**Supplementary materials**

**Table S2.** Descriptive statistical characteristics of bioclimatic variables by Sparganium species (Sr – *S. emersum* “*rothertii* ”, Se – *S. emersum*, *S. hyperboreum*) in NEA

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| Descriptive statistics by group  group: Sr  vars n mean sd median trimmed mad min max range skew kurtosis se  bio\_01 1 102 -6.97 4.18 -5.81 -7.10 6.66 -13.49 0.94 14.43 0.11 -1.32 0.41  bio\_02 2 102 9.57 2.11 9.57 9.60 2.42 5.63 13.22 7.58 -0.23 -1.06 0.21  bio\_03 3 102 19.68 3.08 18.91 19.57 4.08 15.08 25.99 10.91 0.24 -1.17 0.31  bio\_04 4 102 1539.28 399.90 1506.90 1556.78 532.28 835.96 2067.33 1231.38 -0.14 -1.40 39.60  bio\_05 5 102 18.80 2.56 19.10 18.80 3.11 14.60 23.30 8.70 -0.13 -1.28 0.25  bio\_06 6 102 -30.10 8.99 -30.00 -30.52 13.05 -42.70 -13.50 29.20 0.22 -1.39 0.89  bio\_07 7 102 48.91 11.31 49.05 49.31 17.64 28.90 64.10 35.20 -0.19 -1.43 1.12  bio\_08 8 102 8.90 2.17 9.60 9.05 1.61 4.30 12.07 7.77 -0.68 -1.00 0.21  bio\_09 9 102 -14.18 7.06 -13.19 -14.79 5.52 -25.73 2.73 28.47 0.57 0.04 0.70  bio\_10 10 102 11.88 1.34 11.92 11.89 1.70 9.27 14.05 4.78 0.03 -1.16 0.13  bio\_11 11 102 -25.14 8.76 -24.17 -25.55 11.91 -36.68 -9.58 27.10 0.15 -1.42 0.87  bio\_12 12 102 372.37 115.81 339.91 364.66 106.88 170.00 611.00 441.00 0.55 -0.69 11.47  bio\_13 13 102 62.39 16.49 62.00 61.84 21.50 32.00 96.00 64.00 0.23 -0.92 1.63  bio\_14 14 102 10.72 3.59 9.97 10.54 4.40 5.00 19.00 14.00 0.38 -0.87 0.36  bio\_15 15 102 52.71 4.34 53.40 52.75 3.62 34.14 73.11 38.96 0.17 6.15 0.43  bio\_16 16 102 170.77 48.46 164.00 169.71 68.94 82.00 260.00 178.00 0.15 -1.11 4.80  bio\_17 17 102 41.58 14.55 37.00 40.62 13.34 20.00 75.00 55.00 0.62 -0.63 1.44  bio\_18 18 102 152.43 33.01 157.00 153.84 41.51 77.00 214.00 137.00 -0.35 -0.88 3.27  bio\_19 19 102 57.25 16.41 52.00 56.93 14.83 25.00 92.00 67.00 0.26 -0.76 1.63  ------------------------------------------------------------------------------  group: Se  vars n mean sd median trimmed mad min max range skew kurtosis se  bio\_01 1 55 -10.74 1.41 -10.60 -10.76 1.22 -13.61 -5.43 8.19 0.58 2.13 0.19  bio\_02 2 55 10.76 1.59 10.30 10.69 1.73 8.49 14.97 6.48 0.38 -0.90 0.21  bio\_03 3 55 16.43 1.81 16.50 16.34 1.68 13.48 23.17 9.68 0.84 1.71 0.24  bio\_04 4 55 2110.80 141.97 2116.98 2114.97 181.97 1737.86 2337.88 600.02 -0.34 -0.83 19.14  bio\_05 5 55 22.90 2.47 23.70 23.10 2.22 17.80 26.10 8.30 -0.63 -0.96 0.33  bio\_06 6 55 -42.39 2.40 -42.70 -42.42 1.93 -46.90 -33.40 13.50 0.70 1.93 0.32  bio\_07 7 55 65.29 4.27 65.10 65.40 5.63 57.60 71.90 14.30 -0.23 -1.13 0.58  bio\_08 8 55 13.39 2.96 15.03 13.65 1.53 8.00 16.25 8.25 -0.72 -1.24 0.40  bio\_09 9 55 -26.73 7.31 -30.75 -27.39 3.58 -34.60 -12.92 21.68 0.74 -1.03 0.99  bio\_10 10 55 14.38 1.92 15.25 14.58 1.33 10.15 16.62 6.47 -0.82 -0.74 0.26  bio\_11 11 55 -36.75 2.19 -36.72 -36.82 2.27 -40.75 -27.23 13.52 1.21 4.52 0.29  bio\_12 12 55 277.18 45.94 280.00 274.09 25.20 201.00 512.00 311.00 2.27 10.33 6.19  bio\_13 13 55 46.16 5.73 46.00 45.93 5.93 37.00 60.00 23.00 0.29 -0.37 0.77  bio\_14 14 55 7.04 2.23 6.00 6.82 1.48 4.00 13.00 9.00 0.81 0.04 0.30  bio\_15 15 55 60.13 6.66 61.77 60.19 8.57 49.34 71.47 22.13 -0.06 -1.41 0.90  bio\_16 16 55 128.12 16.83 128.00 128.60 11.86 93.00 159.00 66.00 -0.32 -0.40 2.27  bio\_17 17 55 24.98 5.99 24.00 24.42 5.93 15.00 43.00 28.00 0.97 0.98 0.81  bio\_18 18 55 127.29 17.17 128.00 128.02 11.86 90.00 159.00 69.00 -0.43 -0.27 2.32  bio\_19 19 55 32.02 6.98 31.00 31.31 5.93 19.00 55.00 36.00 1.08 1.26 0.94  ------------------------------------------------------------------------------  group: Sh  vars n mean sd median trimmed mad min max range skew kurtosis se  bio\_01 1 218 -9.62 4.09 -11.01 -9.85 3.77 -16.73 0.00 16.73 0.53 -0.98 0.28  bio\_02 2 218 9.63 2.15 9.62 9.68 2.70 5.42 13.73 8.32 -0.20 -1.09 0.15  bio\_03 3 218 18.29 2.47 18.15 18.23 2.43 13.26 26.79 13.53 0.34 -0.15 0.17  bio\_04 4 218 1676.35 374.00 1704.46 1686.25 408.45 853.95 2378.19 1524.24 -0.31 -0.75 25.33  bio\_05 5 218 18.48 3.09 19.15 18.61 3.34 11.00 24.50 13.50 -0.34 -0.90 0.21  bio\_06 6 218 -34.07 8.67 -35.95 -34.39 7.41 -49.70 -14.30 35.40 0.47 -0.70 0.59  bio\_07 7 218 52.56 10.85 53.60 52.93 11.27 28.30 72.10 43.80 -0.37 -0.77 0.73  bio\_08 8 218 9.18 2.37 9.63 9.16 2.31 4.07 15.87 11.80 0.03 -0.42 0.16  bio\_09 9 218 -18.92 7.99 -17.02 -18.37 7.98 -40.13 0.00 40.13 -0.53 -0.33 0.54  bio\_10 10 218 11.12 1.94 11.12 11.24 1.74 6.08 15.87 9.78 -0.48 0.13 0.13  bio\_11 11 218 -29.01 8.54 -31.55 -29.34 7.26 -44.40 0.00 44.40 0.53 -0.43 0.58  bio\_12 12 218 335.83 102.09 313.00 329.29 95.63 154.00 613.00 459.00 0.60 -0.11 6.91  bio\_13 13 218 56.63 13.58 57.00 56.43 13.34 28.00 96.00 68.00 0.19 -0.11 0.92  bio\_14 14 218 10.05 4.08 9.00 9.75 4.45 3.00 19.00 16.00 0.50 -0.74 0.28  bio\_15 15 218 53.00 7.68 53.44 52.71 6.44 33.34 74.90 41.56 0.40 0.68 0.52  bio\_16 16 218 150.59 39.56 146.50 148.82 36.32 72.00 258.00 186.00 0.47 -0.04 2.68  bio\_17 17 218 36.94 13.93 37.00 36.20 16.31 15.00 71.00 56.00 0.37 -0.80 0.94  bio\_18 18 218 141.27 29.89 141.00 142.17 29.65 69.00 207.00 138.00 -0.19 -0.37 2.02  bio\_19 19 218 51.15 20.03 50.00 50.55 23.72 16.00 104.00 88.00 0.23 -0.80 1.36 |

**Table S3.** Polynomial regression coefficients of bioclimatic variables by *Sparganium* species (Se – *S. emersum*, Sr – *S. emersum* “*rothertii*”, *S. hyperboreum*) in NEA. Coefficient values for *S. emersum* “*rothertii*” are used as “intercept”

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| ==============================================  Dependent variable:  ----------------------------  Se Sh  (1) (2)  ----------------------------------------------  bio\_01 0.545\*\*\* -0.508  (0.108) (0.311)    bio\_02 -0.633\*\*\* -0.770\*\*  (0.158) (0.321)    bio\_03 0.015 0.043  (0.279) (0.089)    bio\_04 -0.061\*\*\* -0.009  (0.011) (0.007)    bio\_05 0.006 0.440\*\*  (0.111) (0.207)    bio\_06 -0.798\*\*\* 0.040  (0.293) (0.164)    bio\_07 0.804\*\*\* 0.400\*\*  (0.292) (0.177)    bio\_08 -0.265 -0.070  (0.262) (0.110)    bio\_09 0.182\* -0.176\*\*\*  (0.094) (0.048)    bio\_10 1.185\*\*\* -0.479  (0.132) (0.359)    bio\_11 -1.636\*\*\* 0.237  (0.211) (0.204)    bio\_12 0.179\*\*\* 0.031\*\*  (0.039) (0.014)    bio\_13 -0.550\*\*\* -0.013  (0.191) (0.030)    bio\_14 0.329 0.202  (0.413) (0.148)    bio\_15 -0.176\*\* -0.054\*  (0.071) (0.029)    bio\_16 -0.592\*\*\* -0.073\*  (0.141) (0.037)    bio\_17 -0.332\* -0.166\*\*  (0.176) (0.067)    bio\_18 0.502\*\*\* 0.029  (0.098) (0.022)    bio\_19 -0.307\*\*\* 0.019  (0.093) (0.035)    Constant 4.695\*\*\* 3.167\*\*\*  (0.018) (0.023)    ----------------------------------------------  Akaike Inf. Crit. 479.371 479.371  ==============================================  Note: \**p*<0.1; \*\**p*<0.05; \*\*\**p*<0.01 |