Estimated parameters for Schistosomiasis in Sub-saharan Africa

Data processing

ESPEN data was checked for the presence of duplicated locations. Only locations replicated over time where found and, for each of these entries, the most recent survey was retained. All the countries with less than 50 surveys were excluded from modelling.

Modelling framework

We fit a binomial geostatistical model to Schistosomiasis data for each country both for Haematobium and for Mansoni. The number of individuals, y_i, tested positive for Schistosomiasis out of the number of people examined n_i at each location x_i can be considered as the realisation of a Binomial random variable $Y_i \sim \text{Binom}(n_i, p(x_i))$, with $p(x_i)$ modelled as:

$$\log\left\{\frac{p(x_i)}{1-p(x_i)}\right\} = \mu + S(x_i) + Z_i$$

where $S(x)$ is a zero mean Gaussian process with variance σ^2 and an exponential correlation function given by $\rho(u;\phi) = \exp\{-u/\phi\}$ where $\phi > 0$ is a scale parameter that controls the extent of the spatial correlation and u is the distance between two sampling locations. Moreover, Z_i is a set of independent zero-mean Gaussian variables with mean 0 and variance τ^2.

Results

Table 1 and Table 2 report the estimated parameters obtained by fitting a binomial geostatistical model to Haematobium and Mansoni pre-intervention data respectively. In Figure 1 we compare the distribution of the estimated model parameteres for the two species.

Table 1: Monte Carlo maximum likelihood estimates for the model fitted to Haematobium data.

Country	n	$\hat{\mu}$	$\hat{\sigma}^2$	$\hat{\phi}$	$\hat{\tau}^2$
Benin	286	0.126	2.120	17.919	1.395
Burkina Faso	192	0.068	1.593	29.094	2.679
Chad	178	0.171	2.629	84.547	0.796
Congo (Kinshasa)	226	0.039	1.842	118.435	1.468
Cote D'ivoire	433	0.008	4.118	52.093	1.856
Gabon	110	0.027	1.163	26.165	0.000
Ghana	146	0.092	3.389	147.868	2.186
Kenya	170	0.057	5.001	51.530	1.216
Liberia	1028	0.013	6.582	62.273	0.816
Madagascar	150	0.162	7.255	83.054	0.618

Country	n	$\hat{\mu}$	$\hat{\sigma}^2$	$\hat{\phi}$	$\hat{\tau}^2$
Malawi	641	0.049	1.082	72.034	1.334
Mali	165	0.181	2.703	101.656	2.532
Mauritania	52	0.062	3.309	211.459	0.758
Namibia	256	0.002	14.432	853.474	2.083
Niger	685	0.042	1.490	86.200	3.534
Nigeria	1584	0.062	2.502	72.221	1.569
Rwanda	94	0.007	0.008	4.078	0.002
Senegal	209	0.062	5.564	85.502	2.863
South Sudan	162	0.004	2.799	17.195	0.040
Swaziland	202	0.079	1.024	29.480	0.370
Tanzania (Mainland)	440	0.077	6.928	135.691	0.625
The Gambia	181	0.119	0.599	0.901	0.000
Togo	741	0.024	1.964	36.499	0.671
Zambia	100	0.220	0.980	24.500	0.830

Table 2: Monte Carlo maximum likelihood estimates for the model fitted to Mansoni data.

Country	n	$\hat{\mu}$	$\hat{\sigma}^2$	$\hat{\phi}$	$\hat{\tau}^2$
Burkina Faso	129	0.002	0.000	14.058	3.019
Burundi	200	0.253	2.434	23.829	1.873
Cameroon	123	0.045	2.108	47.763	1.417
Chad	164	0.001	4.115	220.045	0.602
Congo (Kinshasa)	1071	0.012	10.207	197.755	1.556
Cote D'ivoire	400	0.022	4.424	100.686	1.498
Eritrea	131	0.002	4.356	49.196	1.016
Ethiopia	139	0.003	16.577	458.889	7.034
Gabon	96	0.005	0.093	4.362	0.078
Kenya	913	0.000	23.315	90.792	1.133
Liberia	936	0.067	4.513	104.628	0.767
Madagascar	200	0.006	8.645	107.561	1.922
Malawi	631	0.004	1.839	46.976	1.888
Mali	228	0.000	10.232	145.890	3.766
Niger	300	0.002	1.397	21.846	0.735
Nigeria	1662	0.003	3.281	74.988	0.562
Rwanda	99	0.005	5.372	14.013	0.000
Senegal	170	0.000	16.527	182.993	2.636
Sierra Leone	56	0.123	6.996	189.044	0.700
South Africa	157	0.003	0.733	487.697	0.218
South Sudan	257	0.020	4.482	123.826	0.598
Swaziland	226	0.005	0.000	3.338	0.116
Tanzania (Mainland)	526	0.004	6.853	85.005	0.760
The Gambia	105	0.006	0.124	1.842	0.000
Togo	986	0.004	5.543	38.810	0.405
Uganda	1103	0.034	5.814	53.140	1.513

Country	n	$\hat{\mu}$	$\hat{\sigma}^2$	$\hat{\phi}$	$\hat{\tau}^2$
Zambia	101	0.028	6.085	104.941	1.821

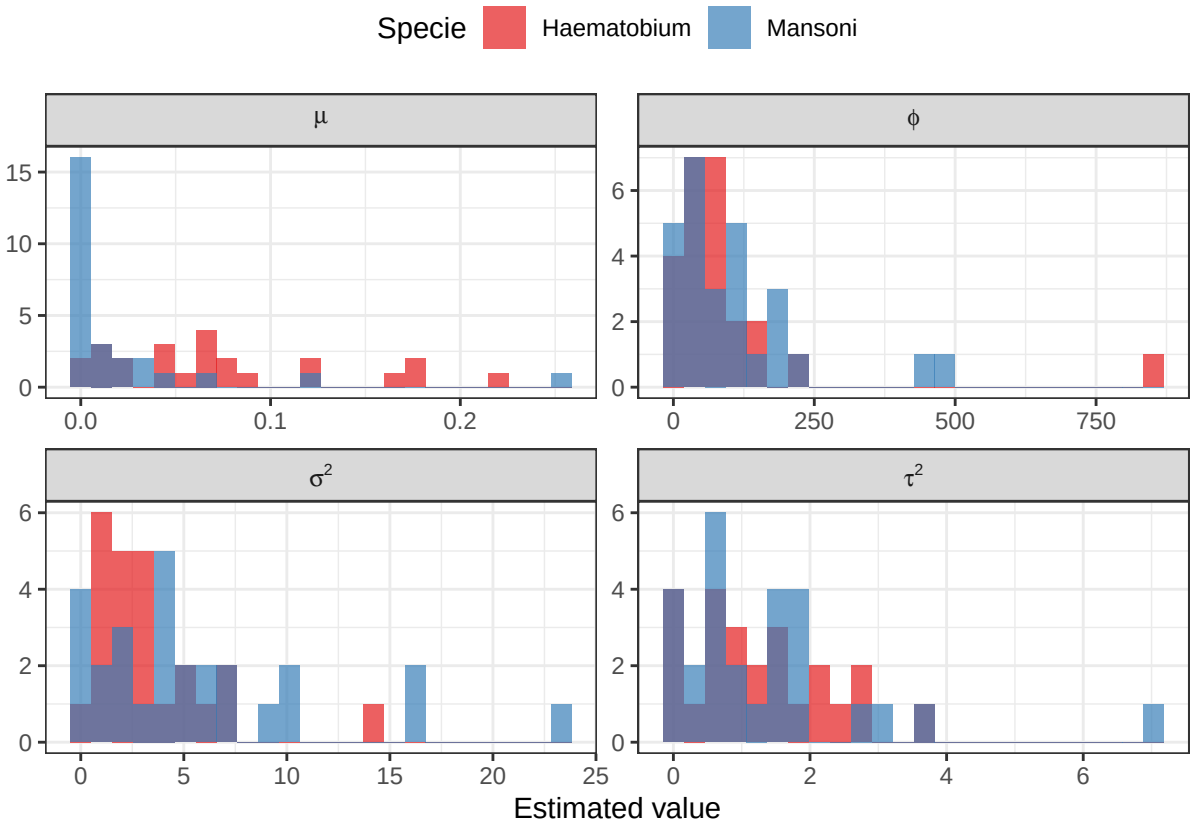

Figure 1: Distribution of parameters estimates for both species.