

Figure D1-10. Chlorophyte density (cells/L) by major taxa group from Meadowbank study area lakes since 2006.

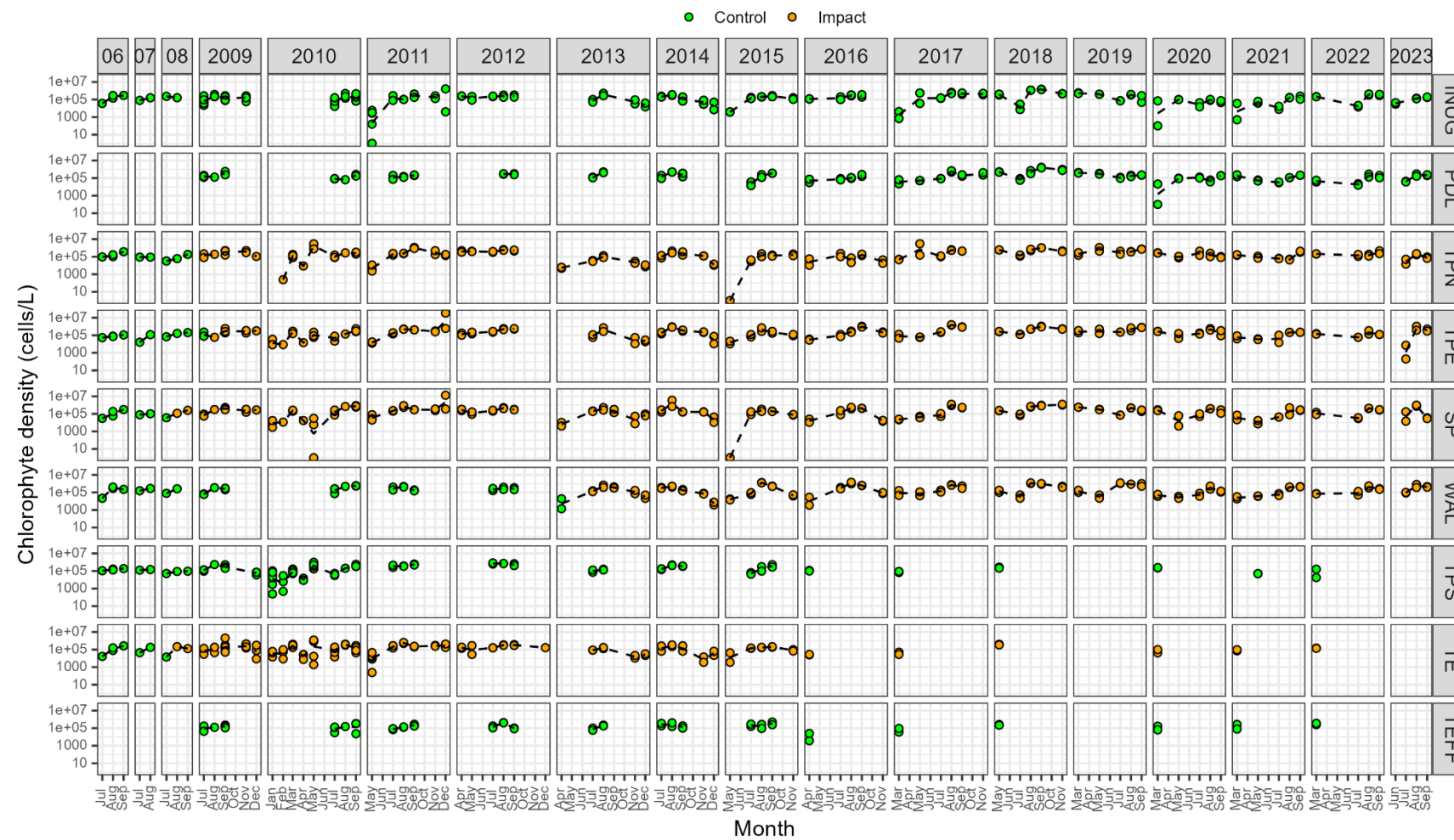


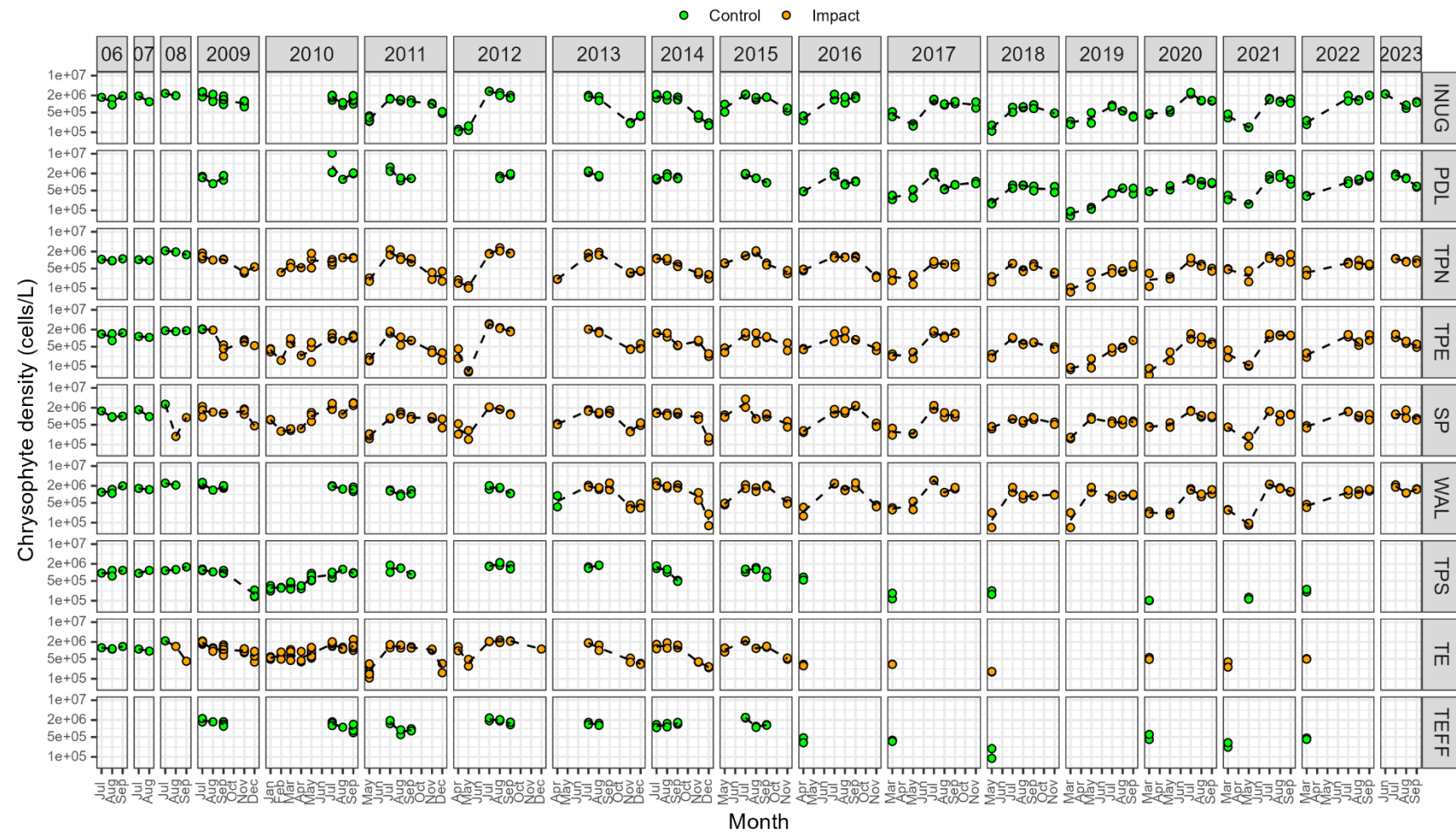
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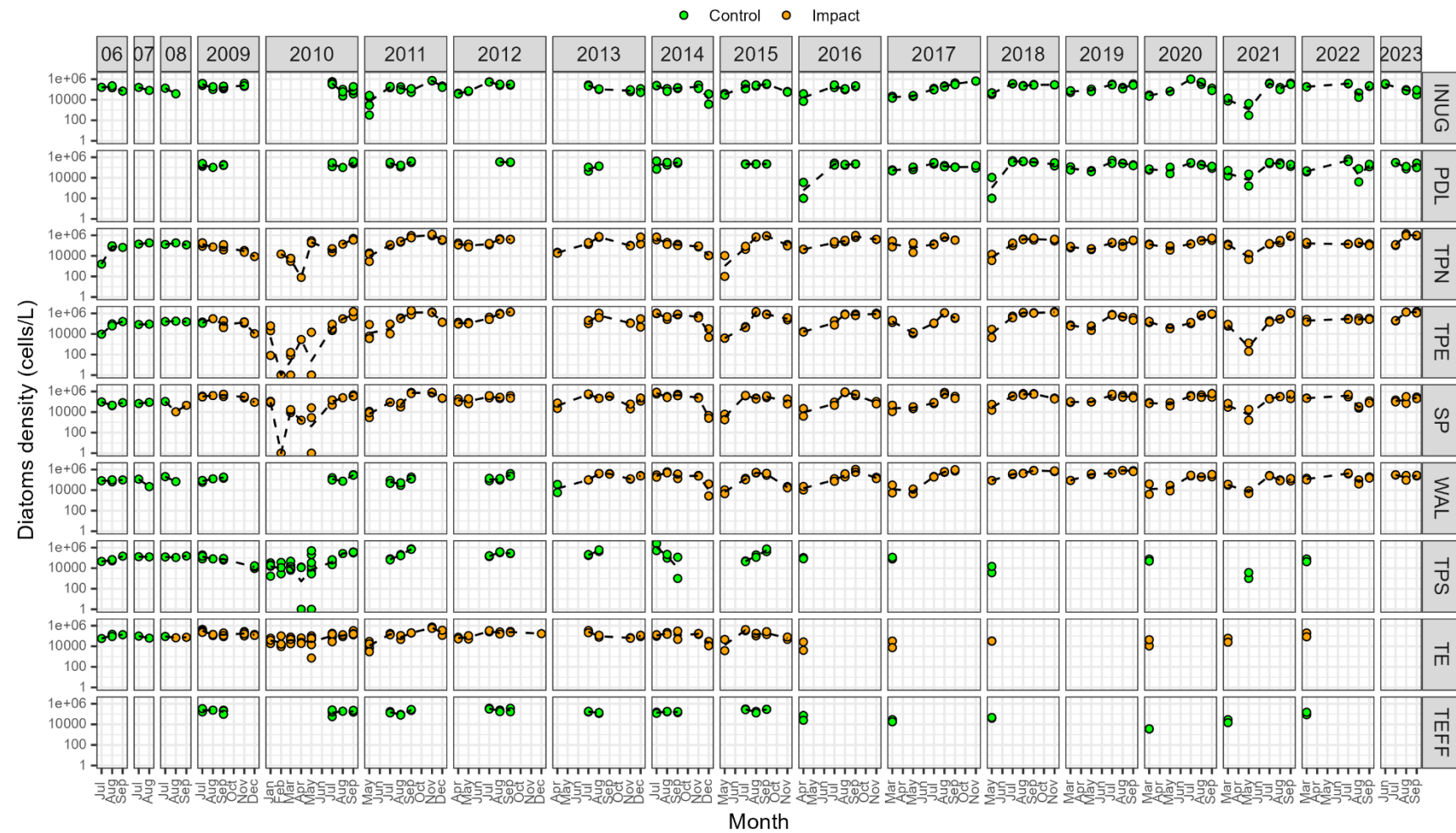
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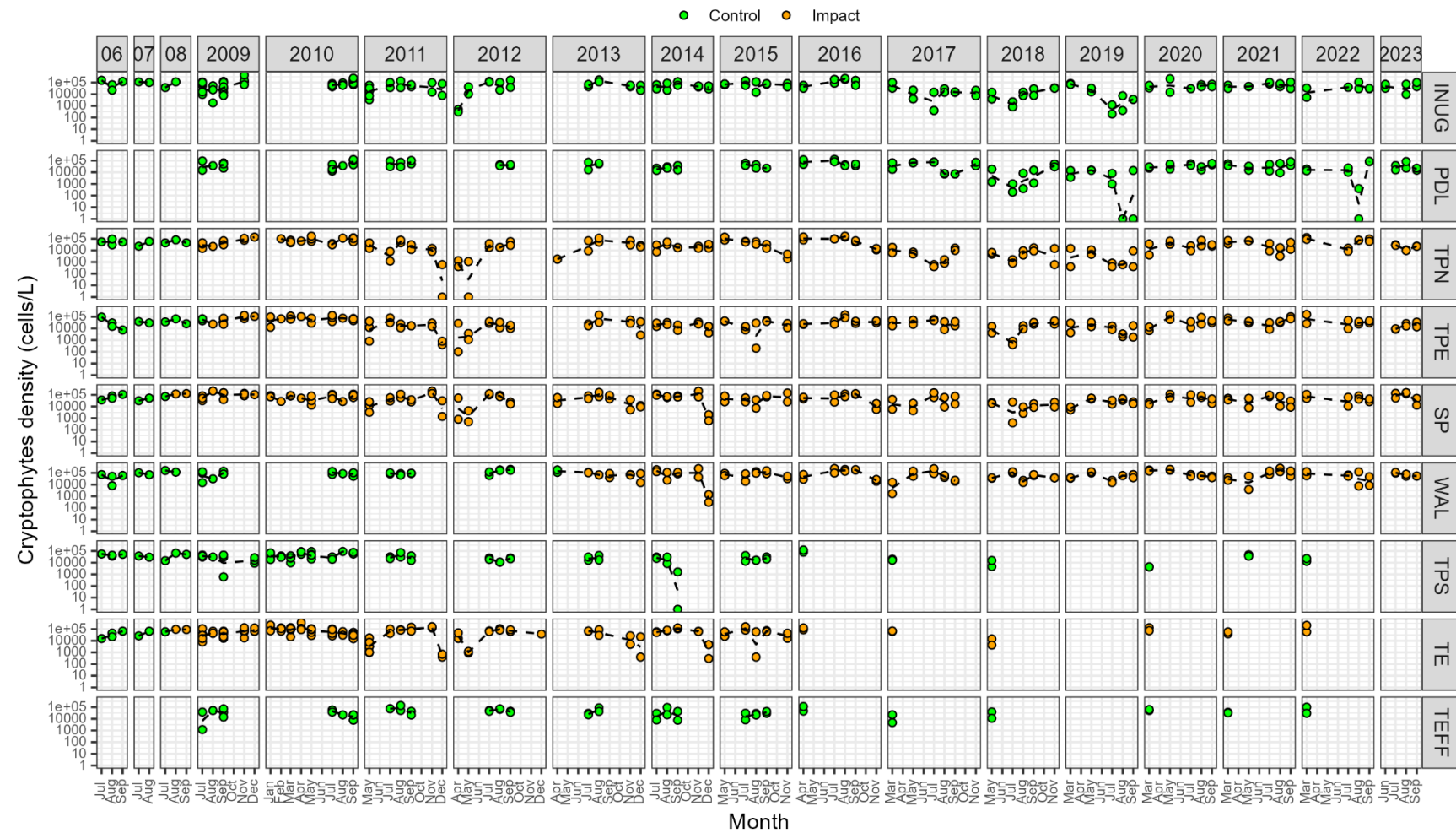
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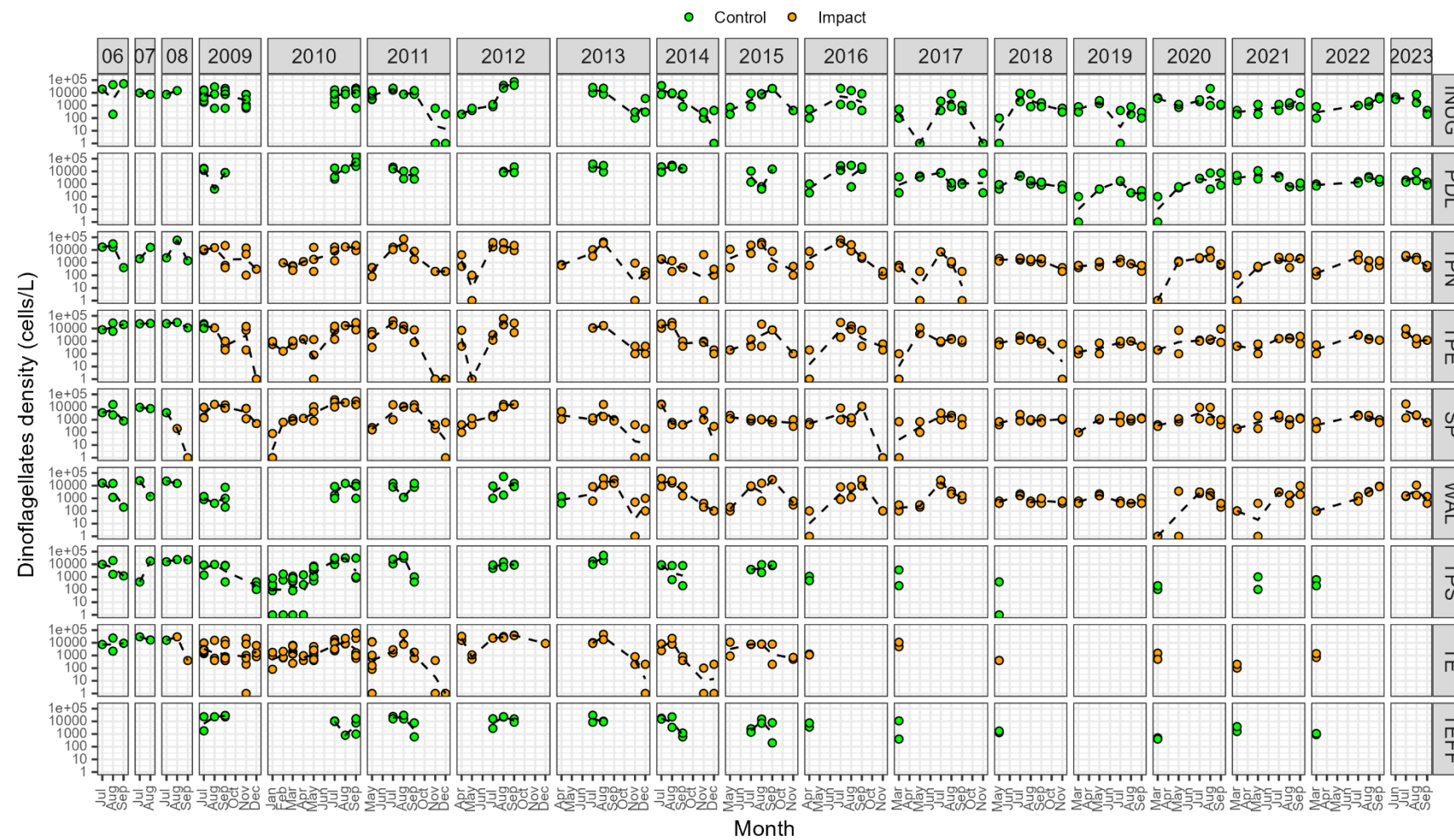
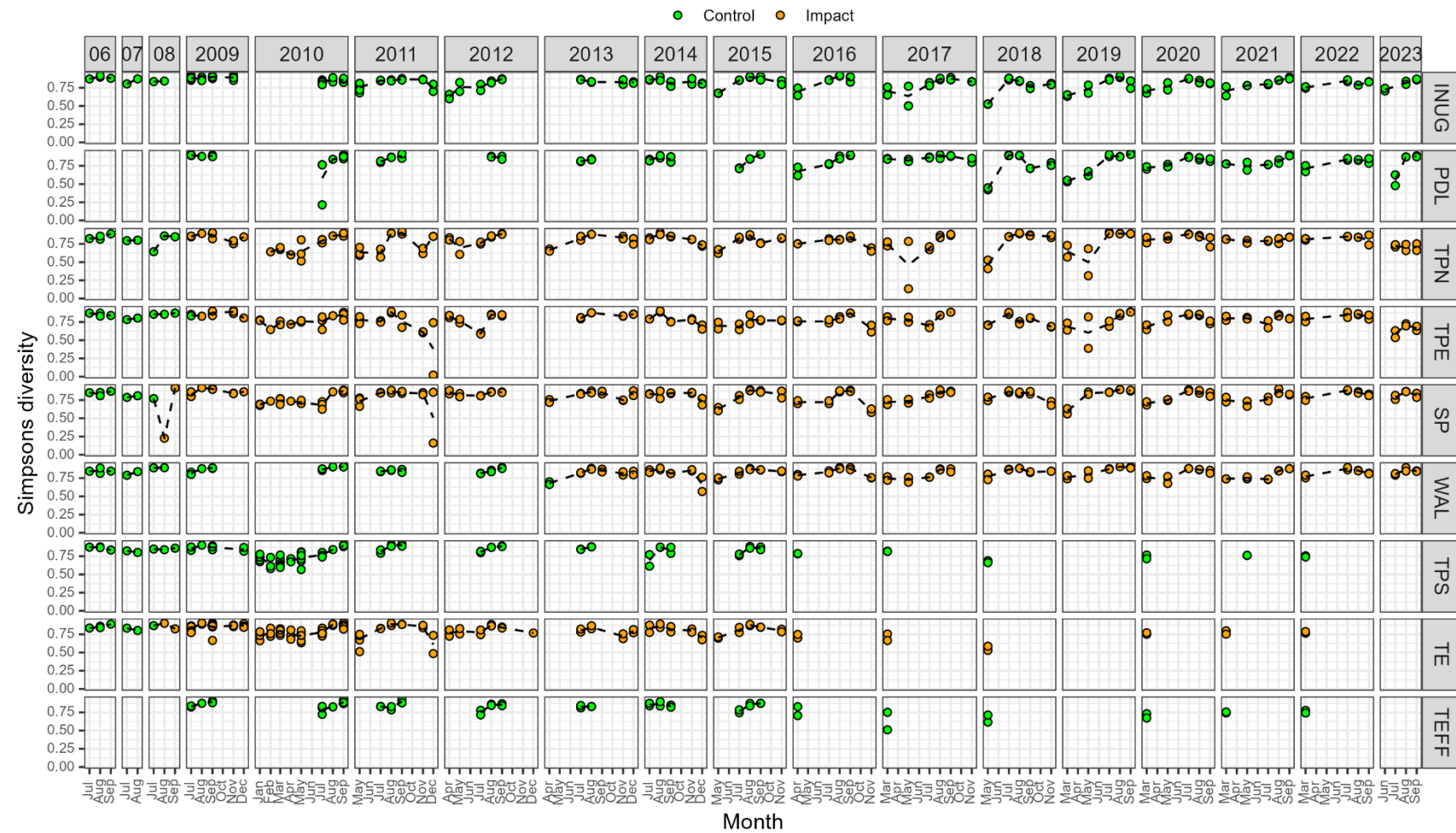


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Appendix D2

Phyto Data – Whale Tail Study Area Lakes

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Table D2-1. Phytoplankton density (cells/L), biomass (mg/m³), and diversity by major taxa group, Whale Tail study lakes, 2023.

Area-Replicate	Date	Phytoplankton Biomass (mg/m³)						Taxa Richness	Simpson's Diversity	
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate			TOTAL
Kangislulik Lake (KAN/MAM)										
MAM - 79	3-Jul-23	0	3.4	79	374	68	3.8	528	25	0.86
MAM - 80	3-Jul-23	0	2.7	79	403	65	0.79	550	26	0.84
MAM - 81	15-Aug-23	0	15	53	72	33	15	188	26	0.59
MAM - 82	15-Aug-23	0.20	20	44	77	17	15	173	25	0.65
MAM - 83	10-Sep-23	0	4.3	122	51	26	4.7	209	28	0.58
MAM - 84	10-Sep-23	0	9.3	113	48	16	2.8	190	23	0.58
Percent Density or Biomass		<0.1	3.0	27	56	12	2.3			
Nemo Lake										
NEM - 79	30-Jun-23	0	2.6	117	318	19	4.5	460	25	0.87
NEM - 80	30-Jun-23	0	0.72	98	304	17	1.5	422	24	0.86
NEM - 81	16-Aug-23	1.4	8.0	84	40	1.3	1.9	136	27	0.81
NEM - 82	16-Aug-23	2.2	8.2	81	23	1.6	1.9	118	26	0.78
NEM - 83	8-Sep-23	3.9	11	45	20	0.34	9.4	89	25	0.88
NEM - 84	8-Sep-23	3.3	11	53	15	1.0	16	100	23	0.86
Percent Density or Biomass		0.81	3.1	36	54	3.1	2.7			
Whale Tail South										
WTS - 79	2-Jul-23	0	3.2	341	97	196	5.5	643	27	0.75
WTS - 80	2-Jul-23	0	1.8	338	91	191	1.8	624	29	0.76
WTS - 81	14-Aug-23	0.21	52	227	135	63	20	496	38	0.67
WTS - 82	14-Aug-23	0.13	55	206	75	56	21	413	37	0.71
WTS - 83	7-Sep-23	0.26	16	52	114	13	5.1	201	27	0.41
WTS - 84	7-Sep-23	0.19	10	53	127	29	4.5	224	26	0.31
Percent Density or Biomass		<0.1	5.3	47	25	21	2.2			
Lake A20										
A20 - 73	30-Jun-23	0	4.2	391	23	137	11	565	29	0.82
A20 - 74	30-Jun-23	0	2.8	383	24	73	4.4	487	28	0.84
A20 - 75	18-Aug-23	0.44	21	211	100	12	66	411	29	0.81
A20 - 76	18-Aug-23	0.42	24	168	150	14	28	384	28	0.81
A20 - 77	7-Sep-23	0	66	508	117	34	9.6	734	36	0.79
A20 - 78	7-Sep-23	0	65	483	114	29	38	729	38	0.79
Percent Density or Biomass		<0.1	5.5	65	16	9.0	4.7			



Table D2-1. Phytoplankton density (cells/L), biomass (mg/m³), and diversity by major taxa group, Whale Tail study lakes, 2023.

Area-Replicate	Date	Phytoplankton Biomass (mg/m³)							Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	TOTAL		
Lake A76										
A76 - 71	1-Jul-23	0	0.29	214	32	25	8.1	279	24	0.59
A76 - 72	1-Jul-23	0	0.68	154	32	27	18	232	22	0.86
A76 - 73	13-Aug-23	0	23	112	59	23	12	229	29	0.80
A76 - 74	13-Aug-23	0.034	17	72	61	13	16	179	26	0.76
A76 - 75	9-Sep-23	0	3.8	34	27	2.0	0.64	67	19	0.53
A76 - 76	9-Sep-23	0	4.5	45	34	2.7	3.1	89	22	0.52
Percent Density or Biomass		<0.1	4.5	59	23	8.6	5.4			
Lake DS1										
DS1 - 69	1-Jul-23	0	2.9	220	5.6	3.1	5.5	237	28	0.73
DS1 - 70	1-Jul-23	0	2.5	189	7.9	7.9	25	232	28	0.76
DS1 - 71	17-Aug-23	0	16	49	9.2	20	38	133	33	0.88
DS1 - 72	17-Aug-23	0.031	8.3	95	6.3	41	38	189	27	0.83
DS1 - 73	9-Sep-23	0	8.3	135	10	18	15	186	34	0.86
DS1 - 74	9-Sep-23	0	0.67	122	4.9	24	11	164	29	0.81
Percent Density or Biomass		<0.1	3.4	71	3.9	10	12			
All Locations										
Relative Density or Biomass (%)		0.11	4.5	51	28	12	4.3			



Table D2-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Whale Tail study lakes, 2023.

Area-Replicate	Date	Phytoplankton Density (cells/L)						TOTAL
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	
Kangislulik Lake (KAN/MAM)								
MAM - 79	3-Jul-23	0	387,936	1,422,832	894,816	132,976	7,384	2,845,944
MAM - 80	3-Jul-23	0	244,256	1,488,288	1,018,344	151,528	200	2,902,616
MAM - 81	15-Aug-23	0	567,736	833,544	2,733,520	44,336	2,800	4,181,936
MAM - 82	15-Aug-23	1,200	934,720	912,568	2,932,472	62,672	9,584	4,853,216
MAM - 83	10-Sep-23	0	244,656	903,600	2,218,472	14,600	1,000	3,382,328
MAM - 84	10-Sep-23	0	330,464	997,192	2,391,488	15,584	600	3,735,328
Percent Density or Biomass		<0.1	12	30	56	1.9	<0.1	
Nemo Lake								
NEM - 79	30-Jun-23	0	50,288	1,405,280	1,446,144	24,168	1,000	2,926,880
NEM - 80	30-Jun-23	0	14,368	1,362,976	1,452,544	36,936	400	2,867,224
NEM - 81	16-Aug-23	6,400	295,344	1,243,032	677,096	7,384	400	2,229,656
NEM - 82	16-Aug-23	35,936	309,112	1,412,511	412,288	7,584	400	2,177,831
NEM - 83	8-Sep-23	18,200	323,280	734,368	353,616	200	400	1,430,064
NEM - 84	8-Sep-23	16,000	222,704	806,808	403,904	600	1,000	1,451,016
Percent Density or Biomass		0.59	9.3	53	36	0.59	<0.1	
Whale Tail South								
WTS - 79	2-Jul-23	0	165,232	4,756,008	871,352	617,016	600	6,410,208
WTS - 80	2-Jul-23	0	114,944	4,195,856	819,824	647,320	200	5,778,144
WTS - 81	14-Aug-23	600	998,976	1,783,232	3,797,264	102,632	3,600	6,686,304
WTS - 82	14-Aug-23	800	1,150,640	1,739,328	3,369,840	99,640	9,984	6,370,232
WTS - 83	7-Sep-23	1,400	941,504	783,056	5,858,992	40,120	600	7,625,672
WTS - 84	7-Sep-23	1,000	388,336	740,152	6,415,344	120,944	7,384	7,673,160
Percent Density or Biomass		<0.1	9.3	35	52	4.0	<0.1	
Lake A20								
A20 - 73	30-Jun-23	0	266,408	4,253,960	351,920	239,616	1,400	5,113,304
A20 - 74	30-Jun-23	0	280,176	3,936,464	424,712	223,968	800	4,866,120
A20 - 75	18-Aug-23	2,400	554,168	1,861,856	2,301,296	46,904	13,600	4,780,224
A20 - 76	18-Aug-23	2,400	632,592	1,530,792	2,232,840	41,320	6,000	4,445,944
A20 - 77	7-Sep-23	0	1,064,232	2,041,456	2,724,768	121,744	1,000	5,953,200
A20 - 78	7-Sep-23	0	1,165,408	2,076,776	2,819,544	86,824	1,600	6,150,152
Percent Density or Biomass		<0.1	13	50	35	2.4	<0.1	



Table D2-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Whale Tail study lakes, 2023.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	TOTAL
Lake A76								
A76 - 71	1-Jul-23	0	28,736	5,333,744	306,840	126,744	1,400	5,797,464
A76 - 72	1-Jul-23	0	93,392	1,667,120	325,392	162,064	3,200	2,251,168
A76 - 73	13-Aug-23	0	1,278,952	1,429,616	1,683,688	112,360	1,800	4,506,416
A76 - 74	13-Aug-23	200	1,537,376	934,120	1,567,944	40,920	2,600	4,083,160
A76 - 75	9-Sep-23	0	272,992	466,960	1,531,992	1,200	200	2,273,344
A76 - 76	9-Sep-23	0	165,832	581,904	1,683,656	1,600	400	2,433,392
Percent Density or Biomass		<0.1	16	49	33	2.1	<0.1	
Lake DS1								
DS1 - 69	1-Jul-23	0	45,904	3,114,672	98,408	22,752	800	3,282,536
DS1 - 70	1-Jul-23	0	9,784	2,541,752	199,768	66,656	5,000	2,822,960
DS1 - 71	17-Aug-23	0	603,656	727,984	236,688	25,768	7,600	1,601,696
DS1 - 72	17-Aug-23	200	387,936	1,573,696	97,592	105,008	9,600	2,174,032
DS1 - 73	9-Sep-23	0	166,032	1,253,016	166,048	36,136	2,200	1,623,432
DS1 - 74	9-Sep-23	0	35,920	1,258,400	56,888	46,320	2,000	1,399,528
Percent Density or Biomass		<0.1	9.7	81	6.6	2.3	0.21	
All Locations								
Relative Density or Biomass (%)		<0.1	12	45	40	2.6	<0.1	



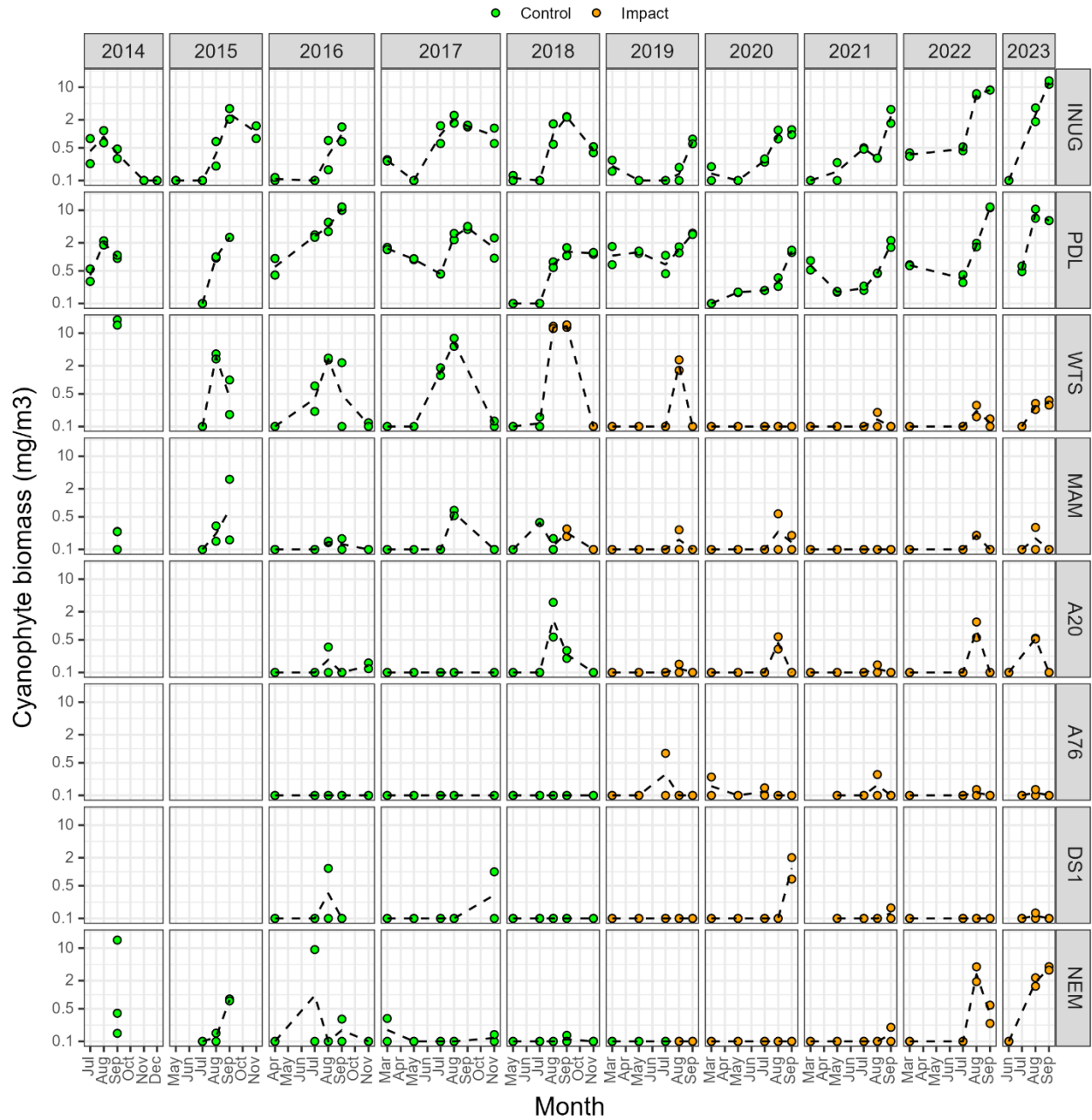
Figure D2-1. Cyanophyte biomass (mg/m³) from Whale Tail study area lakes since 2015.

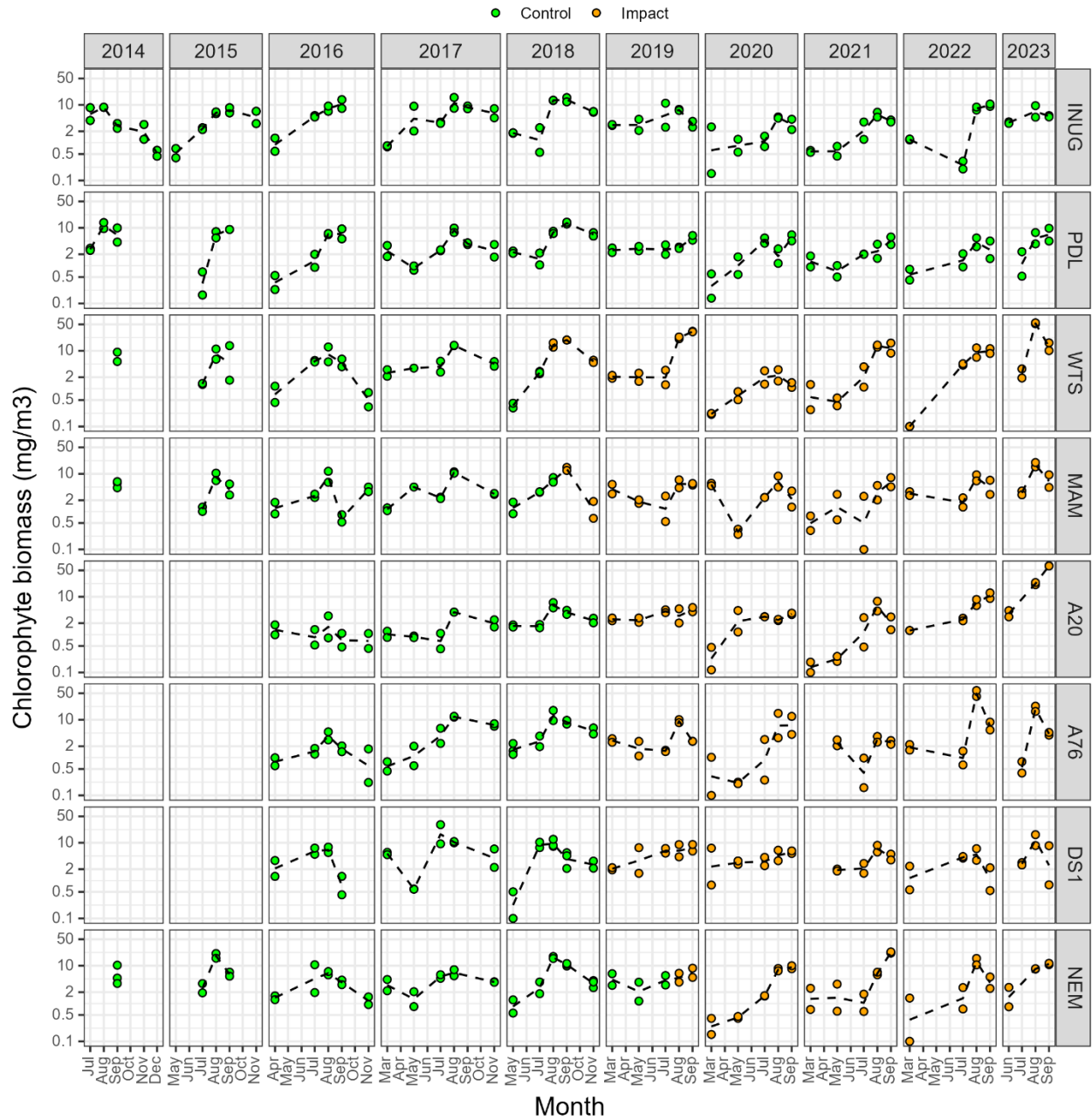
Figure D2-2. Chlorophyte biomass (mg/m³) from Whale Tail study area lakes since 2015.

Figure D2-3. Chrysophyte biomass (mg/m³) from Whale Tail study area lakes since 2015.

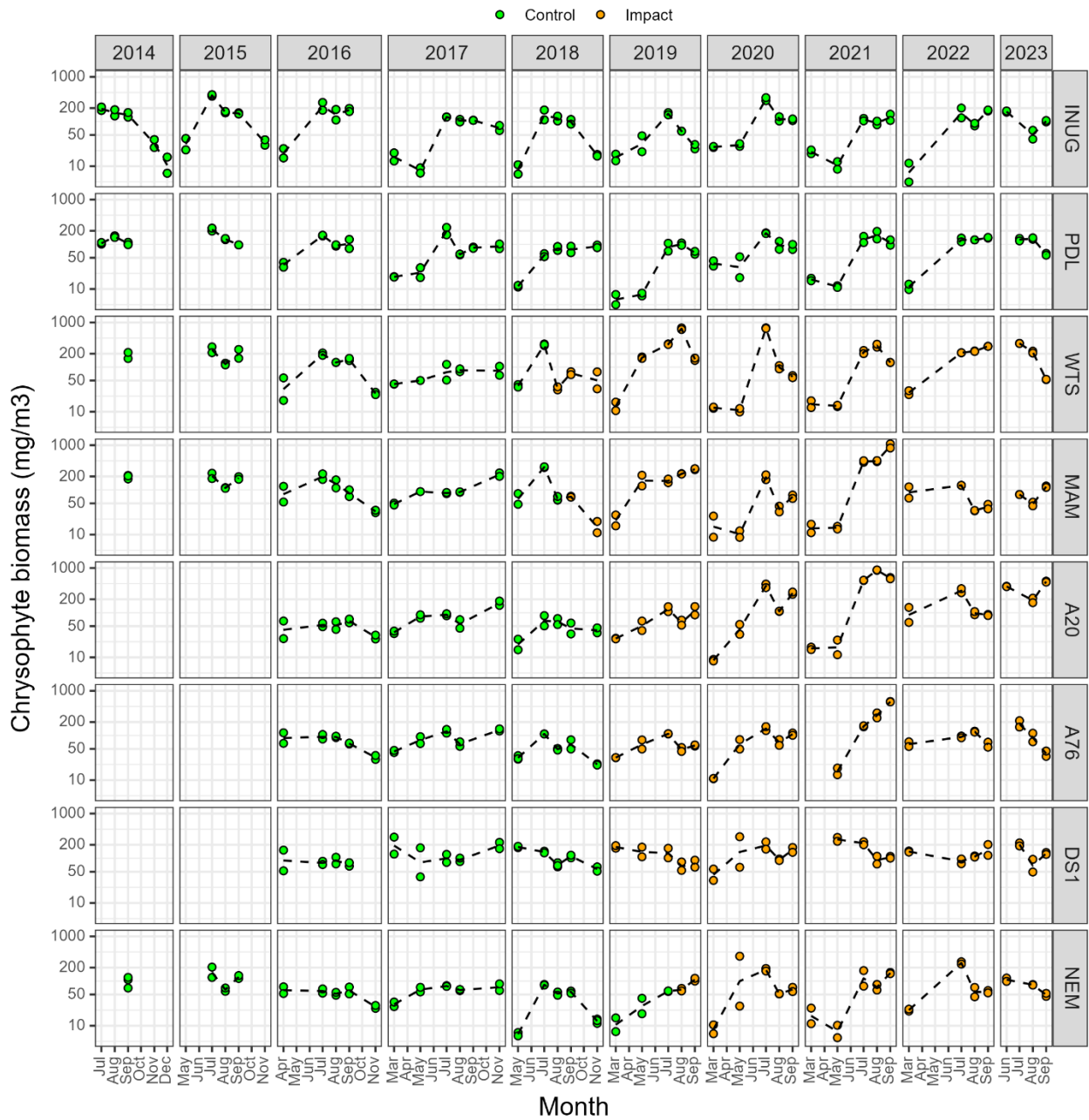


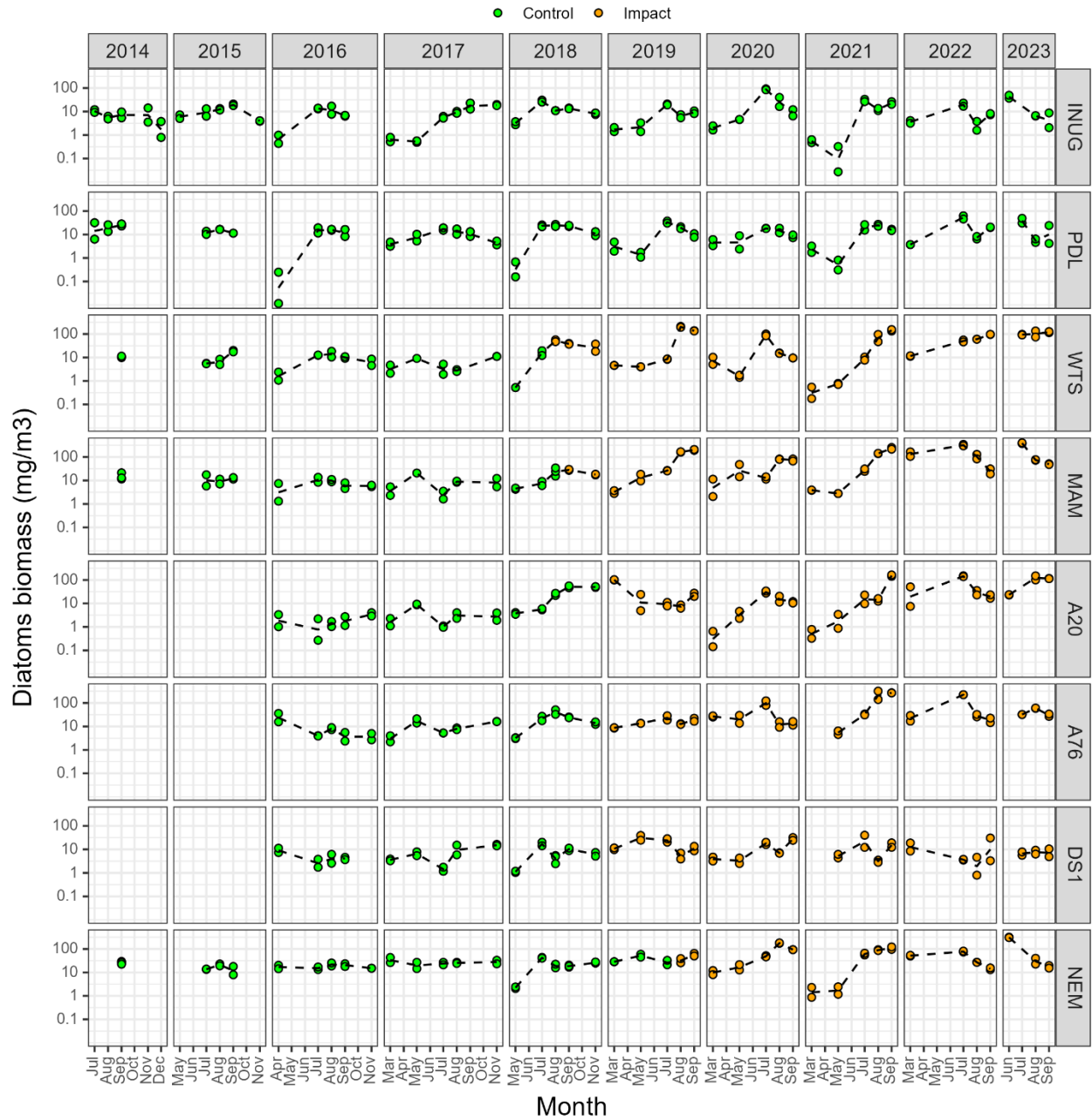
Figure D2-4. Diatoms biomass (mg/m³) from Whale Tail study area lakes since 2015.

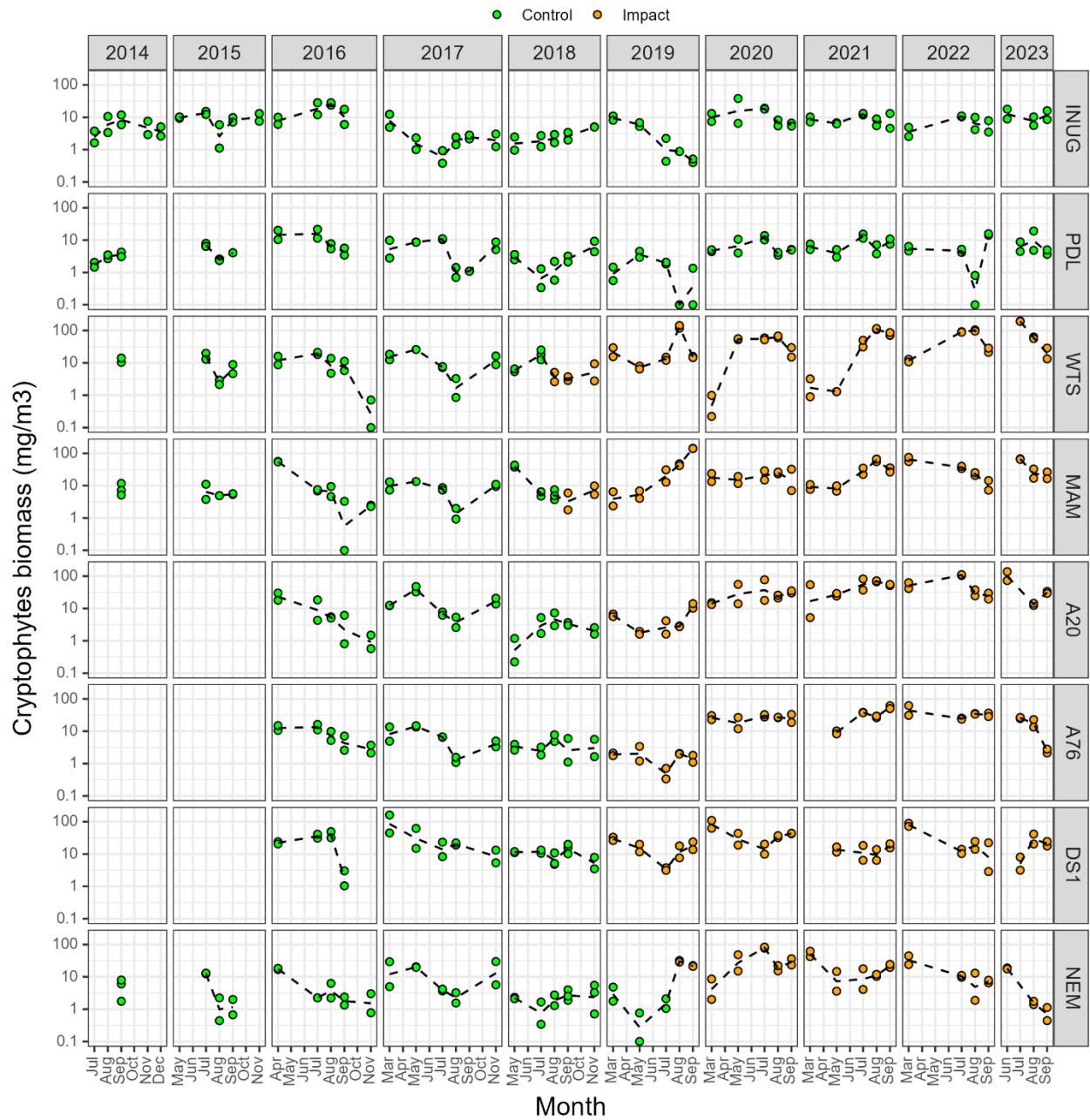
Figure D2-5. Cryptophytes biomass (mg/m³) from Whale Tail study area lakes since 2015.

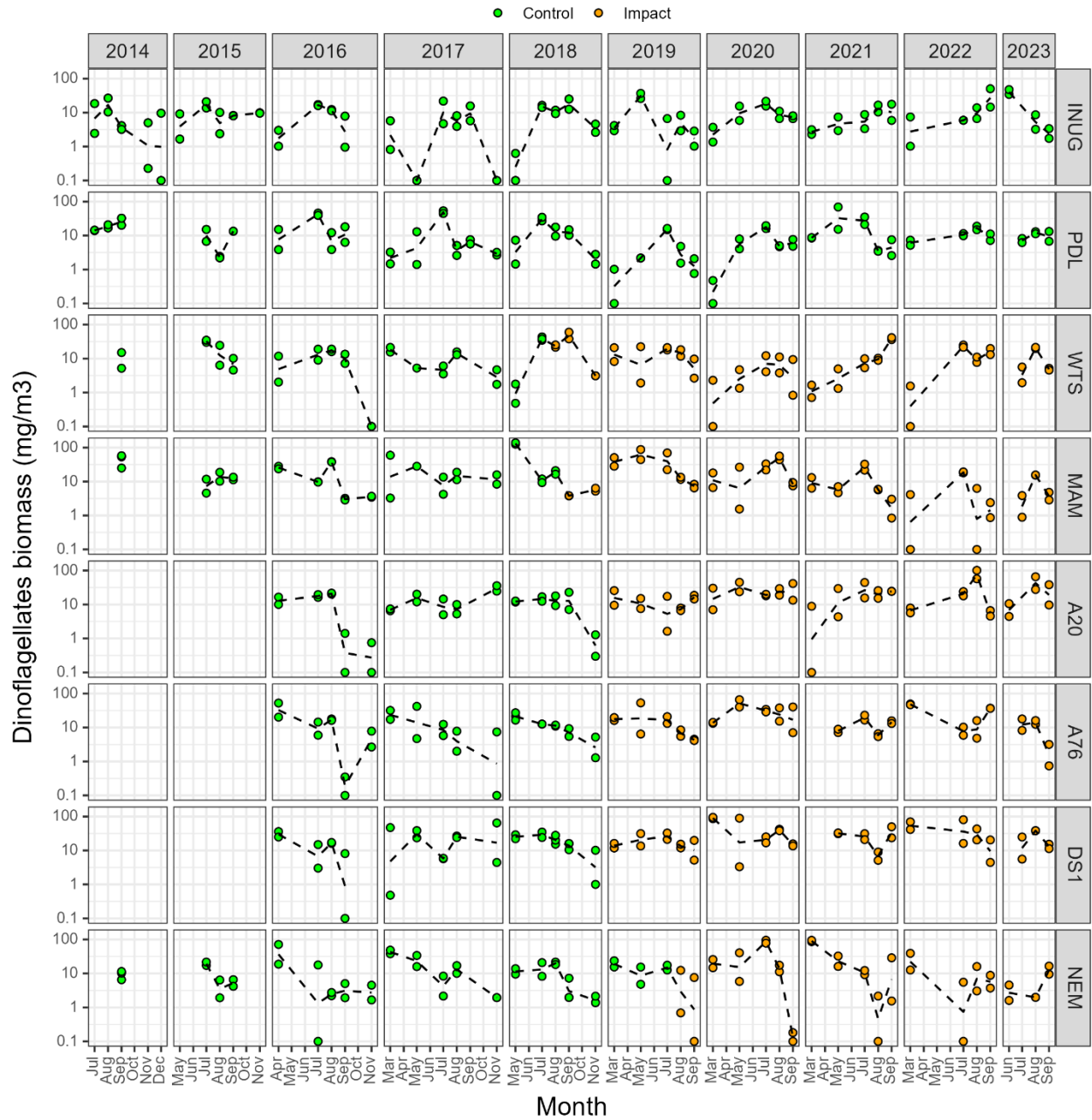
Figure D2-6. Dinoflagellates biomass (mg/m³) from Whale Tail study area lakes since 2015.

Figure D2-7. Phytoplankton density (cells/L) by major taxa group from Whale Tail study area lakes since 2015.

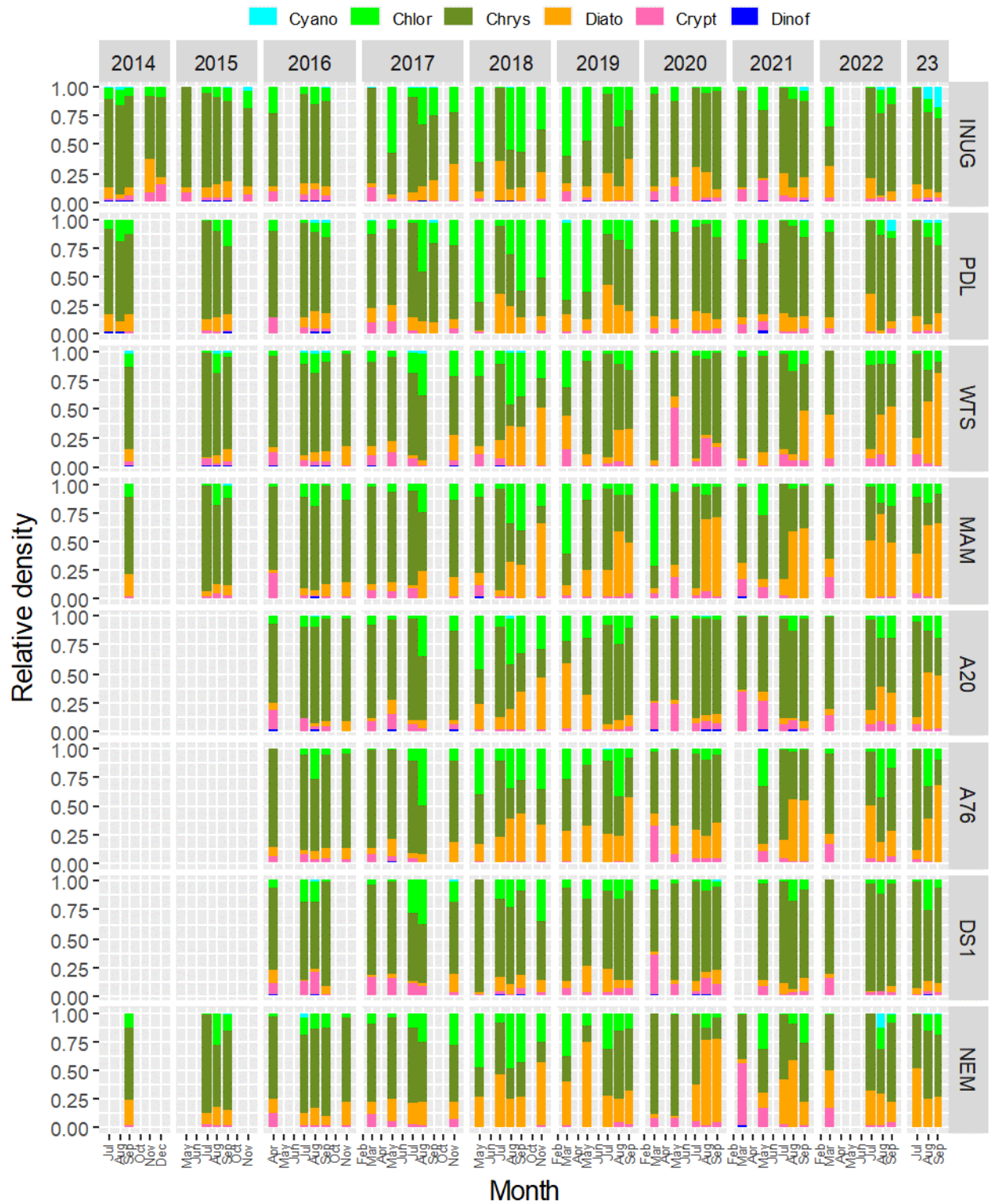
Figure D2-8. Relative phytoplankton density from Whale Tail study area lakes since 2015.

Figure D2-9. Cyanophyte density (cells/L) from Whale Tail study area lakes since 2015.

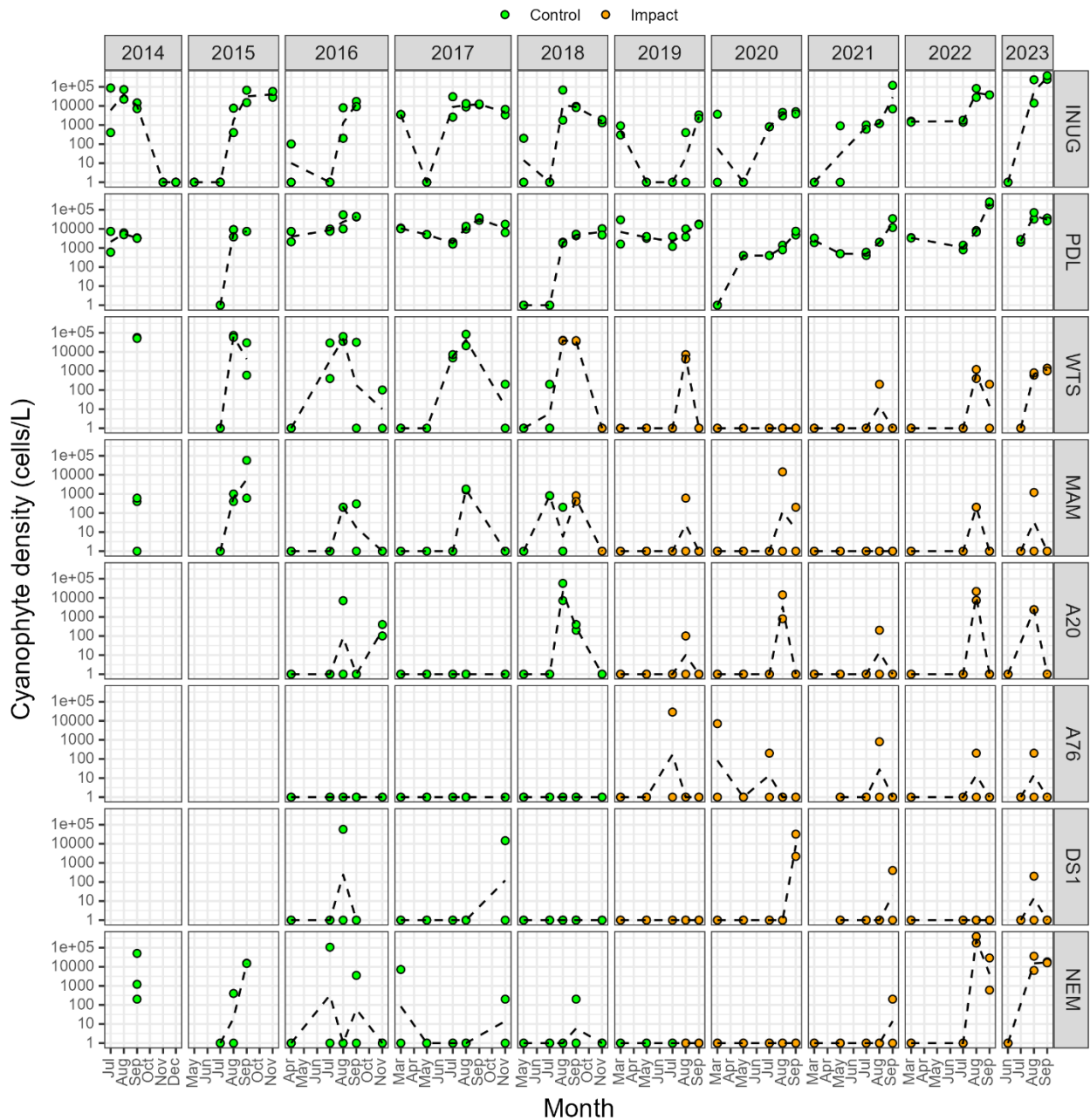


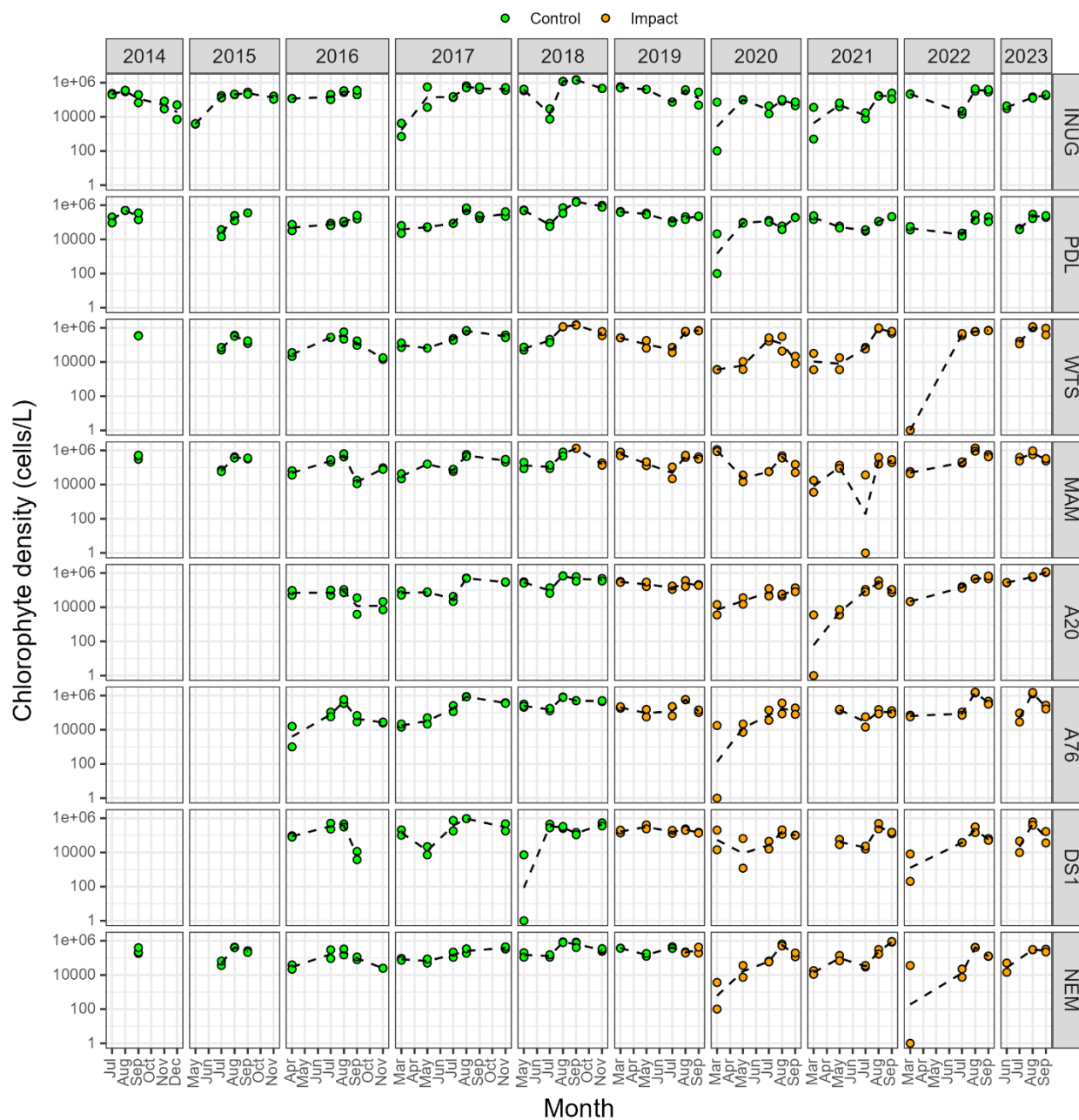
Figure D2-10. Chlorophyte density (cells/L) from Whale Tail study area lakes since 2015.

Figure D2-11. Chrysophyte density (cells/L) from Whale Tail study area lakes since 2015.

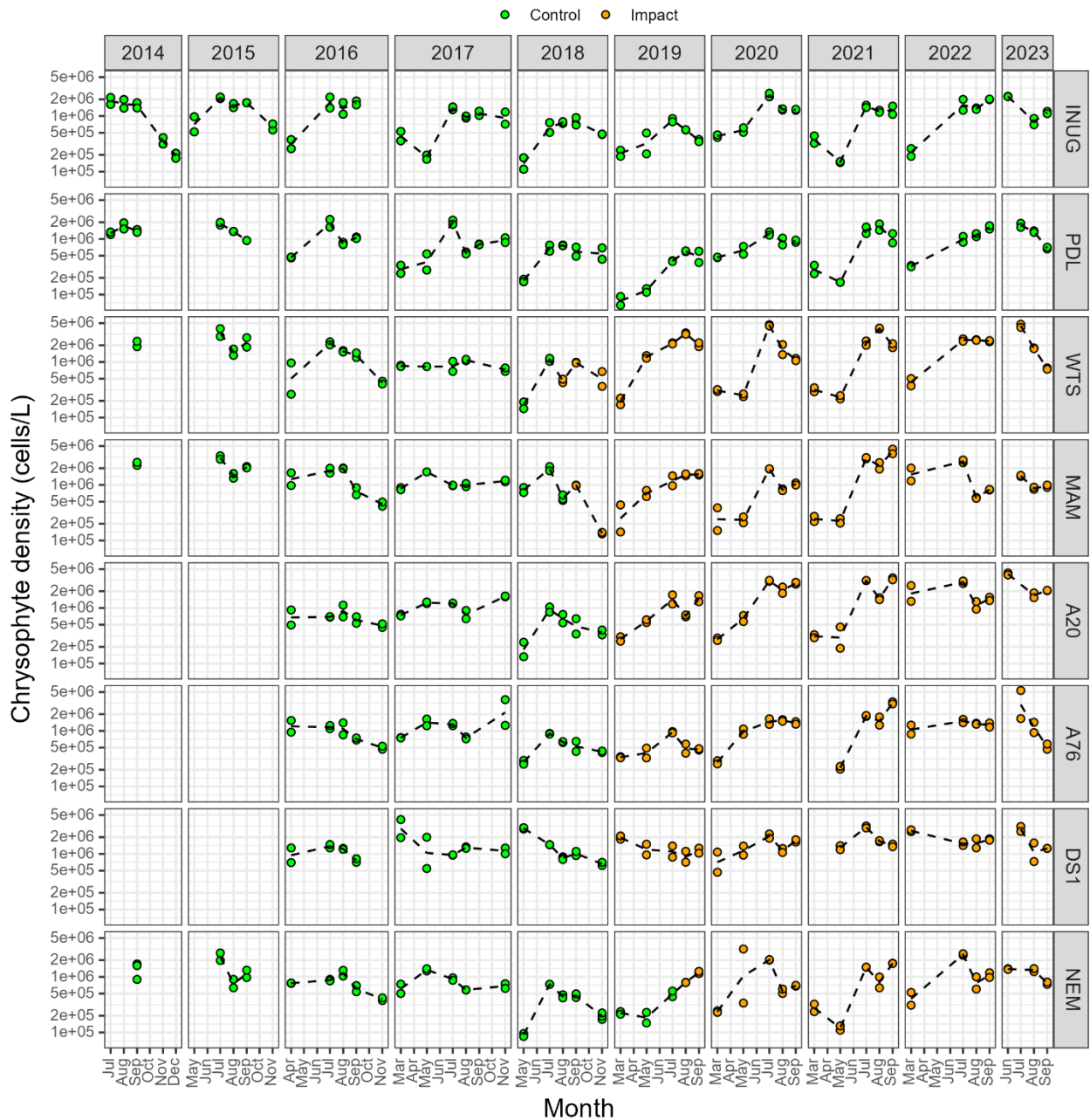


Figure D2-12. Diatoms density (cells/L) from Whale Tail study area lakes since 2015.

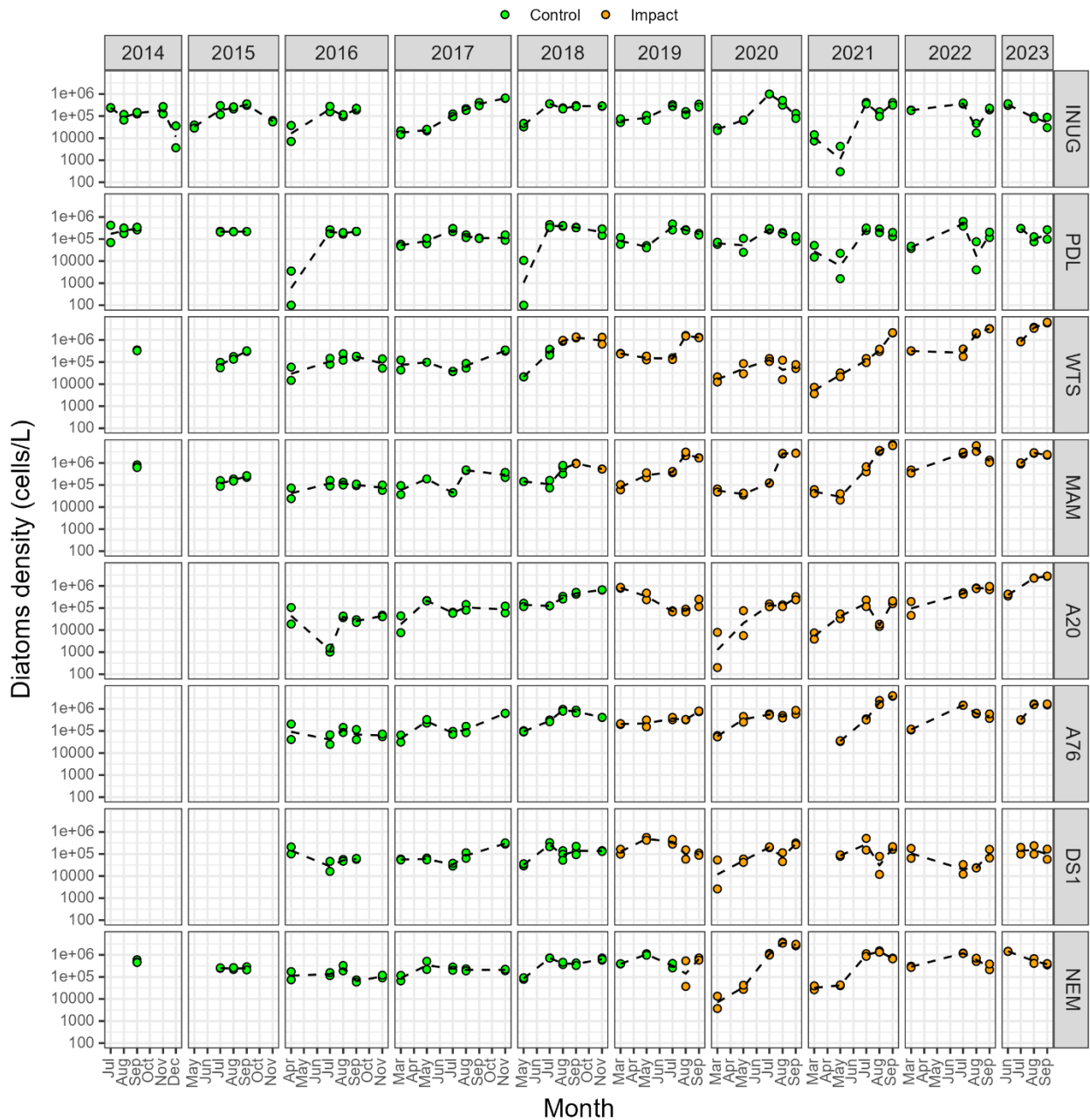


Figure D2-13. Cryptophytes density (cells/L) from Whale Tail study area lakes since 2015.

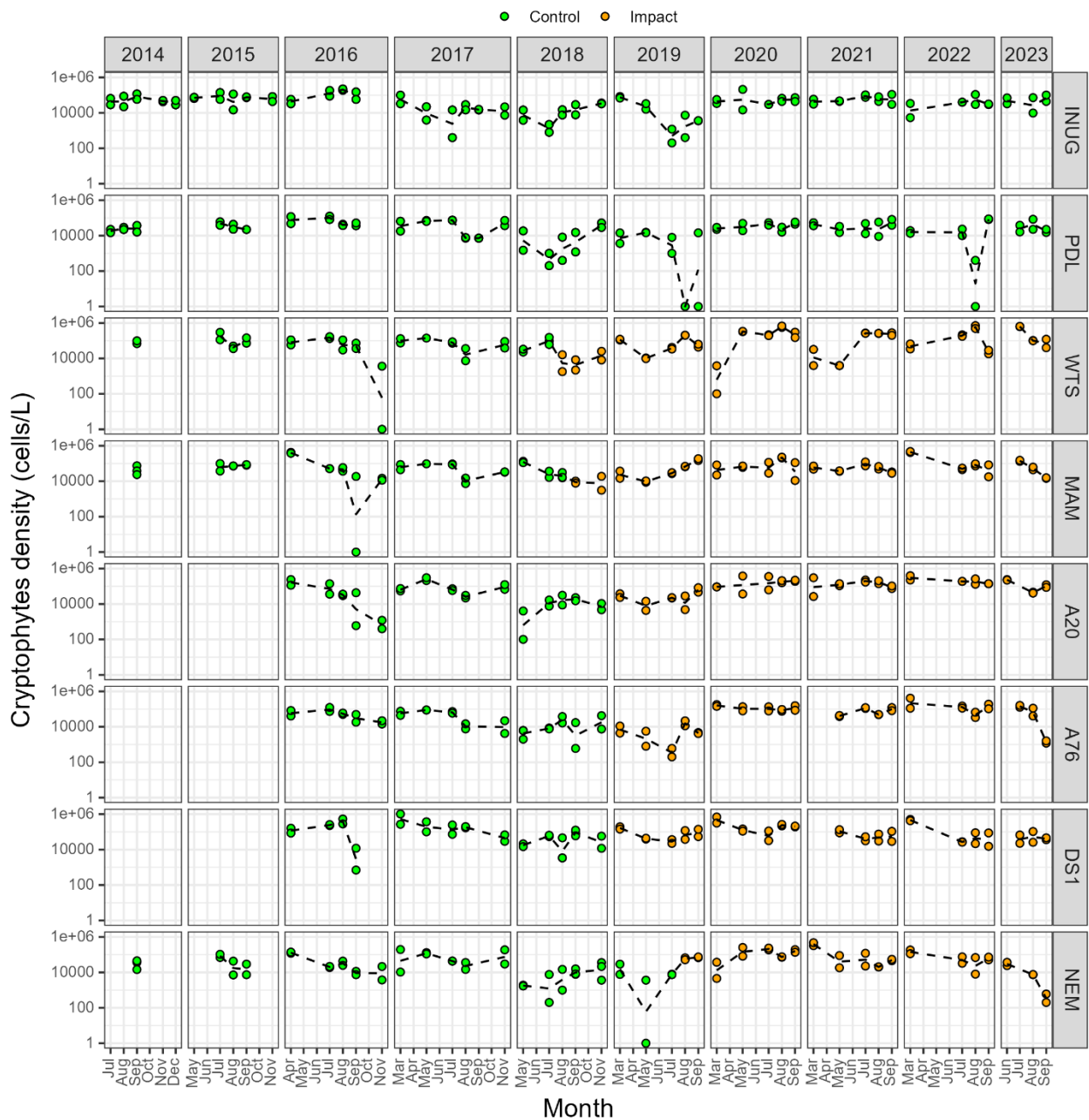


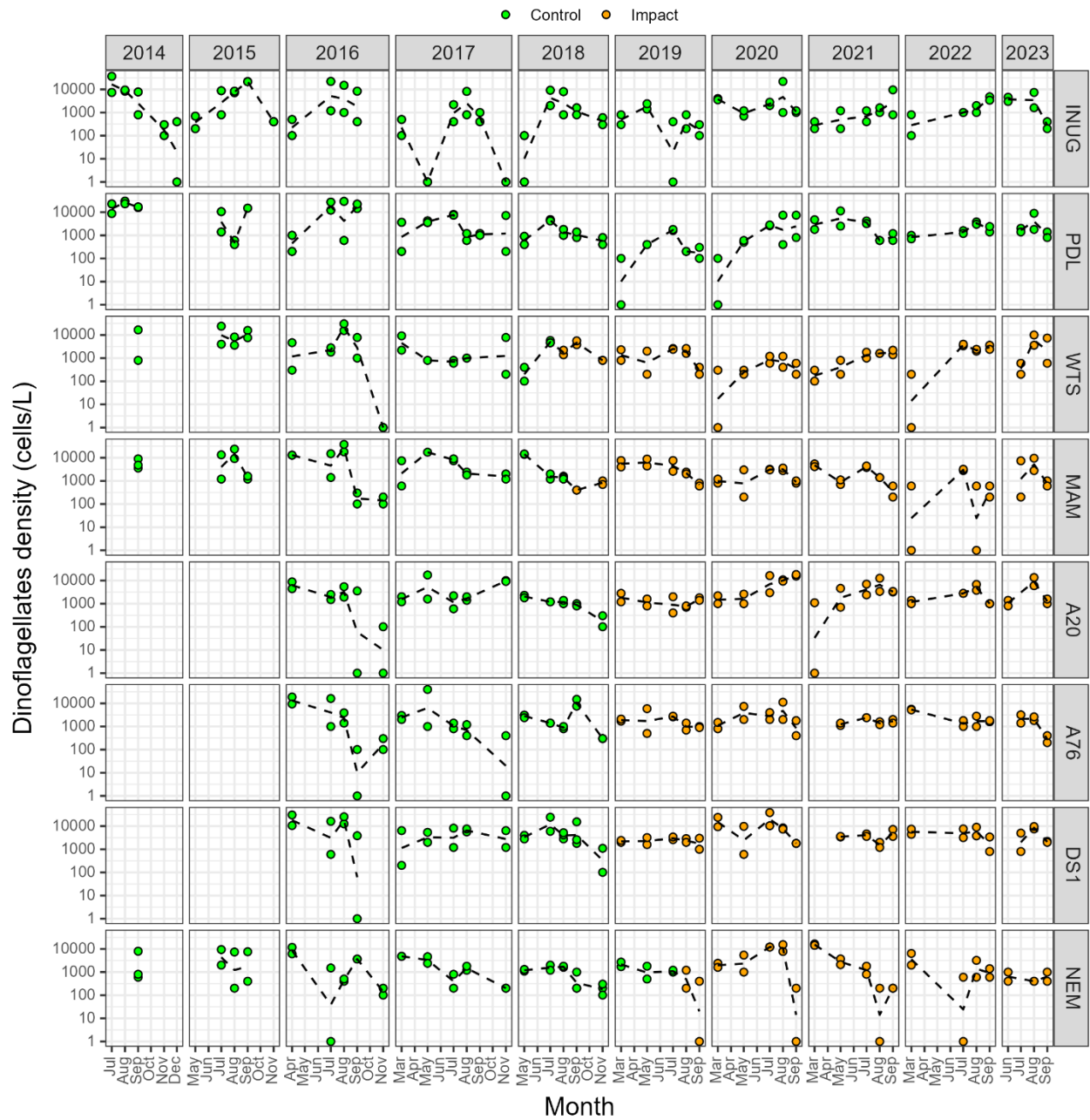
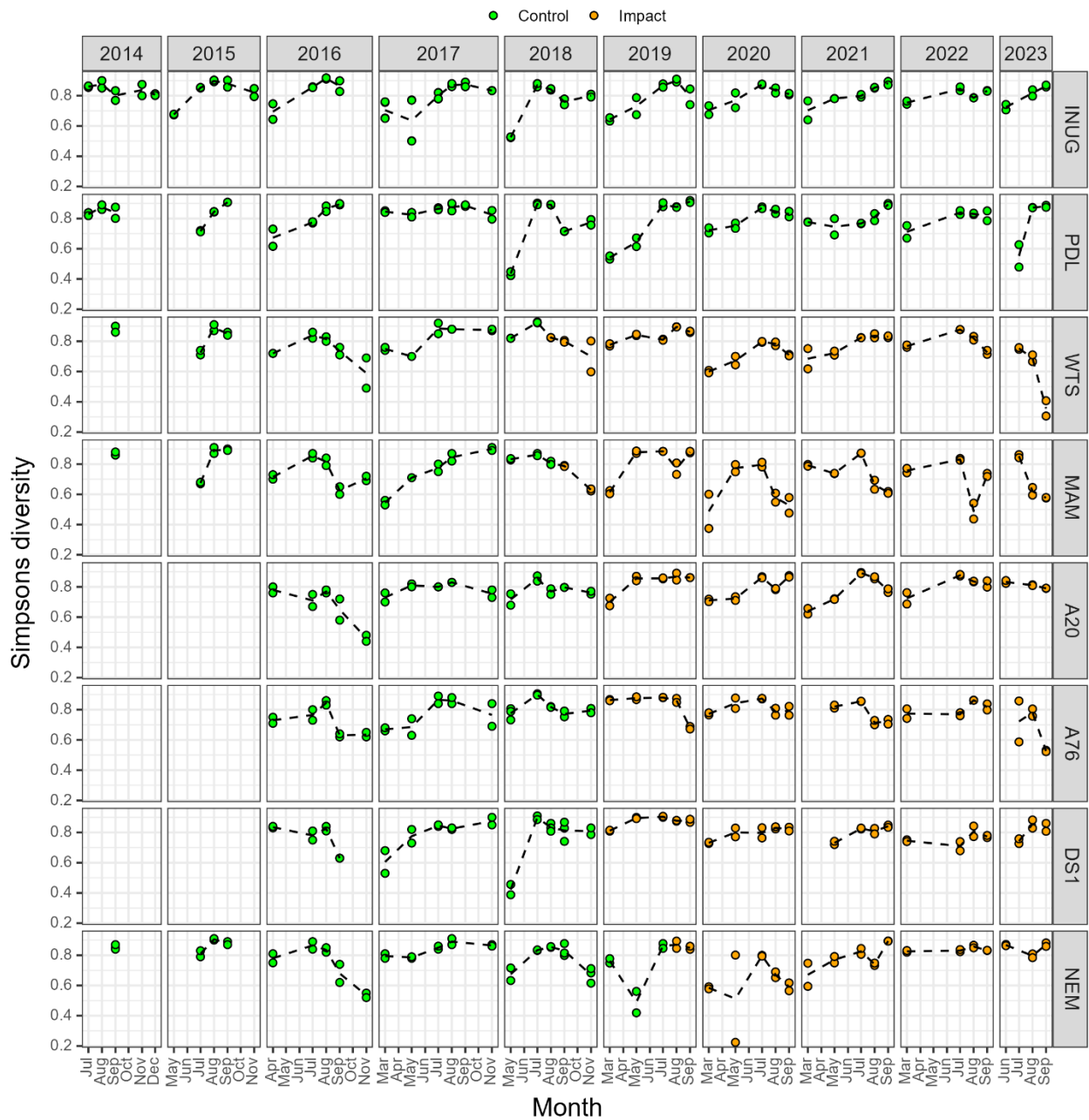
Figure D2-14. Dinoflagellates density (cells/L) from Whale Tail study area lakes since 2015.

Figure D2-15. Simpsons' Diversity for the phytoplankton community from Whale Tail study area lakes since 2015.



Appendix D3

Phyto Data – Baker Lake

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Table D3-1. Phytoplankton density (cells/L), biomass (mg/m³), and diversity by major taxa group, Baker Lake, 2023.

Area-Replicate	Date	Phytoplankton Biomass (mg/m ³)							Taxa	Simpson's
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	TOTAL	Richness	Diversity
Baker Akilahaarjuk Point										
BAP - 85	4-Jul-23	0	2	59	20	33	22	136	23	0.77
BAP - 86	4-Jul-23	0	0	60	13	36	22	131	24	0.81
BAP - 87	17-Aug-23	1	4	40	7	19	8	79	27	0.85
BAP - 88	17-Aug-23	0	4	42	13	17	2	78	23	0.89
BAP - 89	8-Sep-23	0	3	23	8	13	1	49	20	0.78
BAP - 90	8-Sep-23	0	6	19	7	25	1	59	24	0.85
Percent Density or Biomass		0.26	3.6	46	13	27	10			
Baker Barge Dock										
BBD - 85	4-Jul-23	1	1	149	15	33	24	223	32	0.82
BBD - 86	4-Jul-23	0	2	149	15	35	25	227	29	0.83
BBD - 87	18-Aug-23	0	11	74	8	17	6	116	31	0.80
BBD - 88	18-Aug-23	0	5	100	12	19	1	137	31	0.84
BBD - 89	8-Sep-23	0	4	22	25	14	8	72	22	0.75
BBD - 90	8-Sep-23	0	3	48	23	45	6	126	24	0.77
Percent Density or Biomass		<0.1	2.9	60	11	18	7.8			
Baker Proposed Jetty										
BPJ - 85	4-Jul-23	0	1	99	3	32	18	153	22	0.80
BPJ - 86	4-Jul-23	0	0	80	7	44	21	153	23	0.77
BPJ - 87	18-Aug-23	0	7	59	19	17	8	110	30	0.73
BPJ - 88	18-Aug-23	0	1	131	6	11	6	156	27	0.73
BPJ - 89	8-Sep-23	0	3	44	14	31	7	99	24	0.79
BPJ - 90	8-Sep-23	0	6	28	13	8	4	58	25	0.79
Percent Density or Biomass		<0.1	2.5	60	8.7	20	8.8			
All Locations										
Relative Density or Biomass (%)		<0.1	2.9	57	11	21	8.8			



Table D3-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Baker Lake, 2023.

Area-Replicate	Date	Phytoplankton Density (cells/L)						TOTAL
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	
Baker Akilahaarjuk Point								
BAP - 85	4-Jul-23	0	7,384	1,064,432	45,720	146,096	3,400	1,267,032
BAP - 86	4-Jul-23	0	200	1,002,176	50,304	167,048	2,600	1,222,328
BAP - 87	17-Aug-23	7,184	244,256	826,760	78,904	144,480	8,184	1,309,768
BAP - 88	17-Aug-23	7,184	337,648	705,432	160,496	116,144	400	1,327,304
BAP - 89	8-Sep-23	0	165,232	567,536	59,888	66,256	200	859,112
BAP - 90	8-Sep-23	0	173,416	438,824	104,592	132,312	200	849,344
Percent Density or Biomass		0.21	14	67	7.3	11	0.22	
Baker Barge Dock								
BBD - 85	4-Jul-23	7,184	35,920	1,971,616	207,952	157,664	3,800	2,384,136
BBD - 86	4-Jul-23	0	21,552	1,800,000	178,016	178,816	3,200	2,181,584
BBD - 87	18-Aug-23	0	411,488	1,638,552	63,472	188,184	7,784	2,309,480
BBD - 88	18-Aug-23	0	266,808	1,609,416	86,224	223,304	200	2,185,952
BBD - 89	8-Sep-23	0	64,856	704,232	176,264	66,656	1,200	1,013,208
BBD - 90	8-Sep-23	0	79,224	1,128,088	52,936	275,192	1,200	1,536,640
Percent Density or Biomass		<0.1	7.6	76	6.6	9.4	0.15	
Baker Proposed Jetty								
BPJ - 85	4-Jul-23	0	7,184	1,209,712	40,136	78,056	9,184	1,344,272
BPJ - 86	4-Jul-23	0	7,184	1,511,840	150,680	245,272	2,800	1,917,776
BPJ - 87	18-Aug-23	0	251,840	1,703,408	152,680	102,976	8,384	2,219,288
BPJ - 88	18-Aug-23	200	330,464	2,291,896	28,952	73,240	1,600	2,726,352
BPJ - 89	8-Sep-23	0	129,312	891,216	88,624	181,800	7,984	1,298,936
BPJ - 90	8-Sep-23	0	151,064	747,336	66,872	43,904	400	1,009,576
Percent Density or Biomass		<0.1	8.3	79	5.0	6.9	0.29	
All Locations								
Relative Density or Biomass (%)		<0.1	9.3	75	6.2	8.9	0.22	



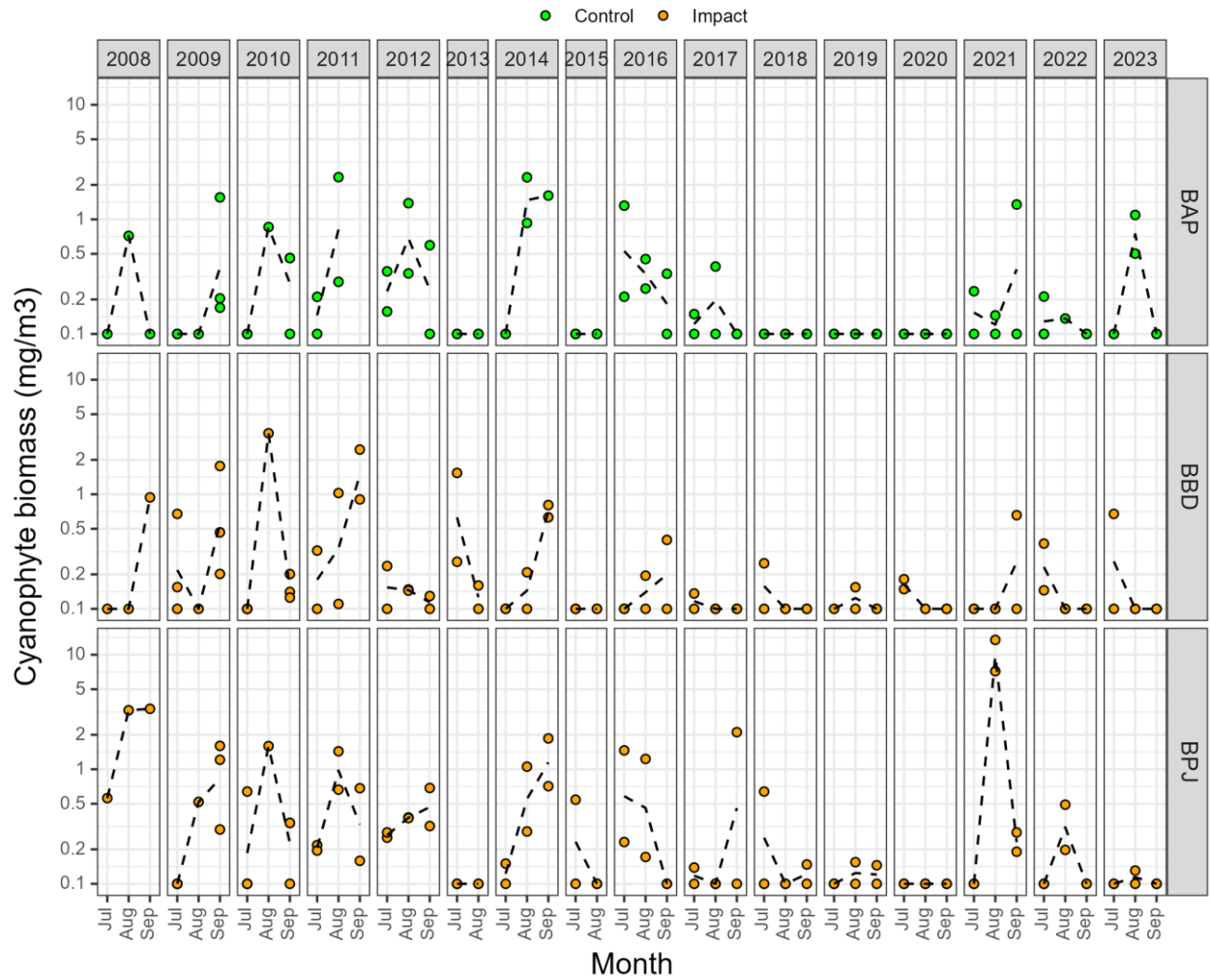
Figure D3-1. Cyanophyte biomass (mg/m³) from Baker Lake since 2008.

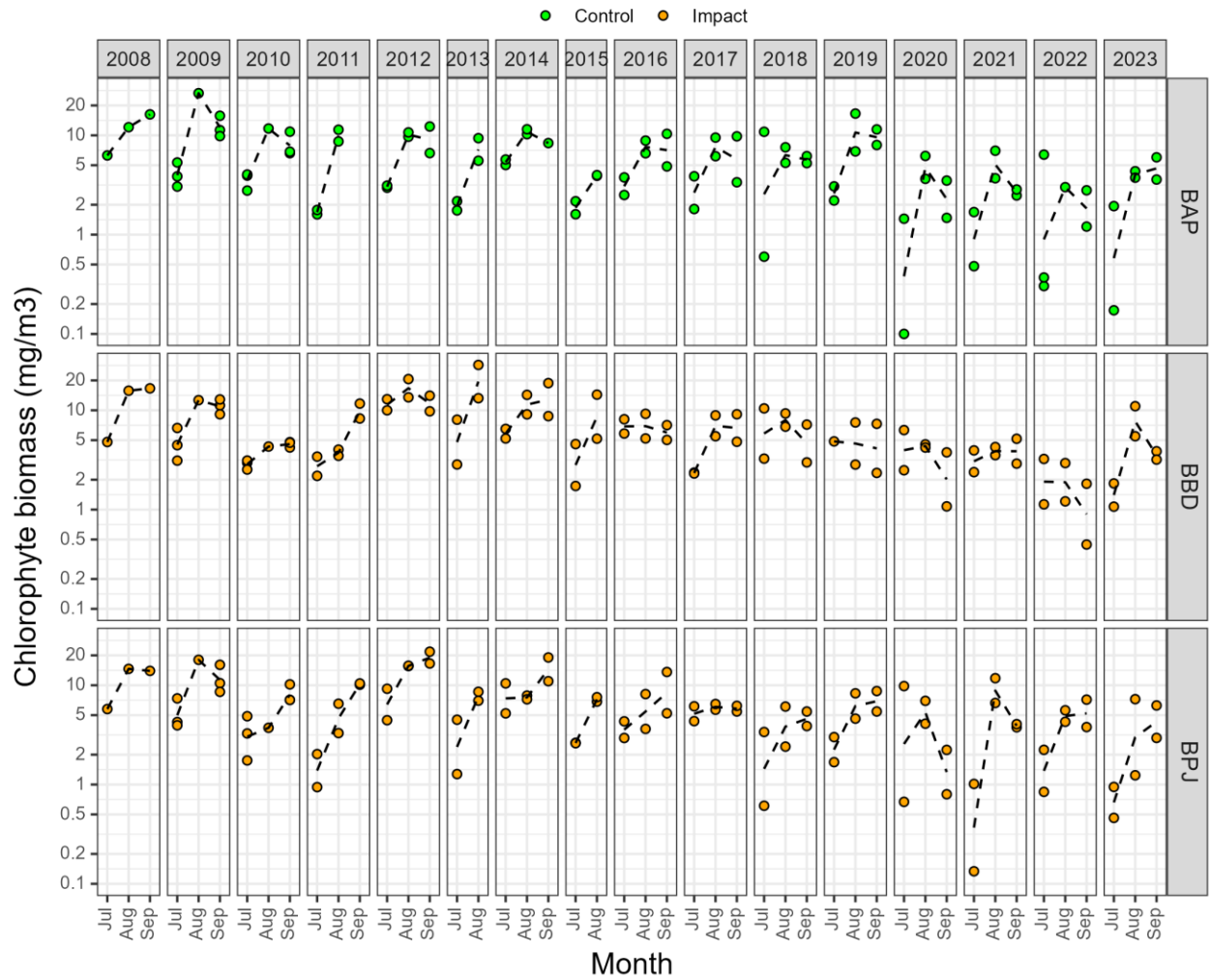
Figure D3-2. Chlorophyte biomass (mg/m³) from Baker Lake since 2008.

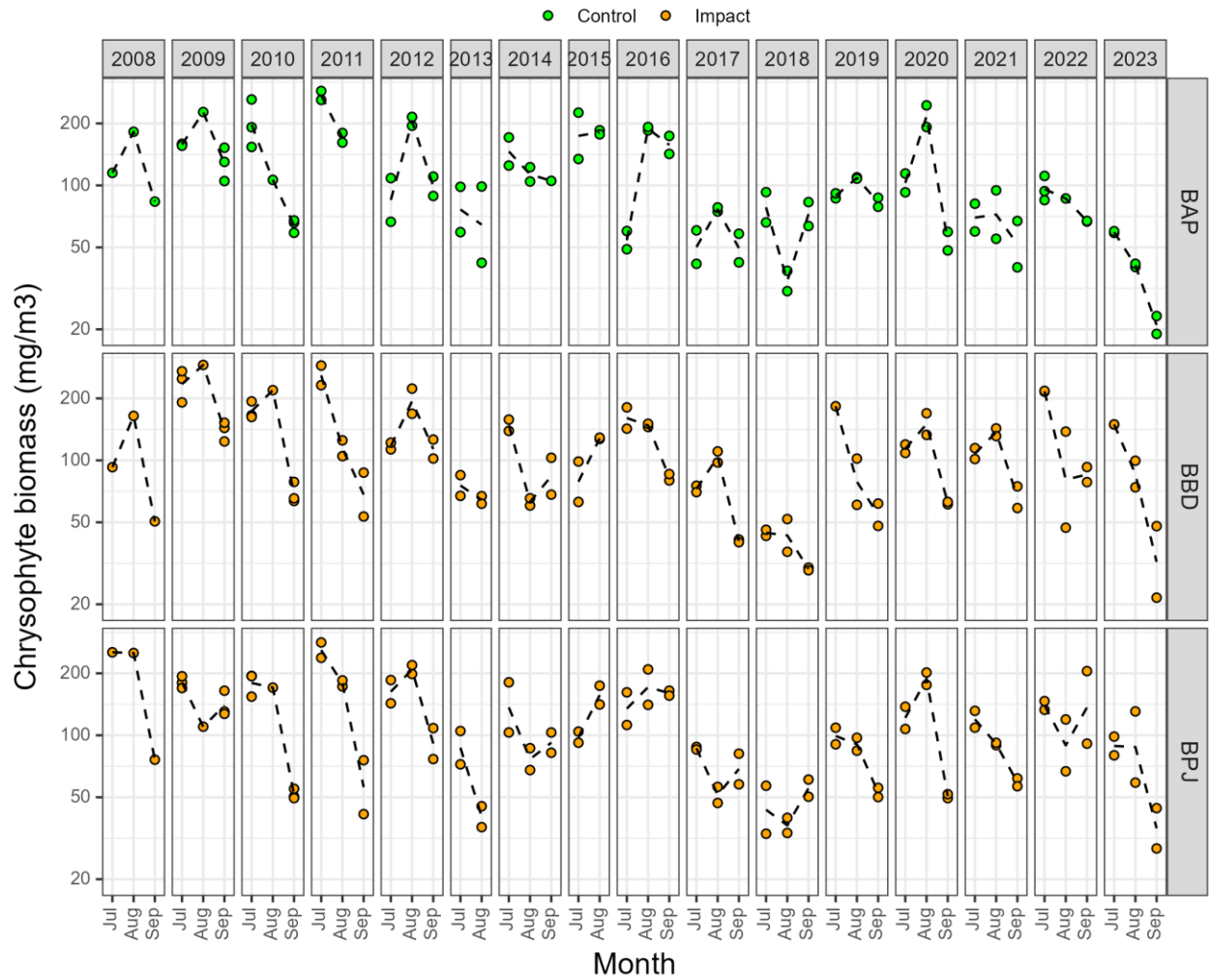
Figure D3-3. Chrysophyte biomass (mg/m³) from Baker Lake since 2008.

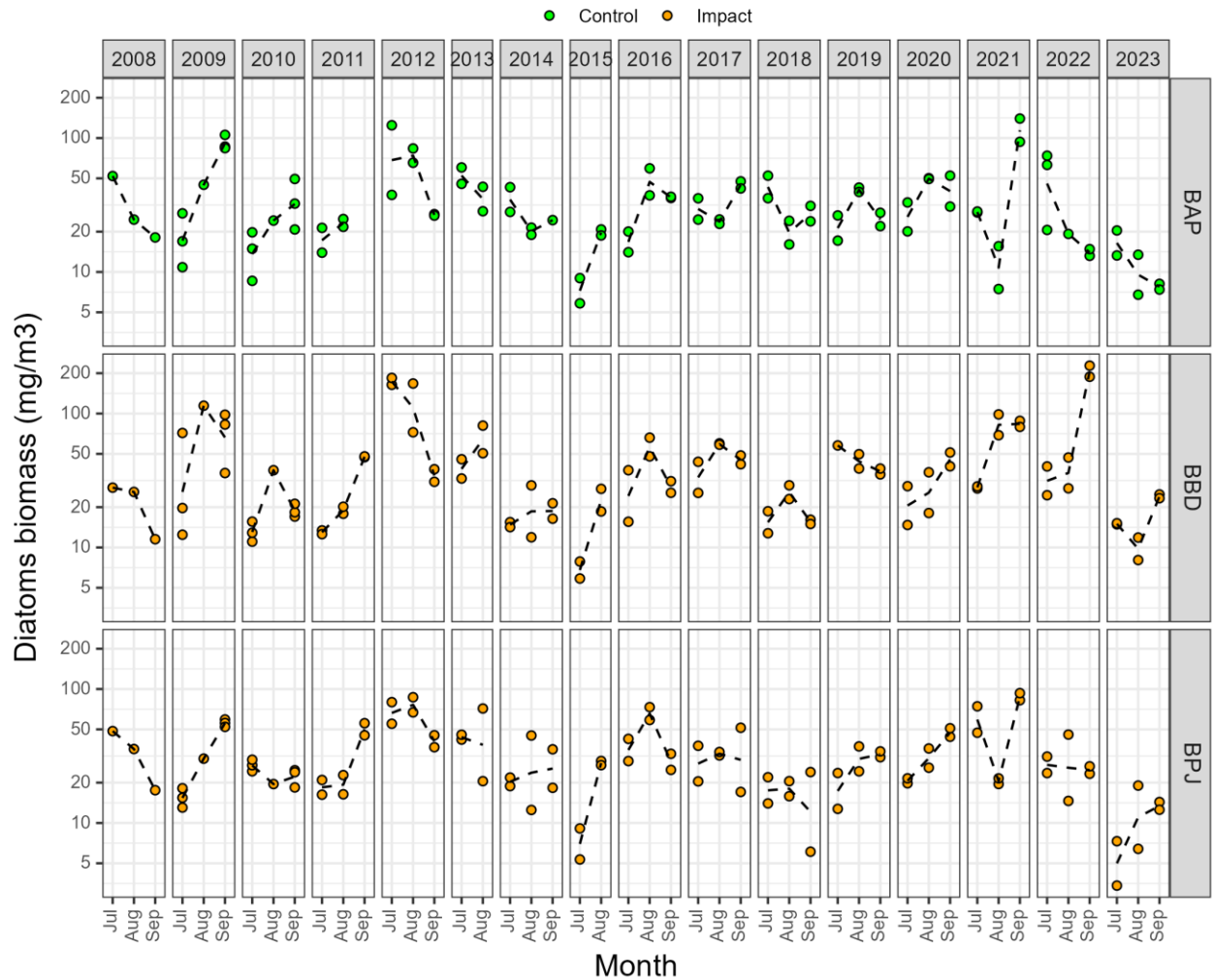
Figure D3-4. Diatoms biomass (mg/m³) from Baker Lake since 2008.

Figure D3-5. Cryptophytes biomass (mg/m³) from Baker Lake since 2008.

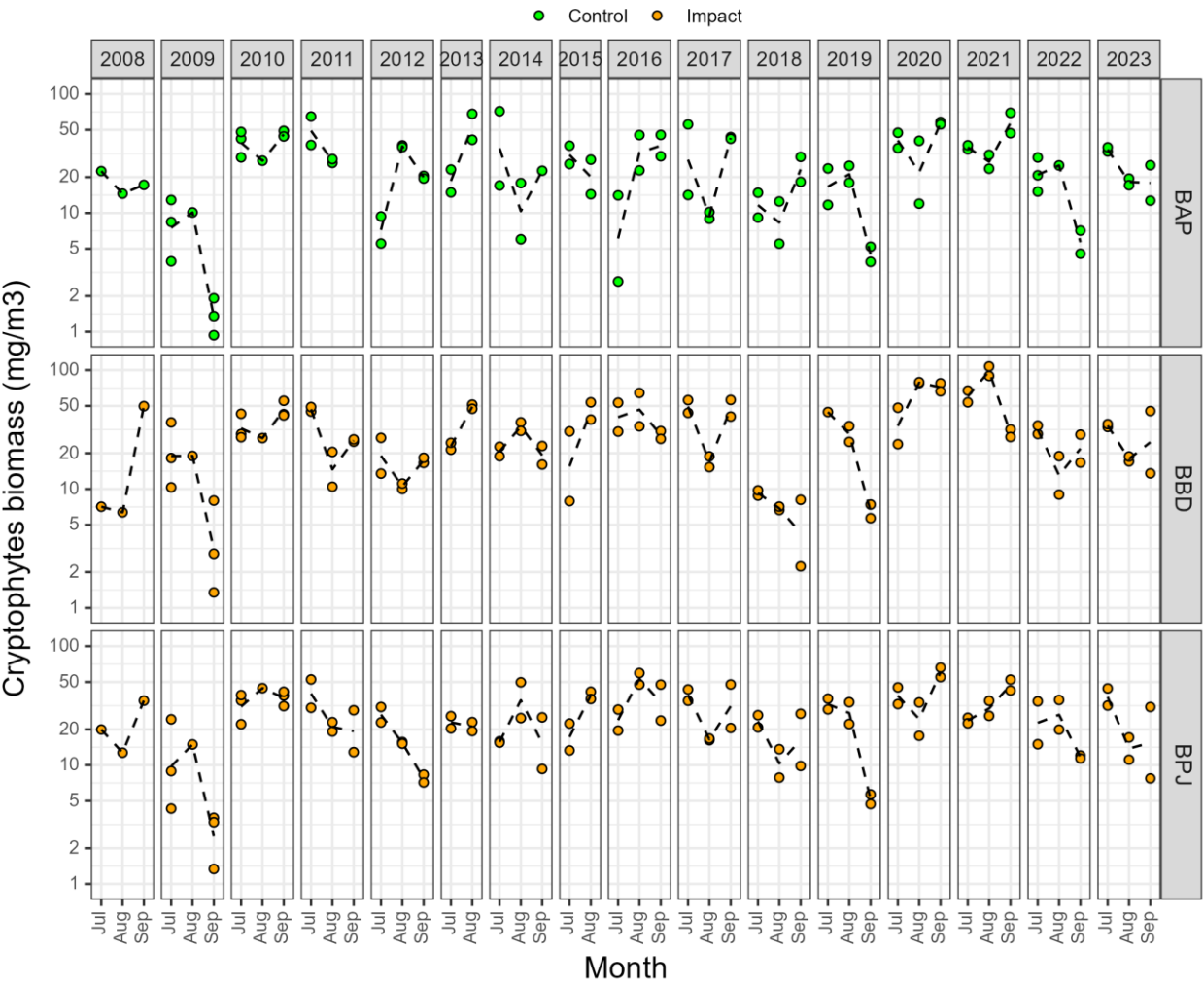


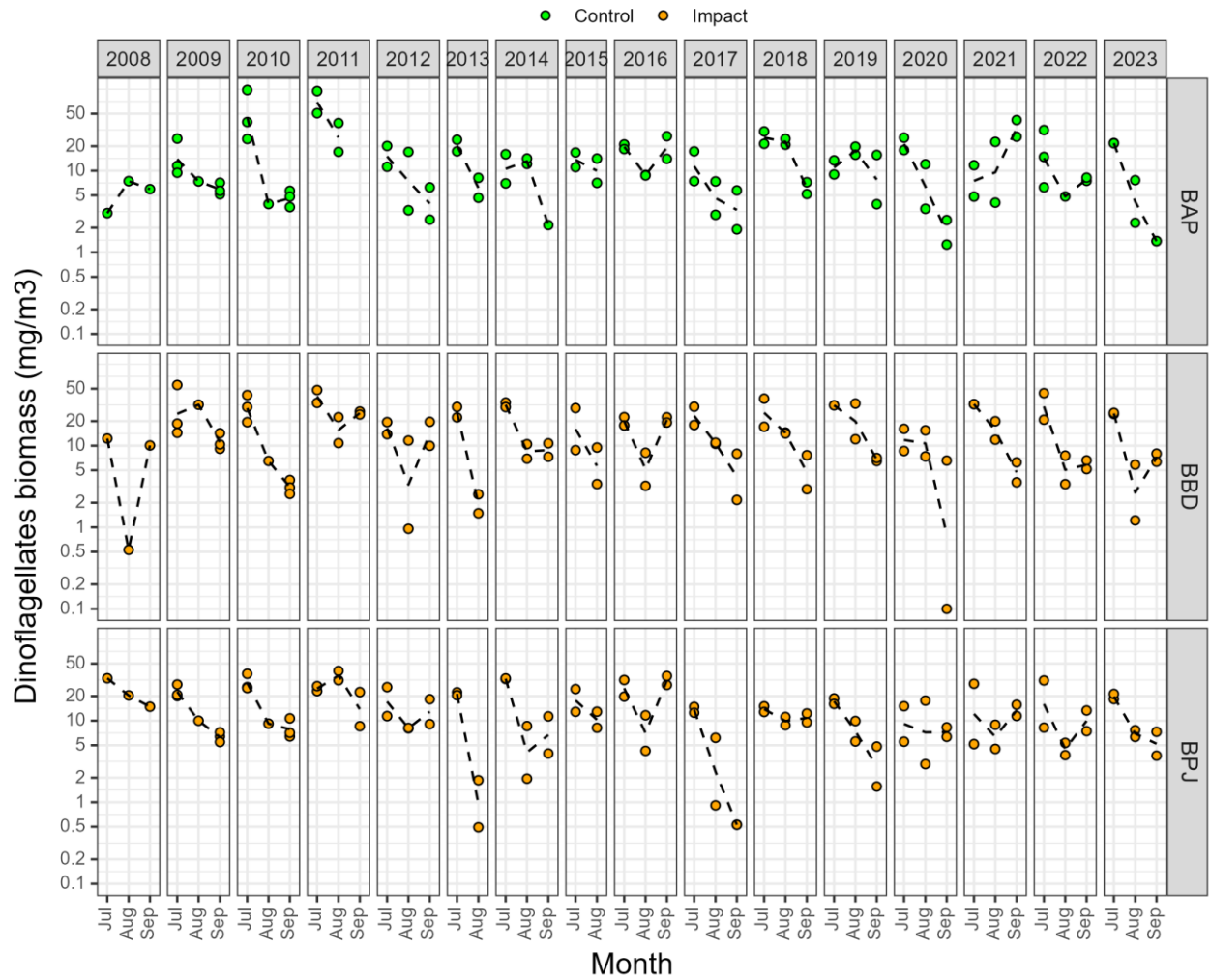
Figure D3-6. Dinoflagellates biomass (mg/m³) from Baker Lake since 2008.

Figure D3-7. Phytoplankton density (cells/L) by major taxa group from Baker Lake since 2008.

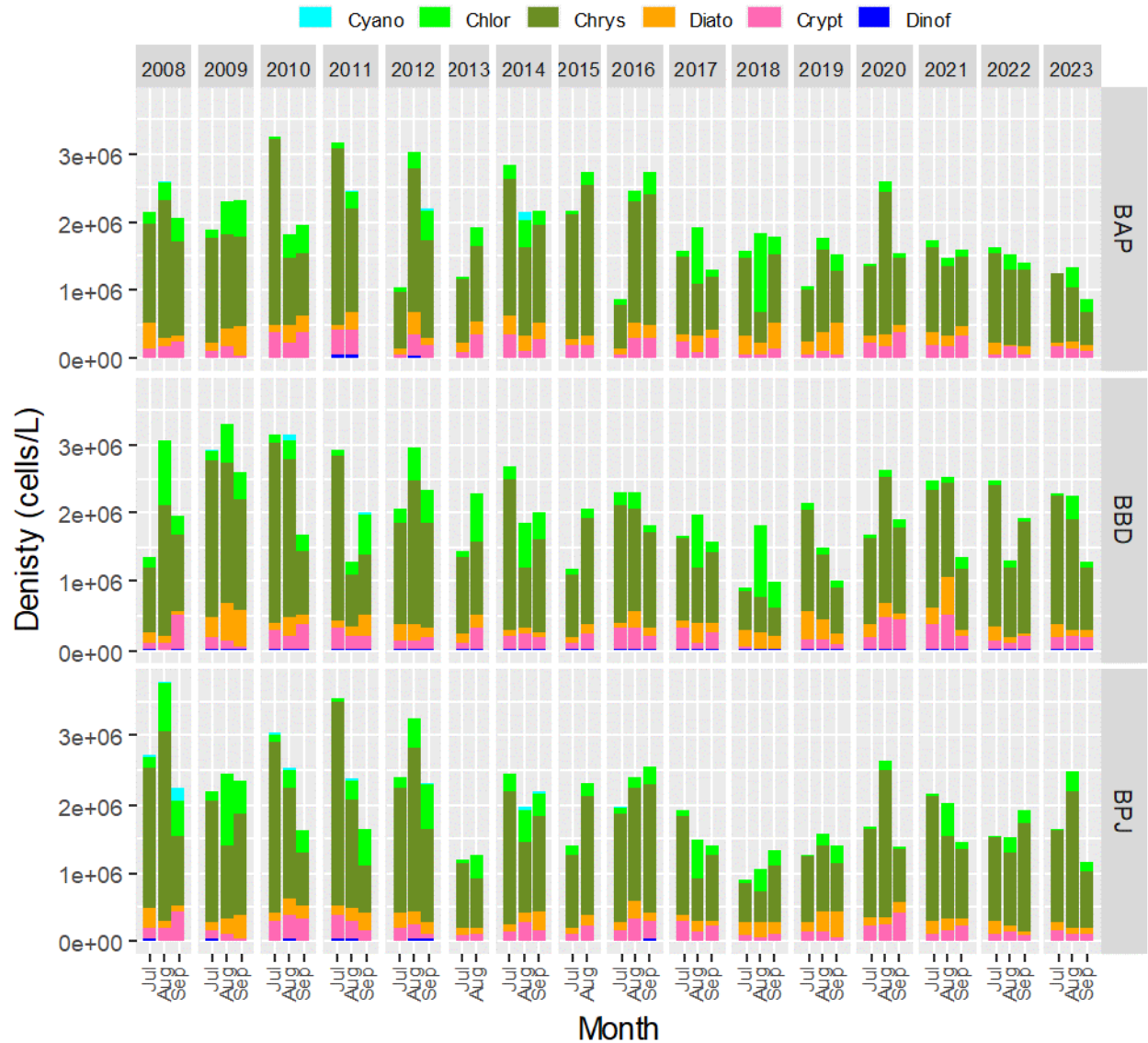


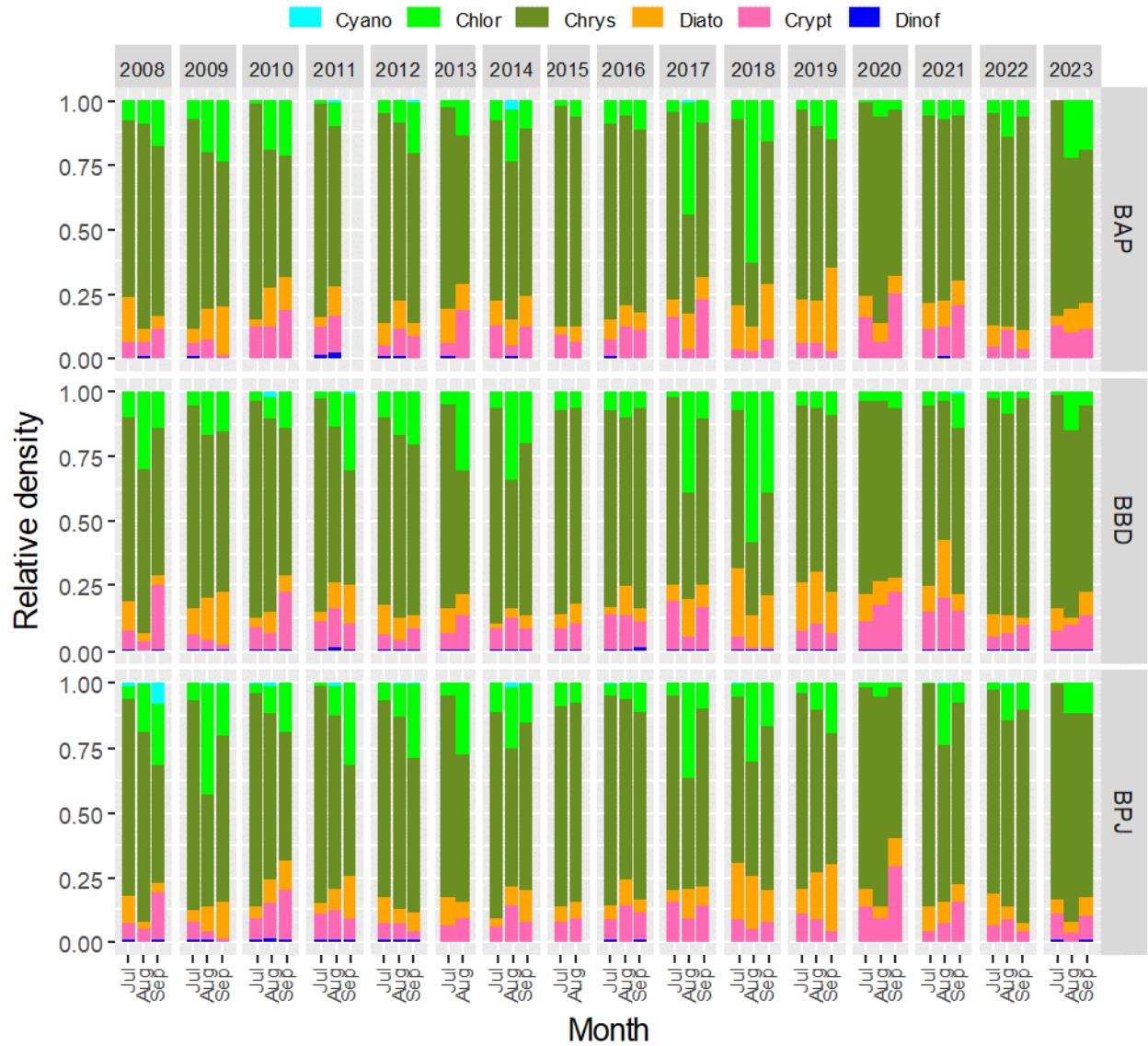
Figure D3-8. Relative phytoplankton density from Baker Lake since 2008.

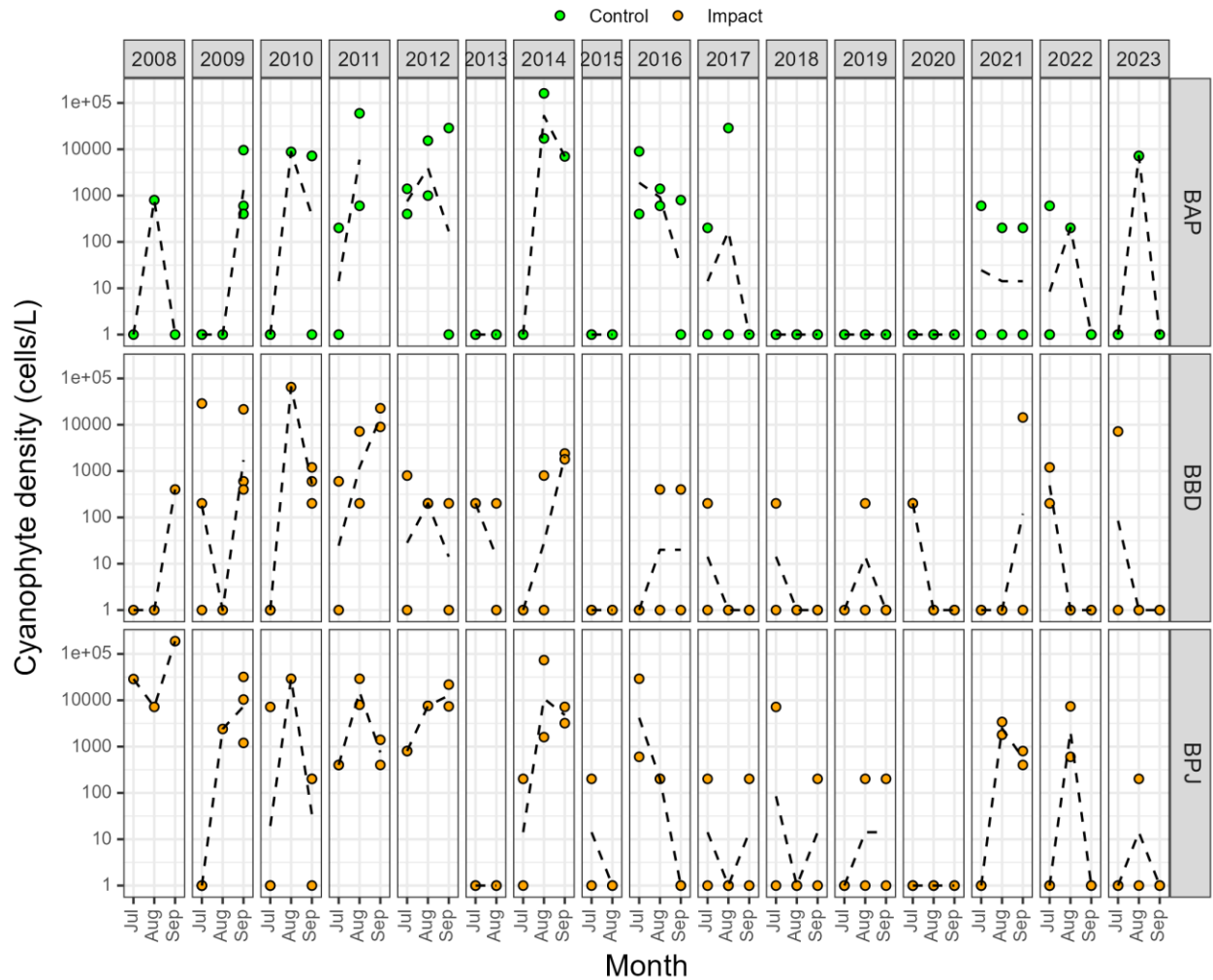
Figure D3-9. Cyanophyte density (cells/L) from Baker Lake since 2008.

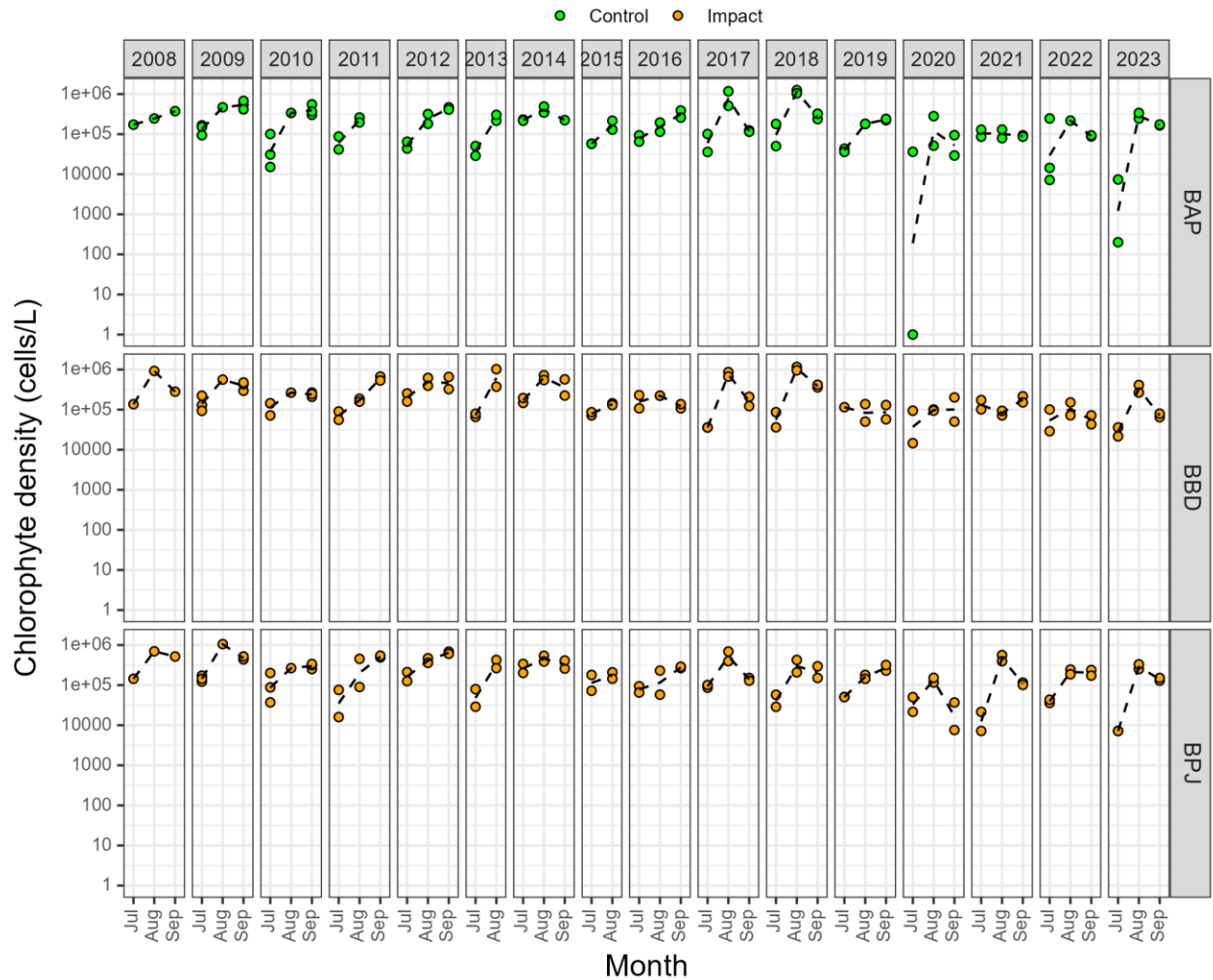
Figure D3-10. Chlorophyte density (cells/L) from Baker Lake since 2008.

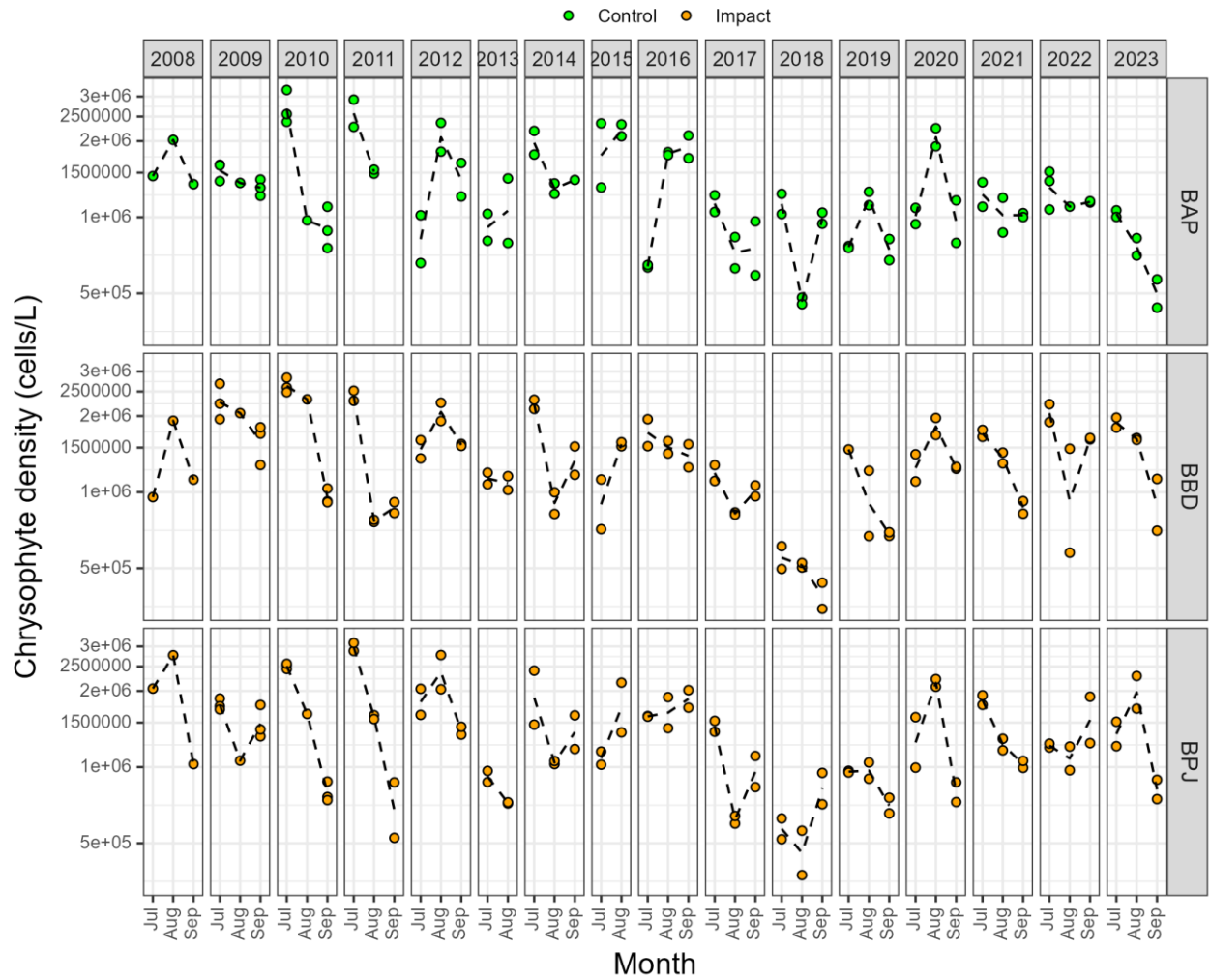
Figure D3-11. Chrysophyte density (cells/L) from Baker Lake since 2008.

Figure D3-12. Diatoms density (cells/L) from Baker Lake since 2008.

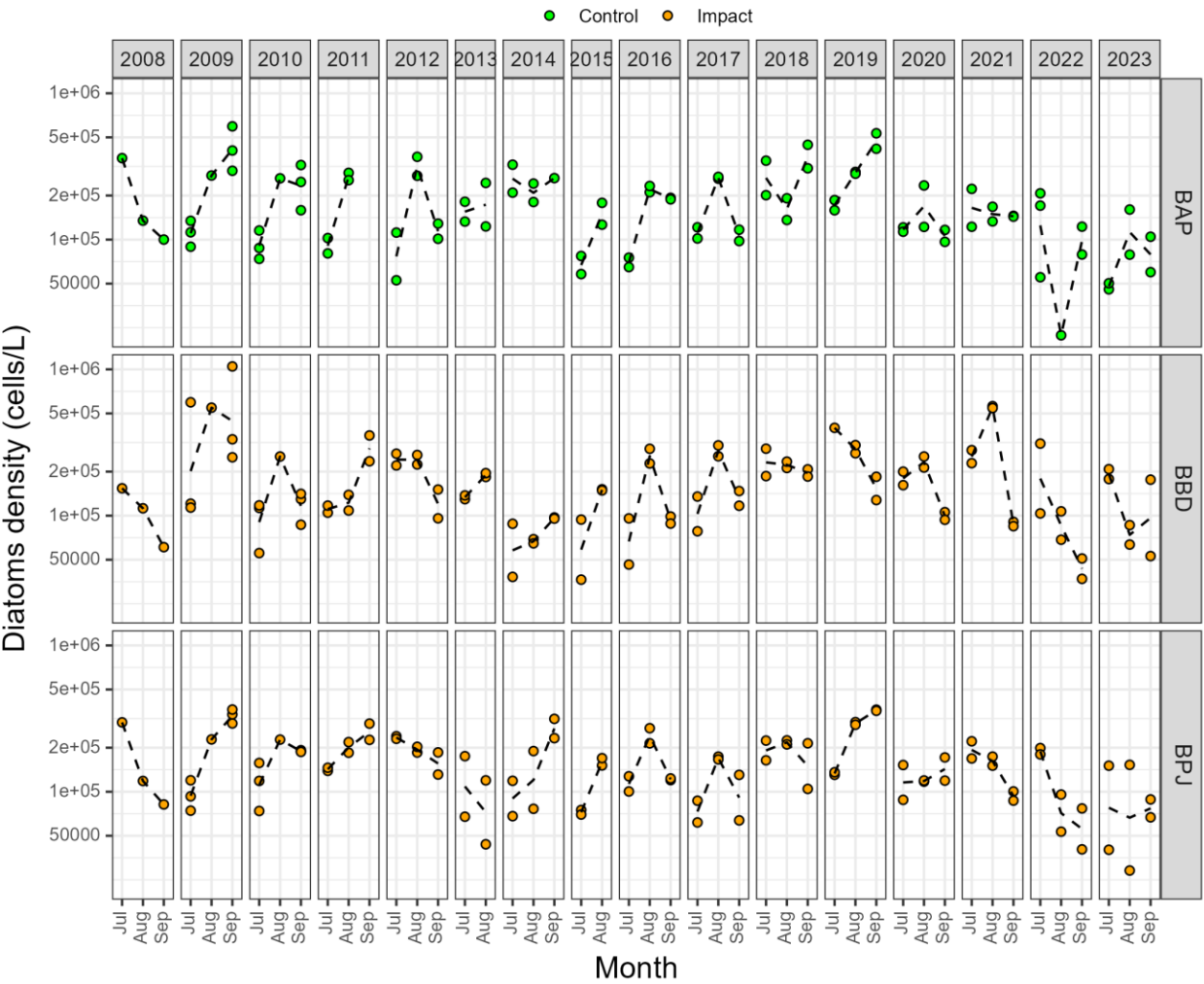


Figure D3-13. Cryptophytes density (cells/L) from Baker Lake since 2008.

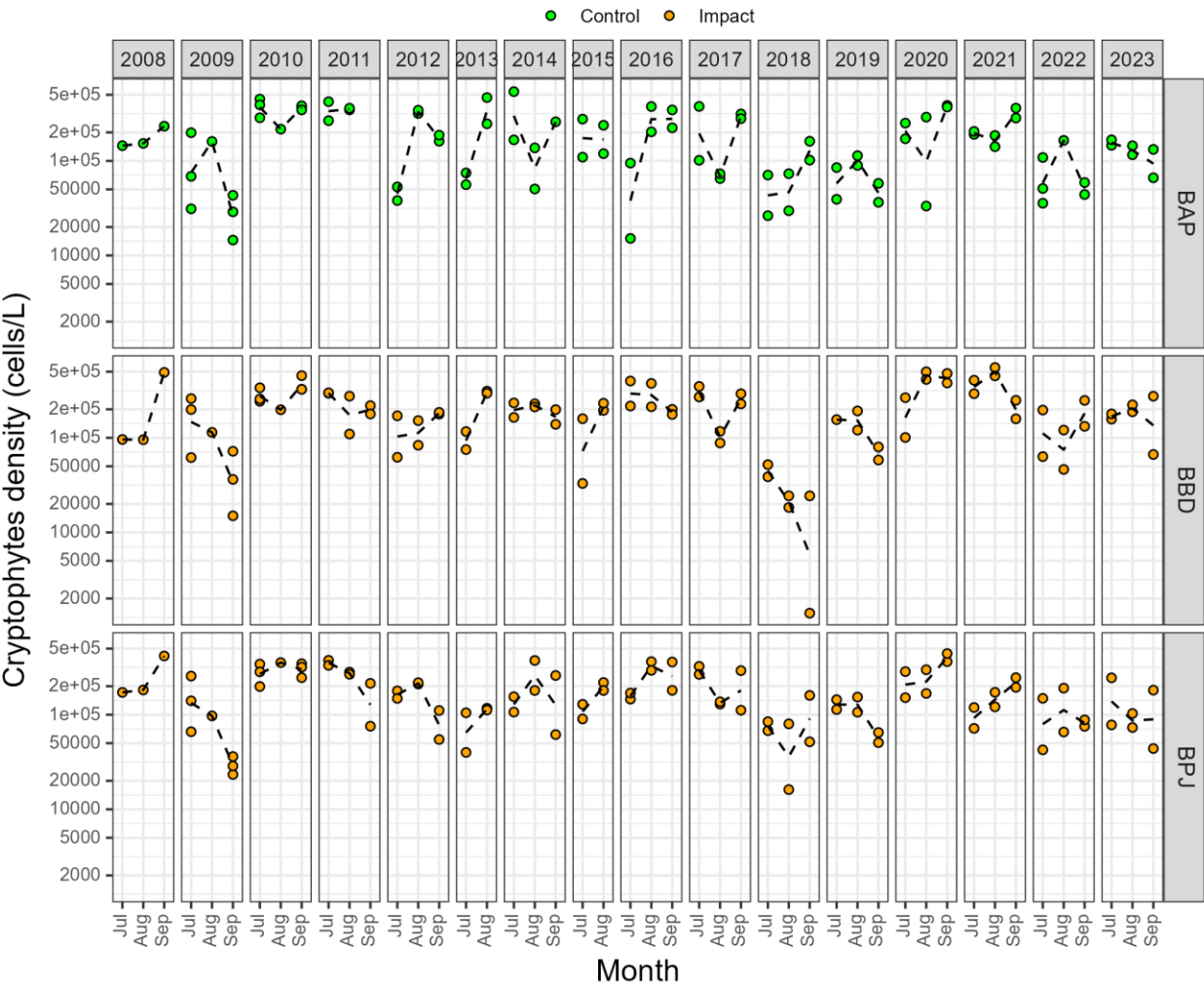


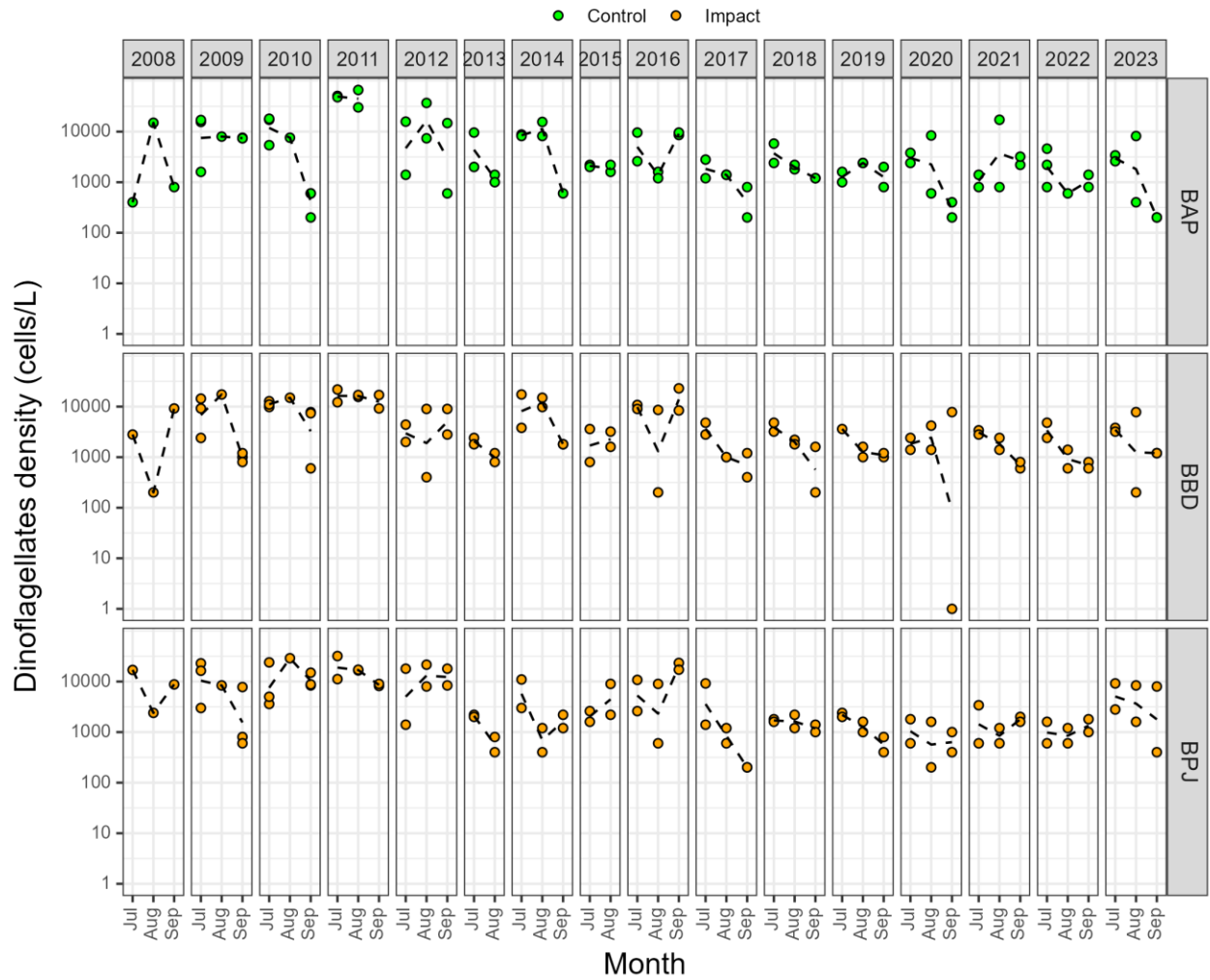
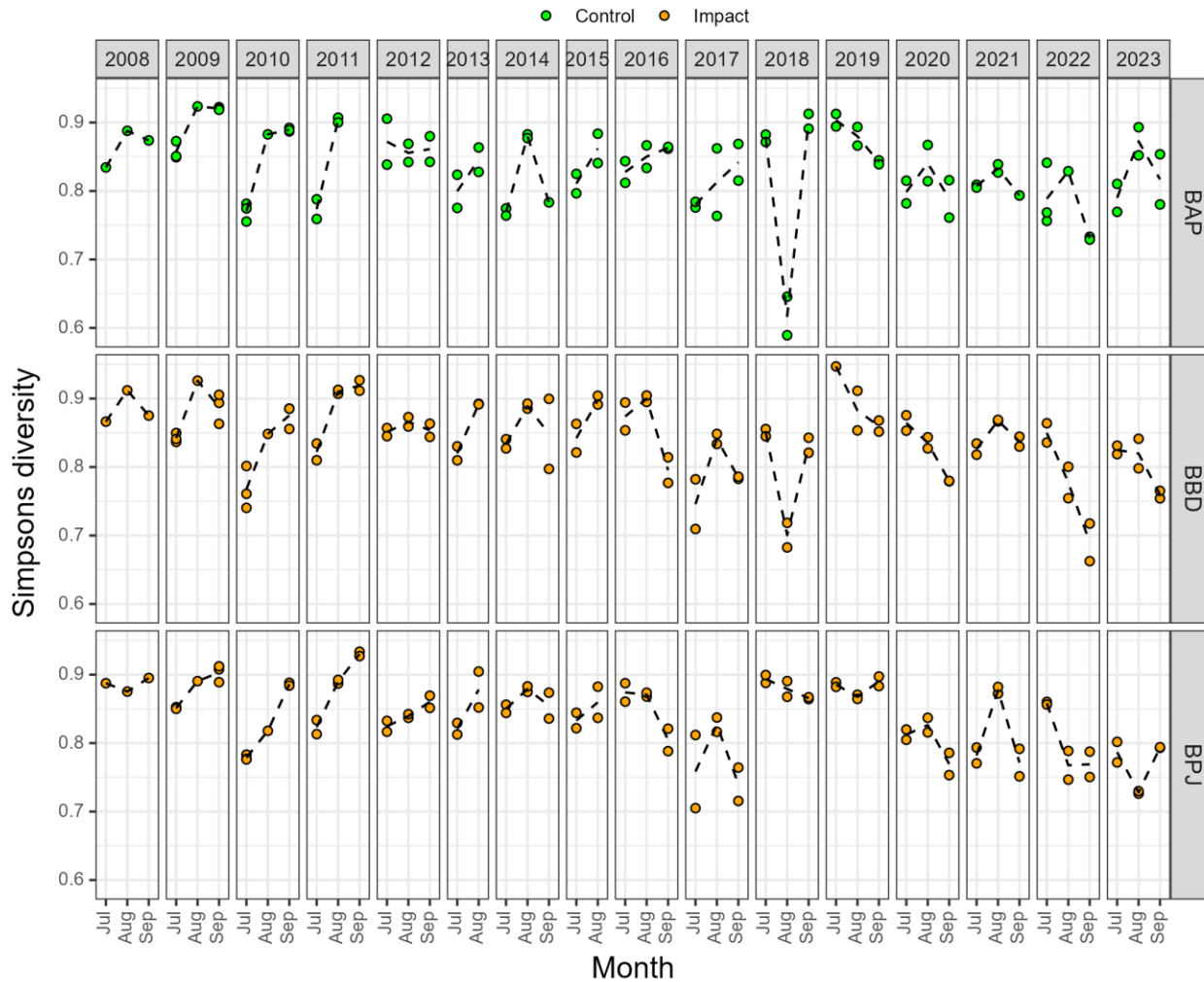
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APPENDIX E

BENTHOS TAXONOMY DATA AND SUPPLEMENTAL PLOTS

Appendix E1

Benthos Data – Meadowbank Study Area Lakes

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Table E1-1. Benthic invertebrate abundance (#/m²) and richness (# taxa) by major taxa group, Meadowbank study area lakes, 2023.

Area-Replicate	Date	Depth (m)	Abundance (#/m²)					Richness (# taxa)					Simpson's Diversity	Bray-Curtis Index	
			Oligochaetes	Insects	Molluscs	Other Taxa¹	TOTAL	Oligochaetes	Insects	Molluscs	Other Taxa¹	TOTAL			
Inuggugayualik Lake															
INUG-1	22-Aug-23	7.8	43	2,978	370	22	3,413	1	10	3	1	15	0.53	0.41	
INUG-2	22-Aug-23	8	43	1,109	457	22	1,630	2	5	3	1	11	0.72	0.10	
INUG-3	22-Aug-23	8.0	22	1,217	196	22	1,457	1	10	3	1	15	0.67	0.20	
INUG-4	22-Aug-23	8.4	0	1,087	109	0	1,196	0	7	1	0	8	0.58	0.18	
INUG-5	22-Aug-23	7.5	0	804	478	0	1,283	0	8	3	0	11	0.87	0.33	
Area Mean			22	1,439	322	13	1,796	0.8	8.0	2.6	0.6	12.0	0.67	0.24	
Pipedream Lake															
PDL-1	22-Aug-23	8.6	22	522	196	0	739	1	3	2	0	6	0.66	0.07	
PDL-2	22-Aug-23	9.0	174	1,022	196	43	1,435	2	4	2	2	10	0.73	0.47	
PDL-3	22-Aug-23	8.5	22	696	304	43	1,065	1	3	2	2	8	0.73	0.13	
PDL-4	22-Aug-23	8.9	22	587	174	174	957	1	3	2	2	8	0.77	0.11	
PDL-5	22-Aug-23	8.8	22	870	217	43	1,152	1	6	2	2	11	0.82	0.13	
Area Mean			52	739	217	60.9	1,070	1.2	3.8	2.0	1.6	8.6	0.74	0.18	
Second Portage Lake															
SP-1	14-Aug-23	9.3	43	1,065	413	43	1,565	1	11	2	1	15	0.90	0.41	
SP-2	14-Aug-23	8.3	0	1,152	370	43	1,565	0	8	2	2	12	0.85	0.52	
SP-3	14-Aug-23	7.0	65	1,565	326	0	1,957	2	9	2	0	13	0.88	0.27	
SP-4	14-Aug-23	7.7	43	696	304	0	1,043	1	6	2	0	9	0.83	0.42	
SP-5	14-Aug-23	9.3	22	413	304	0	739	1	5	2	0	8	0.86	0.38	
Area Mean			35	978	343	17	1,374	1.0	7.8	2.0	0.6	11.4	0.87	0.40	
Third Portage Lake - East Basin															
TPE-1	11-Aug-23	7.5	87	1,130	348	0	1,565	3	10	2	0	15	0.89	0.52	
TPE-2	11-Aug-23	8.2	22	913	435	0	1,370	1	8	2	0	11	0.88	0.54	
TPE-3	11-Aug-23	7.6	304	2,848	478	0	3,630	3	9	2	0	14	0.86	0.62	
TPE-4	11-Aug-23	6.5	43	630	565	0	1,239	2	7	2	0	11	0.83	0.56	
TPE-5	11-Aug-23	6.6	43	1,109	609	22	1,783	1	7	2	1	11	0.88	0.53	
Area Mean			100	1,326	487	4	1,917	2.0	8.2	2.0	0.2	12.4	0.87	0.55	
Third Portage Lake - North Basin															
TPN-1	12-Aug-23	9.5	22	652	130	0	804	1	7	2	0	10	0.89	0.30	
TPN-2	12-Aug-23	8.6	22	457	43	22	543	1	7	2	1	11	0.85	0.58	
TPN-3	12-Aug-23	7.5	196	348	304	0	848	2	4	2	0	8	0.84	0.31	
TPN-4	12-Aug-23	7.7	22	500	174	0	696	1	7	1	0	9	0.82	0.54	
TPN-5	12-Aug-23	9.1	22	217	87	0	326	1	3	2	0	6	0.82	0.42	
Area Mean			57	435	148	4	643	1.2	5.6	1.8	0.2	8.8	0.85	0.43	
Wally Lake															
WAL-1	21-Aug-23	7.9	22	457	239	22	739	1	6	2	1	10	0.77	0.66	
WAL-2	21-Aug-23	9.5	22	5,196	130	43	5,391	1	9	2	2	14	0.58	0.63	
WAL-3	21-Aug-23	8.8	22	4,326	370	22	4,739	1	6	1	1	9	0.49	0.66	
WAL-4	21-Aug-23	7.5	0	3,130	391	43	3,565	0	7	2	2	11	0.55	0.60	
WAL-5	21-Aug-23	7.1	22	2,109	391	22	2,543	1	5	2	1	9	0.58	0.62	
Area Mean			17	3,043	304	30	3,396	0.8	6.6	1.8	1.4	10.6	0.60	0.63	

Notes:

1. "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, Pionidae, Harpacticoida, O. Notostraca, and Gammaracanthidae).



Table E1-2. Raw benthic invertebrate data from the Meadowbank study area lakes 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Meadowbank									
	Inuggugyuulik Lake INUG Control					Pipedream Lake PDL Control				
	1	2	3	4	5	1	2	3	4	5
	22-Aug-23 7.8	22-Aug-23 8.0	22-Aug-23 8.0	22-Aug-23 8.4	22-Aug-23 7.5	22-Aug-23 8.6	22-Aug-23 9.0	22-Aug-23 8.5	22-Aug-23 8.9	22-Aug-23 8.8
ROUNDWORMS										
P. Nemata	1	10	-	1	4	-	2	1	12	4
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
Indeterminate	-	-	-	-	-	-	-	-	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-
F. Naididae										
S.F. Naidinae										
Nais	-	-	-	-	-	-	-	-	-	-
S.F. Tubificinae										
Immatures with hair chaetae	-	-	-	-	-	-	5	1	-	-
Immatures without hair chaetae	-	-	-	-	-	1	-	-	-	-
S.F. Rhyacodrilinae										
Rhyacodrilus coccineus	-	1	-	-	-	-	-	-	-	-
Rhyacodrilus montana	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae										
Lumbriculus	2	1	1	-	-	-	3	-	1	1
Indeterminate	-	-	-	-	-	-	-	-	-	-
ARTHROPODS										
P. Arthropoda										
MITES										
Cl. Arachnida										
O. Acarina										
Immature	-	-	-	-	-	-	-	-	-	-
F. Acarytonotidae										
Acarystonotus	-	-	-	-	-	-	-	1	-	1
F. Hygrobatidae										
Hygrobatas	-	-	-	-	-	-	-	-	-	-
F. Lebertidae										
Lebertia	-	1	1	-	-	-	1	-	5	-
F. Oxidae										
Oxus	1	-	-	-	-	-	1	1	3	1
F. Pionidae										
Indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS										
O. Harpacticoida	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
Cl. Ostracoda	2	1	-	1	3	7	16	9	9	8
INSECTS										
Cl. Insecta										
CADDISFLIES										
O. Trichoptera										
Immature	-	-	-	-	-	-	-	-	-	-
F. Apataniidae										
Apatania	-	-	-	-	-	-	-	-	-	-
F. Hydroptilidae										
Agraylea	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae										
Grensia proterita	-	-	-	-	-	-	-	-	-	1
TRUE FLIES										
O. Diptera										
MIDGES										
F. Chironomidae										
chironomid pupae	-	-	-	-	-	-	-	-	-	-
S.F. Chironominae										
Cladotanytarsus	-	-	-	-	-	-	-	-	-	-
Contempellina	-	-	-	-	-	-	-	-	-	-
Corynocera ambigua	1	-	1	2	-	-	-	-	-	-
Cryptochironomus	-	-	-	-	-	-	-	-	-	-
Dicranetipides	-	-	-	-	-	-	-	-	-	-
Microspectra	107	37	38	35	15	-	1	-	-	-
Microtanipides	10	5	5	7	7	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-
Parachadapelmia	-	-	-	-	-	-	-	-	-	-
Paratanytarsus	3	5	2	2	5	-	-	-	-	-
Polypedilum	-	-	-	-	-	-	-	-	-	-
Sergentia	-	-	-	-	-	-	-	-	-	-
Stempellina	-	-	-	-	-	-	-	-	-	-
Stictochironomus	3	-	3	2	5	18	31	22	19	18
Tanytarsus	-	-	1	-	2	-	-	-	-	-
S.F. Diamesinae										
Patthastia	-	-	-	-	-	-	-	-	-	-
Protanytus	2	2	-	-	-	-	-	-	-	1
Pseudodiamesa	-	-	-	-	-	-	-	-	-	-
S.F. Orthoclaadiinae										
Abiskomyia	-	-	-	-	-	-	-	-	-	-
Cricotopus/Orthocladus	-	-	-	-	-	-	-	-	-	-
Eukiefferella	-	-	-	-	-	-	-	-	-	-
Heterotrissocladius	1	-	1	-	-	-	-	-	-	-
Mesocricotopus	-	-	-	-	-	-	-	-	-	-
Paraccladius	-	-	-	-	-	-	-	-	-	-
Psectrocladius	6	-	3	1	1	-	1	-	-	3
Zalutschia	-	-	-	-	-	-	-	-	-	-
Orthoclaadiinae Genus "Greenland"	-	-	-	-	-	-	-	-	-	-
Indeterminate	-	-	-	-	-	-	-	-	-	-
S.F. Prodiamesinae										
Monodiamesa	2	2	1	1	1	1	-	2	2	6
S.F. Tanypodinae										
Ablabesmyia	-	-	-	-	-	-	-	-	-	-
Procladius	2	-	-	-	1	5	14	8	6	11
Thienemannimyia complex	-	-	1	-	-	-	-	-	-	-
F. Empididae										
Chelifera/Metochela	-	-	-	-	-	-	-	-	-	-
MOLLUSCS										
P. Mollusca										
SNAILS										
Cl. Gastropoda										
F. Valvatidae										
Valvata lewisi	-	-	-	-	-	-	-	-	-	-
Valvata	-	-	-	-	-	-	-	-	-	-
CLAMS										
Cl. Bivalvia										
F. Sphaeriidae										
Psidium/Cyclacalyx	10	12	3	5	10	8	3	11	6	6
Psidium (Cyclacalyx/Neopisidium)	3	1	4	-	5	1	6	3	2	4
Sphaerium nitidum	4	8	2	-	7	-	-	-	-	-

Table E1-2. Raw benthic invertebrate data from the Meadowbank study area lakes 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Meadowbank									
	Inuggugyuulik Lake INUG Control					Pipedream Lake PDL Control				
	1	2	3	4	5	1	2	3	4	5
	22-Aug-23 7.8	22-Aug-23 8.0	22-Aug-23 8.0	22-Aug-23 8.4	22-Aug-23 7.5	22-Aug-23 8.6	22-Aug-23 9.0	22-Aug-23 8.5	22-Aug-23 8.9	22-Aug-23 8.8
TOTAL NUMBER OF ORGANISMS	160	86	67	57	66	41	84	59	65	65
TOTAL NUMBER OF TAXA ^a	17	13	15	10	13	7	12	10	10	13
^a Bold entries excluded from taxa count										
R (Richness) - totals ^{2,3}										
Total	15	11	15	8	11	6	10	8	8	11
Oligochaete	1	2	1	0	0	1	2	1	1	1
Insect	10	5	10	7	8	3	4	3	3	6
Mollusc	3	3	3	1	3	2	2	2	2	2
Other ⁴	1	1	1	0	0	0	2	2	2	2
Abundance (raw) - totals ^{5,6}										
Total	157	75	67	55	59	34	66	49	44	53
Oligochaete	2	2	1	0	0	1	8	1	1	1
Insect	137	51	56	50	37	24	47	32	27	40
Mollusc	17	21	9	5	22	9	9	14	8	10
Other ⁴	1	1	1	0	0	0	2	2	8	2
N (Abundance) - #/m³										
Total	3,413	1,630	1,457	1,196	1,283	739	1,435	1,065	957	1,152
Oligochaete	43	43	22	0	0	22	174	22	22	22
Insect	2,978	1,109	1,217	1,087	804	522	1,022	696	587	870
Mollusc	370	457	196	109	478	196	196	304	174	217
Other ⁴	22	22	22	0	0	0	43	43	174	43

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertidae, F. Oxidae, F. Plonidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m³).

Table E1-2. Raw benthic invertebrate data from the Meadowbank study area lakes 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Meadowbank									
	Second Portage Lake					Third Portage Lake - East Basin				
	SP Impact					TPE Impact				
	1 14-Aug-23 9.3	2 14-Aug-23 8.3	3 14-Aug-23 7.0	4 14-Aug-23 7.7	5 14-Aug-23 9.3	1 11-Aug-23 7.5	2 11-Aug-23 8.2	3 11-Aug-23 7.6	4 11-Aug-23 6.5	5 11-Aug-23 6.6
ROUNDWORMS										
<i>P. Nemata</i>	3	8	3	5	8	1	2	1	4	-
FLATWORMS										
<i>P. Platyhelminthes</i>										
<i>Cl. Turbellaria</i>										
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
ANNELIDS										
<i>P. Annelida</i>										
WORMS										
<i>Cl. Oligochaeta</i>										
<i>F. Enchytraeidae</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Naididae</i>										
<i>S.F. Naidinae</i>										
<i>Nais</i>	-	-	-	-	-	-	-	1	-	-
<i>S.F. Tubificinae</i>										
<i>Immatures with hair chaetae</i>	2	-	2	2	-	1	1	-	-	-
<i>Immatures without hair chaetae</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Rhyacodrilinae</i>										
<i>Rhyacodrilus coccineus</i>	-	-	-	-	-	1	-	11	1	2
<i>Rhyacodrilus montana</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Lumbriculidae</i>										
<i>Lumbriculus</i>	-	-	1	-	1	2	-	2	1	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
ARTHROPODS										
<i>P. Arthropoda</i>										
MITES										
<i>Cl. Arachnida</i>										
<i>O. Acarina</i>										
<i>Immature</i>						-	-	2	-	-
<i>F. Acarytonotidae</i>										
<i>Acarytonotus</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Hygrobatidae</i>										
<i>Hygrobat</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Lebertidae</i>										
<i>Lebertia</i>	-	1	-	-	-	-	-	-	-	1
<i>F. Oxidae</i>	2	1	-	-	-	-	-	-	-	-
<i>Oxus</i>										
<i>F. Pionidae</i>										
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
HARPACTICIDS										
<i>O. Harpacticoida</i>	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
<i>Cl. Ostracoda</i>	5	5	5	1	-	66	34	208	25	32
INSECTS										
<i>Cl. Insecta</i>										
CADDISFLIES										
<i>O. Trichoptera</i>										
<i>Immature</i>						-	-	-	-	-
<i>F. Apataniidae</i>										
<i>Apatania</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Hydroptilidae</i>										
<i>Agraylea</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Limnephilidae</i>										
<i>Grensia proterita</i>	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
<i>O. Diptera</i>										
MIDGES										
<i>F. Chironomidae</i>										
<i>chironomid pupae</i>	-	-	-	-	1	1	2	2	1	3
<i>S.F. Chironominae</i>										
<i>Cladotanytarsus</i>	3	-	-	-	-	-	-	-	-	-
<i>Constempellina</i>	-	-	-	-	-	-	-	-	-	-
<i>Corynocera ambigua</i>	-	-	-	-	-	-	-	-	-	-
<i>Cryptochironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Dicoretendipes</i>	-	-	-	-	-	-	-	-	-	-
<i>Microsetodes</i>	8	7	23	14	-	4	2	4	8	4
<i>Microtendipes</i>	6	-	7	-	1	-	-	-	-	-
<i>Parachironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Paraclopedina</i>	-	-	-	-	-	-	-	-	-	-
<i>Paratanytarsus</i>	2	5	7	1	5	17	7	43	6	13
<i>Polypedilum</i>	-	-	-	-	-	-	-	-	-	-
<i>Sergentia</i>	-	-	-	-	-	1	-	-	-	-
<i>Stempellina</i>	-	-	-	-	-	-	-	-	-	-
<i>Stictochironomus</i>	6	3	8	1	2	10	8	15	1	10
<i>Tanytarsus</i>	4	3	3	-	-	-	-	-	-	-
<i>S.F. Diamesinae</i>										
<i>Patthastia</i>	-	-	-	-	-	1	-	-	-	-
<i>Protanypus</i>	-	-	1	-	-	-	-	-	1	-
<i>Pseudodiamesa</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Orthoclaadiinae</i>										
<i>Abiskomyia</i>	-	-	-	-	-	-	-	-	-	-
<i>Cricotopus/Orthocladus</i>	-	-	-	-	-	-	-	-	-	-
<i>Eukiefferiella</i>	-	-	-	-	-	-	-	-	-	-
<i>Heterotrissocladius</i>	2	-	-	-	-	1	2	4	1	2
<i>Mesocricotopus</i>	-	-	-	-	-	-	-	-	-	-
<i>Paracloadius</i>	-	-	-	-	-	-	-	-	-	-
<i>Psectrocladius</i>	3	18	9	7	3	8	13	37	9	14
<i>Zalutschia</i>	-	-	-	-	-	-	-	-	-	-
<i>Orthoclaadiinae Genus "Greenland"</i>	-	-	-	-	-	-	-	1	-	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Prodiamesinae</i>										
<i>Monodiamesa</i>	1	1	5	1	-	3	3	2	-	2
<i>S.F. Tanypodinae</i>										
<i>Ablabesmyia</i>	-	-	-	-	-	-	-	-	-	-
<i>Procladius</i>	13	15	9	8	7	1	3	10	2	3
<i>Thienemannimyia complex</i>	1	1	-	-	-	5	2	13	-	-
<i>F. Empididae</i>										
<i>Chelifer/Metochela</i>	-	-	-	-	-	-	-	-	-	-
MOLLUSCS										
<i>P. Mollusca</i>										
SNAILS										
<i>Cl. Gastropoda</i>										
<i>F. Valvatidae</i>										
<i>Valvata lewisi</i>	-	-	-	-	-	-	-	-	-	-
<i>Valvata</i>	-	-	-	-	-	-	-	-	-	-
CLAMS										
<i>Cl. Bivalvia</i>										
<i>F. Sphaeriidae</i>										
<i>Psidium/Cyclacalyx</i>	13	13	10	10	9	8	7	12	19	15
<i>Psidium (Cyclacalyx/Neopisidium)</i>	6	4	5	4	5	8	13	10	7	13
<i>Sphaerium nitidum</i>	-	-	-	-	-	-	-	-	-	-

Table E1-2. Raw benthic invertebrate data from the Meadowbank study area lakes 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Meadowbank									
	Second Portage Lake SP Impact					Third Portage Lake - East Basin TPE Impact				
	1	2	3	4	5	1	2	3	4	5
	14-Aug-23 9.3	14-Aug-23 8.3	14-Aug-23 7.0	14-Aug-23 7.7	14-Aug-23 9.3	11-Aug-23 7.5	11-Aug-23 8.2	11-Aug-23 7.6	11-Aug-23 6.5	11-Aug-23 6.6
TOTAL NUMBER OF ORGANISMS	80	85	98	54	42	139	99	378	86	114
TOTAL NUMBER OF TAXA ^a	17	14	15	11	9	17	13	17	13	12
^a Bold entries excluded from taxa count										
R (Richness) - totals ^{2,3}										
Total	15	12	13	9	8	15	11	14	11	11
Oligochaete	1	0	2	1	1	3	1	3	2	1
Insect	11	8	9	6	5	10	8	9	7	7
Mollusc	2	2	2	2	2	2	2	2	2	2
Other ⁴	1	2	0	0	0	0	0	0	0	1
Abundance (raw) - totals ^{5,6}										
Total	72	72	90	48	34	72	63	167	57	82
Oligochaete	2	0	3	2	1	4	1	14	2	2
Insect	49	53	72	32	19	52	42	131	29	51
Mollusc	19	17	15	14	14	16	20	22	26	28
Other ⁴	2	2	0	0	0	0	0	0	0	1
N (Abundance) - #/m³										
Total	1,565	1,565	1,957	1,043	739	1,565	1,370	3,630	1,239	1,783
Oligochaete	43	0	65	43	22	87	22	304	43	43
Insect	1,065	1,152	1,565	696	413	1,130	913	2,848	630	1,109
Mollusc	413	370	326	304	304	348	435	478	565	609
Other ⁴	43	43	0	0	0	0	0	0	0	22

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertidae, F. Oxidae, F. Plonidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m³).

Table E1-2. Raw benthic invertebrate data from the Meadowbank study area lakes 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Meadowbank									
	Third Portage Lake - North Basin					Wally Lake				
	TPN Impact					WAL Impact				
	1 12-Aug-23 9.5	2 12-Aug-23 8.6	3 12-Aug-23 7.5	4 12-Aug-23 7.7	5 12-Aug-23 9.1	1 21-Aug-23 7.9	2 21-Aug-23 9.5	3 21-Aug-23 8.8	4 21-Aug-23 7.5	5 21-Aug-23 7.1
ROUNDWORMS										
<i>P. Nemata</i>	4	2	4	2	3	-	1	2	-	2
FLATWORMS										
<i>P. Platyhelminthes</i>										
<i>Cl. Turbellaria</i>										
indeterminate	-	-	-	-	-	-	-	-	-	-
ANNELIDS										
<i>P. Annelida</i>										
WORMS										
<i>Cl. Oligochaeta</i>										
<i>F. Enchytraeidae</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Naididae</i>										
<i>S.F. Naidinae</i>										
<i>Nais</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Tubificinae</i>										
<i>immatures with hair chaetae</i>	1	-	-	-	-	-	-	-	-	-
<i>immatures without hair chaetae</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Rhyacodrilinae</i>										
<i>Rhyacodrilus coccineus</i>	-	-	7	-	-	-	-	-	-	-
<i>Rhyacodrilus montana</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Lumbriculidae</i>										
<i>Lumbriculus</i>	-	1	2	1	1	1	1	1	-	1
indeterminate	-	-	-	-	-	-	-	-	-	-
ARTHROPODS										
<i>P. Arthropoda</i>										
MITES										
<i>Cl. Arachnida</i>										
<i>O. Acarina</i>										
<i>immature</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Acarytonotidae</i>										
<i>Acarytonotus</i>	-	1	-	-	-	-	-	-	-	-
<i>F. Hygrobatidae</i>										
<i>Hygrobat</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Lebertidae</i>										
<i>Lebertia</i>	-	-	-	-	-	-	1	1	1	1
<i>F. Oxidae</i>										
<i>Oxus</i>	-	-	-	-	-	1	1	-	1	-
<i>F. Pionidae</i>										
indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS										
<i>O. Harpacticoida</i>	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
<i>Cl. Ostracoda</i>	10	9	12	4	2	6	11	5	6	6
INSECTS										
<i>Cl. Insecta</i>										
CADDISFLIES										
<i>O. Trichoptera</i>										
<i>immature</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Apataniidae</i>										
<i>Apatania</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Hydropsychidae</i>										
<i>Agraylea</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Limnephilidae</i>										
<i>Grensia proterita</i>	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
<i>O. Diptera</i>										
MIDGES										
<i>F. Chironomidae</i>										
<i>chironomid pupae</i>	2	-	-	-	-	-	-	-	-	-
<i>S.F. Chironominae</i>										
<i>Cladotanytarsus</i>	-	-	-	-	-	-	9	2	-	-
<i>Contempellina</i>	-	-	-	-	-	-	-	-	-	-
<i>Corynecora ambigua</i>	-	-	-	-	-	14	155	153	107	73
<i>Cryptochironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Dicranodipes</i>	-	-	-	-	-	-	-	-	-	-
<i>Micropectus</i>	-	1	-	1	-	1	36	15	17	11
<i>Microtenipis</i>	-	-	-	-	-	-	-	-	-	-
<i>Parachironomus</i>	-	-	-	-	-	-	-	-	1	-
<i>Paraclopedina</i>	-	-	-	-	-	-	-	-	-	-
<i>Paratanytarsus</i>	4	1	-	3	-	-	13	-	4	1
<i>Polypedium</i>	-	-	-	-	-	-	-	-	-	-
<i>Sergentia</i>	2	-	-	-	-	-	3	-	-	-
<i>Stempellina</i>	-	-	-	-	-	-	-	-	-	-
<i>Stictochironomus</i>	7	7	10	7	5	2	-	16	9	10
<i>Tanytarsus</i>	-	1	-	-	-	1	18	6	-	-
<i>S.F. Diamesinae</i>										
<i>Patthastia</i>	-	-	-	-	-	-	-	-	-	-
<i>Protanytus</i>	-	-	-	1	-	1	-	-	1	-
<i>Pseudodiamesa</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Orthoclaadiinae</i>										
<i>Abiskomyia</i>	-	-	-	-	-	-	-	-	-	-
<i>Cricotopus/Orthocladus</i>	-	-	-	-	-	-	-	-	-	-
<i>Eukiefferiella</i>	-	-	-	-	-	-	-	-	-	-
<i>Heterotrissocladius</i>	1	-	-	-	-	-	-	-	-	-
<i>Mesocricotopus</i>	-	-	-	-	-	-	-	-	-	-
<i>Paracloadius</i>	-	-	-	-	-	-	-	-	-	-
<i>Psectrocladius</i>	2	1	2	1	-	-	-	-	-	-
<i>Zalutschia</i>	-	-	-	-	-	-	-	-	-	-
<i>Orthoclaadiinae Genus "Greenland"</i>	-	-	-	-	-	-	-	-	-	-
indeterminate	-	-	-	-	-	-	-	-	-	-
<i>S.F. Prodiamesinae</i>										
<i>Monodiamesa</i>	-	-	-	1	1	-	1	-	-	-
<i>S.F. Tanypodinae</i>										
<i>Ablabesmyia</i>	-	-	-	-	-	-	1	-	-	-
<i>Procladius</i>	8	7	2	9	4	2	3	7	5	2
<i>Thienemannimyia complex</i>	4	3	2	-	-	-	-	-	-	-
<i>F. Empididae</i>										
<i>Chelifer/Metochela</i>	-	-	-	-	-	-	-	-	-	-
MOLLUSCS										
<i>P. Mollusca</i>										
SNAILS										
<i>Cl. Gastropoda</i>										
<i>F. Valvatidae</i>										
<i>Valvata lewisi</i>	-	-	-	-	-	-	-	-	-	-
<i>Valvata</i>	-	-	-	-	-	-	-	-	-	-
CLAMS										
<i>Cl. Bivalvia</i>										
<i>F. Sphaeriidae</i>										
<i>Psidium/Cyclacalyx</i>	4	1	9	-	3	9	5	17	15	15
<i>Psidium (Cyclacalyx/Neopsisidium)</i>	2	1	5	8	1	2	1	-	3	3
<i>Sphaerium nitidum</i>	-	-	-	-	-	-	-	-	-	-

Table E1-2. Raw benthic invertebrate data from the Meadowbank study area lakes 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Meadowbank									
	Third Portage Lake - North Basin					Wally Lake				
	TPN Impact					WAL Impact				
	1 12-Aug-23 9.5	2 12-Aug-23 8.6	3 12-Aug-23 7.5	4 12-Aug-23 7.7	5 12-Aug-23 9.1	1 21-Aug-23 7.9	2 21-Aug-23 9.5	3 21-Aug-23 8.8	4 21-Aug-23 7.5	5 21-Aug-23 7.1
TOTAL NUMBER OF ORGANISMS	51	36	55	38	20	40	260	225	170	125
TOTAL NUMBER OF TAXA ^a	12	13	10	11	8	11	16	11	12	11
^a Bold entries excluded from taxa count										
R (Richness) - totals ^{2,3}										
Total	10	11	8	9	6	10	14	9	11	9
Oligochaete	1	1	2	1	1	1	1	1	0	1
Insect	7	7	4	7	3	6	9	6	7	5
Mollusc	2	2	2	1	2	2	2	1	2	2
Other ⁴	0	1	0	0	0	1	2	1	2	1
Abundance (raw) - totals ^{5,6}										
Total	37	25	39	32	15	34	248	218	164	117
Oligochaete	1	1	9	1	1	1	1	1	0	1
Insect	30	21	16	23	10	21	239	199	144	97
Mollusc	6	2	14	8	4	11	6	17	18	18
Other ⁴	0	1	0	0	0	1	2	1	2	1
N (Abundance) - #/m³										
Total	804	543	848	696	326	739	5,391	4,739	3,565	2,543
Oligochaete	22	22	196	22	22	22	22	22	0	22
Insect	652	457	348	500	217	457	5,196	4,326	3,130	2,109
Mollusc	130	43	304	174	87	239	130	370	391	391
Other ⁴	0	22	0	0	0	22	43	22	43	22

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertidae, F. Oxidae, F. Plonidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m³).

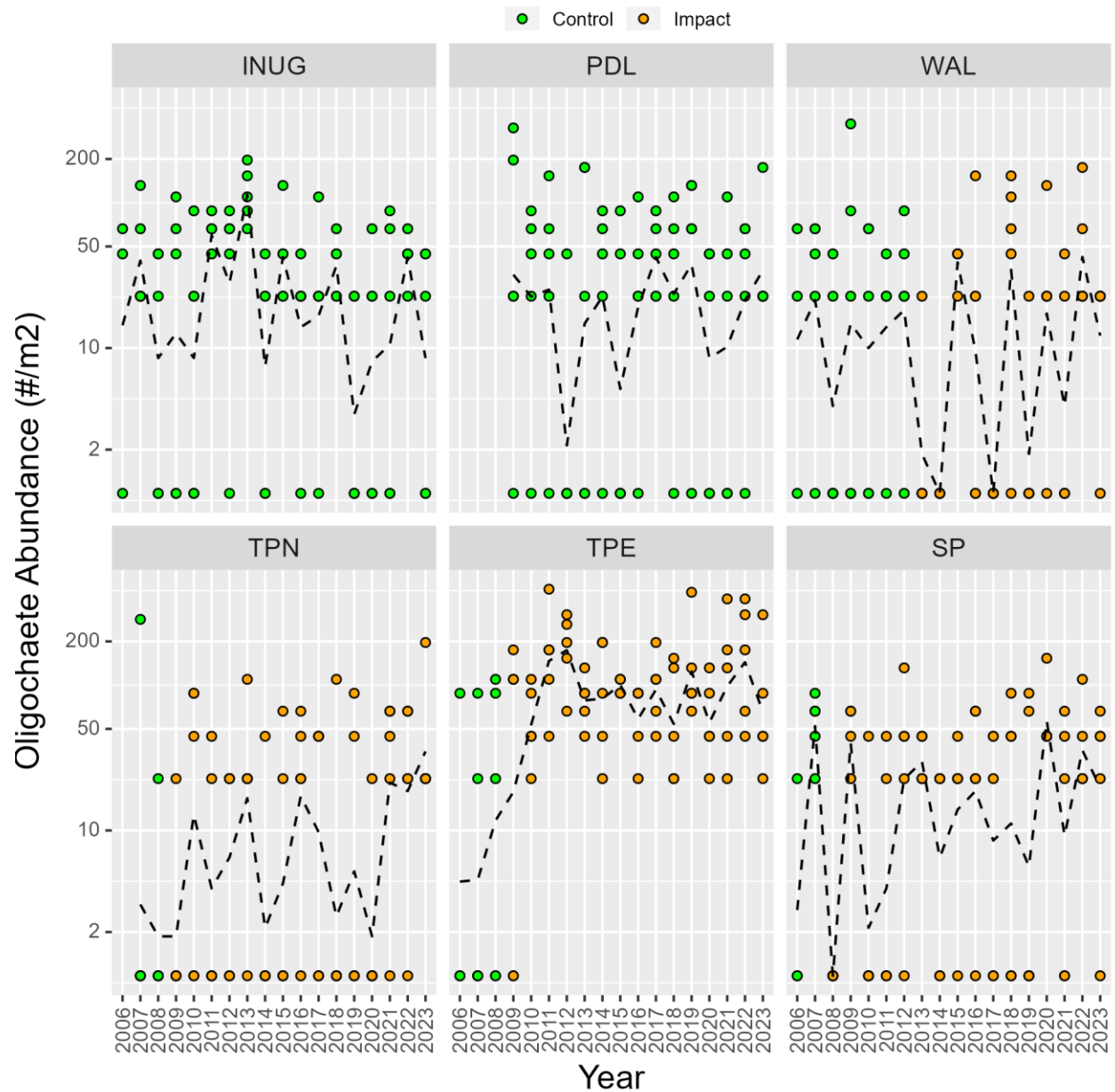
Figure E1-1. Oligochaete abundance (#/m²) from Meadowbank lakes since 2006.

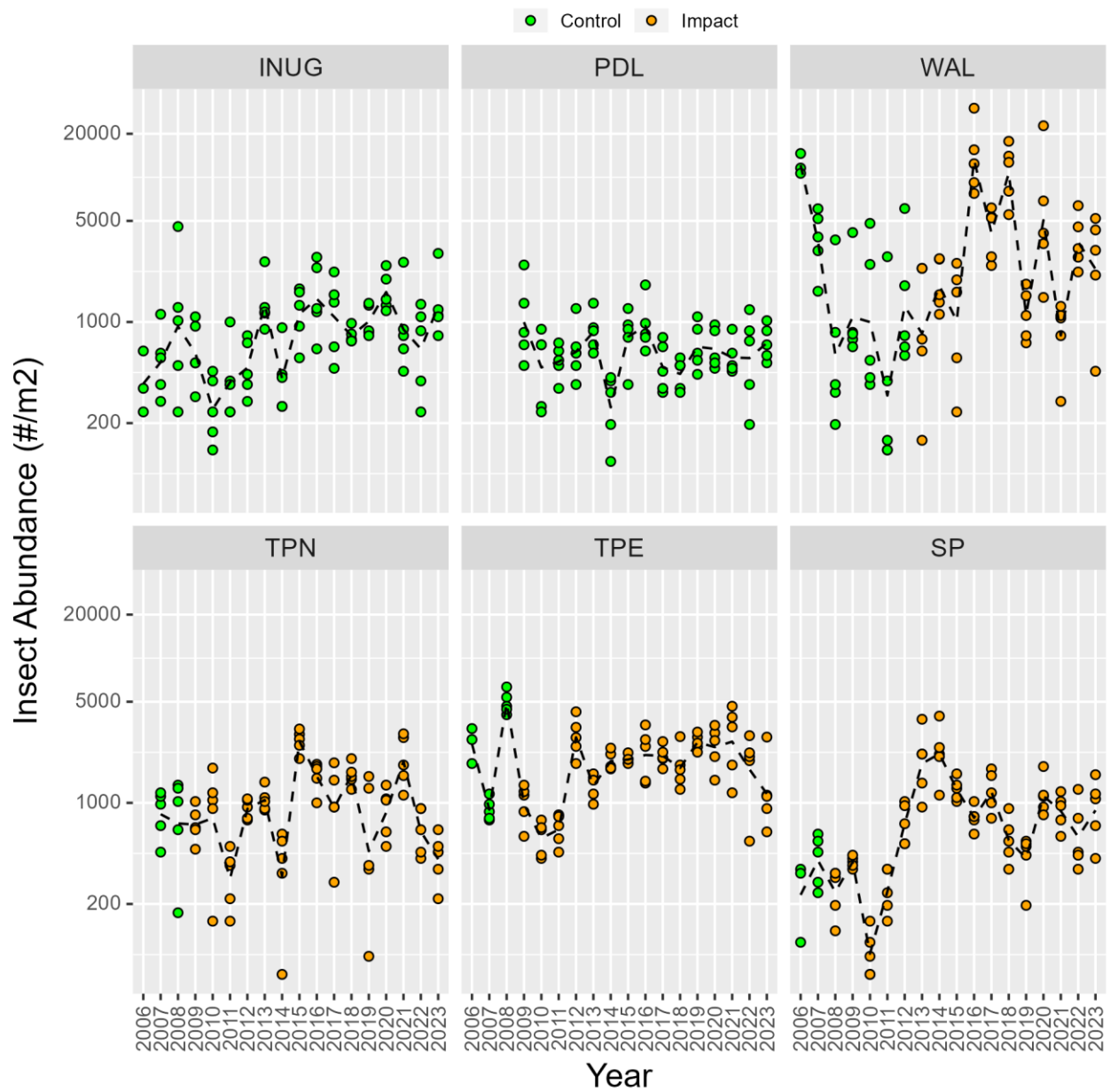
Figure E1-2. Insect abundance (#/m²) from Meadowbank lakes since 2006.

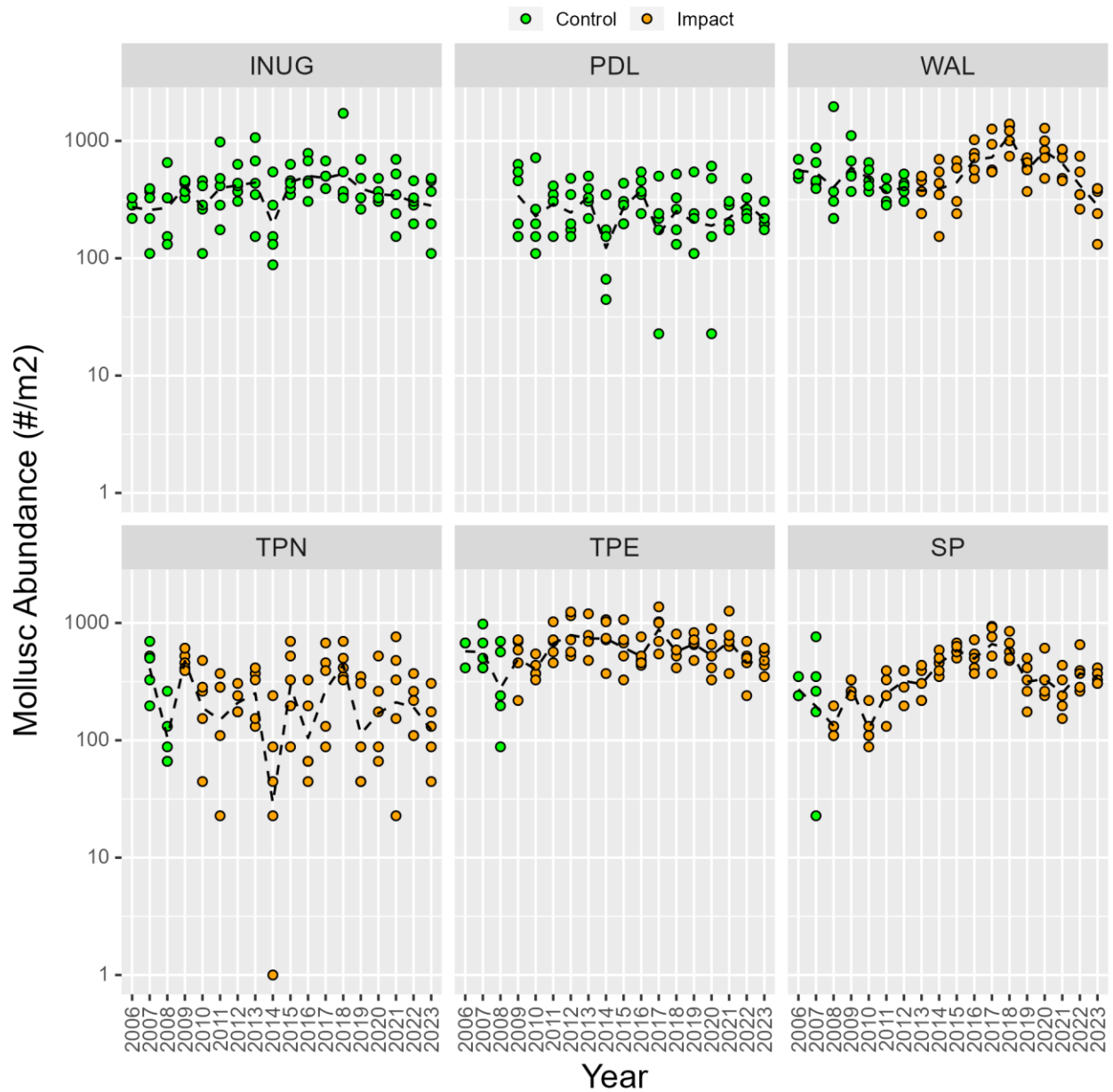
Figure E1-3. Mollusc abundance (#/m²) from Meadowbank lakes since 2006.

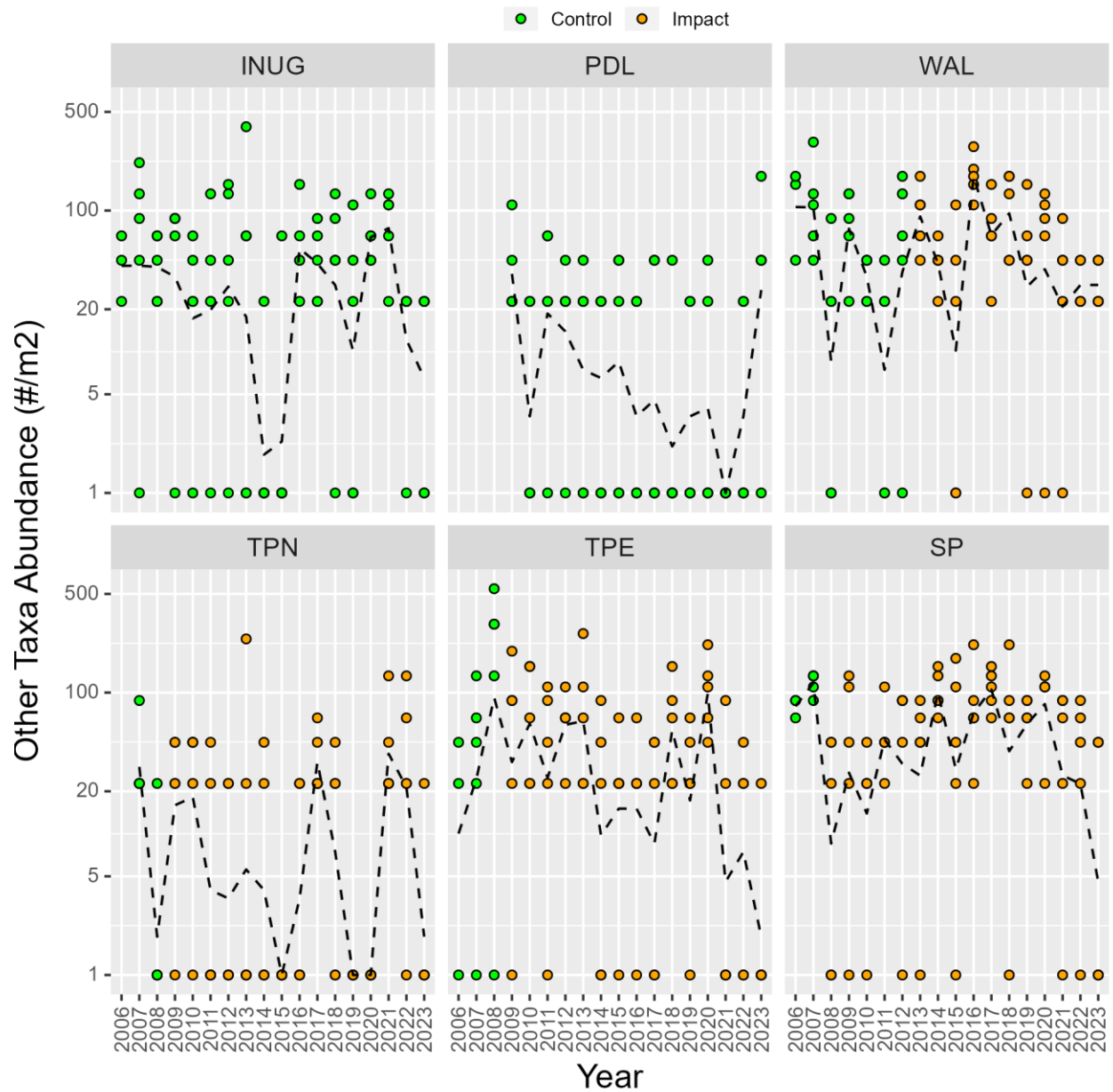
Figure E1-4. Other taxa abundance (#/m²) from Meadowbank lakes since 2006.

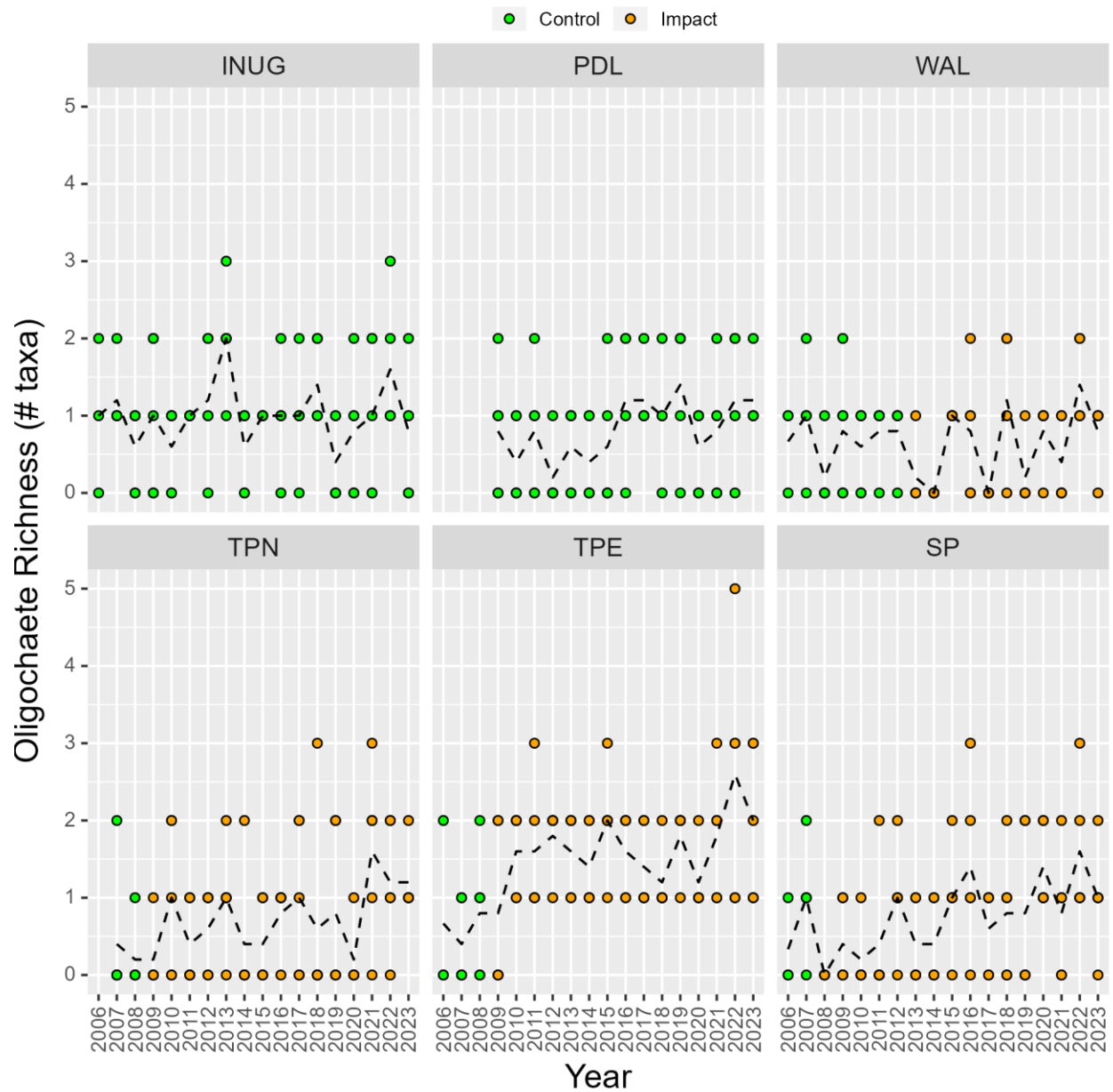
Figure E1-5. Oligochaete richness (# of taxa) from Meadowbank lakes since 2006.

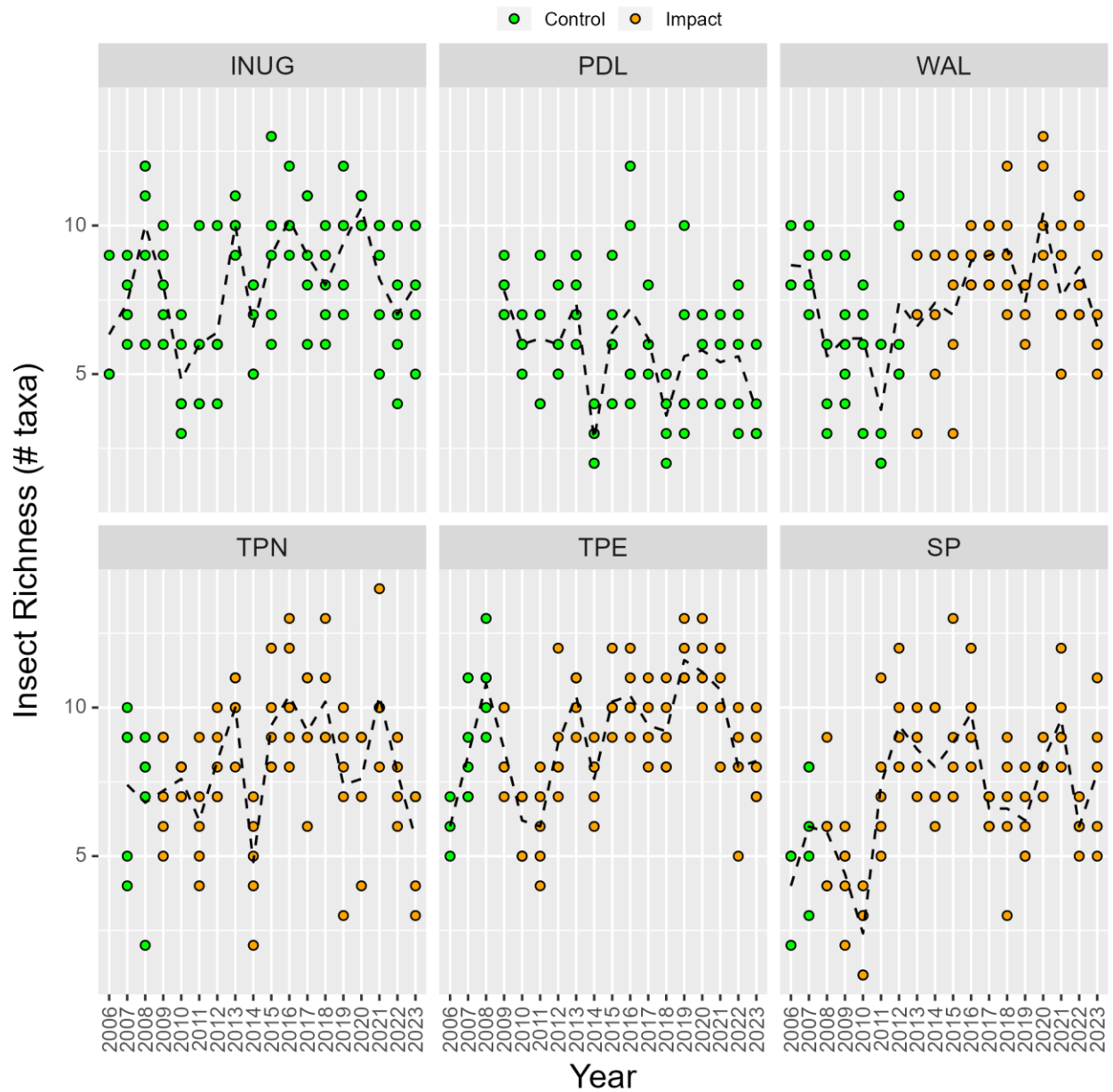
Figure E1-6. Insect richness (# of taxa) from Meadowbank lakes since 2006.

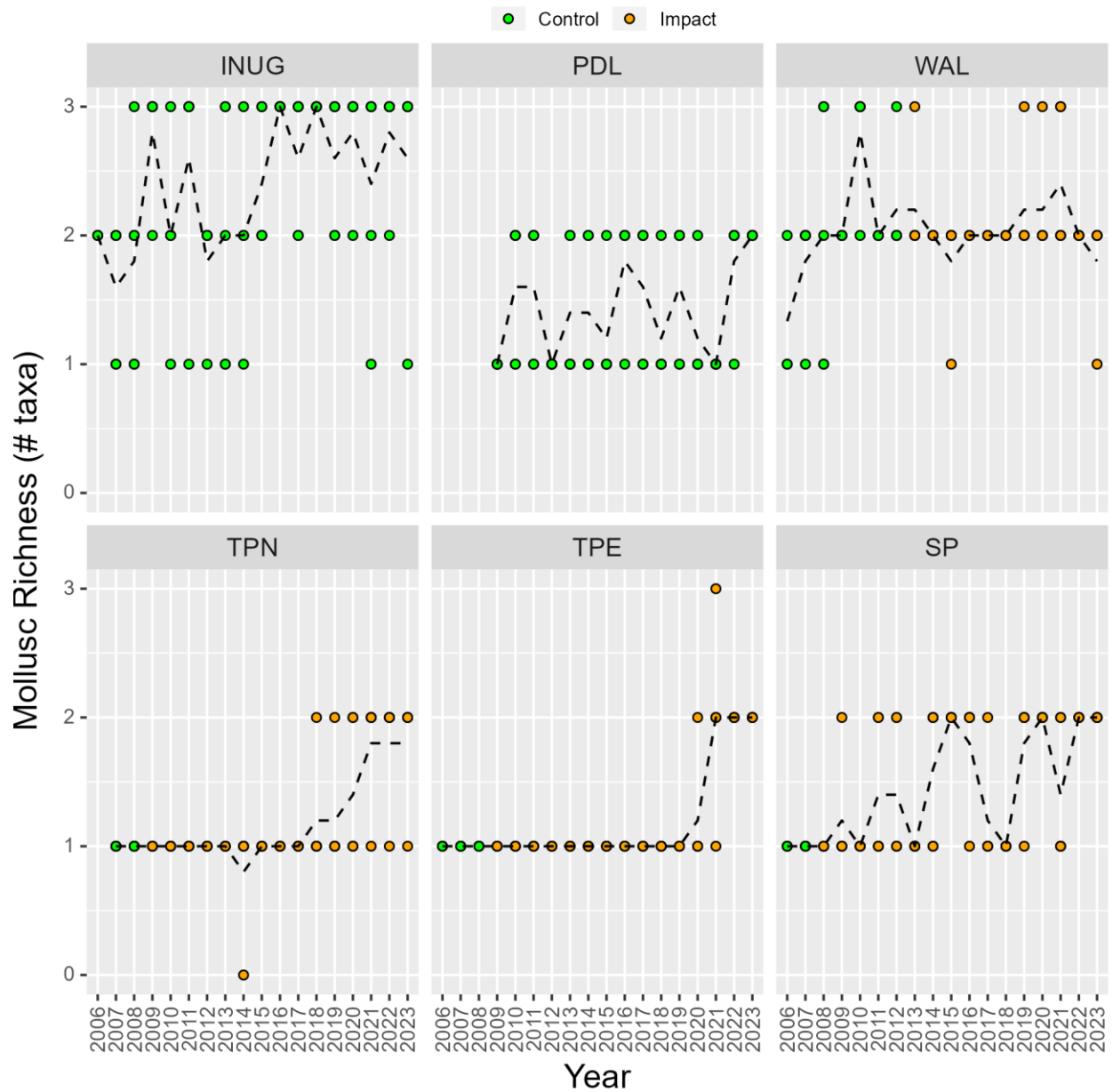
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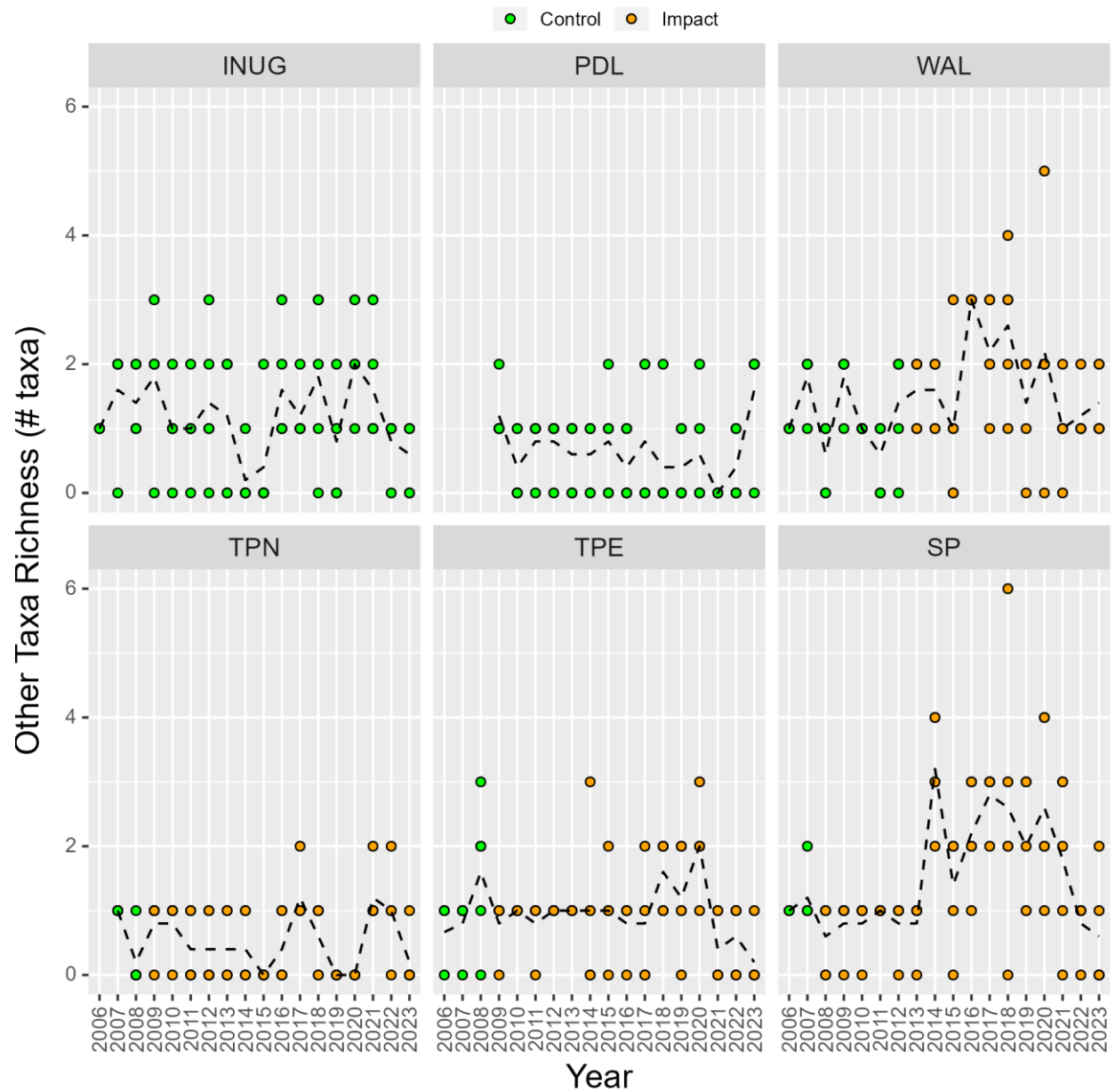
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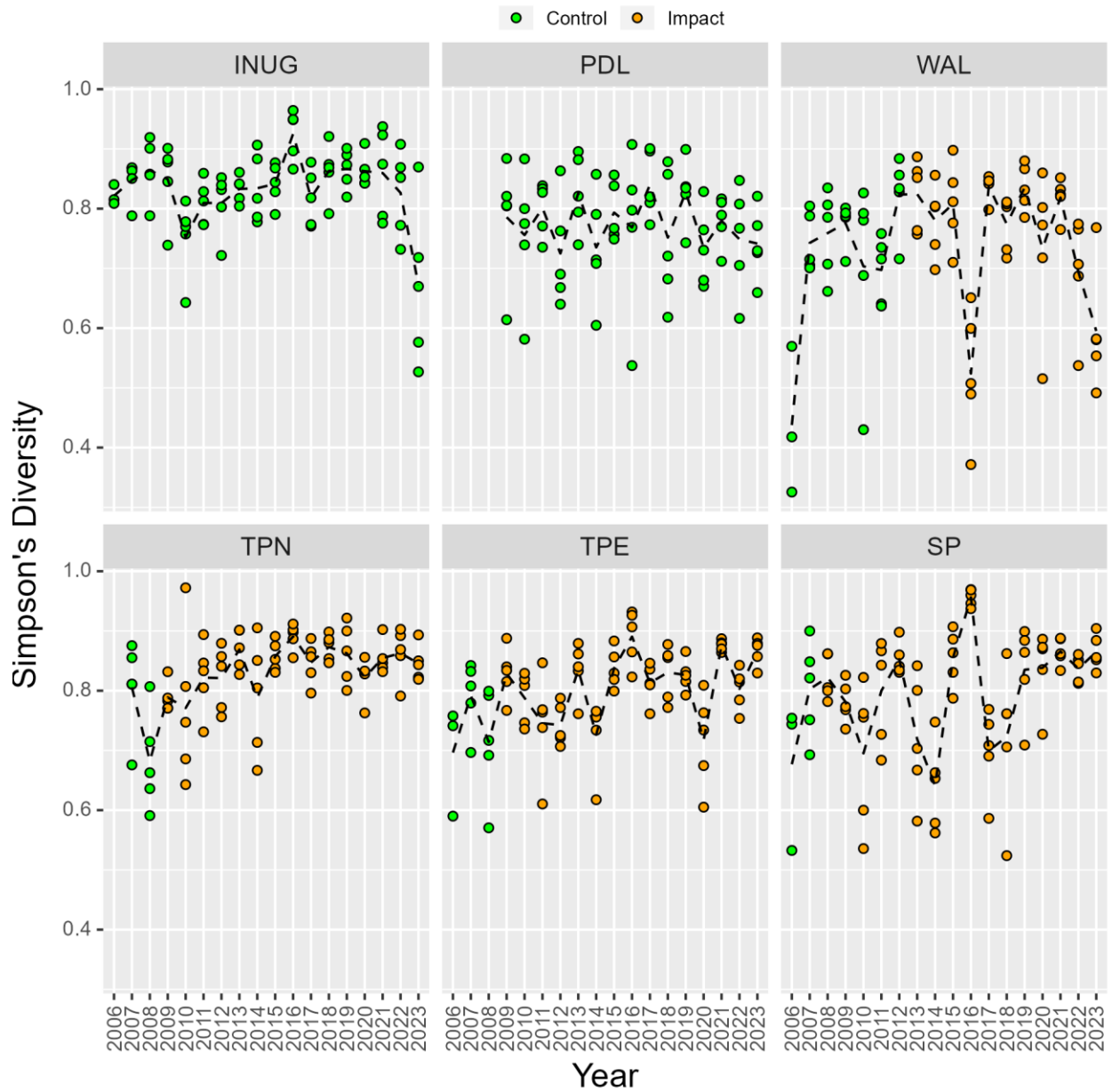
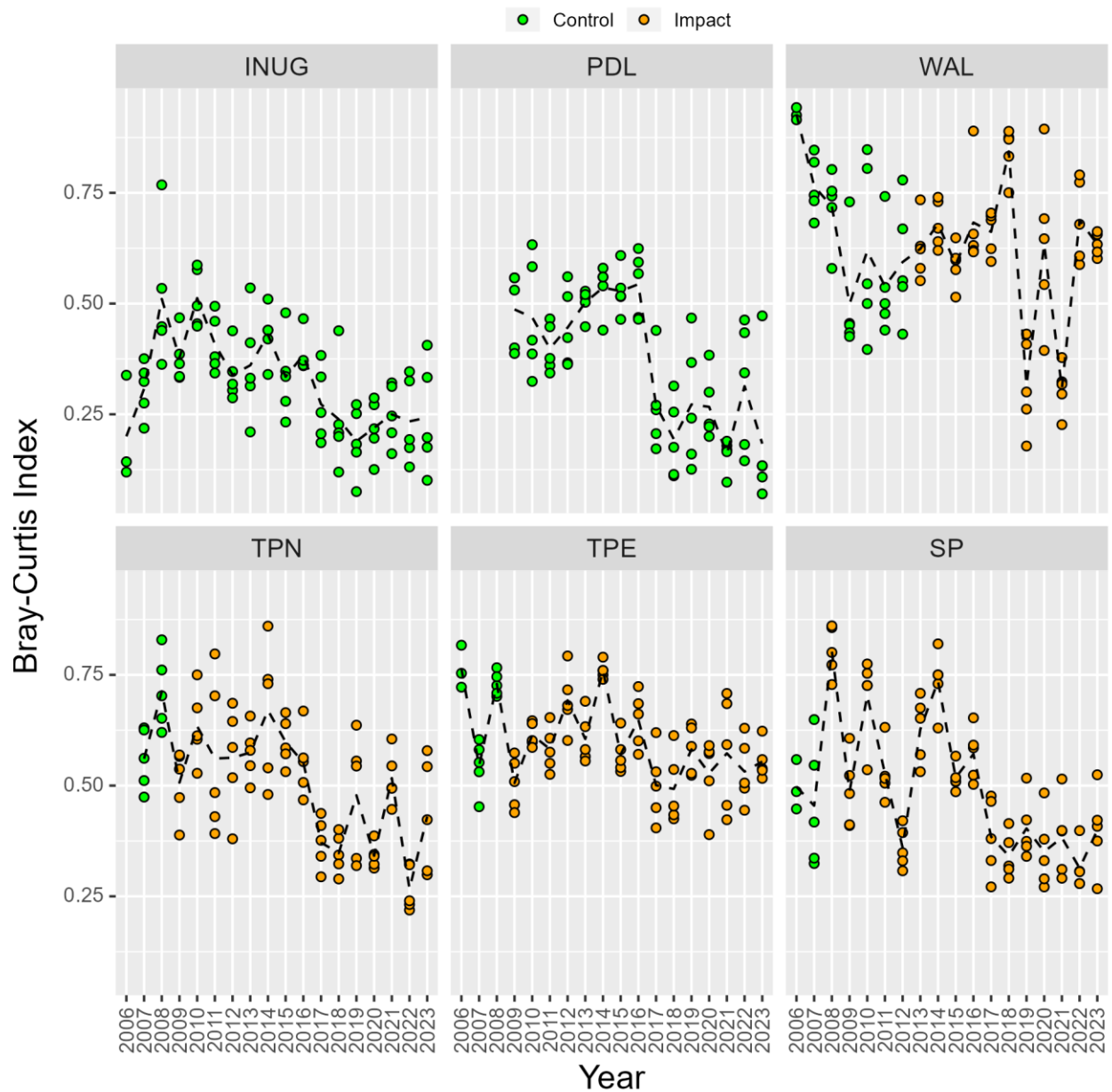
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Appendix E2

Benthos Data – Whale Tail Study Area Lakes

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Benthos Taxonomy – Whale Tail Study Area Lakes

Table E2-1. Benthic invertebrate abundance (#/m²) and richness (# taxa) by major taxa group, Whale Tail study area lakes, 2023.

Area-Replicate	Date	Depth (m)	Abundance (#/m ²)					Richness (# taxa)					Simpson's Diversity	Bray-Curtis Index	
			Oligochaetes	Insects	Molluscs	Other Taxa ¹	TOTAL	Oligochaetes	Insects	Molluscs	Other Taxa ¹	TOTAL			
Whale Tail Lake - South Basin (WTS)															
WTS-1	12-Aug-23	9.0	22	2,543	3,870	283	6,717	1	10	3	3	17	0.71	0.59	
WTS-2	12-Aug-23	8.9	43	3,478	2,283	239	6,043	1	7	3	4	15	0.86	0.60	
WTS-3	12-Aug-23	8.7	22	1,696	1,717	87	3,522	1	8	3	2	14	0.85	0.47	
WTS-4	12-Aug-23	8.7	87	2,283	2,783	87	5,239	2	11	3	2	18	0.83	0.52	
WTS-5	12-Aug-23	9.3	65	1,891	2,283	130	4,370	2	9	3	3	17	0.78	0.52	
Area Mean			47.8	2,378	2,587	165	5,178	1.4	9.0	3.0	2.8	16.2	0.81	0.54	
Kangislulik Lake (KAN/MAM)*															
MAM-1	15-Aug-23	7.9	43	7,826	2,304	65	10,239	1	12	3	2	18	0.73	0.66	
MAM-2	15-Aug-23	7.5	0	6,261	1,935	196	8,391	0	12	3	4	19	0.79	0.63	
MAM-3	15-Aug-23	7.6	130	7,804	2,674	65	10,674	2	10	3	2	17	0.70	0.68	
MAM-4	15-Aug-23	7.9	174	6,587	1,783	196	8,739	2	11	3	3	19	0.77	0.65	
MAM-5	15-Aug-23	8.9	217	8,174	0	217	8,609	2	12	0	4	18	0.74	0.69	
Area Mean			113	7,330	1,739	148	9,330	1.4	11.4	2.4	3.0	18.2	0.74	0.66	
Lake A20															
A20-1	16-Aug-23	8.6	0	3,043	1,196	130	4,370	0	10	2	1	13	0.81	0.46	
A20-2	16-Aug-23	8.0	43	2,891	1,109	130	4,174	1	10	2	3	16	0.71	0.51	
A20-3	16-Aug-23	7.7	22	4,717	1,065	87	5,891	1	11	2	3	17	0.62	0.63	
A20-4	16-Aug-23	8.4	87	2,087	674	43	2,891	2	10	2	2	16	0.80	0.30	
A20-5	16-Aug-23	8.2	43	3,391	1,152	0	4,587	1	11	2	0	14	0.64	0.46	
Area Mean			39	3,226	1,039	78	4,383	1.0	10.4	2.0	1.8	15.2	0.72	0.47	
Lake A76															
A76-1	13-Aug-23	9.0	87	6,870	848	43	7,848	3	9	3	1	16	0.61	0.69	
A76-2	13-Aug-23	8.0	0	2,565	978	174	3,717	0	10	3	3	16	0.86	0.54	
A76-3	13-Aug-23	8.2	65	543	22	0	630	1	5	1	0	7	0.61	0.69	
A76-4	13-Aug-23	8.0	109	2,761	1,413	217	4,500	2	9	3	4	18	0.87	0.58	
A76-5	13-Aug-23	8.0	22	2,848	1,022	109	4,000	1	9	3	3	16	0.85	0.56	
Area Mean			57	3,117	857	109	4,139	1.4	8.4	2.6	2.2	14.6	0.76	0.61	
Lake DS1															
DS1-1	17-Aug-23	6.8	22	1,826	957	65	2,870	1	10	3	2	16	0.85	0.60	
DS1-2	17-Aug-23	7.9	109	1,522	717	43	2,391	1	11	3	2	17	0.82	0.65	
DS1-3	17-Aug-23	9.5	0	304	326	65	696	0	7	3	3	13	0.83	0.19	
DS1-4	17-Aug-23	9.5	22	652	761	87	1,522	1	6	4	2	13	0.83	0.61	
DS1-5	17-Aug-23	8.4	43	1,413	1,239	65	2,761	1	8	4	1	14	0.86	0.57	
Area Mean			39.1	1,143	800	65	2,048	0.8	8.4	3.4	2.0	14.6	0.84	0.52	
Nemo Lake (NEM)															
NEM-1	16-Aug-23	9.0	65	2,283	1,326	87	3,761	1	9	2	2	14	0.87	0.54	
NEM-2	16-Aug-23	9.2	87	4,174	1,717	152	6,130	1	9	3	2	15	0.87	0.57	
NEM-3	16-Aug-23	9.0	65	4,870	1,391	22	6,348	1	10	3	1	15	0.87	0.63	
NEM-4	16-Aug-23	7.4	22	3,283	1,304	65	4,674	1	10	2	1	14	0.89	0.48	
NEM-5	16-Aug-23	8.0	65	3,609	1,283	22	4,978	1	9	2	1	13	0.86	0.59	
Area Mean			61	3,643	1,404	70	5,178	1.0	9.4	2.4	1.4	14.2	0.87	0.56	

Notes:

1. "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, Pionidae, Harpacticoida, O. Notostraca, and Gammaracanthidae).

* Kangislulik Lake (KAN) was previously referred to as Mammoth Lake (MAM).

Table E2-2. Raw benthic invertebrate data from the Whale Tail study area lakes, 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Whale Tail									
	Lake A20 A20 Impact					Lake A76 A76 Impact				
	1	2	3	4	5	1	2	3	4	5
	16-Aug-23	16-Aug-23	16-Aug-23	16-Aug-23	16-Aug-23	13-Aug-23	13-Aug-23	13-Aug-23	13-Aug-23	13-Aug-23
	8.6	8.0	7.7	8.4	8.2	9.0	8.0	8.2	8.0	8.0
ROUNDWORMS										
<i>P. Nematoda</i>	9	1	-	2	-	4	6	1	4	3
FLATWORMS										
<i>P. Platyhelminthes</i>										
<i>Cl. Turbellaria</i>	-	-	-	-	-	2	-	-	-	1
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
ANNELIDS										
<i>P. Annelida</i>										
WORMS										
<i>Cl. Oligochaeta</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Enchytraeidae</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Naididae</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Naidinae</i>	-	-	-	-	-	-	-	-	-	-
<i>Nais</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Tubificinae</i>	-	-	-	-	-	-	-	-	-	-
<i>Immatures with hair chaetae</i>	-	-	-	-	-	1	-	3	2	-
<i>Immatures without hair chaetae</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Rhyacodrilinae</i>	-	-	-	-	-	-	-	-	-	-
<i>Rhyacodrilus coccineus</i>	-	-	-	1	-	1	-	-	-	-
<i>Rhyacodrilus montana</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Lumbricidae</i>	-	2	1	3	2	2	-	-	3	1
<i>Lumbriculus</i>	-	-	-	-	-	-	-	-	-	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
ARTHROPODS										
<i>P. Arthropoda</i>										
MITES										
<i>Cl. Arachnida</i>										
<i>O. Acarina</i>	-	-	-	-	-	-	-	-	-	-
<i>Immature</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Acarytonotidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Acarytonotus</i>	6	-	2	-	-	-	4	-	6	3
<i>F. Hygrobatidae</i>	-	1	-	-	-	-	-	-	1	-
<i>Hygrobat</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Lebertidae</i>	-	3	1	1	-	-	3	-	2	-
<i>Lebertia</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Osiidae</i>	-	2	1	1	-	-	1	-	1	1
<i>Osi</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Pionidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDES										
<i>O. Harpacticoida</i>	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
<i>Cl. Ostracoda</i>	80	47	32	22	63	46	43	-	48	54
INSECTS										
<i>Cl. Insecta</i>										
CADDISFLIES										
<i>O. Trichoptera</i>										
<i>Immature</i>	1	-	-	1	-	-	-	1	-	-
<i>F. Apatanidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Apatania</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Hydropsychidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Agropyia</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Limnephilidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Grensia praeterrita</i>	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
<i>O. Diptera</i>										
MIDGES										
<i>F. Chironomidae</i>										
<i>chironomid pupae</i>	2	-	1	1	-	1	-	-	1	1
<i>S.F. Chironominae</i>										
<i>Cadotanytarsus</i>	-	-	-	-	-	-	-	-	-	-
<i>Constempellina</i>	-	-	-	-	-	-	-	-	-	-
<i>Corynocera ambigua</i>	8	13	19	6	1	218	44	18	46	54
<i>Cryptochironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Dicrotendipes</i>	-	-	-	-	-	2	-	-	-	-
<i>Microspectra</i>	69	95	163	52	117	34	23	-	27	23
<i>Microtendipes</i>	2	1	-	-	6	-	1	-	1	-
<i>Parachironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Paracaddispeima</i>	-	-	-	-	-	-	-	-	-	-
<i>Paratanytarsus</i>	15	8	8	13	4	9	-	-	1	3
<i>Polypedilum</i>	-	-	-	-	-	-	-	-	-	-
<i>Sergentia</i>	-	-	-	-	-	-	-	-	-	-
<i>Stempellinella</i>	-	-	-	-	-	-	-	-	-	-
<i>Stictochironomus</i>	32	5	1	15	11	2	-	2	-	4
<i>Tanytarsus</i>	-	-	-	-	-	4	6	-	21	11
<i>S.F. Diamesinae</i>										
<i>Pathotia</i>	-	-	-	-	-	-	-	-	-	-
<i>Protanytarsus</i>	-	-	1	-	-	-	-	-	-	-
<i>Pseudodiamesa</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Orthocladinae</i>										
<i>Abiskomyia</i>	-	-	6	2	2	4	11	-	2	4
<i>Cricotopus/Orthocladus</i>	-	-	-	-	-	-	-	-	-	-
<i>Eukiefferiella</i>	-	1	-	-	-	-	-	-	-	-
<i>Heterotrissociolus</i>	-	1	-	-	-	-	-	-	-	-
<i>Mesochricotopus</i>	-	-	-	-	-	-	-	-	-	-
<i>Paracaddis</i>	-	-	-	-	-	-	-	-	-	-
<i>Psectrocladius</i>	-	2	2	1	3	-	2	-	-	1
<i>Zalutschia</i>	-	-	-	1	-	-	-	-	-	-
<i>Orthocladinae Genus "Greenland"</i>	-	-	-	-	-	-	-	-	-	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Procladinae</i>										
<i>Monodiamesa</i>	1	1	7	2	3	13	5	3	5	6
<i>S.F. Tanyptodinae</i>										
<i>Abiesomyia</i>	1	-	1	-	-	-	1	-	-	-
<i>Procladius</i>	3	6	4	2	6	29	24	1	22	24
<i>Thienemannimyia complex</i>	6	-	4	-	2	-	1	-	1	-
<i>F. Empididae</i>										
<i>Chelifer/Metachela</i>	-	-	-	-	1	-	-	-	-	-
MOLLUSCS										
<i>P. Mollusca</i>										
SNAILS										
<i>Cl. Gastropoda</i>										
<i>F. Valvatidae</i>										
<i>Valvata lewisi</i>	-	-	-	-	-	-	-	-	-	-
<i>Valvata</i>	-	-	-	-	-	-	-	-	-	-
CLAMS										
<i>Cl. Bivalvia</i>										
<i>F. Sphaeriidae</i>										
<i>Psidium/Cyclocalyx</i>	31	30	32	21	47	24	15	-	25	29
<i>Psidium (Cyclocalyx/Neopisidium)</i>	24	21	17	10	6	10	27	-	37	14
<i>Sphaerium nitidum</i>	-	-	-	-	-	5	3	1	3	4

Table E2-2. Raw benthic invertebrate data from the Whale Tail study area lakes, 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Whale Tail									
	Lake A20 A20 Impact					Lake A76 A76 Impact				
	1	2	3	4	5	1	2	3	4	5
	16-Aug-23	16-Aug-23	16-Aug-23	16-Aug-23	16-Aug-23	13-Aug-23	13-Aug-23	13-Aug-23	13-Aug-23	13-Aug-23
	8.6	8.0	7.7	8.4	8.2	9.0	8.0	8.2	8.0	8.0
TOTAL NUMBER OF ORGANISMS	290	240	303	157	274	411	220	30	259	241
TOTAL NUMBER OF TAXA *	15	18	18	18	15	18	18	8	20	18
* Bold entries excluded from taxa count										
B (Richness) - totals ^{3,5}										
Total	13	16	17	16	14	16	16	7	18	16
Oligochaete	0	1	1	2	1	3	0	1	2	1
Insect	10	10	11	10	11	9	10	5	9	9
Mollusc	2	2	2	2	2	3	3	1	3	3
Other ⁴	1	3	3	2	0	1	3	0	4	3
Abundance (raw) - totals ^{5,6}										
Total	201	192	271	133	211	361	171	29	207	184
Oligochaete	0	2	1	4	2	4	0	3	5	1
Insect	140	133	217	96	156	315	118	25	127	131
Mollusc	55	51	49	31	53	39	45	1	65	47
Other ⁴	6	6	4	2	0	2	8	0	10	5
N (Abundance) - #/m ²										
Total	4,370	4,174	5,891	2,891	4,587	7,848	3,717	630	4,500	4,000
Oligochaete	0	43	22	87	43	87	0	65	109	22
Insect	3,043	2,891	4,717	2,087	3,391	6,870	2,565	543	2,761	2,848
Mollusc	1,196	1,109	1,065	674	1,152	848	978	22	1,413	1,022
Other ⁴	130	130	87	43	0	43	174	0	217	109

- Notes:
1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
 2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S. F. Tubificinae, O. Acarina), and pupae.
 3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
 4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertidae, F. Oxidae, F. Plonidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
 5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
 6. Raw abundance from two grabs (grab area = 0.023 m²).

Table E2-2. Raw benthic invertebrate data from the Whale Tail study area lakes, 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Whale Tail									
	Lake DS1 DS1 Impact					Kangisuluk Lake KAN/MAM Impact				
	1	2	3	4	5	1	2	3	4	5
	17-Aug-23	17-Aug-23	17-Aug-23	17-Aug-23	17-Aug-23	15-Aug-23	15-Aug-23	15-Aug-23	15-Aug-23	15-Aug-23
	6.8	7.9	9.5	9.5	8.4	7.9	7.5	7.6	7.9	8.9
ROUNDWORMS										
<i>P. Nematoda</i>	6	8	1	3	3	2	1	5	3	1
FLATWORMS										
<i>P. Platyhelminthes</i>										
<i>Cl. Turbellaria</i>	-	-	1	1	-	-	2	-	4	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
ANNELIDS										
<i>P. Annelida</i>										
WORMS										
<i>Cl. Oligochaeta</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Enchytraeidae</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Naididae</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Naidinae</i>	-	5	-	1	-	-	-	-	-	-
<i>Nais</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Tubificinae</i>	-	-	-	-	-	-	-	-	-	-
<i>Immatures with hair chaetae</i>	-	-	-	-	-	-	-	-	-	-
<i>Immatures without hair chaetae</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Rhyacodrilinae</i>	-	-	-	-	2	-	-	2	1	8
<i>Rhyacodrilus coccineus</i>	-	-	-	-	-	-	-	-	-	-
<i>Rhyacodrilus montana</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Lumbricidae</i>	1	-	-	-	-	2	-	4	7	2
<i>Lumbriculus</i>	-	-	-	-	-	-	-	-	-	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
ARTHROPODS										
<i>P. Arthropoda</i>										
MITES										
<i>Cl. Arachnida</i>										
<i>O. Acarina</i>	-	-	-	-	-	-	-	-	-	-
<i>Immature</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Acarytonotidae</i>	-	-	-	-	-	1	1	1	-	4
<i>Acalyptonotus</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Hygrobatidae</i>	-	-	1	-	-	-	-	-	-	-
<i>Hygrobat</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Lebertidae</i>	2	1	-	-	-	2	3	2	3	2
<i>Lebertia</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Oridae</i>	1	-	1	3	3	-	3	-	2	3
<i>Orid</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Pionidae</i>	-	1	-	-	-	-	-	-	-	1
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
HARPACTICHOIDS										
<i>O. Harpacticoida</i>	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
<i>Cl. Ostracoda</i>	8	10	3	5	31	65	41	58	53	87
INSECTS										
<i>Cl. Insecta</i>										
CADDISFLIES										
<i>O. Trichoptera</i>										
<i>Immature</i>	2	1	-	-	3	-	-	-	-	-
<i>F. Apataniidae</i>	-	-	-	-	1	-	-	-	-	-
<i>Apatania</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Hydroptilidae</i>	-	1	-	-	-	-	-	-	-	-
<i>Agroyia</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Limnephilidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Grensia praeterita</i>	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
<i>O. Diptera</i>										
MIDGES										
<i>F. Chironomidae</i>										
<i>chironomid pupae</i>	-	-	-	2	-	-	-	-	-	1
<i>S.F. Chironominae</i>										
<i>Cadotanytarsus</i>	-	-	-	-	-	21	-	-	10	18
<i>Constempellina</i>	-	-	-	-	-	-	-	-	-	-
<i>Corynocera ambigua</i>	-	-	-	-	-	226	151	254	178	184
<i>Cryptochironomus</i>	-	-	-	-	-	1	-	-	-	-
<i>Dicrotendipes</i>	-	1	-	-	-	3	3	-	-	-
<i>Microspectra</i>	10	2	-	1	15	42	66	37	30	47
<i>Microtendipes</i>	1	-	-	-	-	6	8	5	6	9
<i>Parachironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Paracidspeima</i>	-	-	-	-	-	-	-	-	-	-
<i>Paratanytarsus</i>	38	41	2	3	27	6	14	13	3	63
<i>Polypedilum</i>	-	-	-	-	-	-	-	-	-	-
<i>Sergentia</i>	-	-	-	-	-	-	-	-	-	-
<i>Stempellinella</i>	-	-	-	-	-	-	-	-	-	-
<i>Stictochironomus</i>	4	4	-	-	3	17	13	19	13	9
<i>Tanytarsus</i>	5	3	-	1	-	12	9	16	30	18
<i>S.F. Diamesinae</i>										
<i>Pathotia</i>	-	1	-	-	-	-	-	-	-	-
<i>Protanytarsus</i>	-	-	1	1	-	-	-	-	-	-
<i>Pseudodiamesa</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Orthocladinae</i>										
<i>Abikomyia</i>	-	-	1	-	-	-	1	-	-	4
<i>Cricotopus/Orthocladus</i>	-	-	-	-	-	-	-	-	-	-
<i>Eukiefferiella</i>	-	-	-	-	-	-	-	-	-	-
<i>Heterotrissocladius</i>	1	-	2	11	2	-	-	-	-	-
<i>Mesochricotopus</i>	-	-	-	-	-	-	-	-	-	-
<i>Paracids</i>	-	-	-	-	-	-	-	-	-	-
<i>Psectrocladius</i>	-	-	1	-	-	-	-	-	3	-
<i>Zalutschia</i>	-	-	-	-	-	-	-	-	-	-
<i>Orthocladinae Genus "Greenland"</i>	-	-	-	-	-	-	-	-	-	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Prodiamesinae</i>										
<i>Monodiamesa</i>	-	-	-	-	-	9	11	4	14	9
<i>S.F. Tanytarsinae</i>										
<i>Abikomyia</i>	3	1	-	-	-	-	-	-	-	3
<i>Procladius</i>	19	10	6	11	11	7	5	6	8	4
<i>Thienemannimyia complex</i>	-	5	1	-	3	10	6	4	8	7
<i>F. Empididae</i>										
<i>Chelifer/Metachela</i>	1	-	-	-	-	-	1	-	-	-
MOLLUSCS										
<i>P. Mollusca</i>										
SNAILS										
<i>Cl. Gastropoda</i>										
<i>F. Valvatidae</i>										
<i>Valvata lewisi</i>	-	12	1	3	3	-	-	-	-	-
<i>Valvata</i>	16	-	-	-	6	-	-	-	-	-
CLAMS										
<i>Cl. Bivalvia</i>										
<i>F. Sphaeriidae</i>										
<i>Psidium/Cyclocalyx</i>	21	17	12	23	23	83	62	76	37	-
<i>Psidium (Cyclocalyx/Neopisidium)</i>	7	4	2	8	25	10	13	29	15	-
<i>Sphaerium nitidum</i>	-	-	-	1	-	13	14	18	30	-

Table E2-2. Raw benthic invertebrate data from the Whale Tail study area lakes, 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Whale Tail									
	Lake DS1 DS1 Impact					Kangituliik Lake KAN/MAM Impact				
	1	2	3	4	5	1	2	3	4	5
	17-Aug-23	17-Aug-23	17-Aug-23	17-Aug-23	17-Aug-23	15-Aug-23	15-Aug-23	15-Aug-23	15-Aug-23	15-Aug-23
	6.8	7.9	9.5	9.5	8.4	7.9	7.5	7.6	7.9	8.9
TOTAL NUMBER OF ORGANISMS	146	128	36	78	161	#	538	428	554	458
TOTAL NUMBER OF TAXA *	18	19	15	16	14	20	21	19	21	21
* Bold entries excluded from taxa count										
R (Richness) - totals ^{3,5}										
Total	16	17	13	13	14	18	19	17	19	18
Oligochaete	1	1	0	1	1	1	0	2	2	2
Insect	10	11	7	6	8	12	12	10	11	12
Mollusc	3	3	3	4	4	3	3	3	3	0
Other ⁴	2	2	3	2	1	2	4	2	3	4
Abundance (raw) - totals ^{5,6}										
Total	132	110	32	70	127	471	386	491	402	396
Oligochaete	1	5	0	1	2	2	0	6	8	10
Insect	84	70	14	30	65	360	288	359	303	376
Mollusc	44	33	15	35	57	106	89	123	82	0
Other ⁴	3	2	3	4	3	3	9	3	9	10
N (Abundance) - #/m ²										
Total	2,870	2,391	696	1,522	2,761	10,239	8,391	10,674	8,739	8,609
Oligochaete	22	109	0	22	43	43	0	130	174	217
Insect	1,826	1,522	304	652	1,413	7,826	6,261	7,804	6,587	8,174
Mollusc	957	717	326	761	1,239	2,304	1,935	2,674	1,783	0
Other ⁴	65	43	65	87	65	65	196	65	196	217

- Notes:
1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (Cl. Acarina, F. Lumbriculidae), immatures (S. F. Tubificinae, Cl. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertidae, F. Oxidae, F. Plonidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m²).

Table E2-2. Raw benthic invertebrate data from the Whale Tail study area lakes, 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Whale Tail									
	Nemo Lake NEM Impact					Whale Tail Lake - South Basin WTS Impact				
	1	2	3	4	5	1	2	3	4	5
	16-Aug-23	16-Aug-23	16-Aug-23	16-Aug-23	16-Aug-23	12-Aug-23	12-Aug-23	12-Aug-23	12-Aug-23	12-Aug-23
	9.0	9.2	9.0	7.4	8.0	9.0	8.9	8.7	8.7	9.3
ROUNDWORMS										
<i>P. Nematoda</i>	2	-	-	-	2	-	3	1	-	-
FLATWORMS										
<i>P. Platyhelminthes</i>										
<i>Cl. Turbellaria</i>	-	1	-	-	-	-	2	-	-	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
ANNELIDS										
<i>P. Annelida</i>										
WORMS										
<i>Cl. Oligochaeta</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Enchytraeidae</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Naididae</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Naididae</i>	-	-	-	-	-	-	-	-	-	-
<i>Nais</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Tubificinae</i>	-	-	-	-	-	-	-	-	-	-
<i>Immatures with hair chaetae</i>	-	-	-	-	-	-	-	1	3	-
<i>Immatures without hair chaetae</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Rhyacodrilinae</i>	-	-	-	-	-	1	2	-	1	2
<i>Rhyacodrilus coccineus</i>	-	-	-	-	-	-	-	-	-	-
<i>Rhyacodrilus montana</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Lumbriculidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Lumbriculus</i>	3	4	3	1	3	-	-	-	-	1
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
ARTHROPODS										
<i>P. Arthropoda</i>										
MITES										
<i>Cl. Arachnida</i>										
<i>O. Acarina</i>	-	-	-	-	-	-	-	-	-	-
<i>Immature</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Acalyptonotidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Acalyptonotus</i>	3	6	1	3	1	3	2	-	3	1
<i>F. Hygrobatidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Hygrobatas</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Lebertidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Lebertia</i>	1	-	-	-	-	2	1	1	-	1
<i>F. Oxiidae</i>	-	-	-	-	-	8	6	3	1	4
<i>Oxus</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Pionidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
HARPACTICHOIDS										
<i>O. Harpacticoida</i>	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
<i>Cl. Ostracoda</i>	20	26	47	47	29	125	71	42	101	72
INSECTS										
<i>Cl. Insecta</i>										
CADDISFLIES										
<i>O. Trichoptera</i>	-	-	-	-	-	-	-	-	-	-
<i>Immature</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Apatanilidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Apatania</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Hydroptilidae</i>	-	-	-	-	-	-	-	-	-	-
<i>Agroyia</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Limnephilidae</i>	-	-	-	-	2	-	-	-	-	-
<i>Grensia praeterita</i>	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
<i>O. Diptera</i>										
MIDGES										
<i>F. Chironomidae</i>										
<i>chironomid pupae</i>	-	1	-	-	1	-	2	-	1	-
<i>S.F. Chironominae</i>										
<i>Cadotanytarsus</i>	2	-	8	1	-	-	-	-	7	-
<i>Constempellina</i>	-	-	-	-	-	-	-	-	-	-
<i>Corynocera ambigua</i>	30	32	32	26	33	3	17	7	8	2
<i>Cryptochironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Dicrotendipes</i>	-	-	-	-	-	-	-	-	-	-
<i>Micropectra</i>	12	33	22	34	18	53	59	28	27	31
<i>Microtendipes</i>	-	2	2	-	-	6	19	3	8	1
<i>Parachironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Paraclosopeima</i>	-	-	-	-	-	-	-	-	-	-
<i>Paratanytarsus</i>	4	26	59	16	9	1	-	-	1	-
<i>Polypedilum</i>	-	-	-	-	-	-	-	-	-	-
<i>Sergentia</i>	-	-	-	-	-	-	-	-	-	-
<i>Stempellinella</i>	-	-	-	-	-	1	-	-	-	-
<i>Stictochironomus</i>	20	42	35	15	37	9	1	7	12	5
<i>Tanytarsus</i>	15	33	37	28	38	17	47	21	17	28
<i>S.F. Diamesinae</i>										
<i>Pathotia</i>	-	-	-	-	-	-	-	-	-	-
<i>Protanytus</i>	-	-	-	-	-	-	-	-	-	1
<i>Pseudodiamesa</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Orthocladinae</i>										
<i>Abakomyia</i>	-	-	-	-	-	6	3	3	3	8
<i>Cricotopus/Orthocladus</i>	-	-	-	-	-	-	-	-	-	-
<i>Eukiefferiella</i>	-	-	-	-	-	-	-	-	-	-
<i>Heterotrissocladius</i>	-	-	-	-	-	-	-	-	-	-
<i>Mesochricotopus</i>	-	-	-	-	-	-	-	-	-	-
<i>Paracloadius</i>	-	-	-	-	-	-	-	-	-	-
<i>Psectrocladius</i>	7	5	7	12	12	-	-	-	-	-
<i>Zalutschia</i>	-	-	-	-	-	-	-	-	-	-
<i>Orthocladinae Genus "Greenland"</i>	-	-	-	-	-	-	-	-	-	-
<i>Indeterminate</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Prodiamesinae</i>										
<i>Monodiamesa</i>	-	-	-	2	-	3	-	1	3	4
<i>S.F. Tanytardinae</i>										
<i>Ablobesomyia</i>	-	-	-	-	-	-	-	-	-	-
<i>Procladius</i>	14	16	16	11	9	18	12	8	16	7
<i>Thienemannimyia complex</i>	1	2	6	6	7	-	-	-	-	-
<i>F. Empididae</i>										
<i>Chelifera/Metachela</i>	-	-	-	-	-	-	-	-	-	-
MOLLUSCS										
<i>P. Mollusca</i>										
SNAILS										
<i>Cl. Gastropoda</i>										
<i>F. Valvatidae</i>										
<i>Valvata lewisi</i>	-	-	-	-	-	-	-	-	-	-
<i>Valvata</i>	-	-	-	-	-	-	-	-	-	-
CLAMS										
<i>Cl. Bivalvia</i>										
<i>F. Sphaeriidae</i>										
<i>Psidium/Cyclocalyx</i>	39	68	57	38	52	155	54	45	84	82
<i>Psidium (Cyclocalyx/Neopisidium)</i>	22	10	6	22	7	13	25	26	40	15
<i>Sphaerium nitidum</i>	-	1	1	-	-	10	26	8	4	8

Table E2-2. Raw benthic invertebrate data from the Whale Tail study area lakes, 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Whale Tail									
	Nemo Lake NEM Impact					Whale Tail Lake - South Basin WTS Impact				
	1	2	3	4	5	1	2	3	4	5
	16-Aug-23	16-Aug-23	16-Aug-23	16-Aug-23	16-Aug-23	12-Aug-23	12-Aug-23	12-Aug-23	12-Aug-23	12-Aug-23
	9.0	9.2	9.0	7.4	8.0	9.0	8.9	8.7	8.7	9.3
TOTAL NUMBER OF ORGANISMS	195	308	339	262	260	434	352	205	342	273
TOTAL NUMBER OF TAXA *	16	17	16	15	15	18	17	16	19	18
* Bold entries excluded from taxa count										
R (Richness) - totals ^{3,5}										
Total	14	15	15	14	13	17	15	14	18	17
Oligochaete	1	1	1	1	1	1	1	1	2	2
Insect	9	9	10	10	9	10	7	8	11	9
Mollusc	2	3	3	2	2	3	3	3	3	3
Other ⁴	2	2	1	1	1	3	4	2	2	3
Abundance (raw) - totals ^{5,6}										
Total	173	282	292	215	229	309	278	162	241	201
Oligochaete	3	4	3	1	3	1	2	1	4	3
Insect	105	192	224	151	166	117	160	78	105	87
Mollusc	61	79	64	60	59	178	105	79	128	105
Other ⁴	4	7	1	3	1	13	11	4	4	6
N (Abundance) - #/m²										
Total	3,761	6,130	6,348	4,674	4,978	6,717	6,043	3,522	5,239	4,370
Oligochaete	65	87	65	22	65	22	43	22	87	65
Insect	2,283	4,174	4,870	3,283	3,609	2,543	3,478	1,696	2,283	1,891
Mollusc	1,326	1,717	1,391	1,304	1,283	3,870	2,283	1,717	2,783	2,283
Other ⁴	87	152	22	65	22	283	239	87	87	130

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbricidae), immatures (S. F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertidae, F. Oxidae, F. Plonidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m²).

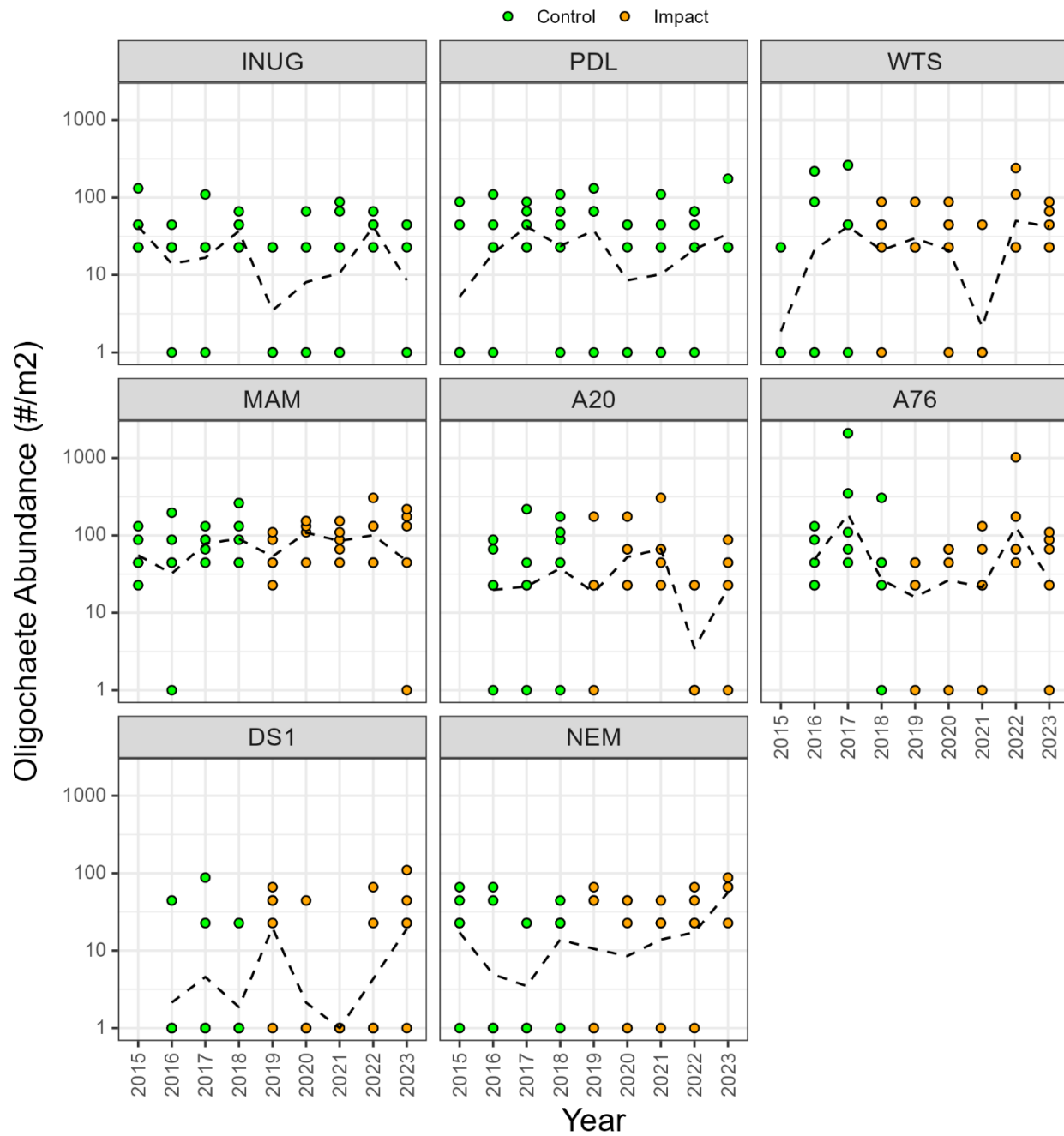
Figure E2-1. Oligochaete abundance (#/m²) from the Whale Tail study lakes since 2015.

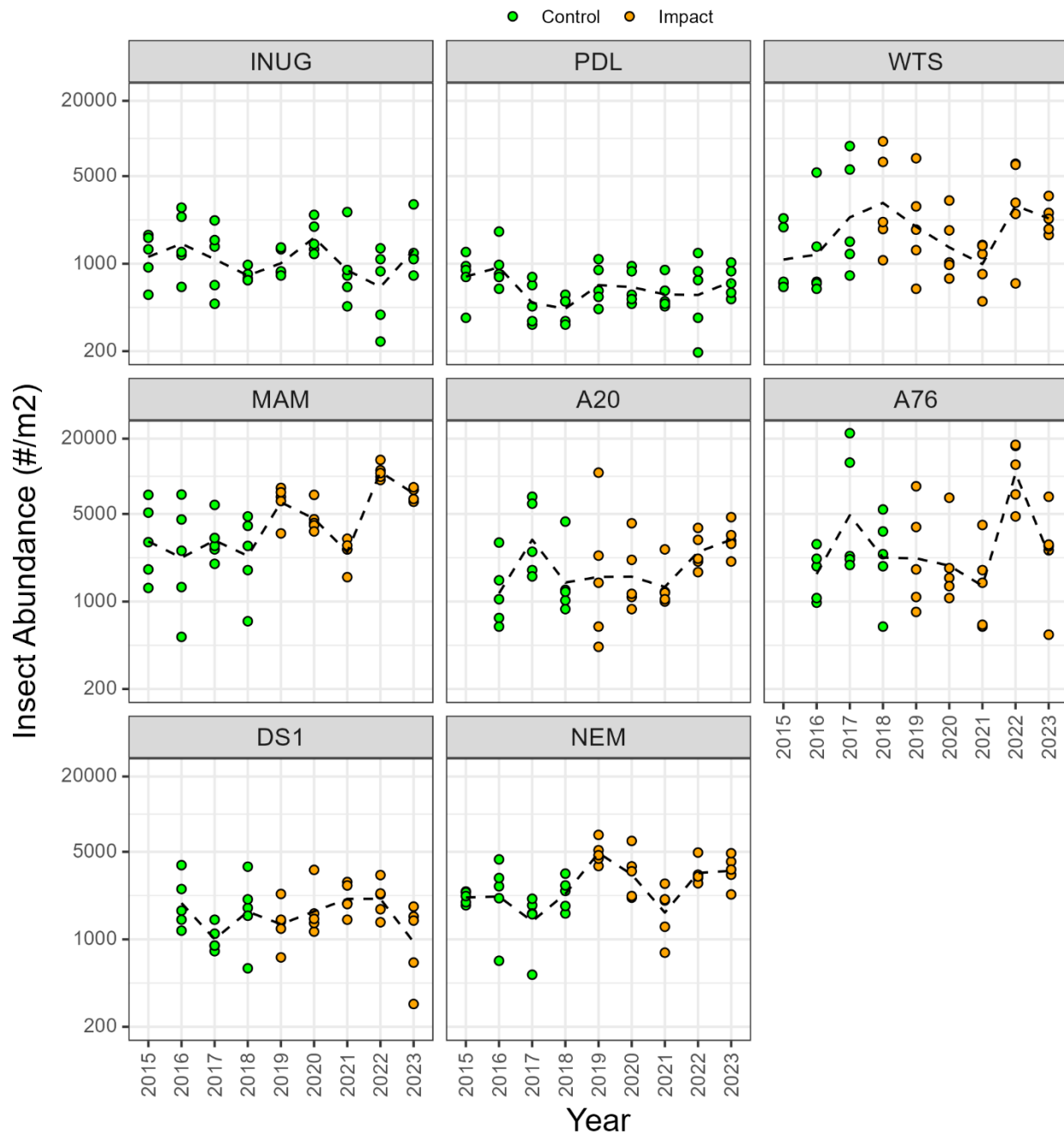
Figure E2-2. Insect abundance (#/m²) from the Whale Tail study lakes since 2015.

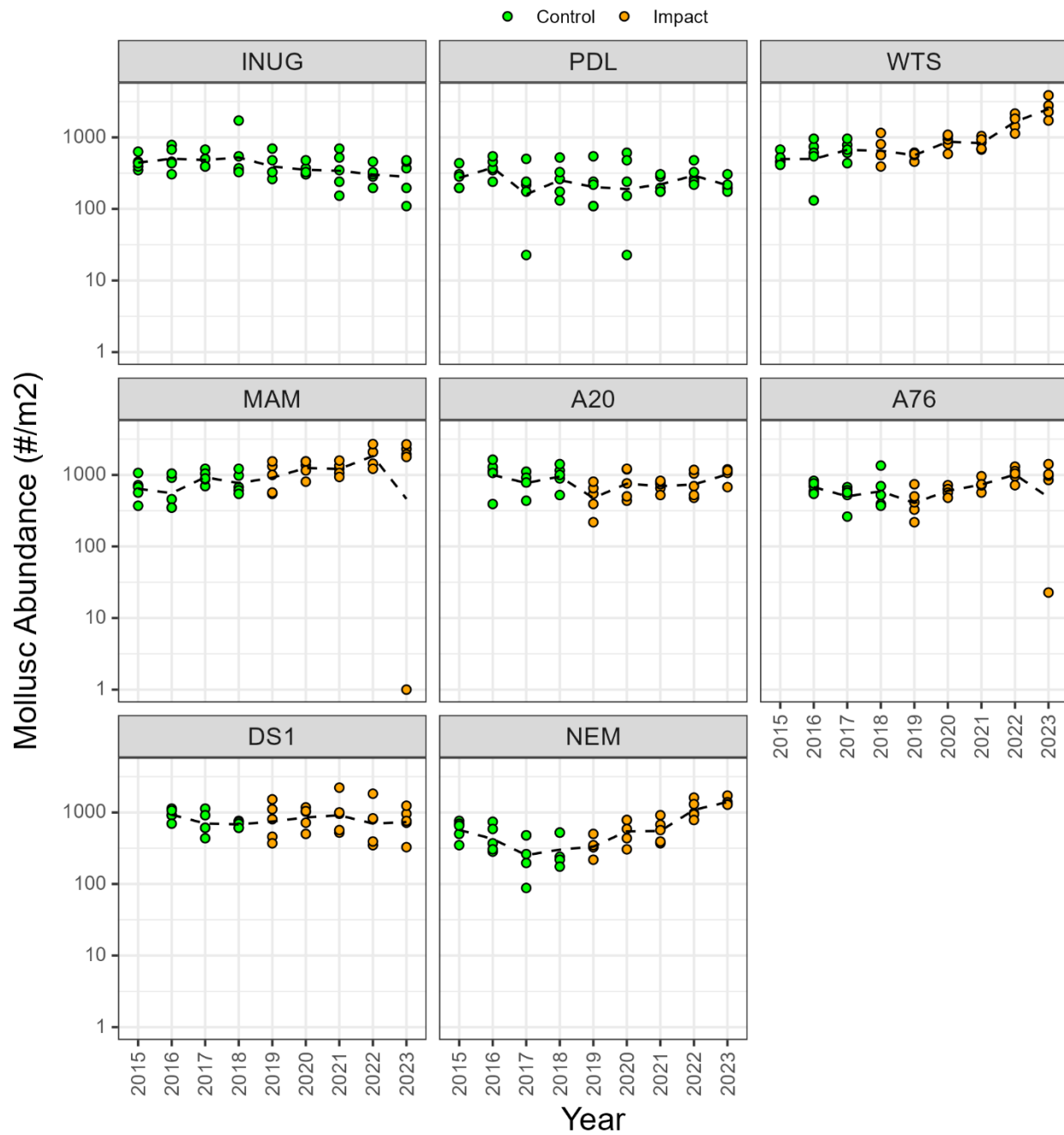
Figure E2-3. Mollusc abundance (#/m²) from the Whale Tail study lakes since 2015.

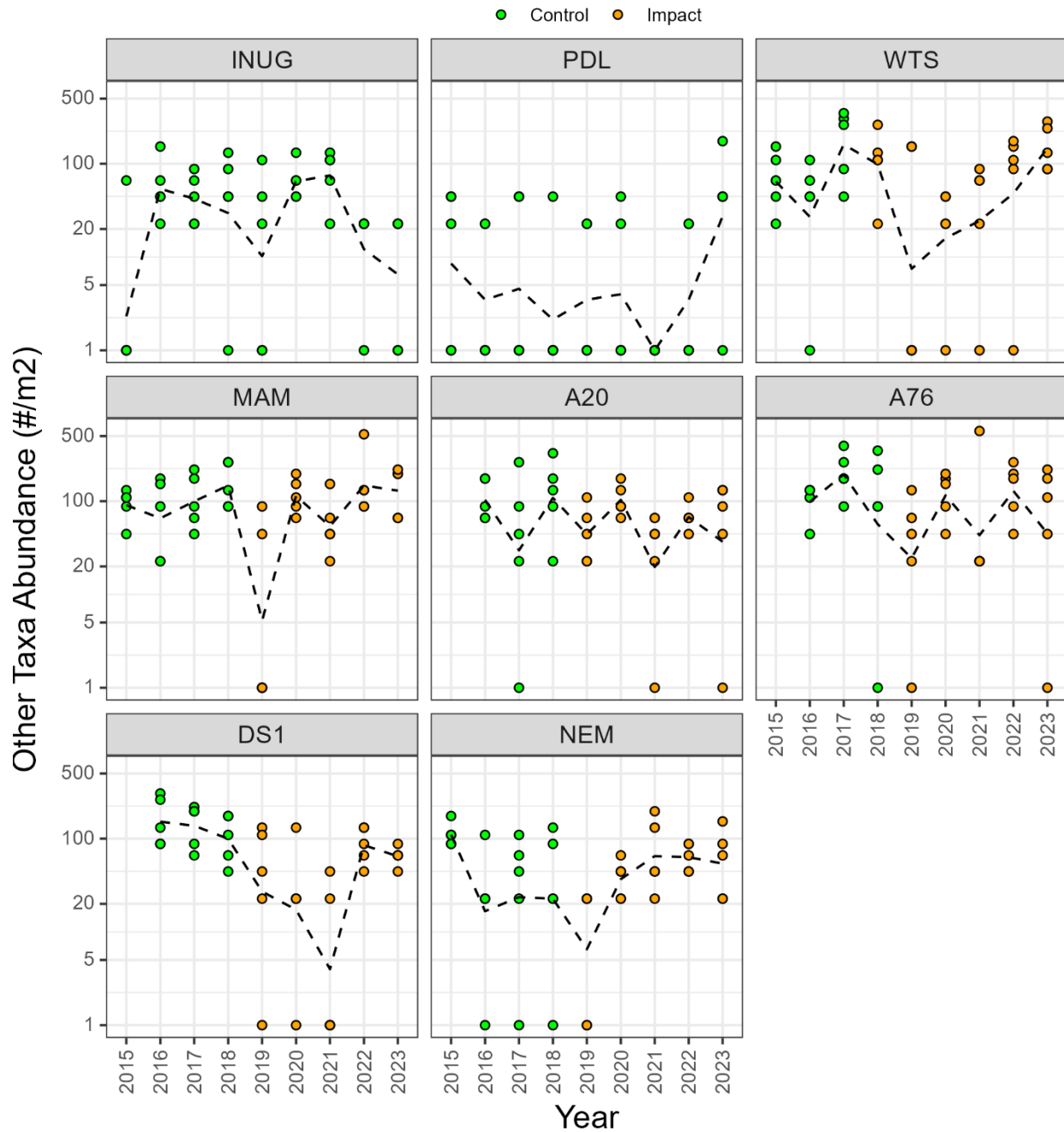
Figure E2-4. Other taxa abundance (#/m²) from the Whale Tail study lakes since 2015.

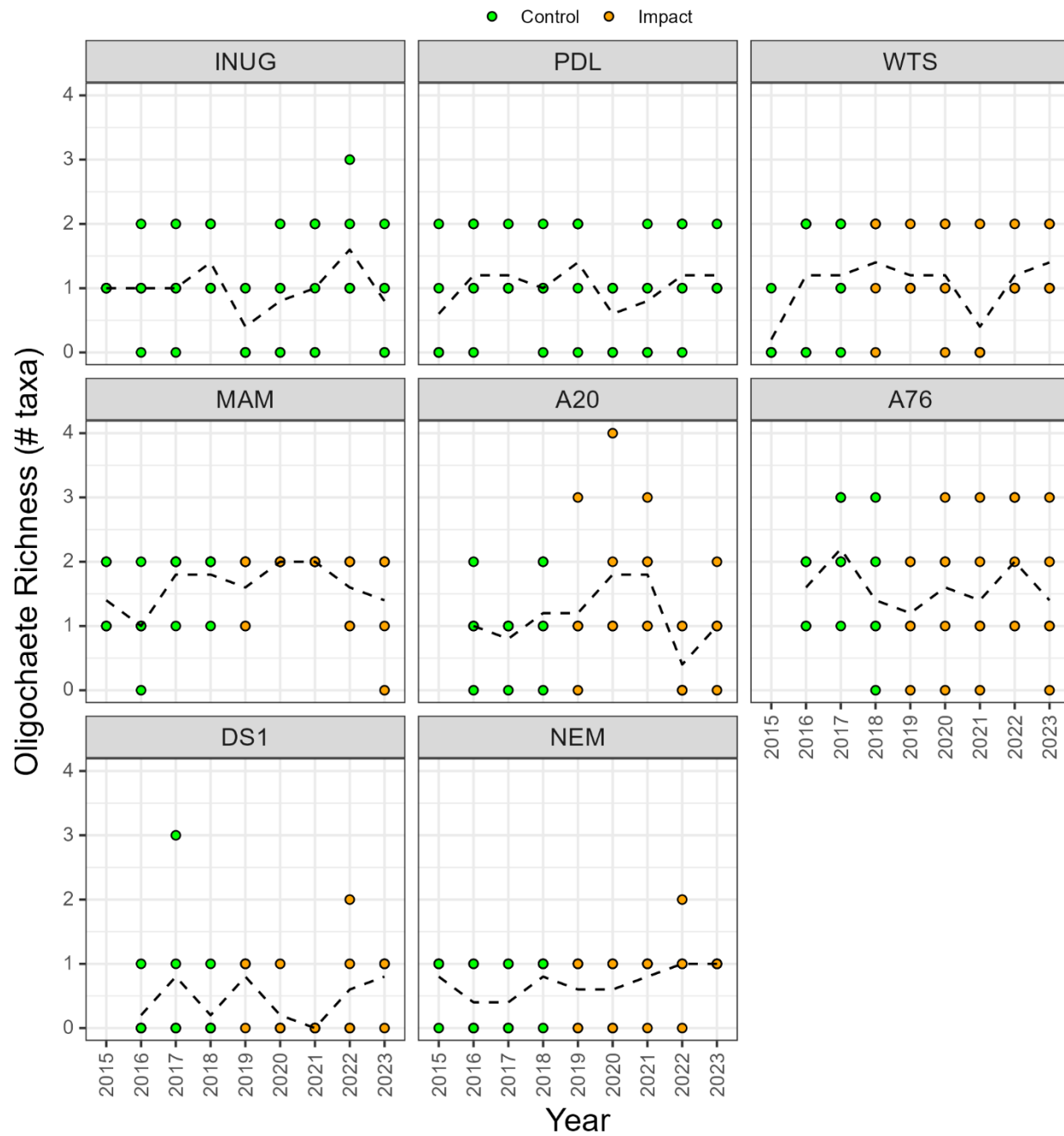
Figure E2-5. Oligochaete richness (# of taxa) from the Whale Tail study lakes since 2015.

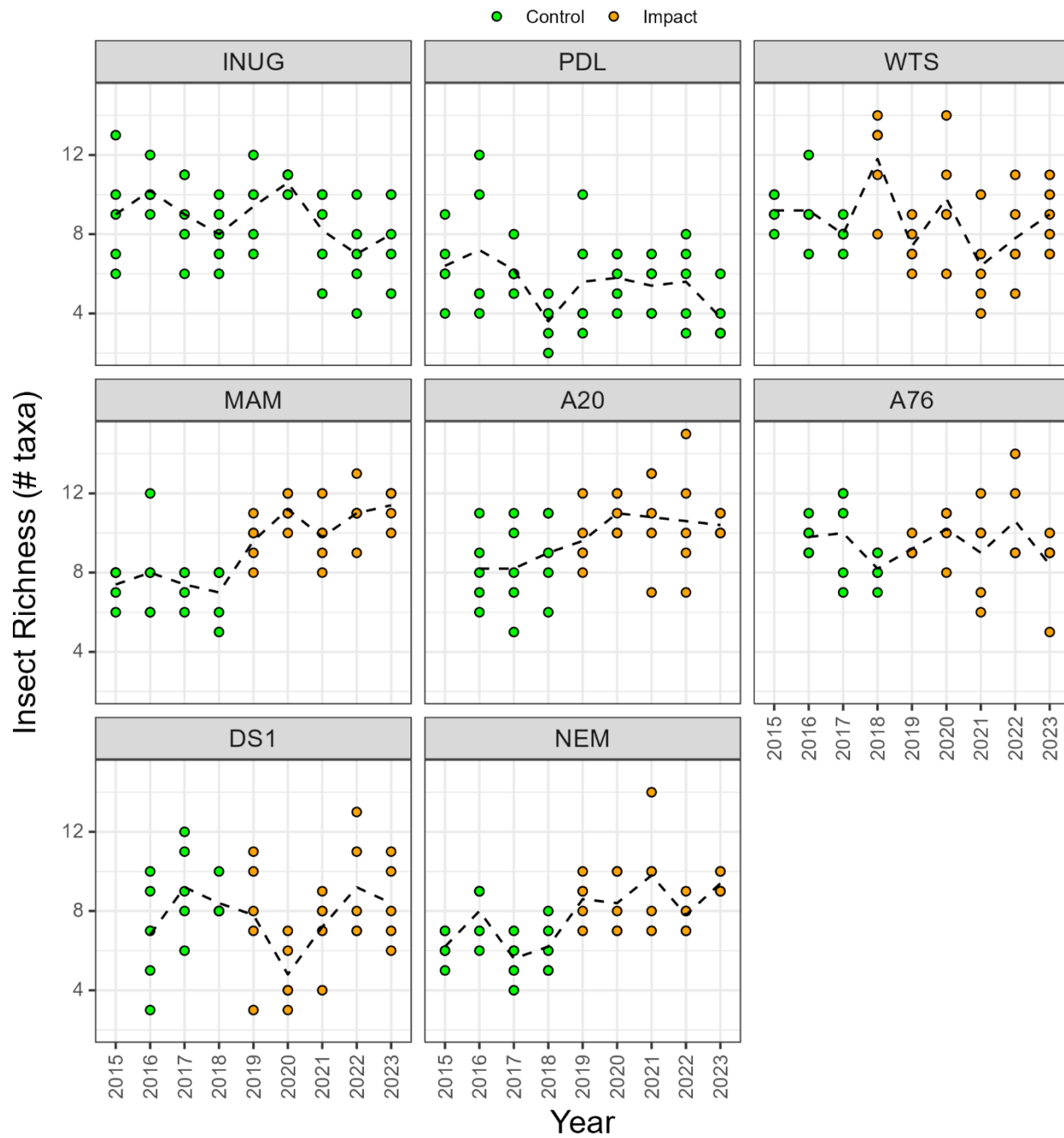
Figure E2-6. Insect richness (# of taxa) from the Whale Tail study lakes since 2015.

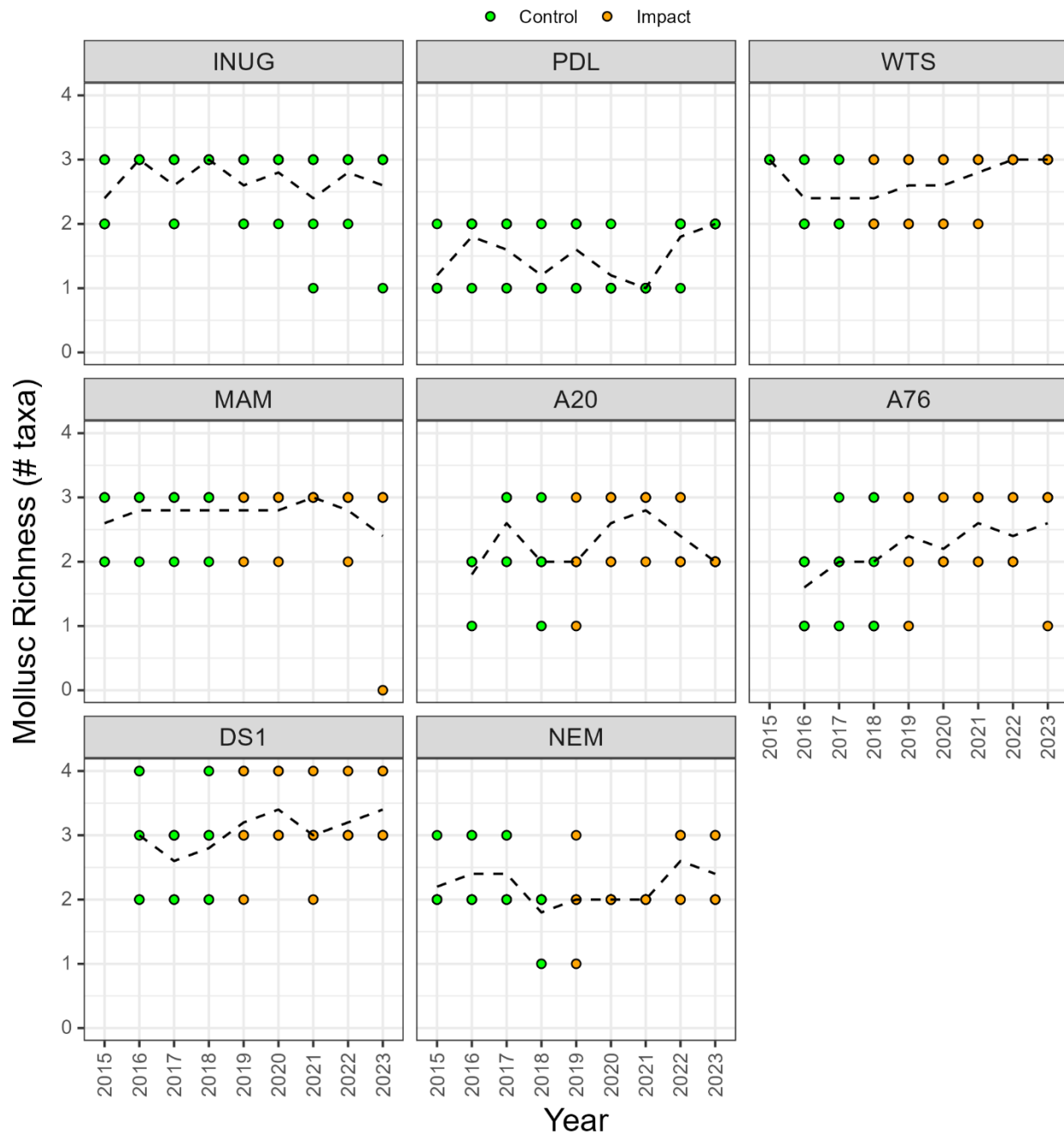
Figure E2-7. Mollusc richness (# of taxa) from the Whale Tail study lakes since 2015.

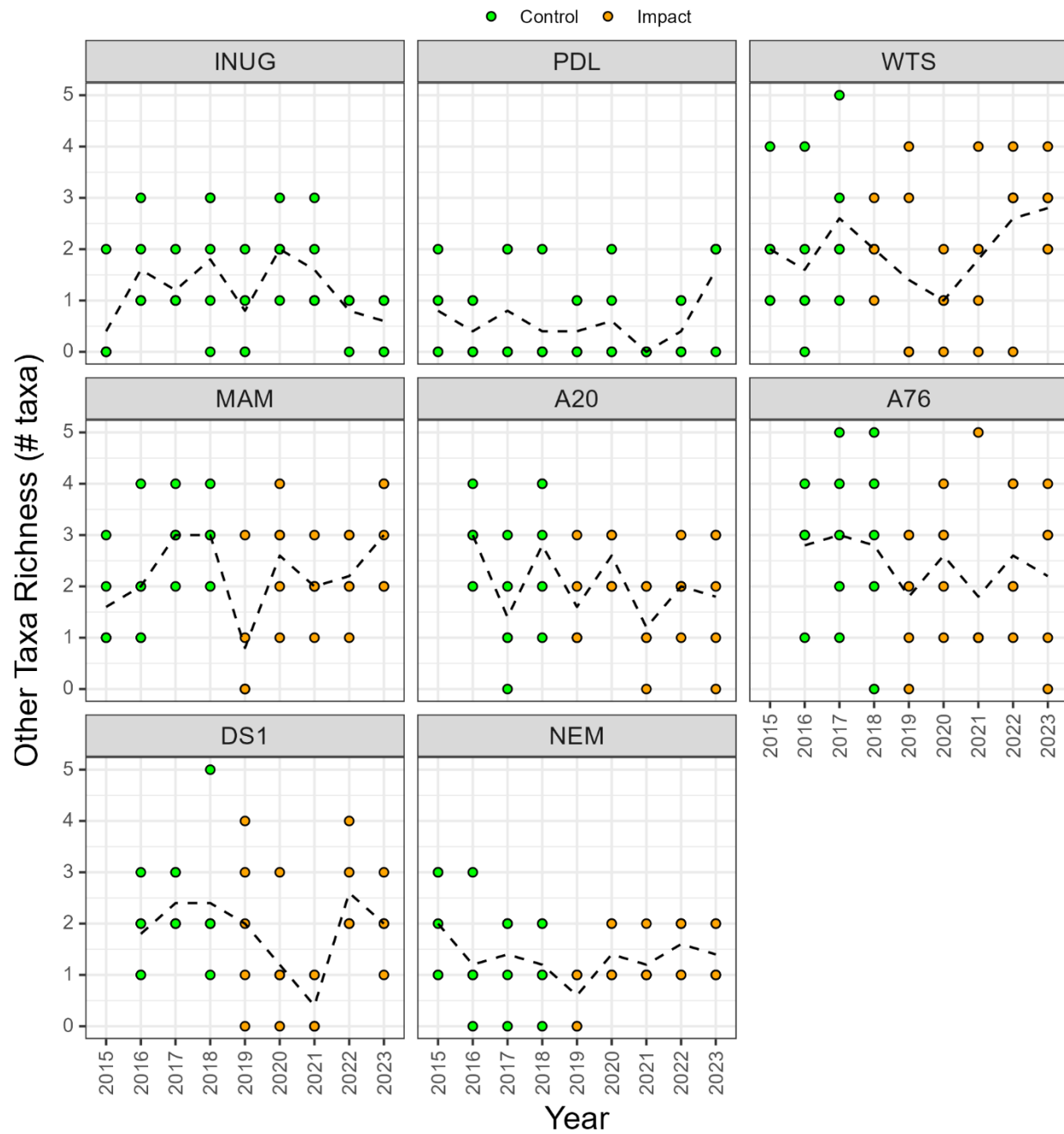
Figure E2-8. Other taxa richness (# of taxa) from the Whale Tail study lakes since 2015.

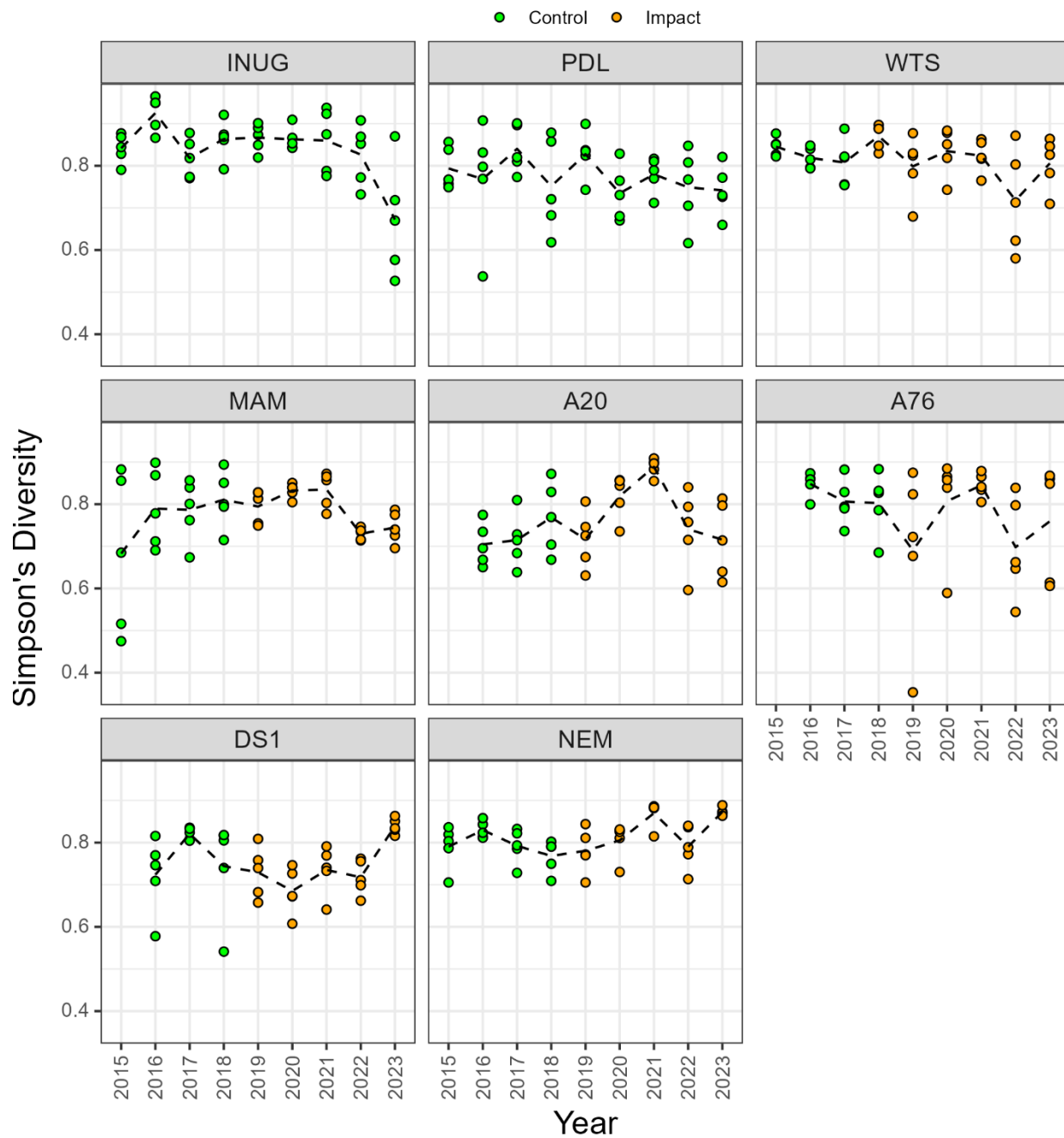
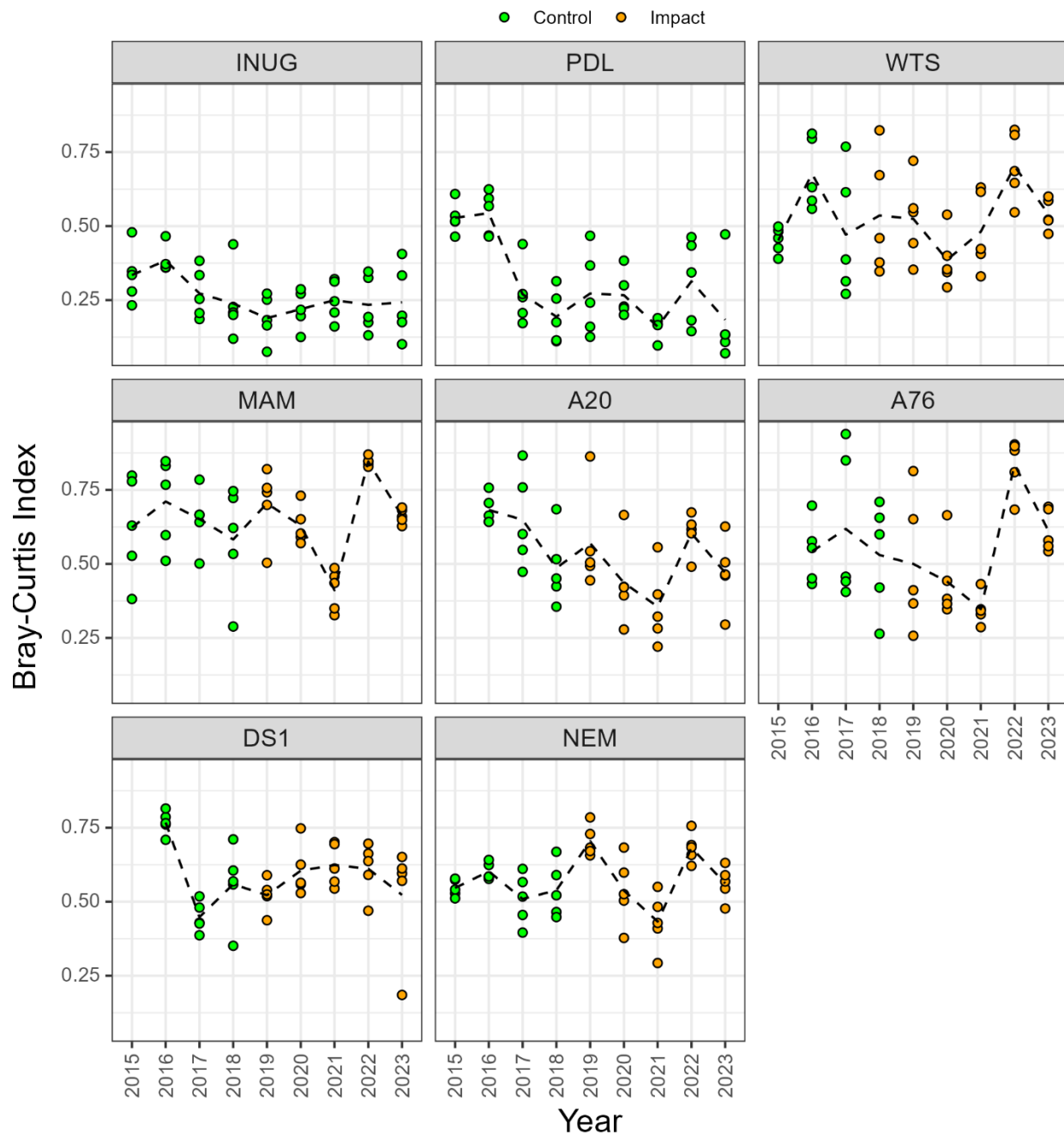
Figure E2-9. Simpson's Diversity for the benthic invertebrate community at the Whale Tail study lakes since 2015.

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Appendix E3

Benthos Data – Baker Lake

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Benthos Taxonomy – Baker Lake

Table E3-1. Benthic invertebrate abundance (#/m²) and richness (# taxa) by major taxa group, Baker Lake, 2023.

Area-Replicate	Date	Depth (m)	Abundance (#/m ²)					Richness (# taxa)					Simpson's Diversity	Bray-Curtis Index	
			Oligochaetes	Insects	Molluscs	Other Taxa ¹	TOTAL	Oligochaetes	Insects	Molluscs	Other Taxa ¹	TOTAL			
Baker Akilahaarjuk Point															
BAP-1	17-Aug-23	6.9	152	1,043	435	391	2,022	2	11	2	4	19	0.92	0.24	
BAP-2	17-Aug-23	7.5	174	1,413	435	217	2,239	2	13	2	3	20	0.91	0.29	
BAP-3	17-Aug-23	7.9	22	413	217	43	696	1	8	2	1	12	0.91	0.35	
BAP-4	17-Aug-23	9.1	1,543	739	630	43	2,957	4	9	1	2	16	0.87	0.44	
BAP-5	17-Aug-23	8.9	22	717	196	239	1,174	1	9	1	3	14	0.91	0.20	
Area Mean			383	865	383	187	1,817	2.0	10.0	1.6	2.6	16.2	0.91	0.30	
Baker Barge Dock															
BBD-1	16-Aug-23	8.4	196	6,848	1,674	22	8,739	3	14	2	1	20	0.63	0.74	
BBD-2	16-Aug-23	7.9	22	652	0	87	761	1	11	0	3	15	0.94	0.45	
BBD-3	16-Aug-23	8.5	22	2,543	630	22	3,217	1	8	2	1	12	0.68	0.63	
BBD-4	16-Aug-23	8.2	65	1,370	22	65	1,522	2	11	1	1	15	0.88	0.37	
BBD-5	16-Aug-23	8.4	65	3,457	1,370	174	5,065	1	10	2	3	16	0.78	0.61	
Area Mean			74	2,974	739	74	3,861	1.6	10.8	1.4	1.8	15.6	0.78	0.56	
Baker East Shore															
BES-1	18-Aug-23	7.4	152	1,565	152	65	1,935	3	11	1	1	16	0.86	0.22	
BES-2	18-Aug-23	9.4	22	1,478	370	130	2,000	1	11	2	1	15	0.81	0.24	
BES-3	18-Aug-23	8.5	43	1,130	304	196	1,674	2	10	2	2	16	0.87	0.18	
BES-4	18-Aug-23	8.5	174	1,239	348	87	1,848	2	8	2	2	14	0.88	0.22	
BES-5	18-Aug-23	8.7	22	1,457	196	217	1,891	1	9	2	3	15	0.83	0.25	
Area Mean			83	1,374	274	139	1,870	1.8	9.8	1.8	1.8	15.2	0.85	0.22	
Baker Proposed Jetty															
BPJ-1	19-Aug-23	8.2	87	1,978	391	87	2,543	2	14	2	2	20	0.91	0.34	
BPJ-2	19-Aug-23	8.2	22	2,239	130	196	2,587	1	13	2	3	19	0.83	0.35	
BPJ-3	19-Aug-23	7.4	0	326	22	22	370	0	8	1	1	10	0.94	0.50	
BPJ-4	19-Aug-23	8.8	65	500	43	0	609	2	8	1	0	11	0.90	0.48	
BPJ-5	19-Aug-23	7.9	22	1,891	391	22	2,326	1	11	2	1	15	0.81	0.47	
Area Mean			39	1,387	196	65	1,687	1.2	10.8	1.6	1.4	15.0	0.88	0.43	

Notes:

1. "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, Pionidae, Harpacticoida, O. Notostraca, and Gammaracanthidae).

Table E3-2. Raw benthic invertebrate data from the Baker Lake, 2023.

Program Location Station Control/Impact?	Baker Akilahazjuk Point					Baker Lake				
	BAP Control					Baker Barge Dock BBD Impact				
	1	2	3	4	5	1	2	3	4	5
	Replicate	Replicate	Replicate	Replicate	Replicate	Replicate	Replicate	Replicate	Replicate	Replicate
	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Sample Depth (m)	17-Aug-23 6.9	17-Aug-23 7.5	17-Aug-23 7.9	17-Aug-23 9.1	17-Aug-23 8.9	16-Aug-23 8.4	16-Aug-23 7.9	16-Aug-23 8.5	17-Aug-23 8.2	17-Aug-23 8.4
ROUNDWORMS										
<i>P. Nemata</i>	7	18	8	6	8	2	5	8	8	8
FLATWORMS										
<i>P. Platyhelminthes</i>										
<i>Cl. Turbellaria</i>										
indeterminate	-	-	-	-	-	-	2	-	-	-
ANNELIDS										
<i>P. Annelida</i>										
WORMS										
<i>Cl. Oligochaeta</i>										
<i>F. Enchytraeidae</i>	-	-	-	-	-	-	1	-	1	-
<i>F. Naididae</i>										
<i>S.F. Naidinae</i>										
<i>Nais</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Tubificinae</i>										
immatures with hair chaetae	2	-	1	16	1	1	-	-	-	-
immatures without hair chaetae	-	-	-	-	-	-	-	-	-	-
<i>S.F. Rhyacodrilinae</i>										
<i>Rhyacodrilus coccineus</i>	-	-	-	19	-	1	-	-	-	-
<i>Rhyacodrilus montana</i>	5	6	-	10	-	7	-	1	2	3
<i>F. Lumbriculidae</i>										
<i>Lumbriculus</i>	-	-	-	-	-	-	-	-	-	-
indeterminate	-	2	-	26	-	-	-	-	-	-
ARTHROPODS										
<i>P. Arthropoda</i>										
MITES										
<i>Cl. Arachnida</i>										
<i>O. Acarina</i>										
immature	1	1	-	-	1	-	-	-	-	-
<i>F. Acarytonotidae</i>										
<i>Acarytonotus</i>	4	3	-	1	2	-	-	-	-	-
<i>F. Hygrobatidae</i>										
<i>Hygrobatris</i>	2	-	-	-	-	-	-	-	-	-
<i>F. Lebertiidae</i>										
<i>Lebertia</i>	9	6	-	1	4	1	1	1	3	6
<i>F. Oxidae</i>										
<i>Oxus</i>	3	1	2	-	5	-	-	-	-	1
<i>F. Pionidae</i>										
indeterminate	-	-	-	-	-	-	-	-	-	1
HARPACTICIDS										
<i>O. Harpacticoida</i>	-	-	-	-	-	-	1	-	-	-
SEED SHRIMPS										
<i>Cl. Ostracoda</i>	-	2	-	6	4	80	5	21	14	75
INSECTS										
<i>Cl. Insecta</i>										
CADDISFLIES										
<i>O. Trichoptera</i>										
immature	-	-	-	-	-	-	-	-	-	-
<i>F. Apataniidae</i>										
<i>Apatania</i>	-	1	-	-	-	1	-	-	-	-
<i>F. Hydroptilidae</i>										
<i>Agraylea</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Limnephilidae</i>										
<i>Grensia proterita</i>	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
<i>O. Diptera</i>										
MIDGES										
<i>F. Chironomidae</i>										
chironomid pupae	11	9	3	2	7	14	3	5	7	12
<i>S.F. Chironominae</i>										
<i>Cladotanytarsus</i>	-	-	-	-	-	-	-	-	-	-
<i>Constempellina</i>	1	1	1	-	-	2	2	-	4	7
<i>Corynocera ambigua</i>	-	-	-	-	-	-	-	-	-	-
<i>Cryptochironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Dicratendipes</i>	-	-	-	-	-	-	-	-	-	-
<i>Microsetra</i>	1	-	-	-	2	10	1	3	5	11
<i>Microtendipes</i>	-	-	-	-	-	-	-	-	-	-
<i>Parachironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Paracloadogelina</i>	-	-	-	-	-	-	1	-	-	-
<i>Paratanytarsus</i>	4	20	3	-	1	-	1	-	2	1
<i>Polypedium</i>	1	-	-	-	-	4	5	3	1	1
<i>Sergentia</i>	-	-	-	-	-	1	-	-	-	-
<i>Stempellinella</i>	-	-	-	-	-	-	1	-	1	-
<i>Stictochironomus</i>	4	7	5	16	-	238	-	80	21	98
<i>Tanytarsus</i>	4	8	1	1	7	13	-	7	-	10
<i>S.F. Diamesinae</i>										
<i>Potthastia</i>	-	2	-	-	-	1	-	-	-	-
<i>Protanypus</i>	1	-	-	-	-	2	4	-	1	-
<i>Pseudodiamesa</i>	-	-	-	1	-	-	-	-	-	-
<i>S.F. Orthocladinae</i>										
<i>Abiskomyia</i>	-	1	-	1	-	10	-	12	-	8
<i>Cricotopus/Orthocladus</i>	-	-	-	-	-	-	-	-	-	-
<i>Eukiefferiella</i>	-	-	-	-	-	-	-	-	-	-
<i>Heterotrissocladius</i>	9	6	1	1	7	2	3	4	3	2
<i>Mesocricotopus</i>	-	-	1	-	1	-	-	1	-	-
<i>Paracloadius</i>	1	1	-	-	2	-	-	-	-	-
<i>Psectrocladius</i>	-	-	-	-	-	-	-	-	-	-
<i>Zalutschia</i>	-	-	-	-	-	-	-	-	-	-
<i>Orthocladinae Genus "Greenland"</i>	-	-	-	-	-	-	-	-	-	-
indeterminate	-	-	-	-	-	-	-	-	1	-
<i>S.F. Prodiamesinae</i>										
<i>Monodiamesa</i>	3	3	3	1	4	9	3	6	4	7
<i>S.F. Tanyptodinae</i>										
<i>Abiadesmyia</i>	-	-	-	-	-	-	-	-	-	-
<i>Procladius</i>	8	1	1	7	1	6	5	3	6	2
<i>Thienemannimyia</i> complex	-	4	-	1	-	-	1	-	-	-
<i>F. Empididae</i>										
<i>Chelifera/Metachela</i>	-	1	-	3	-	2	-	-	-	-
MOLLUSCS										
<i>P. Mollusca</i>										
SNAILS										
<i>Cl. Gastropoda</i>										
<i>F. Valvatidae</i>										
<i>Valvata lewisi</i>	-	-	-	-	-	-	-	-	-	-
<i>Valvata</i>	-	-	-	-	-	-	-	-	-	-
CLAMS										
<i>Cl. Bivalvia</i>										
<i>F. Sphaeriidae</i>										
<i>Pisidium/Cyclocalyx</i>	17	15	3	29	9	53	-	18	-	36
<i>Pisidium (Cyclocalyx/Neopisidium)</i>	3	5	7	-	-	24	-	11	1	27
<i>Sphaerium nitidum</i>	-	-	-	-	-	-	-	-	-	-

Table E3-2. Raw benthic invertebrate data from the Baker Lake, 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Baker Akilahazariuk Point					Baker Lake				
	BAP Control					Baker Barge Dock BBD Impact				
	1	2	3	4	5	1	2	3	4	5
	17-Aug-23 6.9	17-Aug-23 7.5	17-Aug-23 7.9	17-Aug-23 9.1	17-Aug-23 8.9	16-Aug-23 8.4	16-Aug-23 7.9	16-Aug-23 8.5	17-Aug-23 8.2	17-Aug-23 8.4
TOTAL NUMBER OF ORGANISMS	101	124	40	148	67	484	45	177	92	316
TOTAL NUMBER OF TAXA *	20	22	13	18	16	22	17	14	18	18
* Bold entries excluded from taxa count										
R (Richness) - totals ^{2,3}										
Total	19	20	12	16	14	20	15	12	15	16
Oligochaete	2	2	1	4	1	3	1	1	2	1
Insect	11	13	8	9	9	14	11	8	11	10
Mollusc	2	2	2	1	1	2	0	2	1	2
Other ⁴	4	3	1	2	3	1	3	1	1	3
Abundance (raw) - totals ^{5,6}										
Total	93	103	32	136	54	402	35	148	70	233
Oligochaete	7	8	1	71	1	9	1	1	3	3
Insect	48	65	19	34	33	315	30	117	63	159
Mollusc	20	20	10	29	9	77	0	29	1	63
Other ⁴	18	10	2	2	11	1	4	1	3	8
Abundance - totals (#/m²) ⁵										
Total	2,022	2,239	696	2,957	1,174	8,739	761	3,217	1,522	5,065
Oligochaete	152	174	22	1,543	22	196	22	22	65	65
Insect	1,043	1,413	413	739	717	6,848	652	2,543	1,370	3,457
Mollusc	435	435	217	630	196	1,674	0	630	22	1,370
Other ⁴	391	217	43	43	239	22	87	22	65	174

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nematoda, Cl. Ostracoda, Indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertidae, F. Oxidae, F. Plonidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nematoda and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m²).

Table E3-2. Raw benthic invertebrate data from the Baker Lake, 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Baker Lake									
	Baker East Shore BES Control					Baker Proposed Jetty BPJ Impact				
	1	2	3	4	5	1	2	3	4	5
	16-Aug-23 7.4	16-Aug-23 9.4	16-Aug-23 8.5	16-Aug-23 8.5	16-Aug-23 8.7	19-Aug-23 8.2	19-Aug-23 8.2	19-Aug-23 7.4	19-Aug-23 8.8	19-Aug-23 7.9
ROUNDWORMS										
<i>P. Nemata</i>	13	10	7	5	12	5	19	1	6	4
FLATWORMS										
<i>P. Platyhelminthes</i>										
<i>Cl. Turbellaria</i>	-	-	-	-	-	-	-	-	-	-
ANNELIDS										
<i>P. Annelida</i>										
WORMS										
<i>Cl. Oligochaeta</i>										
<i>F. Enchytraeidae</i>	3	1	1	3	-	-	-	-	-	-
<i>F. Naididae</i>										
<i>S.F. Naidinae</i>										
<i>Nais</i>	-	-	-	-	-	-	-	-	-	-
<i>S.F. Tubificinae</i>										
immatures with hair chaetae	1	-	-	-	-	-	-	-	-	-
immatures without hair chaetae	-	-	-	-	-	1	-	-	-	-
<i>S.F. Rhyacodrilinae</i>										
<i>Rhyacodrilus coccineus</i>	-	-	-	-	-	-	-	-	1	-
<i>Rhyacodrilus montana</i>	3	-	1	5	1	3	1	-	2	1
<i>F. Lumbriculidae</i>										
<i>Lumbriculus</i>	-	-	-	-	-	-	-	-	-	-
indeterminate	-	-	-	-	-	-	-	-	-	-
ARTHROPODS										
<i>P. Arthropoda</i>										
MITES										
<i>Cl. Arachnida</i>										
<i>O. Acarina</i>										
immature	-	1	2	-	1	-	-	-	-	-
<i>F. Acarytonotidae</i>										
<i>Acarytonotus</i>	-	-	-	1	4	-	1	-	-	-
<i>F. Hygrobatidae</i>										
<i>Hygrobatris</i>	-	-	-	-	-	1	1	-	-	-
<i>F. Lebertidae</i>										
<i>Lebertia</i>	3	6	7	3	5	3	7	-	-	1
<i>F. Oxidae</i>										
<i>Oxus</i>	-	-	2	-	1	-	-	1	-	-
<i>F. Pionidae</i>										
indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICIDS										
<i>O. Harpacticoida</i>	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
<i>Cl. Ostracoda</i>	38	9	16	9	13	16	2	3	-	2
INSECTS										
<i>Cl. Insecta</i>										
CADDISFLIES										
<i>O. Trichoptera</i>										
immature	-	-	-	-	-	-	-	-	-	-
<i>F. Apataniidae</i>										
<i>Apatania</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Hydroptilidae</i>										
<i>Agraylea</i>	-	-	-	-	-	-	-	-	-	-
<i>F. Limnephilidae</i>										
<i>Grensio proterita</i>	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
<i>O. Diptera</i>										
MIDGES										
<i>F. Chironomidae</i>										
chironomid pupae	28	37	23	22	32	17	45	3	5	7
<i>S.F. Chironominae</i>										
<i>Cladotanytarsus</i>	-	-	-	-	-	-	-	-	-	-
<i>Constempellina</i>	10	5	2	3	3	1	3	-	-	2
<i>Corynocera ambigua</i>	-	-	-	-	-	-	-	-	-	-
<i>Cryptochironomus</i>	-	-	-	-	-	-	-	-	-	-
<i>Dicratendipes</i>	-	-	-	-	-	-	-	-	-	-
<i>Microsetra</i>	1	1	1	1	2	8	3	1	-	3
<i>Microtendipes</i>	-	-	-	-	-	-	-	-	-	-
<i>Parachironomus</i>	3	6	-	-	-	-	-	-	-	-
<i>Paracloadogelina</i>	-	1	1	-	-	1	2	-	1	-
<i>Paratanytarsus</i>	3	-	-	-	1	2	1	1	-	2
<i>Polypedium</i>	-	-	-	-	-	-	-	-	-	-
<i>Sergentia</i>	-	-	-	-	-	-	-	-	-	-
<i>Stempellinella</i>	-	-	-	-	-	1	-	-	-	-
<i>Stictochironomus</i>	3	-	-	-	-	14	8	2	1	42
<i>Tanytarsus</i>	7	5	9	14	9	18	16	3	3	14
<i>S.F. Diamesinae</i>										
<i>Potthastia</i>	-	-	-	-	-	-	-	-	-	-
<i>Protanytus</i>	-	-	-	-	-	1	1	-	-	-
<i>Pseudodiamesa</i>	1	1	1	-	1	1	-	-	-	-
<i>S.F. Orthocladinae</i>										
<i>Abiskomyia</i>	2	-	-	1	-	3	2	-	-	2
<i>Cricotopus/Orthocladus</i>	-	2	1	-	-	-	-	-	-	1
<i>Eukiefferiella</i>	-	-	-	-	-	-	-	-	-	-
<i>Heterotrissocladius</i>	10	4	2	2	7	1	6	-	7	1
<i>Mesocricotopus</i>	-	1	-	-	-	-	1	1	-	-
<i>Paracloadius</i>	-	-	4	8	8	-	3	1	1	1
<i>Psectrocladius</i>	-	-	-	-	-	-	-	-	-	-
<i>Zalutschia</i>	-	-	-	-	-	-	-	-	-	-
<i>Orthocladinae Genus "Greenland"</i>	-	-	-	-	-	-	1	-	-	-
indeterminate	-	-	-	1	1	-	2	-	-	-
<i>S.F. Prodiamesinae</i>										
<i>Monodiamesa</i>	2	2	3	4	1	7	4	2	3	7
<i>S.F. Tanyptodinae</i>										
<i>Abiadesmyia</i>	-	-	-	-	-	-	-	-	-	-
<i>Procladius</i>	2	3	5	1	2	15	6	1	1	5
<i>Thienemannimyia</i> complex	-	-	-	-	-	-	-	-	-	-
<i>F. Empididae</i>										
<i>Chelifera/Metachela</i>	-	-	-	-	-	1	-	-	-	-
MOLLUSCS										
<i>P. Mollusca</i>										
SNAILS										
<i>Cl. Gastropoda</i>										
<i>F. Valvatidae</i>										
<i>Valvata lewisi</i>	-	-	-	-	-	-	-	-	-	-
<i>Valvata</i>	-	-	-	-	-	-	-	-	-	-
CLAMS										
<i>Cl. Bivalvia</i>										
<i>F. Sphaeriidae</i>										
<i>Pisidium/Cyclocalyx</i>	7	7	10	6	7	9	2	1	-	12
<i>Pisidium (Cyclocalyx/Neopisidium)</i>	-	10	4	10	2	9	4	-	2	6
<i>Sphaerium nitidum</i>	-	-	-	-	-	-	-	-	-	-

Table E3-2. Raw benthic invertebrate data from the Baker Lake, 2023.

Program Location Station Control/Impact? Replicate Date Sample Depth (m)	Baker Lake										
	Baker East Shore BES Control					Baker Proposed Jetty BPJ Impact					
	1	2	3	4	5	1	2	3	4	5	
	16-Aug-23 7.4	16-Aug-23 9.4	16-Aug-23 8.5	16-Aug-23 8.5	16-Aug-23 8.7	19-Aug-23 8.2	19-Aug-23 8.2	19-Aug-23 7.4	19-Aug-23 8.8	19-Aug-23 7.9	
TOTAL NUMBER OF ORGANISMS	140	112	102	99	113	#	138	140	21	34	113
TOTAL NUMBER OF TAXA ^a	18	17	19	17	18		22	22	12	12	17
*Bold entries excluded from taxa count											
R (Richness) - totals ^{2,3}											
Total	14	16	17	11	13		20	19	10	11	15
Oligochaete	1	1	2	0	0		2	1	0	2	1
Insect	9	11	10	8	9		14	13	8	8	11
Mollusc	1	1	1	1	1		2	2	1	1	2
Other ⁴	3	3	4	2	3		2	3	1	0	1
Abundance (raw) - totals ^{5,6}											
Total	86	102	86	53	68		117	119	17	28	107
Oligochaete	2	4	2	0	0		4	1	0	3	1
Insect	59	74	52	36	29		91	103	15	23	87
Mollusc	9	13	12	4	19		18	6	1	2	18
Other ⁴	16	11	20	13	20		4	9	1	0	1
Abundance - totals (#/m ²) ⁵											
Total	1,870	2,217	1,870	1,152	1,478		2,543	2,587	370	609	2,326
Oligochaete	43	87	43	0	0		87	22	0	65	22
Insect	1,283	1,609	1,130	783	630		1,978	2,239	326	500	1,891
Mollusc	196	283	261	87	413		391	130	22	43	391
Other ⁴	348	239	435	283	435		87	196	22	0	22

Notes:
1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertidae, F. Oxidae, F. Plonidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m²).

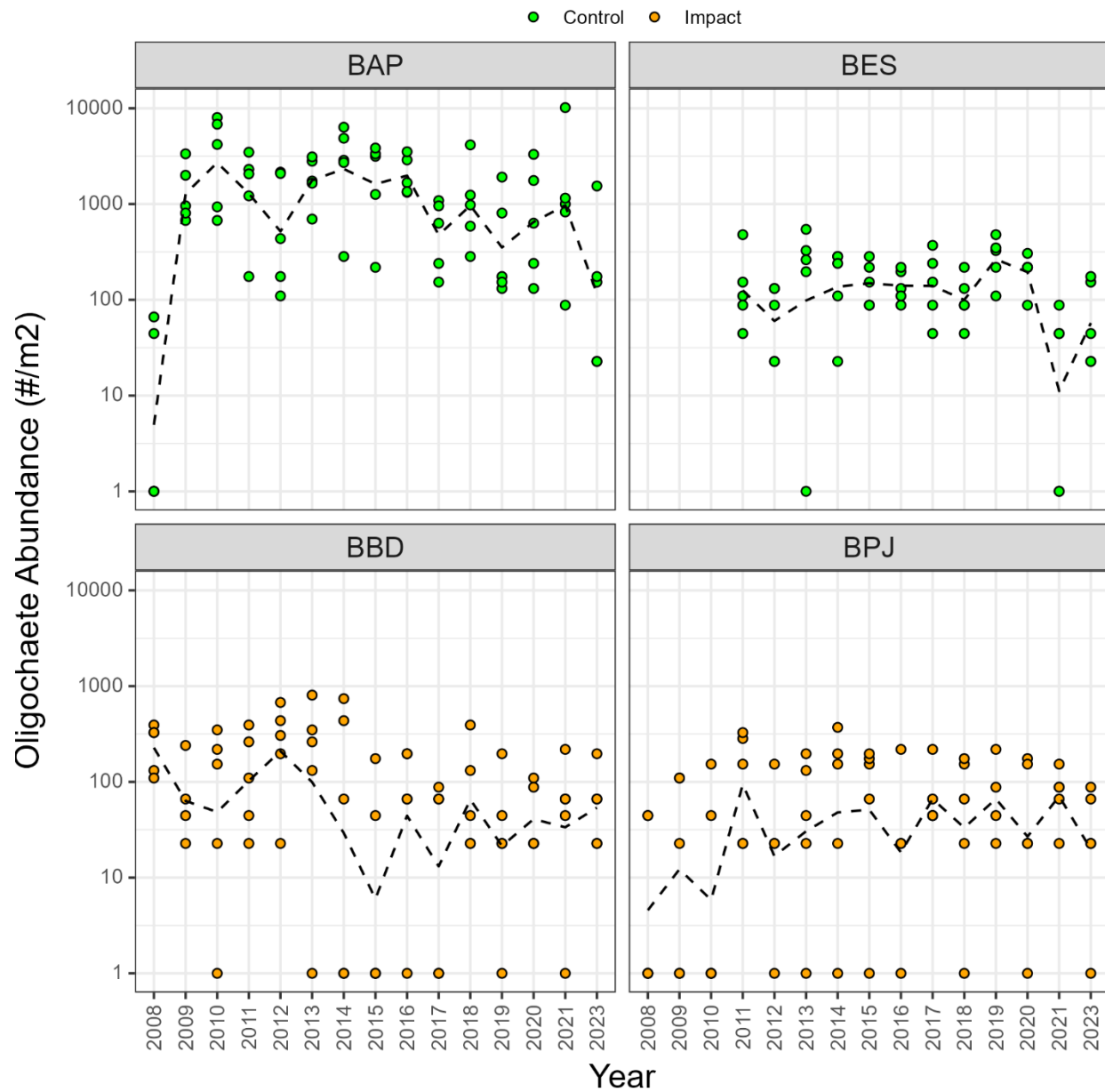
Figure E3-1. Oligochaete abundance (#/m²) from Baker Lake since 2008.

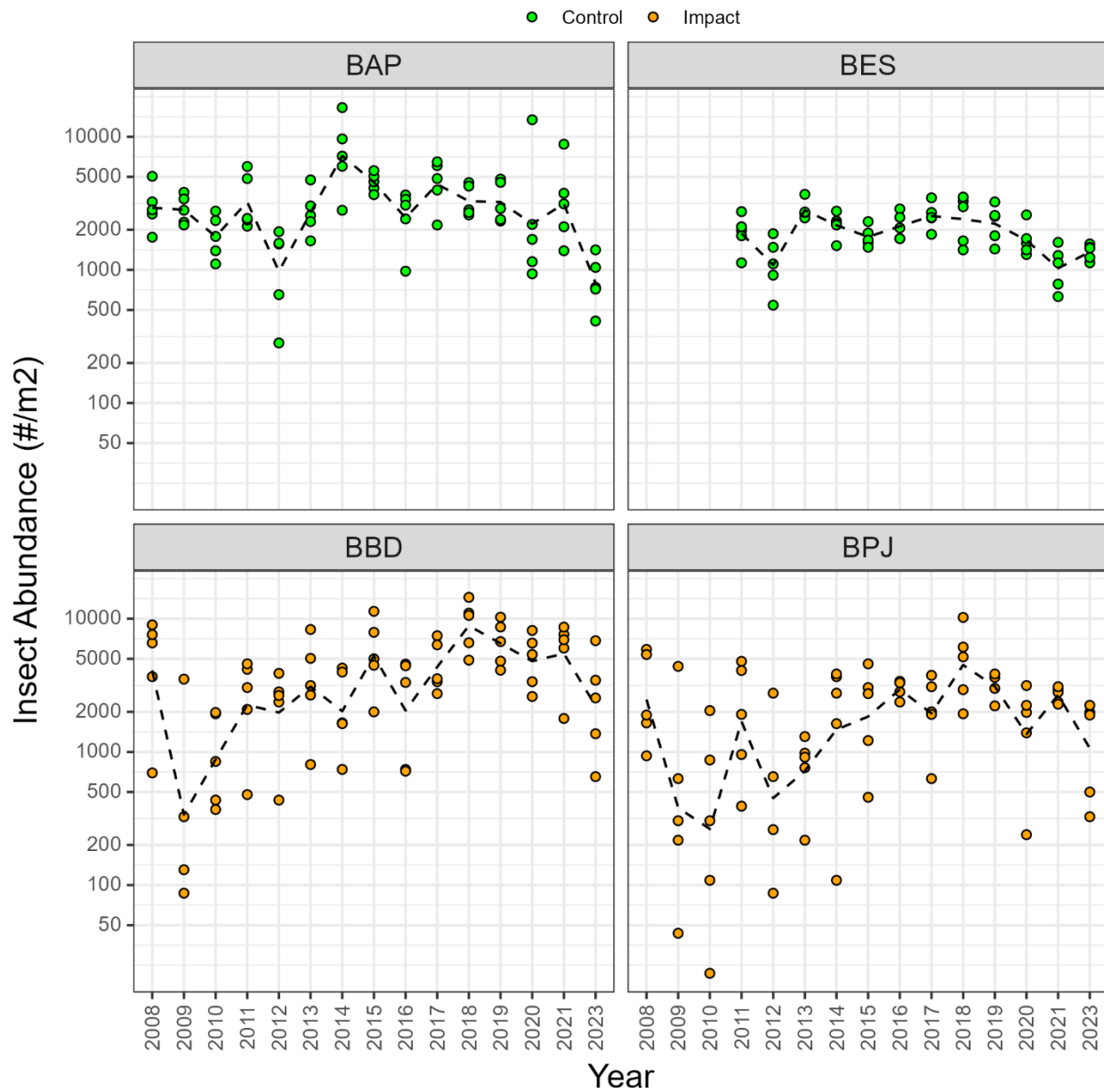
Figure E3-2. Insect abundance (#/m²) from Baker Lake since 2008.

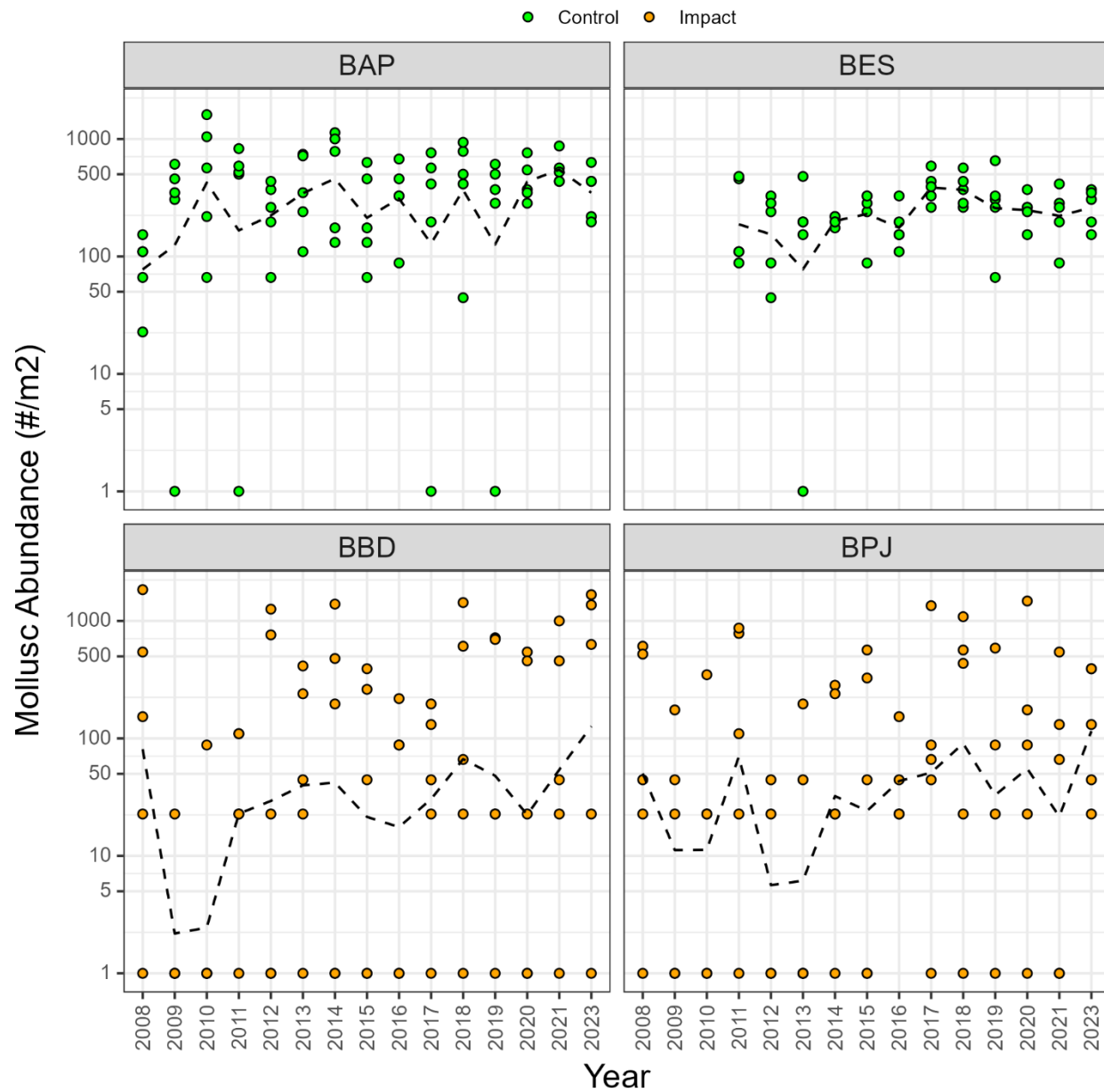
Figure E3-3. Mollusc abundance (#/m²) from Baker Lake since 2008.

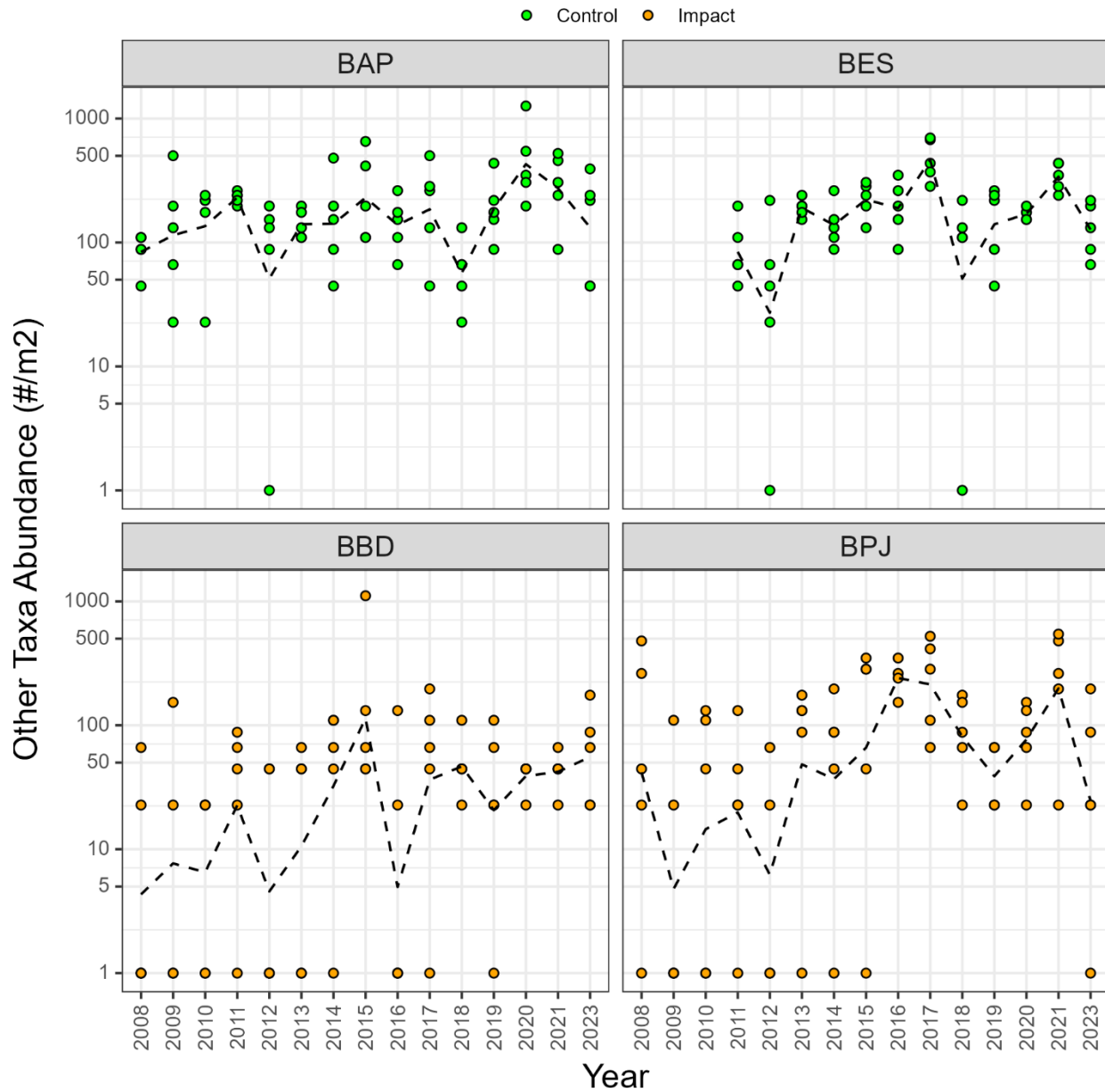
Figure E3-4. Other taxa abundance (#/m²) from Baker Lake since 2008.

Figure E3-5. Oligochaete richness (# of taxa) from Baker Lake since 2008.

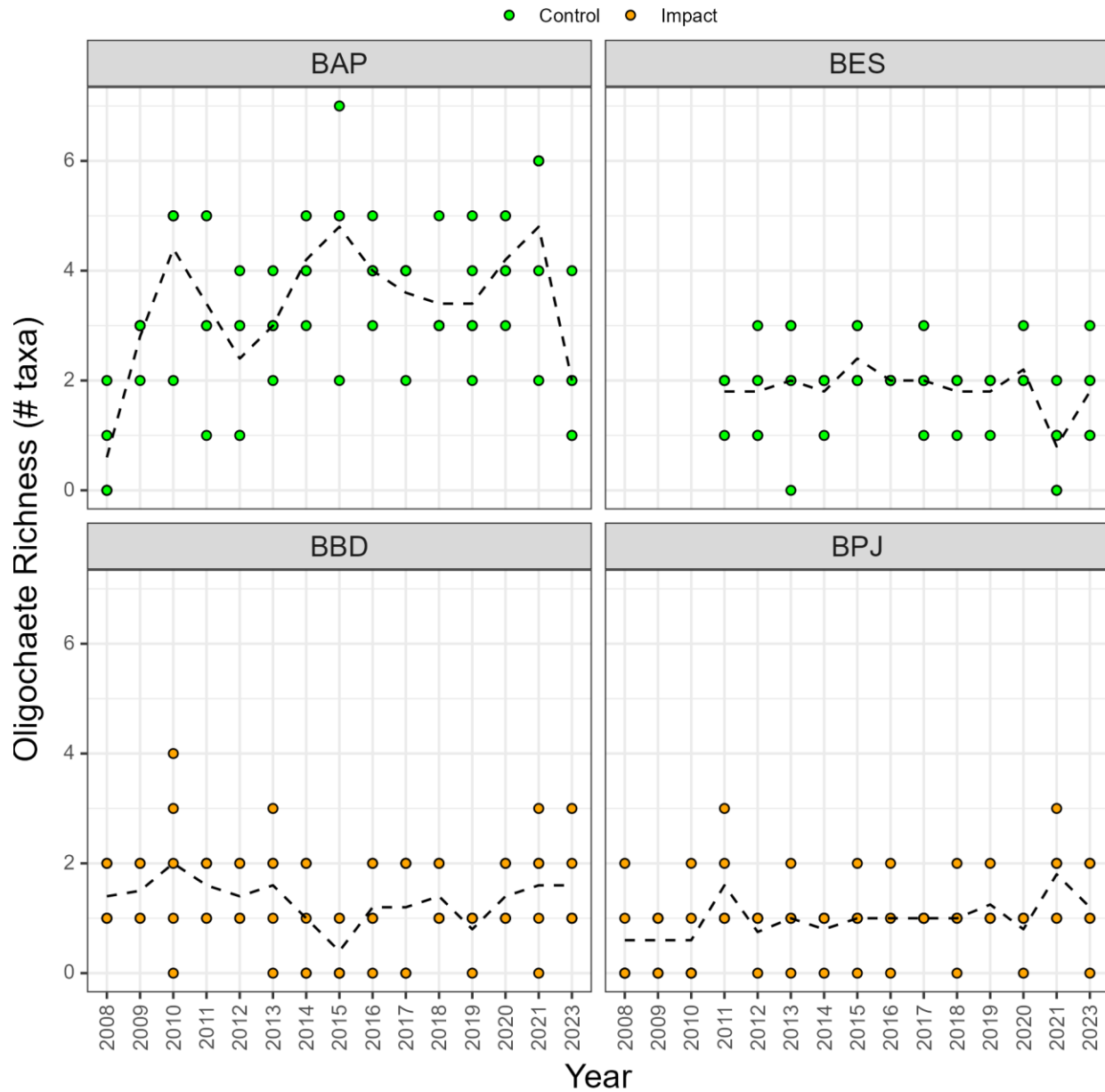


Figure E3-6. Insect richness (# of taxa) from Baker Lake since 2008.

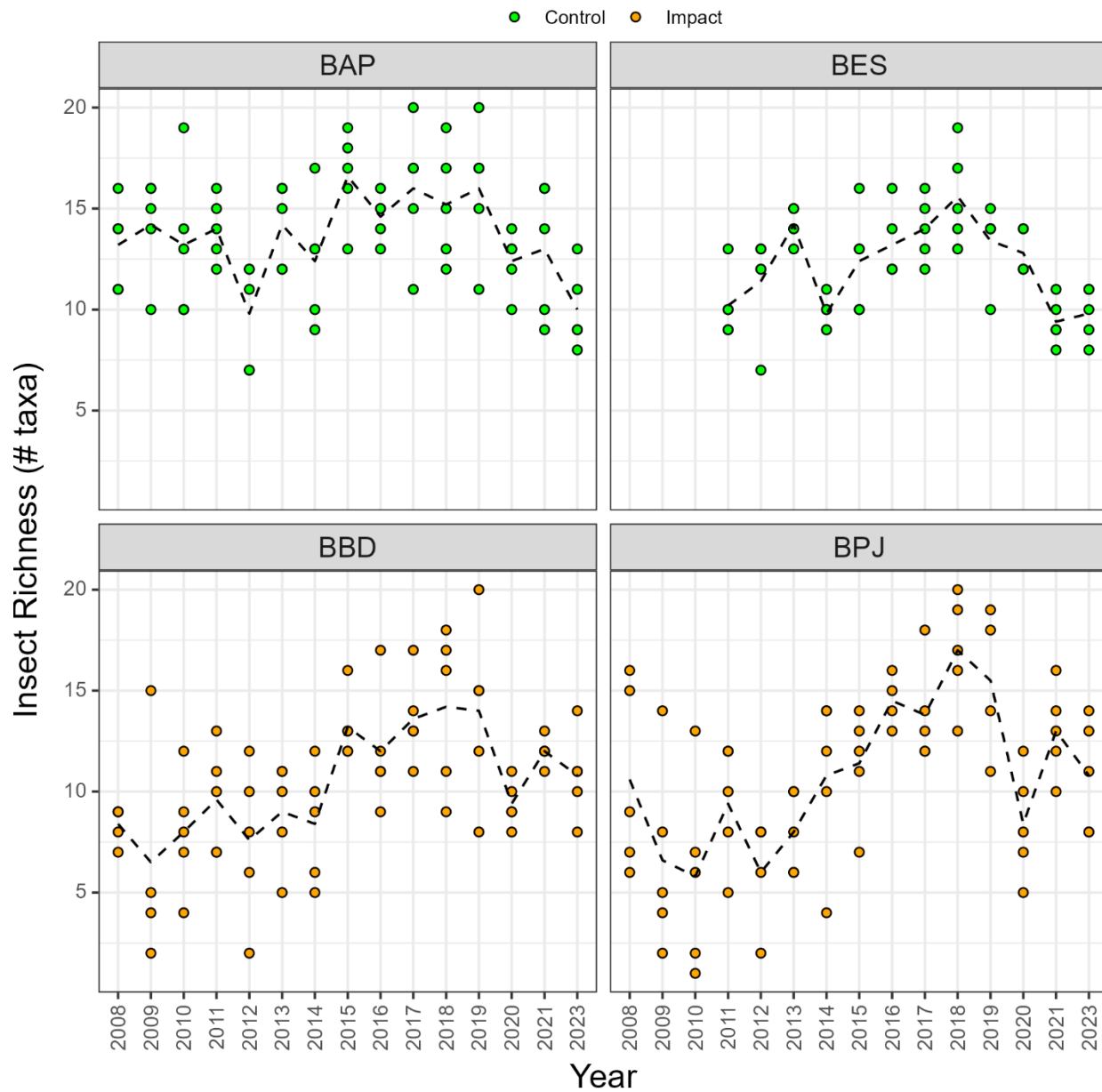


Figure E3-7. Mollusc richness (# of taxa) from Baker Lake since 2008.

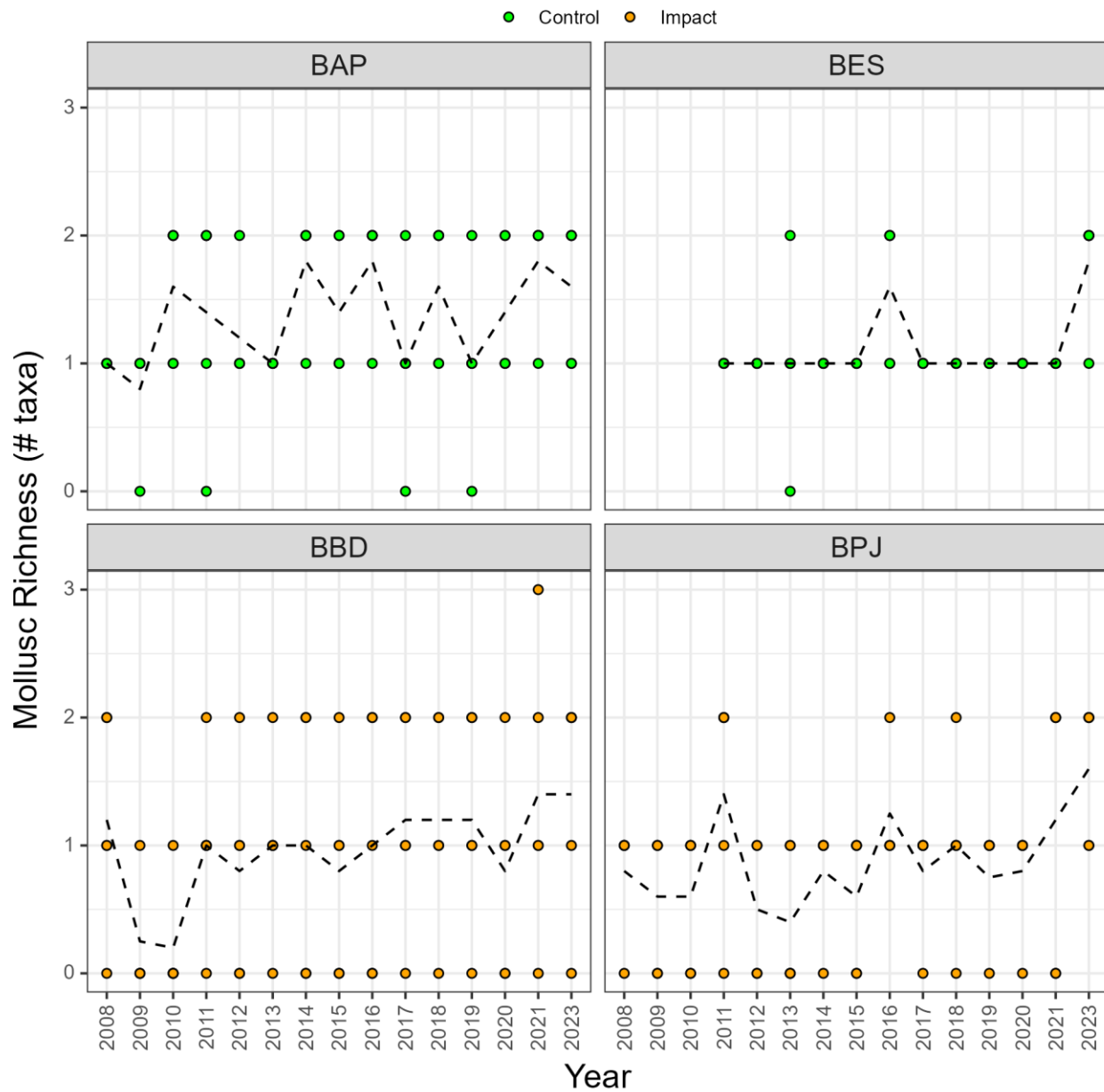


Figure E3-8. Other taxa richness (# of taxa) from Baker Lake since 2008.

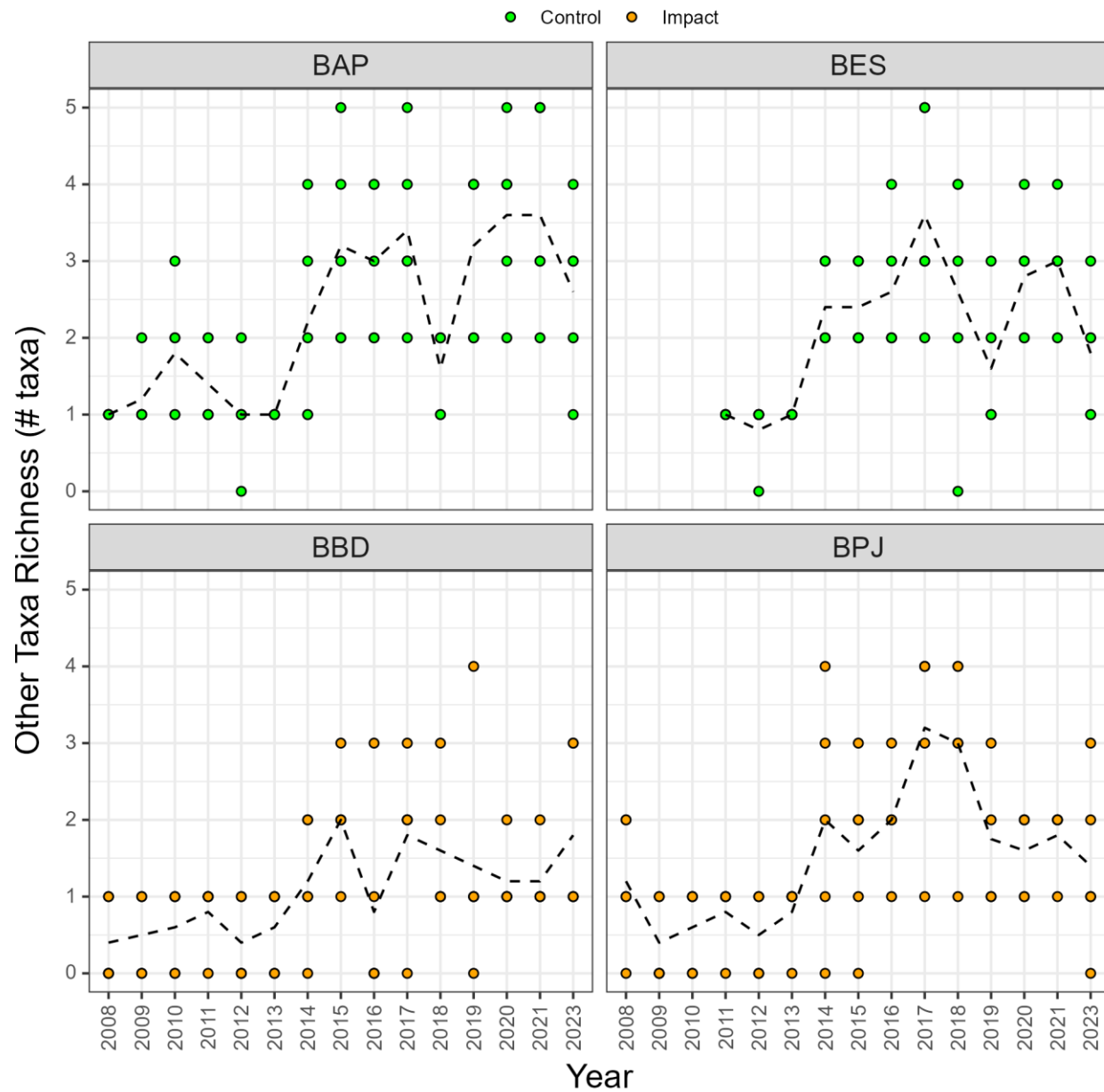


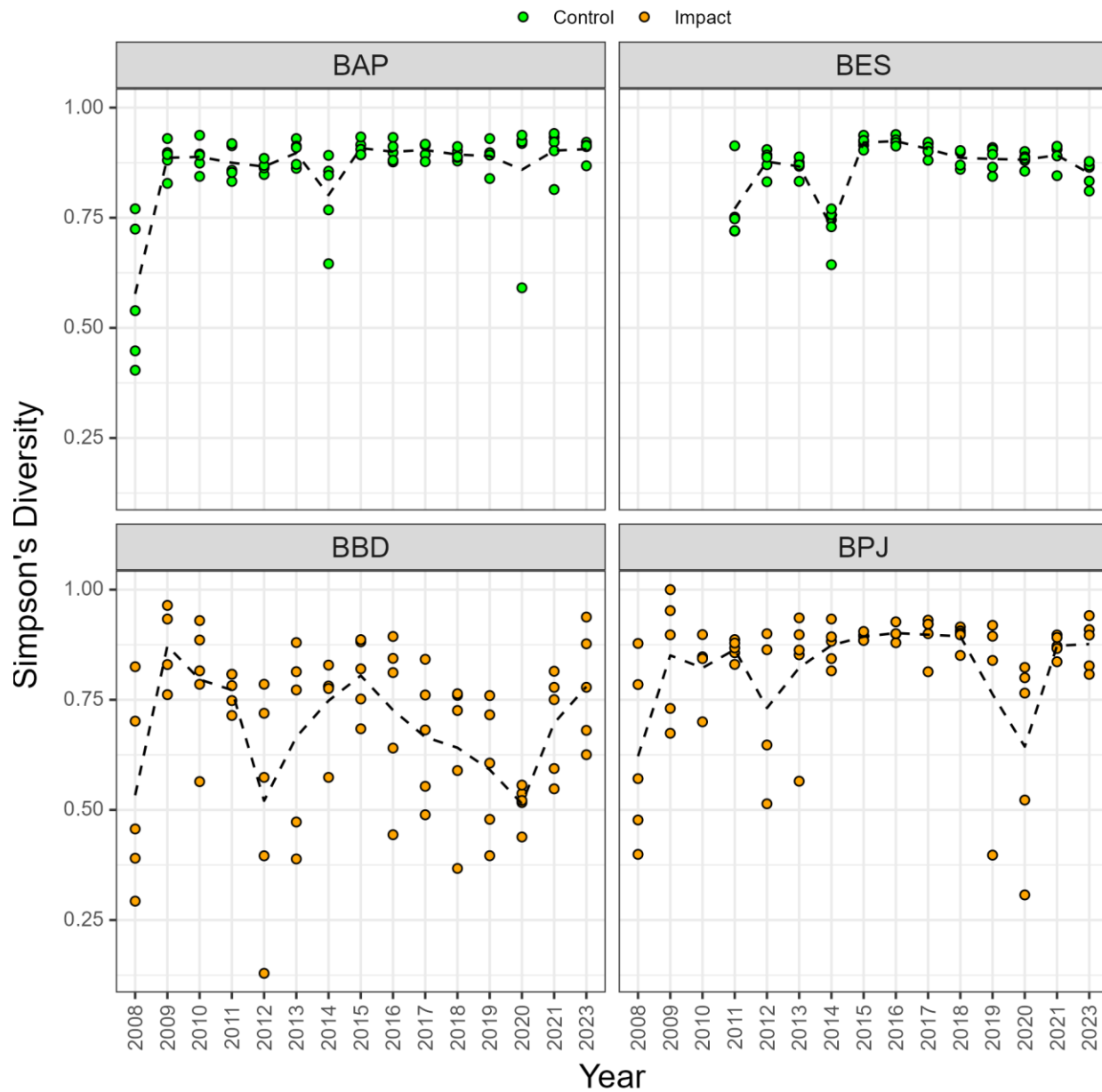
Figure E3-9. Simpsons' Diversity for the benthic invertebrate community at Baker Lake since 2008.

Figure E3-10. Bray-Curtis Index for the benthic invertebrate community at Baker Lake since 2008.

APPENDIX F
2019 WATER QUALITY EFFECTS ASSESSMENT

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F.1 INTRODUCTION

This technical document was prepared by Azimuth Consulting Group Partnership (Azimuth) to provide context on the potential for adverse effects to lower trophic biota (i.e., phytoplankton, zooplankton and benthic invertebrates) due to changes in water parameters that do not have effects-based thresholds (e.g., water quality standards, guidelines or criteria).

F.1.1 Background

The decision framework for the CREMP incorporates the use of *thresholds* (i.e., typically CCME water quality guidelines or effects-based equivalents from other jurisdictions) and *triggers* (i.e., early warning limits typically set between baseline/reference conditions and the threshold for parameters with effects-based guidelines, or set at the 95th percentile of the baseline/reference conditions; see [Appendix I](#) in the 2020 CREMP report for details). To date, for parameters with effects-based thresholds, CREMP monitoring has shown that receiving environment water quality in the Meadowbank and Whale Tail Pit study lakes meets both the trigger and threshold values (i.e., well below water quality guidelines).

Mining-related increases, particularly at NF study areas, have been observed for some parameters without water quality guidelines, including total dissolved solids (TDS), total alkalinity, conductivity, hardness, and certain major ions (i.e., calcium, magnesium, potassium, and sodium). Most of these parameters also exceed predicted concentrations presented in the Meadowbank Final Environment Impact Statement (FEIS) (Cumberland, 2005). In addition, total silicon, which was not routinely measured during the baseline period and shows little in the way of temporal trends, exceeds FEIS predictions. Because silicon was not routinely included in the suite of analyses in the baseline water chemistry samples, the baseline water quality values for Third Portage Lake, Second Portage Lake, and Wally Lake were set to 0 mg/L. This approach resulted in an underestimate of future concentrations for Third Portage Lake, Second Portage Lake, and Wally Lake. Silicon is not recommended as a parameter for evaluating the accuracy of the water quality model predictions for the Meadowbank study area lakes given the underestimate in baseline water chemistry.

As described in the main report, biological monitoring conducted under the CREMP targets the phytoplankton and benthic invertebrate communities. Results to date indicate that communities in the NF areas are functionally intact, with major indices such as taxonomic richness and abundance remaining relatively stable across the more than a decade of events. Thus, the biological data indicate that current water quality in the NF study areas is not adversely affecting

the health of phytoplankton and benthic invertebrate communities compared to baseline or reference conditions.

F.1.2 Rationale

Notwithstanding the evidence showing phytoplankton and benthos communities are similar to baseline/reference conditions, the Kivalliq Inuit Association (KIA), in their review of the 2018 annual report, recommended¹ that Agnico Eagle complete the following:

- i. *Investigate the source of these parameter increases, their spatial extent and the reversibility of these trends.*
- ii. *Discuss the implications of increased conductivity, calcium, magnesium, potassium, sodium, TDS and alkalinity at the near-field sites on lower trophic levels, specifically in terms of the community composition of phytoplankton, zooplankton and benthic invertebrates.*
- iii. *In accordance with AEM Management Response Plan for the Meadowbank Mine Aquatic Environment Monitoring Program, that AEM increase monitoring frequency at the mid-field sites to determine the spatial extent of exceedances observed in the near-field during the open water season.*
- iv. *Conduct an investigation of cause study for the observed changes in water chemistry and determine possible management strategies.*

This technical memorandum is meant to address recommendations i) and ii) above by providing a review of available literature on the effects of selected conventional and ionic compounds on lower trophic level community composition. The outcome of this technical review will help determine if increased monitoring frequency (point iii) and/or investigation of cause studies (point iv) should be considered to help inform adaptive management decisions.

F.1.3 Approach

As described in **Section F.1.1**, the following parameters have been shown to be exceeding baseline/reference conditions and/or FEIS predictions: total dissolved solids (TDS), total alkalinity, conductivity, hardness, certain major ions (i.e., calcium, magnesium, potassium, and sodium), and total silicon. Apart from total silicon, the rest of these parameters are inter-related to some extent or are not parameters of toxicological concern. Rationale for the approach used herein to cover the range of parameters is as follows:

¹ Recommendation 22 in the 2018 Annual Report Comments.

- *TDS* – this parameter is a measure of all dissolved constituents in water, but is comprised primarily of inorganic salts (mainly calcium, potassium, magnesium, sodium, bicarbonates, chlorides, and sulphates). Consequently, it essentially includes total alkalinity (the measure of a solution’s ability to neutralize acid inputs), hardness (the sum of multivalent ions in solution), conductivity (the measure of a solution’s ability to conduct electricity; correlated to dissolved salts), and major ions (concentrations of individual ions in solution). While a site-specific approach that considers the ratios of individual major ions is preferred from a technical perspective, it is not practical for a literature approach due to the sheer number of permutations across these constituents. Consequently, the literature review for the parameters mentioned herein focused on primarily on TDS.
- *Conductivity* – as mentioned above, this parameter is related to TDS and could therefore be excluded for singular focus. However, as there is some effects-based information available (e.g., US EPA 2016), we have included it for additional context.
- *Total silicon* – this parameter plays an important role as an essential dissolved element consumed by the phytoplankton group of algae called diatoms. Relative abundance of this primary producer can have effects on higher trophic level organisms and as community changes occur in response to elevated or reduced silicon.

F.2 LITERATURE REVIEW

A literature review was completed to assess the potential effects of TDS, conductivity and total silicon at different concentrations on fresh water aquatic life (e.g., phytoplankton, zooplankton, benthic invertebrates, and fish species) that may either reasonably be found in the Meadowbank study area lakes or be reasonably comparable. Preference was given to peer-reviewed literature and government sources including articles, studies, effects assessments, published guidance, and literature reviews. Other sources (e.g., unpublished “grey” literature) were also used where relevant.

F.2.1 Total Dissolved Solids

Solids in water can be measured as total solids, total suspended solids (TSS), or total dissolved solids. Total solids is the measure of all both TSS and TDS. TDS is the measure of all dissolved constituents of a solution which may be of anthropogenic origin such as mining activities or road salt-contaminated runoff or natural influences such as soils or geology (Weber-Scannel & Duffy 2007). The measurement of TDS is conducted by the removal of suspended solids by filtration

through a 0.7-micron glass fiber filter followed by drying of the filtrate at 180 degrees Celsius. The dried filtrate residue is divided by the volume of water filtered to determine the concentration of TDS which is usually reported in mg/L (APHA 2017). TDS is comprised mainly of inorganic ions but can also include dissolved organic matter. The potential biological effects of TDS are, therefore, related to the specific composition of the ions, their speciation, and other solids present in water. TDS may also exhibit toxicity through osmotic stress (i.e., where cell desiccation occurs due to leakage Davies & Hall 2007). Except in conditions where ratios and speciation of ionic components are fairly stable, TDS may be a poor predictor of toxicity (Chapman & McPherson 2016).

Similar to conductivity, TDS may be used as a surrogate measure for salinity because this measure tends to provide an estimate of the ionic compounds present (USEPA 1999). While elevated concentrations of TDS may change the osmotic conditions whereby elevated concentrations of TDS leads to potential osmotic stress especially in ultra-oligotrophic lakes with naturally low TDS, the ratios of ions present in solution are important due to the presence of essential macro and micro-minerals (EPA 2002). Meadowbank and Whale Tail study areas feature ultra-oligotrophic lakes with naturally low TDS. Increased chemical density influences the osmotic regulation of metabolism and biotic distribution in aquatic communities (BC MOE 2013).

Due to the complex and variable composition of ions and dissolved solids measured as TDS, a generic TDS guideline for the protection of aquatic life must be overly protective to account for the most toxic potential combination to the most sensitive organisms and life stage (Weber-Scannell and Duffy 2007). Assigning a threshold concentration for TDS is difficult because the high site specificity of this parameter. This challenge is reflected in the absence of any federal water quality guideline, with the exception of an aesthetic objective of less than or equal to 500 mg/L, for TDS (Health Canada 1991). Regulation of TDS is also limited in other jurisdictions with few exceptions such as Alaska, where TDS may not exceed 500 mg/L without a special permit and 1,000 mg/L at any time (ADEC 2012).

The presence of dissolved ions in solution is essential for the survival of aquatic organisms and provides the basis for the lowest trophic residents in the form of mineral uptake. Macro-mineral uptake is required for the support of biochemical functions such as magnesium and potassium (EPA 2002). Another example of the important biological role of dissolved ions is the importance of chloride in osmoregulation (Elphick et al. 2010). Many communities have low sensitivity to TDS these may be more readily detected through biological monitoring which can detect the overall impact of changes of water quality in a system (Buikema et al. 1982). Toxicity is highly

dependent upon both the composition of the residents of the system and the components, speciation, and ratios of the dissolved analytes.

Weber-Scannell and Duffy (2007) reviewed TDS toxicity to aquatic life and recommend deriving ion-specific limits for aquatic life (i.e., rather than for TDS) although this may not satisfy the potential osmotic regulation concerns. Mount et al. (1997) prepared and tested the toxicity of over 2,900 ionic solutions on Daphnids (*Ceriodaphnia dubia* and *Daphnia magna*). Their results suggested the following descending relative ion toxicity: potassium, bicarbonate and magnesium, chloride, sulphate. Neither sodium nor calcium resulted in significant effects (Mount et al., 1997). However, Mount et al. (1997) also found that the potential toxicity of chloride, sulphate, and potassium were reduced in solutions enriched with more than one cation. The inability to identify to attribute the toxicity of a specific constituent of TDS is inherent to the nature of the complex mixture this parameter measures with potential for effect masking, additive toxic effects, and synergistic toxic effects (Goodfellow et al. 2009). Timpano et al. (2010) examined the relationship between benthic macroinvertebrate community metrics in coal field streams and TDS. They caution that impacts from mine-related TDS is confounded because elevated TDS rarely occurs independently of other stressors. This study indicated several benthic macroinvertebrate richness measures were inversely correlated with TDS. Relative species abundance showed no correlation to TDS. Concentrations of TDS in the study streams ranged from 27.8 to 791.6 mg/L. The dominance of sulphate as a constituent in this study may reduce its relevance given the historically low sulphate concentrations in the Meadowbank study area lakes; in addition, the TDS concentrations are also notably higher than those found in the Meadowbank study area lakes.

The TDS review paper by Weber-Scannell and Duffy (2007) showed effects at concentrations less than 250 mg/L with a reported global mean in rivers of 120 mg/L. A TDS receiving environment benchmark 500 mg/L was adopted at Diavik (WLWB, 2013). Scannell and Jacobs (2001) completed a detailed review on the effects of TDS on aquatic life including fish, aquatic invertebrates, and algae focusing on Alaskan waters and TDS components that would be similar to those found in mine effluent. They found no effects to invertebrate growth and survival at concentrations below 1500 mg/L, that there was no reported range of concentrations that caused a toxic response in algae, and that fertilization and hatching rates in salmonids was the most sensitive life stage with affects at concentrations around 750 mg/L. They also concluded that toxicity was due primarily to ionic properties rather than osmotic effects. Chapman, Bailey, and Canaria (1999) completed an assessment of TDS toxicity associated with two mine effluents on chironomid (midge) larvae and early life stages of rainbow trout. They found no toxicity for rainbow trout at concentrations below 2,000 mg/L but did observe effects on chironomids at concentrations greater than 1,100 mg/L. A 2013 Effects Assessment report for the Snap Lake

Mine for De Beers Canada Inc. included results from a site-specific toxicity testing on phytoplankton, zooplankton, benthic invertebrates, and fish species and concluded that *Ceriodaphnia dubia* (a planktonic flea species) was the most sensitive test species and was affected by concentrations of 560 mg/L. A statistical review of the relationship between TDS in the range of 128 to 1,545 mg/L and phytoplankton (chlorophyll-a) in 25 Canadian Lakes by Prepas (1983) did not find a correlation.

Laboratory analysis for the 2019 CREMP water chemistry was completed by ALS Environmental, Burnaby, BC. As reported in the 2019 CREMP (Azimuth 2020), the maximum reported concentration in 2019 was 52.2 mg/L at WAL in March, consistent with the magnitude of concentrations reported in 2018. TDS concentrations in 2019 at other Meadowbank NF stations were as follows: TPE had a maximum of 23.9 mg/L; TPN a maximum of 24.1 mg/L; and SP had a maximum of 32.6 mg/L. The literature cited above suggests that the concentrations of TDS observed in the Meadowbank study area lakes are well below the concentrations where effects will occur. Furthermore, phytoplankton biomass and taxa richness have remained stable as has benthic invertebrate biomass and taxa richness confirming that primary productivity within the study area lakes is not exhibiting adverse effects from elevated TDS.

F.2.2 Conductivity

Much like TDS, specific conductivity has been used as a measurement of ionic strength (Cormier et al., 2012; USEPA, 2016). Conductivity is measured by passing an electrical current through a solution to determine conductance, or the reciprocal of resistance of a solution; therefore, it serves as an indirect measure of only ionic inorganic constituents. It does not have a relationship to dissolved organic compounds because these rarely dissociate (APHA 2018). The TDS method is applicable to waters that mostly contain calcium, magnesium, sodium, potassium, chlorate, sulphate, and chloride and TDS less than 2500 mg/L (APHA 2018). The concentration of all dissociated ions is inversely correlated to the electrical resistance of a solution. Because of the broad nature of TDS, the toxicity potential of a specific conductivity value depends on the toxicity of the ionic composition (USEPA 2016). There is no threshold for specific conductivity at the Meadowbank study area lakes and no federal guidelines.

Water quality parameters are useful indicators of potential effects of local environmental changes on freshwater ecosystems. Anthropogenic influences to water quality such as decreased dissolved oxygen is often correlated with a change in pH and an increase in conductivity, and nutrient concentrations (Leszczynska et al. 2019). The effects of these changes, especially if measured over time may not be detectable through biological monitoring. This is because aquatic communities acclimate to changes in water quality, especially those featuring natural seasonally or daily variability. Conductivity is an example of a naturally variable

parameter that not only includes highly variable toxicity but also varies in measured value in response to natural system input fluctuations (i.e. freshet, rainfall, groundwater influence) (USEPA, 2016; Hood et al. 2006).

As indicated in the 2019 CREMP, some Meadowbank study area lakes have exhibited an increase in conductivity relative to baseline/reference conditions. The mean conductivity in WAL in 2019 was 47.1 $\mu\text{S}/\text{cm}$ which was the highest mean value from the Meadowbank study area. The US EPA provided a draft field-based method for developing aquatic life criteria for specific conductivity in 2016. Cormier et al. used this approach and reviewed the relationship between specific conductivity in West Virginia coal field stream systems and macroinvertebrate health to create a species sensitivity distribution and derive a benchmark relationship. The authors determined that a bench mark of 300 $\mu\text{S}/\text{cm}$ was appropriate to prevent the extirpation of 95% of invertebrate genera in the study area. These results were confirmed in a separate study by Clements and Kotalik (2015).

Michelutti et al. (2002) examined the limnological conditions in 34 lakes and ponds on Victoria Island (arctic Canada) and provided a mean specific conductance of 96.4 $\mu\text{S}/\text{cm}$. Dranga et al. (2017) reviewed and compiled limnological data from 1489 shallow lakes and ponds in northern Canada and found a range of conductivity with a low of 2.5 $\mu\text{S}/\text{cm}$ and a mean specific conductivity of 166 $\mu\text{S}/\text{cm}$. The authors did not find an association between trophic level or vegetation cover and conductivity but did find conductivity was affected by geological area. In comparison, Ruhland et al. (2003) summarized limnological results from 21 Canadian arctic tundra lakes and found specific conductivity ranged from 7.3 to 98.8 $\mu\text{S}/\text{cm}$ with a mean of 17.8 $\mu\text{S}/\text{cm}$. The results reported in the 2019 CREMP suggests that although conductivity in the near-field Meadowbank study area lakes may be elevated compared to baseline and reference, the conductivity remains relatively low compared to other arctic lakes.

F.2.3 Silicon

Elemental silicon is highly abundant. It is relative stable and does not occur in its free form in nature but combines with oxygen and other elements to form oxides or silicates (CCME 2008). The term “silica” is often used to refer to silicon in natural waters and is usually represented by the hydrated form of the oxide (CCME 2008). It is also an essential micronutrient, particularly for diatoms. Silicon limitations can play an important role in phytoplankton dynamics (Shatwell et al. 2013; Saros et al. 2013). A change in the silicon concentrations may impact the succession of different phytoplankton species and the ratio of silicon with different nutrients may influence the ratio of cyanobacteria to diatoms. However, phytoplankton dynamics are also heavily influenced by other factors including temperature and photoperiod (Shatwell et al. 2013). As a primary producer, diatom abundance has cascading effects to higher trophic levels and in some

aquatic food chains silicon availability plays a significant role in energy transfer through effects on diatom productivity (Krause et al. 2018).

This literature review did not find any reports on potential toxic effects to aquatic receptors from low silicon concentrations similar to the concentrations observed in the Meadowbank study area lakes. In general, the conclusion of this the literature review was that there was little data to suggest potential toxicological effects from silicon to aquatic receptors at the range of concentrations that may reasonably be found in Canadian surface freshwater. There are no Canadian federal or provincial guidelines specifically for silicon in water to protect aquatic life. There are, however, several studies that report on the silica concentrations in Canadian surface waters including arctic regions. Natural silicon concentrations in Canadian surface waters are normally less than 5 mg/L silica but are highly variable ranging from 0.02 mg/L to 40 mg/L depending on region (CCME 2008). Antoniadou et al. (2003) reported on chemical limnology of 24 ponds and one arctic lake from the Canadian high arctic. The authors did not report on silicon but did report that concentrations of silica (SiO_2) ranged from 0.01 to 4.05 mg/L with a mean of 1.42 mg/L and a median of 1.18 mg/L. Hamilton et al. (2001) report the physical and chemical limnology of 204 Canadian arctic lakes. They report silicate (SiO_2) concentrations for n=174 ranged from 0.05 to 6.7 mg/L with a mean of 1.1 mg/L.

The mean and median values from the arctic lake studies referenced above are higher than the silicon and silicate (SiO_2) trigger concentrations for the Meadowbank study area lakes. The concentrations in the Meadowbank lakes have remained low despite a statistically significant increase over baseline/reference conditions. The range of silicon concentrations was generally below the trigger of 0.2 mg/L with the exception of SP, which ranged up to 0.23 mg/L, and INUG, which ranged up to 0.21 mg/L. Silicate as SiO_2 was consistently below the trigger of 1.0 mg/L. Importantly, neither silicon nor silicate showed strong temporal trends associated with mining activity (see main report). Thus, the observed differences are more likely due to inherent spatial heterogeneity rather than to actual temporal changes.

The lack of substantial changes in total silicon (or silicate) suggest that changes to lower trophic communities at Meadowbank are unlikely. Based on this literature review the most likely impact from increases in total silicon would be to the phytoplankton assemblage. An increase in concentrations of silicon may favor diatoms whereas a decrease in silicon may favor cyanophytes. The species richness in the Meadowbank study area has remained relatively stable for all sample years, with no obvious changes in diatom biomass. Thus, the results of site-specific biological monitoring support the findings of the literature review that suggest changes to lower trophic communities are unlikely.

F.3 CONCLUSIONS

This literature review was conducted to provide some additional context to help assess the ecological significance of mining-related changes to water quality for parameters without effects-based water quality guidelines. The review results corroborate the findings of site-specific biological monitoring conducted under the CREMP. While changes in the parameters of interest (TDS, conductivity and total silicon) can affect lower trophic level communities, concentrations of these parameters at Meadowbank and Whale Tail remain well below concentrations associated with adverse effects reported in the literature.

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