Aquatic Ecosystem Sciences LLC

TECHNICAL MEMORANDUM

# Upper Klamath Lake 2018 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 2018). The UKL electronic water quality database is now updated with 2018 data (*see Excel spreadsheet: UKL_1990-2018_data_ver_6_28_2019.xlsx*). 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; Nielsen et al. 2018). The current 2018 data report is intended to serve as an annual update to the UKL water quality database, including a summary of 2018 data (basic summary statistics and graphical analysis), and limited comparison of inter- annual trends of UKL data collected for the 29 year period between 1990 and 2018.

## 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 (ARI) to the Sprague River Water Quality Laboratory in Chiloquin OR (SRWQL). During the transition period duplicate samples were analyzed by both laboratories to confirm parameter reproducibility. With the exception of chlorophyll-a[1], all parameters were within acceptable limits with respect to relative percent differences among labs and to expected 1:1 relationships.

During the 2018 sampling season limnological data (Table 1) were collected approximately biweekly from the end of April through October[2] at 10 standardized stations in UKL and Agency Lake (Figure 1; Figure 2). Nutrient quality assurance/quality control analyses are contained in data spreadsheets (UKL_1990-2018_data_with QA_ver_6_28_2019.xlsx and UKL_1990-2018_QA_only.xlsx) available upon request.

In addition, beginning in 2016 the Klamath Tribes initiated data collection for the cyanotoxin, microcystin. Samples were collected both as surface grab and depth-integrated samples at five locations: ALBL (Agency Lake Boat Launch- surface grab only), PM, ER, MN, and AS. Samples were analyzed at the SRWQL using ELISA methodology for total microcystins[3].

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[1] Chlorophyll-a was adjusted to account for a change from spectrophotometric method to fluorometric method beginning in 2009. Between 1990 and 2008 the spectrophotometric method was used by the Aquatic Research Inc. laboratory (ARI) and beginning in 2009 the Sprague River Water Quality Lab (SRWQL) used the fluorometric method. The fluorometric method is more sensitive so values beginning in 2009 are higher relative to years prior to 2009, especially at higher Chl levels. The adjustment is based on 225 split samples collected between 2007 and 2008 that were analyzed by both labs (Appendix III). The adjusted values are used for all time-series comparisons that include data prior to 2009, and the un-adjusted values are used when evaluating individual years.

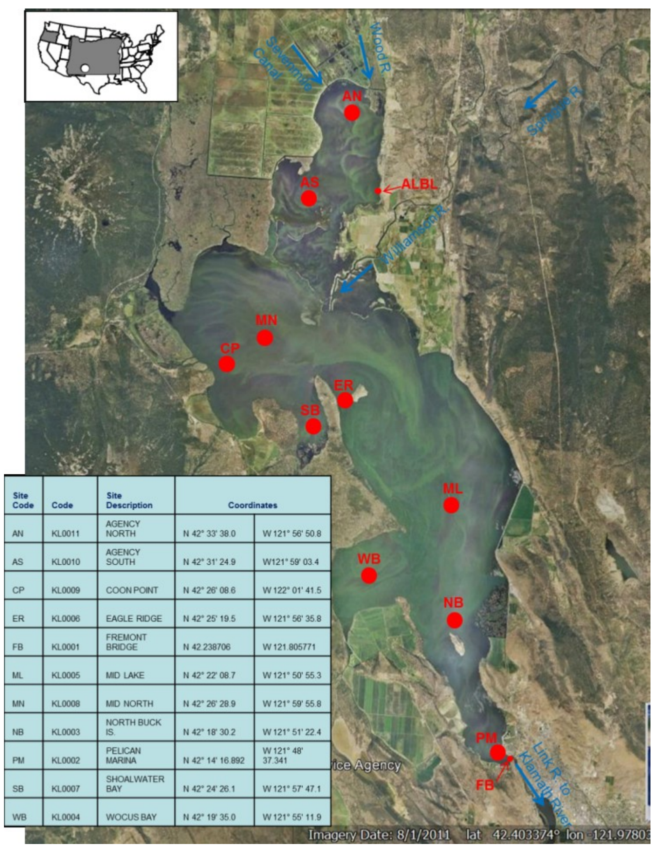
[2] Note that the Fremont Bridge station at the outlet of UKL was sampled prior to April and after October as part of the tributary loading study (see Kann 2015) and based on analyses showing that PM and FB values follow a 1:1 trajectory values for both stations are included here with FB renamed PM for those months (see Figure 2).

[3]EPA Method 546 analyzes for “total” microcystins (MC) and nodularins (NOD) in finished drinking water and in ambient water using enzyme-linked immunosorbent assay (ELISA). The term “Total microcystins and nodularins” is defined as the sum of the congener-independent, intracellular and extracellular microcystin and nodularin that is measurable in a sample.

**Table 1. Limnological parameters sampled in Upper Klamath Lake, 2018.**

| 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 = depth-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.




| Site Code | Code | Site Description | Coordinates | |
|---|---|---|---|---|
| AN | KL0011 | AGENCY NORTH | N 42° 33' 38.0 | W 121° 56' 50.8 |
| AS | KL0010 | AGENCY SOUTH | N 42° 31' 24.9 | W121° 59' 03.4 |
| CP | KL0009 | COON POINT | N 42° 26' 08.6 | W 122° 01' 41.5 |
| ER | KL0006 | EAGLE RIDGE | N 42° 25' 19.5 | W 121° 56' 35.8 |
| FB | KL0001 | FREMONT BRIDGE | N 42.238706 | W 121.805771 |
| ML | KL0005 | MID LAKE | N 42° 22' 08.7 | W 121° 50' 55.3 |
| MN | KL0008 | MID NORTH | N 42° 26' 28.9 | W 121° 59' 55.8 |
| NB | KL0003 | NORTH BUCK IS. | N 42° 18' 30.2 | W 121° 51' 22.4 |
| PM | KL0002 | PELICAN MARINA | N 42° 14' 16.892 | W 121° 48' 37.341 |
| SB | KL0007 | SHOALWATER BAY | N 42° 24' 26.1 | W 121° 57' 47.1 |
| WB | KL0004 | WOCUS BAY | N 42° 19' 35.0 | W 121° 55' 11.9 |

**Figure 1. Location of Upper Klamath Lake sampling stations, 2018. Google Earth Imagery date 8/1/2011.**

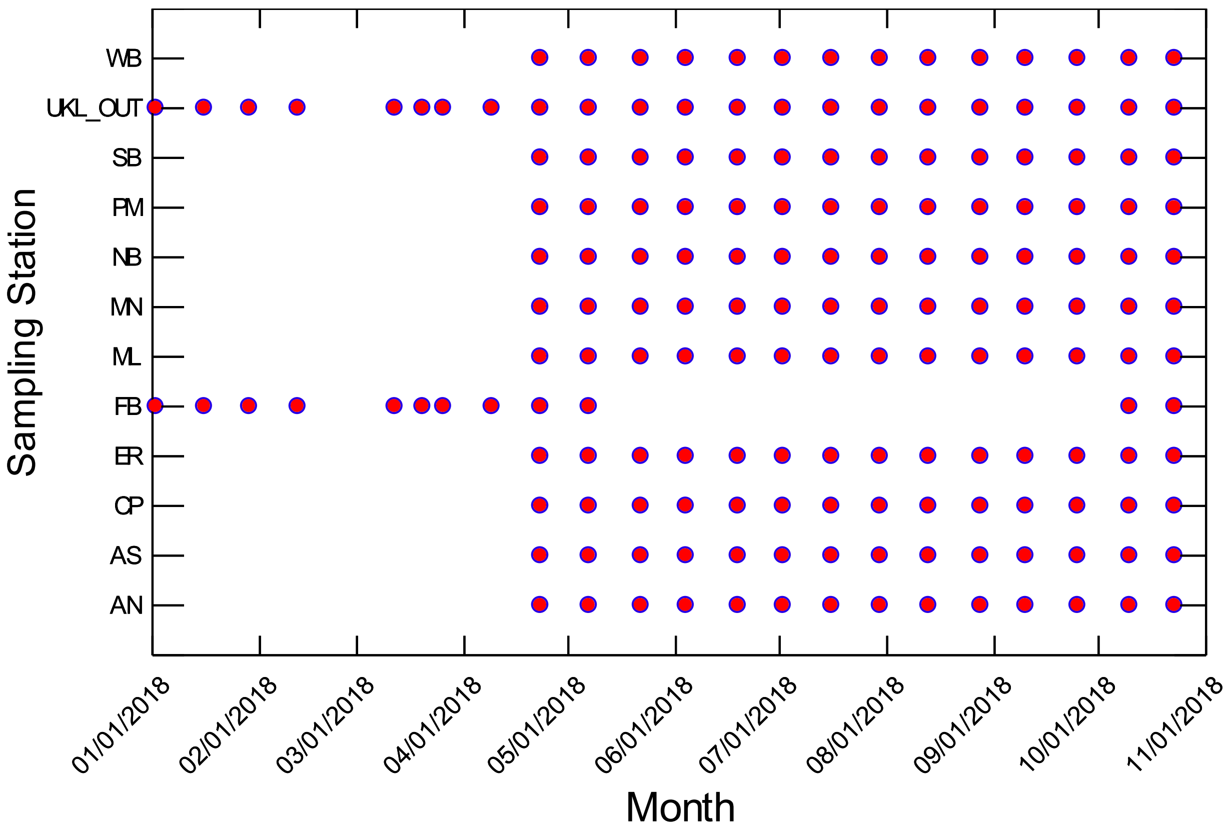



**Figure 2. Spatial-temporal sampling matrix for Upper Klamath Lake, 2018.**

Due to a gap in 2015 Klamath Tribe data collection[4] between June 11th and July 13th, 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 (see Kann 2016 for data description).

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[5]. 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).

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

[5] 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)[6]. Water temperature in 2018 ranged from 9-11 $^{o}$C during late-April and then warmed in early-May to ~15 $^{o}$C. Values then increased through late-May, remained constant in early-June (18 $^{o}$C), declined to <18 $^{o}$C in mid-June before increasing to seasonal highs from early-July to early-August (~23 $^{o}$C), with the seasonal peak occurring during late-July. Overall this is in contrast to 2011 when temperatures generally remained below 12 $^{o}$C into early-June. Temperatures then declined during mid-August and continued to decline through the fall months (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 2018 was slightly elevated in late-April (~8.5), declined to values <8.0 in early-May before increasing again in late-May and early-June (8.0-8.5). Between early- and late-June values increased sharply (>9.5), peaked in early-July, and then gradually declined through the remainder of the season. Consistent with the lack of a temperature increase in early-June, pH also remained relatively low during that period.

Matching the pattern in pH, water column DO values in 2018 were slightly elevated (>10 mg/L) in late-April before declining and remaining <9.0 mg/L between early-May and early-June (Figure 3 and Figure 4). Beginning in mid- to late-June DO increased sharply at most stations, declined slightly in early-July, increased again in mid-July, and beginning in late-July DO began to decline with seasonal minima occurring during August (Figure 3 to Figure 5). 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, for example). 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 both 2015 and 2016 algal biomass did again appear to increase earlier in June in response to higher June temperatures. Similar to 2017 when cooler June temperatures appeared to delay the bloom, suppressed June temperatures in 2018 were also associated with a delayed bloom and both lower pH and DO. Following a more moderate bloom decline than was observed in 2017 (Figure 8), August DO minima in 2018 were also less severe than in 2017 (Figure 5). As shown below and in earlier data and analytical reports (e.g., Kann 2011; Jassby and Kann 2010; Nielsen et al. 2018), 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.

[6] 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).

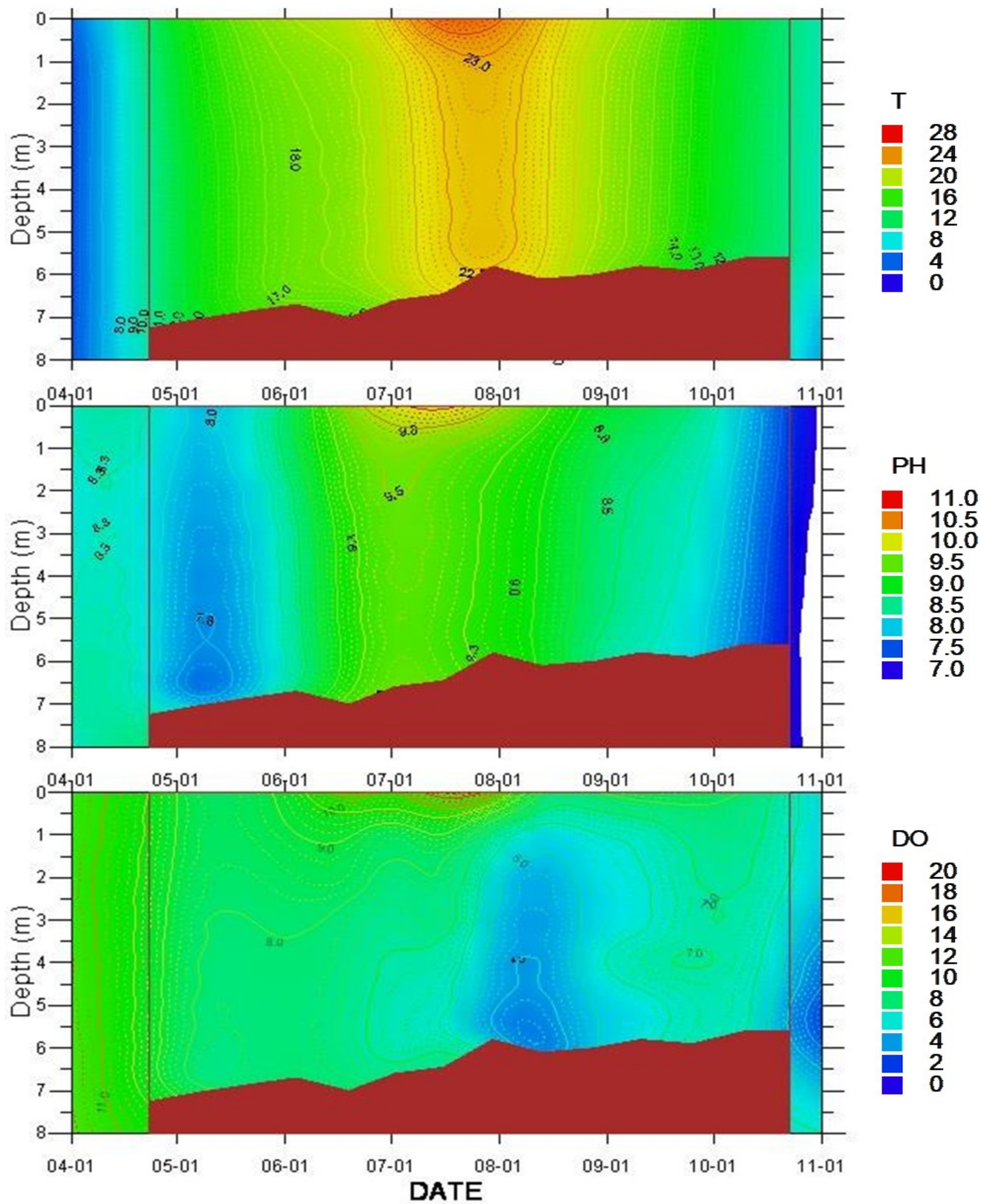



**Figure 3. Depth-time distributions of isotherms of T (°C) and isopleths of D.O (mg/L) and pH at UKL station Eagle Ridge (ER), 2018. Note: 1) brown shaded area on the abscissa denotes the bottom profile depth, and 2) contours are not valid outside of vertical brown lines (begin and end dates for seasonal sampling).**

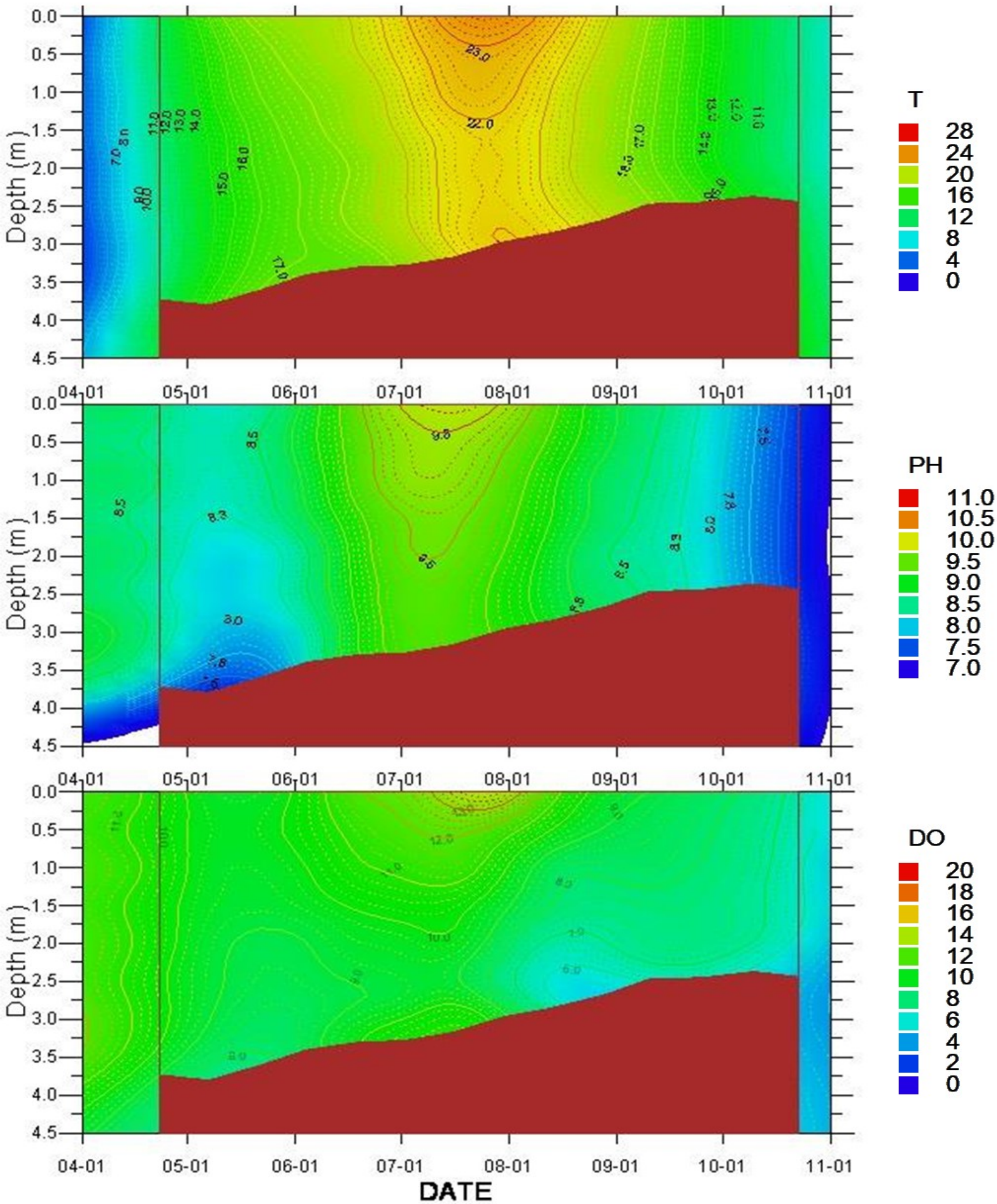



**Figure 4. Depth-time distributions of isotherms of T (˚C) and isopleths of D.O (mg/L) and pH at UKL station Mid North (MN), 2018. Note: 1) brown shaded area on the abscissa denotes the bottom profile depth, and 2) contours are not valid outside of vertical brown lines (begin and end dates for seasonal sampling).**

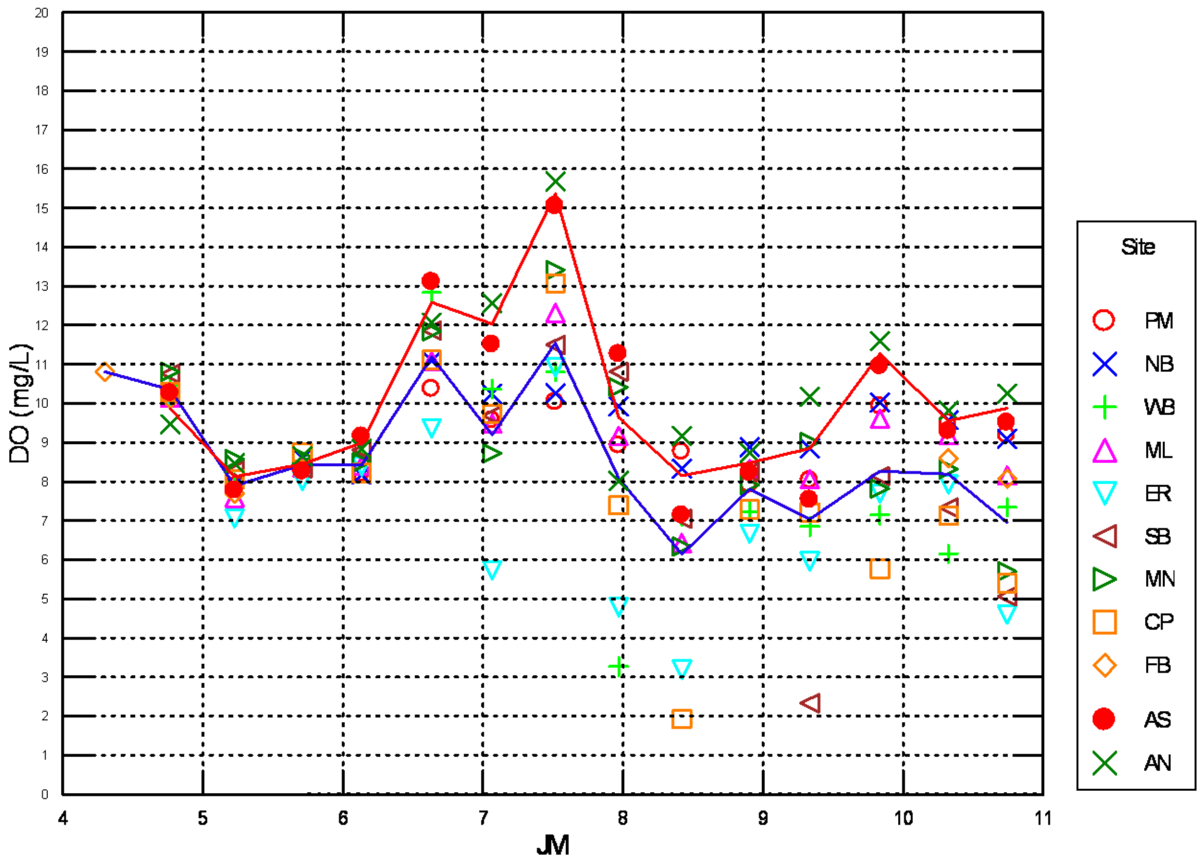



**Figure 5. Water column mean dissolved oxygen values in Upper Klamath Lake in 2018.**

*2017 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, DO was skewed lower for ER and CP (Figure 6)[7]. Secchi depth (transparency) was somewhat lower at PM, WB, and CP and higher at AS and AN. In general and following the trend in bloom dynamics (bloom declines were not as severe in the southern region – see below), stations in the southern region (PM, NB, and ML) tended to have higher pH and DO than the northern stations (ER, SB, MN, and CP). These among-station patterns are not always consistent from year-to-year (see Kann 2011-2018).

Stations PM and WB were among the highest with respect to median and/or upper quartile CHL, while the lower quartile and inter-quartile range for CHL at AS and AN were among the lowest (Figure 7). The low 2018 values at AS and AN were similar to 2012 when both AS and AN showed noticeably lower CHL relative to other stations, especially compared to previous years (Kann 2012). 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 relative to other stations in 2018 (Figure 7). With the exception of SB which was skewed low for SRP, SRP values were similar overall among stations.

Similar to previous years, Agency Lake stations were among the lowest for nitrogen, particularly for TN and for $NH_4$-N (Figure 7; Table 2). The upper quartile value and interquartile range for TN were highest at WB, ER, and SB. Similar to 2010-2017, ER and CP were among the highest for ammonia, and SB, MN, and WB were also high in 2018 ($NH_4$-N; Figure 7; Table 2). Un-ionized ammonia also tended to be highest at ER and CP in 2018 (Figure 7). As in previous years un-ionized ammonia was also high at WB. $NO_3$-N was more similar among sites, but unlike 2017 when values tended to be higher at AS and AN, values in 2018 at AS and AN were lower than other stations. Ammonia values at AS and AN were also lower than other stations in 2018.

Median silica values (~40,000 µg/L)[8] were similar among stations, although medians and UQ values at the Agency Lake stations were lower and showed a narrower interquartile range[9] (Figure 7). See below for a description of seasonal silica dynamics.

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[7] In past years the DO distribution was skewed higher for AS and AN, but in 2017 this was not the case as stations in the southern region of the lake showed high interquartile ranges that were at times higher than AS and AN.
[8] Median values were ~30,000 µg/L in 2012.
[9] The spatial pattern of lower silica medians and narrower interquartile range at the Agency Lake stations is consistent year-to-year.

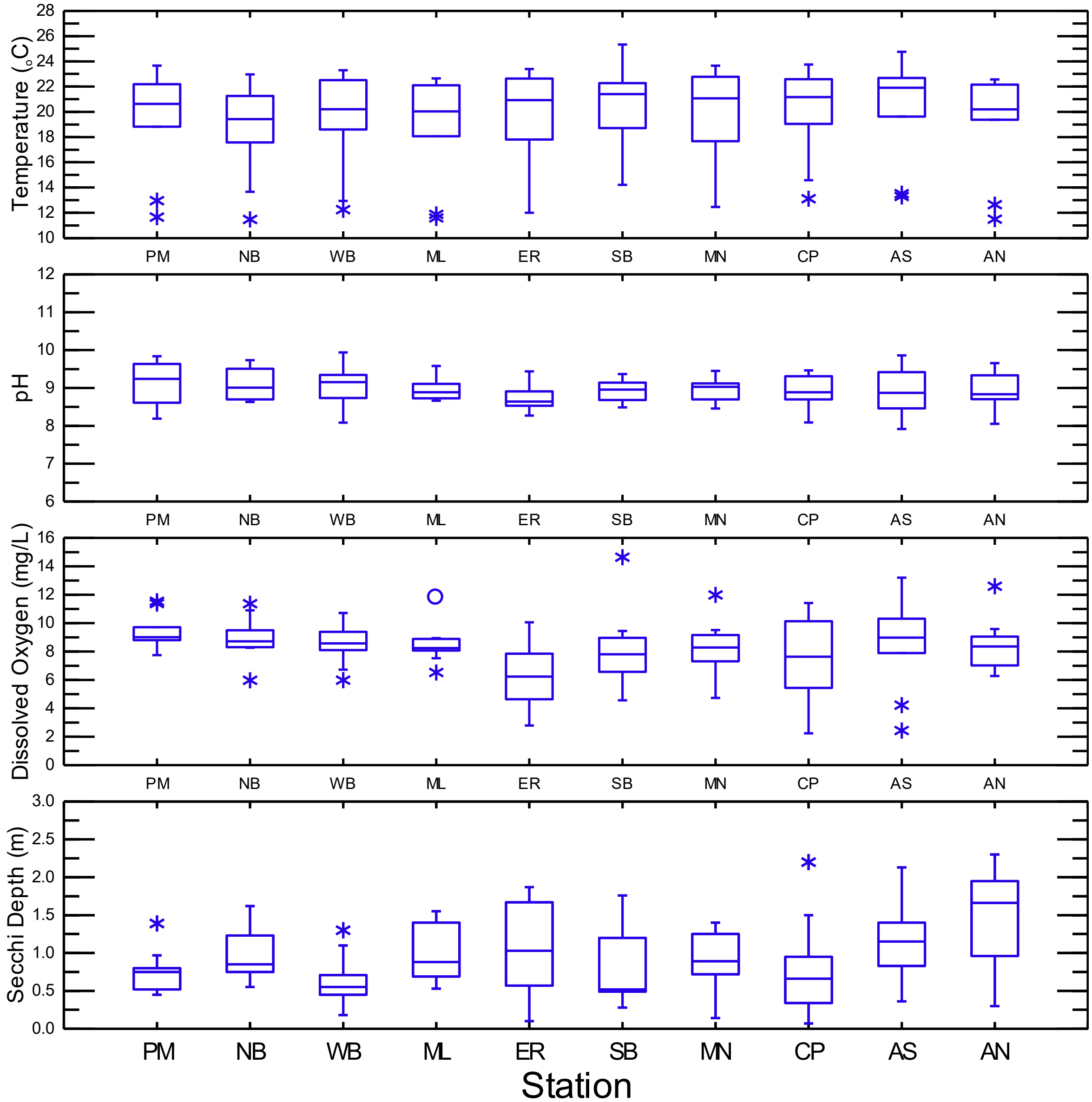


**Figure 6. Station distributions of T (˚C), pH, D.O (mg/L), and Secchi depth, June-September, 2018.**

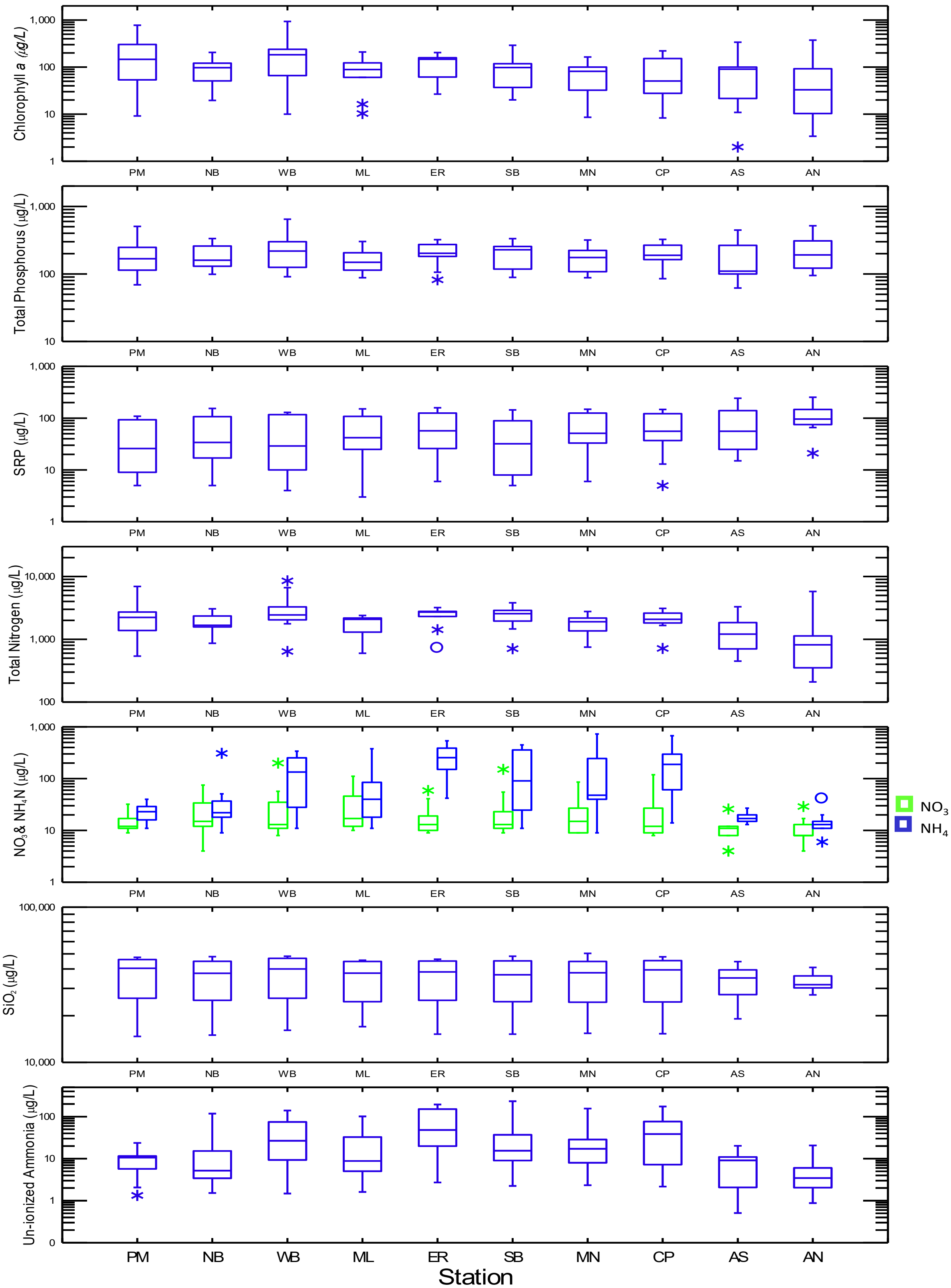


**Figure 7. Station distributions of CHL, TP, SRP, TN, $NO_3$+ $NO_2$-N, $NH_4$-N, $SiO_2$ and un-ionized ammonia, June-September, 2018.**

**Table 2. Water Column mean summary statistics for each UKL station for the June-September period, 2018 (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) | NO3+ NO2 Nitrogen (µg/L) | NH4 Nitrogen (µg/L) | Un-ionized Ammonia (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2018 | AS | 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 |
| 2018 | AS | Median | 19.68 | 9.35 | 10.95 | 0.85 | 90.50 | 110.00 | 56.00 | 1210.00 | 35000.00 | 11.00 | 17.00 | 9.12 |
| 2018 | AS | Arithmetic Mean | 20.22 | 9.16 | 10.43 | 0.93 | 102.08 | 203.67 | 94.22 | 1515.44 | 33300.00 | 11.00 | 18.11 | 7.88 |
| 2018 | AS | Coefficient of Variation | 0.13 | 0.08 | 0.25 | 0.60 | 1.11 | 0.73 | 0.93 | 0.69 | 0.25 | 0.59 | 0.23 | 0.84 |
| 2018 | AS | LQ | 18.82 | 8.59 | 8.05 | 0.68 | 18.93 | 97.75 | 24.25 | 687.00 | 26550.00 | 7.00 | 15.00 | 2.05 |
| 2018 | AS | UQ | 22.36 | 9.79 | 11.90 | 1.08 | 133.18 | 306.00 | 160.75 | 2127.50 | 39600.00 | 12.00 | 20.25 | 11.55 |
| 2018 | ER | 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 |
| 2018 | ER | Median | 18.61 | 9.11 | 6.67 | 0.60 | 147.00 | 202.00 | 57.00 | 2710.00 | 38300.00 | 13.00 | 255.00 | 48.15 |
| 2018 | ER | Arithmetic Mean | 19.38 | 8.95 | 6.97 | 0.77 | 120.97 | 214.33 | 71.67 | 2407.11 | 34444.44 | 20.56 | 278.67 | 87.20 |
| 2018 | ER | Coefficient of Variation | 0.16 | 0.06 | 0.34 | 0.73 | 0.49 | 0.40 | 0.83 | 0.34 | 0.35 | 0.85 | 0.66 | 0.91 |
| 2018 | ER | LQ | 17.97 | 8.43 | 5.49 | 0.34 | 60.50 | 163.00 | 21.25 | 2087.50 | 23600.00 | 9.75 | 124.25 | 16.86 |
| 2018 | ER | UQ | 21.83 | 9.45 | 8.63 | 1.08 | 159.25 | 285.00 | 129.00 | 2857.50 | 45225.00 | 24.50 | 416.75 | 158.01 |
| 2018 | ML | 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 |
| 2018 | ML | Median | 17.96 | 9.21 | 9.17 | 0.84 | 88.70 | 149.00 | 42.00 | 2080.00 | 37600.00 | 17.00 | 40.00 | 8.80 |
| 2018 | ML | Arithmetic Mean | 18.74 | 9.09 | 9.21 | 1.06 | 94.40 | 177.44 | 65.56 | 1779.89 | 34500.00 | 33.78 | 97.78 | 24.04 |
| 2018 | ML | Coefficient of Variation | 0.16 | 0.07 | 0.19 | 0.57 | 0.67 | 0.45 | 0.87 | 0.36 | 0.34 | 1.01 | 1.33 | 1.34 |
| 2018 | ML | LQ | 17.34 | 8.51 | 8.26 | 0.66 | 49.53 | 109.75 | 20.00 | 1247.50 | 23300.00 | 11.50 | 17.50 | 4.78 |
| 2018 | ML | UQ | 21.00 | 9.62 | 9.98 | 1.24 | 129.75 | 228.00 | 116.00 | 2225.00 | 44875.00 | 49.75 | 127.50 | 35.26 |
| 2018 | MN | 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 |
| 2018 | MN | Median | 18.40 | 8.97 | 8.72 | 1.00 | 81.20 | 175.00 | 51.00 | 1900.00 | 37800.00 | 15.00 | 48.00 | 17.16 |
| 2018 | MN | Arithmetic Mean | 19.22 | 8.96 | 9.33 | 1.10 | 73.42 | 180.22 | 75.44 | 1839.89 | 34900.00 | 29.11 | 199.11 | 33.53 |
| 2018 | MN | Coefficient of Variation | 0.16 | 0.07 | 0.24 | 0.37 | 0.66 | 0.50 | 0.76 | 0.35 | 0.37 | 1.03 | 1.32 | 1.42 |
| 2018 | MN | LQ | 17.43 | 8.23 | 7.89 | 0.84 | 31.93 | 103.25 | 28.25 | 1337.50 | 22975.00 | 9.00 | 37.00 | 7.10 |
| 2018 | MN | UQ | 21.66 | 9.52 | 10.77 | 1.44 | 101.68 | 244.75 | 131.00 | 2277.50 | 45300.00 | 39.00 | 319.50 | 31.80 |
| 2018 | NB | 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 |
| 2018 | NB | Median | 17.32 | 9.19 | 9.92 | 0.84 | 97.10 | 160.00 | 34.00 | 1670.00 | 37500.00 | 15.00 | 22.00 | 5.18 |
| 2018 | NB | Arithmetic Mean | 18.49 | 9.19 | 9.53 | 0.87 | 95.17 | 186.00 | 57.33 | 1871.67 | 34700.00 | 28.89 | 56.11 | 20.02 |
| 2018 | NB | Coefficient of Variation | 0.18 | 0.08 | 0.11 | 0.35 | 0.59 | 0.43 | 1.02 | 0.35 | 0.35 | 0.90 | 1.70 | 1.87 |
| 2018 | NB | LQ | 16.94 | 8.72 | 8.72 | 0.73 | 50.63 | 127.50 | 14.25 | 1532.50 | 23975.00 | 11.25 | 16.25 | 3.05 |
| 2018 | NB | UQ | 20.79 | 9.75 | 10.25 | 0.93 | 126.50 | 259.25 | 114.00 | 2385.00 | 44825.00 | 42.50 | 40.50 | 16.59 |
| 2018 | PM | 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 |
| 2018 | PM | Median | 19.30 | 9.53 | 8.92 | 0.62 | 146.00 | 168.00 | 26.00 | 2230.00 | 40400.00 | 12.00 | 23.00 | 10.67 |
| 2018 | PM | Arithmetic Mean | 19.20 | 9.34 | 9.08 | 0.76 | 234.61 | 219.44 | 47.56 | 2661.67 | 35388.89 | 15.22 | 24.33 | 10.09 |
| 2018 | PM | Coefficient of Variation | 0.17 | 0.08 | 0.10 | 0.93 | 1.07 | 0.73 | 0.90 | 0.78 | 0.36 | 0.47 | 0.43 | 0.72 |
| 2018 | PM | LQ | 17.50 | 8.73 | 8.16 | 0.44 | 48.85 | 108.75 | 8.25 | 1221.75 | 24250.00 | 10.75 | 15.25 | 4.78 |
| 2018 | PM | UQ | 21.56 | 9.91 | 9.95 | 0.73 | 335.75 | 302.00 | 94.50 | 3275.00 | 46225.00 | 17.75 | 31.75 | 13.03 |

| Year | Station | Parameter | Temperat ure (°C) | pH | Dissolved Oxygen (mg/L) | Secchi Depth (m) | Chlorophy ll a (µg/L) | Total Phosphor us (µg/L) | Soluble Reactive Phosphorus (µg/L) | Total Nitrogen (µg/L) | Silica (µg/L) | NO3+ NO2 Nitrog en (µg/L) | NH4 Nitrogen (µg/L) | Un-ionized Ammon ia (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2018 | SB | 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 |
| 2018 | SB | Median | 18.84 | 9.16 | 8.80 | 0.77 | 98.00 | 228.00 | 32.00 | 2560.00 | 36700.00 | 13.00 | 257.00 | 15.47 |
| 2018 | SB | Arithmetic Mean | 19.80 | 8.91 | 8.71 | 0.91 | 113.04 | 208.89 | 52.89 | 2392.00 | 34444.44 | 34.00 | 304.33 | 54.64 |
| 2018 | SB | Coefficient of Variation | 0.17 | 0.09 | 0.33 | 0.53 | 0.79 | 0.42 | 0.93 | 0.38 | 0.36 | 1.36 | 1.26 | 1.49 |
| 2018 | SB | LQ | 17.60 | 8.31 | 7.87 | 0.64 | 36.85 | 113.50 | 8.00 | 1827.50 | 23075.00 | 10.75 | 28.75 | 8.34 |
| 2018 | SB | UQ | 22.34 | 9.58 | 10.98 | 1.26 | 142.75 | 267.50 | 92.25 | 2905.00 | 45275.00 | 31.00 | 401.75 | 65.97 |
| 2018 | WB | 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 |
| 2018 | WB | Median | 18.18 | 9.30 | 7.23 | 0.76 | 183.00 | 218.00 | 29.00 | 2440.00 | 40000.00 | 13.00 | 134.00 | 26.64 |
| 2018 | WB | Arithmetic Mean | 19.09 | 9.09 | 8.26 | 0.79 | 289.81 | 281.78 | 52.89 | 3379.89 | 36144.44 | 40.11 | 146.89 | 47.70 |
| 2018 | WB | Coefficient of Variation | 0.17 | 0.10 | 0.34 | 0.77 | 1.19 | 0.77 | 1.03 | 0.75 | 0.35 | 1.55 | 0.82 | 1.17 |
| 2018 | WB | LQ | 17.80 | 8.68 | 7.05 | 0.40 | 55.38 | 117.75 | 9.00 | 1972.50 | 24350.00 | 10.75 | 24.25 | 7.48 |
| 2018 | WB | UQ | 21.40 | 9.68 | 10.48 | 0.90 | 387.00 | 386.25 | 119.50 | 4120.00 | 47075.00 | 40.50 | 259.50 | 90.18 |
| 2018 | AN | 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 |
| 2018 | AN | Median | 19.32 | 9.00 | 10.17 | 1.10 | 22.30 | 191.00 | 96.00 | 815.00 | 31700.00 | 8.00 | 13.00 | 3.45 |
| 2018 | AN | Arithmetic Mean | 19.07 | 9.12 | 10.76 | 1.20 | 72.85 | 230.33 | 124.44 | 1253.78 | 33266.67 | 11.22 | 16.11 | 5.76 |
| 2018 | AN | Coefficient of Variation | 0.14 | 0.06 | 0.23 | 0.57 | 1.63 | 0.61 | 0.65 | 1.39 | 0.14 | 0.70 | 0.62 | 1.05 |
| 2018 | AN | LQ | 17.65 | 8.75 | 8.81 | 0.76 | 6.31 | 121.75 | 72.75 | 328.00 | 29750.00 | 7.00 | 11.00 | 2.03 |
| 2018 | AN | UQ | 21.38 | 9.49 | 12.19 | 1.54 | 90.05 | 322.00 | 171.75 | 1167.50 | 36825.00 | 14.00 | 16.25 | 6.63 |
| 2018 | CP | 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 |
| 2018 | CP | Median | 18.88 | 8.89 | 7.39 | 1.00 | 50.70 | 189.00 | 56.00 | 2080.00 | 39500.00 | 12.00 | 189.00 | 38.52 |
| 2018 | CP | Arithmetic Mean | 19.55 | 8.89 | 7.97 | 0.97 | 91.52 | 206.33 | 71.22 | 2144.89 | 34833.33 | 30.89 | 244.67 | 52.19 |
| 2018 | CP | Coefficient of Variation | 0.15 | 0.08 | 0.40 | 0.52 | 0.88 | 0.40 | 0.76 | 0.35 | 0.36 | 1.20 | 0.95 | 1.05 |
| 2018 | CP | LQ | 17.44 | 8.34 | 6.85 | 0.59 | 27.43 | 151.25 | 31.00 | 1780.00 | 23075.00 | 9.00 | 58.25 | 6.97 |
| 2018 | CP | UQ | 21.94 | 9.50 | 10.07 | 1.41 | 164.25 | 273.75 | 126.50 | 2717.50 | 45375.00 | 35.50 | 364.00 | 78.96 |
| 2018 | UKL_OUT | 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 |
| 2018 | UKL_OUT | Median | 19.30 | 9.53 | 8.92 | 0.62 | 146.00 | 168.00 | 26.00 | 2230.00 | 40400.00 | 12.00 | 23.00 | 10.67 |
| 2018 | UKL_OUT | Arithmetic Mean | 19.20 | 9.34 | 9.08 | 0.76 | 234.61 | 219.44 | 47.56 | 2661.67 | 35388.89 | 15.22 | 24.33 | 10.09 |
| 2018 | UKL_OUT | Coefficient of Variation | 0.17 | 0.08 | 0.10 | 0.93 | 1.07 | 0.73 | 0.90 | 0.78 | 0.36 | 0.47 | 0.43 | 0.72 |
| 2018 | UKL_OUT | LQ | 17.50 | 8.73 | 8.16 | 0.44 | 48.85 | 108.75 | 8.25 | 1221.75 | 24250.00 | 10.75 | 15.25 | 4.78 |
| 2018 | UKL_OUT | UQ | 21.56 | 9.91 | 9.95 | 0.73 | 335.75 | 302.00 | 94.50 | 3275.00 | 46225.00 | 17.75 | 31.75 | 13.03 |

*Seasonal Chlorophyll Pattern and Climate Interaction*

Seasonal patterns in algal biomass (CHL) among stations in 2018 show that Agency Lake had lower CHL in April and May, but were similar to UKL from June to mid-July, before declining in mid-July to levels lower than those observed in UKL (Figure 8). As in 2017, values for Agency Lake in 2018 were notably lower during July-October than they were in UKL. The pattern of early season CHL in Agency Lake being either lower or similar to UKL since 2008, compared to the pattern prior to 2008 when AS and AN increased earlier and declined earlier in the season relative to UKL stations[10], appears to be continuing. 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 2018), water temperature partially explained the early season CHL patterns among the years. For example, low temperatures coincided with a depressed early-June bloom in 2006, 2008, and 2011 (Kann 2017). Water temperatures that increased between late-April and early-May, but then leveled off until mid-June, were also associated with somewhat suppressed CHL values through early-June (Figure 8). However, despite continued stable water temperature between early- and mid-June in 2018, CHL increased sharply during that same period. Likewise, CHL declined between late-May and early June even while temperatures remained stable, indicating that factors other than temperature also influence algal biomass. In 2015 temperature seemed to directly relate to the onset of a 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[11] (Kann 2016). However, it was clear that factors other than temperature were also affecting bloom dynamics in previous years (see Kann 2017 and 2018 for a more complete description of these dynamics).

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. Daily air temperatures in 2018 confirm the stable May to mid-June temperatures noted above, and although late-May to early-June values were stable, they were still relatively high compared to other years (Figure 9a). Temperature values from mid-July through early-September were among the highest relative to the previous 12 years, but were lower than 2017 (Figure 9a; Figure 10). As noted previously (see Kann 2016), June air temperatures in 2015 clearly fit the trend of warmer temperatures leading to earlier bloom development, with late-May and June values among the highest of the 2006-2017 period. Although there was an apparent cooling trend during May-July between 2006 and 2012, this trend was mostly reversed during 2013-2018 (Figure 10).

[10] From 1990-2007 data tend to show CHL at the Agency L. stations increasing and declining earlier than UKL stations.

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

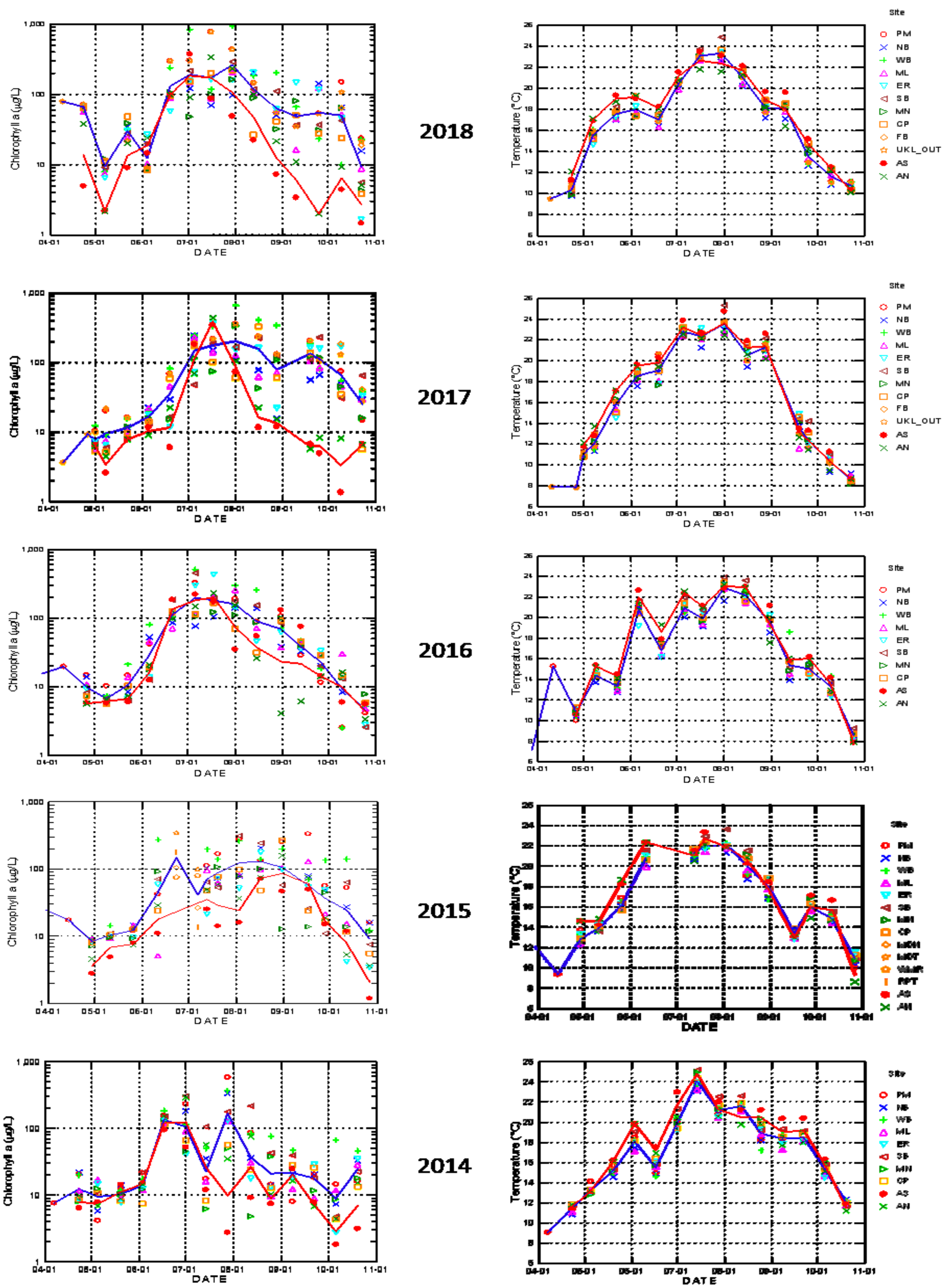


**Figure 8. Seasonal CHL and temperature trends for UKL stations, 2014-2018 (blue line shows the median value for UKL-only, red line shows the median value for Agency Lake-only).**

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 °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 °C. Furthermore, there was an indication that once the 15 °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.

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 2016). This trend appeared to hold in 2018 when suppressed algal biomass was associated with wind speeds among the highest through the early-June period, but that were then among the lowest just preceding the increased CHL that occurred during mid-June (Figure 9b).

Previous analyses 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 tend to co-occur (Kann 2016). Although the pattern was not as strong as other years, these parameters also tended to co-occur in 2018 (Figure 11). 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 2008 and 2011 (blue and cyan ellipses in Figure 11) tended to be cooler and windier than during the same periods in 2009, and 2013 to 2018. 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 eleven years portrayed (Figure 11), and as noted previously also showed relatively low algal biomass levels. The 2013 to 2015 earlier bloom years were associated with warmer and calmer conditions during the late-May to early-June period, with 2015 standing out as one of the calmest and warmest during the late-May to early June period. The late-May to early-June periods in 2017 and 2018 were intermediate with respect to wind and temperature (Figure 11), but the early-June conditions that were cool and windy likely played a role in delayed bloom development (Figure 9).

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). Phenology analyses of UKL plankton data also showed that warmer spring temperatures resulted in earlier phytoplankton blooms as indicated by both CHL and *Aphanizomenon flos-aquae* biomass (Nielsen et al. 2018). As noted below these factors also interact with year-to-year variability in nutrient concentrations.

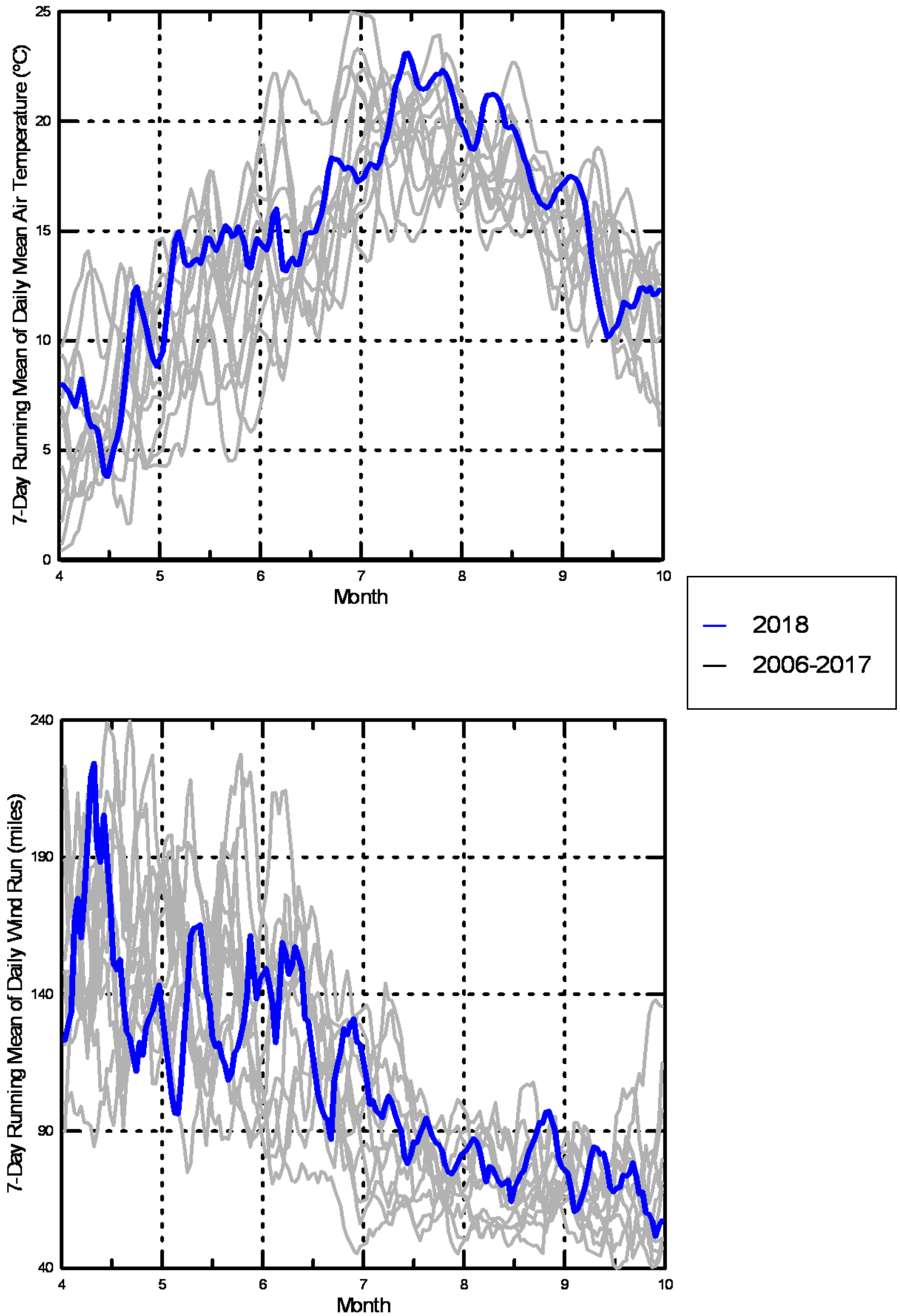


**Figure 9. Time series of the 7-day running mean of daily air temperature (a) and 7-day running mean of the daily wind run in miles (b), April-June, 2006-2018. Data are from the Bureau of Reclamation AgriMet station located at Agency Lake (AGKO).**

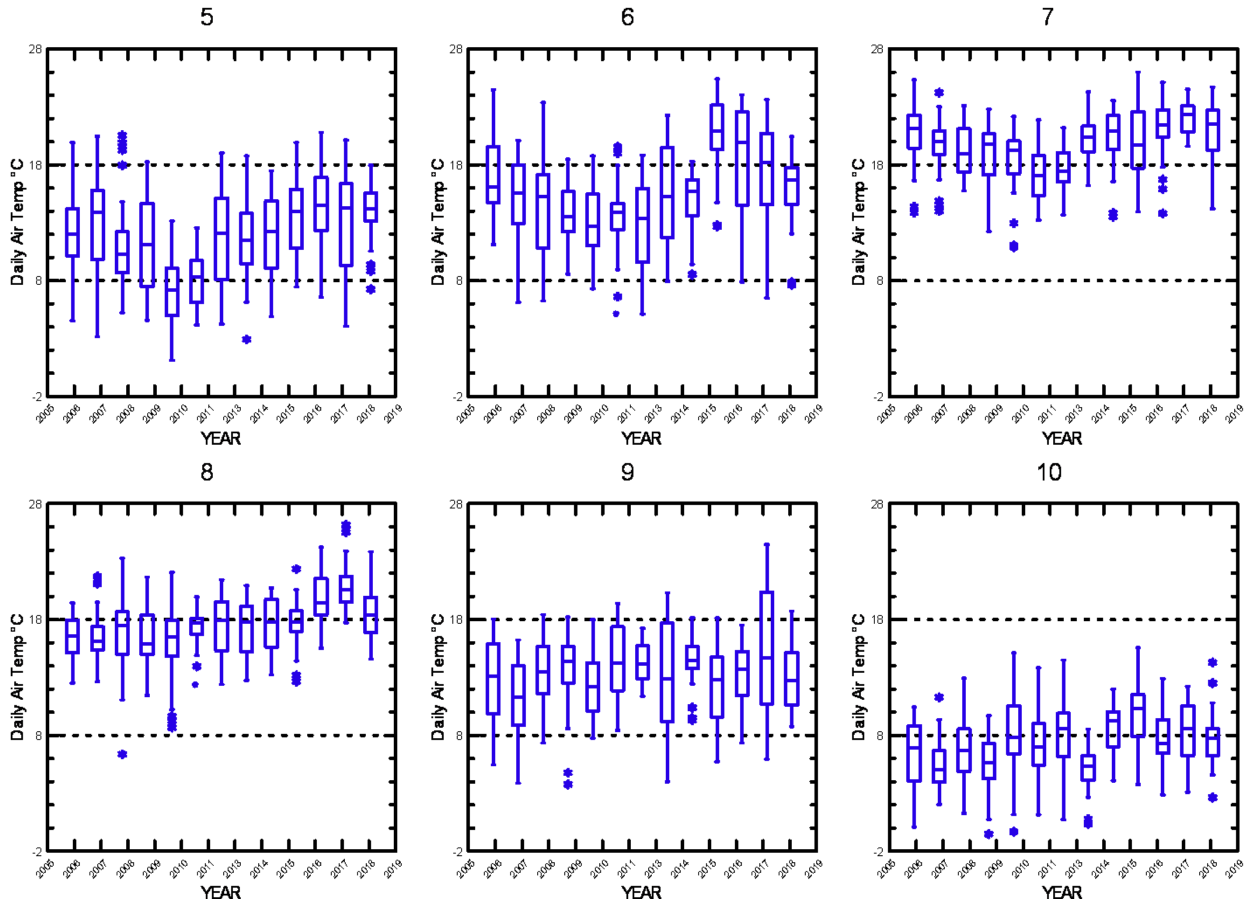


**Figure 10. Annual distribution of Agency Lake AgriMet (AGKO) daily air temperatures, May-October, 2006-2018.**

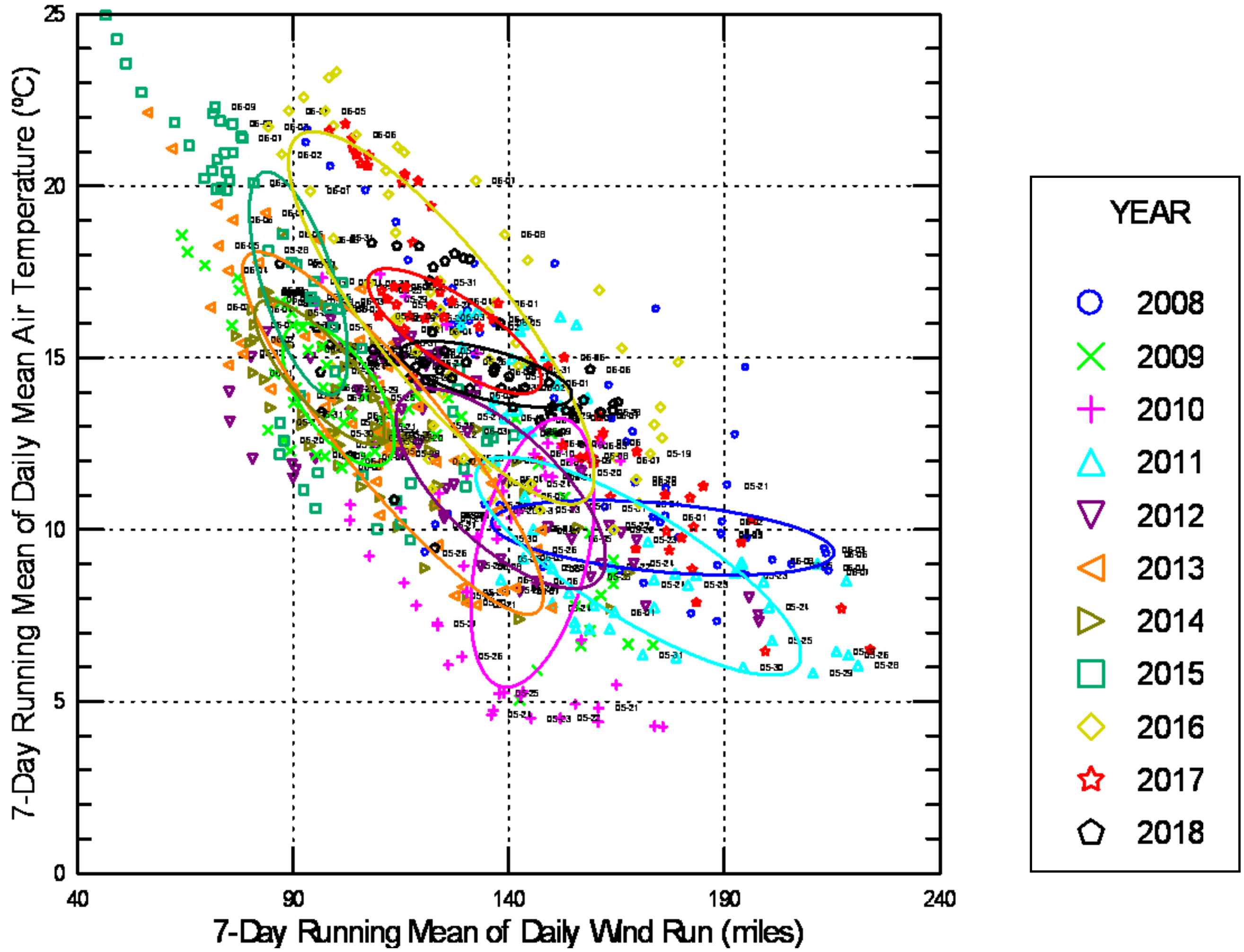


**Figure 11. Scatter plot of the 7-day running mean of the daily wind run (miles) vs. 7-day running mean of daily air temperature ($^{o}$C) during May and June. Data are from the Bureau of Reclamation AgriMet station located at Agency Lake (AGKO). Data labels are day of the month. Confidence ellipses 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 2018 (Figure 12). Monthly distributions for pH in 2018 showed higher values in April than in May (following the trend in CHL; Figure 1), followed by an increase in June and seasonal maxima occurring in July that coincided with lower Secchi depth (indicating reduced transparency) and highest CHL distributions (Figure 13). Similar to 2012 through 2017, lowest seasonal DO concentrations occurred during August in 2018.

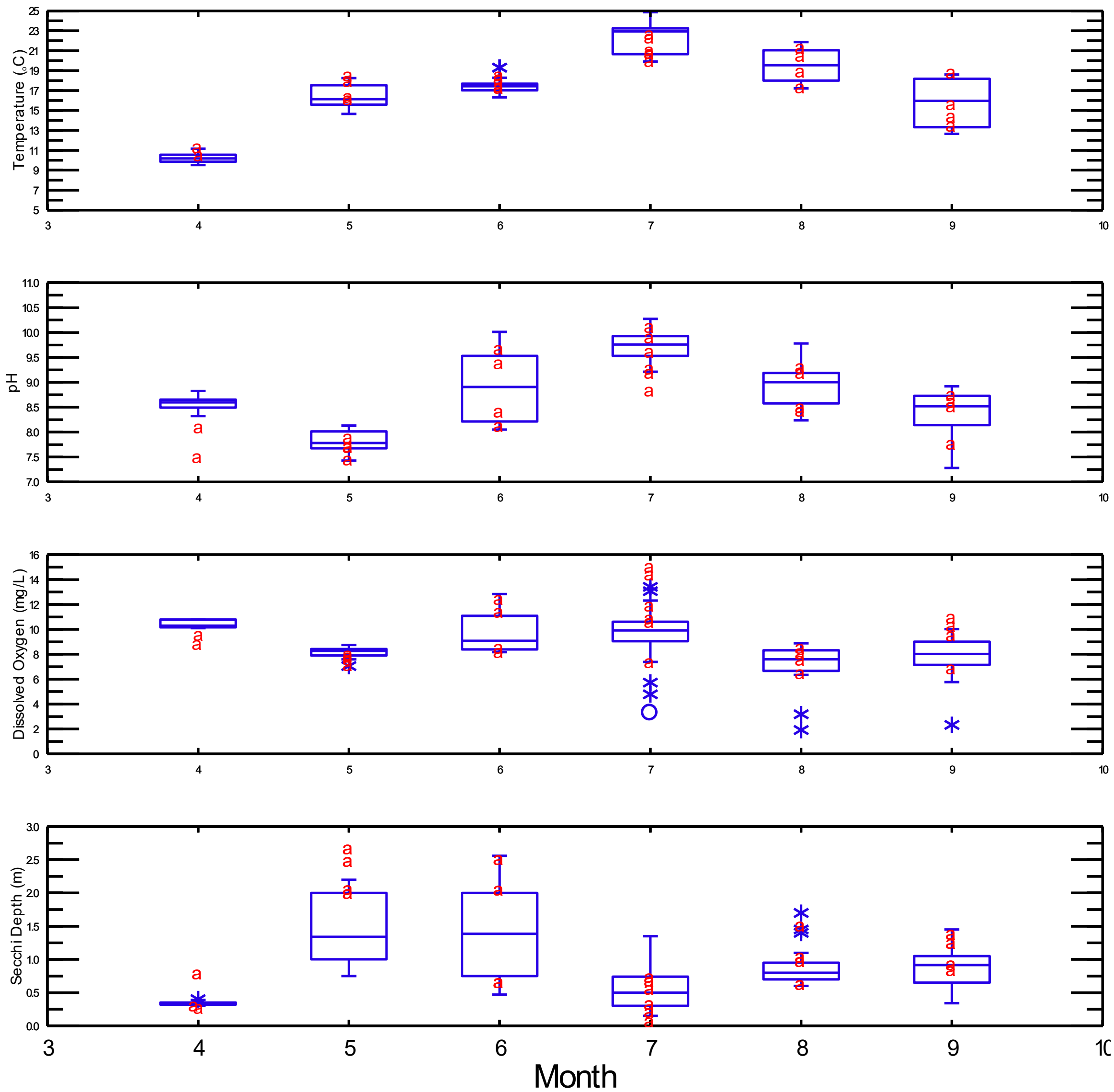


**Figure 12. Monthly distributions of T (˚C), pH, D.O (mg/L), and Secchi depth, 2018 (symbol "a" denotes values for Agency Lake plotted separately from the box plot distribution).**

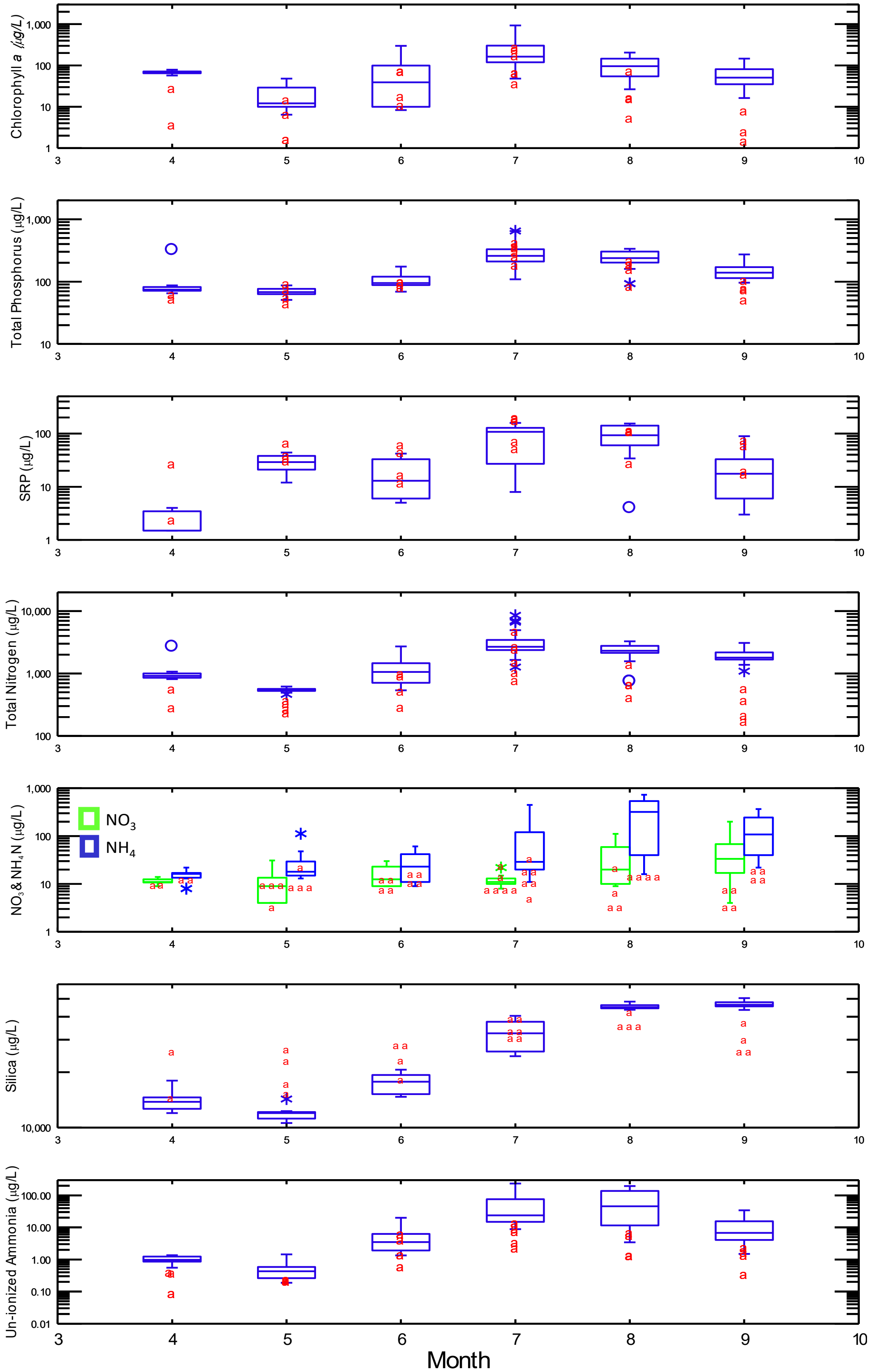


**Figure 13. Monthly distributions of CHL, TP, SRP, TN, $NO_3$+ $NO_2$-N, $NH_4$-N, $SiO_2$ and un-ionized ammonia, 2018 (symbol "a" denotes values for Agency Lake plotted separately from the box plot distribution).**

CHL was elevated during April of 2018, declined in May and peaked in July before declining in August (Figure 13). The typical bimodal CHL peak as indicated by the monthly box plots was not as obvious as some previous years. TP tended to follow the trend in CHL, and SRP was inversely related to CHL in April, May and June[12]. TN generally tracked CHL concentrations; with values elevated in April, declining in May before increasing in June and July. TN tended to be lower overall in Agency Lake. Coinciding with the peak and decline of the *Aphanizomenon* bloom, $NH_4$-N increased in July and August (this was in contrast to 2015 when ammonia increased during the June bloom decline), and $NO_3$-N increased in August and September (Figure 13). Similar to TN, inorganic N tended to be lower in Agency Lake relative to UKL.

A further look at the 2018 time-series with respect to CHL and dissolved nutrients on a lake-wide basis shows that, as in other years, SRP at the UKL stations generally remained low through the initial CHL increase through early-July (Figure 14, Figure 15, 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 (Nielsen et al. 2018; Kann 2010; Walker et al. 2012).

In 2018 and most previous years, TIN (the sum of $NH_4$-N and $NO_3$-N) levels were relatively low during the period leading up to and through the onset the annual *Aphanizomenon* growth period (Figure 15). TIN began to increase in mid-July and into August as algal biomass began to peak and then decline (Figure 15), but then decreased again in mid-September before increasing in October. In addition, TIN was substantially higher at the northern stations (MN, CP, ER, SB) than it was at the southern stations (with the exception of WB), and coincided with a relatively rapid chlorophyll decline (Figure 14). 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). As in earlier years, SRP in 2018 tended to decline into the fall months.

The 2015 dynamics compared to 2016 to 2018 provides a good illustration of the effect of the interaction of bloom phenology, particularly bloom onset, peak and decline, with nutrient parameters. In general April TN:TP values that were >15 tended to coincide with spring diatom blooms (Kann 2012), and 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). April and May TIN:SRP ratios that were notably higher in 2016-2018 than they were in 2015 were associated with a more typical bloom increase, while relatively low May-June TN:TP and TIN:SRP ratios in 2015 (TN:TP <10; TIN:SRP<1) were associated with an earlier *Aphanizomenon*-associated algal biomass rise that peaked in June vs. the typical peak occurring in July (Figure 15). Moreover, although TIN:SRP ratios typically increase in August as TIN levels rise (as they did in 2016-2018), this occurred in late June of 2015 due to the early *Aphanizomenon* peak and decline and subsequent remineralization of organic N to inorganic N. Also unique to 2015 was an unusually early (late-June) and large boom of *Microcystis aeruginosa* which followed the decline in *Aphanizomenon* and increase in TIN (Kann 2016). Multivariate models also showed the importance of temperature (+), SRP (-), resistance to mixing (+), and light extinction (+) as important variables controlling Chl-a and bloom phenology (Nielsen et al. 2018).

[12] In some years SRP is typically slightly elevated in April and May before declining during the period of cyanobacterial biomass increase (indicating uptake) in June, but in 2018 values were low in April while CHL was high indicating diatom uptake of SRP at that time.

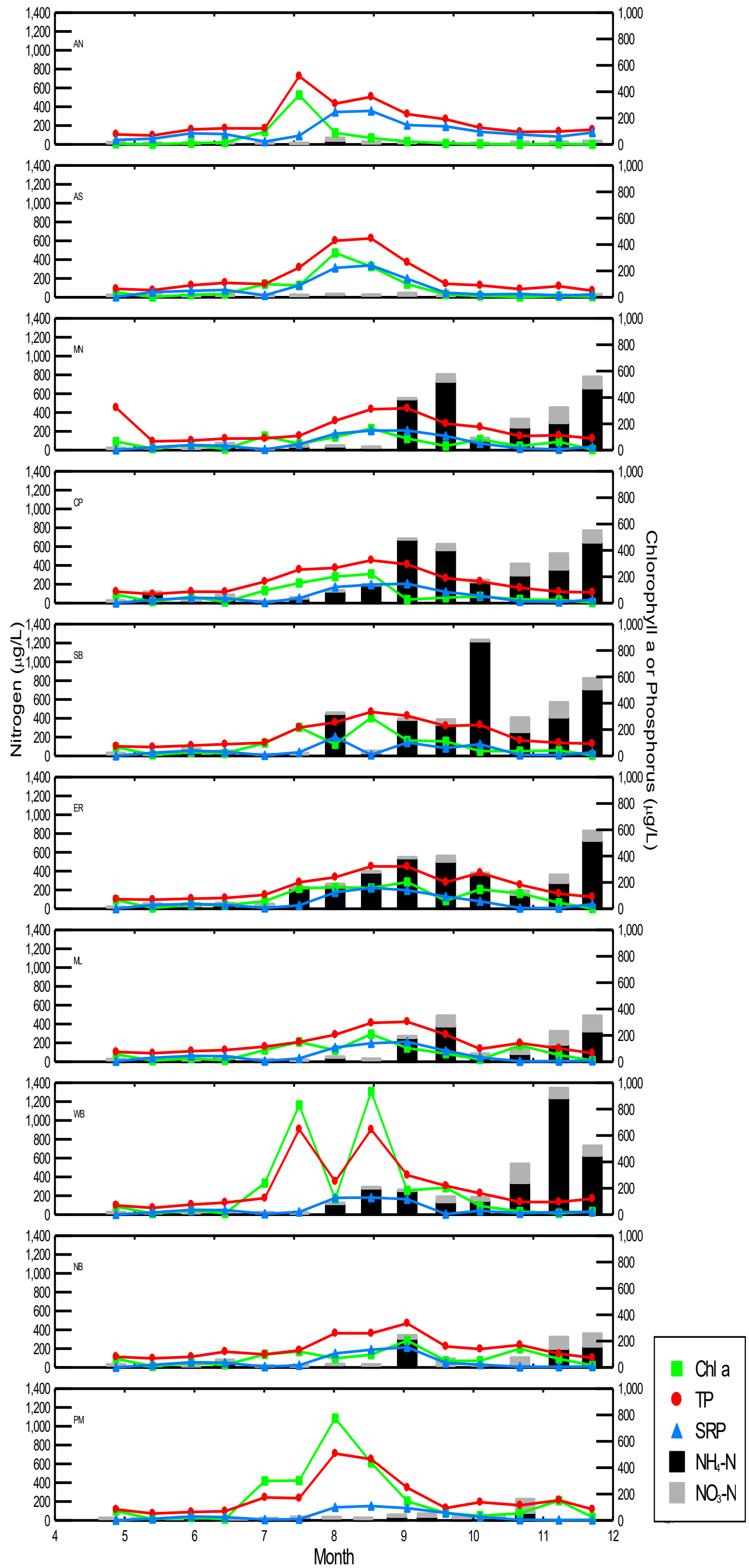


**Figure 14. Chlorophyll, SRP, and TIN time-series for UKL and Agency Lake Stations, 2018.**

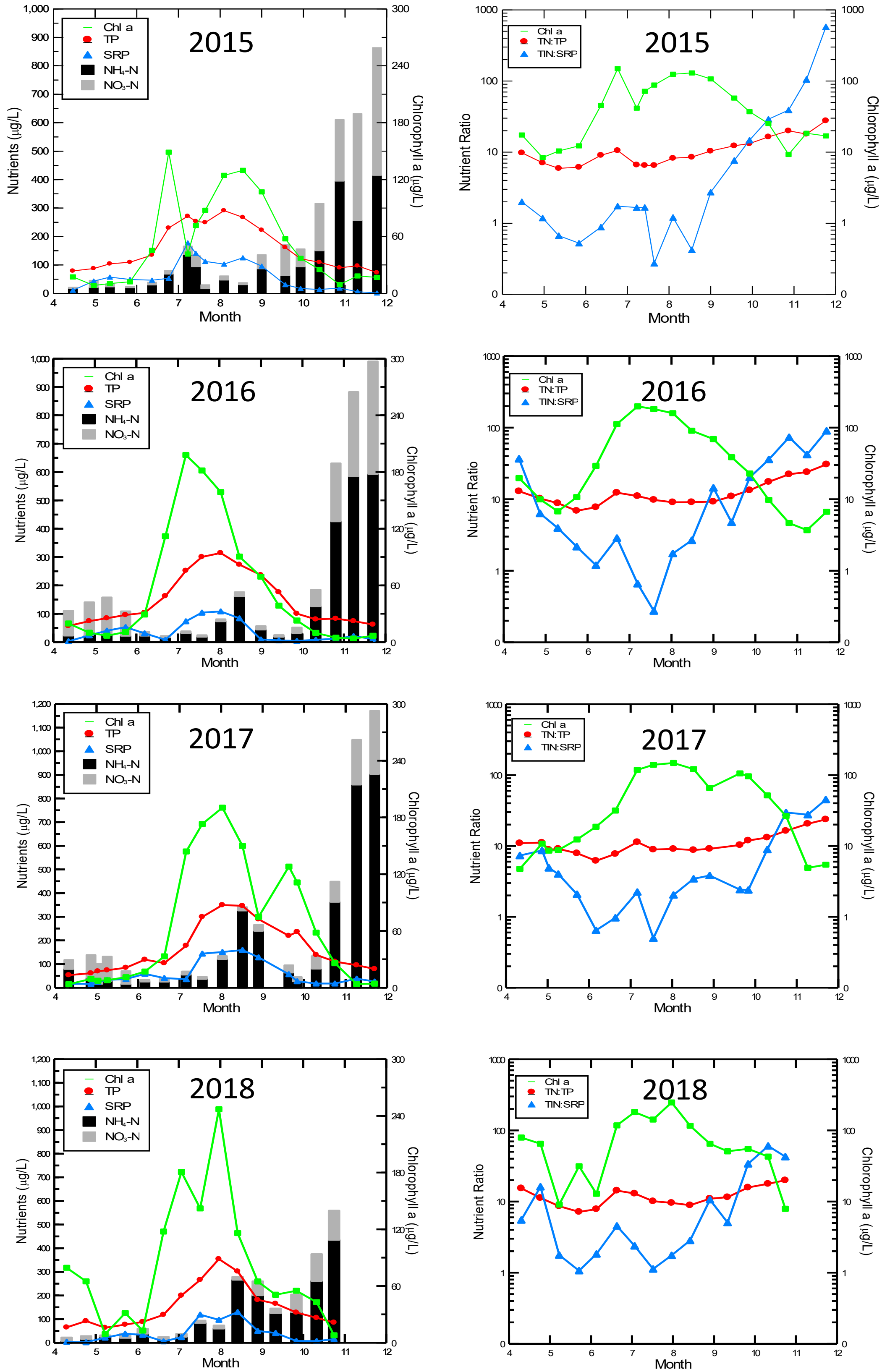


**Figure 15. Lake-wide mean Chlorophyll, SRP, TIN, and nutrient ratio time-series for UKL Stations, 2015-2018.**

An analysis of the ratio of *Aphanizomenon* heterocysts to vegetative cells[13] shows that the heterocyst ratio is low in April prior to the onset of the bloom, increases to highest seasonal levels in May and June (highest in May) as the *Aphanizomenon* bloom is increasing (Figure 16a). The ratios are then lower July-September during the period of bloom decline and ample TIN (e.g., see Figure 15). In addition, the ratio of *Aphanizomenon* heterocysts to vegetative cells was inversely related to the ratio of inorganic N to inorganic P (TIN:PO4) during June (Figure 16b). These analyses support the apparent controlling effect of early-season TIN:SRP (TIN:PO4) ratios on *Aphanizomenon* bloom onset described above. In general, the nitrogen-fixing *Aphanizomenon* should have a competitive advantage over other non-diazotrophic algal species when available nitrogen is low relative to phosphorus.

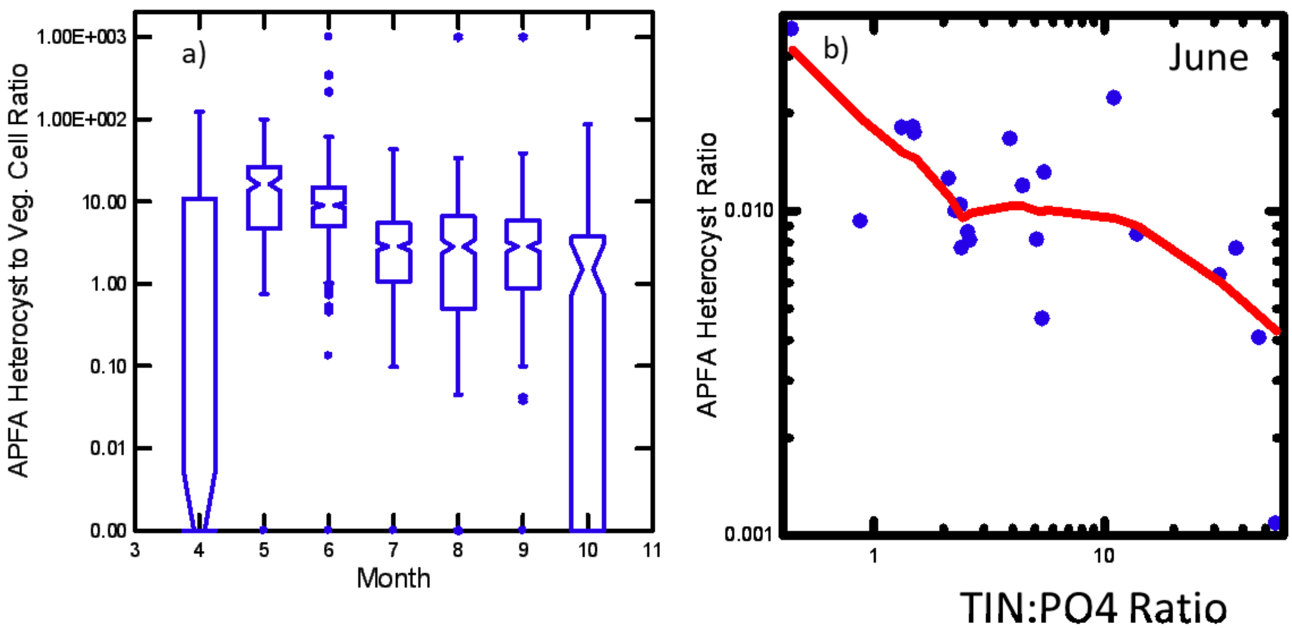


**Figure 16. Monthly box plot of the ratio of *Aphanizomenon* heterocysts to vegetative cells, 1990-2015 (a); ratio of *Aphanizomenon* heterocysts to vegetative cells ratio vs. the total inorganic nitrogen (TIN=$NH_4$-N + $NO_2$+$NO_3$-N) to inorganic P ($PO_4$-P) ratio during June (b).**

[13] The frequency of heterocysts has been shown to be positively related to nitrogen fixation in *Aphanizomenon* (e.g., Lehtimaki et al. 1997). Aphanizomenon heterocyst and vegetative cell data from Kann et al. (2014).

Similar to 2016, silica values in 2018 declined in May with a substantial increase occurring in July (Figure 13; Appendix III). In contrast, 2017 silica values increased in May, then declined in June, and did not substantially increase until August (Kann 2018). 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. The delayed increase in 2017 silica values is apparently tied to the timing of the *Aphanizomenon* increase, which was delayed in 2017 (Appendix II; Appendix III). Spring silica concentrations were depressed in 2018 relative to 2012-2017 and were tied to elevated CHL indicating uptake due to a diatom bloom during that time (Figure 17; Appendix II). Time series graphs in Appendix III indicate that the silica increase is concomitant with initial large CHL and TP increases in June and 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), values in 2016 were higher and similar to 2013 and 2014, and values in 2017 were again somewhat lower. 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, 2016, and 2017 (especially when compared to 2014; no fall values available for 2018), as well as the seasonal spring depression of TIN in the period preceding the rise in CHL due to diazotrophic *Aphanizomenon*.

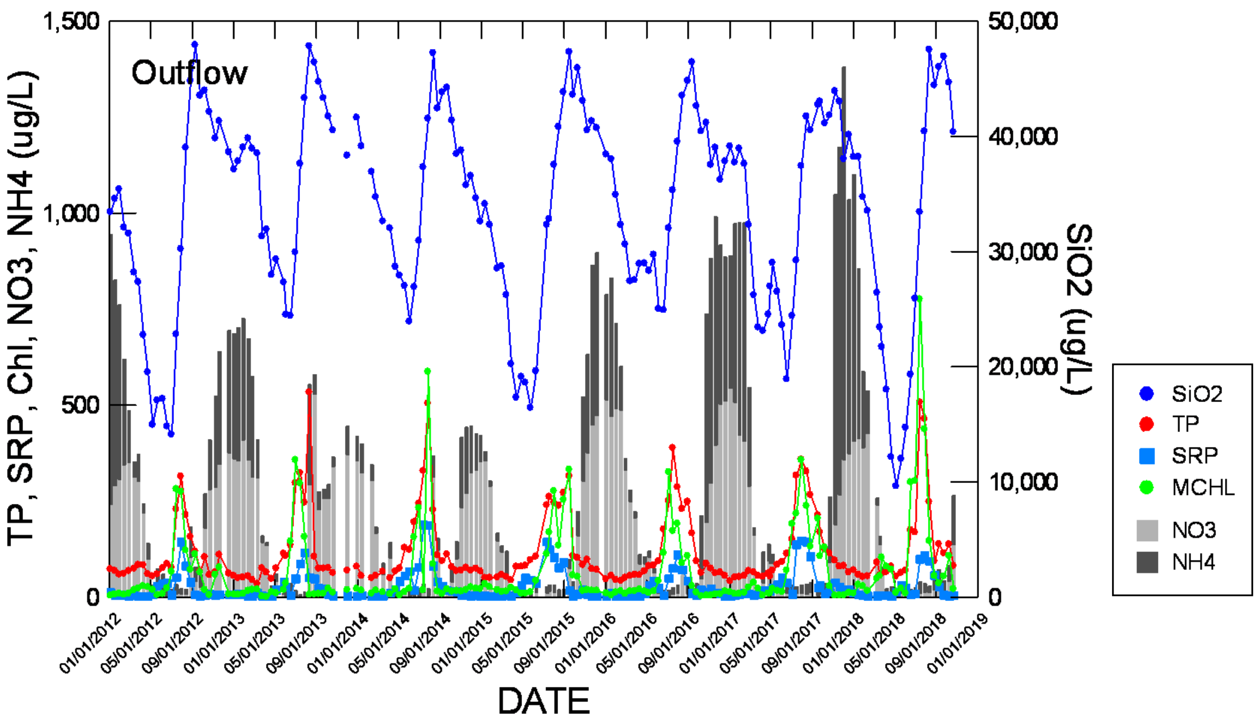


**Figure 17. Outflow Chlorophyll, SRP, TIN (nitrate and ammonia), and silica time-series, 2012 -2018.**

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, 2015-2017 also showed a relatively low frequency of CHL: TP ratios >1, and in 2018 low frequencies occurred in April and somewhat higher (but still low) frequencies occurred in June and July (Figure 18).

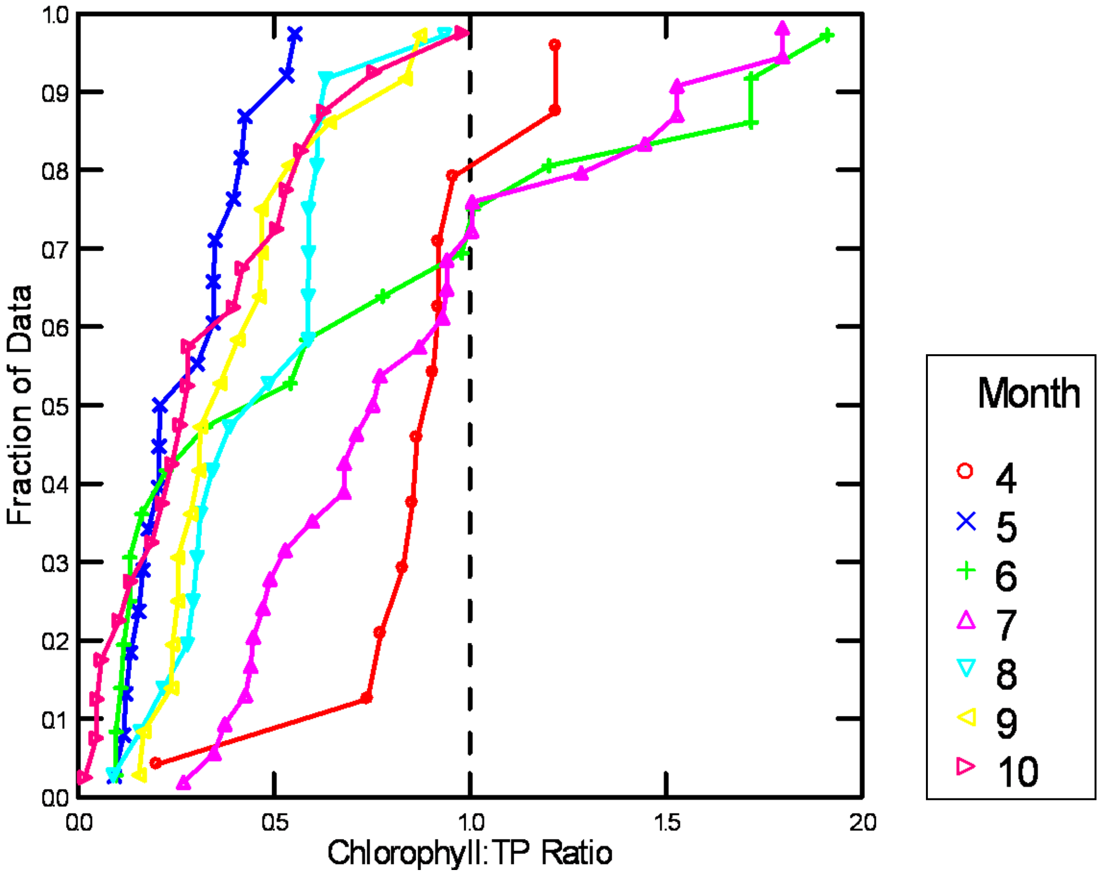


**Figure 18. Quantile plot (cumulative frequency) of April-October chlorophyll to TP ratios in Upper Klamath Lake, 2018.**

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 2017 (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 2010-2017). The 2018 pattern was generally similar to other years; however, the percentage of the water column outside of the photic zone (i.e., does not have sufficient light for photosynthesis) tended to be more protracted than in previous years (mid-June to early-August; Figure 20).

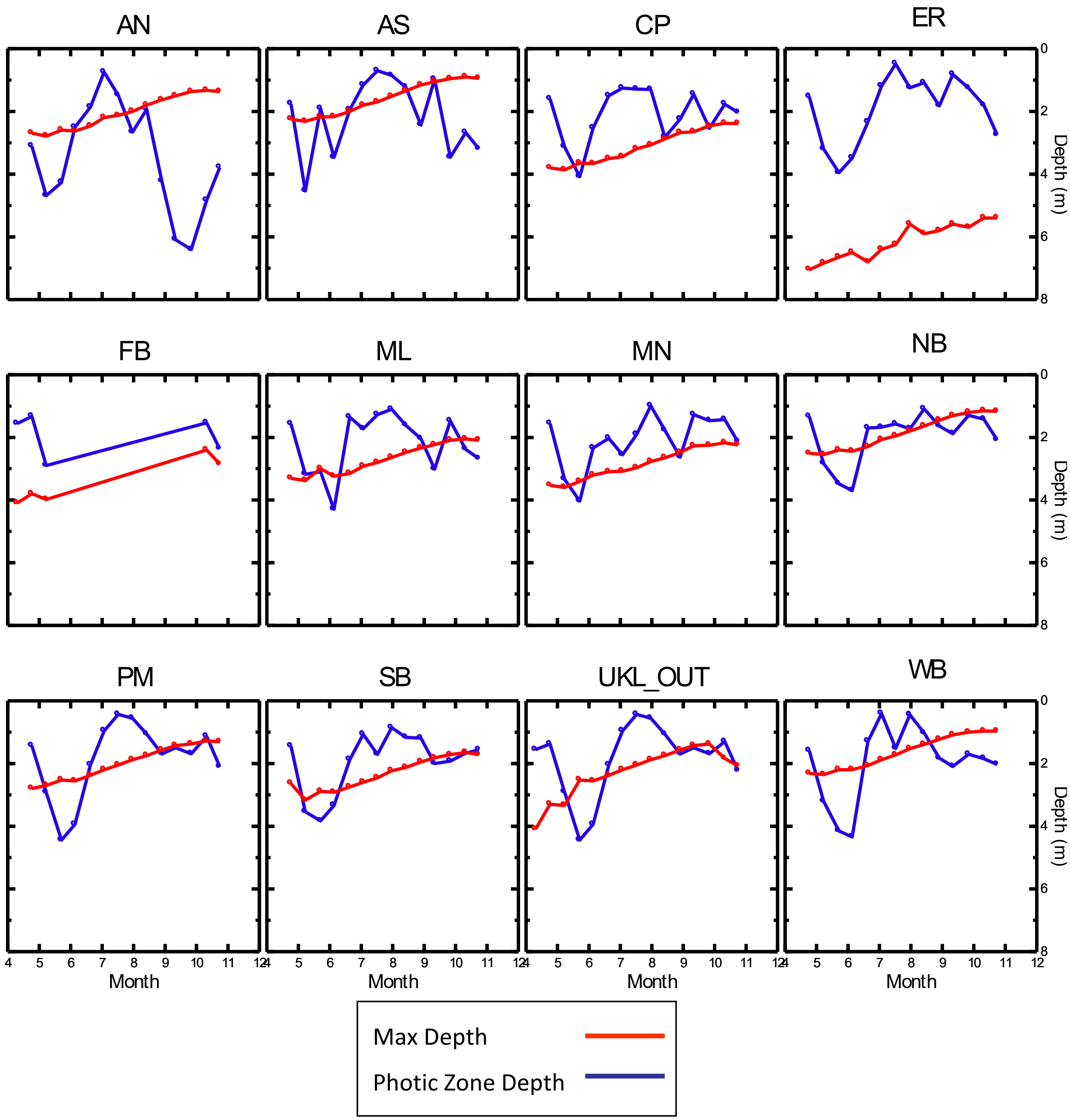


**Figure 19. Photic zone depth and maximum depth at UKL and Agency Lake stations in 2018 (periods when the blue line is shallower than the red line indicate that a portion of the water column is not within the photic zone.**

Light limitation was most apparent at the deeper ER station which showed a greater percentage of the water column to be light limited. 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). This pattern also occurred in 2018, with a reduced photic zone occurring in early-spring, a "clear water" phase occurring for most of May that was followed by a decline in mid-June before increasing again in August (Figure 20).

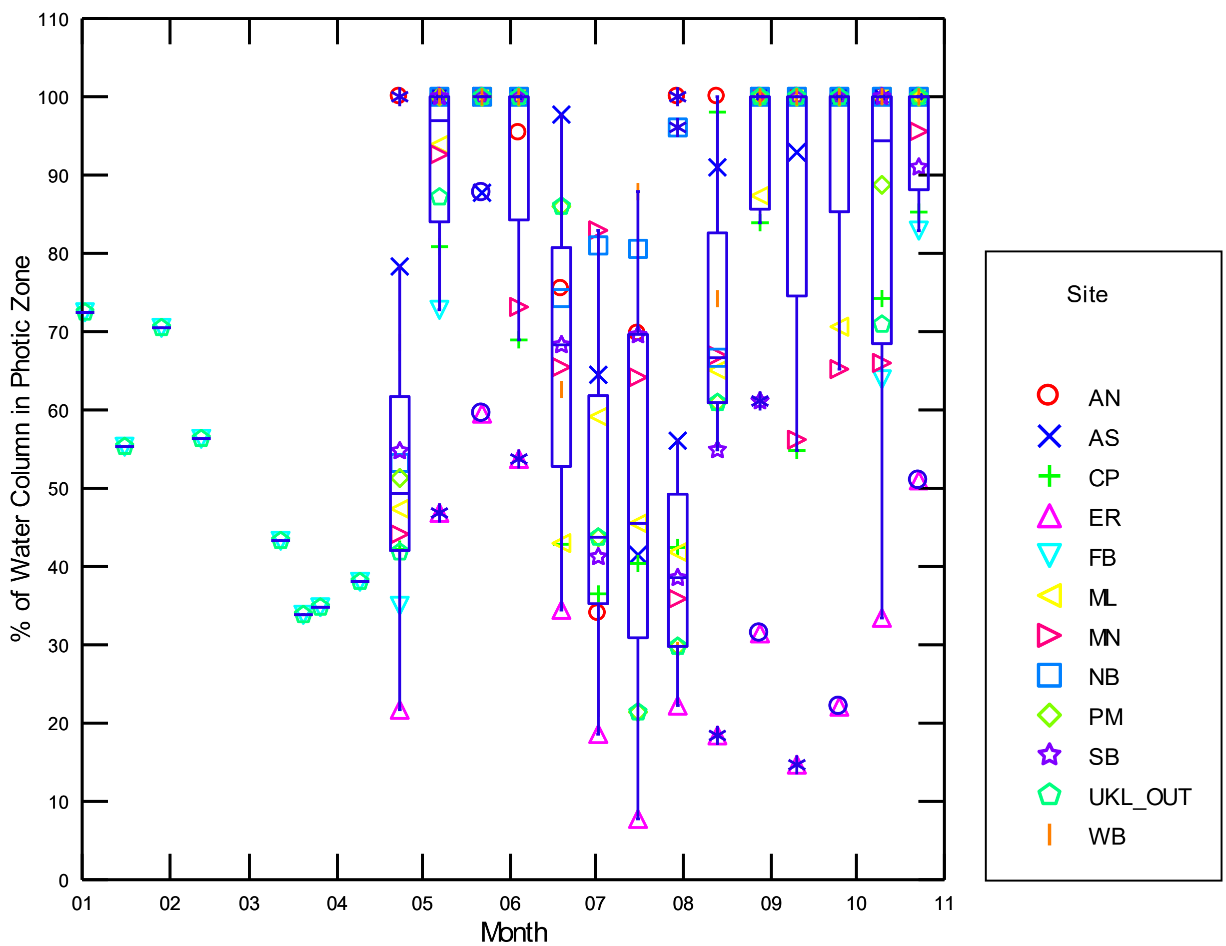


**Figure 20. Percent of the water column in the photic zone for UKL and Agency Lake Stations, 2018.**

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 2013-2016 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. Although the period preceding the bloom in 2017 was also characterized by declining TIN:SRP ratios and a “clear water” phase, it appears a windy and cool period in mid-June may have delayed the biomass increase. 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. Previous multivariate analyses of UKL long-term (1990-2016) can be found in Nielsen et al. (2018).

*Comparison of 2018 to Previous 1990-2017 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. The overall June-September temperature distribution in 2018 was similar to many previous years (but was lower than both 2016 and 2017; Figure 21). Dissimilar to 2010-2014 when the June-Sep UKL pH distributions were among the lowest for the period of record, values in both 2015 and 2016 were in the range of many previous years, but values in 2017 were again lower with 2018 values also somewhat low (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 2014-2018 were intermediate for the June-September period. Lower quartile Secchi disk transparency tended to be somewhat lower in 2018 than many earlier years (Figure 20).

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 through 2018 (Figure 22). Overall CHL levels were lower for the 2010-2014 period compared to the earlier period. TP in 2018 was somewhat lower than the previous three years, and for SRP

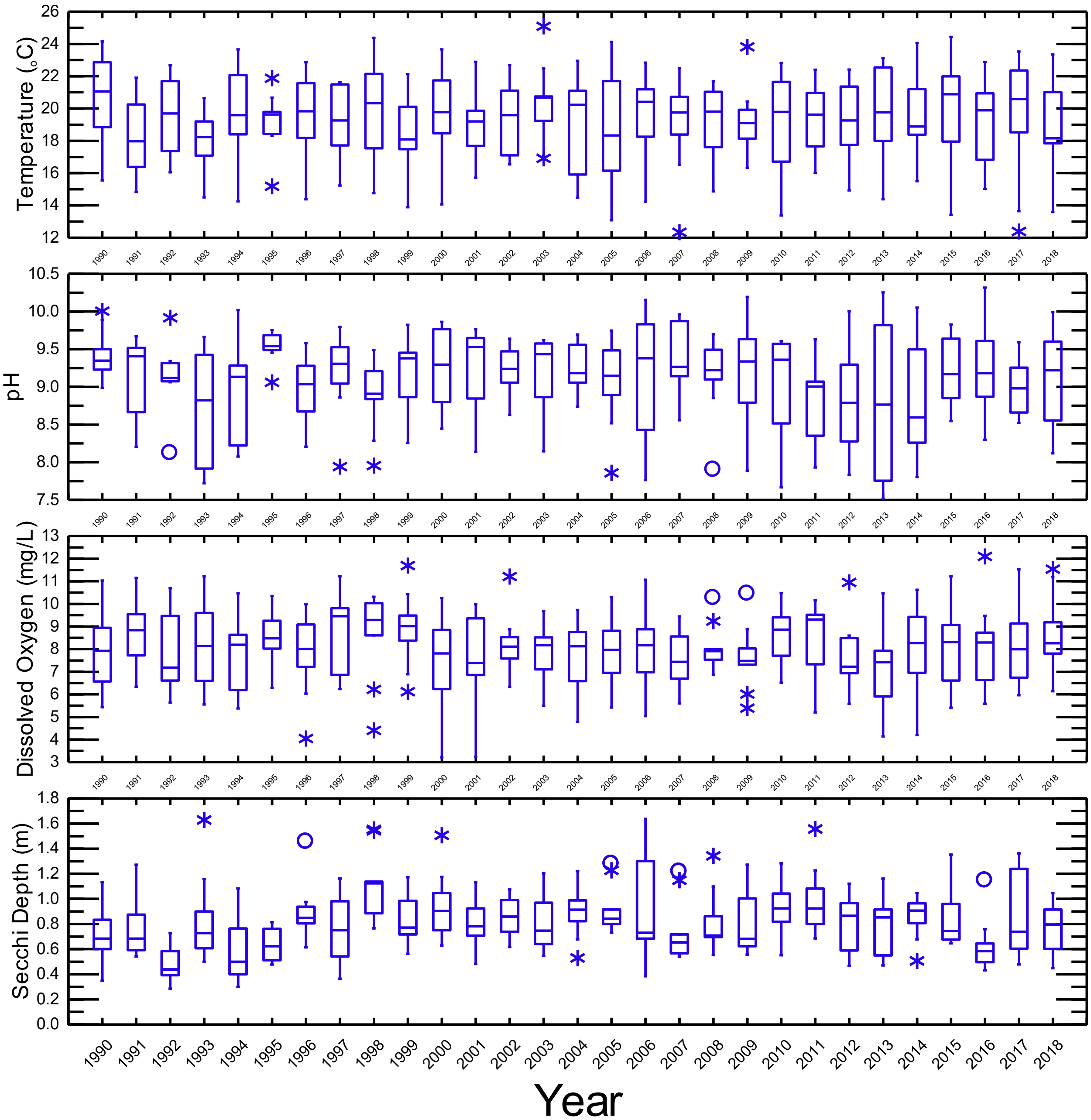


**Figure 21. June-September distribution of UKL-only lake-wide means for T (˚C), pH, D.O (mg/L), and Secchi depth, 1990-2018.**

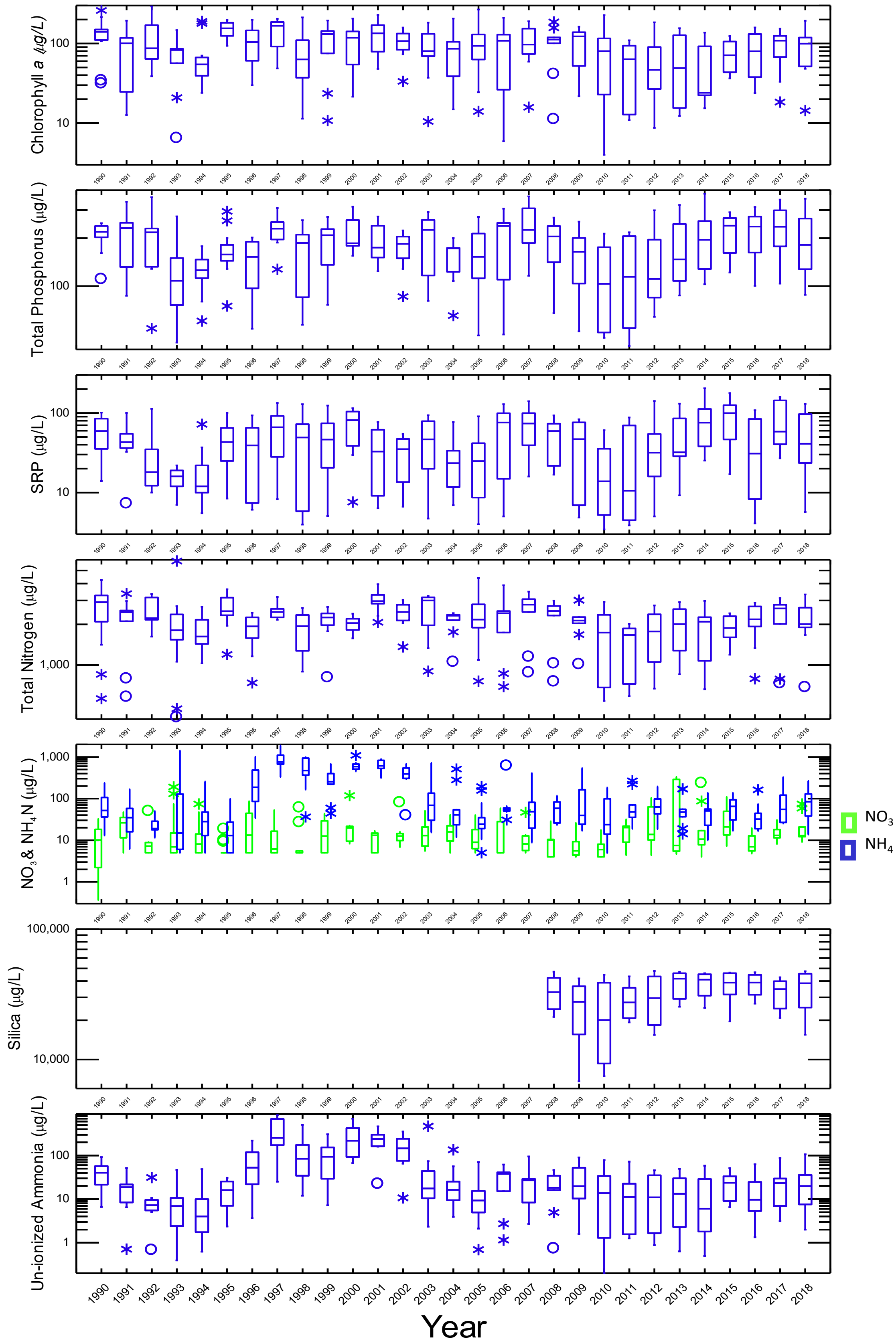


**Figure 22. June-September distribution of UKL-only lake-wide means for CHL, TP, SRP, TN, $NO_3$+ $NO_2$-N, $SiO_2$ and $NH_4$-N, 1990-2018.**

**Table 3. Summary statistics for June-September UKL-only lake-wide means, 1990-2018 (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 | 14.0 | 14.0 | 14.0 | 14.0 | 13.0 | 13.0 | 13.0 | 13.0 | 0.0 | 10.0 | 11.0 | 11.0 |
| 1990 | Median | 21.0 | 9.3 | 7.9 | 0.7 | 139.9 | 219.2 | 59.4 | 2916.1 | | 9.0 | 52.0 | 49.7 |
| 1990 | Arithmetic Mean | 20.7 | 9.4 | 8.0 | 0.7 | 136.8 | 208.3 | 60.7 | 2642.6 | | 11.1 | 84.7 | 54.0 |
| 1990 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.4 | 0.5 | 0.2 | 0.5 | 0.4 | | 1.0 | 0.9 | 0.5 |
| 1990 | LQ | 18.8 | 9.2 | 6.6 | 0.6 | 109.5 | 192.8 | 33.8 | 1922.6 | | 1.7 | 34.4 | 37.3 |
| 1990 | UQ | 22.9 | 9.5 | 8.9 | 0.8 | 156.0 | 239.4 | 87.3 | 3379.4 | | 18.2 | 123.6 | 72.6 |
| 1991 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 3.0 | 7.0 | 7.0 |
| 1991 | Median | 18.0 | 9.4 | 8.8 | 0.7 | 100.5 | 231.6 | 43.1 | 2459.3 | | 26.3 | 35.0 | 28.8 |
| 1991 | Arithmetic Mean | 18.1 | 9.2 | 8.7 | 0.8 | 95.6 | 202.4 | 47.3 | 2171.6 | | 26.1 | 52.3 | 35.2 |
| 1991 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.3 | 0.7 | 0.4 | 0.5 | 0.4 | | 0.8 | 1.1 | 0.9 |
| 1991 | LQ | 16.4 | 8.7 | 7.7 | 0.6 | 24.6 | 122.1 | 35.3 | 1780.0 | | 10.3 | 14.3 | 12.7 |
| 1991 | UQ | 20.4 | 9.5 | 9.6 | 0.9 | 135.5 | 255.7 | 57.9 | 2643.1 | | 41.9 | 73.1 | 56.7 |
| 1992 | N of Cases | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 8.0 |
| 1992 | Median | 19.7 | 9.1 | 7.2 | 0.4 | 87.2 | 217.6 | 18.1 | 2220.0 | | 7.2 | 19.0 | 9.8 |
| 1992 | Arithmetic Mean | 19.5 | 9.1 | 7.9 | 0.5 | 122.8 | 196.3 | 35.1 | 2532.3 | | 11.6 | 25.3 | 13.3 |
| 1992 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.3 | 0.7 | 0.5 | 1.0 | 0.3 | | 1.2 | 0.5 | 0.8 |
| 1992 | LQ | 17.4 | 9.1 | 6.6 | 0.4 | 64.6 | 131.3 | 11.8 | 2114.4 | | 5.0 | 16.7 | 6.9 |
| 1992 | UQ | 21.7 | 9.3 | 9.5 | 0.6 | 173.8 | 236.1 | 44.7 | 3180.1 | | 8.9 | 32.7 | 20.3 |
| 1993 | N of Cases | 10.0 | 10.0 | 10.0 | 10.0 | 9.0 | 18.0 | 18.0 | 18.0 | 0.0 | 18.0 | 18.0 | 9.0 |
| 1993 | Median | 18.2 | 8.8 | 8.1 | 0.7 | 82.6 | 108.0 | 16.0 | 1811.2 | | 7.0 | 14.9 | 15.3 |
| 1993 | Arithmetic Mean | 17.9 | 8.8 | 8.2 | 0.8 | 74.9 | 115.2 | 15.0 | 1977.1 | | 30.1 | 157.2 | 37.6 |
| 1993 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.4 | 0.6 | 0.5 | 0.3 | 0.6 | | 1.7 | 2.2 | 2.1 |
| 1993 | LQ | 17.1 | 7.9 | 6.6 | 0.6 | 47.7 | 76.0 | 12.0 | 1540.0 | | 5.0 | 6.0 | 2.1 |
| 1993 | UQ | 19.2 | 9.4 | 9.6 | 0.9 | 96.2 | 150.0 | 19.0 | 2368.5 | | 14.9 | 128.1 | 20.1 |
| 1994 | N of Cases | 10.0 | 10.0 | 10.0 | 9.0 | 14.0 | 20.0 | 17.0 | 20.0 | 0.0 | 17.0 | 21.0 | 10.0 |
| 1994 | Median | 19.6 | 9.1 | 8.2 | 0.5 | 54.6 | 126.0 | 12.0 | 1626.1 | | 8.1 | 28.1 | 4.6 |
| 1994 | Arithmetic Mean | 19.6 | 9.0 | 7.8 | 0.6 | 69.2 | 127.5 | 18.6 | 1760.7 | | 14.9 | 48.8 | 10.7 |
| 1994 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.4 | 0.7 | 0.2 | 0.9 | 0.3 | | 1.2 | 1.3 | 1.5 |
| 1994 | LQ | 18.4 | 8.2 | 6.2 | 0.4 | 39.3 | 112.3 | 9.7 | 1434.0 | | 5.0 | 11.6 | 1.9 |
| 1994 | UQ | 22.1 | 9.3 | 8.6 | 0.8 | 66.7 | 147.1 | 24.0 | 2160.5 | | 14.4 | 52.6 | 9.9 |
| 1995 | N of Cases | 9.0 | 9.0 | 9.0 | 8.0 | 8.0 | 16.0 | 16.0 | 16.0 | 0.0 | 16.0 | 16.0 | 8.0 |
| 1995 | Median | 19.6 | 9.5 | 8.5 | 0.6 | 155.3 | 158.0 | 43.2 | 2500.0 | | 5.0 | 13.1 | 29.9 |
| 1995 | Arithmetic Mean | 19.2 | 9.5 | 8.6 | 0.6 | 152.0 | 168.1 | 47.2 | 2603.6 | | 6.4 | 22.9 | 31.3 |

| 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 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.2 | 0.2 | 0.3 | 0.5 | 0.2 | | 0.6 | 1.1 | 0.6 |
| 1995 | LQ | 18.4 | 9.5 | 8.0 | 0.5 | 125.4 | 144.3 | 25.0 | 2335.9 | | 5.0 | 5.0 | 17.1 |
| 1995 | UQ | 20.0 | 9.7 | 9.3 | 0.8 | 182.1 | 181.6 | 65.0 | 3147.9 | | 5.0 | 27.9 | 46.5 |
| 1996 | N of Cases | 10.0 | 10.0 | 10.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | 0.0 | 10.0 | 10.0 | 10.0 |
| 1996 | Median | 19.8 | 9.0 | 8.0 | 0.9 | 104.2 | 153.6 | 39.8 | 1936.2 | | 14.2 | 196.3 | 54.0 |
| 1996 | Arithmetic Mean | 19.6 | 9.0 | 7.8 | 0.9 | 106.4 | 142.6 | 41.1 | 1818.8 | | 26.9 | 331.5 | 83.9 |
| 1996 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.3 | 0.5 | 0.4 | 0.8 | 0.3 | | 1.0 | 1.0 | 0.9 |
| 1996 | LQ | 18.2 | 8.7 | 7.2 | 0.8 | 60.7 | 96.9 | 7.4 | 1584.5 | | 5.0 | 85.4 | 22.8 |
| 1996 | UQ | 21.6 | 9.3 | 9.1 | 1.0 | 146.0 | 189.9 | 65.0 | 2251.7 | | 44.4 | 483.1 | 130.4 |
| 1997 | N of Cases | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 0.0 | 8.0 | 8.0 | 8.0 |
| 1997 | Median | 19.3 | 9.3 | 9.5 | 0.8 | 167.5 | 229.6 | 66.1 | 2468.4 | | 6.1 | 761.3 | 302.1 |
| 1997 | Arithmetic Mean | 19.2 | 9.2 | 8.7 | 0.8 | 143.1 | 224.2 | 65.6 | 2499.5 | | 15.6 | 916.0 | 482.1 |
| 1997 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.4 | 0.4 | 0.2 | 0.6 | 0.1 | | 1.2 | 0.5 | 0.8 |
| 1997 | LQ | 17.7 | 9.0 | 6.9 | 0.5 | 92.1 | 196.6 | 33.4 | 2252.5 | | 5.0 | 669.3 | 237.4 |
| 1997 | UQ | 21.5 | 9.5 | 9.8 | 1.0 | 186.4 | 252.1 | 91.9 | 2603.3 | | 22.3 | 1124.6 | 843.5 |
| 1998 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 1998 | Median | 20.3 | 8.9 | 9.3 | 1.1 | 63.0 | 186.8 | 49.2 | 1940.2 | | 5.0 | 471.7 | 170.5 |
| 1998 | Arithmetic Mean | 19.9 | 8.9 | 8.6 | 1.1 | 86.1 | 163.7 | 48.4 | 1824.4 | | 13.7 | 583.0 | 194.9 |
| 1998 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.3 | 0.7 | 0.4 | 0.9 | 0.4 | | 1.4 | 0.6 | 1.0 |
| 1998 | LQ | 17.0 | 8.7 | 8.0 | 0.9 | 36.7 | 84.0 | 5.7 | 1205.6 | | 5.0 | 315.0 | 64.6 |
| 1998 | UQ | 22.4 | 9.3 | 10.1 | 1.2 | 119.9 | 214.9 | 76.4 | 2352.8 | | 10.9 | 947.3 | 259.4 |
| 1999 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 1999 | Median | 18.1 | 9.4 | 9.0 | 0.8 | 131.3 | 208.8 | 46.4 | 2248.7 | | 12.7 | 254.2 | 120.3 |
| 1999 | Arithmetic Mean | 18.2 | 9.1 | 8.9 | 0.8 | 109.1 | 188.1 | 52.5 | 2114.6 | | 18.1 | 307.0 | 154.9 |
| 1999 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.2 | 0.6 | 0.3 | 0.7 | 0.3 | | 0.9 | 0.7 | 1.0 |
| 1999 | LQ | 16.7 | 8.7 | 8.0 | 0.7 | 62.2 | 135.1 | 17.1 | 1924.7 | | 5.0 | 181.7 | 28.9 |
| 1999 | UQ | 20.3 | 9.5 | 9.7 | 1.0 | 154.6 | 234.8 | 77.1 | 2461.3 | | 31.9 | 435.0 | 237.7 |
| 2000 | N of Cases | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 0.0 | 8.0 | 8.0 | 8.0 |
| 2000 | Median | 19.8 | 9.3 | 7.8 | 0.9 | 118.8 | 185.9 | 81.3 | 2043.3 | | 19.8 | 586.9 | 259.9 |
| 2000 | Arithmetic Mean | 19.7 | 9.3 | 7.4 | 0.9 | 109.6 | 215.0 | 71.7 | 2013.9 | | 28.6 | 637.0 | 334.4 |
| 2000 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.3 | 0.6 | 0.3 | 0.5 | 0.1 | | 1.3 | 0.3 | 0.8 |
| 2000 | LQ | 18.5 | 8.8 | 6.2 | 0.8 | 64.6 | 178.9 | 40.0 | 1820.3 | | 9.5 | 511.0 | 107.7 |
| 2000 | UQ | 21.7 | 9.8 | 8.9 | 1.0 | 141.5 | 259.9 | 104.5 | 2204.6 | | 21.6 | 674.5 | 550.4 |
| 2001 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2001 | Median | 19.2 | 9.5 | 7.4 | 0.8 | 134.2 | 174.5 | 32.8 | 2967.4 | | 13.2 | 613.6 | 264.7 |
| 2001 | Arithmetic Mean | 18.8 | 9.2 | 7.4 | 0.8 | 132.8 | 193.4 | 35.3 | 2989.5 | | 11.0 | 645.5 | 275.9 |

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2001 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.2 | 0.5 | 0.3 | 0.7 | 0.2 | | 0.4 | 0.3 | 0.5 |
| 2001 | LQ | 17.3 | 8.8 | 6.5 | 0.7 | 74.7 | 150.9 | 8.7 | 2708.6 | | 5.0 | 492.9 | 226.6 |
| 2001 | UQ | 19.9 | 9.7 | 9.4 | 1.0 | 180.3 | 246.2 | 61.9 | 3357.3 | | 15.0 | 846.6 | 330.3 |
| 2002 | N of Cases | 8.0 | 8.0 | 7.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 0.0 | 8.0 | 8.0 | 8.0 |
| 2002 | Median | 19.6 | 9.2 | 8.1 | 0.9 | 107.4 | 184.2 | 35.5 | 2469.1 | | 12.6 | 397.2 | 168.1 |
| 2002 | Arithmetic Mean | 19.3 | 9.2 | 8.3 | 0.9 | 105.6 | 173.9 | 32.5 | 2400.6 | | 20.3 | 401.0 | 181.8 |
| 2002 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.2 | 0.4 | 0.3 | 0.6 | 0.2 | | 1.2 | 0.5 | 0.6 |
| 2002 | LQ | 17.1 | 9.1 | 7.4 | 0.7 | 84.3 | 151.5 | 16.6 | 2138.1 | | 10.0 | 304.5 | 106.3 |
| 2002 | UQ | 21.1 | 9.5 | 8.7 | 1.0 | 134.8 | 205.1 | 47.3 | 2794.9 | | 14.5 | 545.9 | 260.6 |
| 2003 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2003 | Median | 20.7 | 9.4 | 8.2 | 0.7 | 80.1 | 225.4 | 46.6 | 2999.8 | | 13.0 | 69.1 | 24.1 |
| 2003 | Arithmetic Mean | 20.3 | 9.2 | 7.8 | 0.8 | 90.6 | 204.2 | 48.7 | 2475.0 | | 17.3 | 141.9 | 93.8 |
| 2003 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.3 | 0.6 | 0.4 | 0.7 | 0.4 | | 0.8 | 1.6 | 1.9 |
| 2003 | LQ | 18.7 | 8.8 | 7.0 | 0.6 | 61.3 | 115.0 | 18.1 | 1807.8 | | 7.0 | 27.6 | 11.9 |
| 2003 | UQ | 21.2 | 9.6 | 8.5 | 1.0 | 133.0 | 266.9 | 79.2 | 3175.8 | | 21.1 | 143.0 | 82.0 |
| 2004 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2004 | Median | 20.2 | 9.2 | 8.1 | 0.9 | 85.9 | 172.7 | 23.5 | 2317.7 | | 15.8 | 40.7 | 19.6 |
| 2004 | Arithmetic Mean | 19.3 | 9.2 | 7.7 | 0.9 | 85.1 | 148.8 | 29.1 | 2114.2 | | 17.6 | 113.6 | 37.2 |
| 2004 | Coefficient of Variation | 0.2 | 0.0 | 0.2 | 0.2 | 0.7 | 0.3 | 0.8 | 0.2 | | 0.6 | 1.5 | 1.2 |
| 2004 | LQ | 15.9 | 9.0 | 6.6 | 0.8 | 36.8 | 119.2 | 11.1 | 2050.0 | | 9.2 | 22.0 | 11.4 |
| 2004 | UQ | 21.4 | 9.6 | 8.8 | 1.0 | 109.7 | 173.9 | 38.0 | 2351.3 | | 23.0 | 110.9 | 41.5 |
| 2005 | N of Cases | 18.0 | 18.0 | 18.0 | 9.0 | 16.0 | 18.0 | 18.0 | 18.0 | 0.0 | 18.0 | 18.0 | 18.0 |
| 2005 | Median | 18.3 | 9.1 | 8.0 | 0.8 | 93.2 | 152.8 | 25.1 | 2170.0 | | 9.0 | 24.3 | 10.0 |
| 2005 | Arithmetic Mean | 18.8 | 9.1 | 8.0 | 0.9 | 98.7 | 159.6 | 29.7 | 2332.4 | | 12.7 | 44.3 | 16.3 |
| 2005 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.2 | 0.6 | 0.4 | 0.8 | 0.4 | | 0.7 | 1.2 | 1.2 |
| 2005 | LQ | 16.1 | 8.9 | 7.0 | 0.8 | 63.1 | 112.0 | 8.7 | 1890.0 | | 6.3 | 19.0 | 5.0 |
| 2005 | UQ | 21.7 | 9.5 | 8.8 | 1.0 | 130.4 | 213.9 | 41.7 | 2815.0 | | 18.0 | 35.0 | 22.5 |
| 2006 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2006 | Median | 20.4 | 9.4 | 8.2 | 0.7 | 108.2 | 238.3 | 75.7 | 2416.3 | | 5.0 | 56.3 | 51.2 |
| 2006 | Arithmetic Mean | 19.7 | 9.2 | 8.1 | 0.9 | 95.8 | 198.4 | 61.5 | 2256.0 | | 17.4 | 115.0 | 50.8 |
| 2006 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.5 | 0.7 | 0.5 | 0.7 | 0.5 | | 1.1 | 1.6 | 0.7 |
| 2006 | LQ | 18.2 | 8.4 | 7.0 | 0.7 | 24.6 | 102.9 | 14.7 | 1523.0 | | 5.0 | 49.8 | 24.3 |
| 2006 | UQ | 21.5 | 9.9 | 9.0 | 1.4 | 129.4 | 255.2 | 99.4 | 2786.7 | | 28.5 | 61.5 | 87.4 |
| 2007 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 8.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2007 | Median | 19.8 | 9.3 | 7.4 | 0.7 | 97.1 | 225.5 | 73.6 | 2794.1 | | 8.2 | 48.5 | 41.8 |
| 2007 | Arithmetic Mean | 19.1 | 9.4 | 7.6 | 0.7 | 107.4 | 234.9 | 72.7 | 2513.6 | | 12.8 | 85.2 | 40.3 |

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.3 | 0.5 | 0.4 | 0.6 | 0.4 | | 1.0 | 1.5 | 0.9 |
| 2007 | LQ | 17.9 | 9.1 | 6.6 | 0.6 | 75.5 | 169.5 | 35.7 | 2139.4 | | 5.5 | 17.2 | 11.4 |
| 2007 | UQ | 21.1 | 9.9 | 8.7 | 0.8 | 154.2 | 309.7 | 103.4 | 3115.5 | | 12.9 | 82.5 | 53.3 |
| 2008 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2008 | Median | 19.8 | 9.2 | 7.9 | 0.7 | 112.0 | 205.1 | 59.4 | 2507.3 | 32881.0 | 10.0 | 58.6 | 25.1 |
| 2008 | Arithmetic Mean | 19.0 | 9.2 | 8.1 | 0.8 | 105.6 | 182.2 | 53.5 | 2232.8 | 33614.9 | 9.8 | 57.7 | 32.4 |
| 2008 | Coefficient of Variation | 0.1 | 0.1 | 0.1 | 0.3 | 0.5 | 0.4 | 0.6 | 0.4 | 0.3 | 0.8 | 0.6 | 0.8 |
| 2008 | LQ | 17.1 | 9.0 | 7.5 | 0.7 | 85.6 | 123.2 | 20.7 | 2001.0 | 23578.4 | 4.0 | 25.8 | 13.7 |
| 2008 | UQ | 21.2 | 9.5 | 8.3 | 0.9 | 128.7 | 239.0 | 76.6 | 2756.4 | 43138.3 | 10.9 | 84.3 | 55.9 |
| 2009 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2009 | Median | 19.1 | 9.3 | 7.5 | 0.7 | 122.8 | 164.2 | 46.8 | 2132.8 | 27713.5 | 5.6 | 39.4 | 27.1 |
| 2009 | Arithmetic Mean | 19.1 | 9.2 | 7.7 | 0.9 | 102.8 | 156.5 | 44.2 | 2162.0 | 25708.8 | 9.1 | 134.2 | 52.4 |
| 2009 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.5 | 0.5 | 0.5 | 0.8 | 0.3 | 0.5 | 0.8 | 1.3 | 1.1 |
| 2009 | LQ | 17.7 | 8.7 | 7.0 | 0.6 | 49.9 | 95.4 | 6.5 | 1945.8 | 14134.8 | 4.3 | 23.9 | 11.3 |
| 2009 | UQ | 20.0 | 9.7 | 8.2 | 1.1 | 139.7 | 210.7 | 77.8 | 2448.6 | 37038.8 | 11.2 | 193.7 | 81.3 |
| 2010 | N of Cases | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| 2010 | Median | 19.8 | 9.4 | 8.9 | 0.9 | 81.0 | 112.2 | 16.8 | 1763.0 | 20693.8 | 6.0 | 24.3 | 14.7 |
| 2010 | Arithmetic Mean | 18.9 | 9.1 | 8.7 | 0.9 | 86.1 | 118.1 | 22.1 | 1657.0 | 24176.7 | 7.3 | 55.5 | 25.2 |
| 2010 | Coefficient of Variation | 0.2 | 0.1 | 0.1 | 0.2 | 0.8 | 0.6 | 0.9 | 0.5 | 0.6 | 0.6 | 1.1 | 1.2 |
| 2010 | LQ | 16.7 | 8.5 | 7.7 | 0.8 | 22.8 | 51.2 | 5.2 | 684.1 | 9317.1 | 4.0 | 14.0 | 1.4 |
| 2010 | UQ | 21.6 | 9.6 | 9.4 | 1.0 | 115.5 | 175.4 | 35.6 | 2353.1 | 38837.9 | 8.0 | 99.0 | 44.4 |
| 2011 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2011 | Median | 19.3 | 9.0 | 9.3 | 0.9 | 63.4 | 114.4 | 10.5 | 1668.0 | 27439.3 | 20.1 | 48.0 | 12.7 |
| 2011 | Arithmetic Mean | 18.4 | 8.8 | 8.5 | 1.0 | 55.6 | 127.0 | 31.0 | 1412.9 | 29191.3 | 17.1 | 87.6 | 24.8 |
| 2011 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.3 | 0.7 | 0.6 | 1.2 | 0.4 | 0.3 | 0.6 | 1.0 | 1.1 |
| 2011 | LQ | 16.5 | 8.3 | 7.2 | 0.8 | 12.7 | 52.7 | 4.4 | 709.0 | 20683.5 | 8.0 | 31.3 | 1.6 |
| 2011 | UQ | 20.9 | 9.2 | 9.6 | 1.1 | 94.6 | 208.1 | 71.8 | 1870.0 | 36432.5 | 23.3 | 108.6 | 35.1 |
| 2012 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2012 | Median | 19.3 | 8.8 | 7.2 | 0.9 | 46.7 | 110.9 | 31.7 | 1773.1 | 29618.5 | 13.8 | 62.9 | 14.6 |
| 2012 | Arithmetic Mean | 19.2 | 8.8 | 7.8 | 0.8 | 69.3 | 153.5 | 50.3 | 1661.5 | 30558.3 | 33.0 | 75.1 | 26.5 |
| 2012 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.3 | 0.9 | 0.6 | 0.9 | 0.5 | 0.4 | 1.1 | 0.7 | 1.0 |
| 2012 | LQ | 17.6 | 8.2 | 6.9 | 0.6 | 25.4 | 83.1 | 15.6 | 967.2 | 17643.1 | 9.6 | 39.7 | 1.6 |
| 2012 | UQ | 21.4 | 9.4 | 8.5 | 1.0 | 107.3 | 211.9 | 70.1 | 2391.9 | 44039.1 | 63.8 | 101.8 | 45.6 |
| 2013 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2013 | Median | 19.8 | 8.8 | 7.4 | 0.9 | 49.1 | 147.1 | 32.1 | 2008.0 | 41729.5 | 7.5 | 47.4 | 15.7 |
| 2013 | Arithmetic Mean | 19.7 | 8.9 | 7.3 | 0.8 | 72.8 | 183.0 | 58.0 | 1910.9 | 38043.5 | 115.8 | 67.3 | 29.9 |

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2013 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.3 | 0.8 | 0.5 | 0.7 | 0.4 | 0.2 | 1.3 | 0.9 | 1.1 |
| 2013 | LQ | 17.8 | 7.7 | 5.8 | 0.5 | 14.8 | 104.2 | 28.3 | 1263.7 | 28323.7 | 5.4 | 32.3 | 2.0 |
| 2013 | UQ | 22.6 | 9.9 | 8.2 | 0.9 | 132.0 | 256.5 | 93.0 | 2593.9 | 46135.5 | 296.7 | 83.8 | 62.3 |
| 2014 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2014 | Median | 18.9 | 8.6 | 8.3 | 0.9 | 24.0 | 195.3 | 75.7 | 2091.9 | 41019.7 | 10.6 | 50.7 | 6.1 |
| 2014 | Arithmetic Mean | 19.6 | 8.9 | 8.0 | 0.9 | 53.7 | 212.3 | 89.6 | 1824.0 | 37933.5 | 43.6 | 52.4 | 29.2 |
| 2014 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.2 | 0.9 | 0.5 | 0.7 | 0.4 | 0.2 | 1.7 | 0.8 | 1.3 |
| 2014 | LQ | 18.3 | 8.2 | 6.9 | 0.8 | 21.6 | 122.7 | 35.6 | 1075.3 | 29841.1 | 7.7 | 22.2 | 2.1 |
| 2014 | UQ | 21.3 | 9.6 | 9.5 | 1.0 | 97.4 | 287.1 | 128.9 | 2359.7 | 45192.8 | 34.4 | 66.0 | 49.4 |
| 2015 | N of Cases | 10.0 | 10.0 | 10.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | 8.0 | 10.0 | 10.0 | 10.0 |
| 2015 | Median | 20.9 | 9.2 | 8.3 | 0.7 | 71.4 | 239.7 | 99.5 | 1881.0 | 38943.9 | 22.3 | 65.1 | 35.8 |
| 2015 | Arithmetic Mean | 19.9 | 9.2 | 8.0 | 0.8 | 74.8 | 220.4 | 90.2 | 1902.4 | 37345.9 | 34.9 | 66.5 | 37.1 |
| 2015 | Coefficient of Variation | 0.2 | 0.0 | 0.2 | 0.3 | 0.4 | 0.3 | 0.6 | 0.2 | 0.3 | 0.9 | 0.6 | 0.7 |
| 2015 | LQ | 18.0 | 8.9 | 6.6 | 0.7 | 43.5 | 161.6 | 46.5 | 1601.6 | 31521.4 | 13.4 | 30.7 | 12.2 |
| 2015 | UQ | 22.0 | 9.6 | 9.1 | 1.0 | 105.8 | 267.4 | 125.2 | 2294.8 | 45916.8 | 49.4 | 93.7 | 51.4 |
| 2016 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2016 | Median | 19.9 | 9.2 | 8.3 | 0.6 | 79.9 | 236.6 | 30.9 | 2179.5 | 38938.6 | 7.0 | 32.1 | 11.8 |
| 2016 | Arithmetic Mean | 19.3 | 9.2 | 8.2 | 0.6 | 85.3 | 213.1 | 47.6 | 2125.4 | 37489.4 | 9.7 | 46.8 | 26.9 |
| 2016 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.3 | 0.6 | 0.4 | 0.9 | 0.3 | 0.2 | 0.5 | 1.0 | 1.2 |
| 2016 | LQ | 16.5 | 8.8 | 6.5 | 0.5 | 35.7 | 147.5 | 7.8 | 1779.7 | 30580.1 | 5.5 | 18.8 | 4.8 |
| 2016 | UQ | 21.3 | 9.7 | 8.9 | 0.7 | 135.1 | 280.1 | 88.9 | 2738.1 | 44621.4 | 13.0 | 51.7 | 44.4 |
| 2017 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2017 | Median | 20.6 | 9.0 | 8.0 | 0.7 | 108.4 | 236.1 | 58.3 | 2620.8 | 34677.1 | 13.0 | 55.2 | 31.3 |
| 2017 | Arithmetic Mean | 19.3 | 9.0 | 8.2 | 0.9 | 95.9 | 237.7 | 88.9 | 2219.7 | 33006.3 | 15.8 | 102.4 | 39.6 |
| 2017 | Coefficient of Variation | 0.2 | 0.0 | 0.2 | 0.4 | 0.5 | 0.4 | 0.6 | 0.4 | 0.3 | 0.5 | 1.1 | 1.1 |
| 2017 | LQ | 17.3 | 8.6 | 6.7 | 0.6 | 58.9 | 162.8 | 39.3 | 1707.1 | 24414.0 | 10.9 | 26.6 | 6.3 |
| 2017 | UQ | 22.5 | 9.3 | 9.2 | 1.3 | 128.7 | 310.9 | 145.5 | 2843.3 | 40583.1 | 19.8 | 150.8 | 57.8 |
| 2018 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2018 | Median | 18.2 | 9.2 | 8.3 | 0.8 | 99.4 | 181.5 | 41.1 | 2007.0 | 38454.9 | 13.0 | 84.3 | 33.0 |
| 2018 | Arithmetic Mean | 19.2 | 9.1 | 8.6 | 0.9 | 92.5 | 200.3 | 56.2 | 2160.3 | 34905.2 | 25.6 | 104.8 | 41.2 |
| 2018 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.5 | 0.6 | 0.4 | 0.8 | 0.3 | 0.4 | 0.9 | 0.8 | 1.0 |
| 2018 | LQ | 17.6 | 8.5 | 7.6 | 0.6 | 50.7 | 125.4 | 19.5 | 1841.5 | 23567.7 | 11.8 | 34.9 | 7.5 |
| 2018 | UQ | 21.5 | 9.6 | 9.7 | 1.0 | 125.8 | 274.8 | 102.3 | 2660.7 | 45566.1 | 30.3 | 147.2 | 65.6 |

values were lower than 2017 but not as low as 2016 which was among the lowest for median and lower quartile[14] (Figure 22). While TN was low between 2010 and 2014, and followed the trend in TP and CHL during those years, TN increased during 2015-2018. TN values in 2018 were intermediate overall when compared to the period of record. For the 29 years 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 16 years (2003-2018). The ammonia distribution was intermediate and the nitrate distribution low in 2018. 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 2013-2016 were similar, and showed the highest median, upper and lower quartiles, and inter-quartile range compared to the previous five years. The lower quartile values in 2017 and 2018 were somewhat lower compared to 2013-2016. As expected given lower pH values in recent years, un-ionized ammonia was notably lower during 2010-2014 (especially lower quartile values), and then rebounded somewhat in 2015 to 2018 (Figure 22)

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. For 2016 pH was skewed high and DO low, and both were skewed low for 2017 (Figure 23; Table 4). In 2018 the interquartile range was similar to 2017 for pH but was higher than 2017 for DO. Secchi depth was skewed somewhat low in 2018, especially compared to 2017. 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 and 2016 values rebounded they were still somewhat low relative to previous years. CHL values in 2017 and 2018 were again relatively low (Figure 24; Table 4) compared to many previous years. TP, SRP, and TN values were also relatively low in 2018 (especially lower quartile TN). Both $NO_3$-$NO_2$-N and $NH_4$-N tended to follow the overall 28 year cyclical pattern described above, but 2018 values were among the lowest for the period of record (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.

### *2018 Microcystin Sampling*

Beginning in 2016 the Klamath Tribes initiated data collection for microcystin, a cyanotoxin produced by *Microcystis aeruginosa* occurring in UKL. In 2018 a total of 126 samples were collected, with 14 surface grabs (SG) at Agency Lake Boat Launch (ALBL), and 14 each of depth-integrated (DI) and SG samples at stations PM, ER, MN, and AS. Seasonal trends indicated low values in April and early-May (<0.15 µg/L detection limit; Figure 25). In mid-May station ER (KL0006) increased to ~ 1 µg/L, and station MN (KL0008) to ~6 µg/L. Values were then close to or less than 1 µg/L (except for ER which exceeded 4 µg/L in early-June) through mid-July. Values then increased in mid-July with station ER exceeding 4 µg/L on several occasions (Figure 25). On five occasions during 2018 microcystin values exceeded the Oregon Health Authority (OHA) 4 µg/L recreational advisory level[15]. However, the 2018 OHA

[14] in contrast 2014-2015 were among the highest

[15] Oregon Harmful Algae Bloom Surveillance (HABS) Program Public Health Advisory Guidelines Harmful Algae Blooms in Freshwater Bodies

recreational criterion was based on a draft EPA guidance document[16] that has since been updated. The updated EPA advisory document for microcystin[17] recommends a microcystin value of 8 µg/L, which OHA has subsequently adopted. Microcystin concentrations in 2018 were lower overall at all stations than they were in either 2016 or 2017 (Figure 25). Overall there were 5 exceedances of the OHA advisory level in 2018 compared to 14 in 2017, and 10 in 2016.

## SUMMARY

With the addition of 2018 data, the UKL water quality/limnological database now includes 29 years of data and includes the years 1990-2018. 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). Thus, 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 Nielsen et al. 2018; Jassby and Kann 2010). Unfortunately, the ability to determine long-term trends will be hampered since funding for the Klamath Tribes' UKL monitoring program has been discontinued by the U.S Bureau of Reclamation, and there will be no data collected by the Klamath Tribes in 2019.

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) and Nielsen et al. (2018) is recommended at five year intervals.

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https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/RECREATION/HARMFULALGAEBLOOMS/Documents/Advisory%20Guidelines%20for%20Harmful%20Cyanobacteria%20Blooms%20in%20Recreational%20Waters.pdf

[16] Draft Human Health Recreational Ambient Water Quality Criteria and/or Swimming Advisories for Microcystins and Cylindrospermopsin. https://www.epa.gov/sites/production/files/2016-12/documents/draft-hh-rec-ambient-water-swimming-document.pdf

[17] Recommended Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcystins and Cylindrospermopsin. https://www.federalregister.gov/documents/2019/06/06/2019-11814/recommended-human-health-recreational-ambient-water-quality-criteria-or-swimming-advisories-for

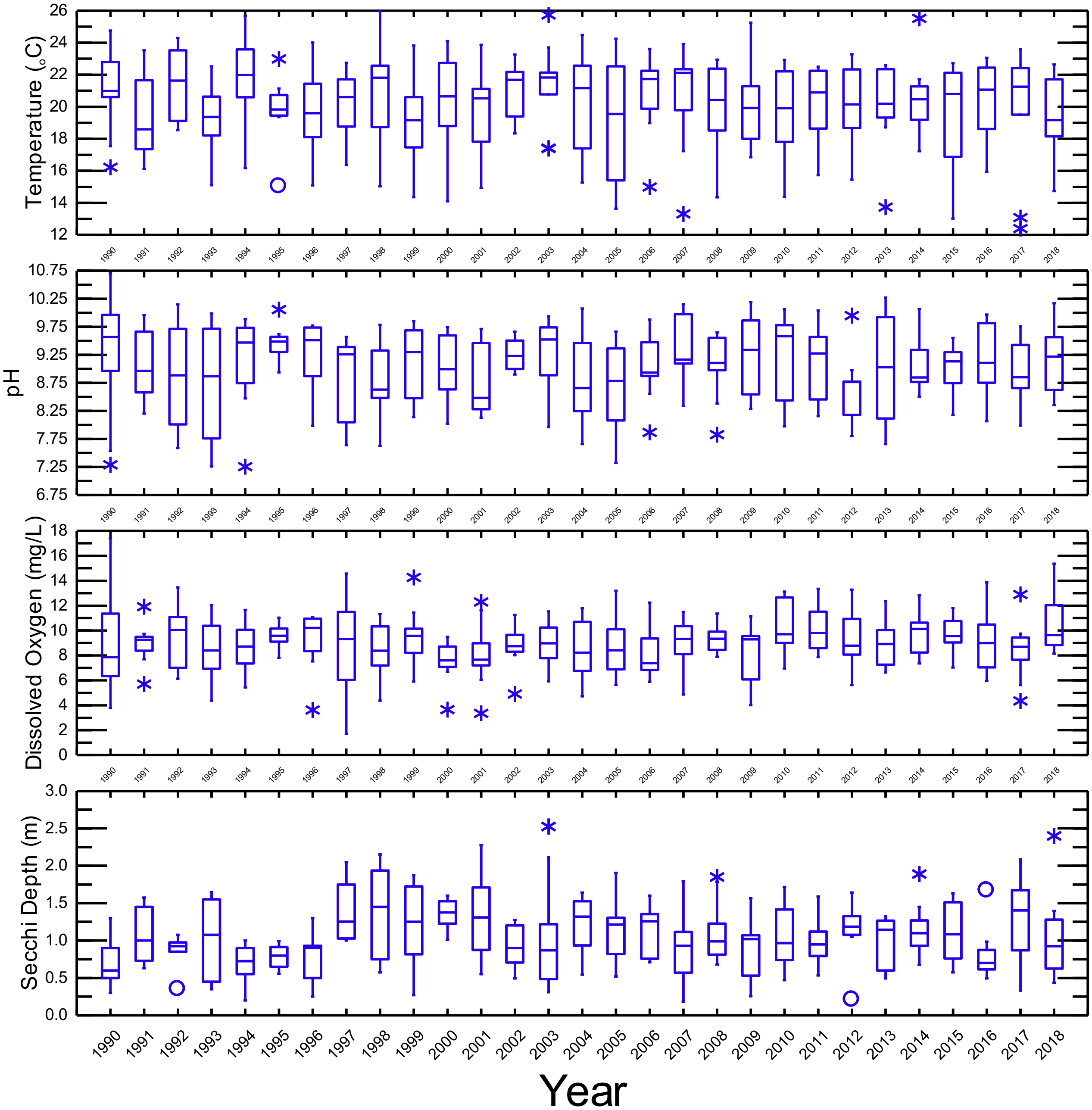


**Figure 23. June-September distribution of Agency Lake means for T (˚C), pH, D.O (mg/L), and Secchi depth, 1990-2018.**

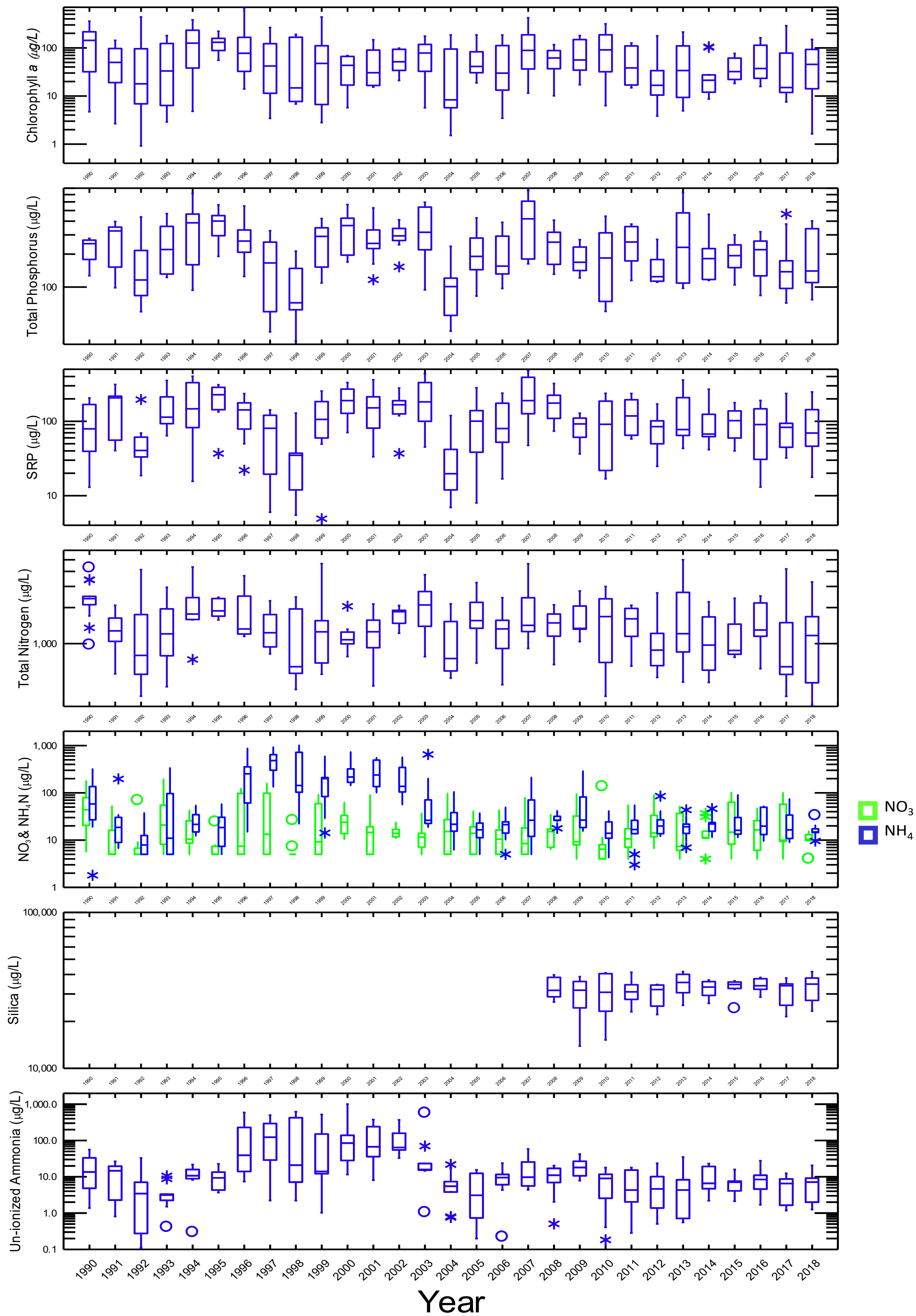


**Figure 24. June-September distribution of Agency Lake means for CHL, TP, SRP, TN, $NO_3$+ $NO_2$-N, $SiO_2$ and $NH_4$-N, 1990-2018.**

**Table 4. Summary statistics for June-September Agency Lake means, 1990-2018 (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 | 14.0 | 14.0 | 14.0 | 10.0 | 13.0 | 13.0 | 13.0 | 13.0 | 0.0 | 9.0 | 11.0 | 11.0 |
| 1990 | Median | 21.0 | 9.6 | 7.9 | 0.6 | 143.1 | 249.0 | 79.0 | 2374.0 | | 20.5 | 58.2 | 13.6 |
| 1990 | Arithmetic Mean | 21.1 | 9.3 | 9.0 | 0.7 | 150.5 | 222.8 | 99.1 | 2411.1 | | 41.2 | 95.3 | 20.3 |
| 1990 | Coefficient of Variation | 0.1 | 0.1 | 0.5 | 0.4 | 0.8 | 0.2 | 0.7 | 0.4 | | 1.4 | 1.0 | 0.9 |
| 1990 | LQ | 20.6 | 9.0 | 6.4 | 0.5 | 31.9 | 178.4 | 34.9 | 2008.9 | | 0.0 | 25.7 | 4.6 |
| 1990 | UQ | 22.8 | 10.0 | 11.4 | 0.9 | 224.1 | 270.4 | 172.4 | 2706.3 | | 55.0 | 136.0 | 33.7 |
| 1991 | N of Cases | 9.0 | 8.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 3.0 | 7.0 | 6.0 |
| 1991 | Median | 18.6 | 9.0 | 9.3 | 1.0 | 50.0 | 325.6 | 205.9 | 1276.4 | | 5.0 | 18.6 | 14.7 |
| 1991 | Arithmetic Mean | 19.2 | 9.1 | 8.9 | 1.0 | 56.3 | 270.6 | 175.2 | 1328.0 | | 20.7 | 43.1 | 13.1 |
| 1991 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.4 | 0.9 | 0.4 | 0.6 | 0.4 | | 1.3 | 1.6 | 0.8 |
| 1991 | LQ | 17.2 | 8.6 | 8.2 | 0.7 | 15.3 | 139.7 | 55.1 | 986.8 | | 5.0 | 8.3 | 2.3 |
| 1991 | UQ | 21.8 | 9.7 | 9.6 | 1.5 | 97.4 | 359.1 | 237.6 | 1731.5 | | 40.4 | 32.3 | 19.6 |
| 1992 | N of Cases | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 7.0 | 8.0 | 7.0 | 0.0 | 8.0 | 8.0 | 8.0 |
| 1992 | Median | 21.6 | 8.9 | 10.0 | 0.9 | 19.4 | 115.9 | 40.5 | 797.3 | | 5.0 | 8.0 | 3.5 |
| 1992 | Arithmetic Mean | 21.4 | 8.9 | 9.5 | 0.9 | 85.7 | 180.2 | 60.7 | 1419.3 | | 13.6 | 11.7 | 7.1 |
| 1992 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.3 | 1.7 | 0.8 | 0.9 | 0.9 | | 1.7 | 0.9 | 1.6 |
| 1992 | LQ | 19.1 | 8.0 | 7.0 | 0.9 | 7.0 | 80.7 | 33.3 | 502.6 | | 5.0 | 5.0 | 0.3 |
| 1992 | UQ | 23.5 | 9.7 | 11.1 | 1.0 | 96.8 | 293.0 | 61.8 | 1755.7 | | 7.0 | 12.7 | 7.9 |
| 1993 | N of Cases | 10.0 | 10.0 | 10.0 | 10.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 1993 | Median | 19.4 | 8.9 | 8.4 | 1.1 | 33.2 | 220.6 | 113.6 | 1206.8 | | 20.8 | 11.0 | 3.1 |
| 1993 | Arithmetic Mean | 19.2 | 8.8 | 8.3 | 1.0 | 66.5 | 255.6 | 160.1 | 1450.5 | | 54.0 | 70.2 | 4.0 |
| 1993 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.5 | 1.0 | 0.5 | 0.6 | 0.6 | | 1.3 | 1.6 | 0.8 |
| 1993 | LQ | 18.2 | 7.8 | 6.9 | 0.5 | 6.0 | 130.7 | 88.3 | 761.5 | | 7.4 | 5.0 | 2.1 |
| 1993 | UQ | 20.6 | 9.7 | 10.4 | 1.6 | 127.6 | 370.7 | 219.7 | 2053.1 | | 81.0 | 108.1 | 4.7 |
| 1994 | N of Cases | 8.0 | 8.0 | 8.0 | 6.0 | 7.0 | 7.0 | 7.0 | 7.0 | 0.0 | 7.0 | 7.0 | 7.0 |
| 1994 | Median | 22.0 | 9.5 | 8.7 | 0.7 | 125.2 | 386.5 | 147.3 | 1763.6 | | 10.5 | 21.5 | 10.7 |
| 1994 | Arithmetic Mean | 21.8 | 9.1 | 8.7 | 0.7 | 157.8 | 350.6 | 198.8 | 2155.6 | | 18.4 | 26.8 | 11.9 |
| 1994 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.4 | 0.9 | 0.6 | 0.8 | 0.6 | | 0.8 | 0.6 | 0.6 |
| 1994 | LQ | 20.6 | 8.7 | 7.4 | 0.6 | 35.2 | 153.5 | 82.1 | 1583.7 | | 8.1 | 14.6 | 8.6 |
| 1994 | UQ | 23.6 | 9.7 | 10.1 | 0.9 | 273.8 | 497.7 | 335.2 | 2893.9 | | 30.8 | 37.3 | 18.2 |
| 1995 | N of Cases | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 0.0 | 8.0 | 8.0 | 8.0 |
| 1995 | Median | 19.8 | 9.5 | 9.6 | 0.8 | 130.6 | 401.3 | 227.9 | 1878.0 | | 5.0 | 19.1 | 9.5 |
| 1995 | Arithmetic Mean | 19.8 | 9.5 | 9.6 | 0.8 | 128.9 | 383.5 | 207.8 | 1988.9 | | 8.0 | 22.1 | 10.1 |

| 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 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.2 | 0.4 | 0.3 | 0.5 | 0.2 | | 0.8 | 0.8 | 0.6 |
| 1995 | LQ | 19.4 | 9.3 | 9.1 | 0.6 | 88.5 | 305.3 | 143.3 | 1695.7 | | 5.0 | 7.4 | 4.4 |
| 1995 | UQ | 20.7 | 9.6 | 10.2 | 0.9 | 157.9 | 449.7 | 286.6 | 2376.4 | | 7.4 | 30.7 | 13.5 |
| 1996 | N of Cases | 8.0 | 8.0 | 8.0 | 6.0 | 8.0 | 8.0 | 8.0 | 8.0 | 0.0 | 8.0 | 8.0 | 8.0 |
| 1996 | Median | 19.6 | 9.5 | 10.2 | 0.9 | 78.5 | 264.5 | 143.0 | 1325.0 | | 8.0 | 254.8 | 39.3 |
| 1996 | Arithmetic Mean | 19.7 | 9.2 | 9.2 | 0.8 | 158.8 | 285.9 | 133.9 | 1871.9 | | 44.1 | 279.6 | 146.1 |
| 1996 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.5 | 1.4 | 0.5 | 0.5 | 0.5 | | 1.2 | 1.0 | 1.4 |
| 1996 | LQ | 18.1 | 8.9 | 8.3 | 0.5 | 36.8 | 208.0 | 87.0 | 1202.5 | | 5.0 | 61.0 | 14.0 |
| 1996 | UQ | 21.4 | 9.7 | 11.0 | 0.9 | 175.5 | 333.5 | 177.0 | 2545.0 | | 99.5 | 359.5 | 232.6 |
| 1997 | N of Cases | 8.0 | 8.0 | 8.0 | 4.0 | 8.0 | 8.0 | 8.0 | 8.0 | 0.0 | 8.0 | 8.0 | 8.0 |
| 1997 | Median | 20.6 | 9.3 | 9.3 | 1.3 | 46.0 | 166.9 | 82.3 | 1234.5 | | 13.3 | 485.0 | 133.7 |
| 1997 | Arithmetic Mean | 20.2 | 8.8 | 8.8 | 1.4 | 80.1 | 167.0 | 76.9 | 1376.6 | | 50.7 | 494.3 | 177.0 |
| 1997 | Coefficient of Variation | 0.1 | 0.1 | 0.5 | 0.3 | 1.2 | 0.6 | 0.7 | 0.4 | | 1.2 | 0.5 | 1.0 |
| 1997 | LQ | 18.8 | 8.0 | 6.0 | 1.0 | 11.9 | 60.5 | 30.5 | 941.5 | | 5.0 | 318.7 | 30.4 |
| 1997 | UQ | 21.7 | 9.4 | 11.5 | 1.8 | 128.6 | 257.6 | 120.7 | 1782.2 | | 103.6 | 643.4 | 293.7 |
| 1998 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 1998 | Median | 21.8 | 8.6 | 8.4 | 1.5 | 14.7 | 71.9 | 34.9 | 642.6 | | 5.0 | 143.0 | 20.9 |
| 1998 | Arithmetic Mean | 20.8 | 8.8 | 8.6 | 1.4 | 66.9 | 107.9 | 37.7 | 1144.3 | | 7.6 | 353.2 | 186.9 |
| 1998 | Coefficient of Variation | 0.2 | 0.1 | 0.3 | 0.4 | 1.2 | 0.6 | 1.0 | 0.7 | | 0.9 | 1.1 | 1.4 |
| 1998 | LQ | 18.2 | 8.4 | 7.0 | 0.7 | 7.5 | 58.3 | 10.7 | 546.4 | | 5.0 | 90.9 | 6.3 |
| 1998 | UQ | 23.0 | 9.4 | 10.4 | 2.0 | 167.5 | 160.8 | 42.4 | 2027.4 | | 5.6 | 749.7 | 456.8 |
| 1999 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 1999 | Median | 19.2 | 9.3 | 9.6 | 1.3 | 47.4 | 290.3 | 106.0 | 1253.3 | | 9.2 | 200.2 | 14.1 |
| 1999 | Arithmetic Mean | 19.1 | 9.1 | 9.5 | 1.2 | 91.1 | 254.0 | 125.0 | 1514.6 | | 28.4 | 198.3 | 117.6 |
| 1999 | Coefficient of Variation | 0.2 | 0.1 | 0.3 | 0.5 | 1.5 | 0.5 | 0.7 | 0.8 | | 1.2 | 0.9 | 1.5 |
| 1999 | LQ | 17.0 | 8.4 | 7.9 | 0.8 | 5.9 | 145.7 | 57.2 | 656.9 | | 5.0 | 69.7 | 11.8 |
| 1999 | UQ | 20.8 | 9.7 | 10.5 | 1.8 | 116.4 | 354.2 | 190.7 | 1619.4 | | 59.7 | 238.9 | 172.8 |
| 2000 | N of Cases | 8.0 | 8.0 | 8.0 | 7.0 | 8.0 | 8.0 | 8.0 | 8.0 | 0.0 | 8.0 | 8.0 | 8.0 |
| 2000 | Median | 20.6 | 9.0 | 7.6 | 1.4 | 44.4 | 365.1 | 190.4 | 1079.1 | | 23.9 | 221.3 | 84.8 |
| 2000 | Arithmetic Mean | 20.3 | 9.0 | 7.5 | 1.4 | 42.4 | 339.5 | 198.0 | 1184.7 | | 27.0 | 286.7 | 192.2 |
| 2000 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.2 | 0.6 | 0.4 | 0.5 | 0.3 | | 0.6 | 0.7 | 1.7 |
| 2000 | LQ | 18.8 | 8.6 | 7.1 | 1.2 | 21.5 | 196.0 | 128.1 | 996.0 | | 13.8 | 167.1 | 28.7 |
| 2000 | UQ | 22.7 | 9.6 | 8.7 | 1.5 | 66.4 | 429.0 | 272.4 | 1249.0 | | 34.1 | 321.2 | 146.9 |
| 2001 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2001 | Median | 20.5 | 8.5 | 7.7 | 1.3 | 30.5 | 250.6 | 151.4 | 1255.5 | | 14.5 | 238.4 | 67.3 |
| 2001 | Arithmetic Mean | 19.7 | 8.8 | 8.1 | 1.3 | 58.6 | 288.1 | 171.7 | 1309.8 | | 21.1 | 305.6 | 140.6 |

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2001 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.5 | 0.9 | 0.5 | 0.7 | 0.4 | | 1.3 | 0.6 | 1.0 |
| 2001 | LQ | 17.5 | 8.3 | 6.9 | 0.8 | 16.4 | 209.3 | 71.5 | 918.6 | | 5.0 | 128.2 | 34.6 |
| 2001 | UQ | 21.4 | 9.5 | 9.6 | 1.8 | 101.5 | 358.5 | 246.3 | 1697.3 | | 20.9 | 503.6 | 266.2 |
| 2002 | N of Cases | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 0.0 | 7.0 | 7.0 | 7.0 |
| 2002 | Median | 21.7 | 9.2 | 8.7 | 0.9 | 51.3 | 293.5 | 166.8 | 1844.5 | | 13.8 | 137.5 | 64.4 |
| 2002 | Arithmetic Mean | 20.9 | 9.3 | 8.7 | 0.9 | 60.8 | 298.2 | 159.0 | 1698.5 | | 15.1 | 236.4 | 132.1 |
| 2002 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.3 | 0.5 | 0.3 | 0.5 | 0.2 | | 0.3 | 0.8 | 1.0 |
| 2002 | LQ | 19.1 | 9.0 | 8.2 | 0.7 | 32.5 | 255.5 | 122.3 | 1458.9 | | 11.6 | 104.0 | 52.8 |
| 2002 | UQ | 22.4 | 9.5 | 9.7 | 1.2 | 93.4 | 372.4 | 190.9 | 1901.9 | | 17.8 | 348.8 | 208.0 |
| 2003 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2003 | Median | 21.8 | 9.5 | 9.0 | 0.9 | 78.1 | 316.9 | 182.3 | 2102.3 | | 11.5 | 26.2 | 15.9 |
| 2003 | Arithmetic Mean | 21.4 | 9.3 | 9.1 | 1.1 | 83.5 | 364.7 | 227.8 | 2078.2 | | 14.8 | 121.4 | 83.6 |
| 2003 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.7 | 0.7 | 0.5 | 0.6 | 0.5 | | 0.8 | 1.7 | 2.2 |
| 2003 | LQ | 19.9 | 8.9 | 7.8 | 0.5 | 30.4 | 205.8 | 99.2 | 1251.6 | | 6.6 | 22.4 | 15.1 |
| 2003 | UQ | 22.5 | 9.7 | 10.6 | 1.4 | 124.8 | 548.7 | 346.8 | 2821.1 | | 18.7 | 103.4 | 35.0 |
| 2004 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2004 | Median | 21.2 | 8.7 | 8.2 | 1.3 | 8.3 | 101.0 | 19.8 | 750.9 | | 15.1 | 21.7 | 5.5 |
| 2004 | Arithmetic Mean | 20.4 | 8.8 | 8.4 | 1.2 | 47.4 | 106.3 | 38.4 | 1105.1 | | 29.4 | 37.2 | 7.6 |
| 2004 | Coefficient of Variation | 0.2 | 0.1 | 0.3 | 0.3 | 1.4 | 0.6 | 1.1 | 0.6 | | 1.2 | 0.9 | 0.9 |
| 2004 | LQ | 17.0 | 8.2 | 6.5 | 0.9 | 5.4 | 54.5 | 11.5 | 583.9 | | 5.0 | 13.6 | 3.1 |
| 2004 | UQ | 23.0 | 9.6 | 10.8 | 1.5 | 96.4 | 138.0 | 56.3 | 1593.9 | | 41.3 | 49.4 | 9.9 |
| 2005 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2005 | Median | 19.5 | 8.8 | 8.4 | 1.2 | 41.0 | 190.4 | 100.5 | 1557.3 | | 14.0 | 16.5 | 3.1 |
| 2005 | Arithmetic Mean | 19.4 | 8.7 | 8.6 | 1.1 | 68.5 | 218.2 | 119.2 | 1783.3 | | 17.1 | 18.4 | 5.7 |
| 2005 | Coefficient of Variation | 0.2 | 0.1 | 0.3 | 0.4 | 0.9 | 0.6 | 0.8 | 0.5 | | 0.8 | 0.5 | 1.1 |
| 2005 | LQ | 15.4 | 8.0 | 6.6 | 0.8 | 29.2 | 129.2 | 36.3 | 1233.5 | | 5.0 | 10.9 | 0.6 |
| 2005 | UQ | 22.9 | 9.4 | 10.4 | 1.3 | 99.9 | 303.6 | 171.0 | 2305.2 | | 24.4 | 23.4 | 12.6 |
| 2006 | N of Cases | 9.0 | 9.0 | 9.0 | 8.0 | 9.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2006 | Median | 21.7 | 8.9 | 7.4 | 1.3 | 29.9 | 155.5 | 80.0 | 1327.0 | | 10.5 | 21.2 | 9.5 |
| 2006 | Arithmetic Mean | 20.8 | 9.0 | 8.2 | 1.1 | 60.2 | 205.8 | 115.7 | 1303.1 | | 13.4 | 22.2 | 9.9 |
| 2006 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.3 | 1.1 | 0.5 | 0.7 | 0.5 | | 0.9 | 0.6 | 0.7 |
| 2006 | LQ | 19.7 | 8.8 | 6.6 | 0.8 | 12.7 | 131.1 | 50.6 | 838.7 | | 5.0 | 13.1 | 5.6 |
| 2006 | UQ | 22.6 | 9.5 | 9.7 | 1.4 | 113.5 | 304.1 | 188.7 | 1685.8 | | 17.2 | 27.2 | 13.0 |
| 2007 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 8.0 | 9.0 | 9.0 | 9.0 | 0.0 | 9.0 | 9.0 | 9.0 |
| 2007 | Median | 22.1 | 9.2 | 9.3 | 0.9 | 88.9 | 420.6 | 189.4 | 1421.5 | | 8.5 | 26.3 | 9.8 |
| 2007 | Arithmetic Mean | 20.5 | 9.4 | 8.9 | 0.9 | 133.8 | 403.2 | 256.3 | 2144.5 | | 18.1 | 55.9 | 17.1 |

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.6 | 1.0 | 0.6 | 0.6 | 0.6 | | 1.3 | 1.2 | 1.0 |
| 2007 | LQ | 19.1 | 9.0 | 7.7 | 0.5 | 37.3 | 176.7 | 120.1 | 1216.3 | | 5.0 | 11.7 | 5.3 |
| 2007 | UQ | 22.7 | 10.0 | 10.4 | 1.1 | 192.5 | 615.2 | 406.1 | 2797.0 | | 19.5 | 83.7 | 25.6 |
| 2008 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2008 | Median | 20.4 | 9.1 | 9.3 | 1.0 | 61.7 | 257.0 | 175.2 | 1488.8 | 31635.7 | 15.2 | 26.4 | 11.0 |
| 2008 | Arithmetic Mean | 19.8 | 9.1 | 9.2 | 1.1 | 62.6 | 263.1 | 180.2 | 1419.3 | 33174.9 | 14.9 | 28.7 | 10.7 |
| 2008 | Coefficient of Variation | 0.2 | 0.1 | 0.1 | 0.4 | 0.6 | 0.4 | 0.5 | 0.4 | 0.2 | 0.6 | 0.2 | 0.7 |
| 2008 | LQ | 17.8 | 8.8 | 8.3 | 0.8 | 31.6 | 157.2 | 107.2 | 1041.8 | 28531.8 | 7.1 | 25.8 | 5.7 |
| 2008 | UQ | 22.4 | 9.6 | 9.9 | 1.4 | 94.5 | 339.8 | 235.2 | 1799.8 | 38602.1 | 18.5 | 33.1 | 17.4 |
| 2009 | N of Cases | 8.0 | 8.0 | 8.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 8.0 |
| 2009 | Median | 19.9 | 9.3 | 9.3 | 1.0 | 56.1 | 168.7 | 92.2 | 1341.1 | 31716.7 | 9.2 | 26.6 | 18.1 |
| 2009 | Arithmetic Mean | 20.1 | 9.2 | 8.1 | 0.9 | 84.5 | 185.6 | 86.3 | 1645.4 | 29927.1 | 25.6 | 65.8 | 20.6 |
| 2009 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.5 | 0.7 | 0.3 | 0.4 | 0.4 | 0.3 | 1.2 | 1.3 | 0.6 |
| 2009 | LQ | 18.0 | 8.5 | 6.1 | 0.5 | 30.5 | 139.0 | 58.2 | 1286.6 | 23854.6 | 7.9 | 18.3 | 11.1 |
| 2009 | UQ | 21.3 | 9.9 | 9.6 | 1.2 | 149.5 | 234.4 | 114.3 | 2130.3 | 36475.2 | 37.0 | 83.4 | 28.0 |
| 2010 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2010 | Median | 19.9 | 9.6 | 9.7 | 1.0 | 90.8 | 184.3 | 91.2 | 1681.7 | 30752.6 | 6.4 | 14.0 | 9.0 |
| 2010 | Arithmetic Mean | 19.3 | 9.2 | 10.5 | 1.0 | 116.7 | 221.9 | 109.6 | 1644.4 | 30044.6 | 20.7 | 17.6 | 8.1 |
| 2010 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.5 | 0.9 | 0.7 | 0.8 | 0.6 | 0.3 | 2.1 | 0.6 | 0.8 |
| 2010 | LQ | 17.0 | 8.4 | 9.0 | 0.7 | 26.1 | 72.1 | 21.6 | 643.2 | 21777.2 | 4.0 | 10.1 | 2.0 |
| 2010 | UQ | 22.3 | 9.8 | 12.7 | 1.5 | 190.3 | 338.5 | 196.3 | 2430.6 | 40493.5 | 8.8 | 24.8 | 12.9 |
| 2011 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2011 | Median | 20.2 | 9.3 | 9.8 | 1.0 | 38.3 | 257.8 | 117.8 | 1608.5 | 30943.2 | 10.6 | 16.7 | 4.3 |
| 2011 | Arithmetic Mean | 19.2 | 9.1 | 10.2 | 1.0 | 55.0 | 250.3 | 131.3 | 1513.5 | 31138.2 | 16.1 | 21.6 | 8.4 |
| 2011 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.3 | 0.8 | 0.4 | 0.5 | 0.3 | 0.2 | 1.0 | 0.7 | 0.9 |
| 2011 | LQ | 17.6 | 8.4 | 8.5 | 0.8 | 16.8 | 163.7 | 64.5 | 1105.8 | 26653.5 | 6.9 | 11.5 | 1.6 |
| 2011 | UQ | 22.2 | 9.6 | 11.7 | 1.1 | 110.0 | 358.9 | 201.9 | 1993.2 | 35506.6 | 18.8 | 28.0 | 15.8 |
| 2012 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2012 | Median | 20.1 | 8.8 | 8.8 | 1.2 | 16.7 | 124.3 | 84.8 | 882.8 | 31998.6 | 14.2 | 19.9 | 4.6 |
| 2012 | Arithmetic Mean | 20.2 | 8.6 | 9.2 | 1.1 | 34.9 | 155.4 | 85.3 | 1118.7 | 29775.7 | 27.6 | 28.0 | 8.0 |
| 2012 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.3 | 1.6 | 0.4 | 0.5 | 0.6 | 0.2 | 1.0 | 0.8 | 1.1 |
| 2012 | LQ | 18.6 | 8.1 | 7.6 | 1.1 | 8.8 | 112.8 | 49.0 | 637.1 | 24522.2 | 11.6 | 13.3 | 1.2 |
| 2012 | UQ | 22.4 | 8.8 | 11.2 | 1.4 | 35.2 | 191.6 | 107.8 | 1386.9 | 34240.1 | 38.3 | 30.5 | 13.2 |
| 2013 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2013 | Median | 20.2 | 9.0 | 8.9 | 1.1 | 33.8 | 230.8 | 77.3 | 1210.2 | 35544.1 | 7.4 | 19.1 | 4.3 |
| 2013 | Arithmetic Mean | 20.1 | 9.0 | 9.0 | 1.0 | 66.7 | 298.6 | 142.4 | 1917.2 | 34999.4 | 19.1 | 20.6 | 9.0 |

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2013 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.4 | 1.1 | 0.8 | 0.8 | 0.8 | 0.2 | 0.9 | 0.6 | 1.3 |
| 2013 | LQ | 19.2 | 8.0 | 7.2 | 0.6 | 9.1 | 106.4 | 61.5 | 790.5 | 29821.4 | 5.6 | 12.8 | 0.7 |
| 2013 | UQ | 22.4 | 10.0 | 10.4 | 1.3 | 122.0 | 492.7 | 226.1 | 2708.2 | 40404.4 | 37.0 | 24.4 | 11.7 |
| 2014 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2014 | Median | 20.5 | 8.8 | 10.1 | 1.1 | 21.2 | 182.0 | 67.3 | 972.2 | 33233.4 | 11.4 | 22.0 | 6.6 |
| 2014 | Arithmetic Mean | 20.5 | 9.1 | 9.7 | 1.2 | 36.7 | 201.3 | 104.5 | 1198.8 | 32560.4 | 15.2 | 23.6 | 11.0 |
| 2014 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.3 | 1.1 | 0.5 | 0.7 | 0.6 | 0.1 | 0.7 | 0.5 | 0.8 |
| 2014 | LQ | 19.1 | 8.7 | 8.2 | 0.9 | 11.5 | 116.9 | 59.9 | 600.6 | 29100.8 | 9.3 | 14.9 | 4.4 |
| 2014 | UQ | 21.4 | 9.5 | 10.7 | 1.3 | 46.2 | 232.1 | 132.4 | 1784.5 | 36046.5 | 19.3 | 28.0 | 20.1 |
| 2015 | N of Cases | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| 2015 | Median | 20.8 | 9.1 | 9.6 | 1.1 | 32.3 | 194.0 | 102.3 | 877.9 | 34534.6 | 14.9 | 16.1 | 7.1 |
| 2015 | Arithmetic Mean | 19.4 | 9.0 | 9.7 | 1.1 | 40.8 | 198.0 | 102.3 | 1183.3 | 33284.7 | 34.8 | 28.3 | 7.0 |
| 2015 | Coefficient of Variation | 0.2 | 0.0 | 0.2 | 0.4 | 0.6 | 0.3 | 0.5 | 0.5 | 0.1 | 1.0 | 1.0 | 0.6 |
| 2015 | LQ | 16.9 | 8.7 | 9.0 | 0.8 | 22.2 | 153.0 | 59.9 | 815.9 | 32527.3 | 8.5 | 13.5 | 4.2 |
| 2015 | UQ | 22.1 | 9.3 | 10.8 | 1.5 | 61.3 | 242.9 | 137.9 | 1459.6 | 35765.1 | 63.5 | 32.7 | 7.6 |
| 2016 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2016 | Median | 21.1 | 9.1 | 9.0 | 0.7 | 37.1 | 219.8 | 90.5 | 1298.5 | 33849.7 | 16.5 | 19.7 | 8.4 |
| 2016 | Arithmetic Mean | 20.2 | 9.2 | 9.1 | 0.8 | 67.6 | 205.4 | 89.6 | 1525.8 | 34127.2 | 19.3 | 27.5 | 9.4 |
| 2016 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.4 | 0.9 | 0.4 | 0.8 | 0.4 | 0.1 | 0.8 | 0.7 | 0.8 |
| 2016 | LQ | 18.0 | 8.7 | 7.0 | 0.6 | 21.9 | 120.0 | 26.7 | 1069.8 | 31290.3 | 5.6 | 13.1 | 4.2 |
| 2016 | UQ | 22.6 | 9.9 | 10.6 | 0.9 | 122.0 | 276.0 | 152.7 | 2218.8 | 37671.2 | 30.0 | 50.1 | 11.1 |
| 2017 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2017 | Median | 21.3 | 8.9 | 8.7 | 1.4 | 15.0 | 138.0 | 83.0 | 641.7 | 33850.0 | 10.0 | 16.5 | 6.5 |
| 2017 | Arithmetic Mean | 19.6 | 8.9 | 8.4 | 1.3 | 59.6 | 188.4 | 98.3 | 1253.9 | 30948.9 | 31.7 | 27.3 | 5.8 |
| 2017 | Coefficient of Variation | 0.2 | 0.1 | 0.3 | 0.5 | 1.5 | 0.7 | 0.7 | 1.0 | 0.2 | 1.1 | 0.9 | 0.7 |
| 2017 | LQ | 17.9 | 8.6 | 7.1 | 0.9 | 10.8 | 91.8 | 41.6 | 552.5 | 25323.4 | 9.3 | 10.6 | 1.6 |
| 2017 | UQ | 22.6 | 9.4 | 9.5 | 1.8 | 82.7 | 224.7 | 120.9 | 1622.9 | 35255.8 | 61.3 | 40.3 | 9.0 |
| 2018 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 2018 | Median | 19.2 | 9.2 | 9.6 | 0.9 | 45.3 | 140.3 | 69.5 | 1169.3 | 34698.7 | 10.5 | 14.9 | 7.1 |
| 2018 | Arithmetic Mean | 19.6 | 9.1 | 10.6 | 1.1 | 61.9 | 211.7 | 105.1 | 1243.6 | 33175.5 | 10.4 | 16.8 | 6.8 |
| 2018 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.6 | 0.9 | 0.6 | 0.8 | 0.8 | 0.2 | 0.4 | 0.4 | 0.9 |
| 2018 | LQ | 18.1 | 8.6 | 8.8 | 0.6 | 12.5 | 109.4 | 45.5 | 461.2 | 27209.9 | 8.4 | 13.8 | 1.9 |
| 2018 | UQ | 21.9 | 9.6 | 12.2 | 1.3 | 104.6 | 347.5 | 166.1 | 1773.3 | 38512.8 | 13.5 | 18.1 | 9.2 |

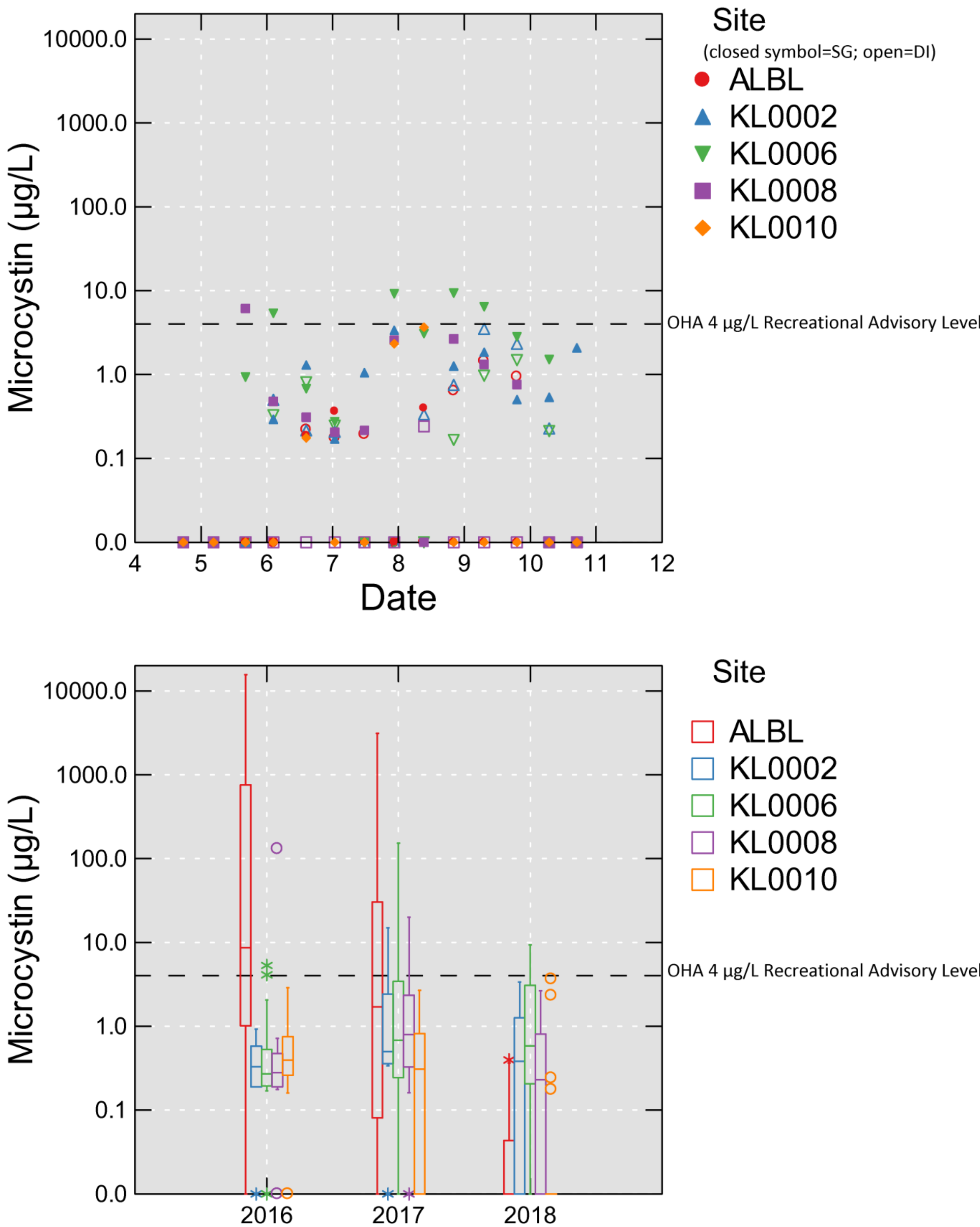


**Figure 25. Upper Klamath and Agency Lakes 2018 microcystin time-series (top panel); and June-October 2016 to 2018 seasonal comparison (bottom panel).**

## LITERATURE CITED

Eldridge, S.L.C., Wherry, S.A., and Wood, T.M., 2014, Statistical analysis of the water-quality monitoring program, Upper Klamath Lake, Oregon, and optimization of the program for 2013 and beyond: U.S. Geological Survey Open File Report 2014-1009, 82 p., http://dx.doi.org/10.3133/ofr20141009

Eldridge, S.L.C, T. M. Wood , K.R. Echols & B.R. Topping (2013) Microcystins, nutrient dynamics, and other environmental factors during blooms of non-microcystin-producing Aphanizomenon flos-aquae in Upper Klamath Lake, Oregon, 2009, Lake and Reservoir Management, 29:1, 68-81

Jassby, A., and J. Kann. 2010. Upper Klamath Lake Monitoring Program: preliminary analysis of status and trends for 1990-2009. Technical Memorandum prepared by Aquatic Ecosystem Sciences LLC for the Klamath Tribes Natural Resources Department, Chiloquin, OR. 55 p.

Kann, J. 1998. Ecology and water quality dynamics of a shallow hypertrophic lake dominated by Cyanobacteria (*Aphanizomenon flos-aquae*). Doctoral Dissertation. University of North Carolina. Curriculum in Ecology. Chapel Hill, North Carolina.

Kann, J., and V. H. Smith. 1999. Chlorophyll as a predictor of elevated pH in a hypereutrophic lake: estimating the probability of exceeding critical values for fish success using parametric and nonparametric models. Can. J. Fish Aquat. Sci. 56: 2262-2270

Kann, J. and E. B. Welch. 2005. Wind control on water quality in shallow, hypereutrophic Upper Klamath Lake, Oregon. Lake Reserv. Manage. 21(2):149-158

Kann, J. 2007. Upper Klamath Lake 2006 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. April 2007.

Kann, J. 2008. Upper Klamath Lake 2007 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. June 2008.

Kann, J. 2009. Upper Klamath Lake 2008 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. June 2009.

Kann, J. 2010. Upper Klamath Lake 2009 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. June 2010.

Kann, J. 2011. Upper Klamath Lake 2010 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. June 2011.

Kann, J. 2012. Upper Klamath Lake 2011 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. July 2012.

Kann, J. 2013. Upper Klamath Lake 2012 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. May 2013

Kann, J. 2014. Upper Klamath Lake 2013 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. May 2014

Kann, J. 2015. Upper Klamath Lake 2014 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. Aug 2016

Kann, J. 2016. Upper Klamath Lake 2015 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. June 2016

Kann, J. 2017. Upper Klamath Lake 2016 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. June 2017

Kann, J. 2018. Upper Klamath Lake 2017 Data Summary Report. Technical Memorandum Prepared for the Klamath Tribes Natural Resources Department, Chiloquin Oregon. June 2018

Kann, J., J.E. Asarian, A. St. Amand. 2014. Initial Analysis of 1990-2013 Phytoplankton and Zooplankton Data for Upper Klamath Lake (Phase I). Prepared by Aquatic Ecosystem Sciences LLC. for the Klamath Tribes Natural Resources Department. 100p. + appendices.

Klamath Tribes 2013a. Standard Operating Procedures (SOP) for Upper Klamath Lake Water Quality Field Sampling. Revision: 2013 v). Klamath Tribes Research Station, Klamath Tribes Natural Resources Department, Chiloquin, OR.

Klamath Tribes 2013b. Quality Assurance Project Plan (QAPP). Revision: 2013 v 0. Klamath Tribes Research Station, Klamath Tribes Natural Resources Department, Chiloquin, OR.

Lehtimäki,J., Moisander P., Sivonen K., Kononen K. 1997. Growth, nitrogen fixation, and nodularin production by two baltic sea cyanobacteria. Appl Environ Microbiol. 63:1647-56.

Lindenberg, M.K., Hoilman, Gene, and Wood, T.M., 2009, Water quality conditions in Upper Klamath and Agency Lakes, Oregon, 2006: U.S. Geological Survey Scientific Investigations Report 2008-5201, 54 p.

Nielsen, J. M., Kann, J., and Brett M. T. 2018. Combined analyses of long-term (1990-2015) water quality and plankton dynamics of Upper Klamath Lake (Phase II). Prepared by Aquatic

Ecosystem Sciences LLC and University of Washington for the Klamath Tribes Natural Resources Department. 107p.

Walker, W.W., J. D. Walker, and J. Kann. 2012. Evaluation of Water and Nutrient Balances for the Upper Klamath Lake Basin in Water Years 1992-2010. Technical Report to the Klamath Tribes Natural Resources Department, Chiloquin, OR. 49 pp. +Appendices.

Wood, T.M., Hoilman, G.R., and Lindenberg, M.K., 2006, Water-quality conditions in Upper Klamath Lake, Oregon, 2002–04: U.S. Geological Survey Scientific Investigations Report 2006-5209, 52 p.

Wood, T.M., Cheng, R.T., Gartner, J.W., Hoilman, G.R., Lindenberg, M.K., and Wellman, R.E., 2008, Modeling hydrodynamics and heat transport in Upper Klamath Lake, Oregon, and implications for water quality: U.S. Geological Survey Scientific Investigations Report 2008–5076, 48 p.

Wong, S.W., Barry, M.J., Aldous, A.R., Rudd, N.T., Hendrixson, H.A., and C.M. Doehring (2011). Nutrient Release from a Recently Flooded Delta Wetland: Comparison of Field Measurements to Laboratory Results. Wetlands 31(2): 433-443.

Wong, S.W., Hendrixson, H.A., and Doehring, C.M., 2010, Post-restoration water quality conditions at the Williamson River Delta, Upper Klamath Basin, Oregon, 2007-2009: The Nature Conservancy. (Internet access at: http://conserveonline.org/workspaces/Williamson.River.Delta.Preserve/documents/postrestoration-water-quality-conditions-at-the/view.html).

## APPENDIX I: Summary statistics of monthly distributions for the June-September period, Upper Klamath Lake Stations; 1990-2018 (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 | 14.0 | 14.0 | 14.0 | 13.0 | 12.0 | 12.0 | 13.0 | 12.0 | 2.0 | 2.0 | 2.0 |
| 1990 | 6 | Median | 16.1 | 9.2 | 8.7 | 1.0 | 50.8 | 118.5 | 18.0 | 795.0 | 25.0 | 62.2 | 50.2 |
| 1990 | 6 | Arithmetic Mean | 17.8 | 9.3 | 9.1 | 1.0 | 91.5 | 129.3 | 19.7 | 1084.6 | 25.0 | 62.2 | 50.2 |
| 1990 | 6 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.3 | 1.2 | 0.3 | 0.4 | 0.6 | 0.2 | 0.3 | 0.3 |
| 1990 | 6 | LQ | 15.6 | 8.9 | 8.1 | 0.8 | 29.9 | 106.0 | 14.8 | 694.0 | 22.0 | 47.9 | 39.7 |
| 1990 | 6 | UQ | 20.7 | 9.5 | 9.3 | 1.2 | 116.0 | 139.0 | 20.0 | 1543.0 | 28.0 | 76.4 | 60.6 |
| 1990 | 7 | N of Cases | 18.0 | 18.0 | 18.0 | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 8.0 | 16.0 | 16.0 |
| 1990 | 7 | Median | 22.5 | 9.5 | 6.9 | 0.6 | 118.6 | 216.0 | 67.0 | 2452.0 | 14.1 | 57.2 | 40.3 |
| 1990 | 7 | Arithmetic Mean | 22.4 | 9.5 | 7.3 | 0.6 | 165.4 | 222.1 | 67.1 | 2654.3 | 13.0 | 93.7 | 48.8 |
| 1990 | 7 | Coefficient of Variation | 0.0 | 0.0 | 0.3 | 0.4 | 0.6 | 0.2 | 0.3 | 0.4 | 0.9 | 1.0 | 0.8 |
| 1990 | 7 | LQ | 21.7 | 9.3 | 6.3 | 0.4 | 95.9 | 194.5 | 53.0 | 2185.0 | 2.8 | 34.2 | 22.0 |
| 1990 | 7 | UQ | 23.0 | 9.6 | 8.7 | 0.8 | 268.7 | 246.0 | 81.0 | 3248.0 | 19.0 | 125.4 | 60.0 |
| 1990 | 8 | N of Cases | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 1990 | 8 | Median | 23.3 | 9.3 | 7.8 | 0.5 | 191.2 | 240.9 | 95.3 | 3428.4 | 20.6 | 100.1 | 48.4 |
| 1990 | 8 | Arithmetic Mean | 22.1 | 9.2 | 7.4 | 0.7 | 201.2 | 242.8 | 94.2 | 3897.0 | 16.8 | 96.1 | 38.4 |
| 1990 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.7 | 0.7 | 0.3 | 0.1 | 0.5 | 0.9 | 0.9 | 0.9 |
| 1990 | 8 | LQ | 19.1 | 9.0 | 5.3 | 0.4 | 82.5 | 171.4 | 87.4 | 2533.4 | 0.0 | 13.8 | 5.7 |
| 1990 | 8 | UQ | 23.5 | 9.4 | 9.1 | 1.0 | 276.1 | 306.9 | 103.7 | 4316.9 | 29.3 | 159.0 | 69.0 |
| 1990 | 9 | N of Cases | 16.0 | 16.0 | 16.0 | 16.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 |
| 1990 | 9 | Median | 18.4 | 9.4 | 9.7 | 0.6 | 149.6 | 228.0 | 57.7 | 3459.1 | 0.0 | 73.3 | 44.8 |
| 1990 | 9 | Arithmetic Mean | 18.5 | 9.4 | 9.0 | 0.7 | 167.3 | 235.2 | 66.6 | 3495.6 | 5.7 | 167.1 | 64.2 |
| 1990 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.5 | 0.8 | 0.2 | 0.3 | 0.3 | 2.0 | 1.1 | 0.8 |
| 1990 | 9 | LQ | 17.8 | 9.2 | 7.4 | 0.5 | 88.5 | 207.0 | 52.5 | 2856.0 | 0.0 | 36.1 | 20.6 |
| 1990 | 9 | UQ | 19.1 | 9.6 | 10.9 | 1.0 | 231.9 | 246.8 | 72.5 | 3722.2 | 8.0 | 231.7 | 97.3 |
| 1991 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 8.0 | 8.0 |
| 1991 | 6 | Median | 15.9 | 8.4 | 8.1 | 0.9 | 16.8 | 88.7 | 19.5 | 681.0 | 39.0 | 5.0 | 0.6 |
| 1991 | 6 | Arithmetic Mean | 15.6 | 8.4 | 8.1 | 0.8 | 19.3 | 90.2 | 21.7 | 686.1 | 44.8 | 6.9 | 0.7 |
| 1991 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.7 | 0.5 | 0.1 | 0.7 | 0.2 | 0.9 | 0.8 | 0.6 |
| 1991 | 6 | LQ | 14.8 | 8.2 | 7.3 | 0.7 | 11.7 | 81.5 | 6.5 | 588.4 | 10.0 | 5.0 | 0.5 |
| 1991 | 6 | UQ | 16.3 | 8.7 | 8.9 | 1.2 | 25.4 | 95.8 | 38.9 | 788.5 | 66.8 | 5.0 | 0.8 |
| 1991 | 7 | N of Cases | 13.0 | 13.0 | 13.0 | 13.0 | 11.0 | 11.0 | 11.0 | 11.0 | 3.0 | 11.0 | 11.0 |
| 1991 | 7 | Median | 19.9 | 9.5 | 8.7 | 0.7 | 119.3 | 157.0 | 40.1 | 2317.3 | 5.0 | 46.0 | 30.3 |
| 1991 | 7 | Arithmetic Mean | 19.5 | 9.5 | 8.7 | 0.7 | 124.8 | 163.1 | 35.7 | 2549.5 | 5.0 | 131.1 | 68.0 |
| 1991 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.4 | 0.5 | 0.2 | 0.4 | 0.3 | 0.0 | 1.3 | 1.1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | 7 | LQ | 18.6 | 9.4 | 7.7 | 0.6 | 80.2 | 141.7 | 20.9 | 2145.5 | 5.0 | 34.0 | 22.8 |
| 1991 | 7 | UQ | 20.3 | 9.7 | 10.4 | 0.8 | 177.0 | 176.0 | 48.1 | 3072.4 | 5.0 | 185.9 | 110.5 |
| 1991 | 8 | N of Cases | 25.0 | 21.0 | 25.0 | 27.0 | 24.0 | 24.0 | 24.0 | 24.0 | 0.0 | 24.0 | 21.0 |
| 1991 | 8 | Median | 20.3 | 9.3 | 9.2 | 0.7 | 115.4 | 225.5 | 55.0 | 2548.8 | | 24.5 | 9.0 |
| 1991 | 8 | Arithmetic Mean | 20.0 | 9.1 | 8.6 | 0.7 | 130.7 | 248.8 | 65.2 | 2833.1 | | 78.7 | 19.3 |
| 1991 | 8 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.6 | 0.9 | 0.3 | 0.5 | 0.5 | | 1.2 | 1.1 |
| 1991 | 8 | LQ | 18.1 | 8.7 | 6.7 | 0.5 | 33.9 | 200.5 | 41.0 | 1959.5 | | 15.7 | 8.0 |
| 1991 | 8 | UQ | 21.8 | 9.5 | 10.1 | 1.1 | 185.5 | 288.0 | 101.0 | 3320.0 | | 156.8 | 26.4 |
| 1991 | 9 | N of Cases | 17.0 | 17.0 | 17.0 | 17.0 | 16.0 | 16.0 | 15.0 | 16.0 | 0.0 | 8.0 | 8.0 |
| 1991 | 9 | Median | 16.2 | 9.6 | 9.0 | 0.7 | 133.8 | 249.4 | 56.8 | 2384.8 | | 17.0 | 11.9 |
| 1991 | 9 | Arithmetic Mean | 16.5 | 9.6 | 8.8 | 0.7 | 177.8 | 299.6 | 61.6 | 2804.9 | | 98.9 | 26.0 |
| 1991 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.5 | 1.1 | 0.4 | 0.3 | 0.4 | | 2.1 | 1.2 |
| 1991 | 9 | LQ | 15.9 | 9.5 | 8.0 | 0.5 | 87.8 | 214.7 | 48.4 | 2017.6 | | 11.0 | 7.5 |
| 1991 | 9 | UQ | 17.2 | 9.8 | 9.9 | 0.9 | 157.9 | 319.2 | 76.3 | 3339.1 | | 51.0 | 31.0 |
| 1992 | 6 | N of Cases | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 16.0 |
| 1992 | 6 | Median | 18.2 | 9.6 | 10.1 | 0.4 | 247.6 | 165.0 | 17.0 | 2500.0 | 5.0 | 33.5 | 22.3 |
| 1992 | 6 | Arithmetic Mean | 18.1 | 9.6 | 10.1 | 0.5 | 256.2 | 193.8 | 25.3 | 2825.6 | 10.0 | 34.5 | 20.4 |
| 1992 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.6 | 0.7 | 0.5 | 1.3 | 0.4 | 1.5 | 0.5 | 0.6 |
| 1992 | 6 | LQ | 15.9 | 9.3 | 9.3 | 0.3 | 105.8 | 123.0 | 10.0 | 2010.0 | 5.0 | 19.0 | 9.2 |
| 1992 | 6 | UQ | 20.0 | 10.0 | 10.8 | 0.6 | 362.2 | 271.0 | 18.0 | 3600.0 | 5.0 | 49.0 | 30.0 |
| 1992 | 7 | N of Cases | 24.0 | 24.0 | 24.0 | 24.0 | 24.0 | 21.0 | 24.0 | 21.0 | 24.0 | 24.0 | 24.0 |
| 1992 | 7 | Median | 21.0 | 9.3 | 7.2 | 0.6 | 125.9 | 239.0 | 38.3 | 2840.0 | 5.0 | 11.8 | 4.9 |
| 1992 | 7 | Arithmetic Mean | 20.3 | 9.2 | 6.9 | 0.6 | 166.9 | 301.5 | 48.5 | 3106.0 | 11.2 | 129.5 | 15.1 |
| 1992 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.5 | 0.9 | 0.4 | 0.7 | 0.3 | 1.5 | 3.1 | 1.5 |
| 1992 | 7 | LQ | 17.9 | 9.1 | 6.2 | 0.3 | 67.5 | 220.8 | 25.0 | 2412.5 | 5.0 | 5.0 | 2.4 |
| 1992 | 7 | UQ | 21.9 | 9.4 | 8.4 | 0.8 | 229.1 | 394.5 | 60.5 | 3666.3 | 7.8 | 46.5 | 16.8 |
| 1992 | 8 | N of Cases | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 |
| 1992 | 8 | Median | 20.6 | 9.2 | 8.7 | 0.3 | 72.4 | 121.0 | 11.3 | 2362.5 | 6.3 | 15.5 | 6.3 |
| 1992 | 8 | Arithmetic Mean | 20.9 | 9.1 | 8.4 | 0.4 | 74.4 | 136.1 | 11.5 | 2436.6 | 7.5 | 20.1 | 6.8 |
| 1992 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.3 | 0.4 | 0.7 | 0.2 | 0.2 | 0.4 | 0.8 | 0.6 |
| 1992 | 8 | LQ | 19.5 | 9.1 | 7.0 | 0.3 | 49.3 | 54.0 | 9.5 | 1935.0 | 5.0 | 9.0 | 3.8 |
| 1992 | 8 | UQ | 23.1 | 9.2 | 10.1 | 0.4 | 96.7 | 207.0 | 13.0 | 2880.0 | 10.3 | 22.5 | 10.3 |
| 1992 | 9 | N of Cases | 8.0 | 8.0 | 8.0 | 8.0 | 6.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| 1992 | 9 | Median | 17.5 | 8.0 | 5.6 | 0.4 | 40.6 | 126.5 | 13.0 | 1585.0 | 5.0 | 12.5 | 0.4 |
| 1992 | 9 | Arithmetic Mean | 17.3 | 8.1 | 5.7 | 0.4 | 43.2 | 131.8 | 14.3 | 1616.9 | 14.3 | 13.1 | 0.9 |
| 1992 | 9 | Coefficient of Variation | 0.0 | 0.1 | 0.2 | 0.2 | 0.5 | 0.2 | 0.3 | 0.1 | 1.5 | 0.5 | 1.5 |
| 1992 | 9 | LQ | 16.9 | 7.8 | 5.0 | 0.3 | 34.1 | 112.5 | 12.0 | 1460.0 | 5.0 | 8.5 | 0.2 |
| 1992 | 9 | UQ | 17.9 | 8.5 | 6.4 | 0.5 | 58.4 | 154.3 | 16.5 | 1797.5 | 12.0 | 16.0 | 0.8 |
| 1993 | 6 | N of Cases | 24.0 | 24.0 | 24.0 | 24.0 | 24.0 | 28.0 | 28.0 | 28.0 | 28.0 | 28.0 | 24.0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1993 | 6 | Median | 17.3 | 8.7 | 9.7 | 1.0 | 66.0 | 78.0 | 8.8 | 1540.0 | 5.0 | 6.5 | 0.6 |
| 1993 | 6 | Arithmetic Mean | 16.7 | 8.6 | 9.7 | 1.1 | 67.0 | 78.3 | 10.7 | 1516.2 | 5.9 | 13.4 | 1.3 |
| 1993 | 6 | Coefficient of Variation | 0.1 | 0.1 | 0.1 | 0.5 | 0.9 | 0.4 | 0.5 | 0.6 | 0.4 | 0.9 | 0.8 |
| 1993 | 6 | LQ | 14.7 | 7.8 | 8.5 | 0.7 | 6.5 | 53.0 | 7.0 | 584.0 | 5.0 | 5.0 | 0.5 |
| 1993 | 6 | UQ | 18.1 | 9.4 | 10.7 | 1.4 | 115.8 | 101.3 | 13.0 | 2200.0 | 5.0 | 17.0 | 2.3 |
| 1993 | 7 | N of Cases | 17.0 | 17.0 | 17.0 | 17.0 | 16.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 16.0 |
| 1993 | 7 | Median | 18.1 | 9.4 | 8.4 | 0.8 | 109.0 | 150.0 | 14.0 | 2055.0 | 5.0 | 7.3 | 7.4 |
| 1993 | 7 | Arithmetic Mean | 18.2 | 9.4 | 8.4 | 0.7 | 135.5 | 139.9 | 13.5 | 2627.0 | 8.5 | 40.6 | 17.6 |
| 1993 | 7 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.4 | 0.7 | 0.3 | 0.2 | 0.6 | 1.1 | 2.1 | 1.8 |
| 1993 | 7 | LQ | 17.7 | 9.2 | 7.7 | 0.5 | 71.0 | 105.5 | 11.0 | 1620.0 | 5.0 | 5.0 | 2.3 |
| 1993 | 7 | UQ | 18.8 | 9.7 | 9.5 | 0.8 | 146.0 | 161.0 | 15.5 | 2720.0 | 5.0 | 26.8 | 12.8 |
| 1993 | 8 | N of Cases | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 16.0 |
| 1993 | 8 | Median | 18.9 | 9.0 | 7.8 | 0.7 | 84.5 | 137.0 | 20.0 | 1840.0 | 11.0 | 12.0 | 6.8 |
| 1993 | 8 | Arithmetic Mean | 18.8 | 8.9 | 7.2 | 0.7 | 101.4 | 148.8 | 19.4 | 1863.9 | 11.9 | 114.0 | 15.8 |
| 1993 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.3 | 0.6 | 0.4 | 0.2 | 0.2 | 0.8 | 1.8 | 1.5 |
| 1993 | 8 | LQ | 16.9 | 8.6 | 5.7 | 0.6 | 71.8 | 101.0 | 15.0 | 1710.0 | 5.0 | 5.0 | 1.9 |
| 1993 | 8 | UQ | 20.6 | 9.2 | 8.8 | 0.8 | 136.5 | 159.0 | 22.0 | 2250.0 | 15.0 | 100.5 | 22.0 |
| 1993 | 9 | N of Cases | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 16.0 |
| 1993 | 9 | Median | 18.1 | 8.1 | 7.3 | 1.1 | 34.0 | 98.3 | 16.5 | 1730.0 | 98.5 | 518.3 | 21.0 |
| 1993 | 9 | Arithmetic Mean | 17.7 | 8.0 | 6.3 | 1.0 | 82.8 | 115.5 | 16.8 | 2439.6 | 117.0 | 1271.9 | 208.6 |
| 1993 | 9 | Coefficient of Variation | 0.2 | 0.1 | 0.4 | 0.4 | 1.6 | 0.6 | 0.4 | 0.9 | 0.9 | 1.4 | 2.4 |
| 1993 | 9 | LQ | 14.8 | 7.3 | 4.6 | 0.7 | 21.0 | 76.0 | 13.0 | 1412.5 | 32.0 | 368.5 | 8.5 |
| 1993 | 9 | UQ | 20.6 | 8.6 | 8.2 | 1.2 | 63.5 | 124.5 | 18.0 | 2430.0 | 184.5 | 942.8 | 62.2 |
| 1994 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 22.0 | 18.0 | 22.0 | 18.0 | 22.0 | 18.0 |
| 1994 | 6 | Median | 16.9 | 9.6 | 9.8 | 0.7 | 103.5 | 85.5 | 5.0 | 1525.0 | 5.0 | 9.0 | 3.9 |
| 1994 | 6 | Arithmetic Mean | 17.1 | 9.6 | 10.1 | 0.7 | 146.6 | 92.3 | 6.2 | 1954.8 | 5.0 | 23.7 | 4.0 |
| 1994 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.2 | 0.6 | 0.4 | 0.4 | 0.6 | 0.0 | 1.4 | 0.3 |
| 1994 | 6 | LQ | 15.7 | 9.3 | 9.5 | 0.6 | 72.0 | 67.0 | 5.0 | 1030.0 | 5.0 | 5.0 | 3.2 |
| 1994 | 6 | UQ | 18.2 | 9.9 | 11.1 | 0.8 | 206.0 | 112.0 | 7.0 | 2330.0 | 5.0 | 18.0 | 4.5 |
| 1994 | 7 | N of Cases | 15.0 | 15.0 | 15.0 | 14.0 | 15.0 | 19.0 | 17.0 | 19.0 | 17.0 | 19.0 | 15.0 |
| 1994 | 7 | Median | 20.8 | 9.9 | 8.1 | 0.9 | 109.0 | 163.0 | 35.0 | 2350.0 | 11.0 | 13.0 | 9.3 |
| 1994 | 7 | Arithmetic Mean | 21.1 | 9.6 | 7.5 | 0.8 | 151.4 | 152.9 | 45.1 | 2325.5 | 14.2 | 74.5 | 27.6 |
| 1994 | 7 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.4 | 0.6 | 0.2 | 0.5 | 0.2 | 1.1 | 1.8 | 1.3 |
| 1994 | 7 | LQ | 19.1 | 9.3 | 6.0 | 0.5 | 78.3 | 117.3 | 28.0 | 1957.5 | 9.4 | 5.0 | 4.2 |
| 1994 | 7 | UQ | 23.3 | 10.0 | 8.5 | 1.1 | 216.9 | 180.0 | 68.5 | 2700.0 | 13.3 | 49.8 | 41.4 |
| 1994 | 8 | N of Cases | 17.0 | 17.0 | 17.0 | 16.0 | 17.0 | 21.0 | 19.0 | 21.0 | 19.0 | 21.0 | 16.0 |
| 1994 | 8 | Median | 21.4 | 8.7 | 6.2 | 0.4 | 54.0 | 143.0 | 13.0 | 1840.0 | 5.0 | 20.0 | 5.7 |
| 1994 | 8 | Arithmetic Mean | 21.3 | 8.8 | 5.9 | 0.4 | 59.5 | 149.4 | 13.9 | 1859.3 | 16.6 | 39.4 | 10.8 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1994 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.2 | 0.2 | 0.1 | 0.4 | 0.1 | 1.3 | 1.3 | 1.9 |
| 1994 | 8 | LQ | 21.0 | 8.6 | 5.3 | 0.4 | 50.4 | 131.6 | 10.3 | 1640.0 | 5.0 | 10.4 | 1.3 |
| 1994 | 8 | UQ | 22.1 | 9.1 | 6.5 | 0.5 | 67.3 | 164.1 | 15.5 | 2087.5 | 13.0 | 47.3 | 8.5 |
| 1994 | 9 | N of Cases | 16.0 | 16.0 | 16.0 | 16.0 | 22.0 | 25.0 | 24.0 | 25.0 | 24.0 | 26.0 | 16.0 |
| 1994 | 9 | Median | 18.7 | 8.2 | 7.8 | 0.4 | 34.5 | 121.0 | 10.0 | 1380.0 | 5.0 | 17.8 | 0.7 |
| 1994 | 9 | Arithmetic Mean | 17.9 | 8.1 | 7.9 | 0.4 | 37.9 | 119.3 | 9.9 | 1454.0 | 8.0 | 38.4 | 1.1 |
| 1994 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.1 | 0.3 | 0.1 | 0.2 | 0.1 | 1.1 | 1.5 | 0.8 |
| 1994 | 9 | LQ | 16.4 | 8.0 | 7.3 | 0.4 | 30.0 | 114.8 | 9.0 | 1370.0 | 5.0 | 5.0 | 0.5 |
| 1994 | 9 | UQ | 19.2 | 8.3 | 8.4 | 0.4 | 45.5 | 125.0 | 11.0 | 1575.0 | 6.3 | 43.5 | 1.5 |
| 1995 | 6 | N of Cases | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 16.0 |
| 1995 | 6 | Median | 17.0 | 9.6 | 10.2 | 0.6 | 200.0 | 124.0 | 14.0 | 2040.0 | 10.0 | 5.0 | 5.6 |
| 1995 | 6 | Arithmetic Mean | 17.5 | 9.6 | 9.9 | 0.6 | 267.4 | 161.8 | 13.9 | 2685.8 | 11.6 | 23.4 | 15.7 |
| 1995 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.4 | 1.0 | 1.0 | 0.4 | 0.7 | 0.6 | 1.6 | 1.5 |
| 1995 | 6 | LQ | 15.2 | 9.5 | 9.5 | 0.5 | 186.5 | 101.0 | 8.0 | 1850.0 | 5.0 | 5.0 | 2.4 |
| 1995 | 6 | UQ | 20.0 | 9.7 | 10.8 | 0.8 | 250.0 | 158.0 | 20.0 | 3020.0 | 16.0 | 25.0 | 20.2 |
| 1995 | 7 | N of Cases | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 16.0 |
| 1995 | 7 | Median | 21.0 | 9.7 | 8.8 | 0.6 | 165.3 | 152.5 | 39.5 | 2475.0 | 5.0 | 5.0 | 3.9 |
| 1995 | 7 | Arithmetic Mean | 20.8 | 9.7 | 8.6 | 0.6 | 174.2 | 163.7 | 41.4 | 2496.3 | 27.9 | 33.0 | 19.3 |
| 1995 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.5 | 0.4 | 0.2 | 0.5 | 0.2 | 2.5 | 2.8 | 2.4 |
| 1995 | 7 | LQ | 19.8 | 9.5 | 8.4 | 0.5 | 126.0 | 140.5 | 24.0 | 2195.0 | 5.0 | 5.0 | 3.4 |
| 1995 | 7 | UQ | 21.9 | 9.9 | 9.3 | 0.7 | 231.0 | 182.5 | 58.8 | 2615.0 | 5.0 | 14.0 | 7.4 |
| 1995 | 8 | N of Cases | 19.0 | 19.0 | 19.0 | 16.0 | 16.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 16.0 |
| 1995 | 8 | Median | 20.2 | 9.6 | 9.0 | 0.7 | 149.8 | 162.0 | 56.0 | 2557.5 | 5.0 | 13.5 | 10.7 |
| 1995 | 8 | Arithmetic Mean | 19.9 | 9.6 | 8.4 | 0.7 | 150.0 | 182.1 | 58.5 | 2708.2 | 5.0 | 57.2 | 36.6 |
| 1995 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.5 | 0.5 | 0.5 | 0.3 | 0.3 | 0.0 | 1.6 | 1.3 |
| 1995 | 8 | LQ | 19.1 | 9.4 | 7.8 | 0.5 | 82.5 | 145.5 | 46.0 | 2380.0 | 5.0 | 5.0 | 3.5 |
| 1995 | 8 | UQ | 20.7 | 9.7 | 9.9 | 1.0 | 204.0 | 177.5 | 72.0 | 3220.0 | 5.0 | 49.0 | 53.9 |
| 1995 | 9 | N of Cases | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 16.0 |
| 1995 | 9 | Median | 18.5 | 9.3 | 8.1 | 0.6 | 144.0 | 264.0 | 76.8 | 3077.5 | 5.0 | 21.0 | 15.9 |
| 1995 | 9 | Arithmetic Mean | 18.7 | 9.3 | 7.6 | 0.6 | 149.5 | 262.1 | 87.8 | 3126.5 | 5.0 | 136.7 | 42.0 |
| 1995 | 9 | Coefficient of Variation | 0.0 | 0.0 | 0.3 | 0.4 | 0.4 | 0.3 | 0.4 | 0.3 | 0.0 | 1.6 | 1.1 |
| 1995 | 9 | LQ | 18.4 | 9.0 | 6.4 | 0.5 | 120.0 | 187.5 | 63.0 | 2300.0 | 5.0 | 18.0 | 9.0 |
| 1995 | 9 | UQ | 18.9 | 9.6 | 9.3 | 0.7 | 195.5 | 319.5 | 99.5 | 3680.0 | 5.0 | 197.3 | 74.8 |
| 1996 | 6 | N of Cases | 12.0 | 12.0 | 12.0 | 6.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| 1996 | 6 | Median | 17.6 | 8.6 | 8.2 | 0.9 | 54.0 | 57.0 | 8.0 | 848.0 | 5.0 | 232.5 | 36.4 |
| 1996 | 6 | Arithmetic Mean | 18.0 | 8.6 | 8.3 | 0.8 | 58.0 | 61.6 | 7.8 | 943.1 | 8.7 | 267.7 | 65.7 |
| 1996 | 6 | Coefficient of Variation | 0.1 | 0.1 | 0.1 | 0.1 | 0.6 | 0.3 | 0.1 | 0.3 | 0.9 | 0.8 | 1.2 |
| 1996 | 6 | LQ | 16.6 | 8.2 | 7.6 | 0.7 | 26.0 | 52.0 | 7.0 | 750.0 | 5.0 | 63.0 | 3.6 |
| 1996 | 6 | UQ | 19.5 | 9.1 | 9.0 | 1.0 | 84.5 | 66.0 | 8.5 | 1045.0 | 10.0 | 449.0 | 112.5 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1996 | 7 | N of Cases | 12.0 | 12.0 | 12.0 | 8.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| 1996 | 7 | Median | 21.7 | 9.4 | 9.0 | 0.8 | 138.5 | 115.3 | 6.0 | 1800.0 | 5.0 | 194.0 | 96.5 |
| 1996 | 7 | Arithmetic Mean | 22.3 | 9.4 | 9.3 | 0.8 | 157.2 | 116.8 | 6.5 | 1850.4 | 5.0 | 275.0 | 127.7 |
| 1996 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.4 | 0.4 | 0.3 | 0.1 | 0.3 | 0.0 | 1.0 | 0.9 |
| 1996 | 7 | LQ | 21.0 | 9.3 | 8.3 | 0.6 | 109.0 | 102.0 | 6.0 | 1580.0 | 5.0 | 32.5 | 20.4 |
| 1996 | 7 | UQ | 23.7 | 9.5 | 10.3 | 1.1 | 202.0 | 122.5 | 7.0 | 1890.0 | 5.0 | 544.5 | 235.6 |
| 1996 | 8 | N of Cases | 12.0 | 12.0 | 12.0 | 7.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| 1996 | 8 | Median | 20.3 | 8.9 | 7.0 | 0.8 | 108.0 | 188.5 | 58.5 | 2165.0 | 33.0 | 242.5 | 73.9 |
| 1996 | 8 | Arithmetic Mean | 20.4 | 9.0 | 7.0 | 0.8 | 110.7 | 178.3 | 63.3 | 2144.2 | 46.6 | 471.2 | 96.6 |
| 1996 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.3 | 0.6 | 0.2 | 0.4 | 0.2 | 0.8 | 0.9 | 0.6 |
| 1996 | 8 | LQ | 19.5 | 8.7 | 5.7 | 0.6 | 62.0 | 155.0 | 43.0 | 1955.0 | 22.5 | 121.0 | 48.8 |
| 1996 | 8 | UQ | 21.2 | 9.3 | 8.4 | 1.1 | 153.5 | 202.0 | 86.5 | 2440.0 | 68.5 | 885.0 | 145.1 |
| 1996 | 9 | N of Cases | 12.0 | 12.0 | 12.0 | 8.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| 1996 | 9 | Median | 15.8 | 8.8 | 7.9 | 1.1 | 89.0 | 182.5 | 71.0 | 2085.0 | 16.0 | 129.0 | 17.1 |
| 1996 | 9 | Arithmetic Mean | 16.0 | 8.8 | 8.2 | 1.2 | 128.7 | 194.1 | 73.0 | 2290.4 | 31.7 | 188.8 | 25.4 |
| 1996 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.4 | 0.7 | 0.2 | 0.3 | 0.3 | 1.3 | 0.9 | 0.7 |
| 1996 | 9 | LQ | 14.3 | 8.7 | 7.3 | 0.8 | 70.0 | 169.0 | 62.0 | 1835.0 | 5.0 | 46.5 | 12.2 |
| 1996 | 9 | UQ | 18.5 | 9.0 | 9.5 | 1.3 | 170.5 | 227.5 | 77.5 | 2550.0 | 45.5 | 279.5 | 38.8 |
| 1997 | 6 | N of Cases | 8.0 | 8.0 | 8.0 | 7.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| 1997 | 6 | Median | 18.9 | 9.6 | 9.9 | 0.5 | 200.0 | 133.5 | 9.0 | 2225.0 | 5.0 | 338.0 | 173.7 |
| 1997 | 6 | Arithmetic Mean | 18.7 | 9.5 | 9.6 | 0.5 | 245.5 | 145.6 | 8.6 | 2486.9 | 5.0 | 454.4 | 263.4 |
| 1997 | 6 | Coefficient of Variation | 0.0 | 0.0 | 0.1 | 0.5 | 0.5 | 0.4 | 0.3 | 0.3 | 0.0 | 0.6 | 0.8 |
| 1997 | 6 | LQ | 18.5 | 9.4 | 8.6 | 0.3 | 182.0 | 103.8 | 7.0 | 2002.5 | 5.0 | 272.5 | 154.5 |
| 1997 | 6 | UQ | 19.0 | 9.7 | 10.7 | 0.7 | 323.5 | 190.0 | 10.0 | 3120.0 | 5.0 | 718.0 | 415.7 |
| 1997 | 7 | N of Cases | 26.0 | 26.0 | 26.0 | 24.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 |
| 1997 | 7 | Median | 21.1 | 9.5 | 8.9 | 0.5 | 185.0 | 232.0 | 52.0 | 2240.0 | 5.0 | 1685.0 | 681.8 |
| 1997 | 7 | Arithmetic Mean | 20.0 | 9.5 | 8.4 | 0.6 | 260.0 | 270.6 | 55.0 | 2759.4 | 7.1 | 1654.9 | 915.3 |
| 1997 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.5 | 1.0 | 0.6 | 0.6 | 0.6 | 0.7 | 0.8 | 0.7 |
| 1997 | 7 | LQ | 16.9 | 9.3 | 6.0 | 0.3 | 127.0 | 182.0 | 26.0 | 1940.0 | 5.0 | 762.0 | 392.8 |
| 1997 | 7 | UQ | 21.5 | 9.8 | 10.2 | 0.8 | 300.0 | 328.0 | 82.0 | 3310.0 | 5.0 | 1940.0 | 1533.8 |
| 1997 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 1997 | 8 | Median | 20.3 | 8.5 | 6.6 | 1.2 | 63.0 | 248.5 | 112.5 | 2650.0 | 51.0 | 903.5 | 85.7 |
| 1997 | 8 | Arithmetic Mean | 20.4 | 8.4 | 6.7 | 1.1 | 120.6 | 268.5 | 117.4 | 3222.8 | 60.0 | 852.9 | 139.1 |
| 1997 | 8 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.3 | 1.8 | 0.5 | 0.3 | 0.7 | 0.6 | 0.4 | 1.7 |
| 1997 | 8 | LQ | 19.4 | 7.8 | 5.2 | 1.0 | 32.0 | 202.0 | 81.0 | 2370.0 | 29.0 | 640.0 | 21.1 |
| 1997 | 8 | UQ | 21.2 | 8.8 | 7.4 | 1.3 | 79.0 | 269.5 | 149.0 | 3090.0 | 92.0 | 1000.0 | 129.4 |
| 1997 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 1997 | 9 | Median | 17.5 | 9.3 | 10.4 | 0.9 | 155.0 | 216.0 | 73.5 | 2135.0 | 5.0 | 649.0 | 253.0 |
| 1997 | 9 | Arithmetic Mean | 17.2 | 9.3 | 10.6 | 0.9 | 174.3 | 229.4 | 69.6 | 2350.8 | 6.1 | 773.4 | 311.3 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1997 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.4 | 0.8 | 0.3 | 0.2 | 0.3 | 0.7 | 0.6 | 0.7 |
| 1997 | 9 | LQ | 15.3 | 9.2 | 9.8 | 0.7 | 60.0 | 173.0 | 58.5 | 1710.0 | 5.0 | 476.0 | 151.6 |
| 1997 | 9 | UQ | 19.0 | 9.4 | 12.0 | 1.1 | 224.0 | 282.0 | 84.0 | 2720.0 | 5.0 | 960.0 | 421.9 |
| 1998 | 6 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 1998 | 6 | Median | 17.3 | 8.8 | 9.8 | 1.2 | 47.0 | 62.0 | 6.0 | 894.0 | 5.0 | 319.0 | 52.7 |
| 1998 | 6 | Arithmetic Mean | 17.3 | 8.9 | 9.6 | 1.1 | 62.4 | 83.0 | 7.4 | 1113.7 | 5.0 | 358.8 | 88.6 |
| 1998 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.3 | 0.6 | 0.6 | 0.5 | 0.4 | 0.0 | 0.6 | 1.3 |
| 1998 | 6 | LQ | 15.5 | 8.7 | 9.3 | 0.9 | 34.6 | 48.9 | 5.0 | 847.0 | 5.0 | 183.0 | 28.2 |
| 1998 | 6 | UQ | 19.4 | 9.0 | 10.1 | 1.2 | 77.8 | 104.5 | 8.4 | 1333.8 | 5.0 | 462.0 | 98.2 |
| 1998 | 7 | N of Cases | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 |
| 1998 | 7 | Median | 23.9 | 9.4 | 9.5 | 0.8 | 172.0 | 193.5 | 49.0 | 2330.0 | 5.0 | 963.0 | 450.9 |
| 1998 | 7 | Arithmetic Mean | 23.4 | 9.3 | 8.3 | 0.8 | 191.1 | 205.1 | 40.3 | 2505.0 | 5.0 | 939.0 | 500.1 |
| 1998 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.6 | 0.4 | 0.3 | 0.9 | 0.3 | 0.0 | 0.3 | 0.4 |
| 1998 | 7 | LQ | 22.3 | 9.1 | 6.6 | 0.5 | 146.9 | 179.0 | 4.0 | 2055.0 | 5.0 | 633.6 | 335.9 |
| 1998 | 7 | UQ | 24.5 | 9.5 | 10.2 | 0.9 | 231.8 | 242.5 | 71.6 | 2815.0 | 5.0 | 1141.3 | 678.8 |
| 1998 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 1998 | 8 | Median | 21.7 | 8.1 | 6.8 | 1.8 | 11.5 | 224.5 | 102.0 | 2150.0 | 63.0 | 979.3 | 59.0 |
| 1998 | 8 | Arithmetic Mean | 21.7 | 8.1 | 6.4 | 1.6 | 74.2 | 240.6 | 109.6 | 2468.9 | 76.8 | 1059.1 | 117.1 |
| 1998 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.5 | 0.4 | 2.1 | 0.4 | 0.3 | 0.5 | 1.1 | 0.6 | 2.0 |
| 1998 | 8 | LQ | 20.3 | 7.8 | 3.2 | 1.5 | 5.9 | 183.0 | 78.0 | 2060.0 | 16.0 | 820.0 | 21.3 |
| 1998 | 8 | UQ | 23.3 | 8.2 | 8.3 | 2.1 | 30.0 | 245.0 | 146.0 | 2440.0 | 88.5 | 1080.0 | 68.8 |
| 1998 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 1998 | 9 | Median | 18.9 | 9.3 | 10.0 | 0.9 | 96.0 | 181.5 | 55.5 | 1847.5 | 5.0 | 287.5 | 89.2 |
| 1998 | 9 | Arithmetic Mean | 18.7 | 9.2 | 9.5 | 0.9 | 116.9 | 198.2 | 61.9 | 1898.2 | 5.9 | 281.9 | 111.3 |
| 1998 | 9 | Coefficient of Variation | 0.2 | 0.0 | 0.2 | 0.3 | 0.5 | 0.3 | 0.4 | 0.3 | 0.3 | 0.9 | 1.0 |
| 1998 | 9 | LQ | 15.1 | 9.0 | 8.7 | 0.7 | 77.0 | 163.0 | 48.0 | 1500.0 | 5.0 | 26.0 | 7.6 |
| 1998 | 9 | UQ | 21.9 | 9.4 | 10.6 | 1.1 | 162.0 | 222.0 | 66.0 | 2270.0 | 5.0 | 521.0 | 220.7 |
| 1999 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 1999 | 6 | Median | 16.8 | 8.8 | 10.1 | 1.1 | 46.0 | 87.0 | 12.0 | 1070.0 | 5.0 | 205.0 | 32.8 |
| 1999 | 6 | Arithmetic Mean | 16.9 | 8.8 | 10.4 | 0.9 | 88.5 | 108.1 | 14.0 | 1307.5 | 5.0 | 261.4 | 81.9 |
| 1999 | 6 | Coefficient of Variation | 0.2 | 0.1 | 0.1 | 0.4 | 1.3 | 0.6 | 0.5 | 0.6 | 0.0 | 0.7 | 1.6 |
| 1999 | 6 | LQ | 14.3 | 8.3 | 9.1 | 0.8 | 21.0 | 73.5 | 7.0 | 740.0 | 5.0 | 151.0 | 8.9 |
| 1999 | 6 | UQ | 19.3 | 9.4 | 11.0 | 1.1 | 110.5 | 105.0 | 21.0 | 1530.0 | 5.0 | 302.0 | 128.7 |
| 1999 | 7 | N of Cases | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 |
| 1999 | 7 | Median | 20.1 | 9.8 | 9.1 | 0.6 | 227.0 | 177.5 | 29.0 | 2490.0 | 5.0 | 263.0 | 167.7 |
| 1999 | 7 | Arithmetic Mean | 19.5 | 9.8 | 9.2 | 0.6 | 236.4 | 201.3 | 27.2 | 2838.2 | 9.6 | 419.8 | 300.0 |
| 1999 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.6 | 0.5 | 0.5 | 0.8 | 0.4 | 0.6 | 0.9 | 0.9 |
| 1999 | 7 | LQ | 18.3 | 9.7 | 8.7 | 0.3 | 127.0 | 146.0 | 5.0 | 1997.5 | 5.0 | 162.3 | 118.8 |
| 1999 | 7 | UQ | 20.8 | 9.9 | 10.5 | 0.9 | 317.9 | 238.3 | 48.3 | 3452.5 | 15.5 | 602.4 | 399.6 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1999 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 1999 | 8 | Median | 21.3 | 9.4 | 7.6 | 0.7 | 166.0 | 289.3 | 81.5 | 2480.0 | 11.0 | 165.0 | 67.8 |
| 1999 | 8 | Arithmetic Mean | 21.2 | 9.4 | 7.8 | 0.7 | 211.9 | 308.0 | 81.7 | 2842.8 | 12.6 | 433.1 | 243.7 |
| 1999 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.5 | 0.9 | 0.5 | 0.1 | 0.5 | 1.0 | 1.3 | 1.4 |
| 1999 | 8 | LQ | 20.2 | 9.3 | 6.7 | 0.5 | 84.0 | 190.0 | 77.0 | 1930.0 | 5.0 | 43.0 | 21.4 |
| 1999 | 8 | UQ | 22.4 | 9.6 | 8.9 | 0.9 | 234.0 | 371.0 | 87.0 | 3150.0 | 14.0 | 854.0 | 435.1 |
| 1999 | 9 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 1999 | 9 | Median | 16.9 | 8.7 | 8.7 | 1.2 | 48.0 | 197.0 | 66.0 | 1950.0 | 43.0 | 358.0 | 31.4 |
| 1999 | 9 | Arithmetic Mean | 16.3 | 8.7 | 8.7 | 1.0 | 83.1 | 224.6 | 77.7 | 2294.3 | 44.4 | 407.0 | 63.5 |
| 1999 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.4 | 1.2 | 0.5 | 0.5 | 0.4 | 0.7 | 0.8 | 1.3 |
| 1999 | 9 | LQ | 14.7 | 8.5 | 7.0 | 0.7 | 21.5 | 157.3 | 47.5 | 1787.5 | 16.0 | 85.3 | 11.0 |
| 1999 | 9 | UQ | 17.9 | 9.0 | 10.6 | 1.3 | 106.8 | 241.3 | 113.8 | 2405.0 | 62.0 | 750.8 | 58.8 |
| 2000 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2000 | 6 | Median | 20.5 | 9.9 | 9.7 | 0.6 | 188.0 | 193.5 | 8.5 | 2385.0 | 14.3 | 793.3 | 609.7 |
| 2000 | 6 | Arithmetic Mean | 20.2 | 9.8 | 9.2 | 0.6 | 233.0 | 194.3 | 21.3 | 2451.7 | 17.9 | 1010.8 | 703.9 |
| 2000 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.5 | 0.6 | 0.4 | 0.9 | 0.3 | 0.9 | 0.6 | 0.6 |
| 2000 | 6 | LQ | 17.7 | 9.6 | 8.0 | 0.4 | 124.5 | 128.0 | 7.0 | 1620.0 | 5.0 | 616.0 | 473.9 |
| 2000 | 6 | UQ | 22.0 | 10.0 | 10.5 | 0.8 | 282.0 | 233.0 | 29.0 | 3030.0 | 22.0 | 1370.0 | 765.8 |
| 2000 | 7 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2000 | 7 | Median | 21.2 | 9.6 | 7.5 | 1.0 | 101.0 | 233.0 | 90.5 | 1660.0 | 10.0 | 521.3 | 314.8 |
| 2000 | 7 | Arithmetic Mean | 21.0 | 9.7 | 7.7 | 0.9 | 170.2 | 460.8 | 89.4 | 2047.6 | 9.6 | 728.3 | 504.9 |
| 2000 | 7 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.5 | 1.0 | 1.2 | 0.1 | 0.5 | 0.2 | 0.7 | 0.9 |
| 2000 | 7 | LQ | 20.3 | 9.5 | 7.1 | 0.5 | 71.0 | 208.0 | 86.0 | 1410.0 | 10.0 | 399.0 | 288.6 |
| 2000 | 7 | UQ | 21.5 | 9.8 | 8.2 | 1.2 | 204.0 | 396.0 | 96.0 | 2540.0 | 10.5 | 1090.0 | 493.5 |
| 2000 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 12.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2000 | 8 | Median | 21.5 | 8.5 | 4.5 | 1.4 | 21.5 | 226.0 | 141.3 | 2277.5 | 66.5 | 870.0 | 71.2 |
| 2000 | 8 | Arithmetic Mean | 21.2 | 8.5 | 4.7 | 1.4 | 33.7 | 222.6 | 126.7 | 2192.2 | 79.9 | 749.0 | 86.3 |
| 2000 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.5 | 0.2 | 1.1 | 0.3 | 0.3 | 0.2 | 0.9 | 0.5 | 0.6 |
| 2000 | 8 | LQ | 18.4 | 8.3 | 2.8 | 1.2 | 17.0 | 174.0 | 113.0 | 1780.0 | 22.0 | 554.0 | 57.3 |
| 2000 | 8 | UQ | 23.5 | 8.7 | 6.3 | 1.6 | 39.0 | 286.5 | 153.0 | 2410.0 | 153.0 | 911.0 | 114.4 |
| 2000 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2000 | 9 | Median | 16.7 | 9.1 | 9.0 | 0.8 | 130.5 | 194.0 | 67.0 | 1795.0 | 17.5 | 514.5 | 132.9 |
| 2000 | 9 | Arithmetic Mean | 16.5 | 9.1 | 8.5 | 0.8 | 148.8 | 184.4 | 63.8 | 1972.5 | 22.7 | 523.1 | 169.2 |
| 2000 | 9 | Coefficient of Variation | 0.2 | 0.0 | 0.2 | 0.3 | 0.6 | 0.1 | 0.2 | 0.3 | 0.6 | 0.3 | 0.7 |
| 2000 | 9 | LQ | 13.8 | 9.0 | 7.5 | 0.7 | 70.0 | 170.0 | 49.0 | 1470.0 | 13.0 | 363.0 | 88.5 |
| 2000 | 9 | UQ | 18.8 | 9.3 | 9.7 | 1.1 | 172.0 | 201.0 | 75.0 | 2180.0 | 28.0 | 679.0 | 234.9 |
| 2001 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2001 | 6 | Median | 16.6 | 9.6 | 9.3 | 0.6 | 160.3 | 132.0 | 7.0 | 2490.0 | 5.0 | 501.0 | 258.0 |
| 2001 | 6 | Arithmetic Mean | 16.8 | 9.6 | 9.4 | 0.6 | 184.6 | 142.9 | 6.9 | 2556.1 | 5.0 | 485.6 | 264.5 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2001 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.3 | 0.4 | 0.4 | 0.1 | 0.3 | 0.0 | 0.5 | 0.6 |
| 2001 | 6 | LQ | 15.9 | 9.5 | 9.0 | 0.6 | 128.0 | 99.0 | 6.0 | 1910.0 | 5.0 | 263.0 | 176.1 |
| 2001 | 6 | UQ | 17.6 | 9.7 | 9.6 | 0.8 | 227.0 | 163.0 | 7.0 | 2990.0 | 5.0 | 553.0 | 318.5 |
| 2001 | 7 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2001 | 7 | Median | 19.6 | 9.7 | 7.9 | 0.7 | 199.0 | 249.0 | 54.0 | 3410.0 | 13.0 | 639.0 | 362.2 |
| 2001 | 7 | Arithmetic Mean | 19.6 | 9.7 | 8.3 | 0.7 | 206.6 | 237.2 | 43.6 | 3364.5 | 12.9 | 611.7 | 390.1 |
| 2001 | 7 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.4 | 0.4 | 0.3 | 0.6 | 0.3 | 0.2 | 0.5 | 0.5 |
| 2001 | 7 | LQ | 19.4 | 9.6 | 7.4 | 0.6 | 142.8 | 183.0 | 11.3 | 2710.0 | 11.3 | 346.3 | 267.9 |
| 2001 | 7 | UQ | 19.9 | 9.9 | 9.4 | 0.9 | 241.0 | 279.8 | 65.4 | 3990.0 | 15.0 | 714.0 | 492.0 |
| 2001 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2001 | 8 | Median | 22.2 | 8.9 | 5.5 | 0.7 | 75.3 | 226.5 | 70.8 | 3150.0 | 8.0 | 861.0 | 231.1 |
| 2001 | 8 | Arithmetic Mean | 21.5 | 8.9 | 5.5 | 0.9 | 81.8 | 238.3 | 65.4 | 3409.7 | 10.3 | 925.9 | 254.4 |
| 2001 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.5 | 0.5 | 0.7 | 0.3 | 0.6 | 0.3 | 0.7 | 0.4 | 0.5 |
| 2001 | 8 | LQ | 19.7 | 8.7 | 3.6 | 0.6 | 38.0 | 180.0 | 30.0 | 2960.0 | 5.0 | 745.0 | 108.5 |
| 2001 | 8 | UQ | 23.0 | 9.2 | 8.0 | 1.0 | 102.5 | 293.0 | 92.0 | 4020.0 | 13.0 | 1080.0 | 389.5 |
| 2001 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2001 | 9 | Median | 16.7 | 8.8 | 7.4 | 1.0 | 96.5 | 173.0 | 22.5 | 2765.0 | 13.0 | 970.0 | 93.6 |
| 2001 | 9 | Arithmetic Mean | 16.9 | 8.6 | 6.4 | 1.0 | 114.8 | 169.8 | 33.8 | 2961.1 | 16.6 | 861.2 | 155.9 |
| 2001 | 9 | Coefficient of Variation | 0.1 | 0.1 | 0.4 | 0.5 | 0.7 | 0.3 | 0.7 | 0.3 | 0.6 | 0.6 | 1.5 |
| 2001 | 9 | LQ | 16.0 | 8.3 | 3.7 | 0.5 | 67.0 | 133.0 | 16.5 | 2340.0 | 11.0 | 414.0 | 25.2 |
| 2001 | 9 | UQ | 17.9 | 9.0 | 8.2 | 1.3 | 167.0 | 192.0 | 57.5 | 3740.0 | 23.0 | 1100.0 | 103.0 |
| 2002 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2002 | 6 | Median | 19.5 | 9.3 | 9.2 | 0.7 | 147.5 | 101.0 | 6.0 | 1847.5 | 6.3 | 249.0 | 125.3 |
| 2002 | 6 | Arithmetic Mean | 19.5 | 9.2 | 9.7 | 0.8 | 167.7 | 119.6 | 6.9 | 1812.5 | 7.8 | 369.1 | 186.1 |
| 2002 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.4 | 0.7 | 0.6 | 0.4 | 0.3 | 0.4 | 1.0 | 1.0 |
| 2002 | 6 | LQ | 17.5 | 9.0 | 8.6 | 0.6 | 97.5 | 74.5 | 5.0 | 1435.0 | 5.0 | 41.0 | 7.0 |
| 2002 | 6 | UQ | 20.8 | 9.4 | 11.0 | 1.0 | 182.0 | 126.0 | 8.0 | 2200.0 | 10.0 | 625.0 | 348.5 |
| 2002 | 7 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2002 | 7 | Median | 21.8 | 9.6 | 7.3 | 0.8 | 147.5 | 177.5 | 41.0 | 2435.0 | 11.5 | 398.8 | 266.0 |
| 2002 | 7 | Arithmetic Mean | 21.7 | 9.6 | 7.1 | 0.8 | 140.7 | 187.2 | 41.6 | 2345.8 | 22.7 | 424.7 | 261.7 |
| 2002 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.3 | 0.4 | 0.2 | 0.4 | 0.2 | 1.3 | 0.3 | 0.4 |
| 2002 | 7 | LQ | 21.1 | 9.5 | 5.5 | 0.6 | 82.0 | 157.5 | 30.0 | 2125.0 | 10.0 | 328.0 | 186.5 |
| 2002 | 7 | UQ | 22.6 | 9.7 | 8.4 | 1.0 | 192.0 | 199.0 | 53.5 | 2580.0 | 13.5 | 526.0 | 342.9 |
| 2002 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2002 | 8 | Median | 19.6 | 9.0 | 8.3 | 0.9 | 67.5 | 170.0 | 39.0 | 2695.0 | 54.8 | 570.5 | 111.9 |
| 2002 | 8 | Arithmetic Mean | 19.8 | 8.8 | 8.0 | 1.0 | 84.2 | 201.6 | 46.8 | 2761.7 | 78.1 | 578.5 | 149.7 |
| 2002 | 8 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.4 | 0.8 | 0.3 | 0.6 | 0.3 | 1.1 | 0.4 | 0.8 |
| 2002 | 8 | LQ | 18.3 | 8.5 | 6.7 | 0.7 | 38.5 | 162.0 | 27.0 | 2240.0 | 8.0 | 420.0 | 46.4 |
| 2002 | 8 | UQ | 21.0 | 9.2 | 9.2 | 1.2 | 123.0 | 245.0 | 67.0 | 2955.0 | 100.0 | 639.0 | 215.6 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002 | 9 | N of Cases | 18.0 | 18.0 | 9.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2002 | 9 | Median | 16.5 | 9.3 | 8.9 | 0.9 | 100.0 | 190.3 | 39.0 | 2652.5 | 12.0 | 309.5 | 94.0 |
| 2002 | 9 | Arithmetic Mean | 16.5 | 9.3 | 8.2 | 0.9 | 109.9 | 211.1 | 42.9 | 2874.4 | 12.5 | 328.9 | 122.1 |
| 2002 | 9 | Coefficient of Variation | 0.0 | 0.0 | 0.1 | 0.3 | 0.5 | 0.3 | 0.4 | 0.3 | 0.2 | 0.4 | 0.6 |
| 2002 | 9 | LQ | 15.9 | 9.1 | 7.1 | 0.7 | 80.0 | 155.0 | 31.0 | 2300.0 | 11.0 | 207.0 | 69.0 |
| 2002 | 9 | UQ | 17.1 | 9.4 | 9.0 | 1.1 | 115.0 | 264.0 | 56.0 | 3340.0 | 13.0 | 448.0 | 165.6 |
| 2003 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2003 | 6 | Median | 20.1 | 8.4 | 8.0 | 1.2 | 16.0 | 90.8 | 18.5 | 1000.0 | 14.5 | 69.5 | 5.4 |
| 2003 | 6 | Arithmetic Mean | 20.0 | 8.4 | 8.1 | 1.1 | 27.6 | 99.7 | 16.5 | 1157.3 | 33.3 | 61.0 | 7.2 |
| 2003 | 6 | Coefficient of Variation | 0.0 | 0.0 | 0.1 | 0.2 | 1.0 | 0.5 | 0.4 | 0.4 | 0.9 | 0.4 | 0.9 |
| 2003 | 6 | LQ | 18.9 | 8.2 | 7.8 | 1.0 | 12.0 | 68.5 | 11.5 | 782.0 | 12.0 | 53.0 | 2.2 |
| 2003 | 6 | UQ | 20.6 | 8.5 | 8.1 | 1.3 | 26.0 | 109.0 | 21.0 | 1305.0 | 56.0 | 76.0 | 9.3 |
| 2003 | 7 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2003 | 7 | Median | 22.4 | 9.5 | 8.5 | 0.7 | 94.0 | 202.0 | 44.0 | 2760.0 | 8.0 | 347.0 | 71.3 |
| 2003 | 7 | Arithmetic Mean | 22.8 | 9.4 | 7.6 | 0.8 | 118.9 | 215.6 | 52.4 | 2846.5 | 8.7 | 422.2 | 211.6 |
| 2003 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.4 | 0.5 | 0.9 | 0.4 | 1.0 | 0.3 | 0.5 | 1.3 | 1.5 |
| 2003 | 7 | LQ | 21.0 | 9.4 | 7.3 | 0.6 | 53.8 | 140.0 | 5.0 | 2177.5 | 5.0 | 22.9 | 13.2 |
| 2003 | 7 | UQ | 24.5 | 9.6 | 9.5 | 1.0 | 150.0 | 280.5 | 82.0 | 3402.5 | 12.0 | 634.5 | 288.0 |
| 2003 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2003 | 8 | Median | 20.5 | 9.5 | 8.5 | 0.6 | 178.5 | 261.5 | 72.5 | 3092.5 | 13.5 | 16.0 | 8.5 |
| 2003 | 8 | Arithmetic Mean | 20.4 | 9.5 | 8.4 | 0.6 | 171.2 | 272.6 | 73.4 | 3152.2 | 13.7 | 40.1 | 16.5 |
| 2003 | 8 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.6 | 2.6 | 2.0 |
| 2003 | 8 | LQ | 20.1 | 9.4 | 7.9 | 0.5 | 150.0 | 229.5 | 63.0 | 2950.0 | 5.0 | 10.0 | 6.6 |
| 2003 | 8 | UQ | 20.8 | 9.6 | 8.8 | 0.7 | 207.0 | 286.0 | 79.0 | 3620.0 | 18.5 | 24.5 | 13.7 |
| 2003 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2003 | 9 | Median | 17.1 | 9.4 | 7.4 | 0.7 | 93.5 | 216.0 | 63.5 | 2480.0 | 16.5 | 98.3 | 29.6 |
| 2003 | 9 | Arithmetic Mean | 17.0 | 9.4 | 7.7 | 0.7 | 134.3 | 261.9 | 57.9 | 2990.3 | 27.9 | 162.4 | 65.3 |
| 2003 | 9 | Coefficient of Variation | 0.0 | 0.0 | 0.3 | 0.4 | 1.3 | 0.7 | 0.5 | 0.6 | 0.9 | 1.2 | 1.4 |
| 2003 | 9 | LQ | 16.4 | 9.3 | 6.1 | 0.5 | 80.0 | 178.0 | 29.0 | 2025.0 | 13.5 | 31.0 | 16.3 |
| 2003 | 9 | UQ | 17.7 | 9.6 | 9.1 | 0.8 | 119.0 | 252.0 | 73.0 | 2970.0 | 32.0 | 229.0 | 94.6 |
| 2004 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2004 | 6 | Median | 17.4 | 9.3 | 9.0 | 1.0 | 65.5 | 69.5 | 7.0 | 1325.0 | 5.0 | 21.5 | 4.3 |
| 2004 | 6 | Arithmetic Mean | 17.4 | 9.2 | 9.4 | 0.8 | 92.7 | 93.9 | 8.0 | 1470.4 | 7.1 | 25.9 | 10.2 |
| 2004 | 6 | Coefficient of Variation | 0.2 | 0.0 | 0.1 | 0.3 | 0.8 | 0.6 | 0.2 | 0.4 | 0.4 | 0.9 | 1.4 |
| 2004 | 6 | LQ | 14.4 | 8.8 | 8.8 | 0.6 | 49.0 | 61.0 | 7.0 | 1050.0 | 5.0 | 12.0 | 3.3 |
| 2004 | 6 | UQ | 20.1 | 9.6 | 10.1 | 1.0 | 123.0 | 112.0 | 9.0 | 1680.0 | 10.0 | 34.0 | 7.2 |
| 2004 | 7 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2004 | 7 | Median | 21.7 | 9.6 | 7.1 | 0.7 | 132.3 | 172.5 | 26.5 | 2180.0 | 19.0 | 22.0 | 13.4 |
| 2004 | 7 | Arithmetic Mean | 21.7 | 9.6 | 7.1 | 0.7 | 185.4 | 183.9 | 27.1 | 2442.8 | 29.1 | 32.2 | 19.4 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2004 | 7 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.5 | 0.9 | 0.5 | 0.6 | 0.4 | 0.8 | 0.9 | 0.8 |
| 2004 | 7 | LQ | 20.7 | 9.5 | 6.4 | 0.5 | 109.0 | 130.0 | 13.0 | 1790.0 | 12.0 | 14.0 | 10.4 |
| 2004 | 7 | UQ | 22.7 | 9.7 | 8.1 | 0.7 | 229.0 | 189.5 | 37.0 | 2480.0 | 54.0 | 41.0 | 25.7 |
| 2004 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2004 | 8 | Median | 21.9 | 9.0 | 5.9 | 1.0 | 85.0 | 178.3 | 53.5 | 2495.0 | 33.0 | 115.5 | 31.0 |
| 2004 | 8 | Arithmetic Mean | 22.0 | 9.0 | 5.7 | 1.0 | 84.8 | 192.3 | 64.1 | 2434.4 | 36.1 | 190.8 | 45.9 |
| 2004 | 8 | Coefficient of Variation | 0.0 | 0.0 | 0.3 | 0.3 | 0.7 | 0.2 | 0.3 | 0.1 | 0.6 | 1.0 | 0.7 |
| 2004 | 8 | LQ | 20.9 | 8.9 | 4.6 | 0.7 | 34.0 | 169.0 | 48.5 | 2170.0 | 20.5 | 48.0 | 17.5 |
| 2004 | 8 | UQ | 23.1 | 9.3 | 6.5 | 1.3 | 109.5 | 198.0 | 86.0 | 2640.0 | 45.0 | 322.0 | 80.7 |
| 2004 | 9 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2004 | 9 | Median | 16.3 | 9.1 | 8.6 | 1.0 | 52.0 | 144.0 | 22.0 | 2060.0 | 14.0 | 96.0 | 22.8 |
| 2004 | 9 | Arithmetic Mean | 17.3 | 9.1 | 8.5 | 0.9 | 86.0 | 159.0 | 26.3 | 2535.9 | 16.6 | 226.2 | 57.6 |
| 2004 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.3 | 1.3 | 0.4 | 0.7 | 0.4 | 0.9 | 1.1 | 1.2 |
| 2004 | 9 | LQ | 15.7 | 9.0 | 7.9 | 0.8 | 16.0 | 123.0 | 10.3 | 1910.0 | 8.0 | 22.3 | 9.3 |
| 2004 | 9 | UQ | 19.5 | 9.2 | 9.2 | 1.1 | 85.5 | 188.5 | 32.8 | 2693.8 | 20.5 | 421.5 | 113.1 |
| 2005 | 6 | N of Cases | 24.0 | 24.0 | 24.0 | 18.0 | 24.0 | 24.0 | 24.0 | 24.0 | 24.0 | 24.0 | 24.0 |
| 2005 | 6 | Median | 16.1 | 9.1 | 9.6 | 1.0 | 60.5 | 85.0 | 6.0 | 1420.0 | 7.5 | 27.0 | 3.6 |
| 2005 | 6 | Arithmetic Mean | 15.9 | 8.9 | 9.5 | 0.8 | 59.7 | 92.4 | 6.8 | 1434.3 | 9.0 | 24.1 | 5.9 |
| 2005 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.4 | 0.5 | 0.4 | 0.4 | 0.3 | 0.6 | 0.4 | 0.8 |
| 2005 | 6 | LQ | 14.5 | 8.8 | 9.4 | 0.7 | 33.5 | 60.5 | 5.0 | 1030.0 | 5.0 | 15.5 | 2.4 |
| 2005 | 6 | UQ | 16.8 | 9.2 | 10.0 | 1.1 | 71.5 | 123.0 | 7.5 | 1830.0 | 11.5 | 33.0 | 11.2 |
| 2005 | 7 | N of Cases | 22.0 | 22.0 | 22.0 | 18.0 | 20.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 |
| 2005 | 7 | Median | 22.0 | 9.5 | 7.6 | 1.0 | 70.0 | 175.5 | 36.0 | 2090.0 | 10.5 | 36.0 | 22.3 |
| 2005 | 7 | Arithmetic Mean | 22.3 | 9.4 | 6.9 | 1.0 | 77.7 | 181.8 | 36.3 | 2428.2 | 10.7 | 96.1 | 43.1 |
| 2005 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.5 | 0.9 | 0.4 | 0.8 | 0.4 | 0.6 | 1.2 | 1.0 |
| 2005 | 7 | LQ | 21.1 | 9.3 | 5.8 | 0.6 | 30.5 | 112.0 | 8.0 | 1890.0 | 5.0 | 15.0 | 10.2 |
| 2005 | 7 | UQ | 23.7 | 9.6 | 8.1 | 1.4 | 100.0 | 260.0 | 53.0 | 3150.0 | 14.0 | 122.0 | 70.8 |
| 2005 | 8 | N of Cases | 31.0 | 31.0 | 31.0 | 26.0 | 29.0 | 31.0 | 31.0 | 31.0 | 31.0 | 31.0 | 31.0 |
| 2005 | 8 | Median | 21.1 | 9.3 | 7.6 | 0.9 | 117.0 | 171.0 | 45.0 | 2400.0 | 13.0 | 19.0 | 8.5 |
| 2005 | 8 | Arithmetic Mean | 20.8 | 9.2 | 7.4 | 0.9 | 132.8 | 196.3 | 51.1 | 2796.8 | 17.9 | 106.3 | 18.0 |
| 2005 | 8 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.5 | 0.7 | 0.3 | 0.6 | 0.4 | 0.7 | 1.9 | 1.1 |
| 2005 | 8 | LQ | 19.2 | 9.1 | 6.7 | 0.7 | 61.5 | 147.0 | 31.1 | 2070.0 | 5.0 | 10.0 | 5.7 |
| 2005 | 8 | UQ | 22.4 | 9.5 | 8.5 | 1.2 | 172.8 | 220.3 | 66.5 | 3335.0 | 23.8 | 117.0 | 29.0 |
| 2005 | 9 | N of Cases | 22.0 | 22.0 | 22.0 | 18.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 |
| 2005 | 9 | Median | 14.1 | 8.9 | 8.2 | 0.7 | 149.5 | 196.0 | 40.0 | 2870.0 | 10.0 | 47.5 | 6.7 |
| 2005 | 9 | Arithmetic Mean | 14.3 | 8.9 | 8.3 | 0.8 | 145.6 | 201.2 | 37.5 | 3010.9 | 10.3 | 79.4 | 12.7 |
| 2005 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.2 | 0.4 | 0.2 | 0.4 | 0.2 | 0.6 | 1.1 | 1.0 |
| 2005 | 9 | LQ | 13.2 | 8.8 | 7.7 | 0.7 | 94.0 | 162.0 | 24.0 | 2510.0 | 5.0 | 18.0 | 4.2 |
| 2005 | 9 | UQ | 15.3 | 9.1 | 9.0 | 0.9 | 169.0 | 237.0 | 47.0 | 3480.0 | 13.0 | 100.0 | 16.5 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2006 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2006 | 6 | Median | 18.3 | 8.0 | 7.2 | 1.6 | 12.0 | 54.0 | 15.0 | 714.5 | 22.5 | 51.5 | 1.8 |
| 2006 | 6 | Arithmetic Mean | 18.2 | 8.0 | 7.3 | 1.6 | 13.6 | 71.7 | 14.6 | 799.4 | 22.5 | 57.2 | 2.0 |
| 2006 | 6 | Coefficient of Variation | 0.0 | 0.0 | 0.1 | 0.1 | 0.7 | 0.7 | 0.3 | 0.2 | 0.4 | 0.4 | 0.5 |
| 2006 | 6 | LQ | 17.6 | 7.8 | 6.9 | 1.5 | 5.3 | 49.0 | 12.0 | 672.0 | 18.0 | 50.0 | 1.2 |
| 2006 | 6 | UQ | 18.8 | 8.2 | 7.8 | 1.7 | 22.0 | 59.0 | 16.0 | 961.0 | 26.0 | 71.0 | 2.7 |
| 2006 | 7 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2006 | 7 | Median | 22.2 | 9.3 | 7.2 | 0.9 | 102.0 | 190.0 | 48.0 | 1990.0 | 22.0 | 112.0 | 31.2 |
| 2006 | 7 | Arithmetic Mean | 22.2 | 9.1 | 7.1 | 1.0 | 106.6 | 214.1 | 59.3 | 2153.3 | 47.4 | 281.3 | 54.0 |
| 2006 | 7 | Coefficient of Variation | 0.0 | 0.1 | 0.3 | 0.4 | 1.0 | 0.5 | 0.9 | 0.4 | 1.2 | 1.3 | 0.9 |
| 2006 | 7 | LQ | 21.6 | 8.8 | 5.2 | 0.7 | 34.0 | 132.3 | 7.0 | 1817.5 | 5.0 | 43.0 | 24.2 |
| 2006 | 7 | UQ | 22.8 | 9.5 | 9.3 | 1.3 | 139.5 | 244.3 | 110.8 | 2307.5 | 65.0 | 447.0 | 66.8 |
| 2006 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2006 | 8 | Median | 20.7 | 9.7 | 8.6 | 0.7 | 107.0 | 258.5 | 87.0 | 3665.0 | 5.0 | 26.5 | 14.8 |
| 2006 | 8 | Arithmetic Mean | 20.7 | 9.8 | 8.7 | 0.7 | 153.3 | 279.1 | 87.1 | 3495.0 | 5.0 | 106.6 | 64.1 |
| 2006 | 8 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.4 | 0.8 | 0.4 | 0.3 | 0.4 | 0.0 | 1.9 | 1.7 |
| 2006 | 8 | LQ | 20.1 | 9.4 | 7.9 | 0.4 | 77.0 | 198.0 | 63.0 | 2000.0 | 5.0 | 12.0 | 6.5 |
| 2006 | 8 | UQ | 21.4 | 10.2 | 9.7 | 0.9 | 190.0 | 305.0 | 103.0 | 5040.0 | 5.0 | 69.0 | 33.5 |
| 2006 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 14.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2006 | 9 | Median | 16.9 | 10.0 | 10.0 | 0.6 | 145.5 | 255.0 | 94.0 | 2510.0 | 5.0 | 61.5 | 37.3 |
| 2006 | 9 | Arithmetic Mean | 16.6 | 10.0 | 10.0 | 0.6 | 205.3 | 287.7 | 90.7 | 3426.7 | 5.0 | 89.3 | 65.8 |
| 2006 | 9 | Coefficient of Variation | 0.2 | 0.0 | 0.2 | 0.5 | 0.9 | 0.4 | 0.5 | 0.6 | 0.0 | 1.1 | 1.2 |
| 2006 | 9 | LQ | 13.9 | 9.8 | 8.4 | 0.4 | 95.0 | 231.0 | 71.0 | 2410.0 | 5.0 | 17.0 | 14.7 |
| 2006 | 9 | UQ | 19.0 | 10.2 | 11.6 | 0.7 | 244.0 | 324.0 | 99.0 | 3870.0 | 5.0 | 121.0 | 96.6 |
| 2007 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2007 | 6 | Median | 17.8 | 8.9 | 8.6 | 1.2 | 27.5 | 117.5 | 35.5 | 899.0 | 5.0 | 19.5 | 2.8 |
| 2007 | 6 | Arithmetic Mean | 17.9 | 8.8 | 8.5 | 1.2 | 63.6 | 140.4 | 32.4 | 1213.3 | 30.4 | 27.4 | 3.9 |
| 2007 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.4 | 1.5 | 0.6 | 0.5 | 0.7 | 1.0 | 0.9 | 0.9 |
| 2007 | 6 | LQ | 16.6 | 8.5 | 7.4 | 1.0 | 13.0 | 93.0 | 15.0 | 796.0 | 5.0 | 5.0 | 1.5 |
| 2007 | 6 | UQ | 19.1 | 9.0 | 9.6 | 1.5 | 57.0 | 126.0 | 48.0 | 1080.0 | 63.0 | 40.0 | 3.7 |
| 2007 | 7 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2007 | 7 | Median | 21.8 | 9.9 | 7.3 | 0.6 | 144.0 | 310.0 | 111.0 | 3230.0 | 5.0 | 21.0 | 16.5 |
| 2007 | 7 | Arithmetic Mean | 21.6 | 9.9 | 7.3 | 0.6 | 162.0 | 316.0 | 93.9 | 3028.9 | 8.3 | 49.9 | 37.8 |
| 2007 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.4 | 0.5 | 0.3 | 0.6 | 0.3 | 0.6 | 1.2 | 1.2 |
| 2007 | 7 | LQ | 20.3 | 9.8 | 5.7 | 0.4 | 99.8 | 262.3 | 27.3 | 2332.5 | 5.0 | 5.0 | 4.4 |
| 2007 | 7 | UQ | 22.6 | 10.0 | 8.8 | 0.8 | 230.3 | 355.0 | 133.8 | 3722.5 | 13.0 | 69.5 | 51.1 |
| 2007 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2007 | 8 | Median | 20.3 | 9.4 | 7.4 | 0.6 | 149.5 | 256.0 | 103.5 | 3090.0 | 5.0 | 28.0 | 19.0 |
| 2007 | 8 | Arithmetic Mean | 20.2 | 9.4 | 6.6 | 0.6 | 140.5 | 288.7 | 98.0 | 3286.7 | 8.4 | 90.8 | 39.3 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | 8 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.5 | 0.5 | 0.3 | 0.2 | 0.4 | 0.5 | 1.1 | 1.0 |
| 2007 | 8 | LQ | 19.4 | 9.3 | 5.2 | 0.5 | 72.0 | 233.0 | 77.0 | 2430.0 | 5.0 | 19.0 | 11.5 |
| 2007 | 8 | UQ | 21.0 | 9.6 | 7.7 | 0.8 | 211.0 | 284.0 | 114.0 | 3910.0 | 12.0 | 184.0 | 75.4 |
| 2007 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 9.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2007 | 9 | Median | 15.0 | 9.2 | 9.2 | 0.6 | 89.0 | 215.0 | 49.5 | 2726.6 | 12.0 | 295.2 | 73.5 |
| 2007 | 9 | Arithmetic Mean | 15.3 | 9.2 | 8.5 | 0.6 | 124.0 | 212.8 | 61.7 | 2907.3 | 14.5 | 324.7 | 73.5 |
| 2007 | 9 | Coefficient of Variation | 0.2 | 0.0 | 0.2 | 0.2 | 0.7 | 0.2 | 0.6 | 0.2 | 0.8 | 1.0 | 0.8 |
| 2007 | 9 | LQ | 12.2 | 9.1 | 7.7 | 0.5 | 85.0 | 178.1 | 39.0 | 2430.0 | 5.0 | 53.0 | 29.9 |
| 2007 | 9 | UQ | 18.1 | 9.4 | 9.6 | 0.7 | 140.3 | 252.0 | 76.0 | 3274.9 | 19.0 | 439.0 | 113.4 |
| 2008 | 6 | N of Cases | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 |
| 2008 | 6 | Median | 18.2 | 9.0 | 9.3 | 1.0 | 50.0 | 76.5 | 17.0 | 1120.0 | 4.0 | 24.5 | 5.3 |
| 2008 | 6 | Arithmetic Mean | 18.3 | 8.8 | 9.2 | 1.0 | 64.7 | 98.8 | 18.5 | 1449.4 | 12.3 | 29.1 | 7.8 |
| 2008 | 6 | Coefficient of Variation | 0.2 | 0.1 | 0.1 | 0.4 | 1.1 | 0.7 | 0.2 | 0.7 | 1.3 | 0.4 | 0.9 |
| 2008 | 6 | LQ | 15.4 | 8.1 | 8.2 | 0.8 | 13.0 | 59.0 | 16.0 | 733.0 | 4.0 | 20.0 | 0.9 |
| 2008 | 6 | UQ | 21.3 | 9.5 | 10.2 | 1.3 | 85.0 | 115.0 | 20.0 | 1760.0 | 4.0 | 36.0 | 14.5 |
| 2008 | 7 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2008 | 7 | Median | 21.2 | 9.6 | 8.3 | 0.7 | 178.5 | 202.0 | 51.0 | 2830.0 | 6.5 | 19.0 | 14.2 |
| 2008 | 7 | Arithmetic Mean | 21.3 | 9.6 | 8.1 | 0.7 | 271.1 | 204.9 | 56.3 | 2703.9 | 7.1 | 84.7 | 39.9 |
| 2008 | 7 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.4 | 1.0 | 0.3 | 0.4 | 0.3 | 0.5 | 1.7 | 1.3 |
| 2008 | 7 | LQ | 20.7 | 9.5 | 7.2 | 0.5 | 132.0 | 177.0 | 39.0 | 1860.0 | 4.0 | 16.0 | 11.2 |
| 2008 | 7 | UQ | 21.4 | 9.9 | 9.2 | 0.8 | 260.0 | 234.0 | 66.0 | 3090.0 | 10.0 | 49.0 | 28.7 |
| 2008 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2008 | 8 | Median | 20.4 | 9.3 | 7.3 | 0.8 | 125.0 | 230.0 | 91.0 | 2975.0 | 6.5 | 118.5 | 47.9 |
| 2008 | 8 | Arithmetic Mean | 20.3 | 9.3 | 7.5 | 0.8 | 148.9 | 263.7 | 88.2 | 2917.8 | 9.2 | 171.2 | 55.8 |
| 2008 | 8 | Coefficient of Variation | 0.0 | 0.0 | 0.3 | 0.3 | 0.7 | 0.3 | 0.3 | 0.3 | 0.8 | 1.2 | 0.8 |
| 2008 | 8 | LQ | 19.7 | 9.2 | 7.1 | 0.7 | 65.0 | 215.0 | 66.0 | 2080.0 | 4.0 | 25.0 | 11.8 |
| 2008 | 8 | UQ | 21.0 | 9.5 | 8.5 | 0.9 | 206.0 | 285.0 | 100.0 | 3170.0 | 12.0 | 276.0 | 98.1 |
| 2008 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2008 | 9 | Median | 16.6 | 9.4 | 8.6 | 0.7 | 114.5 | 220.0 | 66.0 | 2635.0 | 10.0 | 27.5 | 11.8 |
| 2008 | 9 | Arithmetic Mean | 16.5 | 9.2 | 7.6 | 0.7 | 163.1 | 256.0 | 70.1 | 3176.7 | 10.2 | 281.8 | 27.9 |
| 2008 | 9 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.3 | 1.2 | 0.5 | 0.5 | 0.5 | 0.3 | 2.8 | 1.2 |
| 2008 | 9 | LQ | 15.2 | 9.1 | 6.2 | 0.6 | 67.0 | 184.0 | 49.0 | 2060.0 | 9.0 | 22.0 | 10.4 |
| 2008 | 9 | UQ | 17.5 | 9.5 | 9.2 | 0.9 | 182.0 | 292.0 | 82.0 | 3460.0 | 12.0 | 103.0 | 25.8 |
| 2009 | 6 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 26.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2009 | 6 | Median | 18.4 | 9.3 | 8.4 | 0.9 | 82.3 | 65.0 | 6.0 | 1720.0 | 4.0 | 16.0 | 7.7 |
| 2009 | 6 | Arithmetic Mean | 19.0 | 9.1 | 8.3 | 0.9 | 109.0 | 80.4 | 5.6 | 1717.6 | 4.5 | 24.4 | 8.4 |
| 2009 | 6 | Coefficient of Variation | 0.1 | 0.1 | 0.1 | 0.3 | 0.7 | 0.6 | 0.3 | 0.5 | 0.4 | 0.7 | 0.8 |
| 2009 | 6 | LQ | 18.1 | 8.7 | 7.7 | 0.7 | 56.6 | 46.0 | 4.0 | 964.8 | 4.0 | 12.0 | 2.4 |
| 2009 | 6 | UQ | 19.8 | 9.4 | 9.0 | 1.1 | 140.7 | 93.0 | 7.0 | 1962.5 | 4.0 | 27.3 | 10.8 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 7 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2009 | 7 | Median | 21.8 | 8.6 | 5.8 | 1.5 | 49.9 | 154.5 | 53.5 | 2070.0 | 18.0 | 372.5 | 30.3 |
| 2009 | 7 | Arithmetic Mean | 21.7 | 8.4 | 5.9 | 1.6 | 49.7 | 152.1 | 67.3 | 2021.1 | 26.5 | 503.0 | 38.9 |
| 2009 | 7 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.4 | 0.8 | 0.2 | 0.6 | 0.2 | 0.8 | 0.8 | 0.7 |
| 2009 | 7 | LQ | 19.6 | 7.8 | 4.8 | 1.1 | 19.8 | 131.0 | 40.0 | 1640.0 | 12.0 | 150.0 | 13.9 |
| 2009 | 7 | UQ | 23.5 | 9.0 | 7.3 | 1.9 | 56.8 | 166.0 | 97.0 | 2320.0 | 37.0 | 685.0 | 55.9 |
| 2009 | 8 | N of Cases | 17.0 | 17.0 | 17.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 17.0 |
| 2009 | 8 | Median | 19.6 | 9.7 | 8.9 | 0.7 | 146.5 | 191.5 | 41.0 | 2170.0 | 6.0 | 20.5 | 11.6 |
| 2009 | 8 | Arithmetic Mean | 19.5 | 9.8 | 9.0 | 0.6 | 153.0 | 200.4 | 47.1 | 2451.7 | 6.6 | 62.3 | 42.3 |
| 2009 | 8 | Coefficient of Variation | 0.0 | 0.1 | 0.3 | 0.4 | 0.4 | 0.3 | 0.6 | 0.3 | 0.4 | 2.1 | 2.1 |
| 2009 | 8 | LQ | 19.1 | 9.3 | 8.0 | 0.4 | 118.5 | 164.0 | 27.0 | 1880.0 | 4.0 | 17.0 | 9.0 |
| 2009 | 8 | UQ | 20.1 | 10.3 | 10.9 | 0.8 | 189.1 | 213.0 | 66.0 | 2860.0 | 9.0 | 25.0 | 21.5 |
| 2009 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2009 | 9 | Median | 16.1 | 9.8 | 7.9 | 0.6 | 142.5 | 240.5 | 86.0 | 2810.0 | 4.0 | 108.0 | 77.2 |
| 2009 | 9 | Arithmetic Mean | 16.3 | 9.8 | 7.5 | 0.6 | 147.5 | 250.8 | 78.0 | 3103.3 | 7.3 | 238.8 | 123.6 |
| 2009 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.3 | 0.3 | 0.2 | 0.3 | 0.3 | 0.7 | 1.5 | 1.1 |
| 2009 | 9 | LQ | 15.7 | 9.6 | 7.1 | 0.5 | 119.6 | 215.0 | 59.0 | 2450.0 | 4.0 | 27.0 | 19.7 |
| 2009 | 9 | UQ | 17.0 | 9.9 | 8.3 | 0.8 | 174.3 | 306.0 | 95.0 | 3760.0 | 9.0 | 337.0 | 204.7 |
| 2010 | 6 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2010 | 6 | Median | 16.6 | 8.3 | 8.5 | 1.1 | 13.6 | 47.0 | 4.0 | 596.0 | 4.0 | 10.0 | 0.4 |
| 2010 | 6 | Arithmetic Mean | 16.9 | 8.2 | 8.6 | 1.1 | 14.6 | 49.0 | 5.0 | 620.1 | 5.3 | 11.8 | 0.7 |
| 2010 | 6 | Coefficient of Variation | 0.2 | 0.1 | 0.1 | 0.3 | 0.9 | 0.2 | 0.7 | 0.2 | 0.4 | 0.6 | 1.0 |
| 2010 | 6 | LQ | 14.0 | 7.7 | 8.1 | 1.0 | 4.3 | 41.5 | 3.0 | 551.3 | 4.0 | 7.0 | 0.2 |
| 2010 | 6 | UQ | 20.1 | 8.6 | 9.0 | 1.2 | 17.4 | 53.8 | 5.8 | 633.3 | 8.0 | 17.0 | 0.8 |
| 2010 | 7 | N of Cases | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 |
| 2010 | 7 | Median | 22.5 | 9.6 | 9.1 | 1.0 | 93.3 | 81.0 | 8.0 | 1550.0 | 4.0 | 24.0 | 12.1 |
| 2010 | 7 | Arithmetic Mean | 22.1 | 9.5 | 8.5 | 0.9 | 103.9 | 103.9 | 18.7 | 1773.6 | 6.1 | 75.7 | 39.7 |
| 2010 | 7 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.4 | 0.5 | 0.6 | 1.1 | 0.4 | 0.9 | 1.3 | 1.1 |
| 2010 | 7 | LQ | 21.2 | 9.4 | 7.3 | 0.6 | 55.7 | 67.0 | 5.3 | 1400.0 | 4.0 | 14.0 | 9.2 |
| 2010 | 7 | UQ | 22.8 | 9.7 | 9.6 | 1.1 | 124.4 | 141.0 | 21.0 | 2137.5 | 4.0 | 120.5 | 70.3 |
| 2010 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2010 | 8 | Median | 20.4 | 9.4 | 8.6 | 0.7 | 124.6 | 180.5 | 44.5 | 2120.0 | 9.5 | 34.5 | 19.6 |
| 2010 | 8 | Arithmetic Mean | 20.3 | 9.3 | 8.5 | 0.8 | 132.4 | 183.7 | 49.4 | 2326.7 | 17.9 | 158.1 | 34.7 |
| 2010 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.5 | 0.6 | 0.2 | 0.5 | 0.3 | 1.2 | 1.4 | 0.9 |
| 2010 | 8 | LQ | 18.8 | 8.9 | 7.8 | 0.5 | 91.8 | 160.0 | 37.0 | 1930.0 | 4.0 | 25.0 | 13.5 |
| 2010 | 8 | UQ | 21.5 | 9.6 | 9.6 | 0.9 | 154.8 | 201.0 | 70.0 | 2710.0 | 21.0 | 239.0 | 63.2 |
| 2010 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2010 | 9 | Median | 15.9 | 9.5 | 9.0 | 0.7 | 170.6 | 168.5 | 30.5 | 2370.0 | 9.0 | 31.0 | 17.9 |
| 2010 | 9 | Arithmetic Mean | 15.9 | 9.5 | 9.0 | 0.7 | 163.2 | 199.7 | 33.2 | 2772.8 | 13.4 | 116.3 | 30.9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 1.0 | 2.0 | 0.8 |
| 2010 | 9 | LQ | 14.8 | 9.4 | 7.7 | 0.6 | 89.5 | 141.0 | 25.0 | 2190.0 | 4.0 | 27.0 | 14.1 |
| 2010 | 9 | UQ | 16.8 | 9.6 | 10.5 | 0.8 | 216.3 | 220.0 | 34.0 | 2760.0 | 12.0 | 86.0 | 35.9 |
| 2011 | 6 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2011 | 6 | Median | 16.1 | 8.1 | 8.3 | 1.1 | 14.2 | 48.0 | 5.0 | 657.0 | 13.0 | 49.0 | 1.3 |
| 2011 | 6 | Arithmetic Mean | 15.2 | 8.1 | 8.4 | 1.2 | 15.2 | 49.5 | 5.1 | 664.3 | 17.9 | 47.3 | 1.4 |
| 2011 | 6 | Coefficient of Variation | 0.2 | 0.0 | 0.1 | 0.3 | 0.3 | 0.3 | 0.4 | 0.2 | 0.6 | 0.6 | 0.5 |
| 2011 | 6 | LQ | 10.6 | 8.0 | 7.9 | 0.9 | 12.0 | 42.0 | 4.0 | 603.0 | 8.3 | 24.0 | 0.8 |
| 2011 | 6 | UQ | 19.0 | 8.3 | 9.4 | 1.5 | 17.3 | 52.0 | 6.0 | 696.0 | 27.0 | 68.0 | 1.9 |
| 2011 | 7 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2011 | 7 | Median | 20.1 | 9.6 | 10.1 | 0.8 | 98.6 | 97.0 | 7.0 | 1665.0 | 4.0 | 21.5 | 13.2 |
| 2011 | 7 | Arithmetic Mean | 19.8 | 9.6 | 9.7 | 0.8 | 114.4 | 108.4 | 7.6 | 1770.0 | 5.1 | 31.2 | 18.4 |
| 2011 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.2 | 0.5 | 0.3 | 0.5 | 0.3 | 0.4 | 0.9 | 0.8 |
| 2011 | 7 | LQ | 18.5 | 9.5 | 8.5 | 0.7 | 79.0 | 88.0 | 4.0 | 1470.0 | 4.0 | 16.0 | 11.2 |
| 2011 | 7 | UQ | 20.9 | 9.7 | 10.4 | 0.8 | 152.7 | 136.0 | 9.0 | 1830.0 | 4.0 | 32.0 | 21.1 |
| 2011 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2011 | 8 | Median | 22.0 | 9.1 | 7.4 | 1.0 | 41.1 | 205.5 | 69.5 | 1870.0 | 20.0 | 114.0 | 47.4 |
| 2011 | 8 | Arithmetic Mean | 21.8 | 9.1 | 7.3 | 1.0 | 67.7 | 215.1 | 73.3 | 2083.3 | 29.1 | 190.9 | 53.0 |
| 2011 | 8 | Coefficient of Variation | 0.0 | 0.0 | 0.3 | 0.4 | 1.3 | 0.3 | 0.2 | 0.5 | 0.8 | 1.0 | 0.8 |
| 2011 | 8 | LQ | 21.7 | 8.9 | 5.5 | 0.8 | 12.4 | 183.0 | 63.0 | 1480.0 | 17.0 | 44.0 | 18.9 |
| 2011 | 8 | UQ | 22.5 | 9.2 | 9.8 | 1.4 | 67.0 | 222.0 | 83.0 | 2500.0 | 30.0 | 253.0 | 57.6 |
| 2011 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2011 | 9 | Median | 18.1 | 9.0 | 8.8 | 0.8 | 68.2 | 186.0 | 34.5 | 1615.0 | 23.5 | 165.5 | 24.0 |
| 2011 | 9 | Arithmetic Mean | 18.3 | 8.9 | 8.4 | 0.9 | 77.5 | 183.6 | 52.6 | 1742.2 | 33.1 | 170.2 | 32.3 |
| 2011 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.3 | 0.6 | 0.2 | 0.8 | 0.3 | 0.8 | 0.8 | 0.8 |
| 2011 | 9 | LQ | 16.6 | 8.7 | 6.2 | 0.7 | 44.0 | 144.0 | 14.0 | 1520.0 | 13.0 | 20.0 | 6.1 |
| 2011 | 9 | UQ | 19.9 | 9.1 | 10.2 | 1.0 | 98.6 | 207.0 | 90.0 | 1830.0 | 49.0 | 295.0 | 61.6 |
| 2012 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2012 | 6 | Median | 16.4 | 8.1 | 8.5 | 1.0 | 12.0 | 80.0 | 32.0 | 670.5 | 6.0 | 25.0 | 1.0 |
| 2012 | 6 | Arithmetic Mean | 16.3 | 8.1 | 8.5 | 1.0 | 15.7 | 81.9 | 31.8 | 683.1 | 10.9 | 36.4 | 1.2 |
| 2012 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.0 | 0.1 | 0.5 | 0.1 | 0.1 | 0.1 | 0.9 | 0.7 | 0.5 |
| 2012 | 6 | LQ | 15.1 | 7.9 | 8.2 | 0.9 | 9.5 | 73.0 | 29.0 | 616.0 | 4.0 | 20.0 | 0.8 |
| 2012 | 6 | UQ | 17.6 | 8.3 | 8.7 | 1.2 | 24.0 | 86.0 | 35.0 | 719.0 | 13.0 | 47.0 | 1.6 |
| 2012 | 7 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2012 | 7 | Median | 21.1 | 9.7 | 8.4 | 0.6 | 129.0 | 187.0 | 51.0 | 2120.0 | 9.0 | 32.0 | 21.3 |
| 2012 | 7 | Arithmetic Mean | 20.7 | 9.6 | 8.8 | 0.6 | 146.9 | 202.3 | 67.5 | 2188.7 | 10.3 | 58.6 | 36.2 |
| 2012 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.6 | 0.7 | 0.5 | 0.8 | 0.6 | 0.4 | 1.1 | 1.1 |
| 2012 | 7 | LQ | 19.5 | 9.3 | 7.0 | 0.4 | 61.4 | 99.8 | 19.0 | 1097.5 | 8.0 | 23.3 | 13.3 |
| 2012 | 7 | UQ | 21.8 | 10.0 | 10.6 | 0.9 | 211.1 | 276.3 | 138.5 | 2800.0 | 11.8 | 60.0 | 43.6 |

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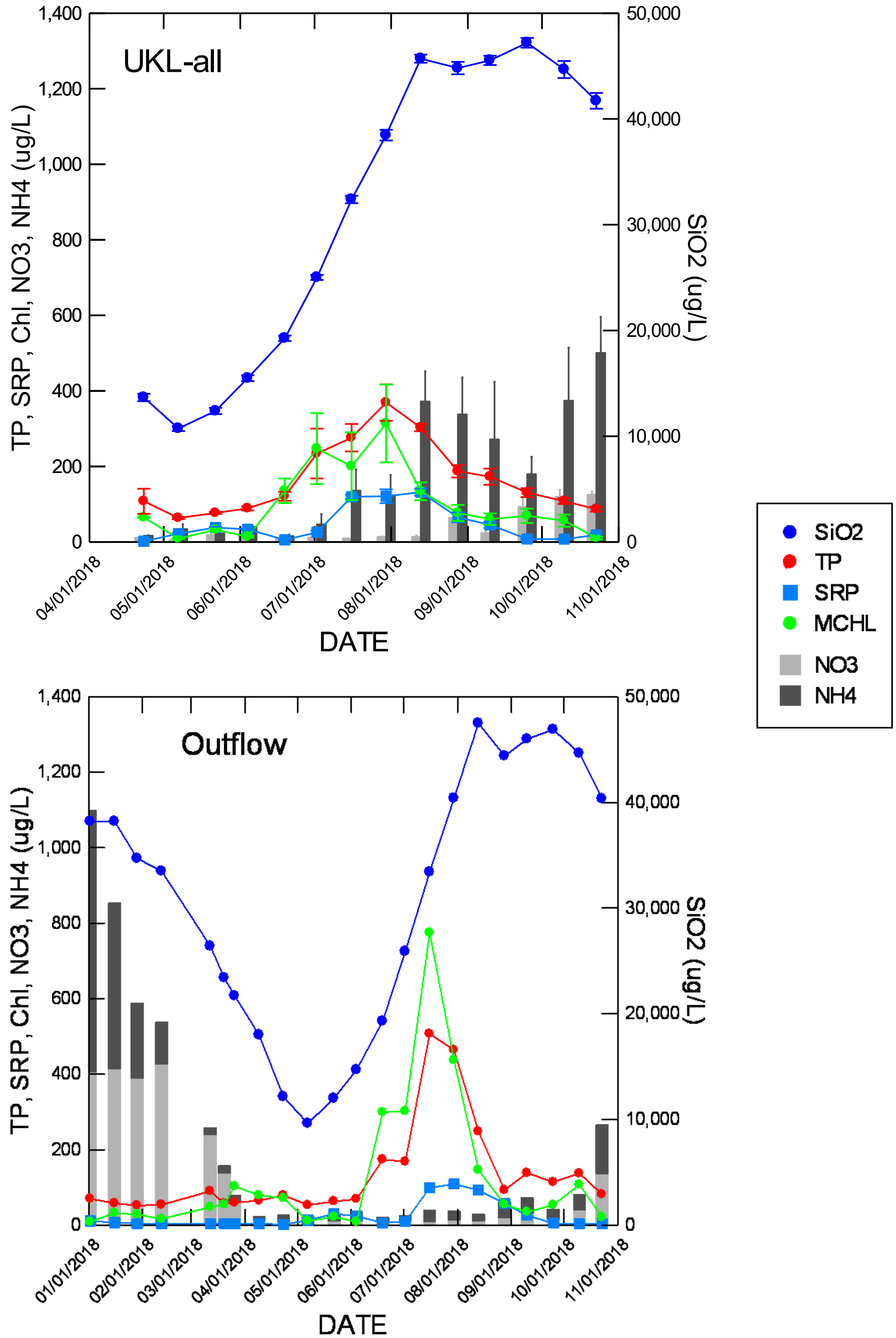
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2012 | 8 | Median | 21.0 | 9.1 | 6.7 | 0.8 | 64.6 | 214.0 | 84.5 | 2085.0 | 34.5 | 87.5 | 31.4 |
| 2012 | 8 | Arithmetic Mean | 21.1 | 9.1 | 6.6 | 0.8 | 83.9 | 233.2 | 91.3 | 2208.9 | 44.2 | 241.2 | 50.7 |
| 2012 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.4 | 0.4 | 0.8 | 0.4 | 0.5 | 0.3 | 0.9 | 1.1 | 0.9 |
| 2012 | 8 | LQ | 19.7 | 8.9 | 4.4 | 0.6 | 43.2 | 171.0 | 66.0 | 1970.0 | 11.0 | 55.0 | 20.3 |
| 2012 | 8 | UQ | 22.3 | 9.4 | 9.5 | 1.0 | 103.9 | 265.0 | 129.0 | 2260.0 | 61.0 | 454.0 | 67.4 |
| 2012 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2012 | 9 | Median | 18.1 | 8.2 | 7.6 | 0.8 | 51.2 | 92.0 | 6.5 | 1520.0 | 73.0 | 89.5 | 3.1 |
| 2012 | 9 | Arithmetic Mean | 17.8 | 8.1 | 7.2 | 0.8 | 49.1 | 88.9 | 12.3 | 1519.4 | 89.7 | 125.6 | 4.5 |
| 2012 | 9 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.3 | 0.6 | 0.3 | 1.1 | 0.2 | 0.6 | 1.0 | 0.8 |
| 2012 | 9 | LQ | 16.8 | 7.8 | 6.3 | 0.7 | 24.9 | 64.0 | 4.0 | 1170.0 | 41.0 | 32.0 | 1.9 |
| 2012 | 9 | UQ | 18.6 | 8.4 | 7.9 | 1.0 | 67.8 | 118.0 | 14.0 | 1830.0 | 146.0 | 181.0 | 7.1 |
| 2013 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2013 | 6 | Median | 17.6 | 9.3 | 9.5 | 0.7 | 64.6 | 128.0 | 19.5 | 1365.0 | 8.0 | 16.0 | 6.6 |
| 2013 | 6 | Arithmetic Mean | 17.7 | 9.3 | 9.9 | 0.7 | 78.6 | 127.7 | 20.7 | 1440.7 | 7.6 | 19.1 | 9.3 |
| 2013 | 6 | Coefficient of Variation | 0.0 | 0.1 | 0.1 | 0.3 | 0.7 | 0.2 | 0.6 | 0.4 | 0.3 | 0.7 | 1.1 |
| 2013 | 6 | LQ | 17.3 | 8.8 | 9.1 | 0.6 | 30.9 | 107.0 | 9.0 | 880.0 | 4.0 | 11.0 | 1.9 |
| 2013 | 6 | UQ | 18.1 | 9.8 | 10.6 | 0.8 | 129.0 | 154.0 | 31.0 | 1990.0 | 9.0 | 23.0 | 12.9 |
| 2013 | 7 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2013 | 7 | Median | 22.5 | 10.0 | 8.6 | 0.6 | 129.0 | 279.0 | 109.0 | 2580.0 | 4.0 | 44.0 | 32.3 |
| 2013 | 7 | Arithmetic Mean | 22.8 | 10.0 | 7.9 | 0.5 | 175.3 | 296.6 | 103.0 | 3009.3 | 5.5 | 84.5 | 64.5 |
| 2013 | 7 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.4 | 0.7 | 0.4 | 0.4 | 0.5 | 0.6 | 1.2 | 1.1 |
| 2013 | 7 | LQ | 22.1 | 9.8 | 6.8 | 0.3 | 99.4 | 246.0 | 71.8 | 2230.0 | 4.0 | 12.3 | 10.8 |
| 2013 | 7 | UQ | 23.3 | 10.2 | 8.9 | 0.6 | 226.4 | 321.8 | 135.5 | 3445.0 | 4.0 | 142.0 | 117.6 |
| 2013 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2013 | 8 | Median | 19.8 | 8.0 | 4.5 | 1.0 | 24.1 | 174.0 | 49.5 | 1775.0 | 253.0 | 260.0 | 7.8 |
| 2013 | 8 | Arithmetic Mean | 19.8 | 8.1 | 4.6 | 1.1 | 36.0 | 202.3 | 60.9 | 1842.8 | 245.8 | 271.4 | 16.1 |
| 2013 | 8 | Coefficient of Variation | 0.0 | 0.1 | 0.5 | 0.2 | 1.0 | 0.7 | 0.5 | 0.2 | 0.7 | 0.9 | 1.3 |
| 2013 | 8 | LQ | 19.3 | 7.4 | 2.1 | 0.9 | 8.3 | 105.0 | 45.0 | 1450.0 | 73.0 | 48.0 | 2.7 |
| 2013 | 8 | UQ | 20.3 | 8.7 | 6.2 | 1.3 | 52.0 | 225.0 | 96.0 | 2140.0 | 351.0 | 392.0 | 19.9 |
| 2013 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2013 | 9 | Median | 16.8 | 7.6 | 6.7 | 0.9 | 11.0 | 88.5 | 29.0 | 1210.0 | 313.0 | 49.5 | 0.6 |
| 2013 | 9 | Arithmetic Mean | 16.7 | 7.6 | 6.6 | 0.9 | 15.6 | 89.2 | 29.2 | 1232.8 | 306.3 | 49.9 | 0.7 |
| 2013 | 9 | Coefficient of Variation | 0.2 | 0.0 | 0.2 | 0.2 | 0.7 | 0.1 | 0.3 | 0.1 | 0.3 | 0.5 | 0.6 |
| 2013 | 9 | LQ | 13.9 | 7.6 | 6.4 | 0.8 | 9.4 | 78.0 | 21.0 | 1130.0 | 241.0 | 33.0 | 0.4 |
| 2013 | 9 | UQ | 18.6 | 7.8 | 7.5 | 1.1 | 16.0 | 98.0 | 37.0 | 1330.0 | 368.0 | 58.0 | 0.7 |
| 2014 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2014 | 6 | Median | 16.7 | 9.0 | 9.5 | 0.7 | 59.6 | 160.5 | 58.5 | 1313.5 | 4.0 | 11.0 | 4.1 |
| 2014 | 6 | Arithmetic Mean | 16.8 | 9.0 | 9.6 | 0.8 | 66.5 | 162.7 | 56.2 | 1398.3 | 6.6 | 19.1 | 3.8 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2014 | 6 | Coefficient of Variation | 0.1 | 0.1 | 0.1 | 0.4 | 0.8 | 0.2 | 0.4 | 0.5 | 0.7 | 0.8 | 0.6 |
| 2014 | 6 | LQ | 15.6 | 8.3 | 8.7 | 0.5 | 14.0 | 130.0 | 42.0 | 676.0 | 4.0 | 9.0 | 1.6 |
| 2014 | 6 | UQ | 18.1 | 9.7 | 10.5 | 1.0 | 112.1 | 195.0 | 75.0 | 2070.0 | 11.0 | 26.0 | 5.4 |
| 2014 | 7 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2014 | 7 | Median | 21.3 | 9.8 | 9.6 | 0.7 | 79.2 | 338.0 | 182.0 | 2530.0 | 9.0 | 36.0 | 28.7 |
| 2014 | 7 | Arithmetic Mean | 21.7 | 9.7 | 8.8 | 0.8 | 116.8 | 338.6 | 159.8 | 2862.6 | 10.4 | 125.5 | 66.9 |
| 2014 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.4 | 1.0 | 0.3 | 0.3 | 0.4 | 0.8 | 1.2 | 1.1 |
| 2014 | 7 | LQ | 20.1 | 9.4 | 7.4 | 0.5 | 36.3 | 247.5 | 109.8 | 2000.0 | 4.0 | 18.0 | 14.5 |
| 2014 | 7 | UQ | 23.6 | 10.0 | 10.7 | 1.0 | 174.2 | 396.0 | 192.3 | 3270.0 | 12.0 | 188.8 | 95.0 |
| 2014 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2014 | 8 | Median | 20.8 | 8.2 | 6.2 | 0.9 | 27.8 | 177.0 | 66.5 | 1560.0 | 174.5 | 58.0 | 3.8 |
| 2014 | 8 | Arithmetic Mean | 20.2 | 8.3 | 5.5 | 0.9 | 41.7 | 192.3 | 82.7 | 1880.0 | 195.7 | 146.4 | 14.7 |
| 2014 | 8 | Coefficient of Variation | 0.1 | 0.1 | 0.4 | 0.3 | 1.0 | 0.4 | 0.6 | 0.4 | 0.6 | 1.4 | 1.6 |
| 2014 | 8 | LQ | 18.8 | 8.0 | 3.2 | 0.7 | 15.4 | 128.0 | 47.0 | 1390.0 | 100.0 | 30.0 | 1.1 |
| 2014 | 8 | UQ | 21.5 | 8.7 | 7.5 | 1.0 | 68.9 | 230.0 | 116.0 | 2300.0 | 313.0 | 116.0 | 12.8 |
| 2014 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 17.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2014 | 9 | Median | 18.3 | 8.0 | 7.9 | 1.0 | 21.7 | 109.0 | 30.0 | 1110.0 | 14.0 | 20.0 | 0.9 |
| 2014 | 9 | Arithmetic Mean | 18.4 | 8.1 | 7.9 | 1.0 | 22.1 | 105.8 | 27.9 | 1087.1 | 17.4 | 23.7 | 1.5 |
| 2014 | 9 | Coefficient of Variation | 0.0 | 0.1 | 0.1 | 0.1 | 0.4 | 0.2 | 0.3 | 0.2 | 0.5 | 0.6 | 1.1 |
| 2014 | 9 | LQ | 18.1 | 7.8 | 7.7 | 0.9 | 13.7 | 94.0 | 21.0 | 956.0 | 11.0 | 14.0 | 0.4 |
| 2014 | 9 | UQ | 18.8 | 8.5 | 8.5 | 1.1 | 27.0 | 113.0 | 32.0 | 1200.0 | 19.0 | 24.0 | 2.1 |
| 2015 | 6 | N of Cases | 13.0 | 13.0 | 13.0 | 9.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 |
| 2015 | 6 | Median | 20.9 | 9.0 | 8.4 | 1.4 | 64.7 | 132.0 | 53.0 | 1280.0 | 12.0 | 34.0 | 8.5 |
| 2015 | 6 | Arithmetic Mean | 20.9 | 9.0 | 9.1 | 1.4 | 86.0 | 171.8 | 48.8 | 1731.5 | 12.0 | 45.8 | 18.8 |
| 2015 | 6 | Coefficient of Variation | 0.0 | 0.0 | 0.1 | 0.3 | 0.9 | 0.5 | 0.2 | 0.7 | 0.4 | 0.7 | 1.3 |
| 2015 | 6 | LQ | 20.5 | 8.8 | 8.3 | 1.2 | 37.8 | 122.3 | 39.5 | 935.8 | 10.3 | 30.0 | 6.9 |
| 2015 | 6 | UQ | 21.5 | 9.5 | 10.3 | 1.5 | 104.7 | 186.8 | 57.0 | 2007.5 | 16.1 | 45.8 | 18.0 |
| 2015 | 7 | N of Cases | 22.0 | 22.0 | 22.0 | 18.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 |
| 2015 | 7 | Median | 21.7 | 9.3 | 10.5 | 0.8 | 70.8 | 254.0 | 126.0 | 1580.0 | 16.0 | 18.0 | 11.9 |
| 2015 | 7 | Arithmetic Mean | 22.2 | 9.3 | 9.6 | 0.9 | 76.9 | 258.4 | 137.5 | 1703.4 | 31.1 | 128.7 | 33.9 |
| 2015 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.3 | 0.5 | 0.2 | 0.2 | 0.3 | 0.9 | 1.5 | 1.3 |
| 2015 | 7 | LQ | 21.4 | 8.9 | 8.6 | 0.7 | 49.6 | 226.0 | 116.0 | 1420.0 | 12.0 | 16.0 | 10.1 |
| 2015 | 7 | UQ | 22.2 | 9.6 | 11.2 | 1.3 | 96.4 | 275.0 | 159.0 | 1880.0 | 53.0 | 176.0 | 44.8 |
| 2015 | 8 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2015 | 8 | Median | 19.6 | 9.8 | 8.6 | 0.5 | 112.8 | 255.0 | 103.0 | 2280.0 | 12.0 | 21.0 | 15.0 |
| 2015 | 8 | Arithmetic Mean | 20.0 | 9.6 | 7.5 | 0.6 | 126.5 | 264.6 | 110.9 | 2415.9 | 38.7 | 97.9 | 47.2 |
| 2015 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.4 | 0.5 | 0.2 | 0.3 | 0.3 | 2.0 | 1.4 | 1.4 |
| 2015 | 8 | LQ | 18.7 | 9.5 | 5.4 | 0.5 | 75.6 | 237.0 | 85.5 | 1857.5 | 5.0 | 16.0 | 11.5 |
| 2015 | 8 | UQ | 21.9 | 9.9 | 9.1 | 0.8 | 195.7 | 277.3 | 138.0 | 2697.5 | 23.3 | 156.5 | 64.6 |

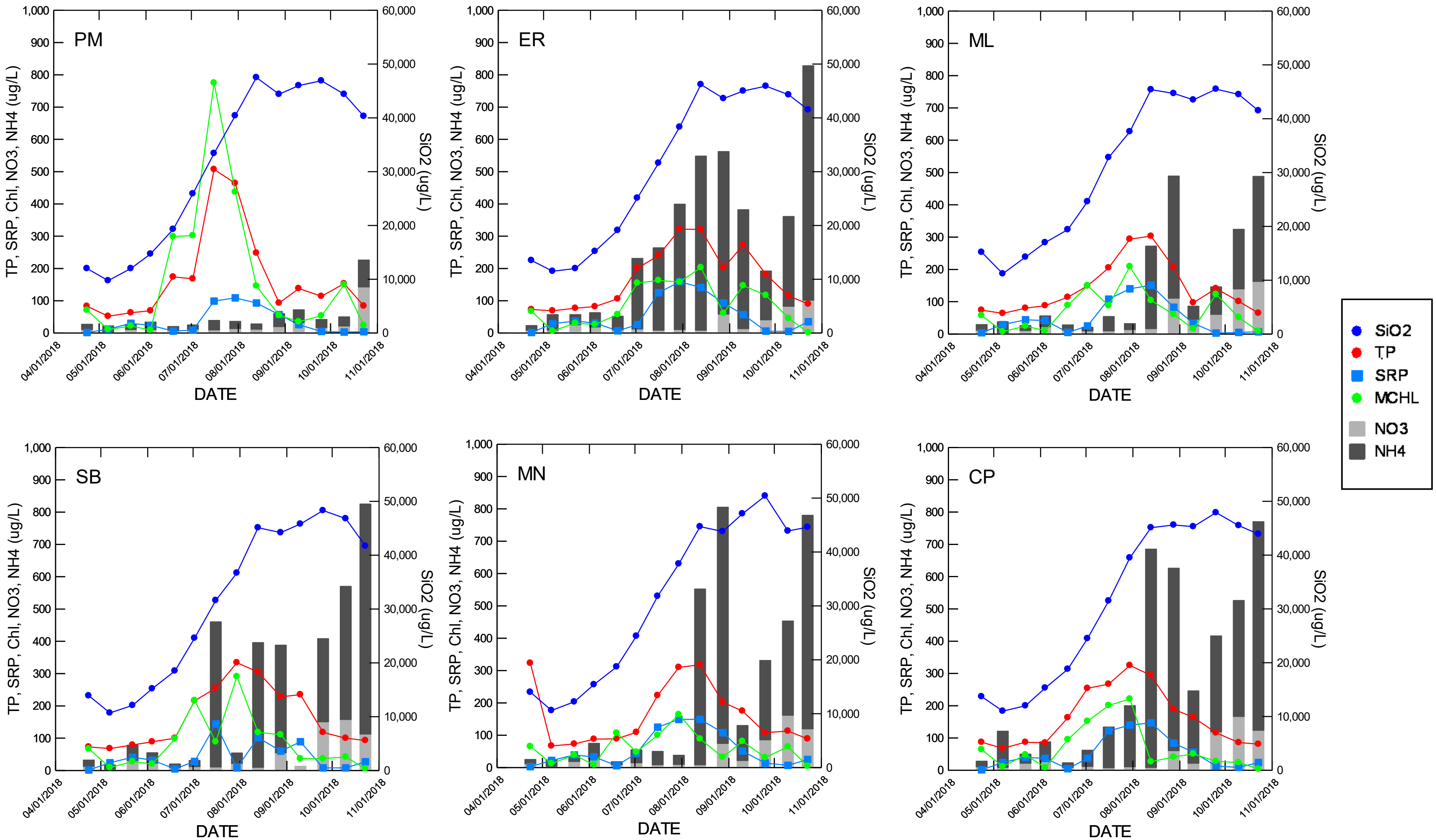
| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2015 | 9 | Median | 14.4 | 8.8 | 6.9 | 0.7 | 48.6 | 124.0 | 27.0 | 1550.0 | 76.0 | 72.0 | 6.4 |
| 2015 | 9 | Arithmetic Mean | 14.7 | 8.7 | 6.7 | 0.7 | 70.7 | 156.2 | 25.5 | 1973.9 | 114.1 | 144.5 | 14.6 |
| 2015 | 9 | Coefficient of Variation | 0.1 | 0.1 | 0.2 | 0.3 | 1.0 | 0.5 | 0.5 | 0.4 | 0.9 | 2.1 | 1.5 |
| 2015 | 9 | LQ | 13.6 | 8.3 | 5.2 | 0.5 | 25.2 | 107.0 | 18.0 | 1470.0 | 34.0 | 23.0 | 3.6 |
| 2015 | 9 | UQ | 16.1 | 9.2 | 8.1 | 0.8 | 71.2 | 173.0 | 34.0 | 2140.0 | 160.0 | 127.0 | 11.4 |
| 2016 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2016 | 6 | Median | 18.4 | 9.4 | 10.5 | 0.8 | 68.4 | 125.0 | 20.0 | 1415.0 | 9.0 | 17.0 | 7.8 |
| 2016 | 6 | Arithmetic Mean | 18.8 | 9.3 | 10.8 | 0.9 | 67.1 | 134.3 | 19.7 | 1413.1 | 8.7 | 20.1 | 7.4 |
| 2016 | 6 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.4 | 0.6 | 0.3 | 0.7 | 0.5 | 0.5 | 0.4 | 0.4 |
| 2016 | 6 | LQ | 17.1 | 8.9 | 9.6 | 0.6 | 40.7 | 101.0 | 7.0 | 742.0 | 4.0 | 14.0 | 4.7 |
| 2016 | 6 | UQ | 21.0 | 9.6 | 12.0 | 1.1 | 98.6 | 168.0 | 27.0 | 2040.0 | 13.0 | 24.0 | 9.7 |
| 2016 | 7 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2016 | 7 | Median | 20.5 | 10.2 | 8.8 | 0.6 | 145.2 | 270.0 | 93.0 | 2750.0 | 4.0 | 16.0 | 14.2 |
| 2016 | 7 | Arithmetic Mean | 20.4 | 10.1 | 8.5 | 0.5 | 176.0 | 286.5 | 87.3 | 3152.2 | 5.8 | 33.7 | 25.7 |
| 2016 | 7 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.5 | 0.5 | 0.2 | 0.3 | 0.4 | 0.4 | 1.2 | 1.0 |
| 2016 | 7 | LQ | 20.0 | 9.9 | 8.0 | 0.3 | 98.6 | 246.0 | 75.0 | 2120.0 | 4.0 | 15.0 | 12.4 |
| 2016 | 7 | UQ | 20.8 | 10.3 | 9.4 | 0.7 | 245.8 | 343.0 | 105.0 | 4780.0 | 8.0 | 22.0 | 19.5 |
| 2016 | 8 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 25.0 | 25.0 |
| 2016 | 8 | Median | 22.0 | 9.1 | 6.9 | 0.5 | 86.4 | 270.0 | 84.0 | 2320.0 | 9.0 | 44.0 | 13.7 |
| 2016 | 8 | Arithmetic Mean | 21.5 | 9.2 | 6.2 | 0.6 | 100.7 | 274.9 | 78.3 | 2531.9 | 15.2 | 161.3 | 51.5 |
| 2016 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.4 | 0.5 | 0.2 | 0.7 | 0.3 | 1.0 | 1.3 | 1.2 |
| 2016 | 8 | LQ | 19.8 | 8.9 | 6.1 | 0.5 | 65.3 | 241.5 | 42.0 | 2190.0 | 8.0 | 24.3 | 9.8 |
| 2016 | 8 | UQ | 22.7 | 9.4 | 7.2 | 0.6 | 125.3 | 294.3 | 130.8 | 2750.0 | 15.8 | 323.5 | 122.7 |
| 2016 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2016 | 9 | Median | 14.9 | 8.4 | 8.6 | 0.6 | 29.7 | 132.5 | 4.5 | 1585.0 | 10.0 | 16.5 | 1.1 |
| 2016 | 9 | Arithmetic Mean | 15.1 | 8.4 | 8.5 | 0.6 | 30.3 | 137.7 | 5.8 | 1626.1 | 19.1 | 30.9 | 1.6 |
| 2016 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.1 | 0.2 | 0.3 | 0.3 | 0.5 | 0.2 | 1.3 | 0.9 | 0.6 |
| 2016 | 9 | LQ | 14.6 | 8.2 | 8.3 | 0.5 | 21.4 | 98.0 | 4.0 | 1280.0 | 4.0 | 14.0 | 0.9 |
| 2016 | 9 | UQ | 15.5 | 8.5 | 9.1 | 0.7 | 38.3 | 173.0 | 6.0 | 1860.0 | 17.0 | 33.0 | 1.9 |
| 2017 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2017 | 6 | Median | 18.8 | 8.7 | 8.3 | 1.4 | 20.0 | 113.0 | 51.0 | 730.0 | 11.0 | 23.0 | 5.4 |
| 2017 | 6 | Arithmetic Mean | 18.9 | 8.8 | 8.6 | 1.3 | 30.0 | 111.9 | 49.4 | 782.2 | 10.8 | 27.9 | 5.1 |
| 2017 | 6 | Coefficient of Variation | 0.0 | 0.0 | 0.1 | 0.2 | 0.7 | 0.2 | 0.2 | 0.3 | 0.4 | 0.6 | 0.5 |
| 2017 | 6 | LQ | 18.2 | 8.5 | 7.8 | 1.2 | 15.7 | 98.0 | 41.0 | 676.0 | 8.0 | 17.0 | 2.6 |
| 2017 | 6 | UQ | 19.1 | 9.0 | 8.9 | 1.4 | 43.8 | 123.0 | 57.0 | 888.0 | 14.0 | 31.0 | 6.6 |
| 2017 | 7 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2017 | 7 | Median | 22.6 | 9.5 | 8.9 | 0.6 | 153.4 | 256.0 | 100.5 | 2280.0 | 11.0 | 30.0 | 17.4 |
| 2017 | 7 | Arithmetic Mean | 22.6 | 9.5 | 8.7 | 0.6 | 146.8 | 239.8 | 92.1 | 2413.3 | 11.4 | 67.4 | 31.6 |

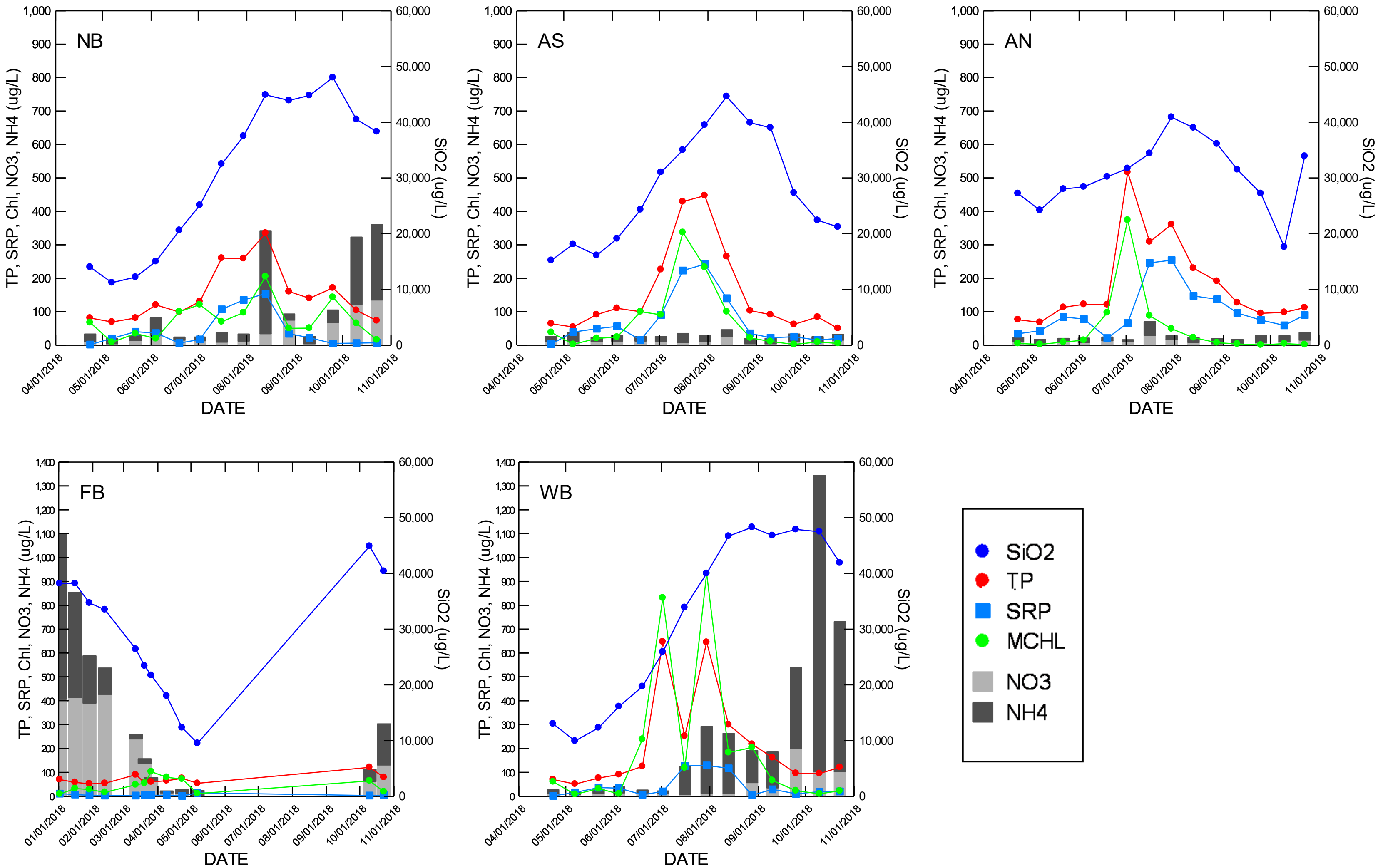
| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017 | 7 | Coefficient of Variation | 0.0 | 0.0 | 0.2 | 0.4 | 0.4 | 0.3 | 0.6 | 0.3 | 0.3 | 1.0 | 0.9 |
| 2017 | 7 | LQ | 22.3 | 9.3 | 7.3 | 0.5 | 99.4 | 169.0 | 43.0 | 2040.0 | 10.0 | 16.0 | 10.5 |
| 2017 | 7 | UQ | 22.9 | 9.8 | 10.4 | 0.8 | 180.7 | 291.0 | 142.0 | 2810.0 | 12.0 | 115.0 | 44.6 |
| 2017 | 8 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2017 | 8 | Median | 21.5 | 9.0 | 6.7 | 0.6 | 110.6 | 327.0 | 154.0 | 2800.0 | 13.0 | 318.0 | 55.0 |
| 2017 | 8 | Arithmetic Mean | 21.8 | 9.0 | 6.7 | 0.8 | 148.9 | 331.7 | 149.7 | 3049.3 | 20.5 | 355.3 | 79.5 |
| 2017 | 8 | Coefficient of Variation | 0.1 | 0.1 | 0.3 | 0.7 | 0.7 | 0.2 | 0.3 | 0.3 | 1.0 | 0.9 | 0.9 |
| 2017 | 8 | LQ | 20.9 | 8.7 | 5.3 | 0.5 | 66.6 | 288.5 | 123.0 | 2420.0 | 10.3 | 25.0 | 14.1 |
| 2017 | 8 | UQ | 22.9 | 9.4 | 8.7 | 1.0 | 232.4 | 365.8 | 181.3 | 3580.0 | 15.8 | 594.3 | 143.9 |
| 2017 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2017 | 9 | Median | 13.0 | 8.7 | 9.9 | 0.7 | 102.8 | 213.0 | 37.0 | 2255.0 | 19.0 | 24.5 | 3.8 |
| 2017 | 9 | Arithmetic Mean | 12.9 | 8.7 | 10.3 | 0.7 | 174.1 | 296.5 | 42.9 | 3243.9 | 31.8 | 62.2 | 6.8 |
| 2017 | 9 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.4 | 1.6 | 1.4 | 0.5 | 1.3 | 0.9 | 1.2 | 1.2 |
| 2017 | 9 | LQ | 11.9 | 8.6 | 9.0 | 0.5 | 91.8 | 169.0 | 25.0 | 2000.0 | 9.0 | 19.0 | 1.4 |
| 2017 | 9 | UQ | 14.1 | 8.9 | 11.5 | 0.8 | 152.0 | 228.0 | 58.0 | 2600.0 | 56.0 | 71.0 | 7.4 |
| 2018 | 6 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2018 | 6 | Median | 17.4 | 8.9 | 9.1 | 1.4 | 40.5 | 95.0 | 15.5 | 1082.5 | 12.5 | 23.0 | 3.6 |
| 2018 | 6 | Arithmetic Mean | 17.5 | 8.9 | 9.7 | 1.4 | 70.0 | 106.9 | 19.2 | 1255.8 | 15.6 | 26.6 | 5.0 |
| 2018 | 6 | Coefficient of Variation | 0.0 | 0.1 | 0.2 | 0.5 | 1.1 | 0.3 | 0.7 | 0.6 | 0.5 | 0.6 | 0.9 |
| 2018 | 6 | LQ | 17.0 | 8.2 | 8.4 | 0.8 | 11.5 | 88.0 | 6.0 | 708.0 | 9.0 | 11.0 | 1.9 |
| 2018 | 6 | UQ | 17.7 | 9.5 | 11.1 | 2.0 | 87.2 | 120.0 | 33.0 | 1460.0 | 23.0 | 42.0 | 6.3 |
| 2018 | 7 | N of Cases | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 2018 | 7 | Median | 22.9 | 9.8 | 9.9 | 0.5 | 134.8 | 259.0 | 108.0 | 2680.0 | 11.0 | 29.0 | 23.7 |
| 2018 | 7 | Arithmetic Mean | 22.3 | 9.7 | 9.6 | 0.5 | 209.5 | 302.8 | 87.0 | 3363.0 | 11.7 | 92.6 | 53.6 |
| 2018 | 7 | Coefficient of Variation | 0.1 | 0.0 | 0.2 | 0.5 | 0.8 | 0.5 | 0.6 | 0.6 | 0.2 | 1.3 | 1.2 |
| 2018 | 7 | LQ | 20.6 | 9.5 | 9.0 | 0.3 | 102.0 | 207.8 | 26.5 | 2362.5 | 10.0 | 19.5 | 14.7 |
| 2018 | 7 | UQ | 23.3 | 9.9 | 10.7 | 0.8 | 230.5 | 331.8 | 128.5 | 3642.5 | 13.0 | 123.3 | 76.1 |
| 2018 | 8 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2018 | 8 | Median | 19.5 | 9.0 | 7.6 | 0.8 | 84.4 | 238.0 | 93.0 | 2315.0 | 20.0 | 320.5 | 45.6 |
| 2018 | 8 | Arithmetic Mean | 19.6 | 9.0 | 7.1 | 0.9 | 89.4 | 236.8 | 95.9 | 2298.6 | 36.4 | 318.5 | 74.0 |
| 2018 | 8 | Coefficient of Variation | 0.1 | 0.0 | 0.3 | 0.3 | 0.5 | 0.3 | 0.4 | 0.3 | 0.8 | 0.8 | 0.9 |
| 2018 | 8 | LQ | 18.0 | 8.6 | 6.7 | 0.7 | 51.3 | 202.0 | 60.0 | 2140.0 | 10.0 | 40.0 | 11.5 |
| 2018 | 8 | UQ | 21.0 | 9.2 | 8.3 | 1.0 | 121.7 | 303.0 | 141.0 | 2770.0 | 59.0 | 539.0 | 136.6 |
| 2018 | 9 | N of Cases | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 2018 | 9 | Median | 16.0 | 8.5 | 8.0 | 0.9 | 48.1 | 139.0 | 18.0 | 1795.0 | 33.5 | 129.0 | 6.8 |
| 2018 | 9 | Arithmetic Mean | 15.8 | 8.4 | 7.8 | 0.9 | 56.7 | 149.0 | 25.4 | 1970.6 | 54.4 | 204.1 | 10.3 |
| 2018 | 9 | Coefficient of Variation | 0.2 | 0.1 | 0.2 | 0.4 | 0.6 | 0.3 | 0.9 | 0.3 | 1.0 | 1.4 | 1.0 |
| 2018 | 9 | LQ | 13.3 | 8.1 | 7.1 | 0.7 | 34.8 | 114.0 | 6.0 | 1670.0 | 17.0 | 40.0 | 4.1 |
| 2018 | 9 | UQ | 18.2 | 8.7 | 9.0 | 1.1 | 72.6 | 171.0 | 33.0 | 2180.0 | 68.0 | 257.0 | 15.5 |

**APPENDIX II: 2018 Seasonal trends in silica and other nutrient parameters in UKL and UKL Outflow (lake-wide mean shown with standard error).**



## 2018 Seasonal trends in silica and other nutrient parameters by station in UKL






**Note: Stations FB and WB have a higher axis.**

## APPENDIX III: Chlorophyll-a adjustment to account for method change from spectrophotometric to fluorometric in 2009.

Chlorophyll-a was adjusted to account for a change from spectrophotometric method to fluorometric method beginning in 2009. Between 1990 and 2008 the spectrophotometric method was used by the Aquatic Research Inc. laboratory (ARI) and beginning in 2009 the Sprague River Water Quality Lab (SRWQL) used the fluorometric method. The fluorometric method is more sensitive so values beginning in 2009 are higher relative to years prior to 2009- especially at higher Chl levels. The adjustment is based on 225 split samples collected between 2007 and 2008 that were analyzed by both labs). The adjusted values are used for all time-series comparisons that include data prior to 2009, and the un-adjusted values are used when evaluating individual years.

Comparison of Spectrophotometric Chl-a performed at ARI Lab and Fluorometric Chl-a performed at SRWQL

```
##
## Call:
## lm(formula = LOG_MCHL_DUP ~ LOG_MCHL, data = filter(df_ari, !OUTLIER))
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.41490 -0.06147  0.01417  0.06789  0.30471
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.18283    0.01904   9.601   <2e-16 ***
## LOG_MCHL     0.87895    0.01070  82.135   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1106 on 224 degrees of freedom
## Multiple R-squared:  0.9679, Adjusted R-squared:  0.9677
## F-statistic:  6746 on 1 and 224 DF,  p-value: < 2.2e-16
```