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Appendix 1. Annual Averages and Standard Errors for Benthic N2 Fixation, Benthic Chlorophyll a, GPP, and ER in the Fertilized and Reference Lakes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | N2 fixation (mg N m-2 day-1) | | | | | | |
|  | **E-5, 3m** | **E-5, 6m** | **Fog 2, 3m** | **Fog 2, 6m** | **E-6, 1.5m** | **E-6, 3m** | **Fog 4, 2.5m** |
| **2000** | 0.39 ± 0.01 | - | 0.08 ± 0.01 | - | 0.33 ± 0.01 | - | 0.31 ± 0.01 |
| **2001** | 0.12 ± 0.03 | - | 0.25 ± 0.10 | - | 0.38 ± 0.23 | - | 0.05 ± 0.01 |
| **2002** | 0.11 ± 0.08 | 0.31±0.12 | 0.46 ± 0.15 | 0.25±0.01 | 0.14 ± 0.08 | 0.07± 0.05 | 0.09 ± 0.01 |
| **2003** | 0.09 ± 0.02 | 0.06±0.13 | 0.46 ± 0.11 | 0.22±0.03 | 0.07 ± 0.02 | 0.11± 0.02 | 0.38 ± 0.32 |
| |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  | |  | |  | |  | | |  | Benthic Chlorophyll a (mg m-2) | | | | | | | | | |  | **E-5, 3m** | | | **Fog 2, 3m** | | **E-6, 1.5m** | | **Fog 4, 2.5m** | | | **2000** | 132  ± 4 | | | 100 ±3 | | 118 ± 11 | | 303 ± 6 | | | **2001** | 144  ± 39 | | | 438 ± 62 | | 217 ± 37 | | 382 ± 81 | | | **2002** | 142  ± 8 | | | 125 ± 12 | | 303 ± 32 | | 545 ± 28 | | | **2003** | 281 ± 22 | | | 254 ± 49 | | 320 ± 29 | | 694 ± 34 | | |  |  | | |  | |  | |  | | |  | Gross Primary Production (mg C m-2 day-1) | | | | | | | | | |  | **E-5, 3m** | | | **Fog 2, 3m** | | **E-6, 1.5m** | | **Fog 4, 2.5m** | | | **2000** | 60 ± NA | | | 110 ± NA | | 115 ± NA | | 132± NA | | | **2001** | 65 ± 52 | | | NA | | 158 ± 23 | | NA | | | **2002** | 53 ± 15 | | | 149 ± NA | | 104 ± 15 | | 66 ± NA | | | **2003** | 30 ± 7 | | | 92± NA | | 203 ± 34 | | 101± NA | | |  |  | | |  | |  | |  | | |  | Ecosystem Respiration (mg C m-2day-1) | | | | | | | | | |  | **E-5, 3m** | | | **Fog 2, 3m** | | **E-6, 1.5m** | | **Fog 4, 2.5m** | | | **2000** | -106 ± NA | | | -142 ± NA | | -152 ± NA | | -168 ± NA | | | **2001** | -106 ± 59 | | | NA | | -202 ± 14 | | NA | | | **2002** | -80 ± 11 | | | -121± NA | | -110 ± NA | | -201± NA | | | **2003** | -83 ± 8 | | | -133± NA | | -197 ± 26 | | -144± NA | | | | | | | | |

There was no significant difference (ANOVA; p>0.05) among seasonal measurements.

Appendix 2. Summary of Repeated Measures ANOVA Models for Benthic Processes in the Fertilized and Reference Lakes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **Numerator DF** | **Denominator DF** | **F-Value** | **p-value** |
| **N**2 **Fixation (mg N**2 **fixed m-2 day-1)** | |  |  |  |  |
|  | Treatment | 1 | 41 | 3.05 | **0.039** |
|  | Year | 3 | 41 | 16.91 | **0.0002** |
| **Gross Primary Production (mg C m-2 day-1)** | |  |  |  |  |
|  | Lake (Deep vs. Shallow) | 1 | 23 | 39.19 | **<0.0001** |
| **Community Respiration (mg C m-2 day-1)** | |  |  |  |  |
|  | Lake | 1 | 23 | 11.51 | **0.003** |
| **Benthic Chlorophyll *a*/Total Chlorophyll** | |  |  |  |  |
|  | Treatment | 1 | 33 | 42.25 | **<0.0001** |
|  | Year | 3 | 33 | 22.81 | **<0.0001** |
|  | Lake (Deep vs. Shallow) | 1 | 33 | 8.92 | **0.005** |

The most parsimonious model was determined by using the maximum likelihood test and resulted in models that included only significant predictors of the Y variable, which did not include significant interaction terms.

Appendix 3. Magnitude of Significant Effects for Repeated Measures ANOVAs for Benthic Processes in Fertilized and Reference Lakes

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  |  | **Estimate** | **Standard Error** | **DF** | **T-Value** | **p-value** |
| **N**2 **Fixation**  **(mg N**2 **fixed m2 day-1)** | |  |  |  |  |  |
|  | **Treatment** |  |  |  |  |  |
|  | Fertilized | 0.083 | 0.020 | 41 | 4.11 | **.** |
|  | Reference | 0.317 | 0.057 | 41 | 4.11 | **0.0002** |
|  | **Year** |  |  |  |  |  |
|  | 2000 | 0.222 | 0.079 | 41 | 2.81 | **0.008** |
|  | 2001 | 0.048 | 0.036 | 41 | 1.36 | 0.182 |
|  | 2002 | 0.007 | 0.032 | 41 | 0.22 | 0.830 |
|  | 2003 | 0.083 | 0.020 | 41 | 4.11 | **.** |
| **GPP (mg C m-2 day-1)** | |  |  |  |  |  |
|  | **Lake** |  |  |  |  |  |
|  | Deep | 49.040 | 11.190 | 23 | -6.26 | **<0.0001** |
|  | Shallow | 119.090 | 8.330 | 23 | 14.30 | **.** |
| **CR (mg C m-2 day-1)** | |  |  |  |  |  |
|  | **Lake Sampling Depth** |  |  |  |  |  |
|  | Deep | -92.700 | 15.877 | 23 | 3.39 | **0.001** |
|  | Shallow | -146.560 | 9.433 | 23 | 3.39 | **.** |
| **Benthic Chlorophyll *a*/Total Chlorophyll** | |  |  |  |  |  |
|  | **Treatment** |  |  |  |  |  |
|  | Fertilized | 0.683 | 0.026 | 33 | 26.16 | **.** |
|  | Reference | 0.857 | 0.027 | 33 | 6.50 | **<0.0001** |
|  | **Year** |  |  |  |  |  |
|  | 2000 | 0.373 | 0.044 | 33 | -7.02 | **<0.0001** |
|  | 2001 | 0.515 | 0.028 | 33 | -6.01 | **<0.0001** |
|  | 2002 | 0.567 | 0.031 | 33 | -3.72 | **0.0007** |
|  | 2003 | 0.683 | 0.026 | 33 | 26.16 | **.** |
|  | **Lake** |  |  |  |  |  |
|  | Deep | 0.613 | 0.023 | 33 | -2.99 | **0.005** |
|  | Shallow | 0.683 | 0.026 | 33 | 26.16 | **.** |

Dummy variables are denoted by a period and are used to determine which variables are significantly different from one another by the corresponding p-value.

Appendix 4. Results from Randomized Coefficent Analysis Relating N2 Fixation Rates to Ambient Light in the Fertilized and Reference Lakes for All Years

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | **Estimate** | **Standard Error** | **DF** | **T-Value** | **p-value** |
|  | Intercept | -0.073 | 0.07 | 156 | -1.04 | 0.300 |
|  | Log Light (E m-2 sec-1) | 0.057 | 0.021 | 156 | 2.74 | **0.007** |
|  | | Slope | Standard Error | DF | T-Value | p-value |
|  | E5 | 0.0004 | 0.0005 | 156 | 0.81 | 0.420 |
|  | E6 | -0.0003 | 0.0003 | 156 | -0.90 | 0.370 |
|  | Fog 2 | 0.0010 | 0.0004 | 156 | 2.79 | **0.006** |
|  | Fog 4 | 0.0001 | 0.0006 | 156 | 0.16 | 0.870 |

Lake Fog 2 was responsible for the overall light effect.

Appendix 5. ANOVA Statistics for the Nutrient Core Incubation Experiment

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **DF** | **Mean Square Error** | | **F-Value** | | **p-value** | |
| *Benthic N2-fixation* |  |  |  | |  | |
| Treatment | 3 | 0.015 | 4.29 | | **0.04** | |
| Error | 8 | 0.003 |  | |  | |
| Total | 11 |  |  | |  | |
|  |  |  |  | |  | |
| *Chlorophyll a* |  |  |  | |  | |
| Treatment | 3 | 1273 | 0.61 | | 0.62 | |
| Error | 16 | 2079 |  | |  | |
| Total | 19 |  |  | |  | |
|  |  |  |  | |  | |
| *Gross Primary Production* |  |  |  | |  | |
| Treatment | 3 | 7313 | 0.44 | | 0.74 | |
| Error | 4 | 16754 |  | |  | |
| Total | 7 |  |  | |  | |
|  |  |  |  | |  | |
| *Respiration* |  |  |  | |  | |
| Treatment | 3 | 1804 | 1.159 | | 0.43 | |
| Error | 4 | 1556 |  | |  | |
| Total | 7 |  |  | |  | |
|  |  |  |  | |  | |
|  |  |  |  | |  | |

There was a significant treatment effect for benthic N2 fixation and for the ending N:P ratio molar concentrations. Treatment was not significant for chlorophyll a, gross primary production, or respiration.