Appendix B. Stream temperature models supplemental tables and figures

Figure 1. Example of mean daily stream temperatures (black) and air temperatures (red) for Kroto Creek (Kroto 2 Upstream) in 2018 and 2019 (top panel). Temperature index values for the same site and years are shown in the bottom panel with large deviations in May indicating a poor relationship between air and stream temperatures.
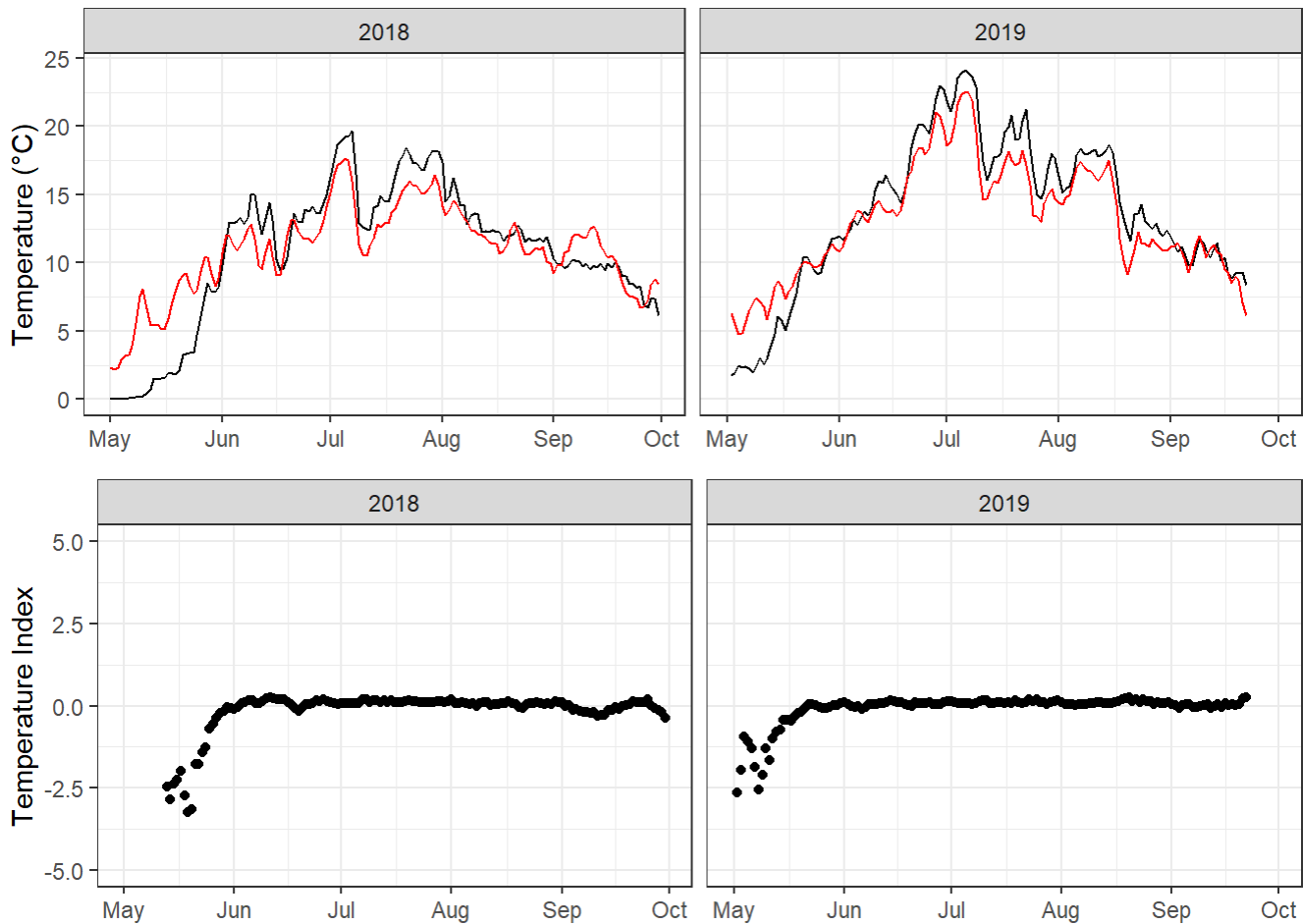
Table 1. Parameter estimates and 95% confidence intervals for the Deshka descriptive model. The random effects section lists the variance of the model residuals and the variance of the sub-watershed random intercepts. Marginal and conditional R^2 are the variation explained by the fixed effects and both fixed and random effects, respectively.

		mean	
Predictors	*Estimates*	*CI*	*p*
(Intercept)	14.6081	14.2350 – 14.9811	**<0.001**
tair3c	0.6676	0.6574 – 0.6778	**<0.001**
tair3c^2	0.0192	0.0179 – 0.0204	**<0.001**
jdc	-0.0302	-0.0313 – -0.0290	**<0.001**
jdc^2	-0.0006	-0.0006 – -0.0006	**<0.001**
sweA1c	-0.0004	-0.0006 – -0.0001	**0.004**
prcp5c	0.0057	0.0048 – 0.0067	**<0.001**
reach_slopec	-0.7314	-0.7830 – -0.6798	**<0.001**
wetlandc	-0.0057	-0.0066 – -0.0048	**<0.001**
catchment_elev_mnc	-0.0046	-0.0056 – -0.0037	**<0.001**
cont_areac	0.0012	0.0011 – 0.0012	**<0.001**
season [spring]	-0.2613	-0.3517 – -0.1708	**<0.001**
sweA1c * wetlandc	-0.0001	-0.0001 – -0.0000	**<0.001**
tair3c * season [spring]	0.2194	0.2035 – 0.2353	**<0.001**
tair3c^2 * season [spring]	-0.0266	-0.0289 – -0.0243	**<0.001**
Random Effects			
σ^2	1.37		
τ_{00} HUC_name	0.54		
Marginal R^2 / Conditional R^2	0.857 / 0.898		

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Table 2. Parameter estimates and 95% confidence intervals for the Anchor-Stariski descriptive model. The random effects section lists the variance of the model residuals and the variance of the sub-watershed random intercepts. Marginal and conditional R^2 are the variation explained by the fixed effects and both fixed and random effects, respectively.

		mean	
Predictors	*Estimates*	*CI*	*p*
(Intercept)	10.9491	10.5506 – 11.3476	**<0.001**
tair3c	0.7068	0.6858 – 0.7279	**<0.001**
tair3c^2	0.0168	0.0134 – 0.0202	**<0.001**
jdc	-0.0120	-0.0132 – -0.0107	**<0.001**
jdc^2	-0.0004	-0.0004 – -0.0003	**<0.001**
sweA1c	-0.0018	-0.0025 – -0.0011	**<0.001**
wetlandc	0.0043	0.0019 – 0.0066	**<0.001**
catchment_elev_mnc	-0.0057	-0.0064 – -0.0050	**<0.001**
cont_areac	0.0034	0.0032 – 0.0036	**<0.001**
sweA1c * wetlandc	0.0001	0.0001 – 0.0002	**<0.001**
Random Effects			
σ^2	1.71		
τ_{00} HUC_name	0.27		
Marginal R^2 / Conditional R^2	0.775 / 0.806		

Table 3. Parameter estimates and 95% confidence intervals for the Kenai descriptive model.

Predictors	Estimates	CI	p
(Intercept)	9.9121	9.8220 – 10.0022	**<0.001**
tair3c	0.2798	0.2544 – 0.3051	**<0.001**
jdc	0.0141	0.0118 – 0.0163	**<0.001**
I(jdc^2)	-0.0004	-0.0005 – -0.0004	**<0.001**
reach_slopec	-0.9020	-0.9373 – -0.8667	**<0.001**
wetlandc	0.0139	0.0118 – 0.0160	**<0.001**
catchment_elev_mnc	-0.0037	-0.0042 – -0.0032	**<0.001**
cont_areac	-0.0001	-0.0001 – -0.0001	**<0.001**
seasonFall	0.1570	-0.0073 – 0.3213	0.061
sweA1c	-0.0110	-0.0118 – -0.0102	**<0.001**
prcp5c	0.0084	0.0065 – 0.0104	**<0.001**
tair3c:seasonFall	0.1283	0.0986 – 0.1580	**<0.001**
wetlandc:sweA1c	0.0003	0.0002 – 0.0003	**<0.001**
tair3c:lakeNo lake	0.0951	0.0748 – 0.1155	**<0.001**

Figure 2. Stream and air temperature relationships in the descriptive models of mean daily stream temperatures. Stream temperatures in the Deshka watershed exhibited hysteresis in the fall as temperatures fell (A). Anchor-Stariski stream-air temperature relationships did not vary by season (B). The response of stream temperatures to air temperatures in the Kenai watershed varied by season (C), and also by lake influence (D).
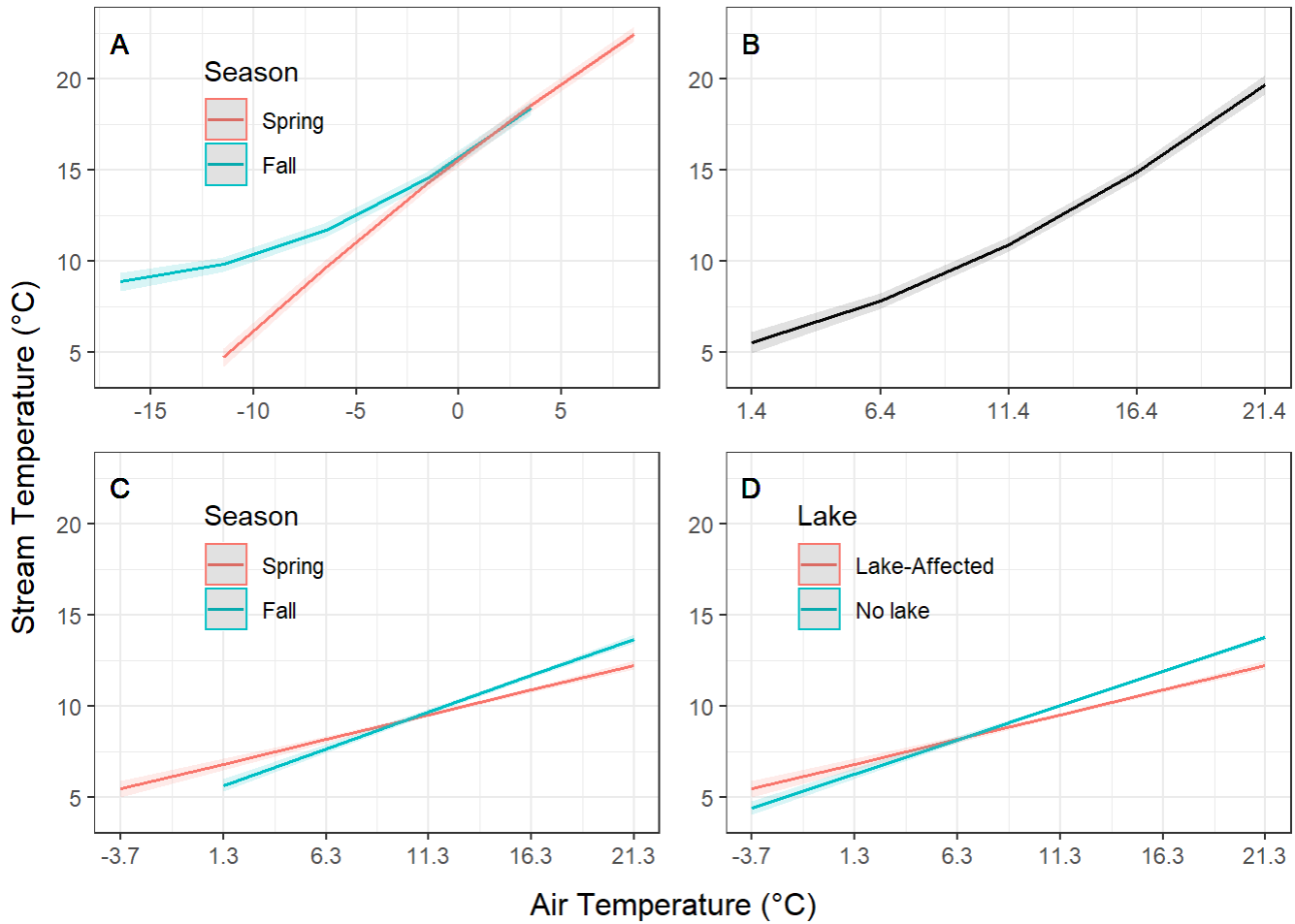
Figure 3. Interactions between SWE and wetlands in the Deshka (A), Anchor-Stariski (B), and Kenai (C) descriptive models of mean daily stream temperatures. In the Deshka watershed, high snowpack from the previous winter cooled summer stream temperatures in stream reaches with high wetland cover. The reverse pattern occurred in the Anchor-Stariski and Kenai watersheds, where years with high snowpack had a cooling effect on stream reaches with low wetland cover.
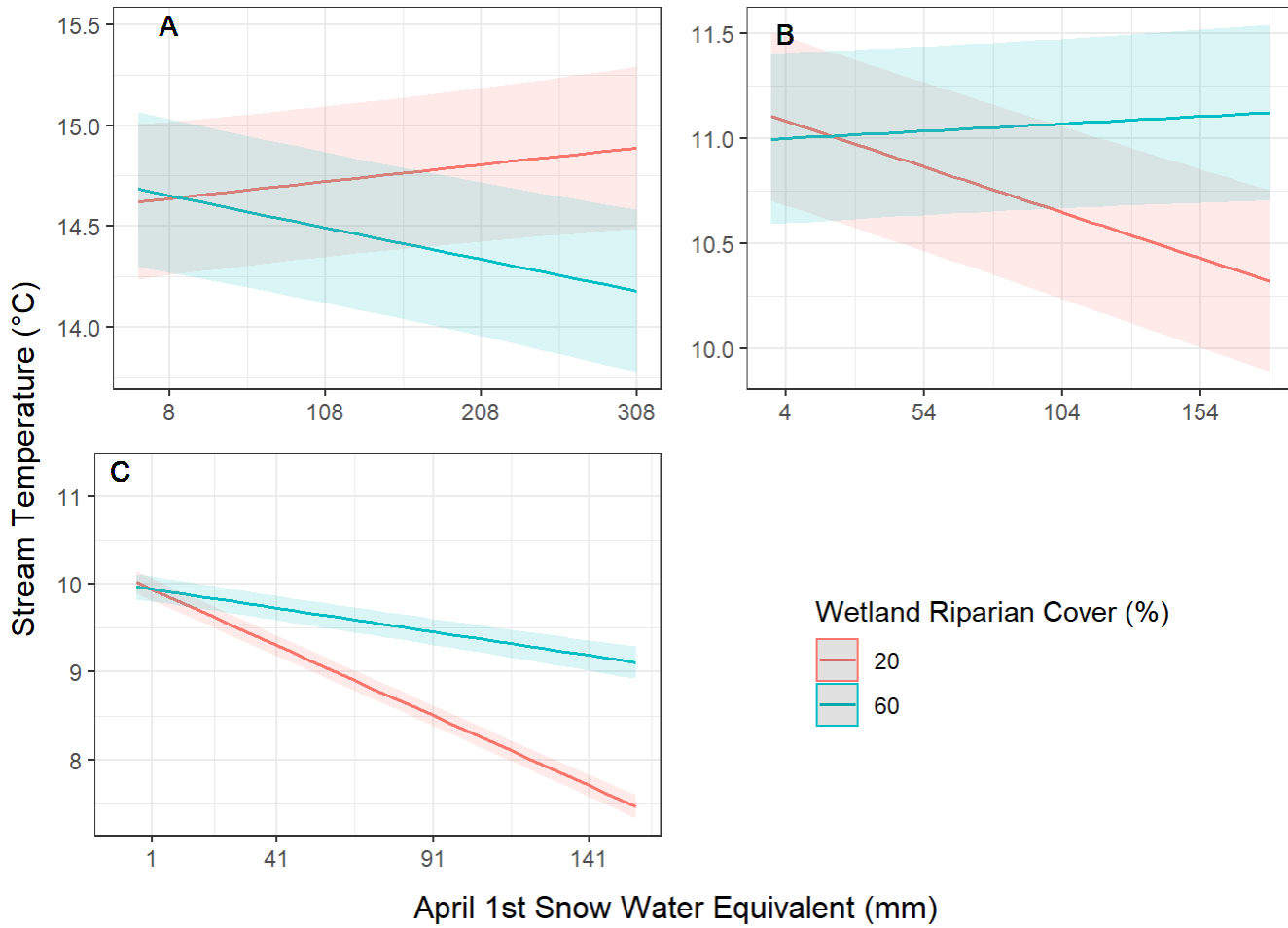
Figure 4. Model cross-validation error versus model complexity, as determined by the number of fixed effects in the model for the Deshka watershed (A) and the Anchor-Stariski watershed (B). For each model, the mean root mean squared error (RMSE) is shown across all cross-validation subsets (n = 10 for Deshka and n = 9 for Anchor-Stariski). For the Deshka watershed, mean RMSE was minimized for a model with ten fixed effects, but similar cross-validation error was obtained for a simpler model with only five fixed effects. For the Anchor-Stariski watershed, mean RMSE was minimized for a model with seven fixed effects, but similar cross-validation error was obtained for a simpler model with only five fixed effects.