nitrogen	NO_3+ NO_2-N (µg/L)		X
Silica	SiO_2 (µg/L)		X
Chlorophyll *a*	CHL (µg/L)		X
Phytoplankton Species Composition and Biomass[c]	(mm^3/L)		X
Zooplankton Species Composition and Biomass[c]	(mg/L)		X

a Profile = collected with multi-parameter WQ probe at multiple depths in water column
b Grab = integrated water column sample collected with “tube sampler” except for zooplankton which was collected with a Schindler-Patalis Trap
c. Phytoplankton and zooplankton data are compiled in spreadsheets provided separately and are not analyzed herein.

[1] Note that the Fremont Bridge station at the outlet of UKL was sampled prior to April and after October as part of the tributary loading study (see Kann 2015) and based on analyses showing that PM and FB values follow a 1:1 trajectory values for both stations are included here.

Nutrient quality assurance/quality control analyses are shown in the accompanying data spreadsheet (Klamath Tribes UKL Water Quality Data 1990-2015_ver_4-26-15.xls)



Site Code	Site Description	Coordinates	
AN	AGENCY NORTH	N 42° 33' 38.0	W 121° 56' 50.8
AS	AGENCY SOUTH	N 42° 31' 24.9	W121° 59' 03.4
CP	COON POINT	N 42° 26' 08.6	W 122° 01' 41.5
ER	EAGLE RIDGE	N 42° 25' 19.5	W 121° 56' 35.8
ML	MID LAKE	N 42° 22' 08.7	W 121° 50' 55.3
MN	MID NORTH	N 42° 26' 28.9	W 121° 59' 55.8
NB	NORTH BUCK IS.	N 42° 18' 30.2	W 121° 51' 22.4
PB	PELCIAN BAY	N 42° 14' 30.2	W 121° 49' 20.3
PM	PELICAN MARINA	N 42° 14' 16.892	W 121° 48' 37.341
SB	SHOALWATER BAY	N 42° 24' 26.1	W 121° 57' 47.1
WB	WOCUS BAY	N 42° 19' 35.0	W 121° 55' 11.9

Figure 1. Location of Upper Klamath Lake sampling stations, 2015. Google Earth Imagery date 8/1/2011.

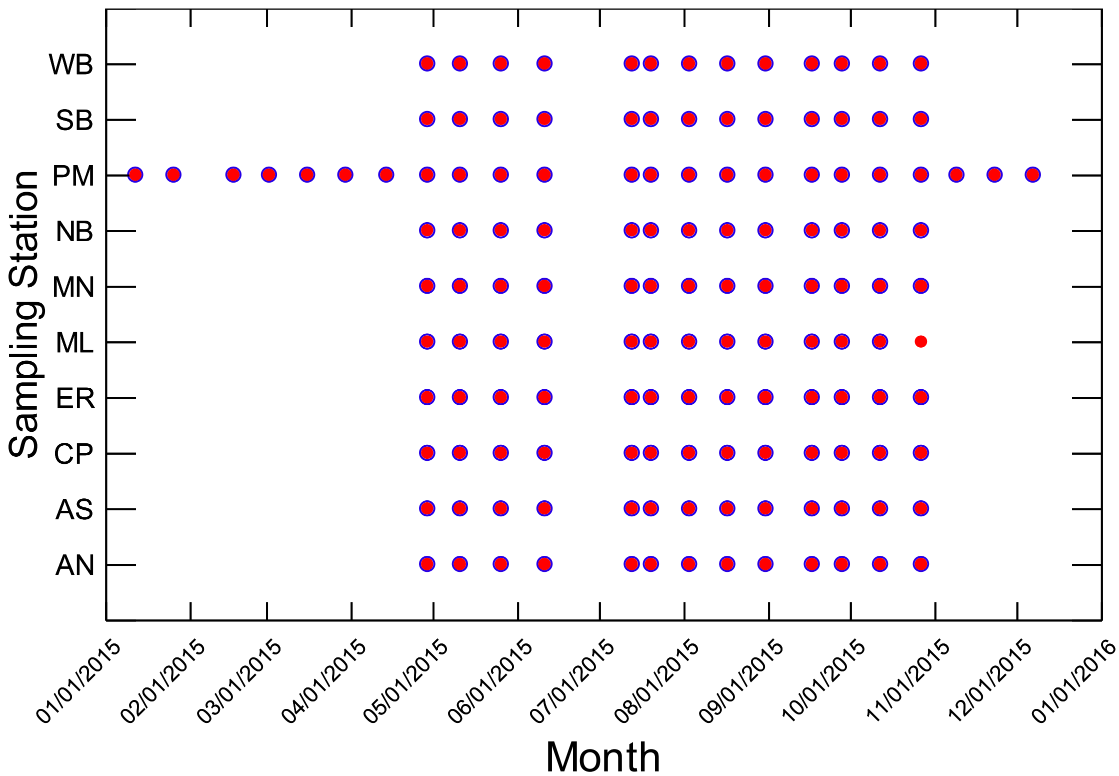


Figure 2. Spatial-temporal sampling matrix for Upper Klamath Lake, 2015.

Due to a gap in 2015 Klamath Tribe data collection[2] between June 11th and July 13th (Figure 2), typically a critical period for bloom development in UKL, data from nearby USGS stations were used to depict conditions during that time period in 2015. Methods for USGS data collection are contained in Eldridge et al. (2014), and USGS sample collection dates utilized in this report (6/23 and 7/7) were chosen to maintain an approximately biweekly data collection frequency[3].

Data reduction consisted of computation of both lake-wide means on a given sample date and of growing season (June-September sample dates) means. Because of bloom timing differences between Upper Klamath and Agency Lake (e.g., see Kann 1998), lake-wide means and analyses are shown separately for Upper Klamath Lake only and Agency Lake only. Chlorophyll and nutrient data tended to be either normally or log-normally distributed both within a date and seasonally. Based on a comparison of both log transformed ($\log_{10}$ or $\log_{10}(x+1)$) and non-transformed data with the normal distribution using Kolmogorov-Smirnov one-sample tests or the Shapiro-Wilk standard test for normality (*cf.* Systat® 2004), the geometric mean tended to provide the best estimate of lake-wide or seasonal central tendency[4]. Lake-wide variability is shown via boxplots which convey the median, interquartile range and outliers. In addition to median and interquartile values, lake-wide central tendency may be portrayed as a mean and standard error or coefficient of variation (e.g., see Table 2).

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[2] Due to reduced Natural Resource Department staffing during that period.

[3] Because USGS stations are not at the exact locations as Klamath Tribes stations, certain site-specific graphs do not include USGS data) and thus maintain the gap (e.g., Figure 3 and Figure 4)

[4] In some cases when the distribution remained significantly different form normal even after transformation, frequency distribution and normal-probability plots indicated that the normality assumption was nonetheless approximately satisfied, especially when compared to untransformed data.

RESULTS/DISCUSSION

Seasonal and Water Column Trends in Profile Water Quality Data (T, DO, and pH)

Water column and seasonal trends in T, DO, and pH are important aspects of water quality dynamics and fish habitat in UKL. Depth-time plots of isotherms and isopleths for these parameters allows both seasonal and depth distribution to be evaluated simultaneously. These are plotted below for two representative stations, ER located in the deep trench area, and MN located in an open-water area in the northern part of the lake (Figure 3; Figure 4)[5]. Similar to 2012-2014 temperature ranged from 11-14 ^{o}C during late-April and early-May at both stations, but then increased in mid-May and early-June to ~16-17 ^{o}C. Overall this is in contrast to 2011 when temperatures generally remained below 12 ^{o}C into early-June. Temperature continued to rise into early June, before peaking in mid-July when temperatures exceeded 22 ^{o}C. Temperatures remained elevated into early August before gradually declining through the remainder of the season (Figure 3; Figure 4).

Unlike 2010 when water column pH initially increased (>9.0) in late-April and early-May (lake observations at that time indicated a massive diatom bloom and further confirmation showed very high biomass of the diatom *Asterionella formosa*), pH in 2015 was similar to 2011-2014 and remained relatively low (<8.75) until early-June. Although the depth-time plots indicate that peak pH values in 2015 did not occur until mid to late July (Figure 3; Figure 4), this is likely due the missing June data points. This is confirmed by continuous data collected near the MN station by USGS, which shows a pH increase in mid-June, followed by a large decline[6] and another increase in late July (Figure 5). pH values then did not drop below 9.5 until mid-September, somewhat later than many previous years.

Water column DO values were initially elevated in late-April and early-May (9-10 mg/L), declined slightly into early-June (8-9.5 mg/L) and then increased in early-June, achieving seasonal maximum levels between 10-14 mg/L in late July (Figure 3 and Figure 4). Lower DO values were observed in late-August to mid-September, however, low DO occurring in June was not measured by the Klamath Tribes, but low values are shown in USGS data (Figure 5). As noted previously (e.g., Kann 2012), trends in pH and DO can be influenced by temperature and algal dynamics (cool late-spring and early-summer conditions were associated with low algal productivity, a delayed bloom, and moderate bloom decline in 2011). However, 2012 did not fit this trend with algal productivity remaining low in May and June despite water temperatures that were substantially warmer than 2011, indicating that factors other than water temperature also influence algal productivity and subsequent DO and pH dynamics. In 2013 earlier warming did appear to be associated with an earlier bloom peak and coinciding peaks in pH and DO, in 2014, despite mid-May warming, algal biomass remained low until mid-June (see below Figure 8), and in 2015 algal biomass does again appear to increase earlier in response to higher June temperatures. As shown below and in earlier data and analytical reports (e.g., Kann 2011; Jassby and Kann 2010), differences in pH and dissolved oxygen can be explained in part by the interaction of both climate and bloom dynamics, which can also be influenced by lake level.

[5] For reference purposes similar depth-time plots were constructed for these stations for all years of data (1990-2014) and are shown in Appendix I of Kann (2015).
[6] See below discussion of mid-June *Aphanizomenon* bloom crash.

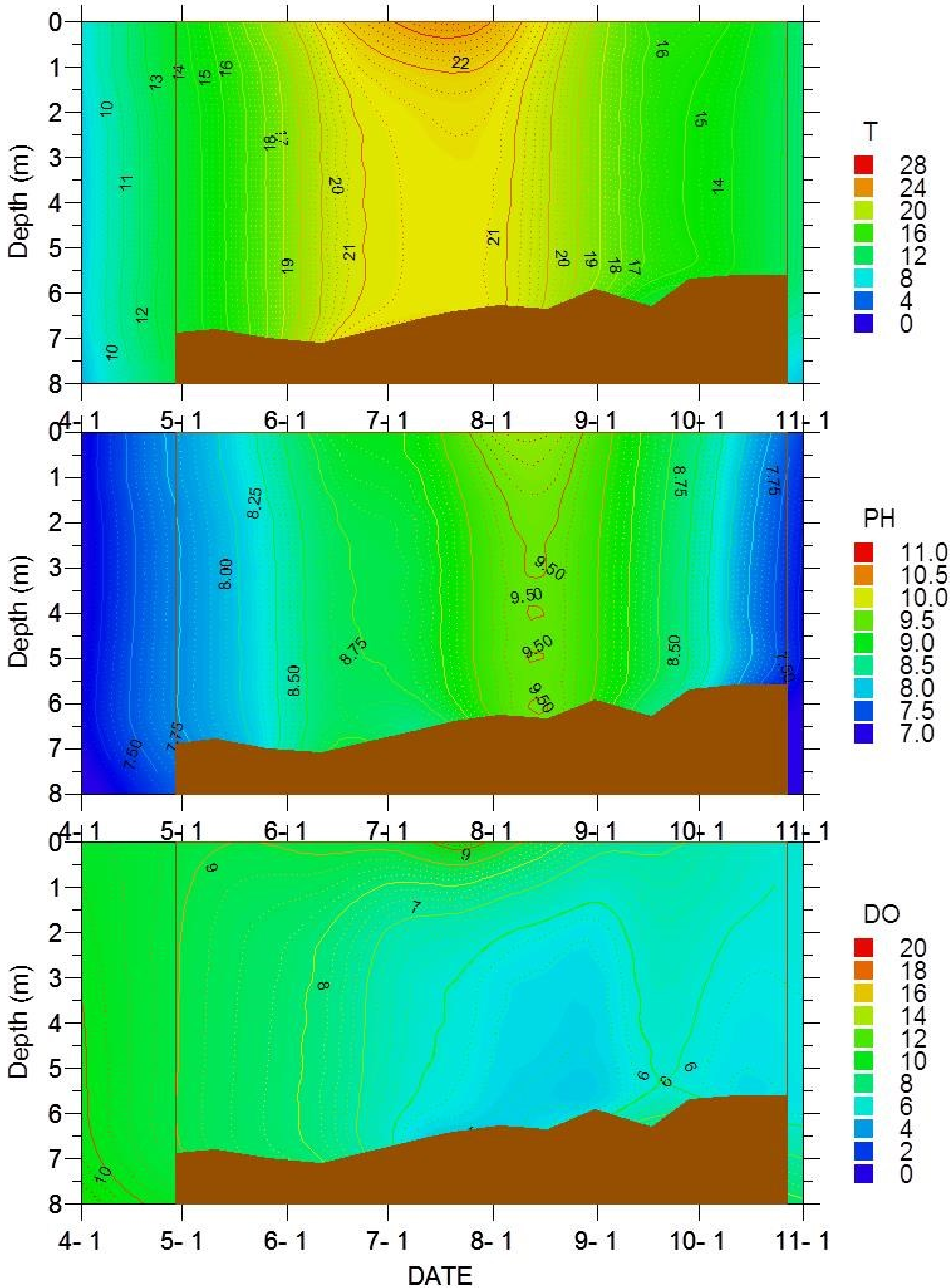

Figure 3. Depth-time distributions of isotherms of T (°C) and isopleths of D.O (mg/L) and pH at UKL station Eagle Ridge (ER), 2015. Note: 1) brown shaded area on the abscissa denotes the bottom profile depth, and 2) contours are not valid outside of vertical brown lines (begin and end dates for seasonal sampling).

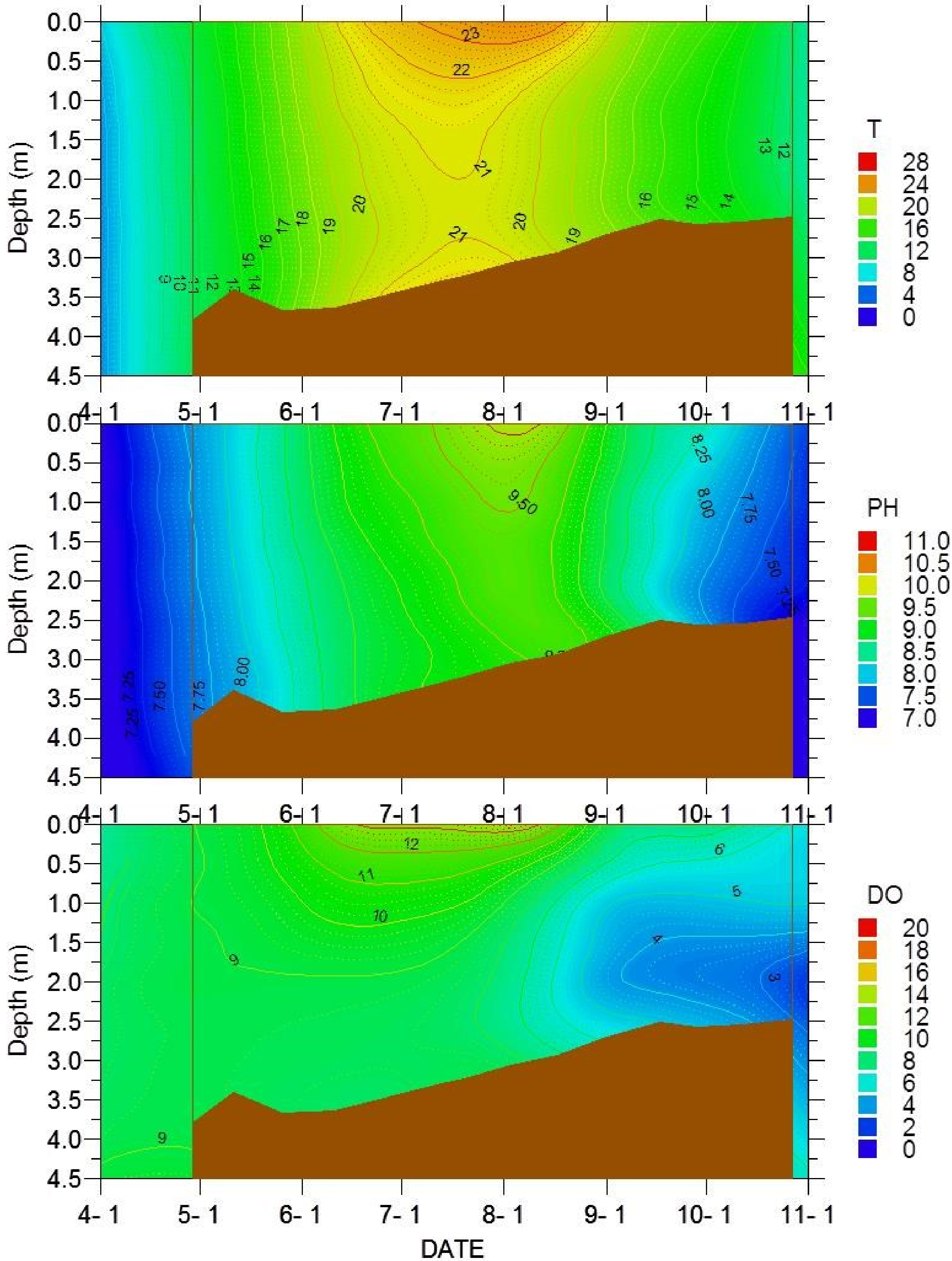

Figure 4. Depth-time distributions of isotherms of T (˚C) and isopleths of D.O (mg/L) and pH at UKL station Mid North (MN), 2015. Note: 1) brown shaded area on the abscissa denotes the bottom profile depth, and 2) contours are not valid outside of vertical brown lines (begin and end dates for seasonal sampling).

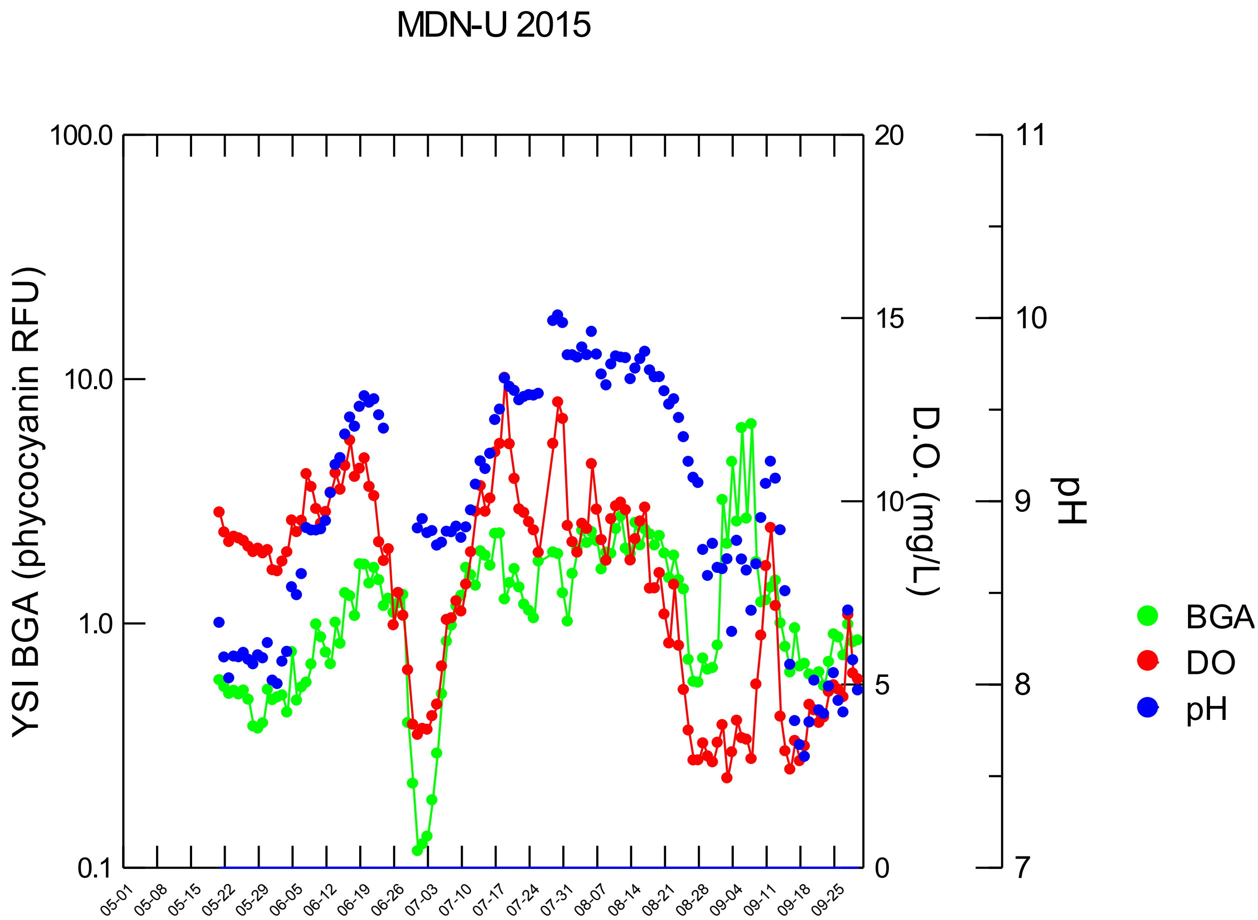

Figure 5. USGS continuous water quality monitoring data from station MDN-U located in the northern portion of UKL. BGA=phycocyanin pigment indication cyanobacterial biomass. Source: http://waterdata.usgs.gov/nwis/uv/?site_no=422622122004003

2013 Station Distributions

The distribution of parameter values for each station for the June-September period (chosen here to encompass the major algal growing season in UKL) are shown in Figure 6 and Figure 7. Although the seasonal timing of water quality has been shown to vary among stations (see below analyses comparing individual stations by date), the season-wide distributions as indicated by the interquartile range (25^{th} -75^{th} percentiles or box hinges in the plots below) tend to overlap for most parameters. In addition, although the timing of sample collection can affect the distribution of these variables (particularly temperature, pH and dissolved oxygen—see Jassby and Kann 2010), the below plots reflect water column means which are less sensitive to the effect of sample timing than are surface values. Nonetheless, as with previous years, certain stations tended to stand out on a seasonal basis. For example, the DO distribution (as indicated by the upper or lower quartile) was skewed higher for WB and AN, and skewed lower for ER, SB, and MN, and CP (Figure 6). Secchi depth (transparency) was somewhat lower at PM, WB, and SB and higher at AN. These among-station patterns are not always consistent from year-to-year (see Kann 2011-2014).

Stations PM, WB and SB were among the highest with respect to median and/or upper quartile CHL, while the lower quartile value for CHL at stations ML, MN, and AN were among the lowest (Figure 7). However, the inter-quartile CHL range was similar among many other stations. In contrast to 2012 when both AS and AN showed noticeably lower CHL, especially compared to previous years (Kann 2012), 2015 values for AS were more similar to other years, but AN showed relatively low CHL. Unlike 2010 and 2011 (but similar to 2012) when the AS and AN stations showed higher upper quartile and median values for TP, UQ values were not high in 2015 (Figure 7). With the exception of PM which was skewed low and An which was skewed high for SRP, values were similar overall among stations.

Similar to previous years, Agency Lake stations were among the lowest for nitrogen, particularly for NH_4-N, but also for NO_3-N, and TN (Figure 7; Table 2). The upper quartile value and interquartile range for TN were highest at WB and SB. Similar to 2010-14, ER, SB, and CP were among the highest for ammonia (NH_4-N; Figure 7; Table 2). WB also showed relatively high NH_4-N in 2015. Un-ionized ammonia also tended to be highest at WB, ER, SB, and CP in 2015 (Figure 7). NO_3-N was similar among sites, except for SB, MN, and CP which had slightly higher values.

Median silica values (~40,000 µg/L)[7] were similar among stations, although medians at the Agency Lake stations were lower and showed a much narrower interquartile range[8] (Figure 7). See below for a description of seasonal silica dynamics.

[7] Median values were ~30,000 µg/L in 2012.

[8] The pattern of lower silica medians and narrower interquartile range at the Agency Lake stations is consistent year-to-year.

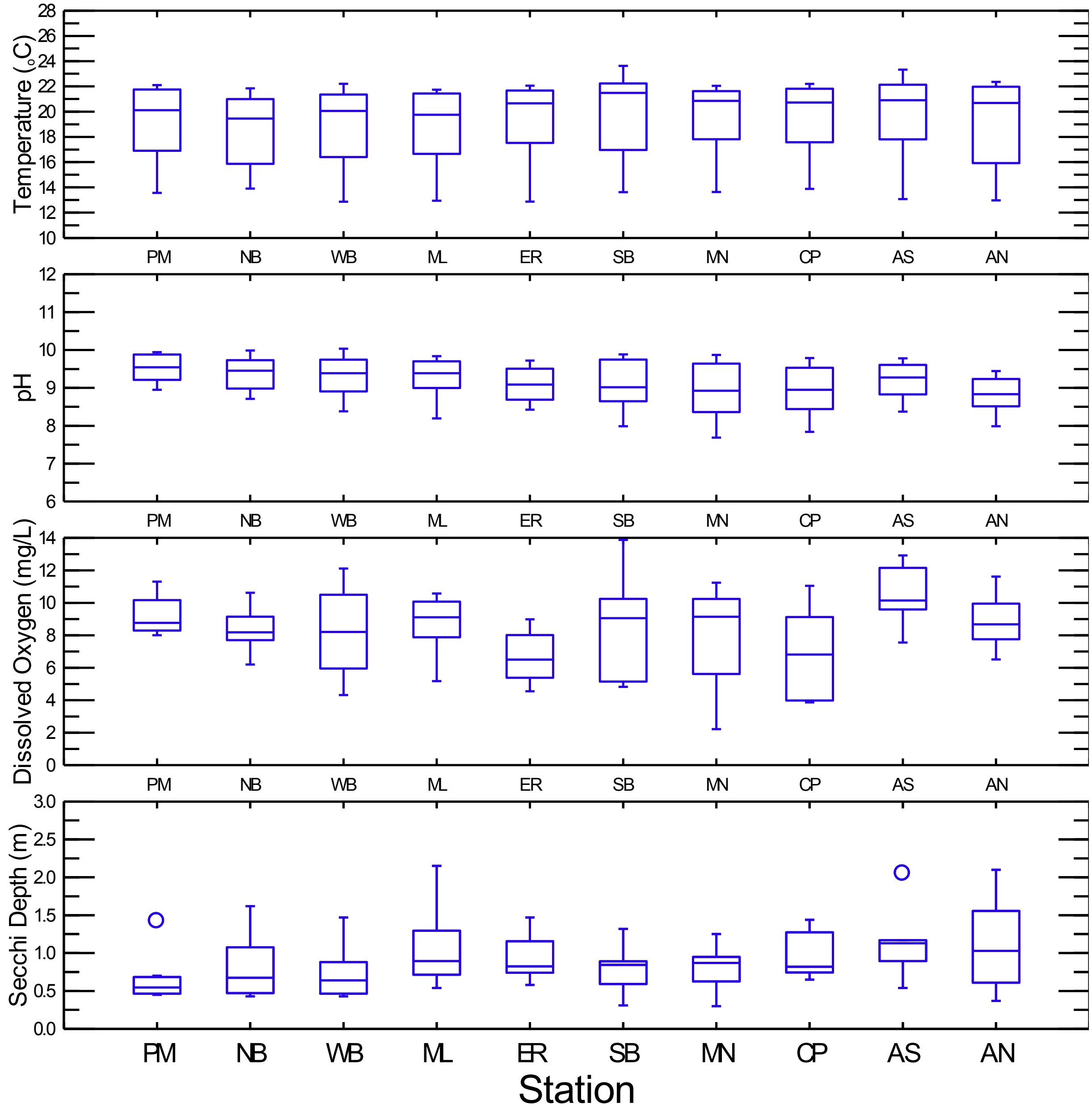

Figure 6. Station distributions of T (˚C), pH, D.O (mg/L), and Secchi depth, June-September, 2015.

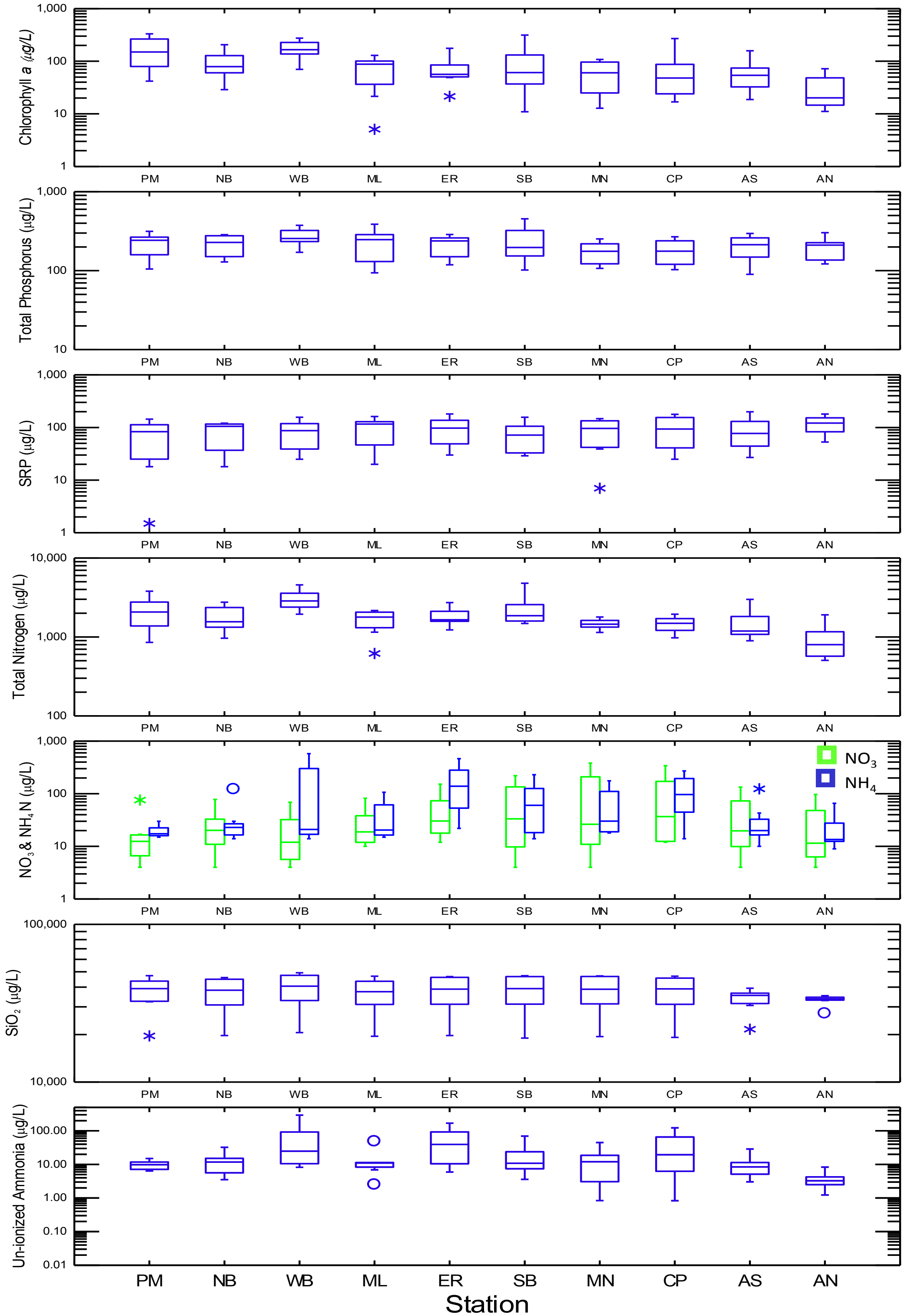

Figure 7. Station distributions of CHL, TP, SRP, TN, NO_3+ NO_2-N, NH_4-N, SiO_2 and un-ionized ammonia, June-September, 2015.

Table 2. Summary statistics for each UKL station for the June-September period, 2015 (LQ= Lower Quartile; UQ=Upper Quartile).

Year	Station	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	Silica (µg/L)	NO_3+NO_2 Nitrogen (µg/L)	NH_4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2015	AS	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	AS	Median	20.91	9.28	10.15	1.13	54.15	214.00	79.50	1190.00	35450.00	21.00	20.00	8.58
2015	AS	Arithmetic Mean	19.76	9.20	10.53	1.12	62.36	204.88	93.00	1515.63	33512.50	46.38	34.38	10.27
2015	AS	Coefficient of Variation	0.17	0.05	0.17	0.39	0.70	0.35	0.67	0.47	0.16	1.17	1.09	0.79
2015	AS	LQ	17.81	8.83	9.59	0.90	32.75	152.00	45.00	1080.00	31500.00	10.00	16.50	5.30
2015	AS	UQ	22.13	9.61	12.16	1.17	74.20	260.50	134.50	1850.00	36600.00	85.50	34.00	11.37
2015	ER	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	ER	Median	20.65	9.09	6.50	0.83	56.40	238.50	100.50	1650.00	38900.00	32.50	147.00	40.49
2015	ER	Arithmetic Mean	19.33	9.09	6.67	0.94	72.93	213.38	98.00	1835.00	37325.00	51.75	186.13	58.90
2015	ER	Coefficient of Variation	0.17	0.05	0.24	0.36	0.65	0.30	0.55	0.27	0.26	0.93	0.89	1.02
2015	ER	LQ	17.52	8.69	5.38	0.74	50.45	152.00	49.00	1580.00	31150.00	18.00	56.00	10.53
2015	ER	UQ	21.67	9.51	8.01	1.16	86.10	260.00	137.00	2135.00	46100.00	74.50	298.00	97.02
2015	ML	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	ML	Median	19.76	9.39	9.11	0.90	88.40	247.50	116.50	1795.00	37500.00	19.00	20.50	11.00
2015	ML	Arithmetic Mean	18.80	9.28	8.74	1.06	74.55	228.63	96.13	1641.00	36350.00	28.88	40.88	14.05
2015	ML	Coefficient of Variation	0.17	0.06	0.20	0.49	0.57	0.45	0.53	0.33	0.25	0.85	0.89	1.01
2015	ML	LQ	16.65	9.00	7.88	0.72	41.80	138.00	47.50	1320.00	31100.00	12.00	16.50	8.48
2015	ML	UQ	21.44	9.70	10.08	1.30	100.95	288.00	129.50	2060.00	43600.00	38.50	65.50	11.34
2015	MN	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	MN	Median	20.86	8.92	9.15	0.87	62.25	178.50	97.00	1450.00	38850.00	35.00	30.50	12.09
2015	MN	Arithmetic Mean	19.54	8.93	7.94	0.81	62.13	175.00	87.63	1468.75	37537.50	118.63	67.13	14.48
2015	MN	Coefficient of Variation	0.15	0.09	0.39	0.38	0.61	0.32	0.60	0.15	0.26	1.32	1.02	1.00
2015	MN	LQ	17.82	8.36	5.62	0.63	29.40	122.50	42.00	1335.00	31350.00	11.00	19.00	3.58
2015	MN	UQ	21.63	9.64	10.24	0.95	96.45	219.00	134.50	1625.00	46700.00	235.50	122.00	19.43
2015	NB	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	NB	Median	19.46	9.46	8.18	0.68	79.10	228.50	105.50	1560.00	38350.00	20.50	23.00	11.83
2015	NB	Arithmetic Mean	18.55	9.38	8.36	0.81	97.29	216.38	83.00	1780.38	36725.00	26.38	33.63	12.67
2015	NB	Coefficient of Variation	0.16	0.05	0.16	0.53	0.60	0.30	0.52	0.36	0.25	0.89	1.07	0.73
2015	NB	LQ	15.87	8.98	7.71	0.47	61.60	152.00	40.50	1335.00	30850.00	11.00	16.50	5.66
2015	NB	UQ	20.99	9.73	9.15	1.08	131.00	277.50	116.50	2365.00	44850.00	33.00	27.00	15.28
2015	PM	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	PM	Median	20.11	9.55	8.77	0.55	151.00	242.50	83.50	2080.00	39150.00	12.50	17.50	9.92
2015	PM	Arithmetic Mean	19.15	9.52	9.22	0.66	171.70	222.63	74.06	2139.25	37212.50	19.13	19.63	9.88
2015	PM	Coefficient of Variation	0.17	0.04	0.14	0.49	0.62	0.34	0.69	0.45	0.24	1.23	0.26	0.31
2015	PM	LQ	16.91	9.21	8.30	0.47	84.30	172.00	26.50	1380.00	32550.00	7.50	16.00	7.10
2015	PM	UQ	21.76	9.88	10.17	0.69	264.50	266.00	113.50	2770.00	43700.00	16.50	22.50	11.79
2015	SB	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00

Year	Station	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	Silica (µg/L)	NO_3+NO_2 Nitrogen (µg/L)	NH_4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2015	SB	Median	21.49	9.02	9.05	0.85	60.90	197.00	73.50	1865.00	39200.00	49.50	70.50	10.82
2015	SB	Arithmetic Mean	19.83	9.09	8.45	0.79	105.20	238.38	76.38	2291.25	37525.00	79.00	84.25	20.03
2015	SB	Coefficient of Variation	0.18	0.07	0.38	0.39	1.06	0.50	0.61	0.48	0.27	1.10	0.91	1.10
2015	SB	LQ	16.97	8.65	5.16	0.59	39.30	155.50	33.00	1595.00	31200.00	10.00	18.50	7.51
2015	SB	UQ	22.24	9.75	10.24	0.89	157.60	323.00	106.00	2570.00	46600.00	144.00	126.00	25.40
2015	WB	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	WB	Median	20.06	9.39	8.21	0.64	168.00	256.00	87.50	2860.00	40700.00	12.00	89.50	27.22
2015	WB	Arithmetic Mean	18.84	9.31	8.22	0.73	177.00	272.75	84.88	3023.75	39012.50	23.75	337.63	70.21
2015	WB	Coefficient of Variation	0.18	0.06	0.33	0.48	0.39	0.26	0.58	0.28	0.26	1.14	1.38	1.38
2015	WB	LQ	16.40	8.91	5.95	0.47	137.50	235.00	40.00	2395.00	32900.00	6.00	17.00	10.78
2015	WB	UQ	21.35	9.74	10.49	0.88	230.00	326.50	121.00	3585.00	47500.00	40.50	577.00	92.26
2015	AN	N of Cases	8.00	8.00	8.00	8.00	8.00	7.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	AN	Median	20.68	8.84	8.68	1.03	20.65	211.00	121.50	812.00	33750.00	11.50	13.50	3.26
2015	AN	Arithmetic Mean	19.06	8.82	8.86	1.11	31.28	194.57	119.75	939.13	33150.00	30.50	23.88	3.71
2015	AN	Coefficient of Variation	0.19	0.06	0.19	0.54	0.71	0.34	0.37	0.51	0.08	1.17	0.88	0.58
2015	AN	LQ	15.92	8.52	7.76	0.61	14.65	134.75	88.00	571.50	33100.00	7.00	12.50	2.50
2015	AN	UQ	21.98	9.23	9.95	1.56	48.30	226.75	153.00	1165.00	34500.00	53.00	32.00	4.29
2015	CP	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	CP	Median	20.73	8.95	6.82	0.82	48.00	177.00	94.50	1490.00	39000.00	46.50	100.50	27.25
2015	CP	Arithmetic Mean	19.54	8.93	6.85	0.97	75.81	180.75	98.88	1471.88	37212.50	102.00	120.75	40.47
2015	CP	Coefficient of Variation	0.15	0.08	0.42	0.32	1.10	0.35	0.62	0.23	0.26	1.17	0.76	1.08
2015	CP	LQ	17.57	8.44	3.99	0.75	24.05	120.50	43.50	1225.00	31150.00	12.50	45.00	6.35
2015	CP	UQ	21.82	9.53	9.13	1.28	87.75	239.50	156.00	1715.00	45650.00	172.50	194.50	66.33

Seasonal Chlorophyll Pattern and Climate Interaction

Seasonal differences in algal biomass (CHL) among stations in 2015 show that, unlike both the previous seven years (2008-2014) when early season CHL in Agency Lake was similar to UKL stations through the initial bloom peak, and 2006 (Kann 2011) and 2007 when AS and AN increased earlier and declined earlier in the season relative to UKL stations[9]; early season CHL in Agency Lake was lower than UKL stations through the initial bloom peak (Figure 8). The general trend towards greater similarity between Agency and UKL Lakes in terms of the June algal biomass increase and seasonal maxima and decline in the later years likely reflects greater connectivity between the two lakes due wetland restoration activities on the Williamson Delta Preserve (e.g., Wong et al. 2010; 2011).

As noted in previous annual data reports (Kann 2008 to 2015), water temperature partially explained the early season CHL patterns among the years. Low temperatures coincided with a depressed early-June bloom in 2006, and in 2008 much cooler lake-wide water temperature (median value <7 ^{o}C) in late April and early-May also coincided with low CHL levels. However, it was clear that factors other than temperature were also affecting bloom dynamics in those years (Figure 8).

For example, in 2010, late-April and early-May CHL was noticeably higher than the previous four years (generally >80 µg/L) due to an unusually large diatom bloom (*Asterionella formosa*) occurring at that time– despite temperatures in a range similar to many of the previous years (Kann 2011). The large 2010 diatom bloom then declined rapidly beginning in mid-May and by early-June, chlorophyll levels were less than 10 µg/L. In contrast, CHL levels in 2011 were only slightly elevated in late-April and early-May (generally <20 µg/L), and except for a decline in mid-May (<7 µg/L), they remained generally less than 20 µg/L (often less than 10 µg/L at many stations) through the end of June (Figure 8). During this same period water column temperature remained very cool (<11 ^{o}C through early June) and although mid-June temperature increased to ~16 ^{o}C in UKL (they were 1-2 deg. warmer in Agency Lake), they only rose slightly, remaining <20 ^{o}C through most of July of 2011 (Figure 8). In contrast, water temperatures during the previous five years generally exceeded 20 ^{o}C by early-July, if not sooner.

In 2012, the CHL pattern was more similar to 2010, although the spring levels ~30 µg/L were still substantially lower than the ~100 µg/L achieved in 2010. May-June levels were similar, as was the peak which occurred mid to late-July of both 2011 and 2012. Water temperature warmed more rapidly than 2011, and CHL also increased to levels >50 µg/L by early-July. CHL did not undergo a lake-wide decline in August as it did in 2011.

Similar to 2013 and 2014, spring CHL values were also relatively low (generally <10-15 µg/L) in 2015, and while 2013 and 2015 increased in late- May/early-June, 2014 values remained low in early-June before increasing in mid- to late-June (Figure 8). 2013-2015 showed relatively rapid increases to values >100-200 µg/L by mid-June, and showed relatively earlier peaks than many previous years. The mid-June peaks were not necessarily associated with water temperatures that were warmer than other years (~18 ^{o}C in 2013), and in fact 2014 showed a temperature decline in mid-June (Figure 8; (~16 ^{o}C). However, the 2015 Chl increase and peak were clearly associated with warmer June water temperatures.

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[9] Between 1990-2007 data tend to show the Agency L. stations increasing and declining earlier than UKL stations.

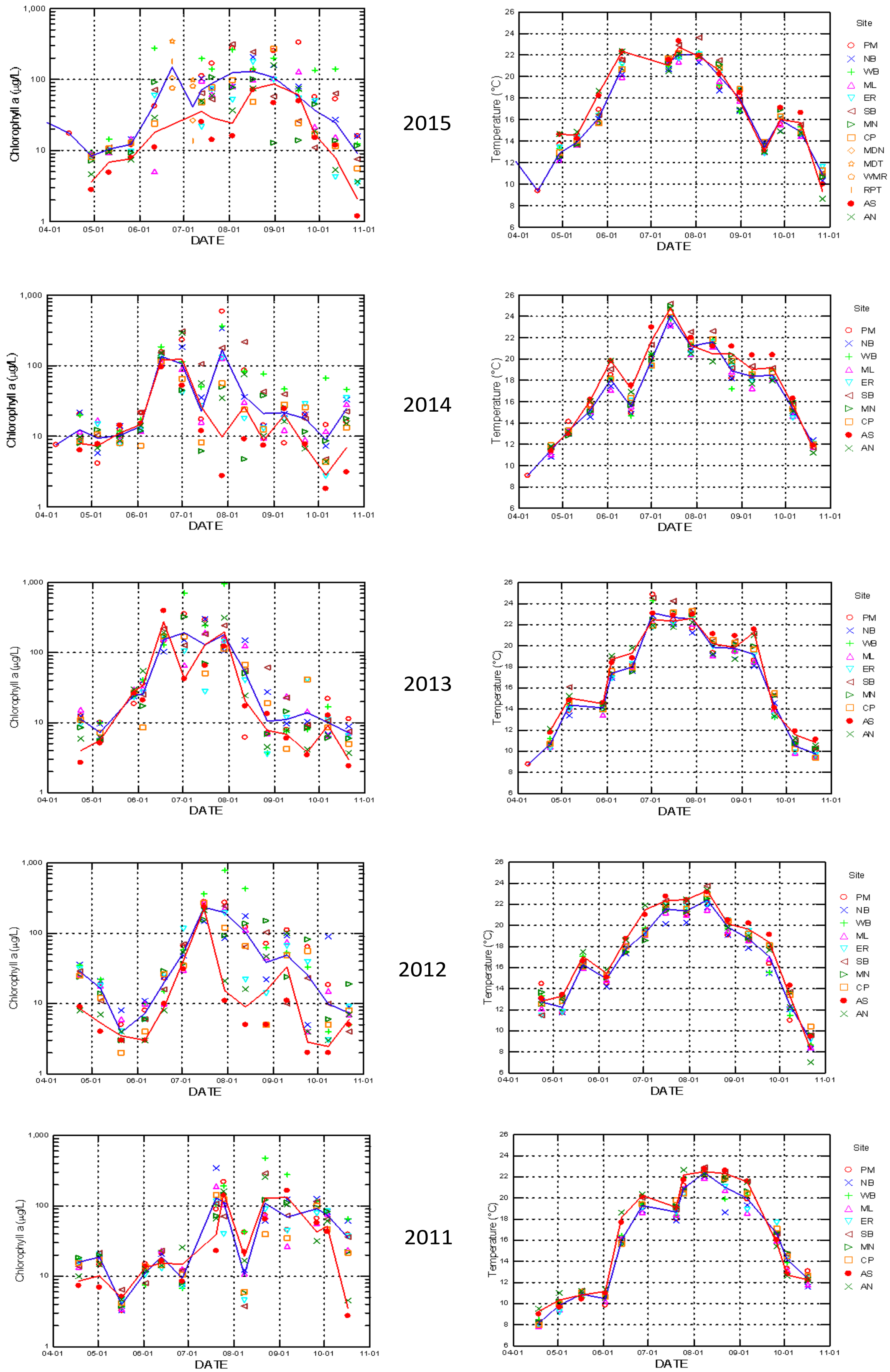

Figure 8. Seasonal CHL and temperature trends for UKL stations, 2011-2015 (blue line shows the median value for UKL-only, red line shows the median value for Agency Lake-only).

Somewhat unique to 2015 was the very early CHL decline occurring in late June (Figure 8). This bloom decline is also indicated by the continuous USGS phycocyanin data which shows phycocyanin abruptly declining ~June 20th and rebounding to previous levels on ~July 10th (Figure 5). As noted below, the early bloom was comprised of diazotrophic *Aphanizomenon,* but after the bloom crash and the influx of available nitrogen, non-diazotrophic *Microcystis* dominated. Temperature seemed to directly relate to the onset of the relatively early *Aphanizomenon* bloom, and indirectly to the earlier than usual *Microcystis* bloom in that it was timed to the *Aphanizomenon* crash and the influx of nitrogen[10].

Because water temperature in the above plots is measured biweekly, and due to UKL's shallow depth, a short lag-time is generally observed with respect to equilibrium with ambient air temperatures (e.g., Wood et al. 2006), it is also instructive to evaluate daily air temperatures as another indicator of water column warming.

Previous analyses of daily data obtained from the USBR AgriMet station located near Agency Lake indicated at least partial tracking of May air temperature and CHL levels (Kann 2011; 2012). For example, temperature declines in mid-May of 2006 and 2008 that remained near or below 15 ^{o}C through mid-June were associated with suppressed CHL levels in early-June (Kann 2011). In 2007 and 2009, air temperatures warmed between mid- and late-May and were associated with elevated CHL levels in early June, and in 2010, when temperatures cooled substantially in mid-May and portions of June, CHL also remained suppressed during early and mid-June. Analyses for previous years indicated a threshold temperature of ~15 for *Aphanizomenon* bloom development in Upper Klamath Lake (Kann 1998; Kann 2011). However, as noted previously (Kann 2011) high CHL levels due to spring diatom blooms can be achieved even at temperatures much cooler than 15 ^{o}C. Furthermore, there was an indication that once the 15 ^{o}C threshold was reached, cool temperatures towards the end of June and into July also had an apparent effect on suppressing continuing algal biomass development.

June air temperatures in 2015 clearly fit the trend of warmer temperatures leading to earlier bloom development, with late-May and early June values among the highest of the 2006-2014 period (Figure 9a;Figure 10). Although there was an apparent cooling trend during May-July between 2006 and 2012, this trend reversed itself during 2013-2015 (Figure 10).
Analysis of wind speed as an indicator of the extent of water column mixing showed that the periods directly preceding and during the typical period of June bloom development in previous years tended to show that higher wind speeds were associated with lower algal biomass and vice versa (e.g., Kann 2015). This trend held in 2015 when increased algal biomass was associated with wind speeds among the lowest during late-May and June (Figure 9b).

Also similar to previous 2006-2014 analysis of air temperature and wind speed data that showed wind and temperature to be related such that warm/calm conditions co-occur and that cool/windy conditions co-occur (Kann 2015), these parameters also tended to co-occur in 2015 (Figure 11). For example, confidence ellipses computed for the period encompassing 10 days prior to and subsequent to June 1st (the typical historical period of initial *Aphanizomenon* increase) show that 2006, 2008, and 2011 (red, green, and maroon ellipses in Figure 11) tended to be cooler and windier than during the same periods in 2009,2013, 2014, and 2015.

[10]*Microcystis* does not appear in UKL until the *Aphanizomeno*n bloom crash which typically occurs between mid-July and mid-August.

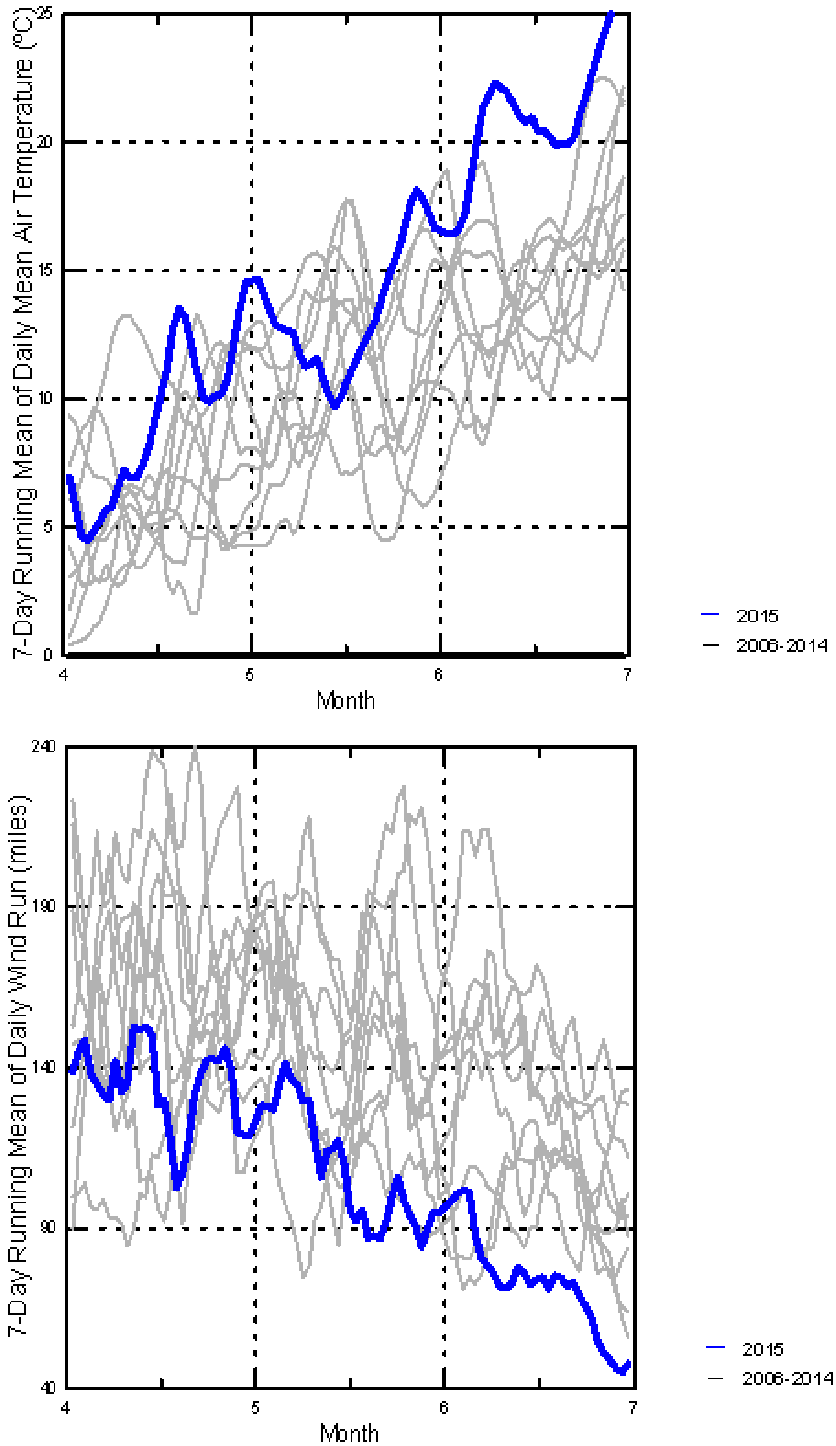

Figure 9. Time series of the 7-day running mean of daily air temperature (a) and 7-day running mean of the daily wind run in miles (b), April-June, 2006-2015. Data are from the Bureau of Reclamation AgriMet station located at Agency Lake (AGKO).

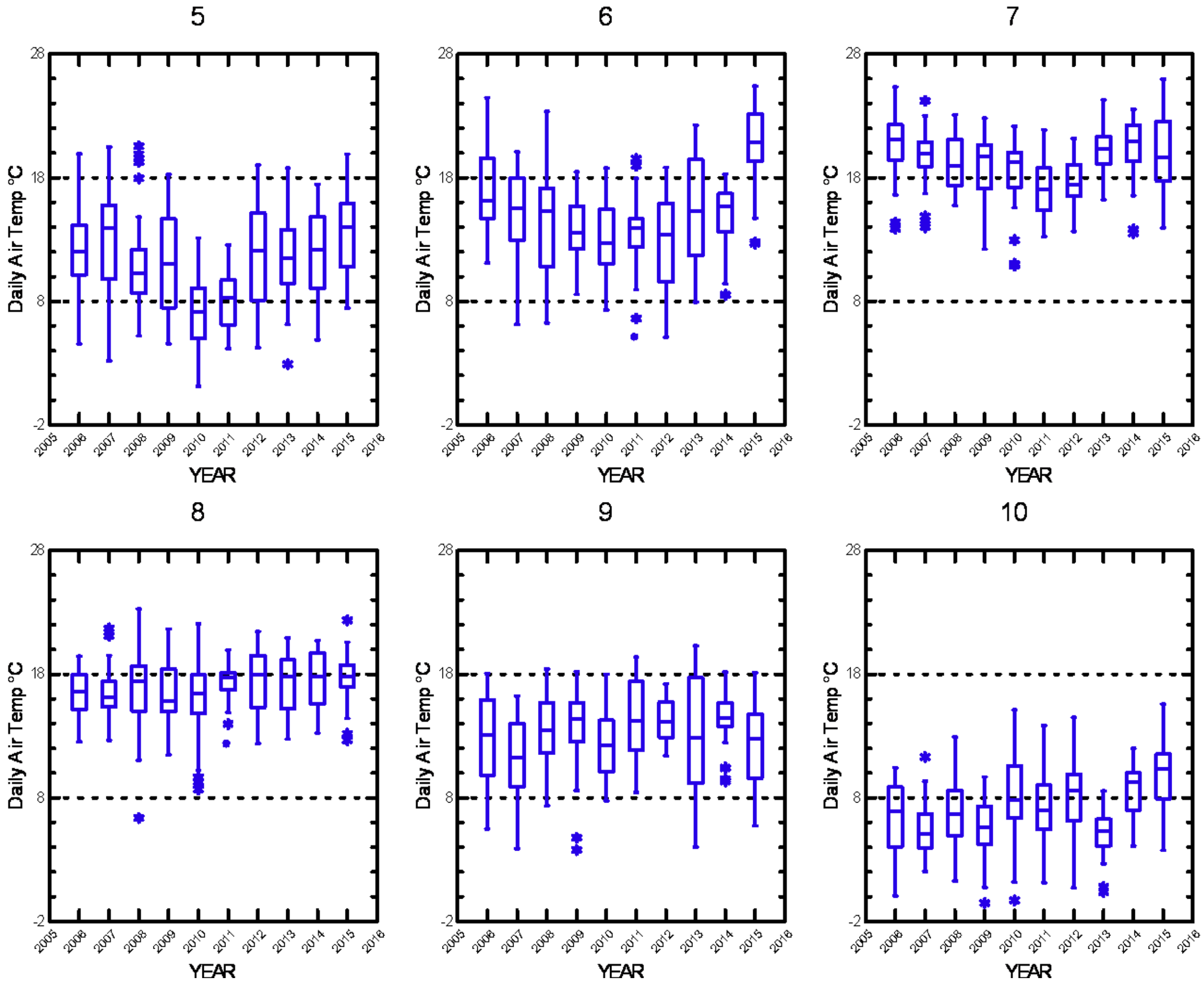

Figure 10. Annual distribution of Agency Lake AgriMet (AGKO) daily air temperatures during July, 2006-2015.

Overall, years showing lower wind speed and warmer temperatures tend to be associated with higher early- and mid-June CHL than the other years. For example, during 2011the late-May to early-June period was among the coolest and windiest of the six years portrayed (Figure 11), and as noted above also showed relatively low algal biomass levels. Both the 2013 and 2014 earlier bloom years were associated with warmer and calmer conditions during the late-May to early-June period. In this case, 2015 stands out as one of the calmest and warmest during the late-May to early June period.

These climate data indicate that cooler and well mixed conditions during the usual early season bloom development period (e.g., Kann and Welch 2005) contribute to variability in year-to-year bloom development. Multivariate analyses performed on the longer 1990-2009 data set also showed that wind and temperature, along with lake elevation were determinants of CHL levels in UKL (Jassby and Kann 2010). As noted below these factors also interact with varying year-to-year variability in nutrient concentrations.

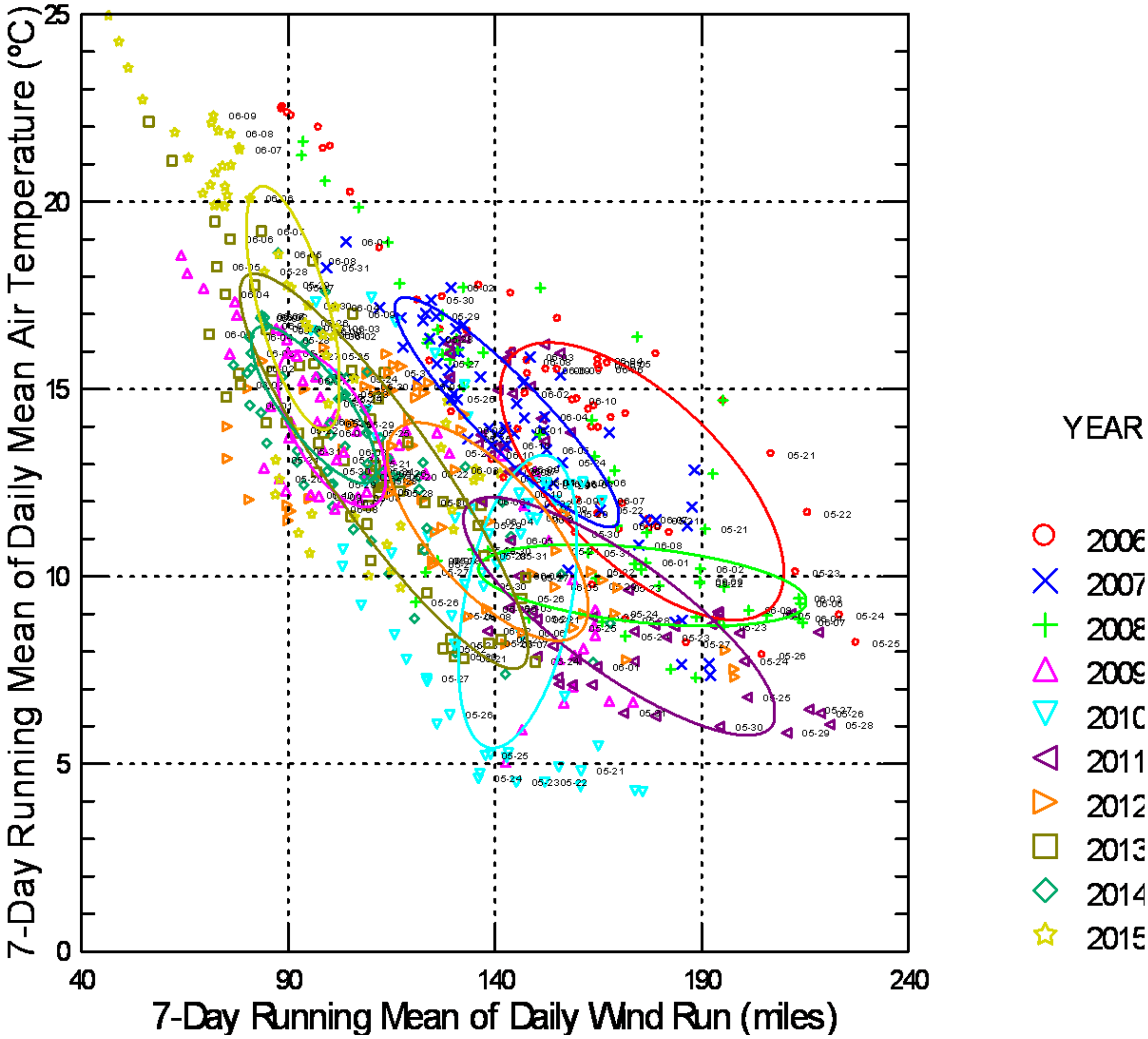

Figure 11. Scatter plot of the 7-day running mean of the daily wind run (miles) vs. 7-day running mean of daily air temperature (^oC) during May and June. Data are from the Bureau of Reclamation AgriMet station located at Agency Lake (AGKO). Data labels are day of the month. Confidence ellipses are drawn for dates occurring during the last 10 days of May and first 10 days of June; confidence ellipses are centered on the sample means of the x and y variables where the unbiased sample standard deviations of x and y determine its major axes and the sample covariance between x and y, its orientation (Systat 2013).

Basic statistics for monthly distributions over all sampling years are shown in Appendix 1. Peak water temperatures occurred in July of 2015 as it did in 2014 (this is in contrast to some earlier years when the August median was higher) (Figure 12). Monthly distributions for pH in 2015 showed a progressive seasonal increase with seasonal maxima occurring in August that coincided with lower Secchi depth (indicating reduced transparency) and highest CHL distributions (Figure 13). Similar to 2012 through 2014, lower DO occurred during August in 2015, and although the timing of low DO was similar to other years, August DO was relatively low compared to many previous years and continued into September.

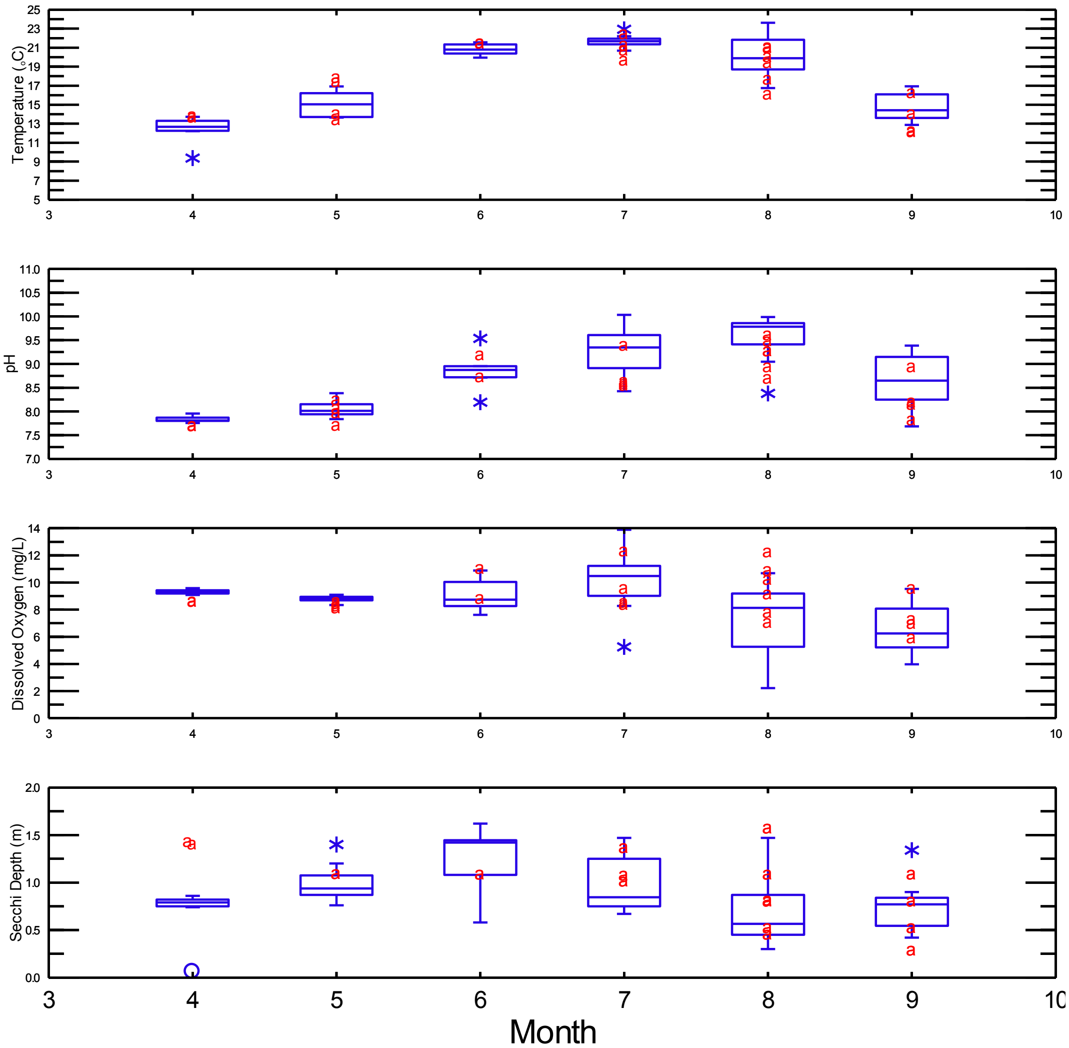

Figure 12. Monthly distributions of T (˚C), pH, D.O (mg/L), and Secchi depth, 2015 (symbol "a" denotes values for Agency Lake plotted separately from the box plot distribution).

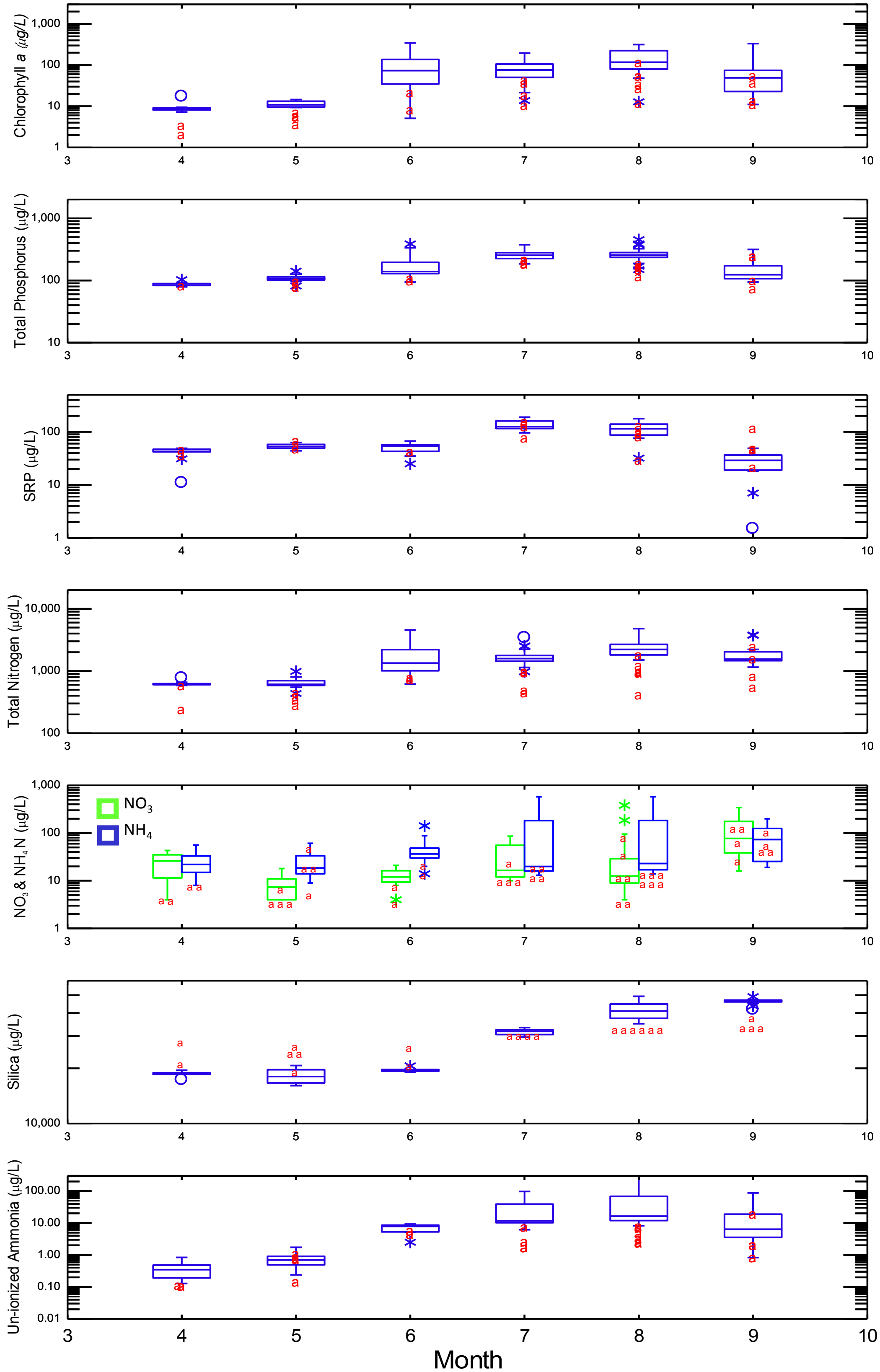

Figure 13. Monthly distributions of CHL, TP, SRP, TN, NO_3+ NO_2-N, NH_4-N, SiO_2 and un-ionized ammonia, 2015 (symbol "a" denotes values for Agency Lake plotted separately from the box plot distribution).

Because the CHL decline in 2015 straddled June and July, the typical bimodal CHL peak as indicated by the monthly box plots was not as obvious as in other years (Figure 13). TP tended to follow the initial trend in CHL, but still remains high during bloom decline, and peaks in August. SRP remained constant through the June biomass increase, before peaking in July during the bloom decline. TN increased during June, with values then remaining somewhat constant through the season. Coinciding with the decline of the initial *Aphanizomenon* bloom, NH_4-N increased in June (this was in contrast to 2014 when ammonia decreased through June), and NO_3-N increased in July and then again in September (Figure 13) Note that Figure 14 is shown below for reference but the missing sampling dates in June preclude interpretation for the Klamath Tribes stations for that period in 2015.

A further look at the 2015 time-series with respect to CHL and dissolved nutrients on a lake-wide basis (Figure 15; which includes June dates for USGS stations) shows that, as in other years, SRP at the UKL stations generally remained low through the initial June CHL peak before increasing during the algal biomass decline in early July (Figure 14 and Appendix III). As noted previously, there is evidence that SRP is limiting the early season bloom in UKL, especially since SRP values remain suppressed even when internal sources of phosphorus are increasing during that time period (Kann 2010; Walker et al. 2012).

In 2015 and most previous years, TIN (the sum of NH_4-N and NO_3-N) levels were relatively low during the late-spring period leading up to the annual *Aphanizomenon* (Figure 15). TIN began to increase in late-June and especially early-July when algal biomass declined precipitously (Figure 15), but then decreased again in mid-July before increasing in September. As in earlier years, SRP in 2015 tended to decline into the fall months. Unlike 2011 when TIN declined in the fall, values of TIN also increased in 2015 (values continued to increase in 2012 and 2103 as well). Spring and fall TIN tended to show an increased proportion of NO_3-N, while summer TIN was comprised predominantly of NH_4-N (Figure 15). However, fall NH_4-N values were high relative to other years.

In previous years April TN:TP values were >15, which was associated with diatom blooms observed in spring (Kann 2012). However, in 2015 April TN:TP ratios were closer to 10 (Figure 15). In most years the TN:TP and TIN:SRP ratios declined in May and June during the period preceding the rise of nitrogen-fixing *Aphanizomenon* in UKL (TN:TP ratios were generally lower than 10 and TIN:SRP<2.5) (Figure 15). Relatively low May-June TN:TP and TIN:SRP ratios in 2015 (TN:TP <10; TIN:SRP<1) also seemed to be associated with an earlier *Aphanizomenon*-associated algal biomass rise (Figure 15). Although TIN:SRP ratios typically increase in August as TIN levels rise, this occurred in late June of 2015 due to the early *Aphanizomenon* decline and subsequent remineralization of organic N to inorganic N. Also unique to 2015 was an unusually early and large boom of *Microcystis aeruginosa* which followed the decline in *Aphanizomenon* and increase in TIN (Figure 16). Although *Microcystis* typically follows the decline in *Aphanizomenon* and rise in TIN in UKL (Kann 2015; Eldridge et al. 2012), this usually happens in late-July or August as it did in 2014 (Figure 15; Figure 16). The cause of the early bloom decline in 2015 is uncertain; however, it may be related to the warm/calm conditions causing early and rapid *Aphanizomenon* growth rate and subsequent light limitation due to self- shading. In that regard, climate favored the early onset of both bloom species, but a source of TIN was still associated with the onset of the non-diazotrophic *Microcystis.* Relatively early blooms occurred in both 2013 and 2014 (Figure 15) that were also associated with warmer late spring conditions (Figure 11)

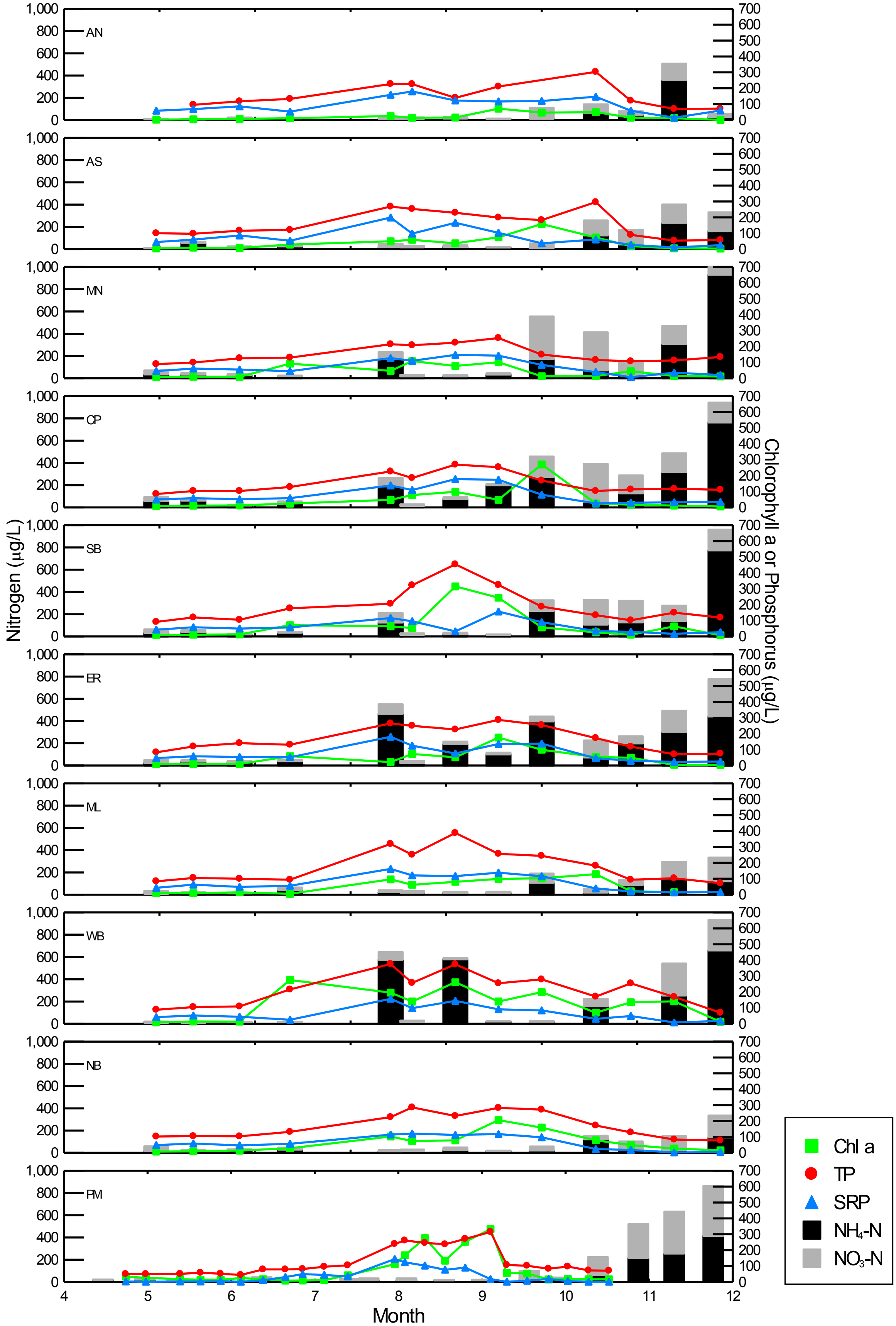

Figure 14. Chlorophyll, SRP, and TIN time-series for UKL and Agency Lake Stations, 2015.

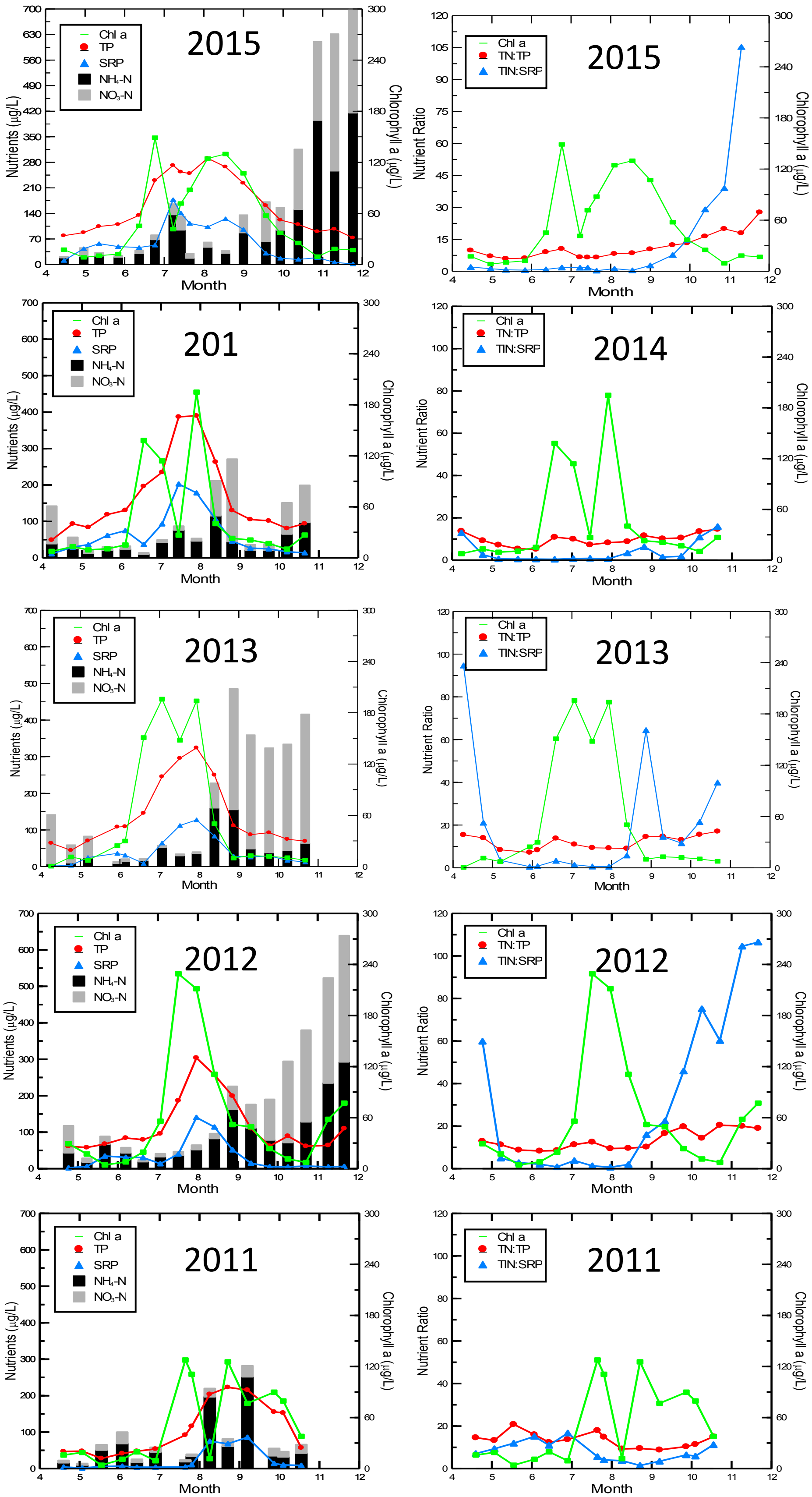

Figure 15. Lake-wide mean Chlorophyll, SRP, TIN, and nutrient ratio time-series for UKL Stations, 2015.

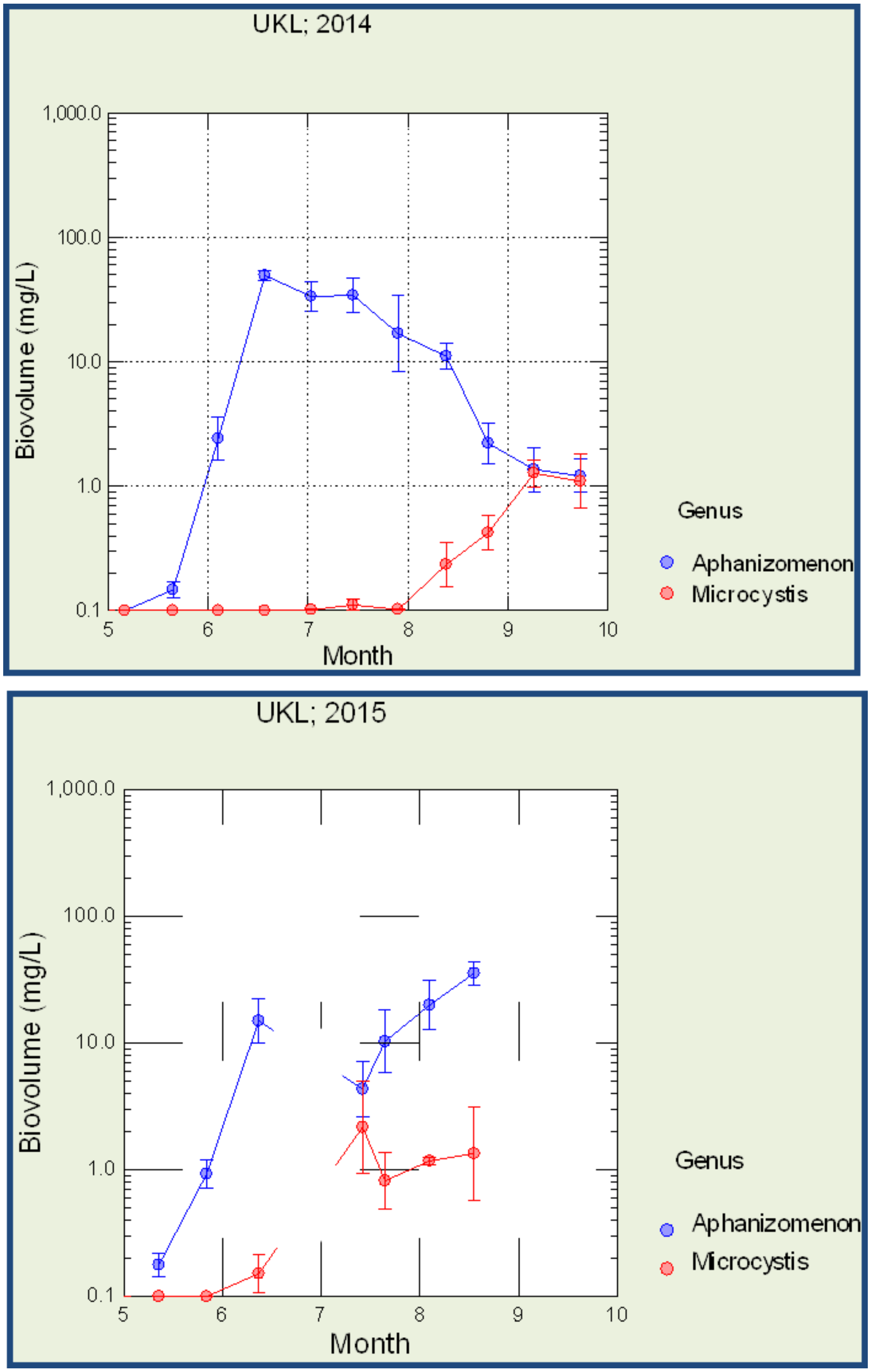

Figure 16. Biovolume of *Aphanizomenon and Microcystis* in UKL, 2014-2015. See Kann et al. 2014 for methodology.

Silica showed declining and lowest seasonal values April-June, and a substantial increase beginning in July, with elevated values continuing through mid-September (Figure 13; Appendix III). These trends are likely tied to silica uptake during spring diatom blooms, and subsequent summer sediment recycling and lack of uptake due to diatom decline during periods of *Aphanizomenon* dominance. Time series graphs in Appendix III indicate that the silica increase is concomitant with initial large CHL and TP increases in July, and that silica concentration increases (>45,000 µg/L) continue into September before gradually declining in the fall, and continue to decline to seasonal lows in the spring. The Agency Lake sites showed a more muted pattern with somewhat higher values in the spring compared to other stations, and the magnitude of summer increases were less pronounced, especially at AN (Appendix III). Silica values in the spring and early summer of 2013 and 2014 were noticeably higher (>25,000 µg/L) than in 2012 when they were ~15,000 µg/L (Kann 2013). The reason for this is not yet clear, but TP values were also higher during this period in 2013 and 2014. Silica values in 2015 were again lower and similar to those in 2012 (Appendix III; Figure 17). Trends at the outflow station (Figure 17), which include winter data, show the seasonal silica trend that includes a spring depression likely due to diatom uptake. The outflow data also clearly show the relatively high TIN occurring in the fall of 2015 (especially when compared to 2014), as well as the seasonal spring depression of TIN in the period preceding the rise in CHL due to diazotrophic *Aphanizomenon*.

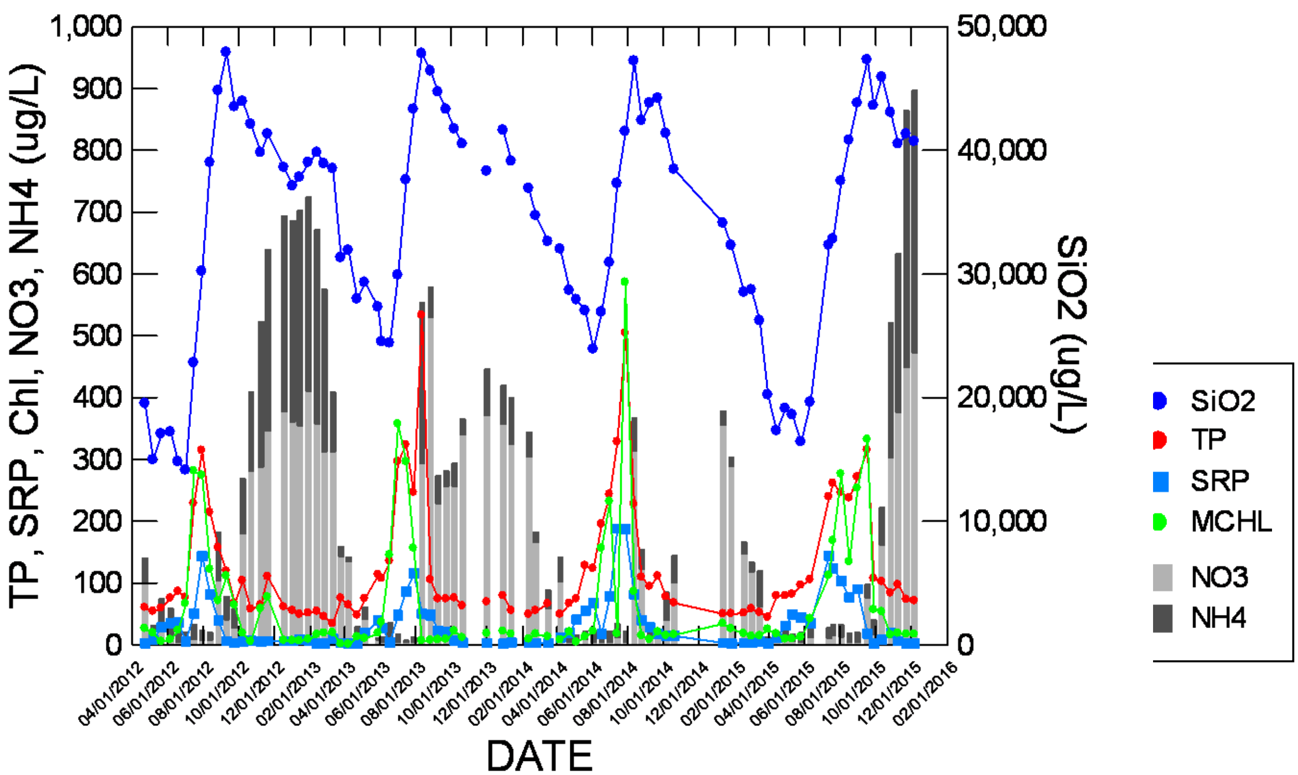

Figure 17. Outflow Chlorophyll, SRP, TIN (nitrate and ammonia), and silica time-series, 2012 -2015.

In 2009, chlorophyll to TP ratios greater than 1 (which indicate potential P limitation- see Kann 2010) were observed at a high frequency in June during the initial bloom increase; in 2010 CHL: TP ratios >1 occurred in April, part of May, July, and part of September (Kann 2011), and in 2012 the frequency of CHL: TP ratios >1 was similar to 2011, occurring at a high frequency only in July (Kann 2013). In 2013 both June and July showed an increased frequency of CHL:TP >1 but in 2014 a relatively low frequency of CHL: TP ratios >1 occurred, with only a few stations in June and July above 1 (Kann 2014; Kann 2015). Interestingly, 2015 also showed (Figure 18) a relatively low frequency of CHL: TP ratios >1; one station in June, two in August, and one in September (Figure 18). However the June frequency is clearly underestimated due to the lack of Klamath Tribes data during peak bloom development in that month.

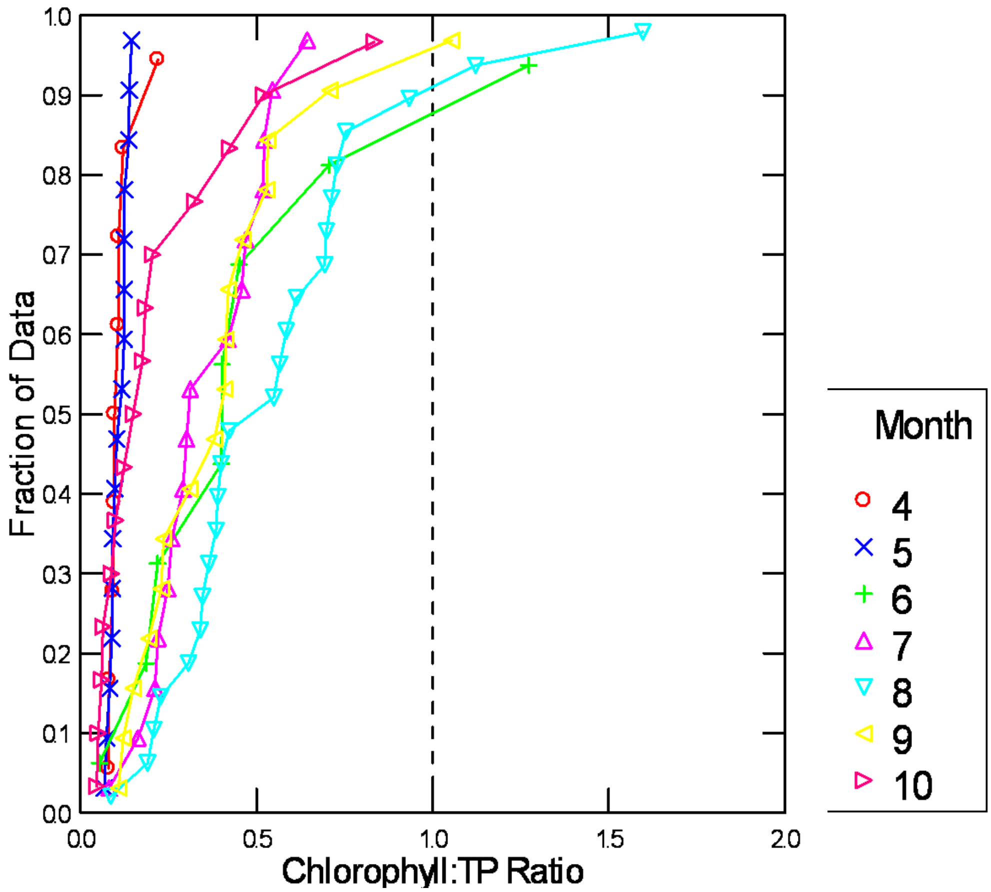

Figure 18. Quantile plot (cumulative frequency) of April-October chlorophyll to TP ratios in Upper Klamath Lake, 2015.

The underwater light environment is another factor that can influence both bloom dynamics and other water quality parameters, especially those that are photosynthetically driven. Although not discussed in detail here, a plot of photic zone depth (defined as the depth where 99% of incident light is absorbed as computed from extinction coefficients) relative to the maximum depth at UKL and Agency Lake stations shows that, as in other years, despite the shallow nature of the system that the photic zone depth was at times shallower than maximum depth in 2015 (Figure 19; occurring when the blue line is above red line). The typical UKL pattern shows a relatively shallow photic zone during the spring diatom bloom, a deeper photic zone that extends the depth of the water column during much of May and early-June, a shallower photic zone during late-

June to mid-July algal blooms, a decline (i.e., deeper photic zone- although not as extreme as the May decline) during August bloom declines, and finally another shallow photic zone period during bloom rebound in late-August and September (Kann 2010-2013). The 2015 pattern was generally similar to other years[11], showing that at times a percentage of the water column is outside of the photic zone (e.g., does not have sufficient light for photosynthesis; Figure 20).

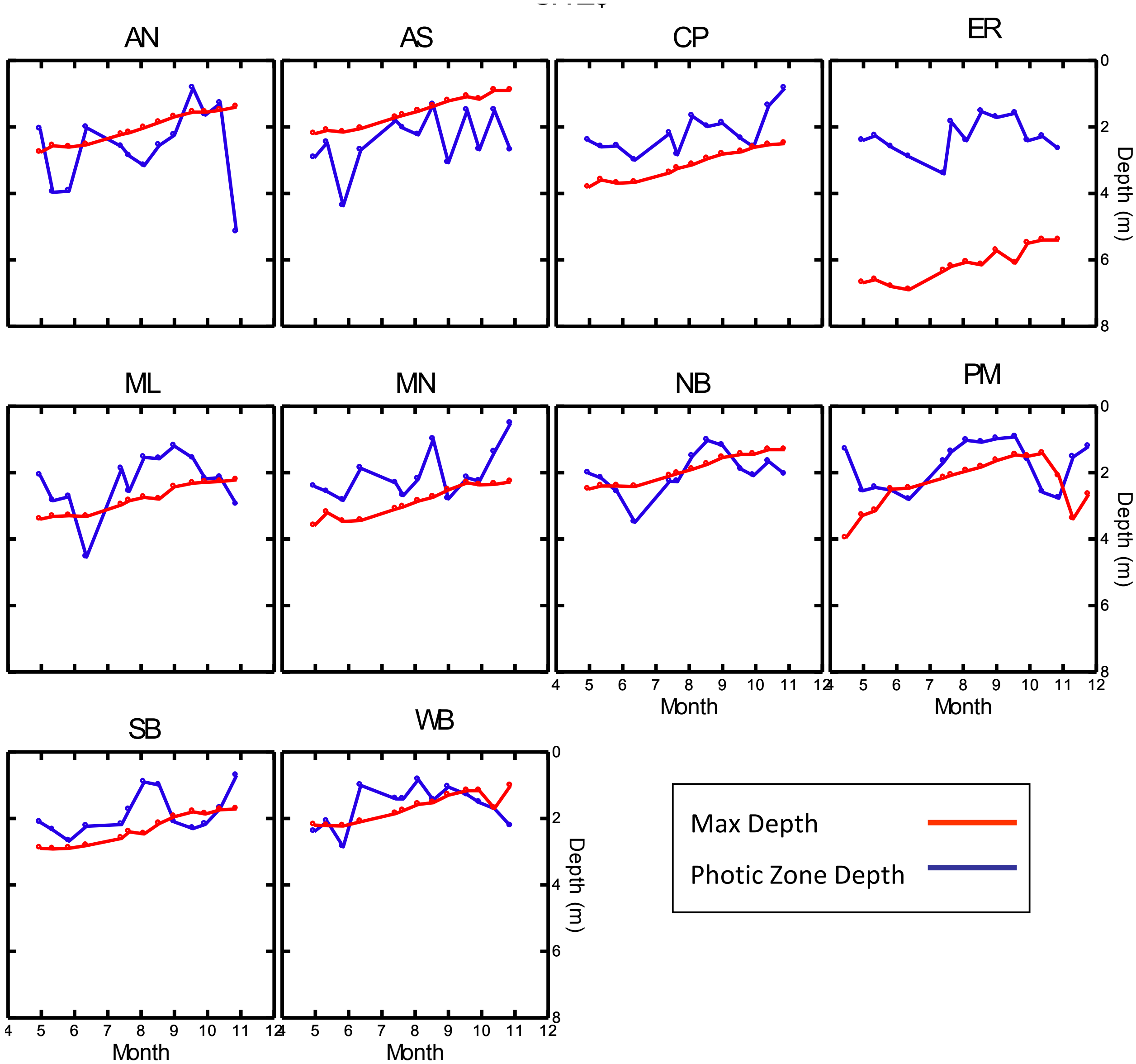

Figure 19. Photic zone depth and maximum depth at UKL and Agency Lake stations in 2015 (periods when the blue line is shallower than the red line indicate that a portion of the water column is not within the photic zone.

[11] However, the June trend in photic zone depth is incomplete due to missing values.

Light limitation is more apparent at the deeper ER station which showed a greater percentage of the water column to be light limited. Perhaps due to shallower lake depths in 2015, the photic zone was often greater than the bottom depth during the second half of the season (Figure 19 and Figure 20).

To the extent that underwater light is influenced by seasonal algal dynamics (in concert with ambient light and the interaction with lake depth), decreases in available light during the early spring were likely influenced by diatom blooms (e.g., Kann 2011). These light decreases are generally followed by a “clear water” phase in May (with some variability in timing) as the diatoms decline (Kann 2014). In 2012, a reduced photic zone occurred in early-spring, with a “clear water” phase occurring in late-May, and although the photic zone was again reduced in early June, the lake was then relatively clear again in late-June prior to a sharp decrease in transparency in mid-July (Kann 2013). In both 2013 and 2014 there was a “clear water” phase in early June which preceded the algal biomass increase in July, and in 2015 a mid- to late-May increase in clarity preceded the June algal biomass increase (Figure 20).

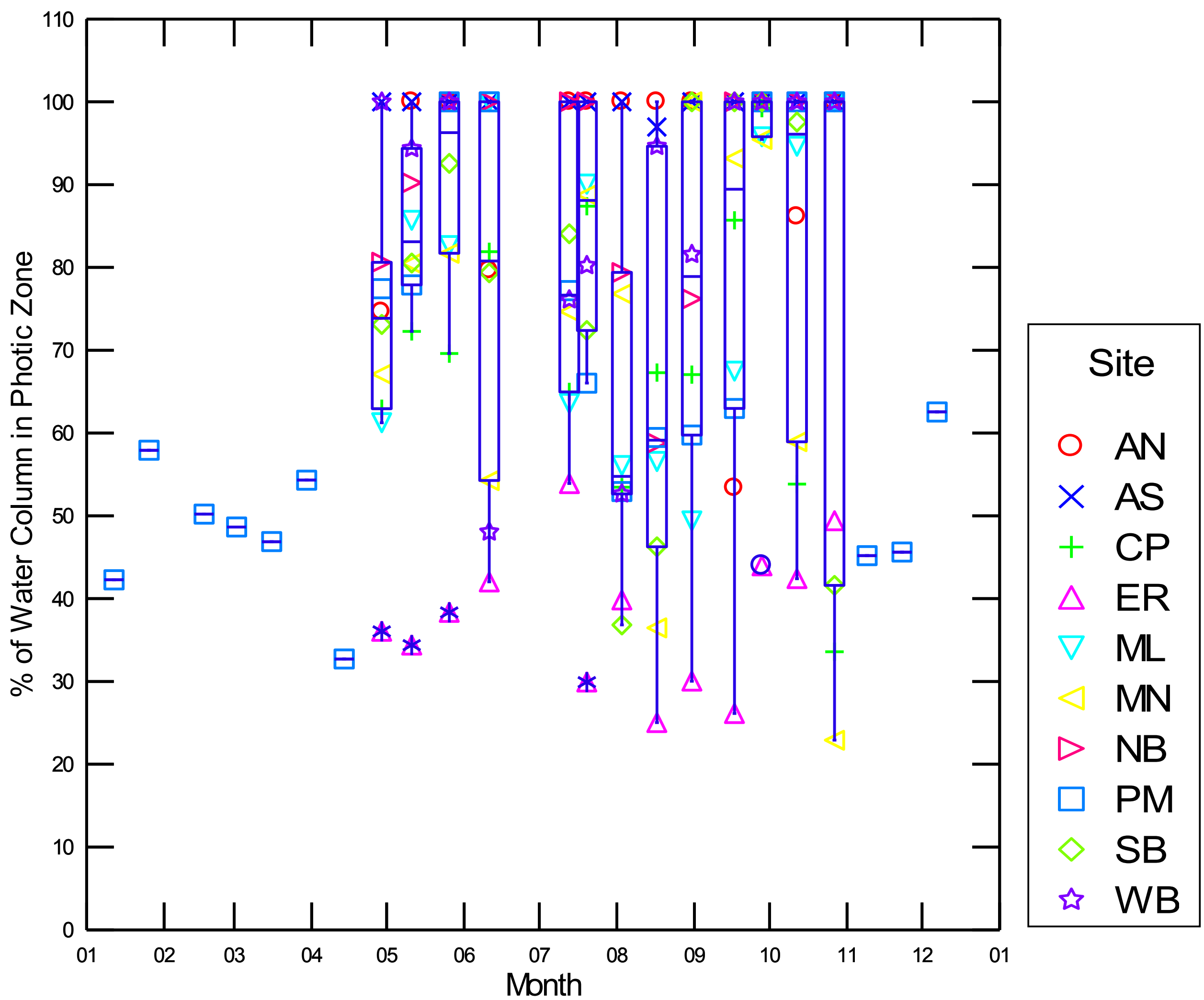

Figure 20. Percent of the water column in the photic zone for UKL and Agency Lake Stations, 2015.

As is typical for many shallow lake ecosystems, the concentration of nutrients, their ratios, the underwater light climate, and climatic variables (e.g., temperature and wind speed) are important determinants of annual bloom dynamics of *Aphanizomenon* in UKL. During the 2010 and 2009 growing seasons (see Kann 2010; 2011) it appears that the late-spring decline in TN:TP (indicating more nitrogen limiting conditions), a later (June as opposed to May) "clear water" phase (nitrogen fixation generally has a high energy/light requirement) and cooler May-June temperatures were important determinants of *Aphanizomenon* bloom timing. Likewise, relatively high TIN concentrations and high TIN:SRP ratios, a late "clear water" phase, generally cooler and windier conditions during late-May and early-June, and cool temperatures in July apparently influenced bloom dynamics in 2011. The bloom pattern in 2012 fell somewhere in between the 2009-2010 and 2011 pattern, with declining TIN:SRP ratios and a "clear water" phase also preceding the summer *Aphanizomenon* increase.

The 2013, 2014, and 2015 bloom initiation patterns were also characterized declining TIN:SRP ratios and a "clear water" phase, as well as by warmer/calmer climatic conditions. In particular, 2015 experienced an early bloom and unusually early bloom crash (decline) of *Aphanizomenon* that was followed by an unusually early *Microcystis* bloom. As shown by Jassby and Kann (2010), lake level and climate interact to determine bloom magnitude during the early season.

As noted above, this report serves as an annual data summary, and additional multivariate modelling is beyond the current scope. However, it is recommended that the interaction among these variables as well as other controlling factors such as lake level and hydrodynamic patterns be further explored further with additional multivariate statistical analyses using the long-term dataset.

Comparison of 2015 to Previous 1990-2014 Data

To facilitate inter-annual comparisons of the major water quality variables, lake-wide means and medians were computed for UKL-only and Agency Lake-only. The distributions for the June-September period are shown in Figure 21 to Figure 24, and summary statistics in Tables 3 and 4. Despite early season temperature values that were relatively high, the overall June-September lower quartile in 2015 was relatively low, although the median was among the highest (Figure 21). Dissimilar to 2010-2014 when the June-Sep UKL pH distributions were among the lowest for the period of record, values in 2015 were again in the range of many previous years (Figure 21; Table 3). In contrast to 2011 when median DO concentration was higher than all other years for the period of record, median DO in 2012 and 2013 were among the lowest despite the lack of a large bloom decline, and 2014 and 2015 were intermediate. As expected due to its controlling effect on pH, median and lower quartile CHL in 2014 (as in 2013) also tended to be among the lowest for the period of record, but rebounded in 2015 (Figure 22). Overall CHL levels were lower for the previous 5 years (2010-2014) compared to the earlier period.

TP in 2015 was intermediate to high compared to other years, but SRP in 2015 (as in 2013 and 2014) was among the highest for the inter-quartile range and UQ values (Figure 22). However, while TN was low and followed the trend in TP and CHL during the previous 5 years, TN remained low in 2015 despite the rebound in CHL and pH. For the 25 year of record, the ammonia distribution was similar from 1990-1995, was elevated from 1996-2002, and then decreased to pre-1996 levels during the past 13 years (2003-2015). The ammonia and nitrate distributions were low overall in 2015, but were somewhat higher than 2014. Inter-annual silica variability is indicated, with 2009 and 2010 showing reduced lower quartile values, possibly due to enhanced diatom blooms in spring of those years (Figure 22). Silica values in 2013-2015 were similar, and showed the highest median, upper and lower quartiles, and inter-quartile range compared to the previous five years. As expected given lower pH values in recent years, un-ionized ammonia was notably lower during 2010-2014 (especially lower quartile values), but rebounded somewhat in 2015.

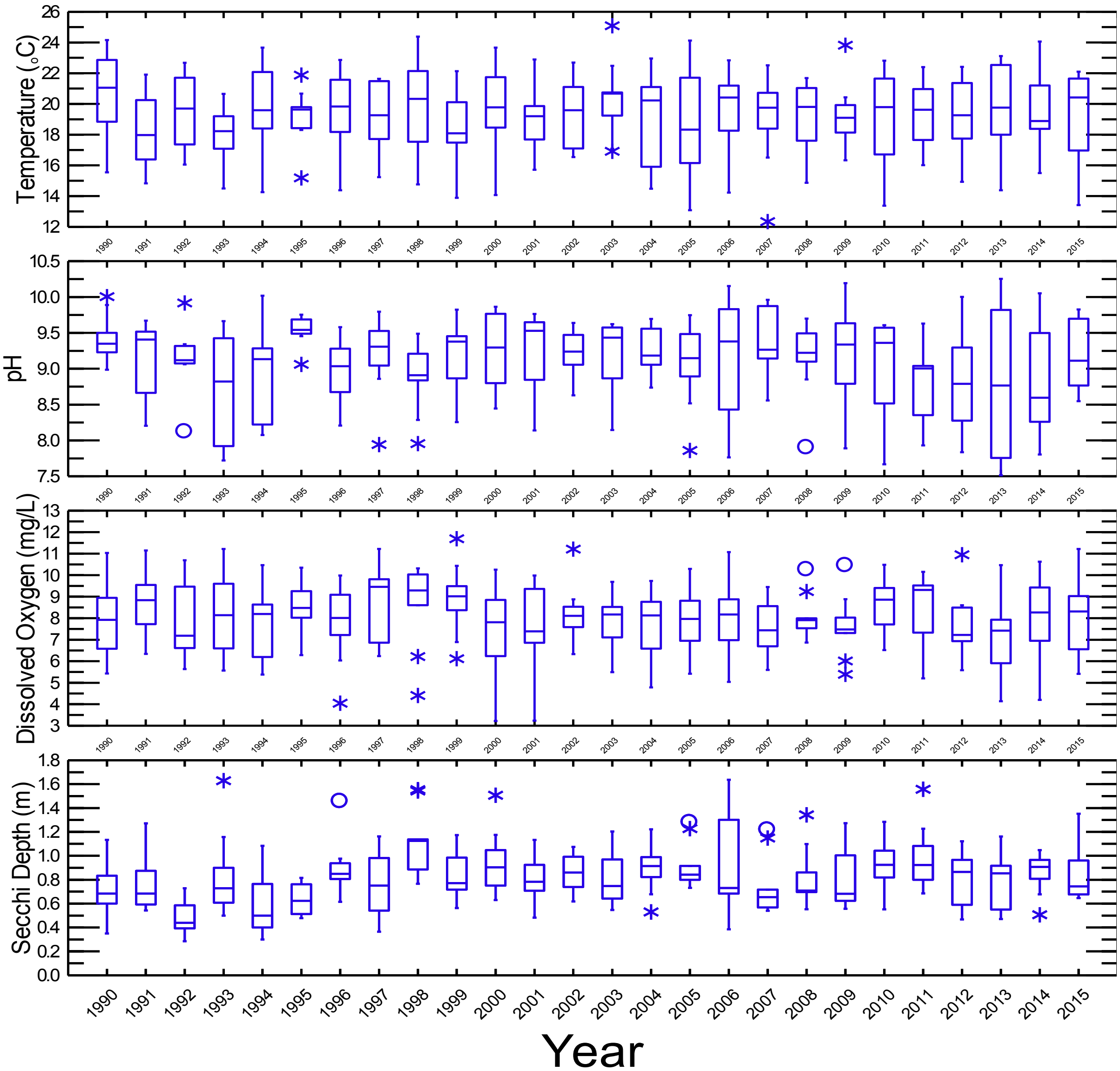

Figure 21. June-September distribution of UKL-only lake-wide means for T (˚C), pH, D.O (mg/L), and Secchi depth, 1990-2015.

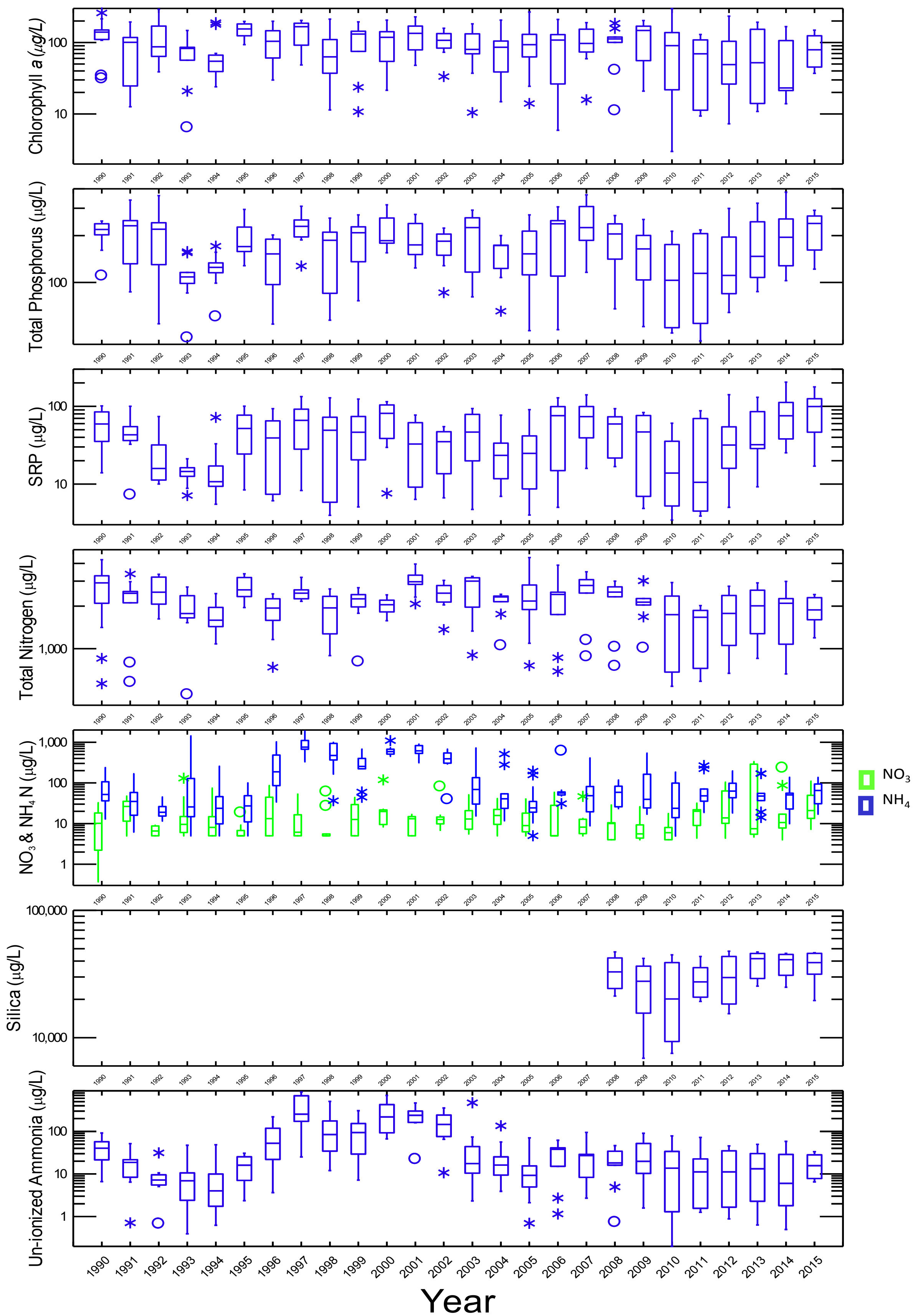

Figure 22. June-September distribution of UKL-only lake-wide means for CHL, TP, SRP, TN, NO_3+ NO_2-N, SiO_2 and NH_4-N, 1990-2015.

Table 3. Summary statistics for June-September UKL-only lake-wide means, 1990-2015 (LQ= Lower Quartile; UQ=Upper Quartile).

Year	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	Silica (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
1990	N of Cases	14.00	14.00	14.00	14.00	13.00	13.00	13.00	13.00	0.00	10.00	11.00	11.00
1990	Median	21.05	9.35	7.93	0.68	139.91	219.19	59.35	2916.12		9.04	51.96	49.74
1990	Arithmetic Mean	20.71	9.41	8.00	0.72	136.77	208.35	60.66	2642.61		11.11	84.68	53.95
1990	Coefficient of Variation	0.12	0.03	0.21	0.36	0.45	0.19	0.50	0.43		1.00	0.87	0.54
1990	LQ	18.84	9.23	6.58	0.60	109.49	192.81	33.76	1922.61		1.66	34.39	37.30
1990	UQ	22.86	9.50	8.94	0.83	155.99	239.41	87.34	3379.41		18.25	123.58	72.62
1991	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	3.00	7.00	7.00
1991	Median	17.97	9.41	8.84	0.68	100.53	231.59	43.11	2459.31		26.34	34.97	28.76
1991	Arithmetic Mean	18.11	9.17	8.66	0.77	95.58	202.44	47.32	2171.56		26.12	52.31	35.16
1991	Coefficient of Variation	0.13	0.06	0.16	0.32	0.70	0.43	0.54	0.42		0.80	1.09	0.90
1991	LQ	16.38	8.66	7.65	0.59	24.61	122.06	35.32	1780.00		10.33	14.30	12.70
1991	UQ	20.36	9.54	9.56	0.91	135.47	255.72	57.90	2643.12		41.86	73.10	56.67
1992	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	0.00	8.00	8.00	8.00
1992	Median	19.69	9.12	7.19	0.44	87.18	220.07	16.04	2530.52		6.57	18.98	9.79
1992	Arithmetic Mean	19.53	9.13	7.86	0.48	122.76	200.16	25.32	2571.30		6.83	22.22	13.34
1992	Coefficient of Variation	0.13	0.05	0.23	0.30	0.71	0.47	0.85	0.26		0.27	0.48	0.77
1992	LQ	17.36	9.07	6.61	0.39	64.57	130.27	11.31	2065.52		5.00	15.44	6.89
1992	UQ	21.70	9.32	9.47	0.59	173.82	242.27	32.00	3201.93		8.74	26.27	20.30
1993	N of Cases	10.00	10.00	10.00	10.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
1993	Median	18.22	8.82	8.14	0.73	82.63	108.59	14.54	1772.42		9.54	25.68	15.28
1993	Arithmetic Mean	17.91	8.77	8.21	0.83	74.91	109.72	14.21	1841.27		25.90	234.53	37.61
1993	Coefficient of Variation	0.12	0.08	0.23	0.41	0.60	0.31	0.31	0.35		1.58	2.01	2.09
1993	LQ	17.08	7.92	6.60	0.61	47.66	95.38	11.64	1619.51		5.76	12.60	2.07
1993	UQ	19.20	9.43	9.60	0.90	96.19	125.74	16.58	2374.96		22.52	211.36	20.07
1994	N of Cases	10.00	10.00	10.00	9.00	14.00	15.00	15.00	15.00	0.00	15.00	16.00	10.00
1994	Median	19.59	9.13	8.20	0.50	54.63	125.00	10.73	1590.00		8.06	24.03	4.57
1994	Arithmetic Mean	19.61	8.96	7.82	0.59	69.24	123.57	17.65	1704.74		15.17	49.18	10.71
1994	Coefficient of Variation	0.16	0.08	0.21	0.43	0.73	0.20	0.97	0.23		1.28	1.38	1.53
1994	LQ	18.40	8.22	6.20	0.40	39.28	115.25	9.05	1420.73		5.00	10.22	1.90
1994	UQ	22.08	9.28	8.64	0.77	66.69	134.47	19.83	1983.65		15.07	46.00	9.95
1995	N of Cases	9.00	9.00	9.00	8.00	8.00	8.00	8.00	8.00	0.00	8.00	8.00	8.00
1995	Median	19.64	9.54	8.48	0.62	155.27	170.13	52.78	2608.21		5.00	27.92	29.91
1995	Arithmetic Mean	19.16	9.53	8.56	0.64	152.04	192.23	52.74	2697.85		7.22	34.94	31.33
1995	Coefficient of Variation	0.10	0.02	0.14	0.21	0.24	0.29	0.62	0.19		0.67	0.89	0.65
1995	LQ	18.39	9.48	7.96	0.51	125.43	158.26	26.25	2335.87		5.00	11.04	17.08
1995	UQ	20.01	9.69	9.28	0.76	182.09	228.96	77.54	3183.11		7.07	48.65	46.51
1996	N of Cases	10.00	10.00	10.00	7.00	10.00	10.00	10.00	10.00	0.00	10.00	10.00	10.00
1996	Median	19.83	9.04	8.01	0.85	104.18	153.62	39.76	1936.19		14.21	196.35	54.04

Year	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	Silica (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
1996	Arithmetic Mean	19.57	8.96	7.79	0.92	106.37	142.58	41.08	1818.78		26.87	331.45	83.87
1996	Coefficient of Variation	0.13	0.05	0.22	0.29	0.52	0.38	0.83	0.30		1.00	0.97	0.89
1996	LQ	18.17	8.67	7.22	0.79	60.72	96.88	7.39	1584.47		5.00	85.37	22.82
1996	UQ	21.57	9.28	9.09	0.96	146.00	189.91	65.00	2251.72		44.41	483.08	130.41
1997	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	0.00	8.00	8.00	8.00
1997	Median	19.15	9.32	9.46	0.70	179.24	239.20	63.96	2563.17		5.15	778.48	326.65
1997	Arithmetic Mean	19.16	9.19	8.74	0.74	151.07	229.89	64.79	2561.90		16.53	940.60	499.52
1997	Coefficient of Variation	0.12	0.06	0.24	0.38	0.40	0.25	0.65	0.12		1.26	0.51	0.78
1997	LQ	17.72	9.05	6.61	0.54	105.60	200.02	32.76	2331.86		5.00	699.14	238.10
1997	UQ	21.44	9.54	9.98	0.94	194.17	254.61	89.14	2623.76		24.74	1172.09	875.59
1998	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
1998	Median	20.24	8.96	9.21	1.04	75.17	182.22	48.56	1897.19		5.00	509.73	186.18
1998	Arithmetic Mean	19.88	8.89	8.61	1.09	86.82	163.17	47.05	1821.28		14.28	588.46	199.64
1998	Coefficient of Variation	0.17	0.05	0.22	0.23	0.73	0.45	0.92	0.36		1.37	0.63	0.93
1998	LQ	16.96	8.70	7.85	0.91	38.75	85.24	5.56	1237.28		5.00	298.81	59.19
1998	UQ	22.35	9.22	10.08	1.23	119.51	217.54	75.83	2390.57		12.04	963.39	265.35
1999	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
1999	Median	18.09	9.37	9.18	0.77	137.31	212.23	46.37	2267.39		13.08	282.52	129.03
1999	Arithmetic Mean	18.16	9.15	8.92	0.83	111.35	192.87	51.56	2148.97		17.53	306.86	159.61
1999	Coefficient of Variation	0.15	0.06	0.18	0.23	0.59	0.34	0.74	0.27		0.86	0.65	1.00
1999	LQ	16.54	8.74	8.06	0.73	66.00	138.59	16.73	2001.78		5.00	182.83	29.30
1999	UQ	20.24	9.54	9.76	0.97	151.27	239.71	76.28	2470.82		28.91	425.91	244.85
2000	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	0.00	8.00	8.00	8.00
2000	Median	19.78	9.32	8.11	0.88	121.70	182.31	79.95	2025.41		19.81	566.68	267.69
2000	Arithmetic Mean	19.70	9.28	7.54	0.94	111.30	217.36	69.44	2001.16		29.47	618.66	344.30
2000	Coefficient of Variation	0.15	0.06	0.28	0.28	0.53	0.29	0.54	0.13		1.32	0.29	0.78
2000	LQ	18.42	8.82	6.44	0.79	70.72	175.76	38.98	1841.00		9.89	508.31	108.56
2000	UQ	21.76	9.80	8.81	1.04	142.61	268.46	99.92	2192.03		21.41	671.88	580.01
2001	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
2001	Median	19.24	9.53	7.52	0.82	126.35	169.95	30.45	2977.87		13.04	579.59	274.28
2001	Arithmetic Mean	18.76	9.26	7.49	0.81	133.39	193.83	33.37	2977.82		11.05	631.61	281.02
2001	Coefficient of Variation	0.12	0.06	0.29	0.21	0.48	0.29	0.76	0.20		0.45	0.34	0.45
2001	LQ	17.28	8.91	6.75	0.71	85.40	151.85	8.36	2644.97		5.00	477.89	241.21
2001	UQ	19.85	9.66	9.43	0.93	179.29	242.83	59.67	3434.24		14.85	844.90	321.33
2002	N of Cases	8.00	8.00	7.00	8.00	8.00	8.00	8.00	8.00	0.00	8.00	8.00	8.00
2002	Median	19.49	9.27	8.34	0.80	117.27	191.57	33.51	2534.55		13.09	400.43	174.96
2002	Arithmetic Mean	19.30	9.24	8.36	0.82	111.79	176.30	30.73	2437.20		20.45	398.03	184.14
2002	Coefficient of Variation	0.12	0.04	0.18	0.17	0.35	0.26	0.57	0.23		1.25	0.50	0.61
2002	LQ	17.08	9.07	7.41	0.71	96.93	147.66	15.66	2087.72		9.80	296.82	110.58
2002	UQ	21.10	9.49	8.85	0.96	136.92	204.00	44.57	2866.53		13.97	550.33	267.13
2003	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00

Year	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	Silica (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2003	Median	20.65	9.43	8.21	0.76	89.77	232.19	44.04	2995.50		12.63	58.41	24.65
2003	Arithmetic Mean	20.29	9.20	8.01	0.80	93.79	205.53	47.49	2509.98		15.79	136.31	97.26
2003	Coefficient of Variation	0.13	0.06	0.14	0.28	0.56	0.38	0.68	0.36		0.81	1.67	1.96
2003	LQ	18.65	8.89	7.34	0.61	68.45	119.06	18.25	1837.66		6.41	28.40	12.29
2003	UQ	21.18	9.61	8.70	0.92	131.37	267.56	79.34	3213.75		18.33	122.77	80.80
2004	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
2004	Median	20.27	9.23	8.16	0.89	88.89	172.37	22.76	2351.76		15.11	38.68	19.59
2004	Arithmetic Mean	19.31	9.24	7.80	0.88	88.20	151.64	28.11	2152.42		18.46	110.93	36.92
2004	Coefficient of Variation	0.16	0.04	0.20	0.24	0.67	0.28	0.80	0.21		0.66	1.53	1.22
2004	LQ	15.89	9.03	6.61	0.78	37.83	124.03	10.32	2075.49		8.88	21.86	9.71
2004	UQ	21.41	9.58	8.92	1.00	116.79	177.56	36.52	2405.06		25.19	109.24	42.08
2005	N of Cases	18.00	18.00	18.00	9.00	16.00	18.00	18.00	18.00	0.00	18.00	18.00	18.00
2005	Median	18.26	9.16	8.05	0.87	91.85	151.60	24.46	2170.00		9.78	23.26	10.08
2005	Arithmetic Mean	18.80	9.13	8.02	0.90	100.66	158.96	29.21	2356.24		12.84	42.55	15.46
2005	Coefficient of Variation	0.19	0.05	0.17	0.21	0.62	0.39	0.82	0.37		0.72	1.19	1.21
2005	LQ	16.15	8.89	6.95	0.76	63.07	112.00	7.83	1890.00		5.54	19.00	4.96
2005	UQ	21.71	9.51	8.82	0.98	136.17	212.00	40.00	2949.09		18.00	35.00	17.58
2006	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
2006	Median	20.32	9.39	8.18	0.75	115.33	242.24	73.67	2428.00		5.00	54.17	50.04
2006	Arithmetic Mean	19.70	9.20	8.12	0.93	97.93	200.75	60.53	2269.34		18.75	113.66	51.79
2006	Coefficient of Variation	0.13	0.09	0.22	0.48	0.70	0.47	0.73	0.47		1.13	1.64	0.70
2006	LQ	18.17	8.34	6.95	0.62	23.26	101.31	14.53	1516.37		5.00	50.17	24.34
2006	UQ	21.42	9.90	9.05	1.38	128.91	258.09	98.07	2882.74		29.53	61.52	83.01
2007	N of Cases	9.00	9.00	9.00	9.00	8.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
2007	Median	19.57	9.29	7.50	0.60	102.24	233.90	69.09	2804.43		7.71	40.00	34.83
2007	Arithmetic Mean	19.00	9.41	7.74	0.71	114.57	242.35	71.26	2568.16		12.19	77.34	35.98
2007	Coefficient of Variation	0.17	0.05	0.17	0.37	0.53	0.37	0.60	0.37		1.03	1.53	0.97
2007	LQ	17.85	9.14	6.80	0.52	78.64	172.45	34.94	2113.85		5.58	14.16	7.19
2007	UQ	21.05	9.89	8.79	0.84	168.28	323.10	100.50	3196.12		11.72	71.16	46.67
2008	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2008	Median	19.82	9.24	7.94	0.74	125.03	197.33	56.68	2452.13	32900.00	9.88	49.08	23.33
2008	Arithmetic Mean	18.93	9.16	8.12	0.80	114.22	185.31	52.09	2292.28	33630.16	9.84	51.29	29.12
2008	Coefficient of Variation	0.14	0.06	0.13	0.32	0.55	0.41	0.56	0.36	0.30	0.78	0.56	0.81
2008	LQ	16.94	9.03	7.42	0.63	82.08	127.35	20.67	1994.20	23553.57	4.00	24.20	11.38
2008	UQ	21.12	9.53	8.40	0.89	139.52	240.43	75.81	2830.95	43160.71	10.92	80.54	49.98
2009	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2009	Median	19.10	9.35	7.64	0.68	163.64	162.61	44.40	2244.88	27785.71	5.84	32.01	29.33
2009	Arithmetic Mean	19.08	9.24	7.77	0.91	130.95	157.68	42.26	2194.01	25785.56	9.21	119.53	49.56
2009	Coefficient of Variation	0.12	0.07	0.18	0.45	0.52	0.45	0.77	0.27	0.50	0.83	1.30	1.08
2009	LQ	17.66	8.76	7.09	0.63	58.60	100.64	6.34	1949.94	14230.00	4.33	21.43	10.52

Year	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	Silica (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2009	UQ	20.04	9.70	8.29	1.09	182.99	211.44	73.55	2477.45	37035.71	11.03	166.44	75.49
2010	N of Cases	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
2010	Median	19.74	9.37	8.86	0.87	93.33	118.06	16.25	1882.98	20757.14	6.33	22.08	13.40
2010	Arithmetic Mean	18.92	9.08	8.74	0.90	107.92	119.15	21.20	1694.12	24231.36	7.55	50.67	24.22
2010	Coefficient of Variation	0.17	0.07	0.14	0.25	0.88	0.57	0.88	0.51	0.61	0.64	1.10	1.20
2010	LQ	16.74	8.52	7.90	0.80	22.92	50.92	5.24	683.14	9308.57	4.00	13.98	1.49
2010	UQ	21.57	9.58	9.45	1.05	154.84	173.46	33.69	2435.11	39085.71	8.00	97.36	44.54
2011	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2011	Median	19.26	9.00	9.47	0.92	76.73	116.10	10.63	1646.00	27514.29	19.92	45.71	12.14
2011	Arithmetic Mean	18.33	8.83	8.51	0.97	64.67	127.64	30.27	1416.92	29220.63	17.14	81.10	23.20
2011	Coefficient of Variation	0.20	0.07	0.19	0.28	0.80	0.58	1.16	0.42	0.30	0.58	1.04	1.13
2011	LQ	16.43	8.28	7.23	0.77	11.53	52.31	4.27	702.18	20700.00	7.73	30.22	1.51
2011	UQ	20.91	9.21	9.65	1.08	114.51	206.76	69.82	1864.88	36403.57	24.44	100.82	32.82
2012	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2012	Median	19.27	8.87	7.46	0.88	51.76	109.97	31.06	1799.31	29757.14	13.08	52.28	16.58
2012	Arithmetic Mean	19.15	8.83	7.80	0.80	84.32	153.10	49.02	1658.57	30520.63	33.26	69.00	23.83
2012	Coefficient of Variation	0.13	0.09	0.19	0.29	0.98	0.57	0.96	0.47	0.44	1.12	0.66	1.02
2012	LQ	17.50	8.16	6.76	0.53	22.46	82.91	14.60	978.63	17592.86	9.36	35.86	1.65
2012	UQ	21.37	9.42	8.57	0.96	136.07	213.89	67.23	2345.59	43996.43	62.99	90.01	40.71
2013	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2013	Median	19.68	8.79	7.71	0.84	50.26	145.77	30.90	2000.63	41985.71	7.29	37.50	11.68
2013	Arithmetic Mean	19.61	8.90	7.33	0.77	89.26	184.65	56.66	1930.97	38028.57	114.21	60.82	26.16
2013	Coefficient of Variation	0.15	0.12	0.27	0.31	0.91	0.51	0.75	0.38	0.24	1.30	0.92	1.21
2013	LQ	17.84	7.69	5.83	0.55	12.61	105.00	27.74	1254.90	28332.14	5.67	25.88	2.09
2013	UQ	22.48	9.87	8.42	0.92	161.65	261.48	90.43	2670.94	46125.00	292.96	78.20	45.85
2014	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2014	Median	18.75	8.58	8.31	0.85	26.71	196.46	74.73	2130.58	40942.86	10.84	42.44	6.06
2014	Arithmetic Mean	19.51	8.88	8.08	0.84	65.55	215.48	87.62	1879.79	37939.68	43.35	44.59	23.48
2014	Coefficient of Variation	0.13	0.10	0.24	0.22	1.01	0.53	0.74	0.45	0.22	1.72	0.74	1.31
2014	LQ	18.27	8.20	7.22	0.71	19.99	124.05	34.27	1056.36	29867.86	6.90	21.23	1.64
2014	UQ	21.23	9.59	9.54	1.00	120.00	294.19	123.77	2431.20	45192.86	36.82	53.89	38.42
2015	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	Median	20.37	9.14	8.46	0.74	82.55	244.69	96.84	1885.92	38950.00	24.35	54.29	21.44
2015	Arithmetic Mean	19.15	9.23	8.23	0.83	86.64	218.07	82.48	1917.51	37383.93	33.46	53.27	28.60
2015	Coefficient of Variation	0.17	0.05	0.21	0.29	0.43	0.30	0.55	0.23	0.25	0.89	0.54	0.75
2015	LQ	16.88	8.83	6.93	0.65	57.37	154.01	38.36	1635.31	31585.71	11.61	25.84	12.74
2015	UQ	21.61	9.71	9.08	0.94	111.28	264.86	116.20	2356.52	45957.14	47.87	79.35	41.58

Although for Agency Lake in 2013 both pH and DO were noticeably lower compared to many previous years, median values (LQ values were higher) in both 2014 and 2015 were low for pH but intermediate for DO (Figure 23; Table 4). Lower quartile and median values of CHL in Agency Lake in 2014 were also among the lowest for the period of record, and while 2015 values rebounded they were still somewhat low relative to previous years (Figure 24; Table 4). However, TP and SRP values were intermediate in 2015, and TN low compared to previous years. Upper quartile NO_3-NO_2-N was higher in 2015, and NH_4-N tended to follow the overall 25 year cyclical pattern described above (Figure 24). Both Agency and UKL Lakes continued to show several periods of apparent sub-decadal cyclical increases and decreases for nutrient parameters over the period of record (Figure 22 and Figure 24). Inter-annual silica variability and overall values in Agency Lake are lower relative to UKL.

SUMMARY

With the addition of 2015 data, the UKL water quality/limnological database now includes 26 years of data and includes the years 1990-2015. Given the dynamic and variable nature of shallow, high productivity lakes such as UKL, a long-term monitoring program is essential for assessing change relative to management programs, as well as for understanding lake dynamics.

For example, as noted in earlier reports, ongoing wetland restoration is occurring in vast areas of the periphery of UKL (e.g., Wong et al. 2010; 2011), riparian and nutrient management plans (e.g., Oregon 1010 and TMDL plans) have been developed, and water use plans have been implemented (e.g., KBRT Wood River Valley programs).

Continued monitoring is recommended to accommodate the restoration time-frame (restoration of ecological function can be a multi-decade process) for Klamath Basin activities and to increase statistical power (sample size) for multi-variable analyses. Such a long-term database allows for statistical time series or trend analysis, as well as multi-variable assessment of the relationship between controlling variables (e.g., climate) and important water quality parameters (e.g., see Jassby and Kann 2010).

Further analysis (beyond the scope of the current data summary report) of the noticeable differences in algal biomass (CHL), as well as other water quality parameters among years will provide an opportunity to gain further insight into annual controlling factors of bloom dynamics. Additional multivariate analyses, time-series and trend analyses such as Seasonal Kendal Tests, as well as integration with current lake literature on shallow lakes and *Aphanizomenon* bloom dynamics are recommended. The analysis of the long-term Upper Klamath Lake phytoplankton and zooplankton datasets will also significantly aid in understanding annual water quality variability. A comprehensive statistical analysis of the type provided in Jassby and Kann (2010) is recommended at five year intervals[12].

[12] The next 5-year interval occurred with the addition of 2014 sampling data.

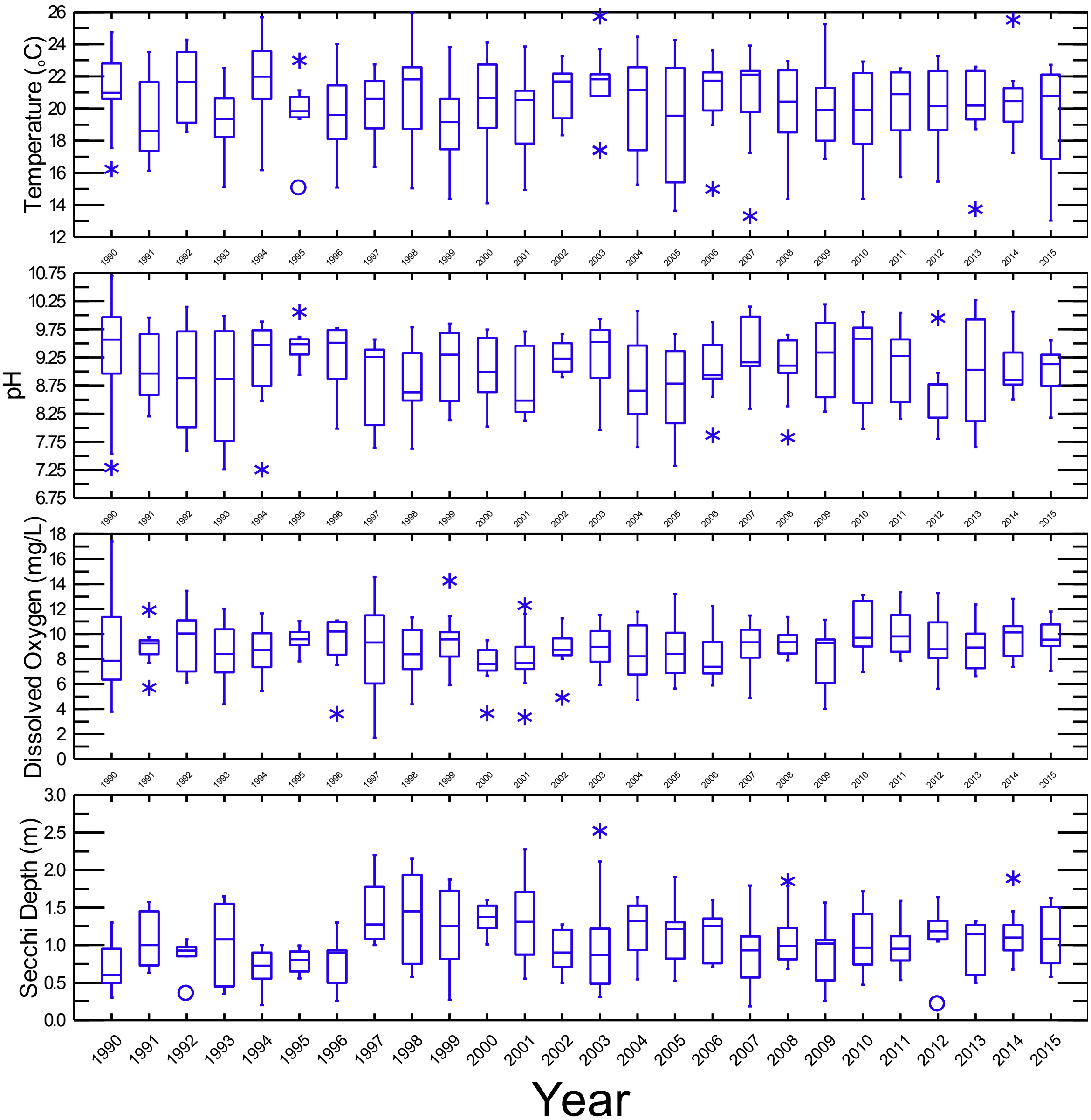

Figure 23. June-September distribution of Agency Lake means for T (˚C), pH, D.O (mg/L), and Secchi depth, 1990-2015.

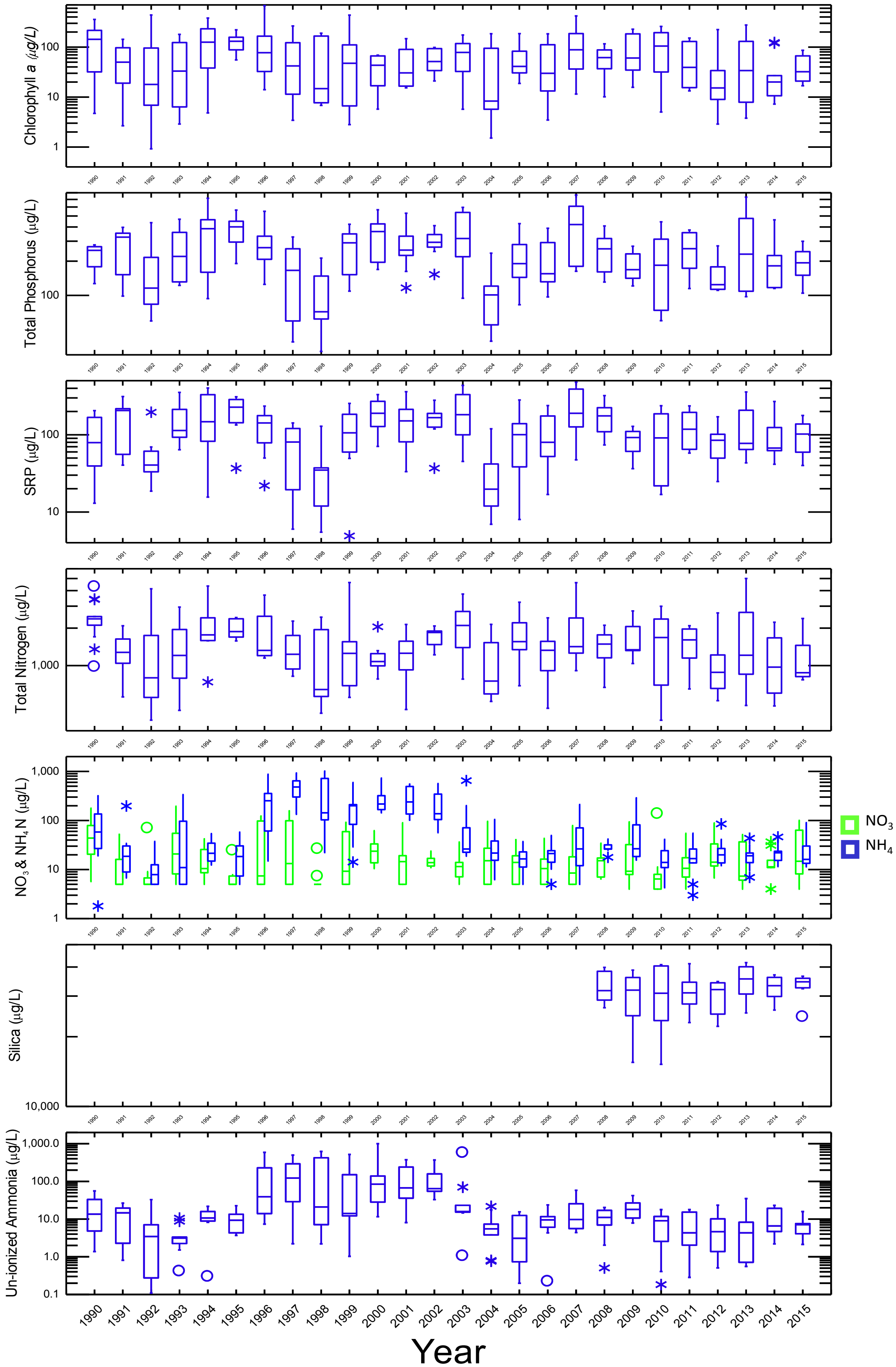

Figure 24. June-September distribution of Agency Lake means for CHL, TP, SRP, TN, NO_3+ NO_2-N, SiO_2 and NH_4-N, 1990-2015.

Table 4. Summary statistics for June-September Agency Lake means, 1990-2015 (LQ=Lower Quartile; UQ=Upper Quartile).

Year	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	Silica (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
1990	N of Cases	14.00	14.00	14.00	11.00	13.00	13.00	13.00	13.00	0.00	9.00	11.00	11.00
1990	Median	20.98	9.57	7.87	0.60	143.08	249.00	79.00	2374.00		20.50	58.20	13.60
1990	Arithmetic Mean	21.07	9.31	9.04	0.75	150.55	222.79	99.07	2411.14		41.20	95.25	20.32
1990	Coefficient of Variation	0.11	0.11	0.45	0.42	0.76	0.23	0.73	0.37		1.41	1.04	0.89
1990	LQ	20.60	8.97	6.35	0.50	31.86	178.35	34.88	2008.88		0.00	25.74	4.56
1990	UQ	22.80	9.97	11.36	0.98	224.12	270.39	172.35	2706.25		55.00	135.95	33.72
1991	N of Cases	9.00	8.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	3.00	7.00	6.00
1991	Median	18.59	8.96	9.26	1.00	50.03	325.57	205.94	1276.40		5.00	18.62	14.69
1991	Arithmetic Mean	19.16	9.07	8.94	1.04	56.33	270.59	175.19	1327.97		20.72	43.14	13.11
1991	Coefficient of Variation	0.14	0.07	0.19	0.36	0.88	0.44	0.59	0.39		1.31	1.60	0.76
1991	LQ	17.22	8.58	8.22	0.71	15.34	139.72	55.14	986.82		5.00	8.30	2.29
1991	UQ	21.79	9.66	9.56	1.46	97.38	359.05	237.57	1731.54		40.37	32.25	19.61
1992	N of Cases	8.00	8.00	8.00	8.00	8.00	7.00	8.00	7.00	0.00	8.00	8.00	8.00
1992	Median	21.64	8.88	10.04	0.93	19.44	115.94	40.54	797.33		5.00	7.96	3.51
1992	Arithmetic Mean	21.42	8.87	9.49	0.87	85.73	180.21	60.74	1419.28		13.59	11.72	7.06
1992	Coefficient of Variation	0.11	0.11	0.27	0.26	1.73	0.83	0.93	0.93		1.67	0.93	1.57
1992	LQ	19.12	8.01	7.01	0.85	7.04	80.68	33.32	502.55		5.00	5.00	0.28
1992	UQ	23.52	9.71	11.10	0.98	96.75	293.05	61.80	1755.67		7.05	12.74	7.89
1993	N of Cases	10.00	10.00	10.00	10.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
1993	Median	19.36	8.87	8.41	1.08	33.18	220.62	113.59	1206.83		20.82	11.00	3.13
1993	Arithmetic Mean	19.20	8.78	8.30	1.05	66.52	255.56	160.11	1450.52		53.98	70.24	4.01
1993	Coefficient of Variation	0.12	0.12	0.31	0.53	1.03	0.51	0.60	0.58		1.33	1.58	0.85
1993	LQ	18.21	7.76	6.94	0.45	6.03	130.69	88.27	761.51		7.37	5.00	2.06
1993	UQ	20.63	9.72	10.38	1.55	127.62	370.71	219.71	2053.15		80.96	108.06	4.71
1994	N of Cases	8.00	8.00	8.00	6.00	7.00	7.00	7.00	7.00	0.00	7.00	7.00	7.00
1994	Median	21.98	9.47	8.71	0.73	125.21	386.48	147.26	1763.64		10.49	21.52	10.69
1994	Arithmetic Mean	21.77	9.13	8.67	0.68	157.85	350.57	198.76	2155.59		18.42	26.79	11.89
1994	Coefficient of Variation	0.13	0.10	0.23	0.42	0.90	0.65	0.77	0.57		0.79	0.58	0.61
1994	LQ	20.59	8.75	7.36	0.55	35.24	153.50	82.14	1583.72		8.11	14.60	8.56
1994	UQ	23.58	9.73	10.06	0.90	273.76	497.74	335.16	2893.88		30.85	37.30	18.17
1995	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	0.00	8.00	8.00	8.00
1995	Median	19.83	9.49	9.59	0.80	130.64	401.30	227.86	1878.00		5.00	19.12	9.46
1995	Arithmetic Mean	19.75	9.47	9.57	0.78	128.89	383.50	207.81	1988.93		8.04	22.13	10.12
1995	Coefficient of Variation	0.11	0.03	0.10	0.21	0.41	0.32	0.45	0.18		0.84	0.81	0.65
1995	LQ	19.45	9.30	9.12	0.65	88.51	305.29	143.33	1695.69		5.00	7.38	4.35

Year	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	Silica (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
1995	UQ	20.73	9.57	10.16	0.92	157.91	449.69	286.58	2376.43		7.38	30.68	13.48
1996	N of Cases	8.00	8.00	8.00	6.00	8.00	8.00	8.00	8.00	0.00	8.00	8.00	8.00
1996	Median	19.59	9.51	10.21	0.90	78.50	264.50	143.00	1325.00		8.00	254.75	39.28
1996	Arithmetic Mean	19.67	9.25	9.22	0.80	158.81	285.88	133.88	1871.88		44.13	279.56	146.11
1996	Coefficient of Variation	0.14	0.07	0.28	0.46	1.38	0.45	0.52	0.52		1.22	0.99	1.40
1996	LQ	18.10	8.87	8.35	0.50	36.75	208.00	87.00	1202.50		5.00	61.00	14.04
1996	UQ	21.44	9.74	10.95	0.93	175.50	333.50	177.00	2545.00		99.50	359.50	232.62
1997	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	0.00	8.00	8.00	8.00
1997	Median	20.60	9.26	9.33	1.28	46.00	166.87	82.29	1234.47		13.34	484.99	133.72
1997	Arithmetic Mean	20.15	8.83	8.75	1.43	80.09	167.01	76.94	1376.63		50.75	494.31	176.95
1997	Coefficient of Variation	0.11	0.09	0.47	0.33	1.16	0.65	0.68	0.40		1.25	0.51	0.99
1997	LQ	18.76	8.05	6.05	1.08	11.85	60.50	30.50	941.50		5.00	318.70	30.41
1997	UQ	21.71	9.39	11.50	1.78	128.64	257.59	120.75	1782.20		103.65	643.42	293.73
1998	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
1998	Median	21.81	8.63	8.38	1.45	14.72	71.87	34.89	642.61		5.00	143.00	20.91
1998	Arithmetic Mean	20.84	8.80	8.56	1.39	66.86	107.95	37.72	1144.32		7.64	353.18	186.92
1998	Coefficient of Variation	0.17	0.08	0.27	0.45	1.23	0.62	1.01	0.73		0.93	1.10	1.42
1998	LQ	18.20	8.36	7.03	0.72	7.50	58.27	10.72	546.42		5.00	90.90	6.33
1998	UQ	22.99	9.40	10.39	1.97	167.49	160.77	42.39	2027.35		5.58	749.69	456.80
1999	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
1999	Median	19.16	9.30	9.58	1.25	47.43	290.27	105.99	1253.28		9.25	200.23	14.13
1999	Arithmetic Mean	19.10	9.11	9.52	1.21	91.12	254.03	125.02	1514.63		28.37	198.27	117.60
1999	Coefficient of Variation	0.15	0.08	0.26	0.47	1.52	0.46	0.67	0.83		1.16	0.89	1.46
1999	LQ	17.01	8.44	7.88	0.80	5.88	145.70	57.15	656.95		5.00	69.71	11.75
1999	UQ	20.80	9.72	10.48	1.75	116.44	354.19	190.65	1619.39		59.67	238.88	172.83
2000	N of Cases	8.00	8.00	8.00	7.00	8.00	8.00	8.00	8.00	0.00	8.00	8.00	8.00
2000	Median	20.65	9.00	7.61	1.38	44.37	365.07	190.38	1079.10		23.87	221.26	84.75
2000	Arithmetic Mean	20.32	9.03	7.49	1.36	42.42	339.48	197.98	1184.70		26.98	286.67	192.21
2000	Coefficient of Variation	0.16	0.07	0.24	0.16	0.61	0.42	0.46	0.32		0.64	0.67	1.74
2000	LQ	18.80	8.63	7.08	1.21	21.49	195.95	128.15	996.04		13.77	167.08	28.72
2000	UQ	22.73	9.60	8.71	1.53	66.41	428.97	272.41	1249.00		34.06	321.15	146.91
2001	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
2001	Median	20.53	8.48	7.66	1.31	30.50	250.63	151.42	1255.53		14.49	238.44	67.26
2001	Arithmetic Mean	19.69	8.81	8.13	1.34	58.58	288.10	171.68	1309.84		21.11	305.57	140.63
2001	Coefficient of Variation	0.14	0.07	0.33	0.45	0.91	0.45	0.70	0.42		1.27	0.61	1.01
2001	LQ	17.51	8.26	6.92	0.84	16.38	209.26	71.48	918.62		5.00	128.18	34.62
2001	UQ	21.36	9.47	9.65	1.82	101.47	358.49	246.32	1697.26		20.87	503.58	266.23
2002	N of Cases	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	0.00	7.00	7.00	7.00
2002	Median	21.68	9.23	8.75	0.90	51.31	293.49	166.81	1844.52		13.83	137.48	64.44
2002	Arithmetic Mean	20.92	9.26	8.69	0.93	60.78	298.17	158.99	1698.46		15.14	236.42	132.13
2002	Coefficient of Variation	0.09	0.03	0.23	0.33	0.55	0.30	0.47	0.18		0.30	0.79	0.96

Year	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	Silica (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2002	LQ	19.12	8.97	8.17	0.70	32.54	255.49	122.31	1458.87		11.60	104.04	52.84
2002	UQ	22.38	9.55	9.74	1.22	93.43	372.35	190.87	1901.93		17.77	348.78	208.04
2003	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
2003	Median	21.82	9.52	8.97	0.87	78.09	316.90	182.25	2102.31		11.49	26.25	15.87
2003	Arithmetic Mean	21.40	9.28	9.08	1.08	83.50	364.72	227.76	2078.22		14.80	121.38	83.61
2003	Coefficient of Variation	0.13	0.07	0.20	0.71	0.69	0.53	0.63	0.49		0.79	1.70	2.21
2003	LQ	19.93	8.89	7.78	0.47	30.43	205.84	99.21	1251.60		6.59	22.43	15.11
2003	UQ	22.53	9.75	10.56	1.44	124.77	548.65	346.83	2821.06		18.71	103.41	34.99
2004	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
2004	Median	21.15	8.66	8.22	1.32	8.33	100.96	19.78	750.92		15.12	21.72	5.50
2004	Arithmetic Mean	20.44	8.79	8.35	1.21	47.37	106.35	38.37	1105.13		29.37	37.19	7.62
2004	Coefficient of Variation	0.17	0.10	0.29	0.34	1.38	0.63	1.09	0.57		1.20	0.92	0.95
2004	LQ	17.00	8.18	6.48	0.86	5.39	54.48	11.46	583.94		5.00	13.58	3.06
2004	UQ	22.98	9.57	10.78	1.54	96.45	138.00	56.27	1593.94		41.32	49.42	9.90
2005	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
2005	Median	19.55	8.78	8.41	1.22	41.00	190.41	100.51	1557.31		14.00	16.49	3.09
2005	Arithmetic Mean	19.40	8.70	8.57	1.13	68.45	218.19	119.23	1783.30		17.13	18.36	5.73
2005	Coefficient of Variation	0.21	0.10	0.29	0.36	0.88	0.55	0.83	0.46		0.83	0.52	1.09
2005	LQ	15.40	8.01	6.63	0.81	29.23	129.20	36.31	1233.49		5.00	10.94	0.60
2005	UQ	22.90	9.42	10.38	1.33	99.87	303.57	171.04	2305.18		24.42	23.44	12.59
2006	N of Cases	9.00	9.00	9.00	8.00	9.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
2006	Median	21.72	8.93	7.39	1.26	29.85	155.48	80.00	1327.04		10.49	21.23	9.53
2006	Arithmetic Mean	20.80	9.00	8.25	1.13	60.15	205.80	115.70	1303.05		13.40	22.23	9.92
2006	Coefficient of Variation	0.13	0.07	0.27	0.30	1.05	0.52	0.71	0.50		0.93	0.60	0.71
2006	LQ	19.65	8.79	6.61	0.76	12.66	131.10	50.57	838.71		5.00	13.13	5.63
2006	UQ	22.58	9.49	9.67	1.36	113.49	304.08	188.71	1685.76		17.15	27.16	12.98
2007	N of Cases	9.00	9.00	9.00	9.00	8.00	9.00	9.00	9.00	0.00	9.00	9.00	9.00
2007	Median	22.11	9.17	9.34	0.93	88.88	420.62	189.40	1421.53		8.49	26.35	9.76
2007	Arithmetic Mean	20.54	9.38	8.91	0.90	133.76	403.15	256.31	2144.51		18.08	55.92	17.13
2007	Coefficient of Variation	0.17	0.07	0.24	0.55	1.03	0.56	0.63	0.62		1.31	1.24	1.02
2007	LQ	19.15	9.03	7.70	0.50	37.29	176.70	120.12	1216.27		5.00	11.69	5.31
2007	UQ	22.71	10.00	10.40	1.15	192.54	615.24	406.12	2797.03		19.48	83.68	25.57
2008	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2008	Median	20.43	9.10	9.34	0.99	61.74	257.04	175.24	1488.79	31650.00	15.16	26.39	11.04
2008	Arithmetic Mean	19.82	9.07	9.22	1.12	62.58	263.09	180.20	1419.34	33200.00	14.86	28.71	10.66
2008	Coefficient of Variation	0.16	0.07	0.12	0.39	0.63	0.40	0.46	0.35	0.16	0.62	0.25	0.65
2008	LQ	17.82	8.83	8.31	0.81	31.57	157.22	107.18	1041.79	28550.00	7.06	25.78	5.74
2008	UQ	22.44	9.56	9.93	1.37	94.48	339.81	235.17	1799.78	38612.50	18.53	33.13	17.42
2009	N of Cases	8.00	8.00	8.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	8.00
2009	Median	19.92	9.34	9.29	1.02	60.51	168.71	92.19	1341.10	31800.00	9.25	26.57	18.09
2009	Arithmetic Mean	20.06	9.25	8.13	0.91	100.17	185.56	86.34	1645.39	30156.11	25.56	65.84	20.57

Year	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	Silica (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2009	Coefficient of Variation	0.14	0.08	0.30	0.48	0.81	0.30	0.39	0.36	0.27	1.16	1.33	0.61
2009	LQ	17.99	8.54	6.08	0.51	30.34	138.99	58.18	1286.60	24037.50	7.87	18.31	11.08
2009	UQ	21.28	9.86	9.56	1.17	184.49	234.36	114.28	2130.33	36487.50	37.03	83.35	28.03
2010	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2010	Median	19.91	9.58	9.70	0.97	104.72	184.34	91.24	1681.73	30850.00	6.42	14.00	9.01
2010	Arithmetic Mean	19.35	9.20	10.51	1.04	116.02	221.85	109.63	1644.39	30183.33	20.72	17.62	8.07
2010	Coefficient of Variation	0.17	0.09	0.21	0.45	0.85	0.67	0.84	0.58	0.33	2.12	0.65	0.83
2010	LQ	16.97	8.42	9.00	0.68	25.72	72.13	21.60	643.19	22137.50	4.00	10.12	2.03
2010	UQ	22.28	9.83	12.73	1.49	205.09	338.46	196.30	2430.56	40500.00	8.81	24.79	12.90
2011	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2011	Median	20.24	9.28	9.81	0.95	39.24	257.77	117.79	1608.54	30950.00	10.62	16.75	4.33
2011	Arithmetic Mean	19.22	9.08	10.18	0.97	62.00	250.33	131.29	1513.48	31150.00	16.05	21.57	8.42
2011	Coefficient of Variation	0.20	0.07	0.18	0.32	0.94	0.40	0.54	0.34	0.20	0.98	0.74	0.89
2011	LQ	17.55	8.42	8.54	0.76	15.32	163.67	64.51	1105.81	26662.50	6.90	11.52	1.65
2011	UQ	22.22	9.61	11.69	1.13	130.15	358.92	201.92	1993.21	35525.00	18.84	28.03	15.85
2012	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2012	Median	20.15	8.77	8.78	1.19	15.25	124.30	84.79	882.80	32000.00	14.17	19.90	4.63
2012	Arithmetic Mean	20.21	8.62	9.18	1.15	39.37	155.38	85.33	1118.69	29850.00	27.61	28.00	8.04
2012	Coefficient of Variation	0.12	0.07	0.27	0.35	1.79	0.38	0.52	0.64	0.17	0.98	0.84	1.12
2012	LQ	18.60	8.14	7.65	1.07	7.46	112.82	48.96	637.14	24587.50	11.59	13.28	1.16
2012	UQ	22.37	8.82	11.16	1.37	35.73	191.62	107.78	1386.92	34250.00	38.32	30.51	13.23
2013	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2013	Median	20.19	9.03	8.92	1.15	33.96	230.84	77.35	1210.22	35550.00	7.37	19.12	4.33
2013	Arithmetic Mean	20.06	8.99	8.97	0.96	79.85	298.63	142.38	1917.22	35027.78	19.09	20.60	8.99
2013	Coefficient of Variation	0.14	0.11	0.22	0.37	1.24	0.77	0.80	0.77	0.17	0.95	0.55	1.32
2013	LQ	19.17	8.05	7.25	0.58	7.62	106.44	61.50	790.49	29850.00	5.55	12.77	0.69
2013	UQ	22.38	10.01	10.38	1.27	146.77	492.74	226.11	2708.23	40412.50	36.96	24.36	11.71
2014	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
2014	Median	20.46	8.85	10.13	1.10	20.04	182.02	67.27	972.22	33250.00	11.37	21.98	6.60
2014	Arithmetic Mean	20.52	9.09	9.74	1.16	39.81	201.27	104.51	1198.82	32655.56	15.24	23.60	10.98
2014	Coefficient of Variation	0.11	0.06	0.17	0.31	1.18	0.55	0.69	0.56	0.12	0.74	0.52	0.77
2014	LQ	19.14	8.72	8.22	0.91	10.15	116.87	59.93	600.59	29450.00	9.25	14.89	4.35
2014	UQ	21.38	9.51	10.67	1.32	50.17	232.09	132.39	1784.48	36112.50	19.33	28.02	20.06
2015	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	Median	20.80	9.13	9.56	1.09	32.30	193.96	102.29	877.89	34550.00	14.91	16.15	7.13
2015	Arithmetic Mean	19.41	9.01	9.70	1.12	42.97	197.99	102.25	1183.26	33331.25	34.76	28.32	6.99
2015	Coefficient of Variation	0.18	0.05	0.15	0.38	0.62	0.32	0.47	0.48	0.12	1.04	0.97	0.59
2015	LQ	16.86	8.75	9.04	0.76	21.15	152.97	59.90	815.86	32550.00	8.54	13.46	4.23
2015	UQ	22.12	9.30	10.77	1.51	66.94	242.89	137.88	1459.64	35775.00	63.45	32.73	7.61

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APPENDIX I: Summary statistics of monthly distributions for the June-September period, Upper Klamath Lake Stations; 1990-2015 (LQ= Lower Quartile; UQ=Upper Quartile).

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
1990	6	N of Cases	13.00	13.00	13.00	12.00	11.00	11.00	12.00	11.00	2.00	2.00	2.00
1990	6	Median	16.13	9.18	8.86	1.00	59.88	119.00	17.00	795.00	25.00	62.15	50.15
1990	6	Arithmetic Mean	17.91	9.34	9.15	0.93	97.13	131.42	19.65	1110.97	25.00	62.15	50.15
1990	6	Coefficient of Variation	0.15	0.05	0.17	0.35	1.13	0.29	0.41	0.60	0.17	0.32	0.30
1990	6	LQ	15.58	8.94	8.09	0.75	31.11	108.25	14.50	678.50	22.00	47.90	39.69
1990	6	UQ	20.80	9.64	9.77	1.20	117.34	140.50	20.00	1649.00	28.00	76.40	60.62
1990	7	N of Cases	17.00	17.00	17.00	15.00	15.00	15.00	15.00	15.00	8.00	15.00	15.00
1990	7	Median	22.23	9.42	7.12	0.50	138.06	215.00	67.00	2347.00	14.05	47.00	32.98
1990	7	Arithmetic Mean	22.40	9.48	7.30	0.61	169.95	222.47	66.13	2660.73	12.96	95.26	48.84
1990	7	Coefficient of Variation	0.04	0.03	0.30	0.46	0.62	0.24	0.36	0.41	0.85	1.04	0.88
1990	7	LQ	21.73	9.27	6.29	0.40	95.14	193.75	52.50	2172.50	2.80	31.23	20.85
1990	7	UQ	23.08	9.65	8.90	0.86	277.74	246.50	81.00	3373.00	19.00	128.63	61.97
1990	8	N of Cases	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
1990	8	Median	23.30	9.28	7.82	0.50	191.16	240.90	95.30	3428.40	20.60	100.10	48.42
1990	8	Arithmetic Mean	22.12	9.24	7.41	0.73	201.19	242.78	94.21	3897.02	16.83	96.11	38.40
1990	8	Coefficient of Variation	0.12	0.02	0.27	0.71	0.72	0.33	0.14	0.48	0.95	0.94	0.87
1990	8	LQ	19.14	9.04	5.27	0.35	82.45	171.40	87.43	2533.40	0.00	13.80	5.65
1990	8	UQ	23.49	9.37	9.05	1.00	276.12	306.93	103.65	4316.88	29.33	159.00	68.97
1990	9	N of Cases	15.00	15.00	15.00	15.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00
1990	9	Median	18.20	9.37	9.62	0.60	146.91	228.00	59.40	3428.20	0.00	85.60	44.77
1990	9	Arithmetic Mean	18.49	9.41	8.88	0.71	164.34	235.71	67.61	3478.16	6.14	175.25	65.65
1990	9	Coefficient of Variation	0.06	0.03	0.29	0.47	0.83	0.23	0.33	0.30	1.96	1.08	0.85
1990	9	LQ	17.68	9.24	6.81	0.43	76.11	201.20	52.38	2818.95	0.00	35.93	20.55
1990	9	UQ	19.13	9.60	10.91	0.98	235.41	251.16	72.88	3593.58	9.13	269.46	105.02
1991	6	N of Cases	16.00	16.00	16.00	16.00	14.00	14.00	14.00	14.00	14.00	7.00	7.00
1991	6	Median	15.85	8.43	8.08	0.85	16.82	88.70	19.45	680.97	46.50	5.00	0.61
1991	6	Arithmetic Mean	15.64	8.42	8.14	0.79	19.43	90.42	22.38	691.38	50.46	7.14	0.75
1991	6	Coefficient of Variation	0.05	0.03	0.10	0.70	0.50	0.13	0.73	0.18	0.76	0.79	0.58
1991	6	LQ	14.93	8.17	7.38	0.35	12.39	83.00	7.00	593.31	16.00	5.00	0.48
1991	6	UQ	16.34	8.62	8.91	1.20	24.34	94.50	39.25	802.00	73.50	5.00	0.81
1991	7	N of Cases	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	3.00	10.00	10.00
1991	7	Median	19.86	9.43	8.91	0.68	106.91	154.50	40.47	2271.19	5.00	60.50	40.33
1991	7	Arithmetic Mean	19.51	9.49	8.79	0.70	118.29	161.83	37.28	2476.27	5.00	139.65	71.88
1991	7	Coefficient of Variation	0.06	0.02	0.24	0.42	0.52	0.21	0.39	0.29	0.00	1.30	1.11
1991	7	LQ	18.42	9.37	7.57	0.50	77.00	141.30	23.50	2136.10	5.00	31.00	20.71
1991	7	UQ	20.32	9.67	10.45	0.80	138.77	176.00	48.50	2445.53	5.00	207.50	125.14
1991	8	N of Cases	22.00	18.00	22.00	24.00	21.00	21.00	21.00	21.00	0.00	21.00	18.00
1991	8	Median	20.34	9.28	9.18	0.66	126.02	241.00	55.00	2638.00		29.00	10.09
1991	8	Arithmetic Mean	20.05	9.14	8.56	0.71	140.23	256.93	65.00	2934.13		80.60	21.56
1991	8	Coefficient of Variation	0.09	0.06	0.24	0.64	0.88	0.27	0.47	0.46		1.19	0.99

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
1991	8	LQ	18.26	8.71	6.71	0.46	38.90	211.88	41.00	2004.75		16.33	8.11
1991	8	UQ	21.76	9.59	10.11	1.05	196.12	297.00	99.00	3387.25		153.88	37.99
1991	9	N of Cases	15.00	15.00	15.00	15.00	14.00	14.00	13.00	14.00	0.00	7.00	7.00
1991	9	Median	16.30	9.59	9.03	0.72	133.81	271.50	56.80	2384.80		18.00	12.69
1991	9	Arithmetic Mean	16.59	9.57	8.76	0.75	186.95	311.78	63.30	2894.41		111.57	28.76
1991	9	Coefficient of Variation	0.06	0.03	0.20	0.47	1.08	0.44	0.35	0.41		2.03	1.16
1991	9	LQ	15.89	9.47	7.68	0.51	87.79	219.19	46.62	2068.20		13.00	9.32
1991	9	UQ	17.48	9.77	9.90	1.00	172.75	333.90	78.98	3939.40		51.50	31.16
1992	6	N of Cases	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1992	6	Median	18.21	9.61	10.07	0.40	247.58	162.00	15.00	2625.00	5.00	33.50	22.26
1992	6	Arithmetic Mean	18.24	9.63	10.15	0.51	257.75	195.18	14.14	2874.29	5.00	32.86	20.55
1992	6	Coefficient of Variation	0.14	0.04	0.13	0.63	0.70	0.55	0.31	0.42	0.00	0.52	0.63
1992	6	LQ	15.95	9.34	9.22	0.30	96.10	121.00	10.00	1960.00	5.00	15.00	8.18
1992	6	UQ	20.33	9.94	10.90	0.60	377.70	271.00	18.00	3600.00	5.00	49.00	31.18
1992	7	N of Cases	21.00	21.00	21.00	21.00	21.00	18.00	21.00	18.00	21.00	21.00	21.00
1992	7	Median	21.05	9.30	7.28	0.60	125.90	246.00	41.50	2835.00	5.00	12.00	5.68
1992	7	Arithmetic Mean	20.30	9.15	6.82	0.57	159.64	299.08	49.95	3095.83	9.26	147.26	16.96
1992	7	Coefficient of Variation	0.11	0.04	0.36	0.47	0.87	0.35	0.76	0.31	1.42	2.90	1.43
1992	7	LQ	18.00	9.06	5.71	0.30	67.50	217.00	25.00	2420.00	5.00	5.00	2.44
1992	7	UQ	21.71	9.35	8.81	0.80	220.35	379.00	59.75	3635.00	7.63	49.50	18.37
1992	8	N of Cases	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1992	8	Median	20.62	9.15	8.66	0.30	72.38	121.00	11.25	2362.50	6.25	19.00	6.33
1992	8	Arithmetic Mean	20.82	9.12	8.23	0.36	75.70	137.61	11.57	2443.93	7.68	21.00	6.89
1992	8	Coefficient of Variation	0.10	0.02	0.28	0.26	0.37	0.66	0.25	0.23	0.41	0.84	0.63
1992	8	LQ	19.45	9.01	6.93	0.30	49.30	54.00	9.00	1980.00	5.00	5.00	2.22
1992	8	UQ	22.65	9.22	9.89	0.40	99.90	212.00	14.00	2880.00	10.50	23.00	11.24
1992	9	N of Cases	7.00	7.00	7.00	7.00	6.00	7.00	7.00	7.00	7.00	7.00	7.00
1992	9	Median	17.45	7.97	5.12	0.40	40.55	136.00	13.00	1620.00	5.00	12.50	0.39
1992	9	Arithmetic Mean	17.24	8.12	5.63	0.39	43.21	134.57	14.43	1639.29	15.57	13.21	0.96
1992	9	Coefficient of Variation	0.04	0.06	0.16	0.23	0.46	0.20	0.30	0.15	1.44	0.55	1.53
1992	9	LQ	16.82	7.75	4.95	0.30	34.05	113.63	11.50	1482.50	5.00	6.75	0.19
1992	9	UQ	17.61	8.57	6.31	0.48	58.40	154.38	18.25	1811.25	15.50	16.50	0.88
1993	6	N of Cases	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
1993	6	Median	17.26	8.68	9.65	0.90	65.00	89.00	8.50	1660.00	5.00	5.00	0.65
1993	6	Arithmetic Mean	16.76	8.62	9.75	1.05	67.20	81.48	10.69	1498.40	5.67	13.38	1.28
1993	6	Coefficient of Variation	0.11	0.08	0.14	0.46	0.87	0.42	0.52	0.60	0.39	1.00	0.77
1993	6	LQ	14.71	7.77	8.47	0.64	6.70	46.75	7.00	518.38	5.00	5.00	0.53
1993	6	UQ	18.36	9.35	10.93	1.40	114.38	102.38	12.25	2252.50	5.00	16.00	2.29
1993	7	N of Cases	15.00	15.00	15.00	15.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1993	7	Median	18.23	9.31	8.37	0.80	109.00	121.25	14.00	1870.00	5.00	12.75	7.44
1993	7	Arithmetic Mean	18.29	9.38	8.42	0.65	140.07	138.93	13.29	2350.71	9.96	55.39	19.32
1993	7	Coefficient of Variation	0.03	0.03	0.16	0.39	0.71	0.36	0.18	0.52	1.04	1.77	1.69
1993	7	LQ	17.78	9.16	7.83	0.50	71.00	97.00	11.00	1590.00	5.00	5.00	2.30

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
1993	7	UQ	18.80	9.65	9.44	0.80	150.00	175.00	15.00	2330.00	15.00	45.00	14.05
1993	8	N of Cases	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1993	8	Median	18.91	8.93	7.60	0.73	84.50	137.00	19.00	1790.00	14.25	32.00	7.66
1993	8	Arithmetic Mean	18.86	8.80	6.95	0.67	99.93	141.25	19.21	1786.07	14.93	173.96	17.46
1993	8	Coefficient of Variation	0.10	0.05	0.28	0.36	0.62	0.34	0.29	0.24	0.67	1.35	1.44
1993	8	LQ	17.37	8.55	5.15	0.50	71.50	100.00	14.00	1490.00	10.00	5.00	1.93
1993	8	UQ	20.66	9.12	8.67	0.80	125.00	159.00	22.00	2250.00	16.00	332.00	25.23
1993	9	N of Cases	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1993	9	Median	18.07	7.99	6.21	1.05	34.00	105.25	17.50	1785.00	126.50	662.00	17.21
1993	9	Arithmetic Mean	17.74	7.92	5.92	0.99	63.22	114.04	17.75	2482.14	126.68	1253.50	130.53
1993	9	Coefficient of Variation	0.17	0.08	0.43	0.36	1.63	0.49	0.39	0.77	0.86	1.26	2.97
1993	9	LQ	14.87	7.29	4.18	0.80	18.00	79.00	14.00	1595.00	35.00	473.00	5.59
1993	9	UQ	20.64	8.45	7.96	1.20	58.00	122.00	18.50	2740.00	178.00	1012.50	42.13
1994	6	N of Cases	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1994	6	Median	16.87	9.55	9.83	0.73	103.25	85.50	5.00	1525.00	5.00	7.75	3.82
1994	6	Arithmetic Mean	16.96	9.55	10.04	0.71	134.43	80.79	6.32	1846.14	5.00	9.50	4.09
1994	6	Coefficient of Variation	0.09	0.04	0.09	0.21	0.58	0.30	0.37	0.54	0.00	0.58	0.25
1994	6	LQ	15.67	9.25	9.49	0.60	69.00	60.00	5.00	1020.00	5.00	5.00	3.22
1994	6	UQ	18.15	9.92	10.91	0.80	186.50	94.00	7.00	2330.00	5.00	12.00	4.65
1994	7	N of Cases	11.00	11.00	11.00	10.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
1994	7	Median	20.79	9.93	8.40	1.03	109.00	159.00	33.00	2010.00	11.00	13.00	9.34
1994	7	Arithmetic Mean	21.12	9.71	7.75	0.86	149.32	150.18	43.50	2238.64	16.00	53.86	20.12
1994	7	Coefficient of Variation	0.09	0.05	0.18	0.40	0.68	0.22	0.52	0.28	1.22	1.97	1.33
1994	7	LQ	19.25	9.29	6.68	0.50	67.75	117.25	26.00	1697.50	8.13	5.00	4.20
1994	7	UQ	23.26	10.04	8.61	1.10	212.38	181.13	68.00	2692.50	13.63	45.50	24.25
1994	8	N of Cases	15.00	15.00	15.00	14.00	15.00	15.00	15.00	15.00	15.00	15.00	14.00
1994	8	Median	21.42	8.72	6.19	0.40	56.00	143.00	11.50	1940.00	5.00	20.00	5.90
1994	8	Arithmetic Mean	21.28	8.82	5.88	0.44	60.70	151.80	14.30	1957.00	18.57	44.63	11.83
1994	8	Coefficient of Variation	0.07	0.04	0.28	0.23	0.22	0.15	0.43	0.13	1.26	1.37	1.82
1994	8	LQ	21.08	8.60	5.30	0.40	51.50	132.88	10.25	1740.00	5.00	10.13	1.58
1994	8	UQ	22.13	9.14	6.52	0.50	67.75	175.75	16.00	2185.00	22.00	44.50	8.70
1994	9	N of Cases	15.00	15.00	15.00	15.00	19.00	20.00	20.00	20.00	20.00	21.00	15.00
1994	9	Median	18.70	8.15	7.83	0.40	40.00	119.00	10.00	1435.00	5.00	19.00	0.78
1994	9	Arithmetic Mean	17.81	8.12	7.88	0.38	39.42	118.75	9.83	1471.00	8.55	43.95	1.17
1994	9	Coefficient of Variation	0.13	0.03	0.14	0.15	0.28	0.09	0.16	0.11	1.16	1.37	0.72
1994	9	LQ	15.61	7.97	7.21	0.33	30.00	113.50	9.00	1370.00	5.00	14.50	0.56
1994	9	UQ	19.27	8.30	8.52	0.40	48.13	124.50	11.00	1580.00	7.50	43.88	1.54
1995	6	N of Cases	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1995	6	Median	17.00	9.59	10.19	0.64	200.00	126.25	11.50	2110.00	10.00	9.00	5.60
1995	6	Arithmetic Mean	17.45	9.60	9.85	0.60	273.86	178.11	12.57	2869.64	12.04	26.82	16.13
1995	6	Coefficient of Variation	0.14	0.02	0.11	0.39	1.05	1.01	0.38	0.69	0.66	1.59	1.55
1995	6	LQ	15.19	9.52	9.49	0.49	179.00	111.00	8.00	1850.00	5.00	5.00	2.44
1995	6	UQ	19.29	9.69	10.70	0.80	249.00	158.00	16.00	3020.00	17.00	25.00	17.00

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
1995	7	N of Cases	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1995	7	Median	21.01	9.66	8.83	0.58	150.25	164.50	47.50	2300.00	5.00	5.00	3.91
1995	7	Arithmetic Mean	20.75	9.65	8.54	0.59	164.75	167.29	46.82	2403.93	21.36	43.29	21.30
1995	7	Coefficient of Variation	0.06	0.02	0.20	0.42	0.36	0.19	0.47	0.23	2.87	2.50	2.35
1995	7	LQ	19.71	9.43	8.40	0.46	114.00	139.00	30.00	2005.00	5.00	5.00	3.36
1995	7	UQ	21.84	9.85	9.22	0.79	205.00	184.00	64.00	2580.00	5.00	14.00	7.37
1995	8	N of Cases	17.00	17.00	17.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1995	8	Median	20.18	9.59	8.83	0.69	144.25	174.50	66.00	2622.50	5.00	29.00	17.27
1995	8	Arithmetic Mean	19.89	9.54	8.30	0.70	141.71	196.82	66.14	2716.43	5.00	83.89	41.39
1995	8	Coefficient of Variation	0.06	0.03	0.24	0.53	0.50	0.56	0.19	0.33	0.00	1.29	1.20
1995	8	LQ	19.01	9.35	7.71	0.41	79.00	145.00	59.00	2200.00	5.00	11.00	7.50
1995	8	UQ	20.78	9.74	9.66	1.02	187.00	186.00	75.50	3115.00	5.00	146.00	66.33
1995	9	N of Cases	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1995	9	Median	18.47	9.33	8.08	0.59	154.50	287.00	91.50	3392.50	5.00	41.50	18.84
1995	9	Arithmetic Mean	18.66	9.27	7.38	0.65	152.00	287.93	98.04	3337.14	5.00	188.79	46.51
1995	9	Coefficient of Variation	0.03	0.04	0.32	0.42	0.43	0.30	0.33	0.27	0.00	1.28	1.05
1995	9	LQ	18.36	9.01	5.25	0.46	120.00	206.00	75.00	2555.00	5.00	18.00	8.96
1995	9	UQ	18.88	9.53	9.29	0.84	198.00	341.00	126.50	4220.00	5.00	330.00	74.85
1996	6	N of Cases	10.00	10.00	10.00	5.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
1996	6	Median	17.65	8.60	8.20	0.80	54.00	58.50	7.50	869.50	5.00	232.50	36.36
1996	6	Arithmetic Mean	17.92	8.63	8.37	0.83	60.95	63.05	7.60	971.95	8.40	274.00	67.17
1996	6	Coefficient of Variation	0.08	0.05	0.10	0.13	0.59	0.28	0.13	0.34	0.94	0.84	1.19
1996	6	LQ	16.60	8.21	7.79	0.73	30.00	52.00	7.00	750.00	5.00	63.00	3.55
1996	6	UQ	19.27	9.09	9.05	0.94	95.00	66.00	8.00	1170.00	5.00	489.00	112.52
1996	7	N of Cases	10.00	10.00	10.00	8.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
1996	7	Median	21.72	9.42	8.98	0.84	138.50	115.25	6.00	1740.00	5.00	194.00	96.53
1996	7	Arithmetic Mean	22.22	9.43	9.18	0.80	154.75	118.40	6.55	1849.50	5.00	265.95	123.48
1996	7	Coefficient of Variation	0.06	0.02	0.16	0.40	0.48	0.28	0.15	0.33	0.00	0.96	0.89
1996	7	LQ	21.04	9.31	8.47	0.57	100.00	102.00	6.00	1580.00	5.00	31.00	19.58
1996	7	UQ	23.47	9.50	9.73	1.05	199.00	124.00	7.00	1870.00	5.00	482.00	227.00
1996	8	N of Cases	10.00	10.00	10.00	7.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
1996	8	Median	20.28	8.94	7.05	0.76	94.00	188.50	58.50	2165.00	26.00	242.50	73.94
1996	8	Arithmetic Mean	20.18	9.00	7.20	0.83	106.74	181.30	66.10	2129.00	43.40	451.40	93.71
1996	8	Coefficient of Variation	0.05	0.04	0.27	0.30	0.63	0.16	0.39	0.21	0.86	0.85	0.54
1996	8	LQ	19.51	8.70	5.99	0.64	60.00	166.00	50.00	1910.00	22.00	122.00	54.40
1996	8	UQ	20.48	9.37	8.75	1.09	154.00	202.00	89.00	2440.00	51.00	791.00	128.57
1996	9	N of Cases	10.00	10.00	10.00	8.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
1996	9	Median	15.76	8.80	7.87	1.13	83.50	182.50	71.00	2010.00	20.50	180.50	26.58
1996	9	Arithmetic Mean	16.28	8.81	8.10	1.15	115.60	190.00	73.80	2141.50	36.10	211.40	28.16
1996	9	Coefficient of Variation	0.13	0.03	0.16	0.38	0.72	0.20	0.33	0.33	1.21	0.83	0.60
1996	9	LQ	14.76	8.65	7.12	0.80	69.00	165.00	61.00	1780.00	5.00	47.00	14.04
1996	9	UQ	18.68	9.05	9.18	1.34	119.00	214.00	78.00	2350.00	48.00	324.00	41.45
1997	6	N of Cases	7.00	7.00	7.00	6.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
1997	6	Median	18.93	9.55	9.64	0.50	197.00	123.00	9.00	2190.00	5.00	298.00	163.65
1997	6	Arithmetic Mean	18.70	9.50	9.46	0.52	218.71	133.93	8.57	2312.14	5.00	394.86	219.21
1997	6	Coefficient of Variation	0.03	0.02	0.12	0.41	0.45	0.36	0.29	0.30	0.00	0.64	0.77
1997	6	LQ	18.48	9.37	8.52	0.40	182.00	101.13	6.50	1983.75	5.00	271.75	153.65
1997	6	UQ	18.98	9.63	10.55	0.70	211.25	150.75	10.50	2462.50	5.00	518.25	240.12
1997	7	N of Cases	23.00	23.00	23.00	21.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
1997	7	Median	21.13	9.54	9.06	0.51	190.00	225.00	56.00	2240.00	5.00	1680.00	664.94
1997	7	Arithmetic Mean	20.04	9.53	8.51	0.54	267.48	271.30	56.70	2782.39	6.74	1666.33	912.40
1997	7	Coefficient of Variation	0.11	0.03	0.28	0.53	1.05	0.61	0.60	0.58	0.69	0.88	0.74
1997	7	LQ	17.13	9.30	6.32	0.32	129.50	183.50	27.00	1895.00	5.00	773.75	400.59
1997	7	UQ	21.79	9.76	10.24	0.80	291.25	319.00	82.00	3247.50	5.00	1937.50	1452.47
1997	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
1997	8	Median	20.26	8.55	6.57	1.15	64.25	242.75	112.50	2650.00	46.50	853.50	72.78
1997	8	Arithmetic Mean	20.44	8.40	6.81	1.08	131.10	269.69	116.59	3276.88	55.47	836.13	143.60
1997	8	Coefficient of Variation	0.07	0.07	0.28	0.34	1.79	0.48	0.34	0.72	0.65	0.44	1.72
1997	8	LQ	19.39	7.80	5.16	0.88	34.00	201.50	82.50	2355.00	23.00	619.00	20.50
1997	8	UQ	21.23	8.82	7.70	1.30	114.50	280.75	146.50	3170.00	84.50	979.75	138.66
1997	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
1997	9	Median	17.50	9.29	10.37	0.85	155.00	205.50	68.50	2065.00	5.00	597.00	233.42
1997	9	Arithmetic Mean	17.24	9.28	10.50	0.90	172.59	220.34	67.65	2337.19	6.28	757.50	302.12
1997	9	Coefficient of Variation	0.13	0.02	0.17	0.37	0.81	0.33	0.21	0.36	0.72	0.62	0.71
1997	9	LQ	15.12	9.20	9.40	0.68	58.50	164.50	58.25	1665.00	5.00	471.50	150.92
1997	9	UQ	19.25	9.40	11.90	1.18	227.00	277.00	82.00	2945.00	5.00	902.00	396.34
1998	6	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1998	6	Median	17.43	8.86	9.70	1.18	45.00	62.00	6.00	906.50	5.00	302.50	54.86
1998	6	Arithmetic Mean	17.26	8.87	9.61	1.13	62.63	82.63	7.58	1123.58	5.00	360.23	93.68
1998	6	Coefficient of Variation	0.12	0.03	0.12	0.34	0.65	0.56	0.54	0.43	0.00	0.61	1.29
1998	6	LQ	15.57	8.71	9.18	0.93	34.75	49.75	5.00	828.00	5.00	187.00	29.72
1998	6	UQ	19.27	9.01	10.08	1.25	77.50	101.00	9.25	1322.50	5.00	454.00	102.64
1998	7	N of Cases	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
1998	7	Median	23.87	9.39	8.10	0.75	172.00	193.50	49.00	2330.00	5.00	963.00	450.85
1998	7	Arithmetic Mean	23.33	9.34	8.00	0.82	192.10	206.97	41.43	2500.67	5.00	957.03	499.29
1998	7	Coefficient of Variation	0.05	0.03	0.33	0.57	0.43	0.27	0.92	0.26	0.00	0.31	0.39
1998	7	LQ	22.22	9.13	6.18	0.55	124.63	159.00	4.00	2071.25	5.00	647.88	352.75
1998	7	UQ	24.49	9.49	10.08	0.94	243.25	257.50	72.88	2662.50	5.00	1173.75	647.07
1998	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
1998	8	Median	21.68	8.15	6.81	1.82	13.00	224.50	111.50	2220.00	55.00	1004.75	59.28
1998	8	Arithmetic Mean	21.72	8.12	6.58	1.55	82.40	246.91	113.28	2555.63	62.28	1122.09	127.56
1998	8	Coefficient of Variation	0.07	0.04	0.49	0.43	1.97	0.38	0.34	0.49	1.10	0.59	1.97
1998	8	LQ	20.37	7.79	3.45	1.14	6.38	191.00	80.00	2065.00	15.50	826.00	21.74
1998	8	UQ	23.22	8.23	8.46	2.00	50.00	248.50	146.50	2475.00	79.50	1090.00	70.59
1998	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
1998	9	Median	18.94	9.28	9.97	1.01	92.50	181.50	55.50	1847.50	5.00	287.50	89.23

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
1998	9	Arithmetic Mean	18.74	9.20	9.46	0.91	115.41	198.09	63.00	1883.59	5.69	279.72	107.45
1998	9	Coefficient of Variation	0.18	0.03	0.17	0.26	0.52	0.34	0.39	0.30	0.33	0.88	0.97
1998	9	LQ	15.32	9.04	8.67	0.73	72.00	162.25	48.50	1490.00	5.00	24.00	7.59
1998	9	UQ	21.77	9.38	10.50	1.13	156.00	221.50	70.50	2230.00	5.00	501.25	182.50
1999	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
1999	6	Median	16.79	8.76	10.07	1.05	46.00	87.75	12.00	1112.50	5.00	238.50	32.83
1999	6	Arithmetic Mean	16.91	8.83	10.48	0.93	95.44	111.78	13.78	1361.03	5.00	275.25	88.83
1999	6	Coefficient of Variation	0.16	0.07	0.14	0.43	1.25	0.59	0.55	0.55	0.00	0.68	1.54
1999	6	LQ	14.34	8.26	9.12	0.70	22.50	74.25	6.50	750.50	5.00	153.00	9.48
1999	6	UQ	19.40	9.39	11.43	1.09	126.75	118.50	21.00	1930.00	5.00	309.50	131.93
1999	7	N of Cases	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
1999	7	Median	20.06	9.82	9.05	0.57	223.00	177.50	29.00	2310.00	5.00	233.00	161.82
1999	7	Arithmetic Mean	19.48	9.80	9.06	0.63	224.03	193.90	27.53	2719.00	9.53	393.20	279.94
1999	7	Coefficient of Variation	0.07	0.02	0.19	0.56	0.57	0.44	0.85	0.38	0.58	0.91	0.99
1999	7	LQ	18.26	9.65	8.67	0.32	125.00	138.00	5.00	1912.50	5.00	150.75	108.38
1999	7	UQ	20.79	9.90	10.26	0.87	299.13	222.50	48.75	3377.50	15.25	549.00	372.41
1999	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
1999	8	Median	21.12	9.42	7.63	0.74	142.50	234.50	81.00	2405.00	11.00	165.00	67.81
1999	8	Arithmetic Mean	21.12	9.43	7.63	0.74	183.13	285.41	80.47	2626.25	12.94	431.94	245.72
1999	8	Coefficient of Variation	0.06	0.02	0.24	0.44	0.88	0.44	0.12	0.48	0.99	1.32	1.45
1999	8	LQ	20.15	9.30	6.13	0.53	76.00	187.00	74.50	1855.00	5.00	61.00	26.92
1999	8	UQ	22.33	9.58	8.89	1.02	232.50	357.50	84.75	3040.00	14.00	641.00	359.04
1999	9	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1999	9	Median	17.09	8.74	8.65	1.15	46.50	190.50	66.50	2020.00	43.00	363.50	32.51
1999	9	Arithmetic Mean	16.41	8.70	8.53	0.99	74.03	209.48	79.02	2244.38	45.71	405.35	58.42
1999	9	Coefficient of Variation	0.12	0.04	0.26	0.37	1.16	0.44	0.46	0.33	0.64	0.80	1.23
1999	9	LQ	14.73	8.42	6.85	0.65	24.00	152.00	52.00	1805.00	16.00	91.50	12.63
1999	9	UQ	17.97	9.00	10.38	1.30	97.50	216.00	113.50	2400.00	61.00	740.50	58.12
2000	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2000	6	Median	20.47	9.81	9.42	0.61	183.00	172.50	8.50	2275.00	14.25	733.50	540.53
2000	6	Arithmetic Mean	20.09	9.77	9.10	0.66	203.09	184.72	21.59	2322.50	17.78	929.59	617.91
2000	6	Coefficient of Variation	0.12	0.03	0.17	0.42	0.62	0.40	0.98	0.34	0.98	0.58	0.60
2000	6	LQ	17.57	9.60	7.98	0.43	106.25	124.00	7.00	1602.50	5.00	606.50	436.15
2000	6	UQ	21.90	9.98	10.23	0.88	271.00	227.00	32.50	2947.50	21.50	1355.00	718.17
2000	7	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2000	7	Median	21.13	9.64	7.48	0.99	96.50	228.00	91.50	1605.00	10.00	521.25	314.78
2000	7	Arithmetic Mean	20.94	9.64	7.54	0.90	164.69	369.25	90.88	2012.25	9.56	706.50	476.78
2000	7	Coefficient of Variation	0.03	0.03	0.18	0.50	1.02	1.20	0.14	0.57	0.22	0.75	0.95
2000	7	LQ	20.24	9.45	6.90	0.55	69.75	206.25	87.50	1390.00	10.00	368.00	229.27
2000	7	UQ	21.56	9.82	8.15	1.22	189.00	321.00	96.50	2295.00	10.25	927.00	481.09
2000	8	N of Cases	16.00	16.00	16.00	10.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2000	8	Median	21.49	8.49	4.47	1.35	21.25	226.00	141.25	2277.50	66.50	870.00	79.33
2000	8	Arithmetic Mean	21.26	8.52	4.58	1.44	34.16	224.91	129.00	2240.31	76.22	778.31	92.43

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2000	8	Coefficient of Variation	0.12	0.04	0.43	0.22	1.16	0.27	0.34	0.22	0.85	0.42	0.52
2000	8	LQ	18.54	8.34	2.89	1.20	17.00	183.50	118.25	1920.00	18.50	570.00	57.65
2000	8	UQ	23.47	8.68	6.14	1.75	37.00	262.75	158.00	2460.00	134.00	970.50	124.51
2000	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2000	9	Median	16.70	9.10	8.58	0.80	116.00	189.00	67.00	1680.00	18.25	484.00	116.02
2000	9	Arithmetic Mean	16.55	9.08	8.43	0.87	135.34	182.22	64.50	1899.69	23.88	496.00	150.28
2000	9	Coefficient of Variation	0.16	0.03	0.19	0.28	0.64	0.11	0.25	0.34	0.60	0.35	0.69
2000	9	LQ	14.25	8.92	7.37	0.69	68.50	163.50	51.00	1445.00	13.25	357.50	79.61
2000	9	UQ	18.69	9.29	9.84	1.14	170.75	200.75	75.50	2160.00	29.00	604.75	188.41
2001	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2001	6	Median	16.64	9.62	9.34	0.57	160.25	132.00	7.00	2490.00	5.00	501.50	258.00
2001	6	Arithmetic Mean	16.87	9.59	9.42	0.60	187.38	145.09	6.84	2565.63	5.00	498.53	269.94
2001	6	Coefficient of Variation	0.08	0.02	0.10	0.30	0.40	0.40	0.12	0.28	0.00	0.51	0.57
2001	6	LQ	15.91	9.49	8.84	0.54	134.00	101.50	6.00	1900.00	5.00	253.50	160.93
2001	6	UQ	17.57	9.71	9.65	0.73	233.50	162.50	7.00	2942.50	5.00	645.25	332.70
2001	7	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2001	7	Median	19.66	9.68	7.90	0.73	193.50	247.50	59.00	3340.00	13.00	623.00	356.18
2001	7	Arithmetic Mean	19.59	9.68	8.18	0.74	200.60	234.40	45.38	3330.08	12.77	614.31	384.17
2001	7	Coefficient of Variation	0.03	0.02	0.20	0.43	0.45	0.31	0.61	0.30	0.20	0.51	0.50
2001	7	LQ	19.22	9.55	7.32	0.55	135.00	179.00	11.50	2545.00	11.50	347.50	268.49
2001	7	UQ	19.94	9.83	9.38	0.93	240.50	279.50	66.00	3890.00	14.50	716.00	481.92
2001	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2001	8	Median	22.17	8.94	5.51	0.85	75.25	226.50	70.75	3120.00	8.00	861.00	231.10
2001	8	Arithmetic Mean	21.49	8.91	5.35	0.95	84.88	238.50	66.72	3387.81	10.63	934.00	253.38
2001	8	Coefficient of Variation	0.08	0.04	0.51	0.49	0.72	0.32	0.63	0.27	0.70	0.42	0.54
2001	8	LQ	19.81	8.75	3.63	0.61	41.00	175.00	31.75	2862.50	5.00	676.50	137.70
2001	8	UQ	22.94	9.14	8.08	1.31	120.25	302.50	98.50	3820.00	14.50	1115.00	363.27
2001	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2001	9	Median	16.72	8.74	6.67	1.09	82.50	165.00	31.00	2765.00	13.25	970.00	93.57
2001	9	Arithmetic Mean	16.85	8.49	6.09	1.03	102.69	168.03	36.34	2894.38	17.59	878.84	142.18
2001	9	Coefficient of Variation	0.06	0.08	0.38	0.40	0.69	0.30	0.62	0.30	0.58	0.58	1.66
2001	9	LQ	16.01	7.91	3.69	0.75	60.00	132.00	16.75	2285.00	11.50	419.50	19.61
2001	9	UQ	17.85	8.99	7.99	1.33	140.25	195.50	57.75	3690.00	25.00	1165.00	102.73
2002	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2002	6	Median	19.53	9.25	9.24	0.72	142.00	101.00	6.50	1847.50	6.25	249.00	125.25
2002	6	Arithmetic Mean	19.40	9.23	9.71	0.76	168.09	122.25	7.22	1786.22	8.00	381.56	192.20
2002	6	Coefficient of Variation	0.10	0.03	0.19	0.44	0.73	0.65	0.36	0.35	0.45	1.02	1.04
2002	6	LQ	17.49	9.08	8.55	0.56	90.25	74.25	5.50	1382.50	5.00	43.50	9.09
2002	6	UQ	20.75	9.43	11.21	1.04	209.00	127.50	8.50	2155.00	10.00	660.00	349.90
2002	7	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2002	7	Median	21.79	9.61	7.34	0.75	147.50	177.50	41.00	2435.00	11.00	398.75	265.97
2002	7	Arithmetic Mean	21.70	9.58	7.17	0.78	138.91	189.81	42.44	2345.00	18.34	416.78	260.60
2002	7	Coefficient of Variation	0.05	0.02	0.25	0.30	0.42	0.24	0.45	0.18	1.28	0.35	0.37

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2002	7	LQ	20.95	9.50	5.97	0.59	81.50	160.25	30.00	2130.00	10.00	321.50	188.59
2002	7	UQ	22.66	9.69	8.36	0.97	186.00	207.50	55.25	2600.00	13.25	510.50	333.05
2002	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2002	8	Median	19.59	8.96	8.38	0.85	77.00	174.00	39.00	2745.00	54.75	585.25	111.89
2002	8	Arithmetic Mean	19.75	8.85	8.02	0.96	89.77	205.88	47.19	2830.31	70.59	590.75	153.35
2002	8	Coefficient of Variation	0.08	0.06	0.28	0.40	0.80	0.32	0.62	0.26	1.11	0.38	0.77
2002	8	LQ	18.57	8.59	6.69	0.69	40.25	158.00	30.50	2285.00	11.00	439.00	57.92
2002	8	UQ	20.83	9.21	9.68	1.21	134.50	249.50	61.50	2962.50	87.50	701.00	218.11
2002	9	N of Cases	16.00	16.00	8.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2002	9	Median	16.46	9.27	8.88	0.89	98.00	190.25	45.50	2652.50	12.00	309.50	86.52
2002	9	Arithmetic Mean	16.54	9.24	8.11	0.93	110.66	213.56	44.84	2922.50	12.50	336.69	121.11
2002	9	Coefficient of Variation	0.05	0.02	0.15	0.35	0.58	0.32	0.37	0.28	0.17	0.45	0.62
2002	9	LQ	15.91	9.12	6.88	0.69	77.50	151.00	31.50	2270.00	11.00	205.75	64.49
2002	9	UQ	17.14	9.43	9.00	1.10	136.00	267.00	57.50	3600.00	13.25	449.00	165.94
2003	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2003	6	Median	20.08	8.40	8.02	1.24	16.00	90.75	18.50	1000.00	15.25	69.50	5.42
2003	6	Arithmetic Mean	19.98	8.40	8.16	1.16	28.90	102.16	16.91	1187.03	35.88	62.19	7.51
2003	6	Coefficient of Variation	0.05	0.04	0.10	0.17	1.04	0.47	0.33	0.44	0.83	0.34	0.91
2003	6	LQ	19.10	8.15	7.72	0.99	11.50	68.75	11.75	793.50	12.00	53.50	2.31
2003	6	UQ	20.60	8.59	8.24	1.28	34.00	112.50	21.00	1507.50	63.00	75.75	9.75
2003	7	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2003	7	Median	22.55	9.50	8.43	0.69	82.50	212.00	45.00	2785.00	9.00	380.00	73.13
2003	7	Arithmetic Mean	22.74	9.34	7.43	0.80	108.06	213.40	54.35	2843.96	8.69	448.54	217.97
2003	7	Coefficient of Variation	0.08	0.05	0.38	0.55	0.85	0.41	0.95	0.33	0.44	1.29	1.55
2003	7	LQ	20.86	9.37	6.19	0.56	49.75	142.00	5.00	2235.00	5.00	23.75	13.51
2003	7	UQ	24.51	9.57	9.47	0.99	148.00	280.00	86.00	3325.00	12.00	720.00	284.82
2003	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2003	8	Median	20.53	9.51	8.52	0.58	176.00	261.50	73.50	3045.00	13.50	16.00	8.48
2003	8	Arithmetic Mean	20.39	9.51	8.35	0.60	167.75	274.75	75.47	3124.06	13.59	43.25	17.37
2003	8	Coefficient of Variation	0.03	0.02	0.20	0.32	0.34	0.23	0.21	0.16	0.68	2.57	1.99
2003	8	LQ	20.09	9.44	7.91	0.48	139.50	234.75	69.00	2870.00	5.00	11.00	6.92
2003	8	UQ	20.73	9.62	8.93	0.67	200.50	306.50	79.50	3505.00	19.25	23.25	12.77
2003	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2003	9	Median	17.08	9.40	7.19	0.69	93.50	216.50	63.50	2480.00	16.50	151.25	29.58
2003	9	Arithmetic Mean	16.99	9.34	7.56	0.69	138.69	271.88	59.44	3064.69	29.38	177.63	70.34
2003	9	Coefficient of Variation	0.04	0.04	0.27	0.45	1.35	0.66	0.51	0.61	0.92	1.15	1.33
2003	9	LQ	16.41	9.11	5.89	0.42	74.50	180.50	32.00	2047.50	12.25	33.50	14.77
2003	9	UQ	17.56	9.58	8.97	0.87	118.00	290.00	74.00	3060.00	41.75	241.00	108.62
2004	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2004	6	Median	17.41	9.31	9.02	0.96	65.50	69.50	7.50	1325.00	5.00	21.50	4.36
2004	6	Arithmetic Mean	17.35	9.25	9.27	0.83	89.53	94.56	8.19	1448.00	7.38	27.41	11.09
2004	6	Coefficient of Variation	0.17	0.04	0.09	0.31	0.82	0.62	0.21	0.41	0.38	0.84	1.35
2004	6	LQ	14.55	8.85	8.75	0.71	40.00	60.50	7.00	1035.00	5.00	13.00	3.36

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2004	6	UQ	20.02	9.60	9.81	1.00	109.00	101.00	9.50	1570.00	10.00	35.50	7.69
2004	7	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2004	7	Median	21.69	9.63	7.38	0.66	132.25	172.50	30.50	2120.00	16.00	22.00	13.38
2004	7	Arithmetic Mean	21.68	9.63	7.12	0.72	187.50	187.81	28.94	2456.88	25.69	32.66	19.56
2004	7	Coefficient of Variation	0.05	0.02	0.17	0.49	0.90	0.51	0.56	0.44	0.88	0.98	0.85
2004	7	LQ	20.97	9.54	6.35	0.49	103.50	131.50	14.00	1745.00	9.75	12.00	8.59
2004	7	UQ	22.71	9.72	8.15	0.76	210.50	194.75	41.00	2525.00	41.00	38.00	24.32
2004	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2004	8	Median	21.93	9.03	5.86	0.95	80.50	178.25	56.00	2450.00	29.50	159.00	37.25
2004	8	Arithmetic Mean	22.03	9.03	5.69	1.02	76.88	191.34	65.88	2410.00	35.41	206.13	48.79
2004	8	Coefficient of Variation	0.05	0.05	0.31	0.33	0.72	0.26	0.33	0.14	0.63	0.92	0.69
2004	8	LQ	21.17	8.86	4.22	0.76	28.50	170.00	48.00	2130.00	20.25	42.50	19.14
2004	8	UQ	23.05	9.35	6.77	1.26	108.25	195.00	88.50	2660.00	41.50	342.00	82.33
2004	9	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2004	9	Median	16.24	9.14	8.49	1.04	51.00	140.50	24.50	2030.00	14.50	105.00	24.95
2004	9	Arithmetic Mean	17.25	9.11	8.51	0.96	81.54	155.15	26.69	2447.08	16.81	226.94	58.68
2004	9	Coefficient of Variation	0.12	0.02	0.17	0.29	1.33	0.38	0.75	0.45	0.90	1.11	1.20
2004	9	LQ	15.57	8.99	7.80	0.84	15.50	122.00	10.50	1860.00	9.00	22.50	9.34
2004	9	UQ	19.44	9.26	9.24	1.13	74.00	177.50	32.50	2575.00	20.00	418.00	106.88
2005	6	N of Cases	19.00	19.00	19.00	16.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00
2005	6	Median	15.94	9.07	9.73	0.97	61.00	84.00	6.00	1410.00	5.00	27.00	3.81
2005	6	Arithmetic Mean	15.73	8.96	9.70	0.87	58.79	92.58	6.84	1403.74	8.53	24.53	6.24
2005	6	Coefficient of Variation	0.08	0.04	0.09	0.42	0.53	0.44	0.43	0.30	0.54	0.43	0.77
2005	6	LQ	14.46	8.73	9.48	0.75	29.25	63.25	5.00	990.00	5.00	15.25	2.27
2005	6	UQ	16.72	9.22	10.17	1.11	71.75	114.25	7.00	1815.00	11.00	33.00	11.21
2005	7	N of Cases	18.00	18.00	18.00	16.00	17.00	18.00	18.00	18.00	18.00	18.00	18.00
2005	7	Median	22.01	9.45	7.17	1.02	59.00	175.50	36.00	2090.00	7.50	69.00	36.67
2005	7	Arithmetic Mean	22.38	9.41	6.77	1.04	75.78	184.39	36.94	2431.67	10.17	111.44	48.80
2005	7	Coefficient of Variation	0.07	0.03	0.26	0.49	0.96	0.41	0.82	0.37	0.61	1.12	0.90
2005	7	LQ	21.09	9.23	5.76	0.58	19.75	124.00	8.00	1890.00	5.00	15.00	10.16
2005	7	UQ	23.72	9.60	8.12	1.40	101.75	260.00	53.00	3150.00	14.00	137.00	74.08
2005	8	N of Cases	25.00	25.00	25.00	23.00	24.00	25.00	25.00	25.00	25.00	25.00	25.00
2005	8	Median	21.12	9.33	7.58	0.88	108.00	195.00	52.00	2470.00	13.00	19.00	8.99
2005	8	Arithmetic Mean	20.88	9.16	7.34	0.94	131.27	205.32	55.94	2835.60	17.54	128.12	20.60
2005	8	Coefficient of Variation	0.10	0.06	0.23	0.51	0.78	0.34	0.58	0.38	0.77	1.68	1.02
2005	8	LQ	19.20	9.06	6.57	0.64	54.50	150.75	32.63	2047.50	5.00	8.75	5.08
2005	8	UQ	22.40	9.48	8.63	1.22	172.00	227.50	70.75	3417.50	25.75	133.00	31.34
2005	9	N of Cases	18.00	18.00	18.00	16.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
2005	9	Median	14.08	8.90	8.12	0.72	139.50	194.00	40.50	2870.00	10.00	57.50	8.39
2005	9	Arithmetic Mean	14.16	8.92	8.13	0.79	137.17	198.28	39.61	2978.33	10.72	91.78	14.46
2005	9	Coefficient of Variation	0.10	0.02	0.13	0.23	0.47	0.24	0.42	0.21	0.61	1.04	0.92
2005	9	LQ	13.25	8.79	7.28	0.67	89.00	162.00	27.00	2510.00	5.00	23.00	4.56
2005	9	UQ	15.06	9.07	8.82	0.97	169.00	237.00	52.00	3290.00	14.00	113.00	18.66

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2006	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2006	6	Median	18.32	7.99	7.24	1.61	12.00	54.00	15.00	714.50	22.50	53.00	1.76
2006	6	Arithmetic Mean	18.14	7.99	7.34	1.59	13.24	74.19	15.00	793.13	22.75	58.00	1.98
2006	6	Coefficient of Variation	0.04	0.03	0.06	0.11	0.65	0.74	0.27	0.23	0.38	0.38	0.48
2006	6	LQ	17.52	7.75	6.96	1.46	5.60	49.50	12.50	674.00	18.50	47.00	1.33
2006	6	UQ	18.73	8.22	7.79	1.73	20.00	59.00	17.50	919.00	27.00	72.50	2.62
2006	7	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2006	7	Median	22.23	9.33	7.39	0.88	111.50	187.50	48.00	2065.00	20.00	101.50	31.97
2006	7	Arithmetic Mean	22.18	9.11	7.13	0.94	110.88	212.08	59.58	2192.08	40.50	288.67	56.42
2006	7	Coefficient of Variation	0.04	0.06	0.30	0.40	1.00	0.56	0.92	0.43	1.19	1.28	0.84
2006	7	LQ	21.57	8.81	5.26	0.73	36.50	134.50	7.00	1825.00	5.00	41.00	24.96
2006	7	UQ	22.84	9.53	9.24	1.21	137.00	242.50	115.50	2340.00	61.50	534.00	66.20
2006	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2006	8	Median	20.67	9.71	8.30	0.71	99.00	246.00	94.50	3160.00	5.00	30.00	18.02
2006	8	Arithmetic Mean	20.67	9.75	8.53	0.66	147.25	269.44	90.19	3386.25	5.00	118.88	71.44
2006	8	Coefficient of Variation	0.04	0.04	0.17	0.42	0.85	0.40	0.25	0.46	0.00	1.80	1.60
2006	8	LQ	20.13	9.37	7.70	0.40	76.00	198.00	68.50	1975.00	5.00	14.00	8.60
2006	8	UQ	21.23	10.17	9.68	0.91	177.00	292.50	104.50	4565.00	5.00	79.00	55.40
2006	9	N of Cases	16.00	16.00	16.00	12.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2006	9	Median	16.95	9.98	10.04	0.60	142.50	255.00	94.00	2500.00	5.00	61.50	37.33
2006	9	Arithmetic Mean	16.66	9.99	9.84	0.58	200.31	287.38	94.06	3389.38	5.00	95.13	70.68
2006	9	Coefficient of Variation	0.16	0.02	0.21	0.57	1.00	0.42	0.43	0.63	0.00	1.08	1.12
2006	9	LQ	14.07	9.80	8.30	0.32	89.00	230.50	77.00	2385.00	5.00	26.50	17.38
2006	9	UQ	18.97	10.16	11.28	0.84	224.00	299.50	99.50	3515.00	5.00	146.50	99.99
2007	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2007	6	Median	17.80	8.93	8.62	1.19	27.50	116.00	35.50	899.00	5.00	19.50	3.15
2007	6	Arithmetic Mean	17.86	8.81	8.45	1.18	51.06	127.19	32.63	1100.88	30.44	28.31	4.17
2007	6	Coefficient of Variation	0.08	0.04	0.14	0.31	1.46	0.54	0.52	0.59	0.98	0.86	0.84
2007	6	LQ	16.65	8.58	7.38	1.01	13.00	91.50	16.00	800.00	5.00	8.50	1.95
2007	6	UQ	18.97	9.04	9.61	1.46	56.50	123.00	48.00	1070.00	63.00	45.00	5.13
2007	7	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2007	7	Median	21.79	9.92	7.31	0.62	140.50	302.50	111.00	3065.00	5.00	23.00	18.10
2007	7	Arithmetic Mean	21.54	9.92	7.29	0.60	160.38	312.38	93.96	3012.50	8.17	51.88	39.57
2007	7	Coefficient of Variation	0.06	0.01	0.25	0.38	0.48	0.35	0.55	0.26	0.59	1.19	1.19
2007	7	LQ	20.14	9.88	5.88	0.40	100.50	254.50	27.50	2355.00	5.00	5.00	4.36
2007	7	UQ	22.60	10.01	8.73	0.75	222.50	361.00	133.50	3660.00	13.00	69.00	50.90
2007	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2007	8	Median	20.32	9.39	7.33	0.61	122.00	256.00	105.50	2660.00	5.00	32.00	20.15
2007	8	Arithmetic Mean	20.24	9.41	6.49	0.62	135.13	292.88	101.06	3244.38	8.50	99.63	42.59
2007	8	Coefficient of Variation	0.04	0.02	0.26	0.48	0.57	0.32	0.22	0.40	0.52	1.03	0.91
2007	8	LQ	19.48	9.26	5.03	0.44	68.00	236.00	87.50	2415.00	5.00	20.00	11.65
2007	8	UQ	21.03	9.57	7.75	0.84	202.50	304.00	115.50	3935.00	12.00	197.50	76.68
2007	9	N of Cases	16.00	16.00	16.00	16.00	8.00	16.00	16.00	16.00	16.00	16.00	16.00

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2007	9	Median	15.03	9.23	9.15	0.66	88.00	199.25	49.52	2665.87	13.00	295.22	73.51
2007	9	Arithmetic Mean	15.36	9.18	8.41	0.63	123.25	209.28	63.45	2872.70	15.76	343.10	75.09
2007	9	Coefficient of Variation	0.21	0.03	0.22	0.20	0.70	0.21	0.59	0.23	0.75	1.01	0.74
2007	9	LQ	12.50	9.04	7.39	0.51	85.00	177.98	39.42	2414.04	5.01	77.00	33.20
2007	9	UQ	18.46	9.34	9.52	0.74	150.50	245.00	83.50	3172.43	19.99	481.75	115.76
2008	6	N of Cases	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
2008	6	Median	17.78	8.95	9.23	1.03	48.00	77.00	18.00	1120.00	4.00	25.00	5.10
2008	6	Arithmetic Mean	18.28	8.82	9.19	1.00	66.80	101.83	18.83	1488.48	13.39	30.26	7.80
2008	6	Coefficient of Variation	0.16	0.08	0.12	0.37	1.08	0.68	0.20	0.67	1.27	0.42	0.94
2008	6	LQ	15.24	8.05	8.19	0.71	13.50	59.00	17.00	737.00	4.00	20.25	0.88
2008	6	UQ	21.29	9.51	10.22	1.34	94.00	121.00	21.50	1902.50	18.25	36.00	14.27
2008	7	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2008	7	Median	21.22	9.61	8.02	0.73	160.00	199.50	54.00	2600.00	6.50	19.50	14.23
2008	7	Arithmetic Mean	21.34	9.60	7.99	0.66	260.63	199.63	57.75	2603.75	7.13	93.19	43.24
2008	7	Coefficient of Variation	0.05	0.03	0.22	0.40	1.03	0.26	0.37	0.34	0.46	1.66	1.30
2008	7	LQ	20.63	9.43	6.77	0.50	130.50	164.00	42.00	1855.00	4.00	16.50	11.79
2008	7	UQ	21.45	9.79	9.16	0.89	259.50	230.50	68.50	3035.00	10.00	76.50	49.10
2008	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2008	8	Median	20.22	9.27	7.20	0.80	101.50	230.00	94.00	2870.00	9.00	153.00	67.67
2008	8	Arithmetic Mean	20.28	9.26	7.24	0.78	140.94	267.88	92.75	2891.88	9.81	190.00	61.24
2008	8	Coefficient of Variation	0.04	0.03	0.27	0.26	0.80	0.35	0.25	0.35	0.74	1.08	0.74
2008	8	LQ	19.63	9.15	6.58	0.70	61.50	209.50	82.00	2070.00	4.00	25.00	12.18
2008	8	UQ	21.03	9.44	8.36	0.94	191.00	297.50	108.50	3405.00	13.00	287.00	99.88
2008	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2008	9	Median	16.55	9.31	8.39	0.70	98.00	197.50	66.00	2475.00	10.00	35.00	12.02
2008	9	Arithmetic Mean	16.51	9.16	7.42	0.71	155.13	253.44	72.44	3116.25	10.69	314.25	29.99
2008	9	Coefficient of Variation	0.08	0.06	0.32	0.33	1.28	0.51	0.45	0.59	0.32	2.61	1.19
2008	9	LQ	15.56	9.04	5.99	0.62	64.00	180.50	53.50	2055.00	9.00	23.00	10.35
2008	9	UQ	17.55	9.48	9.05	0.89	159.00	267.00	84.50	3255.00	12.00	151.50	31.54
2009	6	N of Cases	24.00	24.00	24.00	24.00	23.00	24.00	24.00	24.00	24.00	24.00	24.00
2009	6	Median	18.41	9.29	8.35	0.86	95.36	67.50	6.00	1670.00	4.00	18.50	7.66
2009	6	Arithmetic Mean	18.96	9.09	8.29	0.90	135.88	82.21	5.75	1735.04	4.54	25.58	8.70
2009	6	Coefficient of Variation	0.07	0.06	0.11	0.35	0.78	0.57	0.29	0.52	0.44	0.72	0.81
2009	6	LQ	18.10	8.77	7.54	0.74	60.00	46.00	4.00	986.50	4.00	12.50	2.44
2009	6	UQ	19.68	9.42	8.98	1.10	176.03	99.00	7.00	1990.00	4.00	28.50	10.87
2009	7	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2009	7	Median	21.77	8.47	5.73	1.51	45.34	159.50	60.00	2175.00	20.50	456.00	35.97
2009	7	Arithmetic Mean	21.78	8.34	5.70	1.61	49.92	156.75	71.81	2080.63	28.56	558.75	41.41
2009	7	Coefficient of Variation	0.10	0.09	0.32	0.39	0.91	0.20	0.55	0.18	0.81	0.75	0.71
2009	7	LQ	19.66	7.63	4.60	1.09	16.26	136.00	40.50	1740.00	13.00	247.50	14.44
2009	7	UQ	23.61	8.92	7.02	2.04	60.45	171.00	97.00	2330.00	38.50	902.50	57.93
2009	8	N of Cases	15.00	15.00	15.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	15.00
2009	8	Median	19.58	9.69	8.94	0.68	166.89	191.50	41.00	2115.00	6.00	22.00	11.78

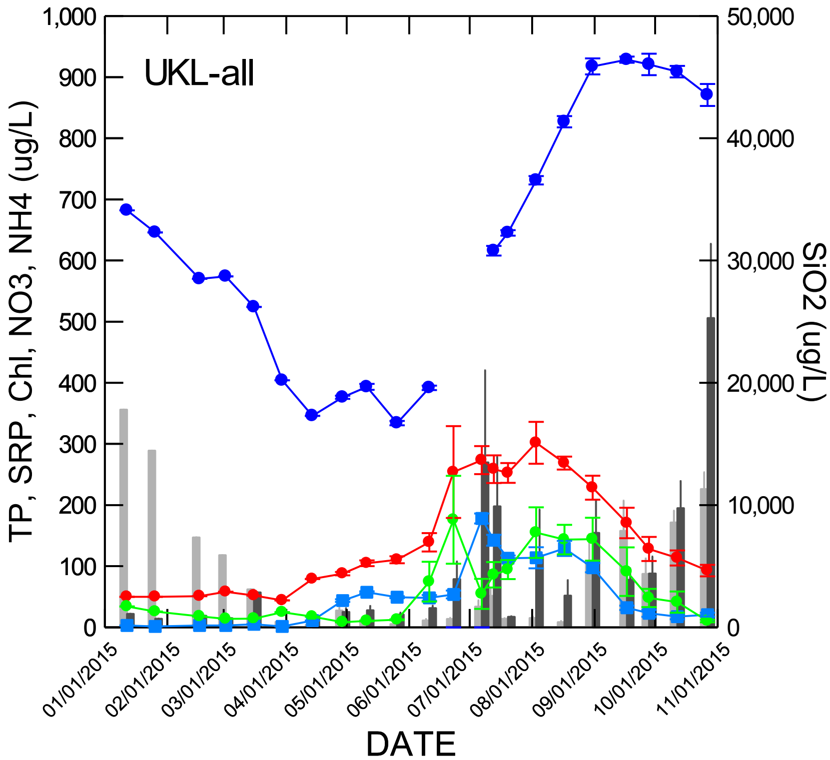
Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2009	8	Arithmetic Mean	19.53	9.74	8.87	0.62	186.03	195.38	48.06	2353.13	6.69	68.19	46.51
2009	8	Coefficient of Variation	0.03	0.06	0.29	0.41	0.45	0.27	0.57	0.32	0.45	2.02	2.06
2009	8	LQ	19.10	9.20	7.88	0.48	132.42	154.50	26.50	1855.00	4.00	17.00	8.14
2009	8	UQ	20.10	10.25	10.80	0.80	229.95	212.50	69.00	2800.00	9.00	35.00	22.80
2009	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2009	9	Median	16.48	9.81	7.79	0.57	174.81	240.50	90.50	2810.00	4.00	121.00	86.29
2009	9	Arithmetic Mean	16.35	9.77	7.39	0.62	182.81	251.44	82.06	3103.13	7.69	265.69	137.16
2009	9	Coefficient of Variation	0.05	0.02	0.17	0.28	0.33	0.19	0.25	0.27	0.74	1.44	1.00
2009	9	LQ	15.82	9.66	6.58	0.48	142.87	218.00	69.00	2470.00	4.00	33.00	22.56
2009	9	UQ	17.02	9.92	8.19	0.77	223.45	279.50	96.00	3670.00	10.00	379.50	231.07
2010	6	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2010	6	Median	16.60	8.35	8.51	1.07	12.35	47.50	4.00	602.50	4.00	9.50	0.44
2010	6	Arithmetic Mean	16.86	8.22	8.67	1.10	14.05	50.00	5.17	623.67	5.33	11.79	0.70
2010	6	Coefficient of Variation	0.18	0.05	0.07	0.27	1.05	0.22	0.69	0.19	0.36	0.59	1.00
2010	6	LQ	13.52	7.70	8.13	0.98	3.30	44.00	3.00	546.50	4.00	6.50	0.22
2010	6	UQ	20.10	8.55	9.16	1.20	15.75	54.50	6.00	641.50	8.00	17.00	0.77
2010	7	N of Cases	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
2010	7	Median	22.30	9.51	9.11	0.99	106.50	81.50	8.00	1660.00	4.00	29.00	15.26
2010	7	Arithmetic Mean	22.05	9.51	8.37	0.92	121.06	107.60	20.00	1778.60	5.60	83.25	42.83
2010	7	Coefficient of Variation	0.04	0.02	0.23	0.38	0.57	0.57	1.09	0.39	0.78	1.26	1.12
2010	7	LQ	21.35	9.40	6.80	0.64	60.10	67.00	5.50	1370.00	4.00	14.00	9.37
2010	7	UQ	22.87	9.67	9.61	1.14	148.50	152.50	26.50	2125.00	4.00	153.00	87.45
2010	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2010	8	Median	20.39	9.42	8.62	0.71	135.00	180.50	45.50	2120.00	9.50	42.50	21.75
2010	8	Arithmetic Mean	20.36	9.23	8.53	0.81	153.48	184.25	52.50	2305.00	17.56	174.75	37.22
2010	8	Coefficient of Variation	0.08	0.05	0.18	0.47	0.73	0.18	0.51	0.27	1.25	1.35	0.83
2010	8	LQ	19.24	8.93	7.75	0.52	80.85	162.50	39.00	1920.00	4.00	25.00	13.98
2010	8	UQ	21.70	9.58	9.84	0.96	189.50	199.50	70.50	2640.00	19.50	289.00	66.19
2010	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2010	9	Median	15.90	9.50	8.98	0.74	214.50	175.50	30.50	2420.00	9.00	31.00	17.87
2010	9	Arithmetic Mean	15.91	9.46	9.03	0.69	215.60	206.31	34.00	2851.88	11.38	123.69	31.76
2010	9	Coefficient of Variation	0.07	0.03	0.26	0.38	0.59	0.46	0.47	0.45	1.00	1.96	0.85
2010	9	LQ	15.02	9.37	7.84	0.56	112.00	147.00	25.50	2225.00	4.00	27.00	14.08
2010	9	UQ	16.90	9.64	10.86	0.81	284.00	221.00	36.50	2905.00	11.50	98.50	39.55
2011	6	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2011	6	Median	16.06	8.06	8.35	1.05	12.60	48.00	5.00	655.00	14.00	49.50	1.43
2011	6	Arithmetic Mean	15.25	8.10	8.37	1.17	13.51	49.29	5.19	665.67	18.46	49.29	1.47
2011	6	Coefficient of Variation	0.24	0.03	0.12	0.26	0.39	0.31	0.40	0.21	0.60	0.53	0.45
2011	6	LQ	10.63	7.98	7.86	0.95	9.28	41.50	4.00	605.00	10.00	36.00	0.94
2011	6	UQ	18.97	8.26	9.32	1.50	15.55	52.00	6.50	698.00	27.00	68.00	2.00
2011	7	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2011	7	Median	20.09	9.59	10.19	0.77	115.00	97.00	7.00	1665.00	4.00	23.00	13.73
2011	7	Arithmetic Mean	19.79	9.63	9.84	0.76	136.04	106.50	7.81	1743.13	4.94	32.75	19.34

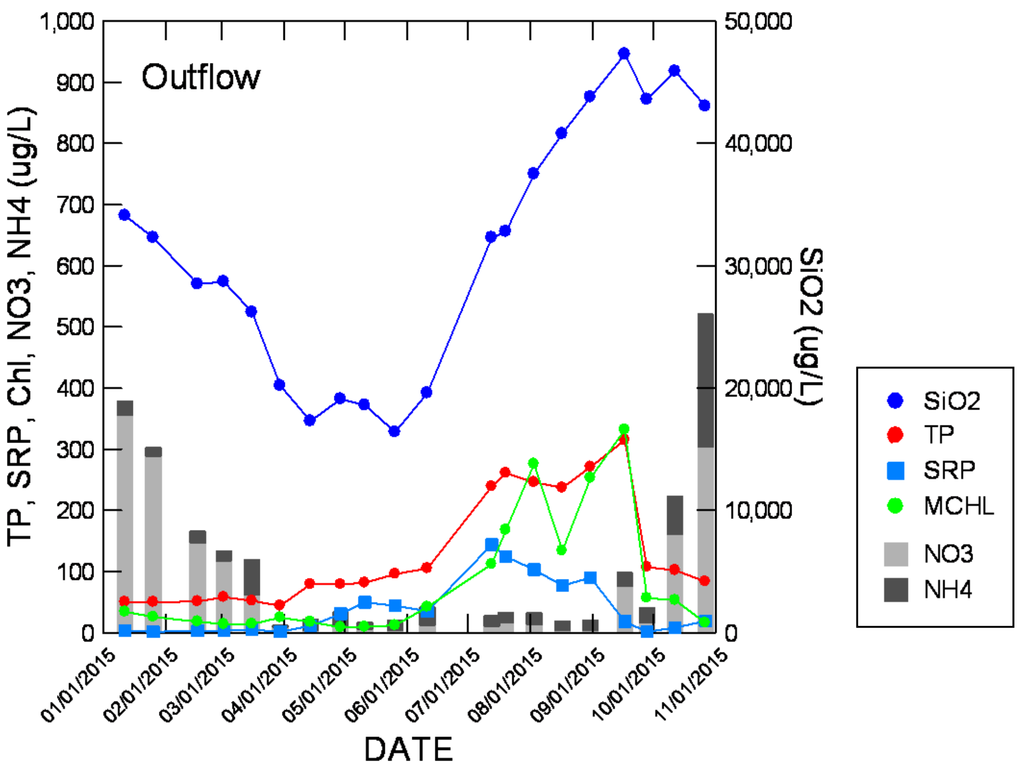
Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2011	7	Coefficient of Variation	0.06	0.02	0.14	0.22	0.54	0.28	0.54	0.28	0.41	0.93	0.81
2011	7	LQ	18.58	9.49	8.91	0.71	96.65	88.00	4.00	1500.00	4.00	17.00	11.65
2011	7	UQ	20.84	9.73	10.49	0.83	166.50	121.50	9.50	1805.00	4.00	36.00	22.37
2011	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2011	8	Median	21.98	9.05	7.45	1.03	42.50	205.50	70.50	1870.00	19.00	114.00	47.37
2011	8	Arithmetic Mean	21.71	9.03	7.26	1.01	84.51	218.13	74.88	2091.88	25.25	200.13	55.06
2011	8	Coefficient of Variation	0.05	0.05	0.35	0.46	1.50	0.30	0.19	0.48	0.79	0.97	0.80
2011	8	LQ	21.38	8.85	5.52	0.78	8.45	184.00	64.00	1525.00	15.50	49.00	19.14
2011	8	UQ	22.51	9.28	9.62	1.41	81.45	227.50	83.00	2285.00	26.00	291.50	74.05
2011	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2011	9	Median	18.12	8.98	8.84	0.79	86.55	187.00	34.50	1660.00	23.50	165.50	27.65
2011	9	Arithmetic Mean	18.29	8.91	8.42	0.89	93.19	185.88	52.25	1771.88	30.69	171.81	34.56
2011	9	Coefficient of Variation	0.10	0.03	0.28	0.35	0.64	0.22	0.79	0.27	0.77	0.81	0.81
2011	9	LQ	16.70	8.72	6.42	0.65	51.30	144.50	13.50	1525.00	14.00	39.50	9.68
2011	9	UQ	20.08	9.11	10.34	1.01	115.50	210.50	96.00	1890.00	42.50	279.00	62.31
2012	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2012	6	Median	16.37	8.13	8.45	1.03	10.50	80.00	31.50	687.00	6.00	24.00	1.03
2012	6	Arithmetic Mean	16.33	8.10	8.44	1.04	14.38	82.06	31.31	692.38	11.31	36.44	1.15
2012	6	Coefficient of Variation	0.09	0.04	0.04	0.12	0.59	0.13	0.14	0.13	0.86	0.72	0.44
2012	6	LQ	15.06	7.82	8.19	0.94	7.00	72.50	28.50	622.00	4.00	17.50	0.77
2012	6	UQ	17.77	8.33	8.72	1.15	23.50	87.50	34.50	734.00	18.50	50.00	1.53
2012	7	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2012	7	Median	21.14	9.65	8.67	0.58	152.00	182.50	49.00	1975.00	9.00	38.00	23.02
2012	7	Arithmetic Mean	20.73	9.62	8.71	0.63	184.71	201.88	67.63	2180.25	10.75	63.67	39.14
2012	7	Coefficient of Variation	0.06	0.04	0.24	0.54	0.87	0.54	0.82	0.59	0.42	1.01	1.02
2012	7	LQ	19.52	9.29	6.77	0.40	68.00	100.50	20.00	1155.00	8.50	25.00	15.54
2012	7	UQ	21.76	9.93	10.56	0.91	258.00	274.50	138.00	2770.00	12.00	69.00	45.75
2012	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2012	8	Median	20.98	9.09	6.70	0.80	68.50	223.00	91.50	2085.00	34.50	113.50	33.53
2012	8	Arithmetic Mean	21.13	9.04	6.41	0.78	100.19	239.13	95.19	2243.13	42.69	265.75	55.28
2012	8	Coefficient of Variation	0.07	0.05	0.46	0.38	1.02	0.39	0.44	0.30	0.91	1.07	0.88
2012	8	LQ	19.89	8.86	4.12	0.58	33.50	173.50	73.00	1980.00	13.00	57.50	24.91
2012	8	UQ	22.41	9.37	9.18	1.04	130.00	276.00	133.00	2260.00	56.50	467.00	72.26
2012	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2012	9	Median	18.13	8.03	7.50	0.81	51.00	92.00	7.50	1520.00	78.50	100.50	3.05
2012	9	Arithmetic Mean	17.89	8.08	7.04	0.85	49.19	88.38	13.25	1523.75	96.69	137.00	4.47
2012	9	Coefficient of Variation	0.07	0.06	0.22	0.25	0.65	0.30	1.02	0.24	0.54	0.97	0.78
2012	9	LQ	17.35	7.72	5.87	0.73	23.50	63.00	4.00	1175.00	61.50	34.50	1.72
2012	9	UQ	18.64	8.37	7.91	1.02	70.50	114.50	18.00	1715.00	147.00	206.00	6.82
2013	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2013	6	Median	17.61	9.33	9.55	0.66	71.90	128.00	19.50	1365.00	8.50	16.00	6.56
2013	6	Arithmetic Mean	17.69	9.29	9.82	0.72	92.24	128.50	21.31	1448.25	7.75	19.25	9.10
2013	6	Coefficient of Variation	0.03	0.06	0.09	0.32	0.76	0.21	0.60	0.44	0.31	0.75	1.19

Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2013	6	LQ	17.21	8.80	9.06	0.54	28.90	102.50	9.00	911.50	6.00	11.50	2.08
2013	6	UQ	18.12	9.82	10.43	0.89	158.00	155.50	32.50	2025.00	9.00	22.00	11.78
2013	7	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2013	7	Median	22.62	9.98	8.36	0.55	154.00	274.50	112.50	2510.00	4.00	59.50	49.28
2013	7	Arithmetic Mean	22.78	9.97	7.74	0.53	223.74	297.63	105.42	2987.08	5.67	94.04	71.66
2013	7	Coefficient of Variation	0.04	0.03	0.22	0.43	0.94	0.38	0.35	0.56	0.57	1.09	1.05
2013	7	LQ	22.06	9.79	6.55	0.34	110.00	240.00	72.50	2180.00	4.00	13.50	11.74
2013	7	UQ	23.25	10.20	8.84	0.67	270.50	320.50	138.00	3335.00	6.00	159.00	125.89
2013	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2013	8	Median	19.98	8.05	5.02	0.92	33.85	174.00	49.50	1805.00	208.50	262.00	7.76
2013	8	Arithmetic Mean	19.81	8.13	4.76	1.04	42.98	187.75	62.28	1891.25	225.06	286.06	17.44
2013	8	Coefficient of Variation	0.03	0.09	0.51	0.26	1.02	0.58	0.51	0.22	0.75	0.91	1.25
2013	8	LQ	19.38	7.50	2.32	0.89	6.96	110.00	45.00	1505.00	69.50	71.00	3.75
2013	8	UQ	20.31	8.78	6.25	1.25	58.35	221.00	97.00	2270.00	343.50	394.50	27.11
2013	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2013	9	Median	16.79	7.65	6.71	0.89	10.01	89.00	31.50	1235.00	326.50	55.00	0.57
2013	9	Arithmetic Mean	16.78	7.64	6.60	0.89	15.22	91.13	30.13	1256.25	314.25	51.75	0.69
2013	9	Coefficient of Variation	0.16	0.03	0.20	0.17	0.75	0.12	0.32	0.11	0.25	0.50	0.57
2013	9	LQ	14.23	7.52	5.80	0.80	8.17	85.00	22.00	1155.00	249.00	36.00	0.46
2013	9	UQ	18.87	7.81	7.69	1.02	18.60	98.50	37.00	1335.00	372.00	58.00	0.71
2014	6	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2014	6	Median	16.73	9.03	9.52	0.71	66.90	160.50	58.50	1313.50	4.00	11.00	4.08
2014	6	Arithmetic Mean	16.78	9.00	9.64	0.78	75.69	163.19	57.94	1384.25	6.94	19.94	3.87
2014	6	Coefficient of Variation	0.09	0.09	0.12	0.41	0.87	0.22	0.36	0.54	0.66	0.77	0.64
2014	6	LQ	15.62	8.27	8.63	0.51	12.50	131.50	43.50	671.50	4.00	9.50	1.57
2014	6	UQ	18.09	9.71	10.74	1.07	128.00	196.50	75.00	2070.00	11.50	31.00	5.84
2014	7	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2014	7	Median	21.33	9.76	9.34	0.66	77.40	339.50	180.50	2335.00	9.00	75.50	45.42
2014	7	Arithmetic Mean	21.71	9.67	8.70	0.79	132.02	336.13	160.88	2812.08	10.83	138.79	73.34
2014	7	Coefficient of Variation	0.09	0.04	0.31	0.40	1.08	0.29	0.31	0.42	0.83	1.15	1.04
2014	7	LQ	20.23	9.31	7.26	0.55	38.30	252.00	112.50	1995.00	4.00	17.50	14.19
2014	7	UQ	23.49	9.96	10.61	1.05	180.50	394.00	195.00	3180.00	13.00	214.50	98.92
2014	8	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2014	8	Median	20.76	8.19	6.20	0.92	27.20	177.00	66.50	1560.00	174.50	64.50	5.39
2014	8	Arithmetic Mean	20.24	8.28	5.52	0.93	45.04	195.38	85.44	1883.75	192.88	159.50	16.21
2014	8	Coefficient of Variation	0.08	0.06	0.42	0.27	1.18	0.42	0.57	0.40	0.63	1.36	1.50
2014	8	LQ	18.98	7.95	3.74	0.75	13.40	128.50	48.50	1395.00	94.00	32.00	1.11
2014	8	UQ	21.49	8.70	7.53	1.05	59.70	233.50	130.00	2205.00	308.50	119.50	18.58
2014	9	N of Cases	16.00	16.00	16.00	16.00	15.00	16.00	16.00	16.00	16.00	16.00	16.00
2014	9	Median	18.42	7.99	7.79	1.02	20.50	109.00	30.00	1130.00	15.00	20.50	0.95
2014	9	Arithmetic Mean	18.43	8.14	7.87	1.00	22.19	106.25	28.63	1105.06	18.13	24.63	1.50
2014	9	Coefficient of Variation	0.03	0.05	0.11	0.16	0.49	0.16	0.33	0.22	0.48	0.64	1.07
2014	9	LQ	18.09	7.82	7.37	0.90	13.63	95.00	24.50	983.00	11.50	14.50	0.50

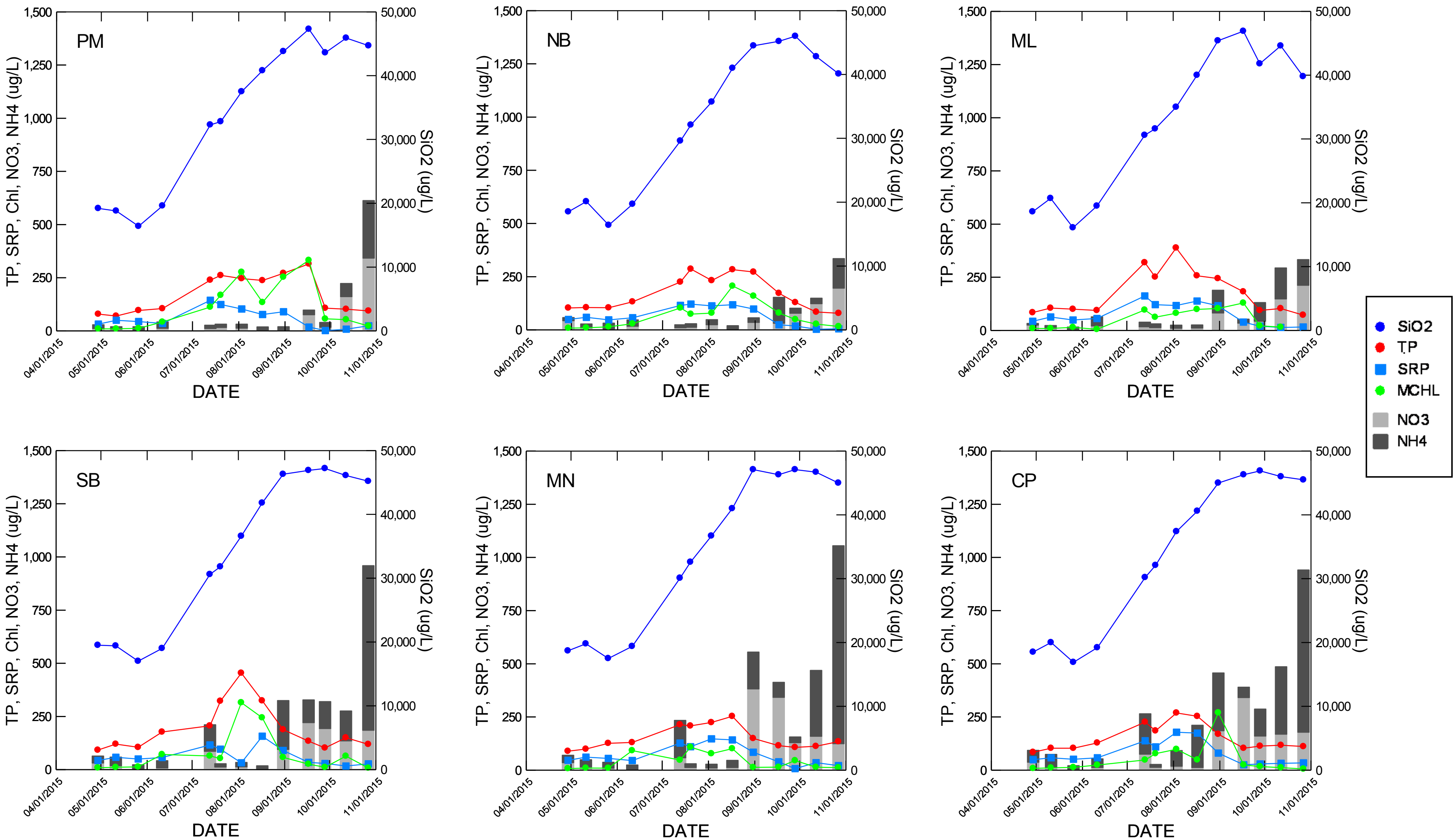
Year	Month	Parameter	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Secchi Depth (m)	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)	Total Nitrogen (µg/L)	NO3+NO2 Nitrogen (µg/L)	NH4 Nitrogen (µg/L)	Un-ionized Ammonia (µg/L)
2014	9	UQ	18.78	8.49	8.25	1.12	27.65	114.00	34.50	1205.00	21.00	28.50	2.15
2015	6	N of Cases	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
2015	6	Median	20.79	8.87	8.73	1.43	50.50	130.50	54.00	1145.00	12.00	32.00	7.86
2015	6	Arithmetic Mean	20.81	8.85	9.07	1.35	74.61	139.13	48.13	1316.88	11.25	31.38	6.90
2015	6	Coefficient of Variation	0.03	0.04	0.13	0.35	1.15	0.28	0.25	0.52	0.53	0.33	0.34
2015	6	LQ	20.38	8.72	8.27	1.08	26.35	116.50	40.00	908.50	6.00	25.00	5.28
2015	6	UQ	21.33	8.95	10.04	1.54	81.55	154.50	57.00	1515.00	14.50	40.00	8.58
2015	7	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2015	7	Median	21.67	9.35	10.49	0.85	75.85	250.50	122.50	1515.00	14.50	18.00	11.55
2015	7	Arithmetic Mean	21.65	9.30	10.10	0.96	90.18	255.63	127.75	1687.81	32.63	107.50	24.05
2015	7	Coefficient of Variation	0.02	0.05	0.19	0.28	0.52	0.20	0.18	0.36	0.92	1.61	1.03
2015	7	LQ	21.35	8.91	9.02	0.75	57.35	219.50	112.50	1355.00	12.00	16.00	10.25
2015	7	UQ	21.95	9.61	11.22	1.25	110.00	275.50	141.00	1775.00	63.50	150.50	39.44
2015	8	N of Cases	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
2015	8	Median	19.88	9.78	8.13	0.57	118.50	255.00	114.50	2220.00	12.50	23.00	16.44
2015	8	Arithmetic Mean	20.02	9.62	7.35	0.67	147.53	266.25	113.46	2392.08	42.63	108.04	51.52
2015	8	Coefficient of Variation	0.10	0.04	0.32	0.43	0.58	0.25	0.31	0.35	1.95	1.34	1.32
2015	8	LQ	18.71	9.41	5.27	0.45	79.80	234.50	87.00	1810.00	9.00	17.00	11.95
2015	8	UQ	21.84	9.86	9.19	0.87	225.00	281.00	140.00	2675.00	29.50	183.50	68.57
2015	9	N of Cases	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
2015	9	Median	14.41	8.65	6.25	0.77	49.05	124.00	29.00	1550.00	77.00	80.50	6.37
2015	9	Arithmetic Mean	14.69	8.61	6.56	0.74	69.52	149.38	27.47	1891.25	122.56	159.75	15.58
2015	9	Coefficient of Variation	0.10	0.06	0.26	0.30	1.14	0.41	0.47	0.41	0.87	1.97	1.45
2015	9	LQ	13.60	8.25	5.22	0.55	22.90	107.00	19.00	1465.00	38.50	25.50	3.55
2015	9	UQ	16.08	9.15	8.08	0.84	74.65	172.50	36.50	2040.00	176.50	127.00	21.42

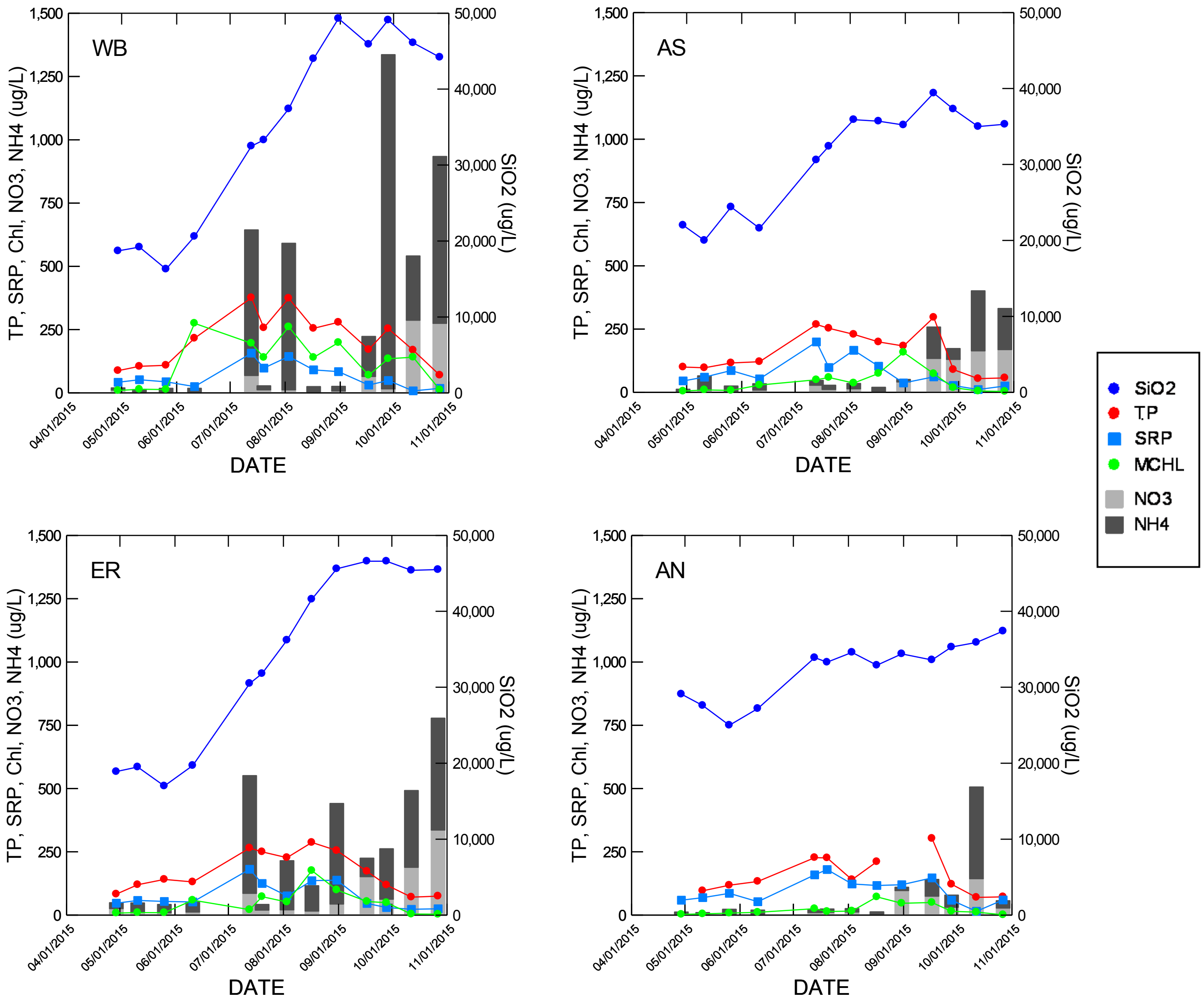
APPENDIX II: 2015 Seasonal trends in silica and other nutrient parameters in UKL and UKL Outflow (lake-wide mean shown with standard error).





2015 Seasonal trends in silica and other nutrient parameters by station in UKL




WB
AS
ER
AN
TP, SRP, Chl, NO3, NH4 (ug/L)
SiO2 (ug/L)
DATE
1,500
1,250
1,000
750
500
250
0
50,000
40,000
30,000
20,000
10,000
04/01/2015
05/01/2015
06/01/2015
07/01/2015
08/01/2015
09/01/2015
10/01/2015
11/01/2015
SiO2
TP
SRP
MCHL
NO3
NH4