Comparative Study of Potential Habitats for *Simulium qinghaiense* (Diptera: Simuliidae) in the Huangshui River Basin, Qinghai–Tibet Plateau: An Analysis Using Four Ecological Niche Models and Optimized Approaches

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Supplementary Materials

Legends for Tables and Figures

Table S1. Field survey sampling site information

Province	Survey sites	Sample points	Longitude	Latitude	Altitude(m)	Sample size
Qinghai	Haiyan County	6	100.8512	37.3012	3838	227
	(HYA)		100.7504	37.1507	3521	170
			100.8615	37.0446	3198	220
			100.994	36.9981	3089	174
			101.0978	36.8202	2978	175
			100.7872	37.0434	3285	164
	Huangyuan County (HY)	2	101.1427	36.6943	3051	212
			101.2842	36.7161	3110	224
	Huangzhong County	4	101.3369	36.6183	3126	226
	(HZA)		101.4822	36.6475	2402	190
			101.3823	36.8197	2786	156
			101.618	36.5812	2447	212
	Xining City (XN)	1	101.7719	36.6343	2238	182
	Huzhu County	2	101.9216	36.6074	2541	225
	(HZ)		102.137	36.5987	2677	219
	Pingan District (PA)	3	101.9073	36.5082	2704	158
			102.0295	36.4851	2404	181
			102.1606	36.4799	2152	182
	Ledu District (LD)	5	102.327	36.5389	2193	223
			102.4307	36.4629	2052	207
			102.5738	36.3527	2226	174
			102.4137	36.6115	2614	214
			102.7675	36.4598	2416	207

	Minhe County	3	102.745	36.3554	1905	110
	(MH)		102.6473	36.2198	2391	103
			102.9349	36.2906	1715	310
	Qilian Mountions (QLM)	0	\	\	\	0
	Tianjun County (TJ)	0	\	\	\	0
	Gangcha County (GC)	0	\	\	\	0
	Qilian County (QL)	0	\	\	\	0
	Menyuan County (MY)	0	\	\	\	0
	Datong County (DT)	0	\	\	\	0
Gansu	Yongdeng County (YD)	1	103.2662	36.3289	1898	226
	Honggu District (HG)	2	103.3343	36.2299	1831	195
			103.2135	36.206051	1804	158
	Yongjing County (YJ)	1	103.0078	36.1724	2032	223
	Tianzhu County (TZ)	0	\	\	\	0

Table S2. Environment variable

Environmental variable	Variable description	Unit
bio1	Annual Mean Temperature	℃
bio2	Mean Diurnal Range	℃
bio3	Isothermality	\
bio4	Temperature Seasonality	\
bio5	Max Temperature of Warmest Month	℃
bio6	Min Temperature of Coldest Month	℃
bio7	Temperature Annual Range	℃
bio8	Mean Temperature of Wettest Quarter	℃
bio9	Mean Temperature of Driest Quarter	℃
bio10	Mean Temperature of Warmest Quarter	℃
bio11	Mean Temperature of Coldest Quarter	℃
bio12	Annual Precipitation	mm
bio13	Precipitation of Wettest Month	mm
bio14	Precipitation of Driest Month	mm
bio15	Precipitation Seasonality	\
bio16	Precipitation of Wettest Quarter	mm
bio17	Precipitation of Driest Quarter	mm
bio18	Precipitation of Warmest Quarter	mm
bio19	Precipitation of Coldest Quarter	mm
Alt	Altitude	m

Table S3. Selected environmental variables post-filtering

Environmental variable	Variable description	Unit
bio2	Mean Diurnal Range	℃

bio9	Mean Temperature of Driest Quarter	℃
bio12	Annual Precipitation	mm
bio14	Precipitation of Driest Month	mm
bio15	Precipitation Seasonality	\
bio18	Precipitation of Warmest Quarter	mm
bio19	Precipitation of Coldest Quarter	mm
Alt	Altitude	m

Table S4. Single-sample Kolmogorov–Sminov test

		AUC	Kappa
N		40	40
Normal parameters a, b	Average	0.921700039	0.729915
	Standard deviation	0.044807644	0.06069
Maximum extreme difference	Absolute	0.109195339	0.093113
	Correct	0.099193227	0.093113
	Negative	-0.109195339	-0.07782
Test statistics		0.109195339	0.093113
Asymptotic significance		.200[d]	.200[d]
Monte Carlo significance		0.2643	0.5068
99% confidence interval	Lower limit	0.252941629	0.493922
	Upper limit	0.275658371	0.519678

**Table S5.** Contribution of environmental variables and permutation importance

Environmental variable	Percent contribution	Permutation importance
bio18	34	55.6
bio14	33.9	3.3
alt	15.9	2
bio12	8	27.8
bio19	4.9	2.9
bio9	2	2.7
bio15	1.2	5.8
bio2	0.1	0

**TableS S6.** Centroid coordinates of distribution and migration distance

Period	Longitude	Latitude	Migration Distance (km）
Current	101.894	36.8427	0
Last Inter Glacial	100.714	37.7299	114.0327
Mid Holocene	101.428	36.876	41.6242
SSP126 (2041-2060)	101.991	36.7313	15.1016
SSP370 (2041-2061)	101.906	36.8111	11.6643

SSP585 (2041-2062)	101.834	36.8537	7.9687
SSP126 (2081-2100)	101.983	36.7535	12.6955
SSP370 (2081-2101)	102.073	36.7444	8.0823
SSP585 (2081-2102)	102.307	36.5746	28.1455
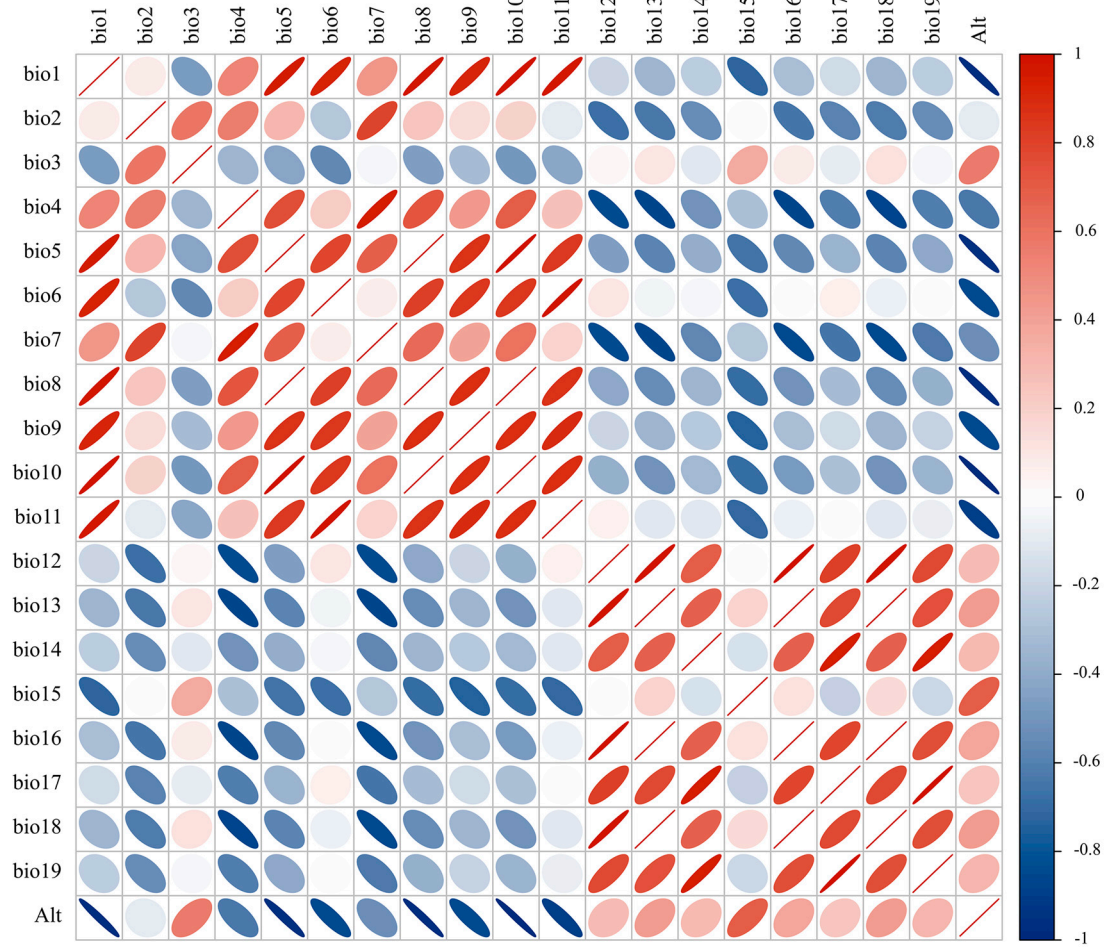
Figure S1. Correlation heatmap of environmental variables.
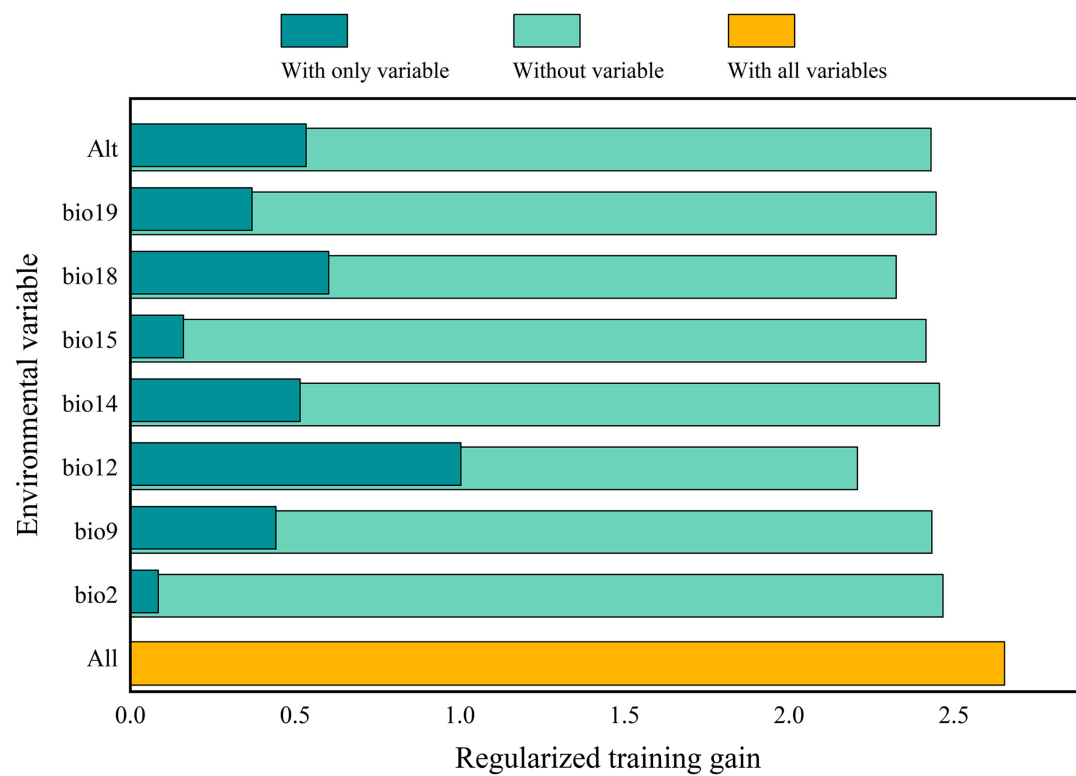
Figure S2. Results of the Jackknife test for primary environmental factors.