

## Supplementary Electronic Material

**Table S1.** Summary of the environmental data for the regions of investigations. WD for water depth.

Region	# lakes		Altitude, m a.s.l.	T July, ° C	WD, m	pH	Distance from treeline, km	Vegetation
Anzher Solovki (AS)	7	median	19	14.6	4.2	5.1	-263.0	Taiga
		min	3	14.6	3	4.7	-263.0	
		max	23	14.6	8	6.2	-261.0	
Central European region (EU)	3	median	153.5	16.9	7.8	6.8	-1239.0	Taiga
		min	137.0	16.5	2.0	6.0	-1434.0	
		max	166.3	18.1	25.0	7.0	-1085.0	
Karelian Isthmus, Ladoga (KL)	23	median	39.0	17.1	5.7	7.0	-873.0	Taiga
		min	3.0	16.7	2.0	5.1	-1074.0	
		max	102.2	17.2	65.0	9.3	-716.0	
Komi (KM)	6	median	113.5	17.0	7.9	7.6	-502.8	Taiga
		min	65	16.8	6.8	5.6	-652.4	
		max	145	17.5	9.2	9.5	-465.3	
Kola Peninsula (KO)	9	median	127.0	13.5	4.0	7.0	-124.0	4 forest tundra
		min	59.0	13.2	1.9	7.0	-137.0	and 5 tundra
		max	145.0	13.9	17.2	7.3	-86.0	
Karelia Zaonezhje (KZ)	12	median	88.0	16.0	8.8	6.8	-610.5	Taiga
		min	7.0	15.4	3.2	6.8	-735.0	
		max	179.0	16.7	30.0	6.8	-477.0	
Novaya Zemlya (NZ)	1		<u>1.5</u>	9.2	1.5	7	356.0	Arctic desert
Onega Peninsula (OP)	6	median	20.5	15.1	3.4	5.3	-275.5	Taiga
		min	16.0	15.10	2.0	4.5	-277.0	
		max	26.0	16.0	4.8	6.2	-274.0	
Pechora (PE)	31	median	75	12.9	5.2	6.9	58.9	23 tundra and
		min	4.8	9.9	0.7	5.2	-199.1	8 northern
		max	514	15.5	140	7.6	141.0	tundra

**Table S2.** Eigenvalues, cumulative % variance and significance of the CCA axes.

Data set with 8 variables	Axis 1	Axis 2	Axis 3	Axis 4
Eigenvalues	0.176	0.117	0.084	0.064
Cumulative % variance of taxon data	5.3	8.9	11.4	13.3
Cumulative % variance of species-environment relation	31.3	52.2	66.7	78.0
Significance (probability) of axis	0.001	0.001	0.001	0.001
Sum of all unconstrained eigenvalues	3.5293			
Sum of all canonical eigenvalues	0.562			
Dataset with 5 significant variables	Axis 1	Axis 2	Axis 3	Axis 4
Eigenvalues	0.154	0.086	0.066	0.056
Cumulative % variance of taxon data	4.7	7.3	9.3	11
Cumulative % variance of species-environment relation	38.2	59.5	75.8	89.6
Significance (probability) of axis	0.001	0.001	0.001	0.001
Sum of all unconstrained eigenvalues	3.293			
Sum of all canonical eigenvalues	0.403			

**Table S3.** Number of occurrences (N), maximum abundance (Max), N2, response to T July (WS model: HOF model; NEW, ES, FM, NR and FE models: Resp, value for significance of the relationship with the T July based on generalized linear response model, set to a quadratic degree and Poisson distribution  $p < 0.05$ : - not significant; significant, small x; highly significant,  $p < 0.001$ , capital X), and WA optima (Opt) and tolerances (tol) for taxa with more than 10 occurrences in data-sets. HOF model I shows no response to July air temperature; II a sigmoidal increasing or decreasing response, III a response which reaches a plateau; IV a unimodal response and V a skewed unimodal response. Data sets: NWE – North West European Russia, WS – West Siberian, ES – East Siberian, FM – full model, NR – North Russian, FE– Far East.

	NWE						WS						ES						NR						FE					
	N	Max	N2	Opt	tol	R	N	Max	N2	Opt	R	N	Max	N2	Opt	tol	R	N	Max	N2	Opt	tol	R	N	Max	N2	Opt	tol	R	
Tanypodinae																														
Ablabesmyia	24	8.33	21.0	15.0	1.9	-	46	8.2	32.5	15.7	V	16	2.4	15.3	17.2	0.7	X	73	3.9	61.4	12.7	3.2	-	36	4.7	28.0	9.7	2.2	X	
Procladius	76	14.6	66.8	15.3	1.8	-	77	13.6	50.3	14.8	IV	14	3.0	12.0	14.9	3.8	X	143	3.7	126.7	12.4	3.2	X	60	3.0	52.7	8.6	2.2	X	
Chironomini																														
Chironomus anthracinus-type	44	26.78	33.9	14.7	1.9	x	66	26.7	29.2	14.1	II	126	6.8	104.1	12.1	5.6	X	158	7.1	124.3	10.9	4.1	X	76	7.1	63.4	7.6	3.0	x	
Chironomus plumosus-type	32	21.53	25.1	16.4	1.6	x	49	39.4	21.2	17.3	II	40	6.0	29.6	17.1	1.7	X	58	4.6	47.7	14.6	3.3	X	18	3.6	15.0	10.8	1.3	X	
Cladopelma	50	11.24	43.5	15.7	1.8	X	50	11.2	27.3	15.2	II	54	3.4	47.5	16.4	2.7	X	80	3.3	68.5	12.9	3.6	-	34	3.3	30.0	9.3	1.8	X	
Dicrotendipes nervosus-type	60	9.36	52.9	15.4	1.7	x	60	23.6	33.0	16.6	II	56	3.9	48.3	16.1	2.5	X	82	4.9	65.8	14.4	3.3	X	31	3.0	26.6	10.0	2.3	X	
Microtendipes pedellus-type	60	27.17	46.3	14.7	1.7	x	43	27.2	20.3	14.3	IV	37	6.4	27.4	14.0	3.0	X	66	6.4	48.3	13.1	2.5	X	29	6.4	20.9	10.9	1.7	-	
Parachironomus varus-type	14	1.79	13.5	14.3	1.6	x	28	6.6	18.3	17.0	II	38	2.8	34.4	17.2	1.8	X	43	2.5	38.7	14.2	3.8	X	20	2.9	17.0	8.8	2.5	X	
Phaenopsectra flavipes-type	18	3.85	16.8	14.6	1.8	-	15	2.8	12.2	14.0	IV	14	3.0	12.0	15.8	2.6	x	15	2.0	13.8	14.2	1.6	X	1	1.1	1.0	6.2	2.0	-	
Polypedilum nubeculosum-type	54	26.32	41.0	15.9	1.7	x	52	8.3	36.5	16.8	IV	54	4.5	46.7	16.4	2.5	X	49	4.5	42.2	14.6	3.7	X	31	4.5	26.4	10.2	2.0	X	
Sergentia coracina-type	63	53.75	47.5	14.7	1.7	X	50	30.8	25.2	12.0	II	34	6.3	26.5	11.8	2.2	X	108	6.3	86.5	11.3	2.1	X	47	6.3	36.5	8.8	1.7	X	
Stictochironomus	21	4.82	18.9	14.1	1.8	x	29	8.3	17.7	12.3	II	12	3.7	10.2	11.5	3.6	x	42	3.7	35.7	12.1	2.1	X	8	3.7	6.7	8.4	2.2	-	
Pseudochironomus	15	6.25	13.5	16.1	1.3	-	18	9.5	12.7	18.3	II	24	3.1	21.0	17.2	1.4	X	23	3.1	19.4	16.9	2.4	X	7	2.0	5.9	10.8	2.7	-	
Tanytarsini																														
Cladotanytarsus mancus-type	69	16.67	57.5	15.2	1.8	x	71	16.7	40.1	15.4	II	5	3.9	3.4	16.1	3.2	X	69	4.1	55.8	11.8	2.7	X	69	4.1	55.8	11.8	2.7	X	
Corynocera ambigua	40	41.46	28.5	14.9	1.7	x	60	56.5	23.9	13.8	IV	48	6.8	37.4	15.1	2.9	X	86	7.5	63.0	13.3	3.2	-	28	6.8	21.6	10.0	2.5	X	
Corynocera oliveri-type	8	19.42	5.0	12.2	2.4		20	41.8	8.5	10.2	IV	17	2.5	15.5	11.8	4.1	-	47	6.5	32.1	10.7	1.8	X	21	2.9	18.2	8.8	2.2	X	
Micropsectra insignilobus-type	42	17.50	34.7	13.7	1.8	X	39	20.1	18.2	12.3	IV	38	6.0	29.3	12.0	2.3	X	79	7.1	59.4	11.9	1.8	X	16	7.1	9.7	9.6	1.4	X	
Micropsectra radialis-type	11	18.18	8.4	13.5	1.4	x	14	18.2	4.8	12.8	IV	7	2.1	6.4	14.7	3.1	-	24	4.3	19.2	13.2	3.2	-	2	1.7	2.0	10.4	2.7	-	

<i>Paratanytarsus penicillatus</i> -type	38	12.14	33.4	14.5	1.8	x	64	24.1	36.7	17.1	II	118	6.8	97.7	11.5	5.9	X	120	4.6	97.8	12.3	4.6	X	44	5.1	36.6	7.7	3.8	X
<i>Stempellinella</i> - <i>Zaurelia</i>	23	18.18	19.0	16.1	1.4	-	41	9.4	26.2	14.2	IV	8	2.6	7.4	14.3	3.6	-	46	3.1	40.2	12.9	2.6	X	12	2.3	10.7	8.6	2.2	X
<i>Tanytarsus lugens</i> -type	48	18.75	40.4	14.7	1.7	x	75	28.8	39.6	12.7	V	80	5.7	65.2	13.5	4.0	X	141	7.2	113.5	11.9	3.0	X	54	7.2	41.4	8.9	2.2	X
<i>Tanytarsus mendax</i> -type	64	23.46	52.4	15.5	1.8	-	63	22.5	35.8	15.4	II	35	3.6	30.8	16.5	2.8	X	103	4.1	88.3	12.6	3.5	X	53	3.7	47.2	8.9	2.3	X
<i>Tanytarsus pallidicornis</i> -type	67	33.3	56.9	15.3	1.8	X	58	33.3	29.5	14.8	IV	17	2.9	15.0	15.5	3.0	X	78	5.8	64.8	13.5	3.2	x	26	2.8	23.6	8.7	2.3	X
<b>Orthocladiinae</b>																													
<i>Corynoneura arctica</i> -type	30	13.58	24.8	14.8	1.8	-	31	11.3	17.4	11.3	II	72	4.6	60.7	13.3	5.5	x	90	3.5	78.9	12.1	3.9	-	37	3.9	32.0	8.0	3.1	-
<i>Cricotopus laricomalis</i> -type	17	6.34	14.6	14.7	2.0	x	54	11.3	26.4	17.8	II	86	5.4	70.5	15.5	3.7	X	84	4.8	67.3	14.5	3.7	X	19	4.8	15.5	10.5	3.0	X
<i>Cricotopus</i> type P	23	6.21	21.3	14.3	1.8	x	24	24.4	15.2	12.6	IV	20	3.0	16.7	12.2	3.0	X	54	3.0	46.5	10.9	2.1	X	24	3.0	21.3	9.0	1.9	X
<i>Heterotrissocladius grimshawi</i> -type	28	18.18	22.5	14.6	1.8	X	13	6.2	5.8	13.6	IV	7	5.2	5.0	11.5	0.5	X	17	5.2	12.8	12.9	1.9	X						-
<i>Heterotrissocladius maeaei</i> -type	21	44.83	15.3	13.0	1.8	x	25	17.9	9.8	12.7	IV	7	5.7	4.5	11.2	0.5	X	31	6.5	20.4	12.7	1.4	X	1	1.0	1.0	9.6	2.0	-
<i>Hydrobaenus conformis</i> -type	6	3.88	5.4	13.1	1.0		17	42.2	8.4	10.4	II	10	3.1	8.4	11.8	4.0	-	25	4.4	19.3	10.4	3.6	X	4	4.4	3.1	5.2	4.5	-
<i>Limnophyes</i> - <i>Paralimnophyes</i>	42	19.51	30.7	14.4	1.7	x	55	30.4	17.6	13.2	II	75	6.5	59.8	11.4	4.7	X	116	6.5	90.9	11.5	3.0	X	45	3.7	39.4	7.6	2.9	-
<i>Orthocladus oliveri</i> -type	12	4.12	11.3	13.8	1.5	x	29	11.0	17.1	11.5	II	35	3.2	29.8	12.1	6.1	x	65	3.9	54.0	11.3	3.4	x	65	3.9	54.0	11.3	3.4	-
<i>Parakiefferiella bathophila</i> -type	36	6.35	33.1	14.5	1.9	x	40	7.4	27.3	14.5	I	38	3.2	32.8	14.9	3.6	x	55	2.6	50.1	13.0	2.5	-	10	2.1	8.9	9.5	2.5	-
<i>Parakiefferiella triquetra</i> -type	13	6.89	11.3	14.8	1.9	-	16	7.4	10.4	11.2	II	5	1.5	4.7	11.8	0.8	-	23	2.7	20.2	11.9	1.3	X	3	1.8	2.8	10.4	2.0	-
<i>Paraphaenocladus</i>	11	3.57	10.4	14.4	1.5	-	12	4.9	8.3	15.6	IV	9	2.4	8.3	14.4	3.5	-	23	2.8	20.5	13.2	3.8	-	4	1.5	4.0	8.5	4.1	X
<i>Psectrocladius septentrionalis</i> -type	41	19.00	32.3	14.6	1.4	x	21	5.7	11.0	13.5	IV	5	2.5	4.7	10.2	3.3	X	25	2.8	20.3	12.2	1.5	-	6	3.4	5.6	9.8	1.7	-
<i>Psectrocladius sordidellus</i> -type	80	46.9	68.7	14.8	1.7	x	87	27.0	57.2	15.1	I	132	6.6	110.4	12.9	5.4	X	163	6.6	138.0	12.2	3.9	X	65	6.6	54.2	7.9	3.3	X
<i>Pseudosmittia</i>	16	3.85	14.6	13.9	2.7	X	13	3.8	9.9	14.5	IV	13	1.9	12.0	10.2	5.2	x	20	1.9	18.4	11.0	3.8	-	9	2.8	7.6	4.9	2.7	X
<i>Zalutschia</i> type B	33	22.93	23.0	14.2	1.4	-	47	61.3	10.9	10.8	II	25	4.0	21.7	11.3	2.4	X	83	7.8	59.6	11.0	2.4	X	33	8.9	21.0	7.7	1.9	-
<i>Zalutschia zalutschicola</i>	41	28.92	30.3	14.9	1.7	x	24	24.3	10.5	12.7	IV	32	7.0	21.5	11.7	1.4	X	77	7.0	54.7	10.7	2.2	X	40	7.0	29.8	8.6	1.6	X