**Supplemental material**

Response of Lower Sacramento River phytoplankton to high-ammonium wastewater effluent

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**Figure S1.** **PO43– concentrations at t = 0 and t = 48 h for each treatment and light level at the three different sites.** Shown are t = 0 (blue) and final t = 48 h PO43– concentrations for the different treatments (control, C, and additives NO3–, NH4+ and effluent, Eff) in each experiment under high light (HL, upper panels) and low light (LL, lower panels) for sites A, B and C.

Table S1. Mean Chl *a* concentration responses (relative to initial) for each N and light treatmentat Station A (α = 0.05).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Light treatment** | **Control** | **NO3–** | **NH4+** | **Effluent** |
| High light | 1.62 | 6.70 | 11.43 | 6.92 |
| Low light | 4.17 | 6.65 | 4.40 | 1.55 |

Table S2. 2-way ANOVA results comparing response of Chl *a* (relative to initial)at Station A (α = 0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Light | 36.72 | 1 | 36.72 | 18.23 | 0.00 | yes |
| Amendments | 93.43 | 3 | 31.14 | 15.46 | 0.00 | yes |
| Light x Amendments | 90.30 | 3 | 30.10 | 14.94 | 0.00 | yes |
| Within | 32.23 | 16 | 2.01 | - | - | - |
| Total | 252.67 | 23 | 10.99 | - | - | - |

Table S3. Mean Chl *a* concentration responses (relative to initial) for each N and light treatmentat Station B (α=0.05).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Light Treatment** | **Control** | **NO3–** | **NH4+** | **Effluent** |
| HL | 2.79 | 4.25 | 4.53 | 9.48 |
| LL | 1.66 | 2.01 | 2.34 | 4.08 |

Table S4. 2-way ANOVA results comparing response of Chl *a* (relative to initial)at Station B (α = 0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Light | 44.56 | 1 | 44.56 | 53.18 | 0.00 | yes |
| Amendments | 70.49 | 3 | 23.50 | 28.04 | 0.00 | yes |
| Light x Amendments | 13.90 | 3 | 4.63 | 5.53 | 0.01 | yes |
| Within | 12.57 | 15 | 0.84 | - | - | - |
| Total | 141.52 | 22 | 6.43 | - | - | - |

Table S5. Mean Chl *a* concentration responses (relative to initial) for each light treatmentat Station C (α=0.05).

|  |  |
| --- | --- |
| **Light Treatment** | **Chl *a* (Final:Initial)** |
| Hight light | 7.84 |
| Low light | 2.72 |

Table S6. Results of 1-way ANOVA comparing response of Chl *a* (relative to initial)under HL and LL at Station B (α = 0.05).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **F crit** | **RMSSE** | **Omega Sq** |
| Between Groups | 31.44 | 1 | 31.44 | 29.28 | 0.01 | 10.13 | 3.49 | 0.85 |
| Within Groups | 3.22 | 3 | 1.07 | - | - | - | - | - |
| Total | 34.67 | 4 | 8.67 | - | - | - | - | - |

Table S7. Mean POC concentration responses (relative to initial) for each N and light treatmentat Station A (α=0.05).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Light Treatment** | **Control** | **NO3–** | **NH4+** | **Effluent** |
| High light | 1.81 | 2.23 | 3.02 | 3.02 |
| Low light | 1.17 | 1.10 | 1.16 | 1.13 |

Table S8. Results of 2-Way ANOVA results comparing POC response (relative to initial)at Station A (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Light | 11.43 | 1 | 11.43 | 299.00 | 0.00 | yes |
| Amendment | 1.62 | 3 | 0.54 | 14.11 | 0.00 | yes |
| Light x Amendment | 1.65 | 3 | 0.55 | 14.40 | 0.00 | yes |
| Within | 0.61 | 16 | 0.04 | - | - | - |
| Total | 15.32 | 23 | 0.67 | - | - | - |

Table S9. Mean POC concentration responses (relative to initial) for each N and light treatmentat Station B (α=0.05).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Light Treatment** | **Control** | **NO3–** | **NH4+** | **Effluent** |
| High light | 2.82 | 2.73 | 2.73 | 3.02 |
| Low light | 1.12 | 1.08 | 1.34 | 1.24 |

Table S10. Results of 2-Way ANOVA results comparing POC response (relative to initial)at Station B (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Light | 15.95 | 1 | 15.95 | 132.75 | 0.00 | yes |
| Amendment | 0.18 | 3 | 0.06 | 0.49 | 0.69 | no |
| Light x Amendment | 0.12 | 3 | 0.04 | 0.34 | 0.80 | no |
| Within | 1.92 | 16 | 0.12 | - | - | - |
| Total | 18.17 | 23 | 0.79 | - | - | - |

Table S11. Mean POCconcentration responses (relative to initial) for each light treatmentat Station C (α=0.05).

|  |  |
| --- | --- |
| **Light Treatment** | **Chl *a* (Final:Initial)** |
| Hight light | 3.12 |
| Low light | 1.07 |

Table S12. Results of 1-way ANOVA comparing response of POC(relative to initial)under HL and LL at Station C (α = 0.05).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **F crit** | **RMSSE** | **Omega Sq** |
| Between Groups | 6.32 | 1 | 6.32 | 5.46 | 0.08 | 7.71 | 1.35 | 0.43 |
| Within Groups | 4.63 | 4 | 1.16 | - | - | - | - | - |
| Total | 10.95 | 5 | 2.19 | - | - | - | - | - |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Station | Start of experiment | | | | End of experiment (t = 48 h) | | | | | | | | | | | | | |
| **Taxon** | **Initial** | | | **Unamended** | | **NH4+** | | | **NO3–** | | | | **Effluent** | | | |
| High light | | | | | | | | | | | | | | | | |
| A | Diatoms | 88.8±5.5% | | 61.9±3.4% | | 80.7±1.7% | | | 91.3±2.0% | | | 87.4±4.9% | | | |
| Chlorophytes | 7.4±5.3% | | 32.9±1.7% | | 11.6±5.1% | | | 4.2±1.6% | | | 7.5±1.5% | | | |
| Cryptophytes | 1.8±0.7% | | 2.4±0.1% | | 3.8±3.2% | | | 1.4±1.4% | | | 1.3±0.3% | | | |
| Cyanobacteria | 1.9±0.4% | | 0.2±1.0% | | 0.4±0.2% | | | 3.0±4.3% | | | 2.0±2.7% | | | |
| B | Diatoms | 95.0±1.9% | | 81.2±17.2% | | 85.4±8.6% | | | 87.8±1.1% | | | 87.4±10.6% | | | |
| Chlorophytes | 2.1±5.3% | | 17.5±17.0% | | 11.7±9.8% | | | 9.0±4.2% | | | 5.4±3.3% | | | |
| Cryptophytes | 1.2±0.7% | | 0.5±0.6% | | 2.3±3.2% | | | 1.8±1.6% | | | 5.7±6.7% | | | |
| Cyanobacteria | 1.7±1.5% | | 0.4±0.7% | | 0.2±0.3% | | | 0.4±0.7% | | | 0.2±0.2% | | | |
| C | Diatoms | 88.5±5.0% | | 75.3±16.8% | | –a | | – a | | | – a | | | |
| Chlorophytes | 4.1±2.7% | | 20.8±18.9% | | – a | | – a | | | – a | | | |
| Cryptophytes | 6.9±2.5% | | 2.0±0.9% | | – a | | – a | | | – a | | | |
| Cyanobacteria | 0.4±0.0% | | 0.1±0.1% | | – a | | – a | | | – a | | | |
| Low light | | | | | | | | | | | | | | | | |
| A | Diatoms | 88.8±5.5% | 90.7±6.6% | | | | 85.7±8.3% | | | 94.9±4.2% | | | 92.2±2.2% | | | | | | |
| Chlorophytes | 7.4±5.3% | 3.2±0.5% | | | | 7.0±7.0% | | | 2.7±1.7% | | | 3.3±0.8% | | | | | | |
| Cryptophytes | 1.8±0.7% | 2.8±2.8% | | | | 1.7±1.3% | | | 0.3±0.2% | | | 2.2±1.7% | | | | | | |
| Cyanobacteria | 1.9±0.4% | 3.2±3.6% | | | | 5.4±6.1% | | | 2.1±2.6% | | | 2.3±1.4% | | | | | | |
| B | Diatoms | 95.0±1.9% | 84.7±13.0% | | | | 67.8±48.0% | | | 95.3±3.1% | | | 94.6±2.8% | | | | | | |
| Chlorophytes | 2.1±5.3% | 5.1±1.8% | | | | 29.7±49.8% | | | 3.4±3.2% | | | 3.1±1.9% | | | | | | |
| Cryptophytes | 1.2±0.7% | 1.1±0.9% | | | | 0.5±0.4% | | | 0.7±0.6% | | | 1.3±0.9% | | | | | | |
| Cyanobacteria | 1.7±1.5% | 7.9±12.9% | | | | 0.0% | | | 0.0% | | | 0.7±1.1% | | | | | | |
| C | Diatoms | 88.5±5.0% | 93.9±1.6% | | | | –a | | | – a | | | – a | | | | | | |
| Chlorophytes | 4.1±2.7% | 2.2±1.0% | | | | – a | | | – a | | | – a | | | | | | |
| Cryptophytes | 6.9±2.5% | 3.2±1.8% | | | | – a | | | – a | | | – a | | | | | | |
| Cyanobacteria | 0.4±0.0% | 0.0% | | | | – a | | | – a | | | – a | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| a Dash indicates no amendment made. | | | | | | | | | | | | | | | | | | |

Table S13. Percentages of total biovolume represented by each phytoplankton taxa at the start of the experiment and after 48 hours of light and nutrient treatment. Diatoms remained the dominant taxon in terms of biovolume across all treatments.

Table S14. Relationship between abundance and biovolume for each phytoplankton taxa across experiments

|  |  |  |  |
| --- | --- | --- | --- |
| **Taxa** | **n** | **r2** | **p (= 0.05)** |
| Diatoms | 18 | 0.3 | 0.02 | |
| Chlorophyta | 17 | 0.6 | < 0.001 | |
| Cryptophyta | 18 | 0.8 | < 0.001 | |
| Cyanobacteria | 17 | 0.5 | 0.002 | |
| other | 18 | 0.4 | 0.003 | |

Table S15. Mean biovolumes (µm3 L-1) of different taxa in the different amendments in the HL treatmentat Station A (α=0.05).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bacillariophyta | Chlorophyta | Chrysophyta | Cryptophyta | Cyanobacteria | Euglenophyta | Pyrrophyta |
| Initial | 8.72x108 | 6.02x107 | 5.76x105 | 1.88x107 | 1.64x107 | 0..00 | 0..00 |
| Control | 1.61x109 | 5.85x107 | 2.82x107 | 1.41x106 | 1.38x107 | 0..00 | 0..00 |
| +NO3 | 1.32x109 | 6.59x107 | 3.59x105 | 2.35x107 | 2.81x107 | 0..00 | 0..00 |
| +NH4 | 2.64 x109 | 3.75x108 | 7.97x106 | 1.63x108 | 1.08x107 | 0..00 | 5.24x107 |
| +Effluent | 3.21x109 | 2.95x108 | 5.26x107 | 4.51x107 | 5.99x107 | 0..00 | 0..00 |

Table S16. 2-Way ANOVA results comparing biovolumes (µm3 L-1) of different taxa in response to amendments in the HL treatmentat Station A (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Amendments | 2.4x1018 | 4 | 6.0x1017 | 2.7 | 0.037 | yes |
| Taxa | 4.6x1019 | 6 | 7.6x1018 | 35 | 4.3x10-19 | yes |
| Amendments x Taxa | 9.2x1018 | 24 | 3.8x1017 | 1.7 | 0.04 | yes |
| Within | 1.5x1019 | 70 | 2.2x1017 | - | - | - |
| Total | 7.3x1019 | 104 | 7.0x1017 | - | - | - |

Table S17. Mean biovolumes (µm3 L-1) of different taxa in the different amendments in the LL treatmentat Station A (α=0.05).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bacillariophyta | Chlorophyta | Chrysophyta | Cryptophyta | Cyanobacteria | Euglenophyta | Pyrrophyta |
| Initial | 8.72x108 | 6.02x107 | 5.76x105 | 1.88x107 | 1.64x107 | 0.00 | 0.00 |
| Control | 1.18x109 | 4.47x107 | 1.71x106 | 5.55x107 | 6.45x107 | 0.00 | 0.00 |
| +NO3 | 1.30x109 | 3.05x107 | 4.58x106 | 1.75x107 | 0.00 | 0.00 | 0.00 |
| +NH4 | 1.31x109 | 7.76x107 | 9.57x105 | 2.42x107 | 5.73x107 | 0.00 | 0.00 |
| +Effluent | 9.60x108 | 3.35x107 | 1.06x106 | 2.5x107 | 2.08x107 | 0.00 | 0.00 |

Table S18. 2-Way ANOVA results comparing biovolumes (µm3 L-1) of different taxa in response to amendments in the LL treatmentat Station A (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Amendments | 8.18x1016 | 4 | 2.04x1016 | 0.034 | 0.85 | no |
| Taxa | 1.58x1019 | 6 | 2.63x1018 | 0.44 | <0.001 | yes |
| Amendments x Taxa | 4.14x1017 | 24 | 1.73x1016 | 0.29 | 0.10 | no |
| Within | 4.20x1018 | 70 | 6.00x1016 | - | - | - |
| Total | 2.05x1019 | 104 | 1.97x1017 | - | - | - |

Table S19. Mean biovolumes (µm3 L-1) of different taxa in the different amendments in the HL treatmentat Station B (α=0.05).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bacillariophyta | Chlorophyta | Chrysophyta | Cryptophyta | Cyanobacteria | Euglenophyta | Pyrrophyta |
| Initial | 7.18x108 | 1.44x107 | 1.53x105 | 9.82x106 | 8.38x106 | 0.00 | 0.00 |
| Control | 2.50x109 | 4.92x108 | 9.86x105 | 2.62x107 | 1.05x107 | 0.00 | 0.00 |
| +NO3 | 1.47x109 | 1.23x108 | 8.40x106 | 4.05x107 | 1.02x107 | 1.72x107 | 0.00 |
| +NH4 | 1.26x109 | 1.96x108 | 4.67x106 | 3.48x107 | 2.22x107 | 0.00 | 0.00 |
| +Effluent | 2.35x109 | 1.66x108 | 2.09x107 | 1.96x108 | 7.04 x106 | 0.00 | 1.12x107 |

Table S20. 2-Way ANOVA results comparing biovolumes (µm3 L-1) of different taxa in response to amendments in the HL treatmentat Station B (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **P** | **sig** |
| Amendments | 1.52x1018 | 4 | 3.79x1017 | 5.44 | <0.001 | yes |
| Taxa | 3.39x1019 | 6 | 5.65x1018 | 81.1 | <0.001 | yes |
| Amendments x Taxa | 5.75x1018 | 24 | 2.40x1017 | 3.44 | <0.001 | yes |
| Within | 4.88x1018 | 70 | 6.97x1016 | - | - | - |
| Total | 4.61x1019 | 104 | 4.43x1017 | - | - | - |

Table S21. Mean biovolumes (µm3 L-1) of different taxa in the different amendments in the LL treatmentat Station B (α=0.05).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bacillariophyta | Chlorophyta | Chrysophyta | Cryptophyta | Cyanobacteria | Euglenophyta | Pyrrophyta |
| Initial | 7.18E+08 | 1.44E+07 | 1.53x105 | 9.82x106 | 8.38x106 | 0.00 | 0.00 |
| Control | 6.88E+08 | 4.20E+07 | 8.05x106 | 7.99x106 | 3.51x107 | 0.00 | 0.00 |
| +NO3 | 1.30E+09 | 3.05E+07 | 0.00 | 4.58x106 | 1.75x107 | 0.00 | 0.00 |
| +NH4 | 1.47E+09 | 9.64E+08 | 4.37x107 | 1.17x107 | 0.00 | 0.00 | 0.00 |
| +Effluent | 1.37E+09 | 3.51E+07 | 6.2x106 | 1.96x107 | 8.90x106 | 0.00 | 0.00 |

Table S22. 2-Way ANOVA results comparing biovolumes (µm3 L-1) of different taxa in response to amendments in the LL treatmentat Station B (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Amendments | 8.51x1017 | 4 | 2.13x1017 | 1.53 | 0.203 | no |
| Taxa | 1.52x1019 | 6 | 2.53x1018 | 1.82 | <0.001 | yes |
| Amendments x Taxa | 2.94x1018 | 24 | 1.22x1017 | 0.88-1 | 0.625 | no |
| Within | 9.73x1018 | 70 | 1.39x1017 | - | - | - |
| Total | 2.87x1019 | 104 | 2.76x1017 | - | - | - |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |

Table S23. Mean biovolumes (µm3 L-1) of different taxa in the HL treatmentat Station C (α=0.05).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bacillariophyta | Chlorophyta | Chrysophyta | Cryptophyta | Cyanobacteria | Euglenophyta | Pyrrophyta |
| Initial | 3.42x108 | 1.15x107 | 3.69x105 | 2.27x107 | 1.73x106 | 0.00 | 0.00 |
| control | 2.05x109 | 2.92x108 | 5.81x107 | 4.79x107 | 1.17x106 | 0.00 | 0.00 |

Table S24. 2-Way ANOVA results comparing biovolumes (µm3 L-1) of different taxa in response to amendments in the HL treatmentat Station C (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Amendments | 9.19x1017 | 1 | 9.19x1017 | 2.77 | 0.11 | no |
| Taxa | 7.01x1018 | 6 | 1.17x1018 | 3.52 | 0.01 | yes |
| Amendments x Taxa | 3.58x1018 | 6 | 5.97x1017 | 1.80 | 0.14 | no |
| Within | 9.29x1018 | 28 | 3.32x1017 | - | - | - |
| Total | 2.08x1019 | 41 | 5.08x1017 | - | - | - |

Table S25. Mean biovolumes (µm3 L-1) of different taxa in the LL treatmentat Station C (α=0.05).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bacillariophyta | Chlorophyta | Chrysophyta | Cryptophyta | Cyanobacteria | Euglenophyta | Pyrrophyta |
| Initial | 3.42x108 | 1.15x107 | 3.69x105 | 2.27x107 | 1.73x106 | 0.00 | 0.00 |
| control | 1.30x109 | 3.26x107 | 6.39x106 | 5.38x107 | 0.00 | 0.00 | 0.00 |

Table S26. 2-Way ANOVA results comparing biovolumes (µm3 L-1) of different taxa in response to amendments in the LL treatmentat Station C (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Amendments | 2.21x1017 | 1 | 2.21x1017 | 5.21 | 0.03 | yes |
| Taxa | 3.39x1018 | 6 | 5.65x1017 | 13.3 | <0.001 | yes |
| Amendments x Taxa | 1.16x1018 | 6 | 1.94x1017 | 4.56 | 0.002 | yes |
| Within | 1.19x1018 | 28 | 4.25x1016 | - | - | - |
| Total | 5.96x1018 | 41 | 1.45x1017 | - | - | - |

Table S27. Mean Fv:Fm for each N and light treatmentat Station A (α=0.05).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Station A means** | **Initial** | **Control** | **NO3–** | **NH4+** | **Effluent** |
| LL | 0.54 | 0.53 | 0.48 | 0.50 | 0.49 |
| HL | 0.51 | 0.51 | 0.53 | 0.53 | 0.52 |

Table S28. Results of 2-Way ANOVA comparing Fv:Fm responses at Station A (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Light | 6.6x10-4 | 1 | 6.57x10-4 | 1.20 | 0.29 | no |
| Amendment | 1.5x10-3 | 4 | 3.77x10-4 | 0.69 | 0.61 | no |
| Light x Amendment | 7.4x10-3 | 4 | 1.84x10-3 | 3.35 | 0.03 | yes |
| Within | 1.1x10-2 | 20 | 5.49x10-4 | - | - | - |
| Total | 2.1x10-2 | 29 | 7.07x10-4 | - | - | - |

Table S29. Mean NH4+ specific uptake rate (V)for each N and light treatmentat Station A (α=0.05).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Light Treatment** | **Initial** | **Control** | **NO3–** | **NH4+** | **Effluent** |
| High light | 0.041 | 0.055 | 0.041 | 0.048 | 0.092 |
| Low light | 0.035 | 0.044 | 0.027 | 0.030 | 0.035 |

Table S30. Results of 2-Way ANOVA comparing NH4+ specific uptake rates (V)at Station A (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Light | 0.003 | 1 | 0.003 | 22.51 | 0.00 | yes |
| Amendment | 0.003 | 4 | 0.001 | 6.02 | 0.00 | yes |
| Light x Amendment | 0.002 | 4 | 0.001 | 4.30 | 0.01 | yes |
| Within | 0.003 | 20 | 0.000 | - | - | - |
| Total | 0.012 | 29 | 0.000 | - | - | - |

Table S31. Mean NH4+ specific uptake rate (V)for each N and light treatmentat Station B (α=0.05).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Light Treatment** | **Initial** | **Control** | **NO3–** | **NH4+** | **Effluent** |
| High light | 0.018 | 0.043 | 0.032 | 0.056 | 0.081 |
| Low light | 0.014 | 0.031 | 0.031 | 0.034 | 0.037 |

Table S32. Results of 2-Way ANOVA comparing NH4+ specific uptake rates (V)at Station B (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Light | 0.002 | 1 | 0.002 | 60.30 | 0.00 | yes |
| Amendment | 0.006 | 4 | 0.002 | 42.86 | 0.00 | yes |
| Light x Amendment | 0.002 | 4 | 0.000 | 12.67 | 0.00 | yes |
| Within | 0.001 | 20 | 0.000 | - | - | - |
| Total | 0.011 | 29 | 0.000 | - | - | - |

Table S33. Mean NH4+ specific uptake rate (V) in the HL treatmentat Station C (α=0.05).

|  |  |
| --- | --- |
| **Light Treatment** | **VNH4+ (h-1)** |
| Initial | 0.0101 |
| Control | 0.0642 |

Table S34. Results of 1-way ANOVA comparing initial and control NH4+ specific uptake rate (V) in the HL treatment at Station C (α = 0.05).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **F crit** | **RMSSE** | **Omega Sq** |
| Between Groups | 0.004 | 1 | 0.004 | 117.93 | 0.00 | 7.71 | 6.27 | 0.95 |
| Within Groups | 0.000 | 4 | 0.000 | - | - | - | - | - |
| Total | 0.005 | 5 | 0.001 | - | - | - | - | - |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |

Table S35. Mean NH4+ specific uptake rate (V) in the LL treatmentat Station C (α=0.05).

|  |  |
| --- | --- |
| **Light Treatment** | **VNH4+ (h-1)** |
| Initial | 0.0085 |
| Control | 0.0272 |

Table S36. Results of 1-way ANOVA comparing initial and control NH4+ specific uptake rate (V) under LL at Station C (α = 0.05).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **F crit** | **RMSSE** | **Omega Sq** |
| Between Groups | 0.0005 | 1 | 0.0005 | 15.34 | 0.02 | 7.71 | 2.26 | 0.71 |
| Within Groups | 0.0001 | 4 | 0.0000 | - | - | - | - | - |
| Total | 0.0007 | 5 | 0.0001 | - | - | - | - | - |

Table S37. Mean NO3- specific uptake rate (V)for each N and light treatmentat Station A (α=0.05).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Light Treatment** | **Initial** | **Control** | **NO3–** | **NH4+** | **Effluent** |
| High light | 0.004 | 0.050 | 0.134 | 0.001 | 0.001 |
| Low light | 0.002 | 0.024 | 0.022 | 0.000 | 0.001 |

Table S38. Results of 2-Way ANOVA comparing NO3- specific uptake rates (V)at Station A (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Light | 0.01 | 1 | 0.006 | 83.35 | 0.00 | yes |
| Amendment | 0.04 | 4 | 0.009 | 121.88 | 0.00 | yes |
| Light x Amendment | 0.00 | 4 | 0.001 | 16.16 | 0.00 | yes |
| Within | 0.00 | 17 | 0.000 | - | - | - |
| Total | 0.05 | 26 | 0.002 | - | - | - |

Table S39. Mean NO3- specific uptake rate (V)for each N and light treatmentat Station B (α=0.05).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Light Treatment** | **Initial** | **Control** | **NO3–** | **NH4+** | **Effluent** |
| High light | 0.0005 | 0.0387 | 0.1031 | 0.0006 | 0.0013 |
| Low light | 0.0004 | 0.0023 | 0.0098 | 0.0019 | 0.0005 |

Table S40. Results of 2-Way ANOVA comparing NO3- specific uptake rates (V)at Station B (α=0.05).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **sig** |
| Rows | 0.005 | 1 | 0.005 | 697.33 | 0.00 | yes |
| Columns | 0.019 | 4 | 0.005 | 718.71 | 0.00 | yes |
| Inter | 0.005 | 4 | 0.001 | 186.78 | 0.00 | yes |
| Within | 0.000 | 18 | 0.000 | - | - | - |
| Total | 0.029 | 27 | 0.001 | - | - | - |

Table S41. Mean NO3- specific uptake rate (V) in the HL treatmentat Station C (α=0.05).

|  |  |
| --- | --- |
| **Light Treatment** | **VNH4+ (h-1)** |
| Initial | 0.0137 |
| Control | 0.0013 |

Table S42. Results of 1-way ANOVA comparing initial and control NO3- specific uptake rate (V) in the HL treatment at Station C (α = 0.05).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **F crit** | **RMSSE** | **Omega Sq** |
| Between Groups | 2.53x10-5 | 1 | 2.53x10-5 | 0.91 | 3.93 | 7.71 | 0.55 | -0.015 |
| Within Groups | 0.0001 | 4 | 2.77x10-5 | - | - | - | - | - |
| Total | 0.0001 | 5 | 2.72x10-5 | - | - | - | - | - |

Table S43. Mean NO3- specific uptake rate (V) in the LL treatmentat Station C (α=0.05).

|  |  |
| --- | --- |
| **Light Treatment** | **VNH4+ (h-1)** |
| Initial | 0.0064 |
| Control | 0.0018 |

Table S44. Results of 1-way ANOVA comparing initial and control NO3- specific uptake rate (V) in the LL treatment at Station C (α = 0.05).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sources** | **SS** | **df** | **MS** | **F** | **p** | **F crit** | **RMSSE** | **Omega Sq** |
| Between Groups | 3.14x10-5 | 1 | 3.14x10-5 | 0.57 | 0.49 | 7.71 | 0.44 | -0.077 |
| Within Groups | 0.0002 | 4 | 5.49x10-5 | - | - | - | - | - |
| Total | 0.0003 | 5 | 5.02x10-5 | - | - | - | - | - |