Supplementary Document: MCMC Diagnostics

A Bayesian Capture-Recapture model of vector-reservoir interaction in an ecological setting: a reservoir-targeted vaccine field study against Borrelia burgdorferi

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MCMC Diagnostics. We computed the Monte-Carlo Standard Error (MCSE), which is a measure of the precision of the posterior distribution obtained from a MCMC algorithm. The purpose of MCSE is to provide a measure of the accuracy of the estimate of the posterior distribution, which is the distribution of the parameters of interest after taking into account the data and prior information. MCSE is calculated by estimating the standard deviation of the MCMC samples of the posterior distribution, which provides a measure of the variability in the posterior estimates due to the Monte Carlo sampling process. This value is then divided by the square root of the effective sample size (ESS), which is the number of independent samples that the MCMC algorithm generates.

Year 2020. For the parameters in the model, we obtained MCSE values between 0.00067 and 0.04953, with mean of 0.01754 and median of 0.01398.

Parameter	MCSE
alpha.adult	0.0057
alpha.behavior	0.0346
alpha.male	0.0033
alpha.site[1]	0.0055
alpha.site[2]	0.0063
alpha.site[3]	0.0059
alpha.site[4]	0.0058
alpha.site[5]	0.0068
alpha.site[6]	0.0068
alpha.subadult	0.0223
beta.site[1]	0.0247
beta.site[2]	0.0245
beta.site[3]	0.0247
beta.site[4]	0.0237
beta.site[5]	0.0249
beta.site[6]	0.0240
lambda[1]	0.0315
lambda[2]	0.0184
lambda[3]	0.0374
lambda[4]	0.0285
lambda[5]	0.0260
lambda[6]	0.0141
p.adult	0.0012
p.male	0.0012
p.subadult	0.0055

psi	0.0141
sigma2.site.encounter	0.0124
sigma2.site.member	0.0169
siteprob[1]	0.0013
siteprob[2]	0.0010
siteprob[3]	0.0012
siteprob[4]	0.0010
siteprob[5]	0.0011
siteprob[6]	0.0011
delta[1]	0.0041
delta[2]	0.0046
delta[3]	0.0038
delta.site[1]	0.0388
delta.site[2]	0.0358
delta.site[3]	0.0486
delta.site[4]	0.0274
delta.site[5]	0.0394
delta.site[6]	0.0378
lambda.site[1]	0.0307
lambda.site[2]	0.0249
lambda.site[3]	0.0490
lambda.site[4]	0.0310
lambda.site[5]	0.0412
lambda.site[6]	0.0245
omega[1]	0.0012
omega[2]	0.0012
omega.site[1]	0.0114
omega.site[2]	0.0080
omega.site[3]	0.0083
omega.site[4]	0.0086
omega.site[5]	0.0088
omega.site[6]	0.0080
rho.dragged	0.0098
rho.ticks	0.0018
sigma2.ExpDraggedTicks	0.0140
sigma2.ExpTicks	0.0007
sigma2.site.dragged.ticks	0.0494
sigma2.site.infected.dragged.ticks	0.0135
sigma2.site.infected.mice	0.0150
sigma2.site.protectiveOspA	0.0414
sigma2.subj.infected.mice	0.0200
sigma2.subj.infticks.drag	0.0495
sigma2.subj.infticks.mice	0.0269
sigma2.subj.protected.mice	0.0225
theta.site[1]	0.0047
theta.site[2]	0.0307
theta.site[3]	0.0120
theta.site[4]	0.0230
theta.site[5]	0.0123
theta.site[6]	0.0079

Year 2021. For the parameters in the model, we obtained MCSE values between 0.00052 and 0.06573, with mean of 0.01584 and median of 0.0109.

Parameter	MCSE
alpha.adult	0.0034
alpha.behavior	0.0183
alpha.male	0.0031
alpha.site[1]	0.0041
alpha.site[2]	0.0041
alpha.site[3]	0.0034
alpha.site[4]	0.0039
alpha.site[5]	0.0040
alpha.site[6]	0.0039
alpha.subadult	0.0158
beta.site[1]	0.0245
beta.site[2]	0.0251
beta.site[3]	0.0245
beta.site[4]	0.0256
beta.site[5]	0.0251
beta.site[6]	0.0255
lambda[1]	0.0238
lambda[2]	0.0258
lambda[3]	0.0161
lambda[4]	0.0657
lambda[5]	0.0165
lambda[6]	0.0390
p.adult	0.0008
p.male	0.0007
p.subadult	0.0046
psi	0.0061
sigma2.site.encounter	0.0077
sigma2.site.member	0.0109
siteprob[1]	0.0006
siteprob[2]	0.0006
siteprob[3]	0.0005
siteprob[4]	0.0012
siteprob[5]	0.0006
siteprob[6]	0.0010
delta[1]	0.0053
delta[2]	0.0047
delta[3]	0.0026
delta.site[1]	0.0402
delta.site[2]	0.0380
delta.site[3]	0.0367
delta.site[4]	0.0286
delta.site[5]	0.0363
delta.site[6]	0.0350
lambda.site[1]	0.0266
lambda.site[2]	0.0271

lambda.site[3]	0.0259
lambda.site[4]	0.0252
lambda.site[5]	0.0297
lambda.site[6]	0.0320
omega[1]	0.0014
omega[2]	0.0013
omega.site[1]	0.0116
omega.site[2]	0.0086
omega.site[3]	0.0072
omega.site[4]	0.0137
omega.site[5]	0.0089
omega.site[6]	0.0078
rho.dragged	0.0102
rho.ticks	0.0019
sigma2.ExpDraggedTicks	0.0054
sigma2.ExpTicks	0.0006
sigma2.site.dragged.ticks	0.0301
sigma2.site.infected.dragged.ticks	0.0127
sigma2.site.infected.mice	0.0154
sigma2.site.protectiveOspA	0.0337
sigma2.subj.infected.mice	0.0317
sigma2.subj.infticks.drag	0.0596
sigma2.subj.infticks.mice	0.0243
sigma2.subj.protected.mice	0.0149
theta.site[1]	0.0169
theta.site[2]	0.0073
theta.site[3]	0.0104
theta.site[4]	0.0056
theta.site[5]	0.0102
theta.site[6]	0.0064

Year 2022. For the parameters in the model, we obtained MCSE values between 0.00016 and 0.06956, with mean of 0.01482 and median of 0.01195.

Parameter	MCSE
alpha.adult	0.0062
alpha.behavior	0.0076
alpha.male	0.0025
alpha.site[1]	0.0064
alpha.site[2]	0.0062
alpha.site[3]	0.0047
alpha.site[4]	0.0062
alpha.site[5]	0.0050
alpha.site[6]	0.0059
alpha.subadult	0.0096
beta.site[1]	0.0131
beta.site[2]	0.0127
beta.site[3]	0.0126

beta.site[4]	0.0131
beta.site[5]	0.0141
beta.site[6]	0.0126
lambda[1]	0.0123
lambda[2]	0.0097
lambda[3]	0.0146
lambda[4]	0.0120
lambda[5]	0.0087
lambda[6]	0.0127
p.adult	0.0003
p.male	0.0005
p.subadult	0.0004
psi	0.0004
sigma2.site.encounter	0.0089
sigma2.site.member	0.0129
siteprob[1]	0.0006
siteprob[2]	0.0004
siteprob[3]	0.0007
siteprob[4]	0.0005
siteprob[5]	0.0006
siteprob[6]	0.0005
delta[1]	0.0047
delta[2]	0.0063
delta[3]	0.0019
delta.site[1]	0.0381
delta.site[2]	0.0303
delta.site[3]	0.0422
delta.site[4]	0.0289
delta.site[5]	0.0359
delta.site[6]	0.0258
lambda.site[1]	0.0194
lambda.site[2]	0.0380
lambda.site[3]	0.0223
lambda.site[4]	0.0696
lambda.site[5]	0.0511
lambda.site[6]	0.0287
omega[1]	0.0017
omega[2]	0.0039
omega.site[1]	0.0196
omega.site[2]	0.0135
omega.site[3]	0.0159
omega.site[4]	0.0248
omega.site[5]	0.0264
omega.site[6]	0.0171
rho.dragged	0.0093
rho.ticks	0.0009
sigma2.ExpDraggedTicks	0.0086
sigma2.ExpTicks	0.0002
sigma2.site.dragged.ticks	0.0327
sigma2.site.infected.dragged.ticks	0.0088

sigma2.site.infected.mice	0.0163
sigma2.site.protectiveOspA	0.0358
sigma2.subj.infected.mice	0.0572
sigma2.subj.infticks.drag	0.0560
sigma2.subj.infticks.mice	0.0140
sigma2.subj.protected.mice	0.0058
theta.site[1]	0.0180
theta.site[2]	0.0068
theta.site[3]	0.0129
theta.site[4]	0.0045
theta.site[5]	0.0135
theta.site[6]	0.0087