



*Supplement of*

## **Thermal regime of High Arctic tundra ponds, Nanuit Itillinga (Polar Bear Pass), Nunavut, Canada**

**Kathy L. Young and Laura C. Brown**

*Correspondence to:* Laura C. Brown (lc.brown@utoronto.ca)

The copyright of individual parts of the supplement might differ from the article licence.

**Supplementary Table S1: Summary of pond site location, pond surface area, and water level (WL) (2007: ~June 18-Aug. 1; 2008: ~June 2-Aug. 28; 2009: ~May 27-Sept. 2; 2010: ~May 17-Aug 2). Frost table (FT) refers to the maximum frost table for the season or the frost table depth for the period specified in the Table. More details can be found in Croft (2011) and Abnizova (2013)**

	Pond1	Pond2	Pond3	Pond4	Pond5	Pond6	Pond7	Pond8	Pond9	Pond10
Coordinates	75° 43'	75° 43'	75° 43'	75° 43'	75° 43'	75° 43'	75° 43'	75° 43'	75° 42'	75° 42'
	30.50"	30.82"	26.67"	28.71"	27.24"	27.24"	23.72"	27.24"	42.74"	40.50"
	98° 25'	98° 25'	98° 25'	98° 25'	98° 25'	98° 25'	98° 25'	98° 25'	98° 26'	98° 26'
	53.83"	54.60"	59.99"	33.49"	28.71"	28.71"	26.76"	14.45"	32.93"	27.14"
Surface area (m <sup>2</sup> )	6375	275	7975	750	1850	1850	10950	1000	5200	6475
<b>2007</b>										
WL (mm)	344	415	359	265	243	176	177	68	99	123
FT (mm)	-635	-410	-645	-475	-310	-710	-650	-595	-851	-432
$\beta^*$	0.10	0.08	0.11	0.08	0.05	0.11	0.10	0.10	-	-
Soil Colour	-	-	-	-	Gray	Gray	Gray	Gray	Very Dark Grayish Brown	Grayish Brown
% Organics	1.65	-	-	-	2.37	-	1.49	1.9	10.9	3.42
<b>2008</b>										
WL (mm)	302	382	347	215	247	107	162	80	-	58
FT (mm)	-731	-569	-738	-544	-580	-814	-745	-675	-	-529
$\beta^*$	0.11	0.07	0.10	0.07	0.07	0.10	0.09	0.08	-	0.07
<b>2009</b>										
WL (mm)	348	433	348	236	200	195	171	158	286	103
FT (mm)	-689	-489	-644	-534	-524	-707	-680	-631	-408	-659
$\beta^*$	0.08	0.06	0.08	0.06	0.06	0.09	0.08	0.08	-	0.08
Bulk Density (g/cm <sup>3</sup> )	1.87	2.10	2.27	1.83	-	1.82	-	1.81	-	2.28
Porosity (%)	22	25	17	25	-	14	-	13	-	11
<b>2010</b>										
WL (mm)	334	456	373	270	266	152	195	178	275	114
FT (mm)	-649	-502	-632	-492	-512	-702	-678	-529	-334	-428
$\beta^*$	0.10	0.08	0.09	0.07	0.08	0.11	0.10	0.10	-	0.07

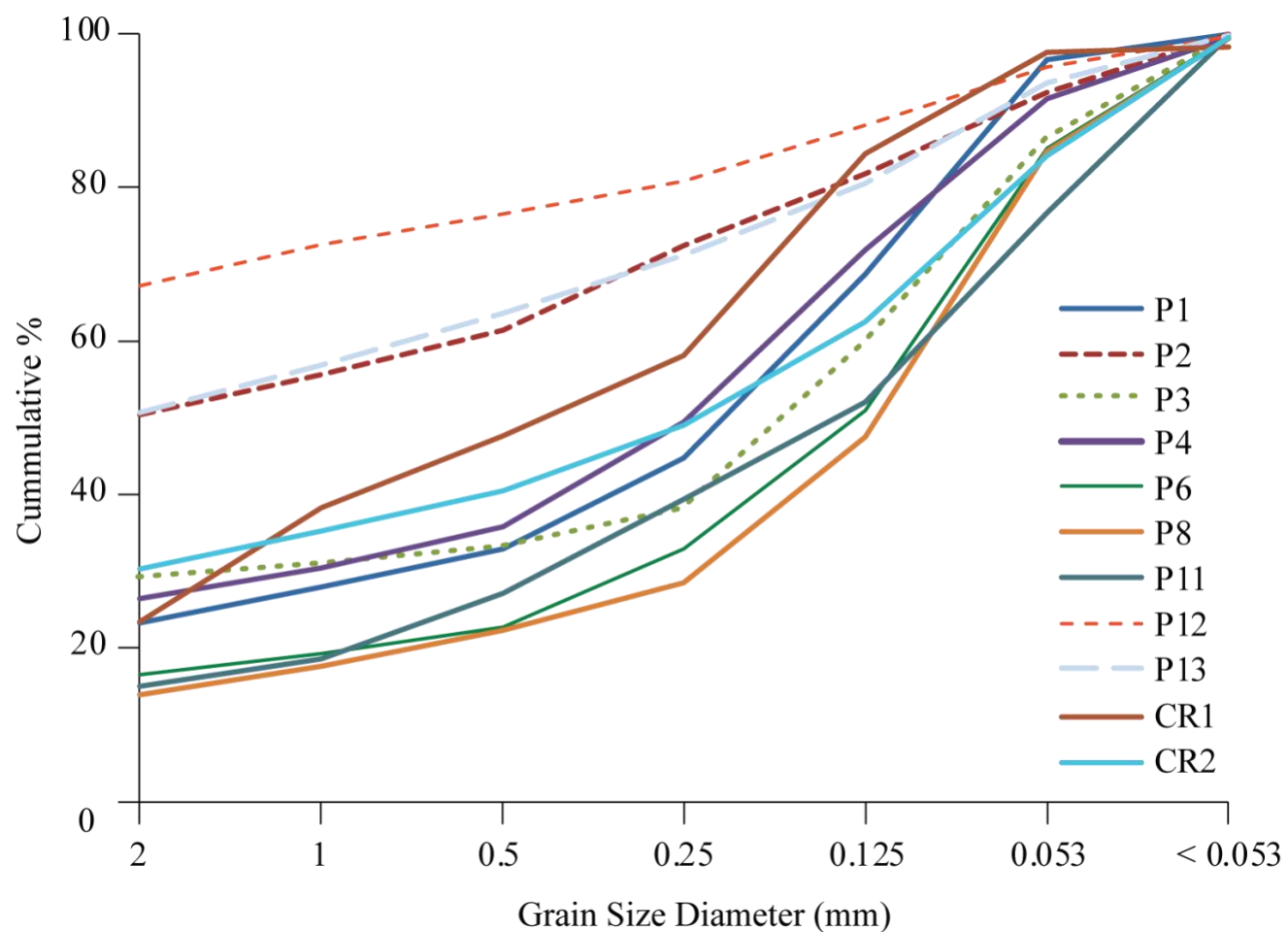
Table S1-continued

	Pond11	Pond12	Pond13	Creek Pond1	Creek Pond2	Meadow Pond	Pingo Pond
Coordinates	75° 43' 33.86" 98° 24' 8.66"	75°43' 26.91" 98°22' 59.49"	75°43' 26.91" 98°22' 59.49"	75°43' 23.08" 98°26' 33.74"	75° 43' 22.08" 98° 22' 50.65"	75°43' 34.92" 98°31' 2.89"	75° 43' 36.14" 98° 31' 29.93"
Surface area (m <sup>2</sup> )	550	10475	1725	650	1250	10666	726
<b>2007</b>							
WL (mm)	132	–	–	–	–	–	–
FT (mm)	-555	–	–	–	–	–	–
Soil Colour	Light Brownish Gray	Olive Gray	Dark Gray	–	–	–	–
% Organics	5.54	3.03	2.92	–	–	–	–
<b>2008</b>							
WL (mm)	141	168	236	202	196	273	149
FT (mm)	-863	-951	-819	-550	-698	-388	-582
$\beta^*$	0.09	0.12	0.11	0.08	0.09	0.06	0.06
<b>2009</b>							
WL (mm)	243	256	303	261	215	525	380
FT (mm)	-825	-903	-882	-544	-612	-307	-252
$\beta^*$	0.10	0.11	0.10	0.07	0.08	0.04	0.03
Bulk Density (g/cm <sup>3</sup> )	1.01	1.53	1.83	1.87	2.31	–	–
Porosity (%)	15	26	13	45	16	–	–
<b>2010</b>							
WL (mm)	247	193	254	328	172	525	435
FT (mm)	-810	-661	-534	-502	-609	-294	-211
$\beta^*$	0.13	–	–	0.07	0.09	0.05	0.03

Table S1-Continued

	East Small Pond	East Med. Pond	East Large Pond	South Small Pond	South Med. Pond	South Large Pond	West Small Pond	West Med. Pond	West Large Pond
Coordinates	75° 44' 6.01" 98° 5' 42.73"	75° 44' 4.80" 98° 5' 28.15"	75° 44' 10.01" 98° 5' 31.62"	75° 41' 50.93" 98° 20' 49.33"	75° 41' 51.36" 98° 20' 40.83"	75° 41' 47.19" 98° 20' 28.74"	75° 42' 20.53" 98° 45' 18.70"	75° 42' 25.24" 98° 45' 17.19"	75° 42' 21.47" 98° 45' 29.00"
Surface area (m <sup>2</sup> )	100	1500	24500	350	2075	3575	2550	7050	31400
<b>2007</b> (July 26- Aug. 2)									
WL (mm)	70	110	125	–	–	–	60	100	130
FT (mm)	-460	-740	-760	–	–	–	-885	-1088	-1020
Soil Colour	Gray	Gray	Light Brownish Gray	–	–	–	–	Light Olive Gray	–
% Organics	3.26	5.1	1.06	–	–	–	–	1.42	–
<b>2008</b> (Aug. 26-Sept 1-fall)									
WL (mm)	135	222	275	180	400	328	261	150	262
FT (mm)	-556	-648	-588	-675	-653	-443	-527	-852	-893
<b>2009</b> (Aug. 3- 5) Summer									
WL (mm)	270	290	245	410	330	381	340	268	350
FT (mm)	-921	-603	-625	-386	-323	-492	-677	-713	-876
<b>2009</b> (Aug. 26-30)-Fall									
WL (mm)	260	294	223	–	–	–	406	222	446
FT (mm)	-968	-948	-1020	–	–	–	-618	-959	-798
<b>2010</b> (June 19- 24)-Spring									
WL (mm)	198	165	104	425	456	284	228	188	195
FT (mm)	-15	-23	-20	0	-6	-30	-75	-68	-30

\* $\beta$ , a coefficient is determined after Woo (1983), where  $Z_f = \beta(t^{0.5})$ . Here  $Z_f$  is the depth to the frost table (taken here as the Max FT),  $t$  is time in days after the initial thaw period. Others (e.g., Qingbai et al., 2015) have referred to  $\beta$  as the *Edaphic Factor* or *scaling parameter*, which considers soil characteristics such as thermal conductivity, bulk density, soil water content, and latent heat of fusion. Qingbai et al. (2015) also used cumulative degree-days for  $t$  instead of days since ground thaw.



Supplementary Figure S1. Grain size analysis of selected centrally located ponds at PBP. Pond sediments reported here were collected in 2009 (see Croft 2011).

**References:**

Qingbai, W., Yandong, H., Hanbo, Y., and Yongzhi, L.: Changes in active-layer thickness and near-surface permafrost between 2002 and 2012 in alpine ecosystems, Qinghai- Xizang (Tibet) Plateau, China, *Global Planet. Change*, 124, 149–155, 2015.

Woo, M. K.: Hydrology of a drainage basin in the Canadian High Arctic, *Ann. Assoc. Am. Geogr.*, 73, 577–596, 1983.