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Tables

Table 1: Surface and bottom water sonde data from each sampling date and site. Temperature is in degrees Celsius, dissolved oxygen is in mg/L, and chl-*a* fluorescence is reported as $\mu\text{g/L}$.

Site	Date	Surface Water			Bottom Water		
		Temperature	DO	Chl-a	Temperature	DO	Chl-a
MB18	7/13/2016	25.1	8.65	13.4	25.1	8.65	13.4
	8/3/2016	27.2	10.7	2.91	26.8	9.27	3.52
	9/19/2016	21.8	8.33	8.84	21.7	8.23	8.84
	10/17/2016	16.5	9.12	ND	16.5	9.09	0.43
	4/25/2017	14.0	10.5	6.68	14.0	10.0	7.52
	7/11/2017	26.3	8.65	12.6	23.6	7.04	3.40
	8/9/2017	24.0	9.18	4.19	23.0	8.55	3.59
	10/3/2017	18.5	9.58	7.36	18.5	9.51	9.43
WE2	7/13/2016	25.1	8.32	3.58	24.9	8.21	1.86
	8/3/2016	26.6	9.68	3.34	25.7	6.32	1.23
	9/19/2016	22.1	7.88	1.92	21.9	7.35	0.53
	10/17/2016	16.9	9.24	0.55	16.9	9.23	0.56
	4/25/2017	11.8	11.3	13.6	11.8	11.4	10.1
	7/11/2017	26.1	8.29	1.05	22.8	7.81	1.18
	8/9/2017	23.9	5.74	0.16	23.0	8.23	0.22
	10/3/2017	19.7	9.62	3.27	19.8	8.81	3.52
WE4	5/18/2016	12.1	10.9	0.85	12.1	10.8	2.62
	6/28/2016	24.2	8.83	1.25	23.3	9.33	0.35
	8/10/2016	26.6	8.02	3.01	25.7	8.53	2.92
	10/3/2016	18.2	8.94	1.58	18.1	8.78	0.16
	6/9/2017	17.9	9.71	0.84	17.6	9.94	1.15
	7/14/2017	23.7	8.57	2.43	23.6	8.28	1.85
	8/2/2017	24.0	9.18	4.19	24.2	5.89	0.20
	10/20/2017	16.1	10.1	0.88	16.1	9.91	1.44
WE13	5/18/2016	12.0	11.1	1.65	11.9	11.1	4.78
	6/28/2016	23.8	6.67	0.77	22.8	6.77	3.61
	8/10/2016	26.2	8.13	8.44	25.9	8.36	7.19
	10/3/2016	18.8	8.72	1.83	18.8	8.72	0.28
	6/9/2017	18.9	9.64	1.03	18.2	9.53	1.70
	7/14/2017	23.2	8.64	2.03	23.2	8.40	2.14
	8/2/2017	25.4	8.90	0.82	23.8	6.01	0.12
	10/20/2017	16.7	9.97	2.88	16.7	9.60	5.41

Table 2: Dissolved water column nutrient concentrations at each sampling site and time. Units are in μM N or P. Measurements below the detection limit are reported as BDL.

Site	Date	Surface Water					Bottom Water				
		NH_4^+	NO_2^-	NO_3^-	Urea	Ortho-P	NH_4^+	NO_2^-	NO_3^-	Urea	Ortho-P
MB18	7/13/2016	0.20	1.38	53.4	6.20	0.20	2.53	1.42	58.0	1.43	0.14
	8/3/2016	5.95	2.92	50.3	0.28	0.05	2.92	1.52	66.1	1.24	0.07
	9/19/2016	0.49	0.780	9.84	1.30	0.63	0.80	0.57	9.99	2.15	0.79
	10/17/2016	2.06	0.65	27.4	1.05	0.74	1.87	0.74	30.0	1.21	0.80
	4/25/2017	4.60	3.08	228	3.51	1.35	4.60	3.22	241	4.28	1.17
	7/11/2017	7.24	11.2	487	4.95	1.76	7.27	10.8	481	3.71	1.94
	8/9/2017	1.12	1.35	98.7	1.39	0.22	1.41	1.26	97.0	6.18	0.20
	10/3/2017	BDL	0.08	0.01	0.67	0.09	BDL	0.03	0.08	0.53	0.18
WE2	7/13/2016	0.09	1.44	17.7	4.03	0.09	1.84	0.80	38.4	1.71	0.09
	8/3/2016	0.28	1.61	4.01	1.47	0.05	1.61	0.49	12.2	1.37	0.05
	9/19/2016	2.41	7.87	5.78	1.57	0.89	7.87	0.75	5.68	1.13	0.94
	10/17/2016	0.43	0.74	20.0	0.73	0.38	0.23	0.75	20.4	0.45	0.38
	4/25/2017	3.81	0.75	60.0	2.07	0.10	3.59	0.67	58.5	1.53	0.05
	7/11/2017	1.17	0.68	51.9	1.93	0.10	2.80	0.75	46.5	1.78	0.16
	8/9/2017	1.03	0.74	34.8	3.58	0.04	1.11	0.71	34.6	2.00	0.06
	10/3/2017	0.83	0.65	14.5	0.95	0.13	0.69	0.61	14.6	0.86	0.12
WE4	5/18/2016	0.83	7.29	6.75	0.44	0.06	1.72	7.29	9.46	0.59	0.05
	6/28/2016	1.58	1.02	23.3	2.42	0.03	1.02	0.64	23.1	0.61	0.03
	8/10/2016	3.20	1.94	8.85	1.15	0.05	1.94	0.79	10.2	2.13	0.08
	10/3/2016	1.86	0.43	18.9	0.94	0.57	1.90	0.43	18.8	0.78	0.56
	6/9/2017	0.30	0.31	31.0	0.70	0.01	0.84	0.29	31.3	1.04	0.03
	7/14/2017	1.21	1.19	37.9	1.17	0.03	1.40	0.82	37.5	0.93	0.03
	8/2/2017	0.99	2.25	93.8	0.93	0.03	0.26	2.37	90.2	1.33	0.04
	10/20/2017	0.41	0.17	14.8	0.33	0.09	0.32	0.17	14.8	0.29	0.09
WE13	5/18/2016	0.29	7.29	19.7	0.28	0.05	6.04	7.28	15.5	0.41	0.06
	6/28/2016	0.28	0.42	21.9	1.01	0.03	0.42	1.22	27.1	1.27	0.03
	8/10/2016	0.20	0.84	1.62	3.23	0.07	0.84	0.23	2.75	1.27	0.07
	10/3/2016	0.95	2.56	7.83	1.12	1.13	0.91	2.53	7.81	1.21	1.13
	6/9/2017	1.91	0.45	33.1	0.88	0.01	2.88	0.45	33.3	4.40	0.06
	7/14/2017	1.19	0.98	34.7	0.53	0.05	0.56	0.36	34.8	0.71	0.03
	8/2/2017	BDL	0.61	41.0	0.30	0.04	0.28	0.53	35.3	0.71	0.04
	10/20/2017	0.53	0.34	14.6	0.43	0.36	0.47	0.34	14.2	0.42	0.37

Table 3: Dissolved water column N and ortho-P fluxes from duplicate unamended cores. A

positive value indicates an efflux from the sediment, and a negative value shows influx into the sediment. SE indicates standard error. Units are in $\mu\text{mol N (or P)}/\text{m}^2/\text{hr}$.

Site	Date	NH ₄ ⁺	SE	NO ₂ ⁻	SE	NO ₃ ⁻	SE	Urea	SE	Ortho-P	SE
MB18	7/13/16	55.9	20.1	-7.52	3.90	-114	42.4	2.37	2.37	4.37	0.44
	8/3/16	58.6	11.1	-1.71	1.74	-205	69.7	5.73	3.15	1.28	0.48
	9/19/16	154	22.1	0.42	1.09	5.70	10.3	2.77	4.61	5.85	0.78
	10/17/16	119	22.0	8.12	2.96	-53.0	23.8	15.4	2.11	6.17	1.22
	4/25/17	66.1	17.1	-11.7	5.85	-46.7	75.6	9.47	3.78	9.36	1.89
	7/11/17	79.4	33.2	-31.5	11.5	-222	117	26.5	7.13	13.0	2.06
	8/9/17	34.6	3.88	-1.80	2.05	-143	49.9	4.34	2.01	2.93	0.22
	10/3/17	4.82	2.67	3.04	1.35	22.4	7.42	2.50	1.22	1.80	0.49
WE2	7/13/16	-6.99	12.8	-1.58	0.75	9.53	18.4	-4.44	5.36	2.47	0.62
	8/3/16	32.5	9.29	-0.30	0.21	-26.8	6.36	10.7	5.79	1.20	0.27
	9/19/16	52.7	20.4	-2.57	0.90	-17.8	7.28	12.9	3.70	2.31	0.95
	10/17/16	-13.1	2.43	0.69	1.56	14.6	15.2	-2.64	2.43	2.13	0.51
	4/25/17	-10.6	3.91	-1.67	0.27	12.4	17.7	4.83	5.69	0.56	0.32
	7/11/17	16.2	7.67	3.74	1.69	-49.1	23.2	18.8	3.27	0.31	0.07
	8/9/17	-5.25	1.24	4.17	1.17	-22.2	5.42	1.62	1.93	0.53	0.06
	10/3/17	5.37	2.70	-3.39	1.11	-4.11	2.05	-0.10	0.83	0.47	0.08
WE4	5/18/16	6.99	2.50	-0.07	0.32	-21.6	3.84	-0.42	0.64	0.71	0.11
	6/28/16	34.0	14.4	-2.26	1.88	-18.0	35.5	-0.22	2.65	3.00	0.94
	8/10/16	42.4	7.68	-2.37	0.39	21.1	1.40	2.58	2.06	1.56	0.34
	10/3/16	117	23.4	2.59	2.76	-79.4	67.8	8.88	1.63	4.47	1.24
	6/9/17	2.95	1.92	0.25	0.11	-5.77	13.4	-3.09	2.37	0.19	0.11
	7/14/17	5.95	3.63	-5.81	1.25	-19.8	4.05	7.90	2.44	0.06	0.10
	8/2/17	-12.9	6.90	0.28	2.71	-115	34.9	6.43	3.89	0.61	0.07
	10/20/17	34.8	10.6	4.91	1.14	8.31	10.9	9.12	1.58	2.37	0.63
WE13	5/18/16	52.9	24.3	3.10	2.06	-22.7	2.36	1.96	0.25	0.68	0.18
	6/28/16	11.0	2.93	0.11	0.24	-15.7	13.3	5.49	3.48	-0.27	0.49
	8/10/16	7.35	2.31	-0.40	0.19	12.6	10.9	2.54	2.51	0.48	0.13
	10/3/16	5.98	2.08	-10.8	1.46	-0.89	12.8	-0.33	4.22	-1.01	0.92
	6/9/17	-11.9	1.55	0.03	0.20	5.38	19.0	-2.36	0.92	0.68	0.35
	7/14/17	-7.15	2.28	3.19	1.06	12.6	7.96	8.50	4.85	0.14	0.16
	8/2/17	-2.14	1.36	-0.97	2.68	-25.8	28.3	4.07	1.43	0.24	0.12
	10/20/17	11.7	3.67	-1.60	0.86	-9.63	5.65	-3.61	0.94	1.51	0.22

Table 4: Preliminary N budget for the western basin of Lake Erie. Units are in 10^6 kg N/yr.

Estimated surface areas for extrapolations: MB18 = 78 km²; WE2 = 300 km²; WE4 and WE13 = 1301 km². DNF = denitrification, DIN = dissolved inorganic N ($\text{NH}_4^+ + \text{NO}_2^- + \text{NO}_3^-$), TN = total N, and WB = western basin. Positive rates indicate a net efflux from the sediment, and negative rates show a net influx into the sediment. These values were scaled to include the entire surface area of the western basin.

	Yearly Average		Average by Site			
	2016	2017	MB18	WE2	WE4	WE13
In Situ DNF	-58.3	-22.3	-0.850	-2.06	-25.4	-21.9
DIN Flux	16.3	3.96	0.633	0.322	4.55	1.20
Urea Flux	1.45	2.17	0.083	0.119	0.622	0.324
Total	-40.5	-16.2	-0.134	-1.62	-20.2	-20.4
TN Load to WB	167	178	3.66	14.1	61.0	61.0
N surplus	126	162	3.53	12.5	40.8	40.6

Figure Captions

Figure 1: Map showing sampling locations in the western basin of Lake Erie. Thin lines in the lake are international and state boundaries.

Figure 2: N transformations across the sediment-water interface at each site in the western basin of Lake Erie. A positive bar indicates efflux, and a negative bar shows influx. Error bars indicate one standard error.

Figure 3: Sediment oxygen demand (SOD) in the western basin. Error bars indicate one standard error.

Figure 4: N₂ transformations across the sediment-water interface in the western basin of Lake Erie: (A) in-situ N₂ flux (²⁸N₂ fluxes + any N fixation), (B) potential denitrification (²⁸N₂ + ²⁹N₂ + ³⁰N₂ + any N fixation), and (C) calculated N fixation. Isotope additions were not performed at WE4 on October 20, 2017.

Figure 5: Western basin gene abundance measured in gene copies per gram of wet sediment. *nirS* (A) codes for the nitrite reductase gene in denitrification, and *nifH* (B) codes for the nitrogenase gene in N fixation.

Figure 6: Linear correlations between (A) NH₄⁺ fluxes and SOD, (B) ortho-P fluxes and SOD, and (C) ortho-P fluxes and NH₄⁺ fluxes.

Figure 7: Conceptual model showing N and ortho-P cycling rates in 2016 and 2017. Rates are reported in $\mu\text{mol N, P, or O}_2/\text{m}^2/\text{hr}$. DNRA was estimated using NIAF as a proxy, as explained in methods, and SOD was used as a proxy for organic matter remineralization.

Figure 1:

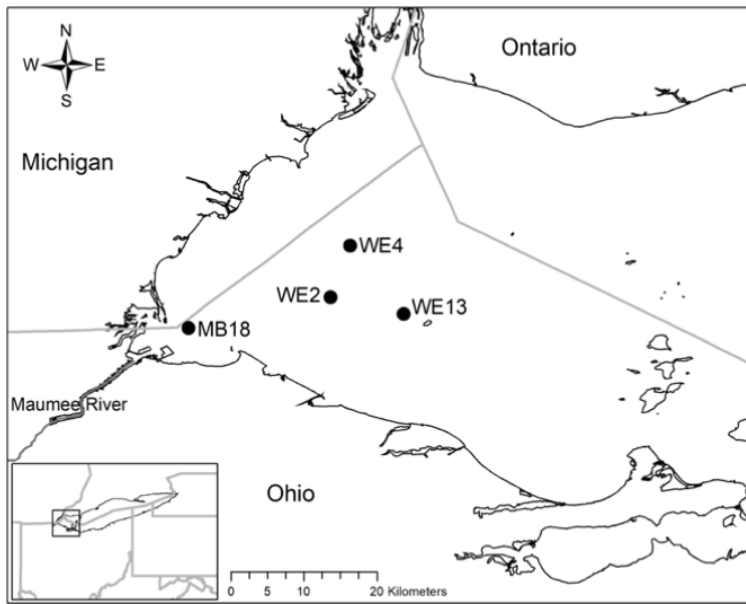


Figure 2:

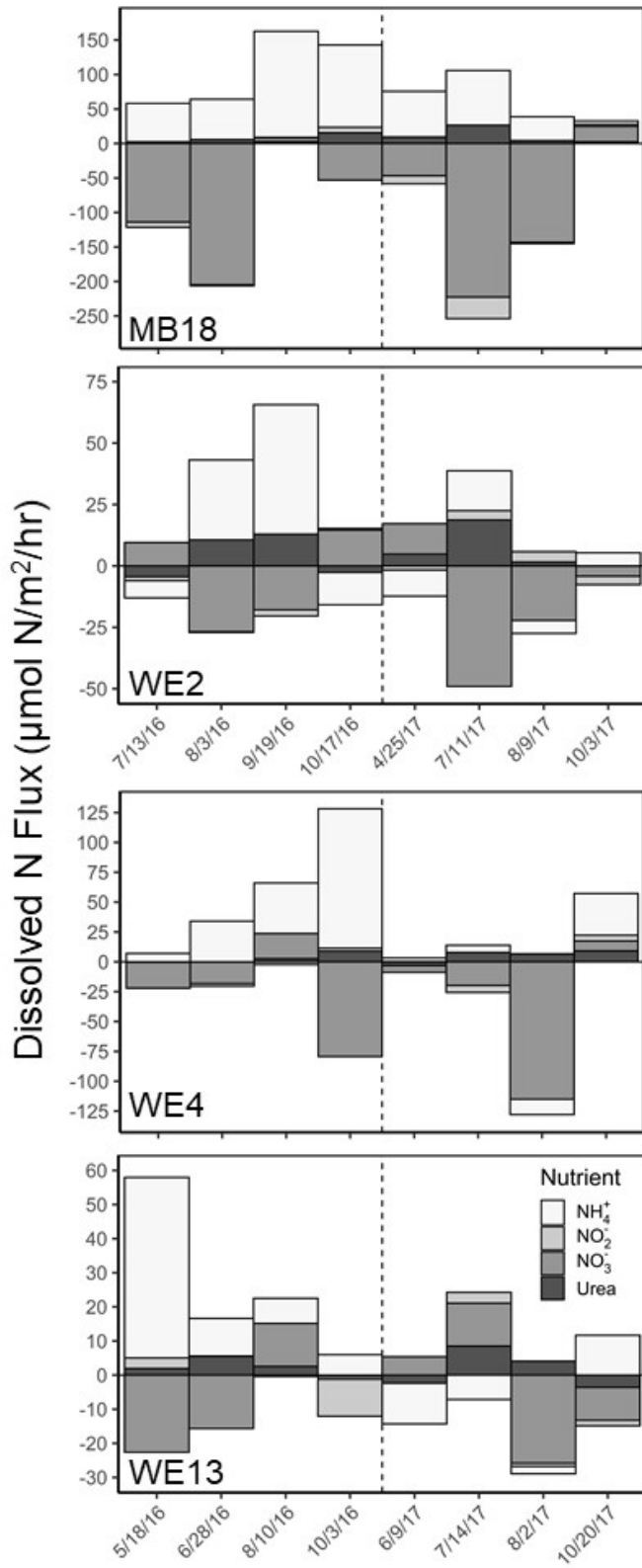


Figure 3:

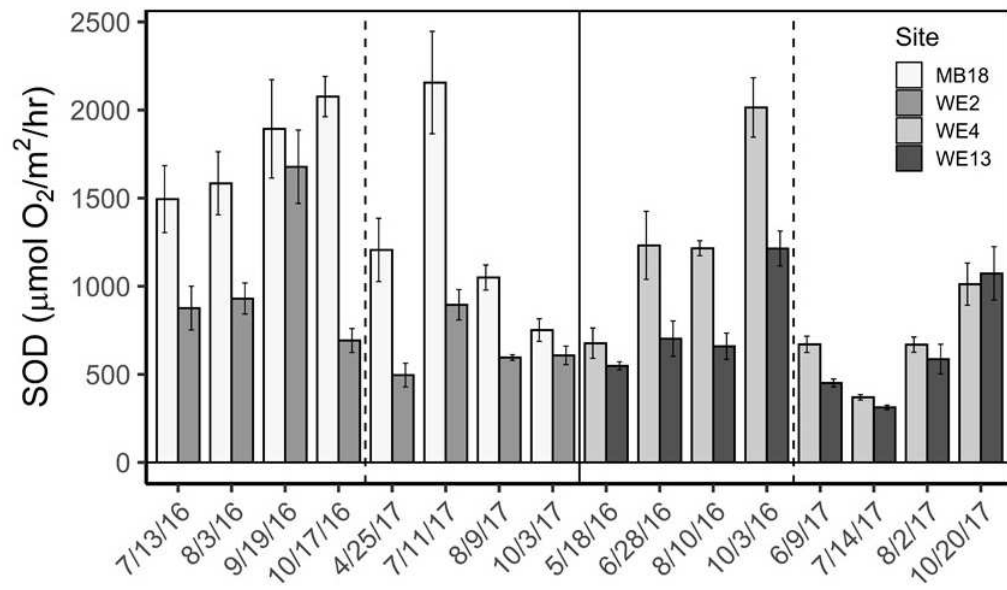


Figure 4:

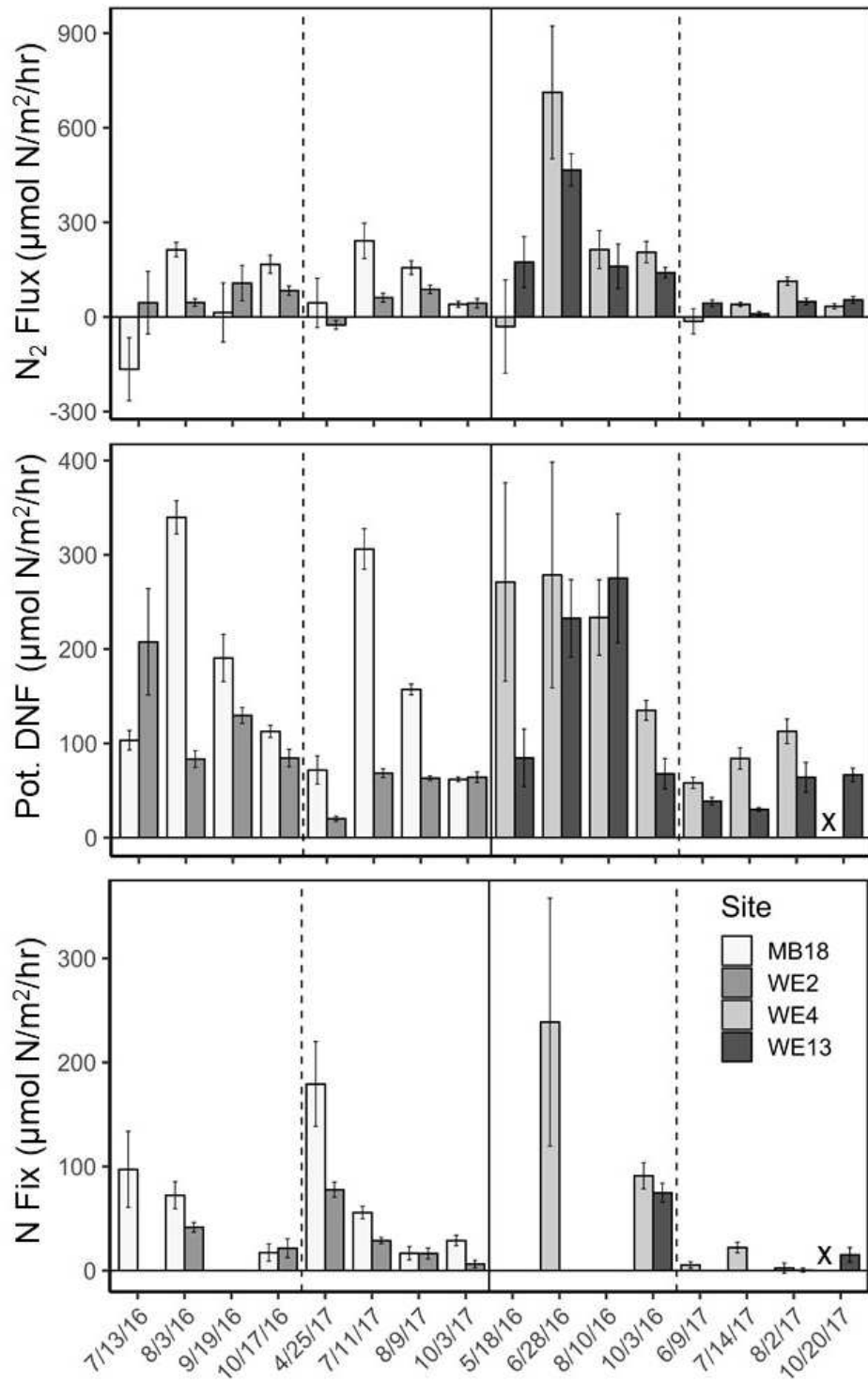


Figure 5:

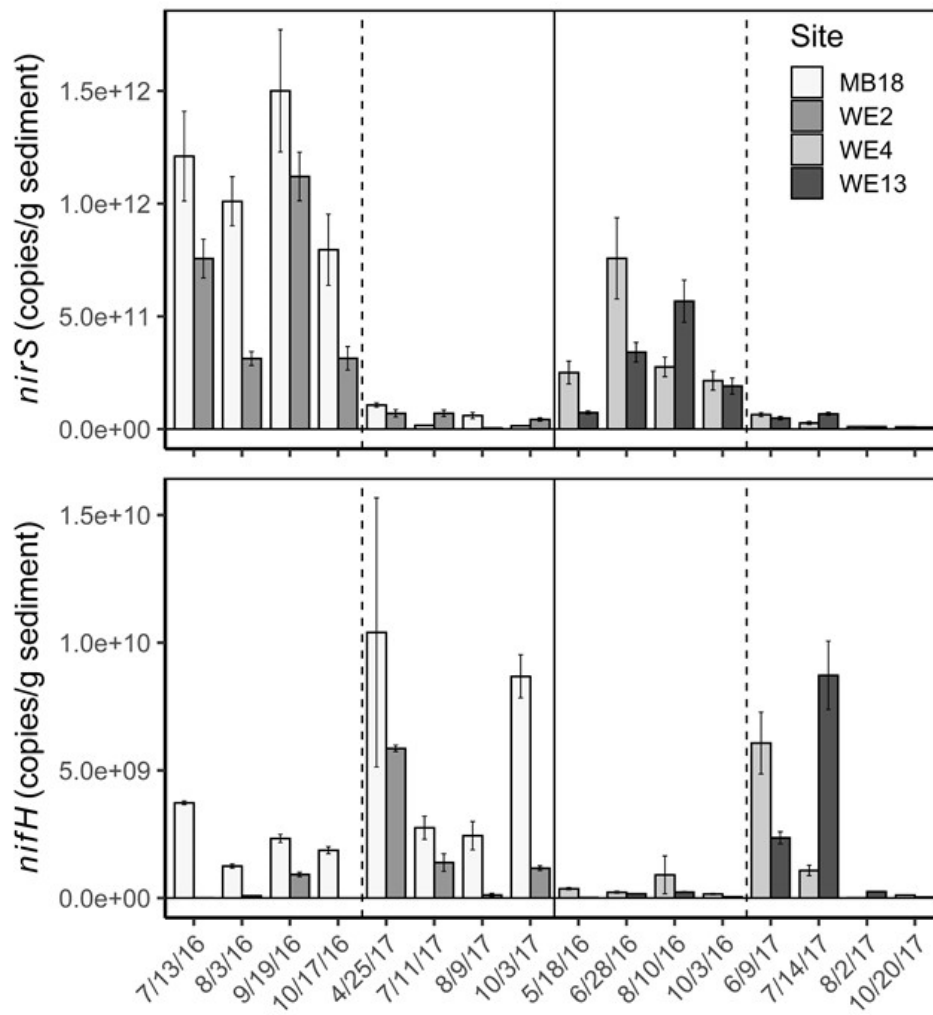


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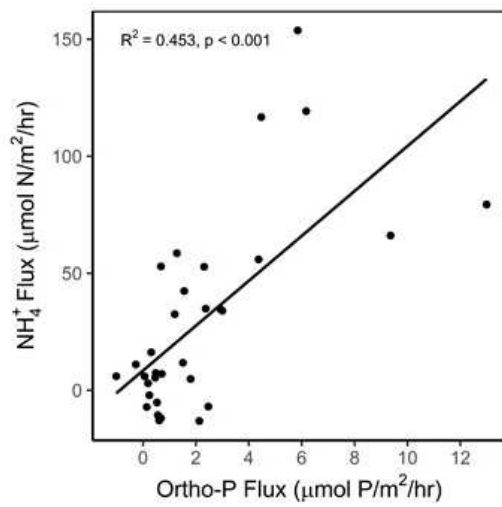
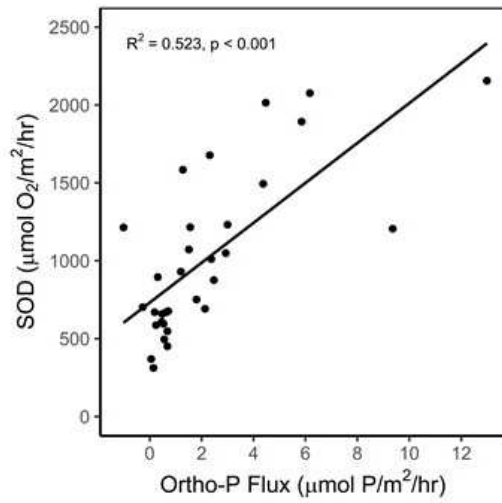
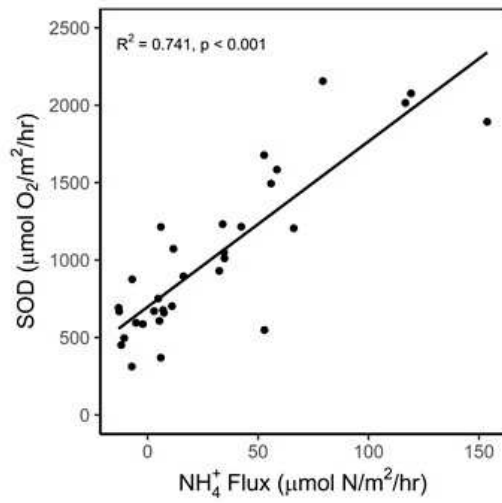


Figure 7:

