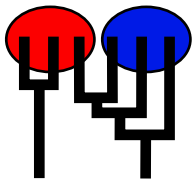
Example: Microsatellite data set

MIGRATION RATE AND POPULATION SIZE ESTIMATION
using the coalescent and maximum likelihood or Bayesian inference
Migrate-n version debug 3.2.17 [x]
Compiled for a SYMMETRIC MULTIPROCESSORS
Program started at Sun Mar 18 20:55:54 2012
Program finished at Sun Mar 18 21:04:46 2012



Options

Datatype: Microsatellite data [Brownian motion]
Missing data: not included

Inheritance scalers in use for Thetas: 1.00 1.00
1.00 1.00 1.00 1.00 1.00
1.00 1.00 1.00
[Each Theta uses the (true) ineritance scalar of the first locus as a reference]

Data set was subsampled: used a random sample of size: 5

Random number seed: (from parmfile) 310705631
Start parameters:

Theta values were generated RANDOM start value from U(min,msx)

M values were generated from the FST-calculation

Connection type matrix:
where m = average (average over a group of Thetas or M,
s = symmetric M, S = symmetric 4Nm, 0 = zero, and not estimated,
* = free to vary, Thetas are on diagonal

Population	1	2	3	4
1 population_numb	*	0	*	*
2 test1	*	*	*	*
3 test2	*	*	*	*
4 population_numb	*	*	*	*

Order of parameters:

1	Θ_1	<displayed>
2	Θ_2	<displayed>
3	Θ_3	<displayed>
4	Θ_4	<displayed>
6	$M_{3->1}$	<displayed>
7	$M_{4->1}$	<displayed>
8	$M_{1->2}$	<displayed>
9	$M_{3->2}$	<displayed>
10	$M_{4->2}$	<displayed>
11	$M_{1->3}$	<displayed>
12	$M_{2->3}$	<displayed>
13	$M_{4->3}$	<displayed>
14	$M_{1->4}$	<displayed>
15	$M_{2->4}$	<displayed>
16	$M_{3->4}$	<displayed>

Mutation rate among loci: Mutation rate is constant for all loci

Analysis strategy: Bayesian inference

Proposal distributions for parameter

Parameter	Proposal
Theta	Slice sampling
M	Slice sampling

Prior distribution for parameter

Parameter	Prior	Minimum	Mean*	Maximum	Delta	Bins
Theta	Uniform	0.000000	10.000000	20.000000	2.000000	500
M	Uniform	0.000000	10.000000	20.000000	2.000000	500

Markov chain settings: Long chain

Number of chains	1
Recorded steps [a]	5000
Increment (record every x step [b]	1
Number of concurrent chains (replicates) [c]	2
Visited (sampled) parameter values [a*b*c]	10000
Number of discard trees per chain (burn-in)	10000

Multiple Markov chains:

Static heating scheme: 4 chains with temperatures 1000000.00 3.00 1.50 1.00

Swapping interval is 1

Print options:

Data file:	infile.msat
Output file:	outfile-bayes
Posterior distribution raw histogram file:	bayesfile
Print data:	No
Print genealogies [only some for some data type]:	None

Data summary

Datatype: Microsatellite data
Number of loci: 10

Population	Locus	Gene copies data	(missing)
1 population_number___0	1	4	(0)
	2	4	(0)
	3	4	(0)
	4	4	(0)
	5	4	(0)
	6	4	(0)
	7	4	(0)
	8	4	(0)
	9	4	(0)
	10	4	(0)
2 test1	1	6	(0)
	2	6	(0)
	3	6	(0)
	4	6	(0)
	5	6	(0)
	6	6	(0)
	7	6	(0)
	8	6	(0)
	9	6	(0)
	10	6	(0)
3 test2	1	40	(0)
	2	40	(0)
	3	40	(0)
	4	40	(0)
	5	40	(0)
	6	40	(0)
	7	40	(0)
	8	40	(0)
	9	40	(0)
	10	40	(0)
4 population_number___1	1	42	(0)
	2	42	(0)
	3	42	(0)
	4	42	(0)
	5	42	(0)

	6	42	(0)
	7	42	(0)
	8	42	(0)
	9	42	(0)
	10	42	(0)
Total of all populations	1	92	(0)
	2	92	(0)
	3	92	(0)
	4	92	(0)
	5	92	(0)
	6	92	(0)
	7	92	(0)
	8	92	(0)
	9	92	(0)
	10	92	(0)

Subsampled dataset

Data set was subsampled randomly per population: 5 samples taken

Locus	Population	Individuals
1	population	0BBK_0BAH 0BBG_0BBM
	test1	0BAJ_0BAB 0BAL_0BBL 0BAR_0BBW
	test2	0BAQ_0BBS 0BAS_0BBT 0BBH_0BAA 0BAX_0BCA 0BBB_0BBX
	population	1BAA_1BAF 1BAQ_1BAN 1BBK_1BAS 1BAL_1BAV 1BAE_1BAI
2	population	0BBK_0BAH 0BBG_0BBM
	test1	0BAJ_0BAB 0BAL_0BBL 0BAR_0BBW
	test2	0BAQ_0BBS 0BAS_0BBT 0BBH_0BAA 0BAX_0BCA 0BBB_0BBX
	population	1BAA_1BAF 1BAQ_1BAN 1BBK_1BAS 1BAL_1BAV 1BAE_1BAI
3	population	0BBK_0BAH 0BBG_0BBM
	test1	0BAJ_0BAB 0BAL_0BBL 0BAR_0BBW
	test2	0BAQ_0BBS 0BAS_0BBT 0BBH_0BAA 0BAX_0BCA 0BBB_0BBX
	population	1BAA_1BAF 1BAQ_1BAN 1BBK_1BAS 1BAL_1BAV 1BAE_1BAI
4	population	0BBK_0BAH 0BBG_0BBM
	test1	0BAJ_0BAB 0BAL_0BBL 0BAR_0BBW
	test2	0BAQ_0BBS 0BAS_0BBT 0BBH_0BAA 0BAX_0BCA 0BBB_0BBX
	population	1BAA_1BAF 1BAQ_1BAN 1BBK_1BAS 1BAL_1BAV 1BAE_1BAI
5	population	0BBK_0BAH 0BBG_0BBM
	test1	0BAJ_0BAB 0BAL_0BBL 0BAR_0BBW
	test2	0BAQ_0BBS 0BAS_0BBT 0BBH_0BAA 0BAX_0BCA 0BBB_0BBX
	population	1BAA_1BAF 1BAQ_1BAN 1BBK_1BAS 1BAL_1BAV 1BAE_1BAI
6	population	0BBK_0BAH 0BBG_0BBM
	test1	0BAJ_0BAB 0BAL_0BBL 0BAR_0BBW
	test2	0BAQ_0BBS 0BAS_0BBT 0BBH_0BAA 0BAX_0BCA 0BBB_0BBX
	population	1BAA_1BAF 1BAQ_1BAN 1BBK_1BAS 1BAL_1BAV 1BAE_1BAI
7	population	0BBK_0BAH 0BBG_0BBM
	test1	0BAJ_0BAB 0BAL_0BBL 0BAR_0BBW
	test2	0BAQ_0BBS 0BAS_0BBT 0BBH_0BAA 0BAX_0BCA 0BBB_0BBX
	population	1BAA_1BAF 1BAQ_1BAN 1BBK_1BAS 1BAL_1BAV 1BAE_1BAI
8	population	0BBK_0BAH 0BBG_0BBM
	test1	0BAJ_0BAB 0BAL_0BBL 0BAR_0BBW
	test2	0BAQ_0BBS 0BAS_0BBT 0BBH_0BAA 0BAX_0BCA 0BBB_0BBX
	population	1BAA_1BAF 1BAQ_1BAN 1BBK_1BAS 1BAL_1BAV 1BAE_1BAI
9	population	0BBK_0BAH 0BBG_0BBM
	test1	0BAJ_0BAB 0BAL_0BBL 0BAR_0BBW
	test2	0BAQ_0BBS 0BAS_0BBT 0BBH_0BAA 0BAX_0BCA 0BBB_0BBX
	population	1BAA_1BAF 1BAQ_1BAN 1BBK_1BAS 1BAL_1BAV 1BAE_1BAI
10	population	0BBK_0BAH 0BBG_0BBM

Locus	Population	Individuals
	test1	0BAJ_0BAB 0BAL_0BBL 0BAR_0BBW
	test2	0BAQ_0BBS 0BAS_0BBT 0BBH_0BAA 0BAX_0BCA 0BBB_0BBX
	population	1BAA_1BAF 1BAQ_1BAN 1BBK_1BAS 1BAL_1BAV 1BAE_1BAI

Allele frequency spectra

Locus 1

Allele	Pop1	Pop2	Pop3	Pop4	All
16	0.500	0.833	0.100	0.167	0.196
19	0.250	-	0.025	0.071	0.054
18	0.250	-	0.050	0.119	0.087
15	-	0.167	0.250	0.024	0.130
21	-	-	0.025	0.167	0.087
23	-	-	0.025	0.119	0.065
17	-	-	0.350	0.095	0.196
22	-	-	0.075	0.119	0.087
25	-	-	0.075	0.024	0.043
24	-	-	0.025	-	0.011
26	-	-	-	0.024	0.011
27	-	-	-	0.048	0.022
29	-	-	-	0.024	0.011
Total	3	2	10	12	13
H_{exp}	0.625	0.278	0.789	0.883	0.874

Locus 2

Allele	Pop1	Pop2	Pop3	Pop4	All
16	0.500	0.333	0.550	0.571	0.543
19	0.250	-	0.025	-	0.022
18	0.250	0.500	0.175	0.119	0.174
17	-	0.167	0.175	0.167	0.163
15	-	-	0.025	-	0.011
21	-	-	0.025	0.071	0.043
20	-	-	0.025	0.024	0.022
22	-	-	-	0.048	0.022
Total	3	3	7	6	8
H_{exp}	0.625	0.611	0.634	0.624	0.518

Locus 3

Allele	Pop1	Pop2	Pop3	Pop4	All
19	0.250	0.333	0.225	0.262	0.250
20	0.500	0.500	0.225	0.476	0.370
18	0.250	0.167	0.050	0.095	0.087
21	-	-	0.350	0.119	0.207

Allele	Pop1	Pop2	Pop3	Pop4	All
22	-	-	0.150	0.048	0.087
Total	3	3	5	5	5
H_{exp}	0.625	0.611	0.751	0.679	0.261

Locus 4

Allele	Pop1	Pop2	Pop3	Pop4	All
16	0.500	0.333	-	0.071	0.076
24	0.500	0.167	0.150	0.024	0.109
15	-	0.167	-	0.048	0.033
25	-	0.333	0.150	0.167	0.163
14	-	-	0.025	0.048	0.033
19	-	-	0.125	0.143	0.120
12	-	-	0.075	-	0.033
20	-	-	0.100	0.190	0.130
23	-	-	0.075	0.119	0.087
28	-	-	0.025	-	0.011
22	-	-	0.075	0.024	0.043
21	-	-	0.200	0.119	0.141
13	-	-	-	0.024	0.011
26	-	-	-	0.024	0.011
Total	2	4	10	12	14
H_{exp}	0.500	0.722	0.871	0.875	0.153

Locus 5

Allele	Pop1	Pop2	Pop3	Pop4	All
20	0.500	0.500	0.375	0.524	0.457
21	0.500	0.500	0.400	0.357	0.391
19	-	-	0.225	0.119	0.152
Total	2	2	3	3	3
H_{exp}	0.500	0.500	0.649	0.584	-0.232

Locus 6

Allele	Pop1	Pop2	Pop3	Pop4	All
19	0.250	-	0.050	-	0.033
20	0.500	0.167	0.050	0.024	0.065
18	0.250	0.500	0.275	0.214	0.261
22	-	0.167	0.225	0.119	0.163
21	-	0.167	0.125	0.476	0.283
16	-	-	0.075	-	0.033
24	-	-	0.200	0.048	0.109

Allele	Pop1	Pop2	Pop3	Pop4	All
17	-	-	-	0.119	0.054
Total	3	4	7	6	8
H_{exp}	0.625	0.667	0.808	0.696	-0.427

Locus 7

Allele	Pop1	Pop2	Pop3	Pop4	All
23	0.250	-	0.025	0.238	0.130
20	0.250	-	0.800	0.143	0.424
22	0.500	0.833	0.050	0.190	0.185
21	-	0.167	0.100	0.333	0.207
19	-	-	0.025	0.095	0.054
Total	3	2	5	5	5
H_{exp}	0.625	0.278	0.346	0.766	-0.704

Locus 8

Allele	Pop1	Pop2	Pop3	Pop4	All
19	0.500	0.500	0.525	0.524	0.522
17	0.500	-	-	0.048	0.043
18	-	0.500	0.050	0.071	0.087
20	-	-	0.175	0.190	0.163
16	-	-	0.100	-	0.043
22	-	-	0.125	0.048	0.076
15	-	-	0.025	0.048	0.033
23	-	-	-	0.071	0.033
Total	2	2	6	7	8
H_{exp}	0.500	0.500	0.665	0.672	-1.022

Locus 9

Allele	Pop1	Pop2	Pop3	Pop4	All
24	0.500	0.333	-	0.024	0.054
19	0.500	-	0.325	0.429	0.359
20	-	0.500	0.300	0.167	0.239
23	-	0.167	0.200	0.143	0.163
22	-	-	0.100	0.024	0.054
18	-	-	0.025	0.071	0.043
21	-	-	0.050	0.095	0.065
25	-	-	-	0.048	0.022
Total	2	3	6	8	8
H_{exp}	0.500	0.611	0.751	0.751	-1.247

Locus 10

Allele	Pop1	Pop2	Pop3	Pop4	All
22	0.500	0.167	0.050	0.214	0.152
20	0.500	0.500	0.425	0.214	0.337
23	-	0.167	0.075	0.167	0.120
24	-	0.167	-	-	0.011
19	-	-	0.200	0.167	0.163
21	-	-	0.075	0.048	0.054
18	-	-	0.100	-	0.043
15	-	-	0.025	0.071	0.043
17	-	-	0.050	0.048	0.043
25	-	-	-	0.071	0.033
Total	2	4	8	8	10
H_{exp}	0.500	0.667	0.752	0.838	-1.434

Average expected heterozygosity

	Pop1	Pop2	Pop3	Pop4	All
H_{exp}	1.125	1.089	1.403	1.474	0.132

Bayesian Analysis: Posterior distribution table

Locus	Parameter	2.5%	25.0%	Mode	75.0%	97.5%	Median	Mean
1	Θ_1	0.80000	1.40000	1.94000	2.60000	3.04000	10.98000	10.72450
1	Θ_2	11.88000	14.36000	14.90000	15.40000	16.20000	10.10000	10.15363
1	Θ_3	9.52000	11.48000	11.98000	13.80000	19.92000	12.90000	12.90064
1	Θ_4	2.60000	3.24000	4.42000	5.52000	11.60000	8.10000	8.94215
1	$M_{3->1}$	5.200	7.160	7.500	8.320	8.680	4.740	4.696
1	$M_{4->1}$	0.280	0.520	1.220	1.840	2.920	1.780	3.067
1	$M_{1->2}$	6.280	14.240	14.580	15.040	18.320	12.300	12.050
1	$M_{3->2}$	0.680	1.640	2.660	4.080	5.680	4.060	5.165
1	$M_{4->2}$	1.320	1.680	2.860	4.400	6.080	12.220	10.186
1	$M_{1->3}$	0.000	0.000	0.180	0.480	2.320	0.780	0.823
1	$M_{2->3}$	0.000	0.000	0.420	1.040	2.520	1.060	1.556
1	$M_{4->3}$	0.360	0.600	0.980	1.400	3.160	1.340	1.517
1	$M_{1->4}$	0.080	0.320	0.700	1.120	3.920	1.700	1.816
1	$M_{2->4}$	0.600	1.080	1.500	1.840	2.840	1.620	1.629
1	$M_{3->4}$	0.000	0.040	0.340	0.520	1.080	0.460	0.449
2	Θ_1	0.20000	0.28000	0.70000	1.04000	12.32000	7.78000	8.49444
2	Θ_2	7.48000	8.04000	8.66000	9.84000	17.44000	10.82000	11.15563
2	Θ_3	0.08000	0.24000	1.98000	3.56000	4.52000	5.58000	6.78894
2	Θ_4	1.76000	4.04000	4.98000	6.00000	6.28000	7.90000	9.16040
2	$M_{3->1}$	4.200	6.400	7.740	8.840	11.280	7.180	6.602
2	$M_{4->1}$	4.040	8.520	10.380	10.760	13.160	9.500	9.054
2	$M_{1->2}$	1.080	2.040	2.700	4.600	8.840	4.060	4.954
2	$M_{3->2}$	0.000	0.000	1.180	2.120	2.440	2.980	5.508
2	$M_{4->2}$	17.640	19.320	19.780	20.000	20.000	12.180	10.941
2	$M_{1->3}$	0.000	1.000	2.100	2.840	7.120	2.220	2.959
2	$M_{2->3}$	0.600	1.000	1.980	2.520	8.600	4.380	5.186
2	$M_{4->3}$	2.240	3.760	5.340	6.360	8.000	5.580	7.387
2	$M_{1->4}$	5.120	7.400	8.780	9.200	9.680	6.180	5.845
2	$M_{2->4}$	0.000	1.160	1.860	2.880	6.560	2.460	2.940
2	$M_{3->4}$	0.920	1.760	3.380	3.880	7.200	3.500	4.094
3	Θ_1	0.28000	1.56000	2.54000	3.52000	9.44000	4.30000	6.24880
3	Θ_2	15.92000	16.20000	16.58000	17.44000	17.76000	9.90000	9.97647
3	Θ_3	10.40000	14.60000	14.98000	15.32000	17.28000	10.02000	10.22500
3	Θ_4	2.16000	6.56000	7.58000	8.16000	11.08000	8.50000	9.67465

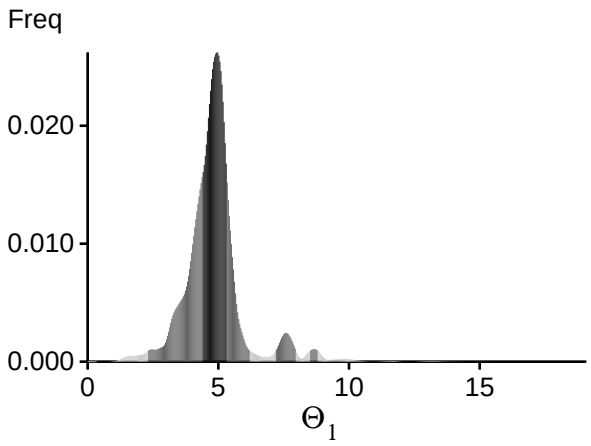
Locus	Parameter	2.5%	25.0%	Mode	75.0%	97.5%	Median	Mean
3	$M_{3->1}$	0.000	1.640	2.180	3.480	10.160	3.740	4.871
3	$M_{4->1}$	0.840	2.600	3.620	4.800	9.600	4.660	5.197
3	$M_{1->2}$	14.240	15.680	16.100	16.480	19.720	11.380	10.875
3	$M_{3->2}$	4.400	9.560	10.300	11.280	13.760	10.980	11.550
3	$M_{4->2}$	2.800	8.240	8.940	9.480	9.960	8.980	9.466
3	$M_{1->3}$	6.000	18.720	19.220	19.520	19.720	12.300	12.075
3	$M_{2->3}$	1.760	3.680	5.940	7.440	11.000	6.420	6.644
3	$M_{4->3}$	14.560	14.880	15.220	16.280	18.920	12.780	12.177
3	$M_{1->4}$	0.120	0.360	1.500	2.360	2.920	2.540	6.931
3	$M_{2->4}$	0.000	0.160	0.820	1.880	2.080	2.260	4.774
3	$M_{3->4}$	0.160	0.840	1.540	2.280	6.440	2.020	2.902
4	Θ_1	12.32000	14.92000	15.34000	15.72000	16.44000	11.66000	11.43519
4	Θ_2	15.20000	19.24000	19.74000	20.00000	20.00000	12.02000	11.14515
4	Θ_3	9.64000	17.68000	18.34000	18.92000	20.00000	15.38000	14.85138
4	Θ_4	13.04000	15.28000	16.30000	16.76000	19.68000	12.62000	12.62024
4	$M_{3->1}$	0.000	0.120	1.060	2.480	2.960	4.500	6.065
4	$M_{4->1}$	2.640	3.000	4.220	5.280	6.160	5.180	8.171
4	$M_{1->2}$	0.200	0.560	1.180	1.760	3.600	1.900	2.956
4	$M_{3->2}$	0.320	1.280	1.660	2.120	2.800	1.740	1.673
4	$M_{4->2}$	0.000	0.440	0.860	1.200	1.960	0.940	0.948
4	$M_{1->3}$	0.400	0.680	1.060	1.640	3.200	1.460	1.653
4	$M_{2->3}$	0.000	0.560	1.140	1.440	2.160	1.140	1.242
4	$M_{4->3}$	0.800	3.000	3.340	3.720	5.360	3.380	3.300
4	$M_{1->4}$	0.040	0.680	1.220	1.520	2.040	1.140	1.090
4	$M_{2->4}$	0.360	1.040	1.420	1.920	3.000	1.620	1.628
4	$M_{3->4}$	0.320	0.960	1.460	1.960	3.880	2.300	3.064
5	Θ_1	0.00000	0.08000	0.54000	1.04000	5.04000	1.54000	2.48698
5	Θ_2	0.00000	0.04000	0.46000	1.84000	2.12000	8.78000	8.92318
5	Θ_3	4.16000	6.52000	7.06000	8.48000	12.52000	9.42000	10.30697
5	Θ_4	0.76000	1.36000	1.94000	2.56000	3.24000	9.34000	9.66627
5	$M_{3->1}$	0.000	2.720	3.340	3.840	7.320	3.420	3.905
5	$M_{4->1}$	3.640	5.120	5.700	8.280	11.040	6.820	6.926
5	$M_{1->2}$	14.080	18.880	19.700	20.000	20.000	14.340	13.076
5	$M_{3->2}$	13.200	13.480	13.940	14.440	16.480	9.420	9.291
5	$M_{4->2}$	0.440	1.200	1.780	3.400	12.120	6.100	7.646
5	$M_{1->3}$	11.680	11.800	12.220	12.600	17.800	10.460	10.288
5	$M_{2->3}$	2.040	6.520	7.460	8.680	15.520	7.780	8.352
5	$M_{4->3}$	1.440	3.400	4.260	5.520	11.560	6.740	7.763
5	$M_{1->4}$	9.120	14.880	15.460	16.480	20.000	15.300	14.193

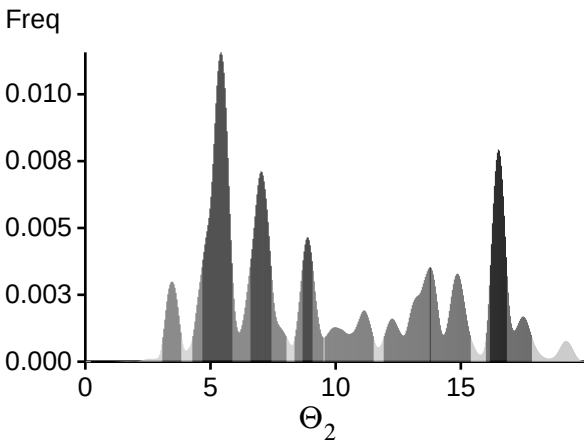
Locus	Parameter	2.5%	25.0%	Mode	75.0%	97.5%	Median	Mean
5	$M_{2->4}$	1.720	5.920	6.940	9.160	11.320	8.180	8.972
5	$M_{3->4}$	0.160	0.320	0.700	3.920	5.920	7.100	7.799
6	Θ_1	3.84000	8.88000	9.34000	9.80000	15.52000	10.18000	10.49855
6	Θ_2	4.08000	4.44000	5.06000	5.44000	10.28000	10.70000	10.61620
6	Θ_3	1.08000	3.24000	5.38000	5.80000	6.16000	8.22000	8.73635
6	Θ_4	1.64000	6.36000	6.94000	7.56000	11.00000	7.26000	8.70139
6	$M_{3->1}$	0.000	0.000	0.300	1.360	1.960	3.940	4.175
6	$M_{4->1}$	0.640	0.880	1.540	2.560	3.520	4.860	6.828
6	$M_{1->2}$	0.200	0.320	0.780	1.160	1.400	2.660	2.590
6	$M_{3->2}$	0.560	1.520	2.780	3.280	3.880	3.900	5.413
6	$M_{4->2}$	1.080	1.800	2.620	3.080	5.880	2.980	3.309
6	$M_{1->3}$	0.000	0.000	0.020	0.920	3.320	1.540	1.558
6	$M_{2->3}$	2.840	6.720	7.300	7.800	13.600	7.060	7.611
6	$M_{4->3}$	7.160	10.440	11.740	12.120	13.880	9.420	8.430
6	$M_{1->4}$	0.680	1.160	1.740	2.400	4.200	2.100	2.254
6	$M_{2->4}$	0.880	3.520	3.820	4.120	5.000	3.020	3.158
6	$M_{3->4}$	1.280	2.040	2.500	2.880	7.880	4.900	4.869
7	Θ_1	0.52000	0.88000	2.18000	3.08000	6.96000	3.54000	6.12135
7	Θ_2	0.00000	0.00000	0.42000	2.52000	4.00000	6.86000	8.16136
7	Θ_3	0.40000	0.64000	1.34000	2.68000	5.92000	3.90000	6.42714
7	Θ_4	0.84000	1.72000	2.46000	3.32000	4.92000	9.14000	9.65045
7	$M_{3->1}$	9.480	12.000	12.420	13.360	14.680	8.620	8.277
7	$M_{4->1}$	1.520	5.920	6.380	7.520	7.920	5.180	5.177
7	$M_{1->2}$	15.640	16.960	17.500	18.600	19.680	13.180	13.057
7	$M_{3->2}$	6.200	9.760	10.180	11.800	12.800	11.500	12.473
7	$M_{4->2}$	4.160	7.600	8.900	10.200	10.400	9.940	10.746
7	$M_{1->3}$	1.880	2.120	2.620	3.680	11.200	5.700	6.212
7	$M_{2->3}$	2.400	5.520	6.780	8.160	9.120	6.660	6.771
7	$M_{4->3}$	0.200	0.520	1.580	3.520	4.520	5.060	7.167
7	$M_{1->4}$	1.720	3.600	3.980	5.360	11.960	6.540	7.227
7	$M_{2->4}$	0.280	0.640	1.180	1.720	9.520	7.060	7.570
7	$M_{3->4}$	0.240	3.520	5.060	5.680	10.560	4.860	5.772
8	Θ_1	1.00000	3.32000	4.30000	5.16000	10.40000	5.22000	6.66983
8	Θ_2	4.88000	7.80000	8.22000	8.64000	9.36000	8.62000	9.80088
8	Θ_3	17.56000	19.36000	19.74000	20.00000	20.00000	11.14000	11.20181
8	Θ_4	2.00000	2.20000	2.58000	3.04000	11.60000	9.30000	9.84006
8	$M_{3->1}$	0.640	1.280	1.780	2.400	4.160	2.180	2.399
8	$M_{4->1}$	0.000	0.840	1.420	2.400	3.880	2.780	4.729

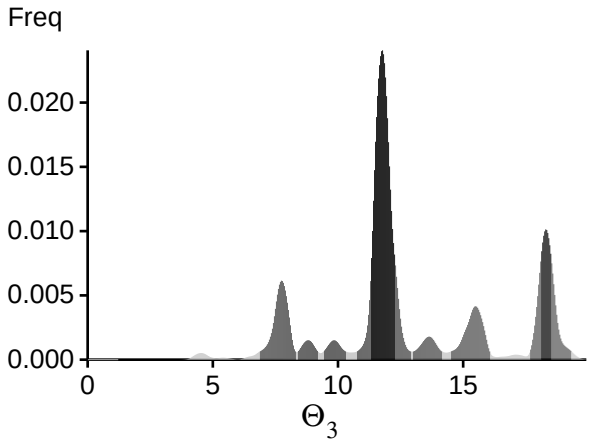
Locus	Parameter	2.5%	25.0%	Mode	75.0%	97.5%	Median	Mean
8	$M_{1->2}$	7.160	15.480	16.020	16.720	19.640	12.380	12.224
8	$M_{3->2}$	1.480	1.720	3.220	4.680	5.640	8.500	9.008
8	$M_{4->2}$	1.920	2.320	3.020	5.800	7.360	6.060	7.758
8	$M_{1->3}$	0.920	1.880	2.420	3.320	8.560	4.740	4.856
8	$M_{2->3}$	0.520	0.880	1.660	2.720	7.840	2.940	4.315
8	$M_{4->3}$	2.000	2.840	3.380	4.800	10.960	5.860	6.233
8	$M_{1->4}$	3.880	5.840	6.900	8.240	12.280	7.700	8.182
8	$M_{2->4}$	3.320	5.280	6.660	7.800	10.640	6.980	7.207
8	$M_{3->4}$	1.760	3.680	4.340	4.880	5.760	10.060	9.445
9	Θ_1	0.00000	0.00000	0.98000	1.68000	3.36000	7.62000	8.00587
9	Θ_2	14.36000	19.16000	19.74000	20.00000	20.00000	13.30000	11.88083
9	Θ_3	6.16000	9.48000	10.54000	11.84000	16.24000	11.66000	12.09657
9	Θ_4	1.24000	1.48000	2.74000	3.12000	3.56000	8.94000	9.47806
9	$M_{3->1}$	0.200	2.400	3.340	4.040	6.200	3.580	4.422
9	$M_{4->1}$	8.680	14.760	15.340	15.840	16.520	13.420	13.449
9	$M_{1->2}$	1.120	1.560	2.100	4.840	5.120	10.820	10.070
9	$M_{3->2}$	2.320	4.200	4.740	5.280	6.720	11.620	10.458
9	$M_{4->2}$	2.680	4.880	5.860	6.280	8.440	9.980	9.766
9	$M_{1->3}$	0.000	0.320	0.740	1.120	2.040	2.540	2.247
9	$M_{2->3}$	0.000	0.000	0.020	0.240	0.400	1.420	1.521
9	$M_{4->3}$	0.640	1.280	1.820	2.560	4.240	2.260	2.521
9	$M_{1->4}$	0.920	1.120	1.740	3.000	4.680	3.020	3.884
9	$M_{2->4}$	0.040	0.280	0.700	1.480	2.240	3.820	3.463
9	$M_{3->4}$	0.800	2.640	3.300	3.920	7.360	4.060	4.216
10	Θ_1	4.80000	7.36000	7.74000	8.08000	9.16000	10.70000	10.90911
10	Θ_2	18.48000	19.28000	19.66000	20.00000	20.00000	11.18000	10.46099
10	Θ_3	7.48000	13.28000	13.62000	15.32000	20.00000	13.54000	12.91738
10	Θ_4	11.28000	11.48000	12.06000	13.08000	17.84000	12.22000	12.31460
10	$M_{3->1}$	0.000	0.000	0.020	0.240	4.400	2.300	2.618
10	$M_{4->1}$	1.680	2.800	3.460	4.520	6.760	3.820	3.942
10	$M_{1->2}$	0.800	2.680	3.740	4.360	6.320	9.580	9.569
10	$M_{3->2}$	10.080	10.560	11.140	11.520	11.720	12.340	12.191
10	$M_{4->2}$	1.480	1.840	3.460	5.400	7.880	5.860	8.377
10	$M_{1->3}$	0.000	0.280	0.700	1.120	3.040	1.020	1.282
10	$M_{2->3}$	0.520	0.920	1.380	1.880	3.720	1.700	1.925
10	$M_{4->3}$	1.120	1.640	2.140	2.760	4.240	2.540	2.814
10	$M_{1->4}$	2.920	4.440	5.220	5.840	7.000	5.020	4.891
10	$M_{2->4}$	0.280	1.680	2.580	3.000	3.800	2.220	2.118
10	$M_{3->4}$	0.760	1.520	1.900	2.640	3.600	2.220	2.246

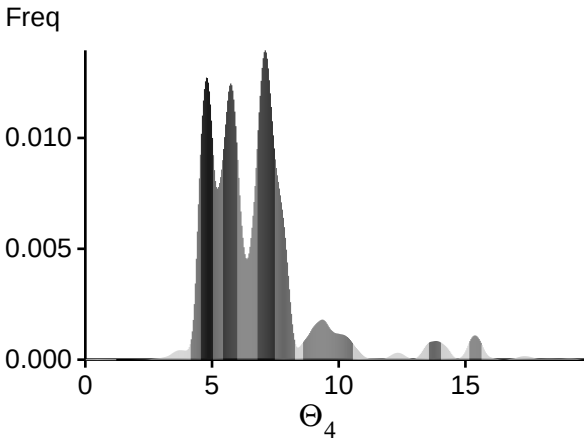
Locus	Parameter	2.5%	25.0%	Mode	75.0%	97.5%	Median	Mean
All	Θ_1	2.28000	4.36000	4.94000	5.32000	6.20000	4.86000	4.86766
All	Θ_2	4.24000	4.64000	5.42000	5.88000	8.04000	8.66000	9.78816
All	Θ_3	10.72000	11.28000	11.78000	12.28000	12.92000	11.98000	12.82785
All	Θ_4	4.12000	6.76000	7.10000	7.48000	8.28000	6.46000	6.79995
All	$M_{3->1}$	0.560	0.840	1.180	1.560	2.440	1.420	1.437
All	$M_{4->1}$	1.200	1.960	2.820	3.480	3.920	3.220	4.109
All	$M_{1->2}$	3.680	4.360	4.620	4.840	6.520	4.700	4.922
All	$M_{3->2}$	4.760	6.120	6.460	6.760	9.880	8.300	7.875
All	$M_{4->2}$	1.840	2.480	2.780	3.240	4.560	3.140	3.214
All	$M_{1->3}$	1.000	1.760	2.060	2.320	3.160	2.100	2.061
All	$M_{2->3}$	0.840	1.080	1.420	1.720	2.200	1.620	1.844
All	$M_{4->3}$	1.360	2.000	2.300	2.600	2.920	2.460	2.644
All	$M_{1->4}$	1.320	2.280	2.620	2.920	3.120	2.700	2.838
All	$M_{2->4}$	1.000	1.440	1.700	1.920	2.280	1.740	1.674
All	$M_{3->4}$	1.000	1.360	1.620	1.840	2.680	1.700	1.726

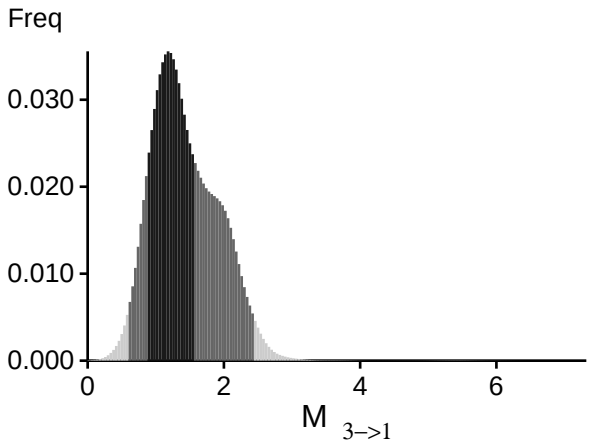
Bayesian Analysis: Posterior distribution over all loci

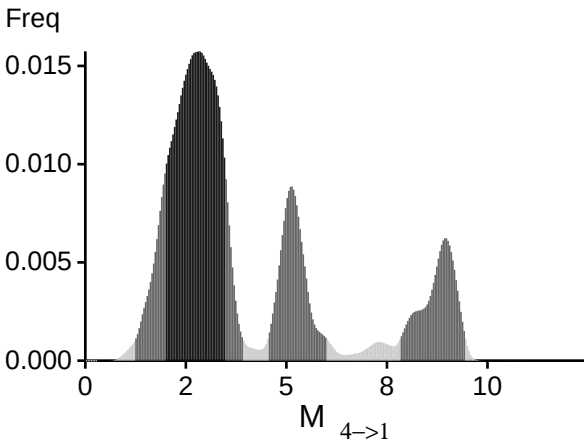


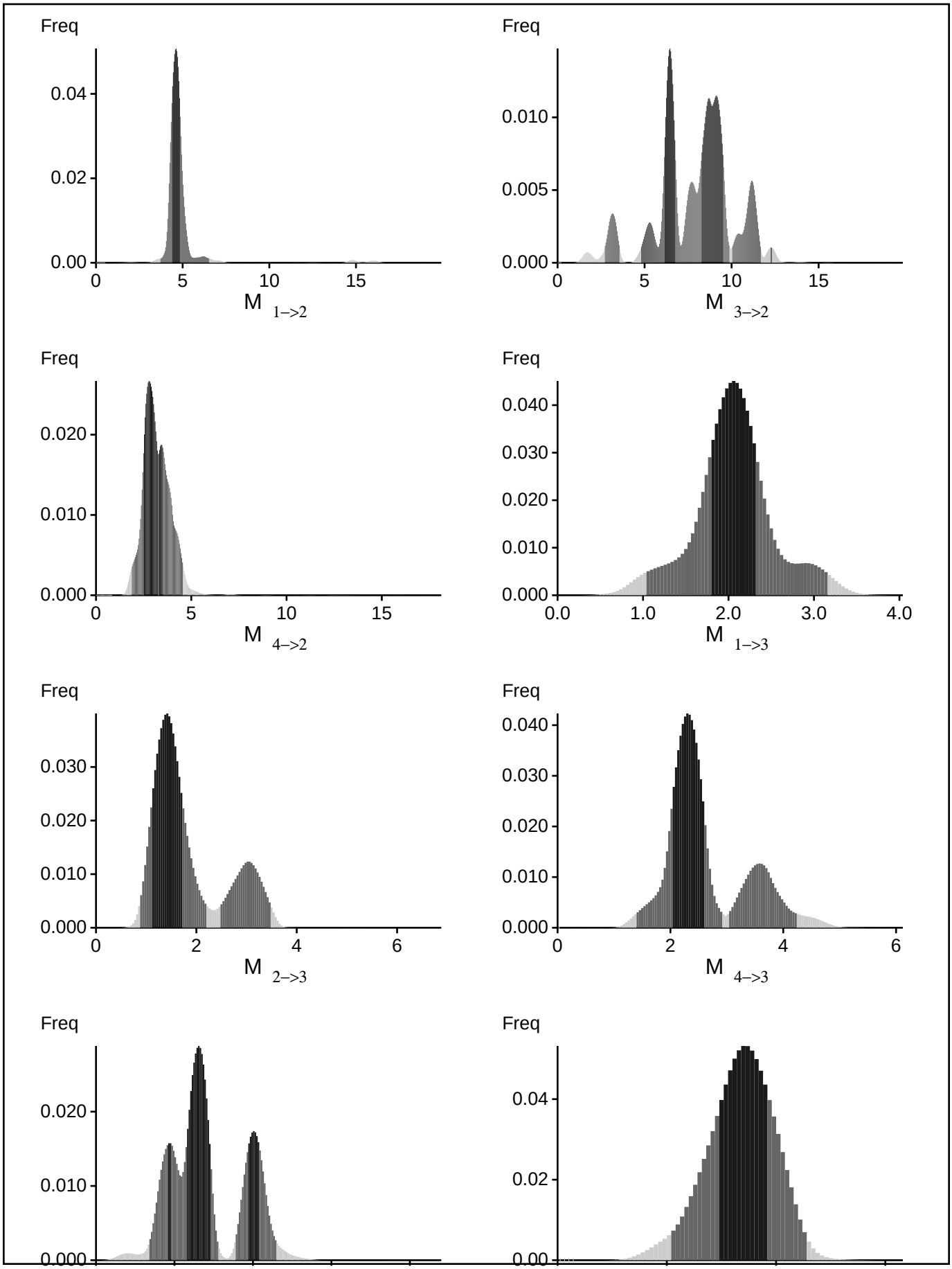


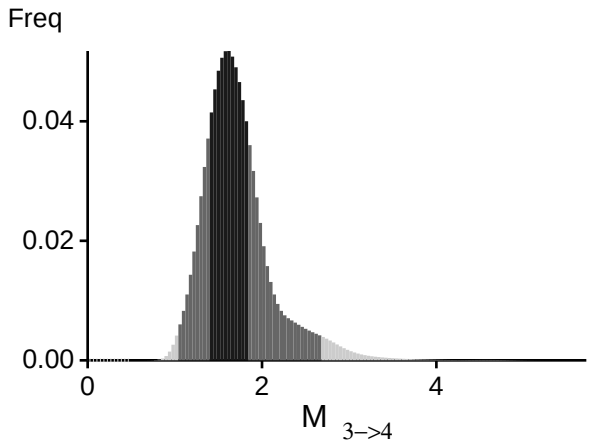









Freq
0.04
0.02
0.00
0
5
10
15
M 1–>2
Freq
0.010
0.005
0.000
0
5
10
15
M 3–>2
Freq
0.020
0.010
0.000
0
5
10
15
M 4–>2
Freq
0.040
0.030
0.020
0.010
0.000
0.0
1.0
2.0
3.0
4.0
M 1–>3
Freq
0.030
0.020
0.010
0.000
0
2
4
6
M 2–>3
Freq
0.040
0.030
0.020
0.010
0.000
0
2
4
6
M 4–>3
Freq
0.020
0.010
0.000
0
2
4
6
8
M 1–>4
Freq
0.04
0.02
0.00
0.0
1.0
2.0
3.0
M 2–>4


Freq
0.04
0.02
0.00
0
2
4
M 3–>4

Log-Probability of the data given the model (marginal likelihood)

Use this value for Bayes factor calculations:
BF = Exp[ln(Prob(D | thisModel) - ln(Prob(D | otherModel)
or as LBF = 2 (ln(Prob(D | thisModel) - ln(Prob(D | otherModel))
shows the support for thisModel]

Locus	Raw thermodynamic score(1a)	Bezier approximation score(1b)	Harmonic mean(2)
1	-785.90	-179.78	-58.99
2	-79.10	-52.72	-49.10
3	-56.41	-45.86	-42.62
4	-721.05	-174.20	-67.12
5	-40.16	-35.42	-34.75
6	-228.49	-85.16	-54.90
7	-67.12	-49.52	-38.79
8	-85.88	-55.20	-45.71
9	-150.61	-71.09	-52.51
10	-248.32	-90.67	-58.32
All	-2489.19	-865.76	-528.96

(1a, 1b and 2) is an approximation to the marginal likelihood, make sure the program run long enough!
(1a, 1b) and (2) should give a similar result, (2) is considered more
crude than (1), but (1) needs heating with several well-spaced chains,
(1b) is using a Bezier-curve to get better approximations for runs with low number
of heated chains
[Scaling factor = -26.153567

Acceptance ratios for all parameters and the genealogies

Parameter	Accepted changes	Ratio
Θ_1	9977/9977	1.00000
Θ_2	10092/10092	1.00000
Θ_3	10041/10041	1.00000
Θ_4	9899/9899	1.00000
$M_{3->1}$	10054/10054	1.00000
$M_{4->1}$	9900/9900	1.00000
$M_{1->2}$	10158/10158	1.00000
$M_{3->2}$	9954/9954	1.00000
$M_{4->2}$	9817/9817	1.00000
$M_{1->3}$	9970/9970	1.00000
$M_{2->3}$	10045/10045	1.00000
$M_{4->3}$	10133/10133	1.00000
$M_{1->4}$	10002/10002	1.00000
$M_{2->4}$	10002/10002	1.00000
$M_{3->4}$	9954/9954	1.00000
Genealogies	22127/50105	0.44161

MCMC-Autocorrelation and Effective MCMC Sample Size

Parameter	Autocorrelation	Effective Sampe Size
Θ_1	0.98012	793.25
Θ_2	0.97700	1143.47
Θ_3	0.98823	895.64
Θ_4	0.97697	749.31
$M_{3->1}$	0.99141	405.34
$M_{4->1}$	0.98698	561.94
$M_{1->2}$	0.99576	477.01
$M_{3->2}$	0.99180	471.82
$M_{4->2}$	0.98588	543.36
$M_{1->3}$	0.98585	471.41
$M_{2->3}$	0.98201	463.83
$M_{4->3}$	0.97357	567.50
$M_{1->4}$	0.98871	499.61
$M_{2->4}$	0.99476	479.47
$M_{3->4}$	0.98131	512.66
Ln[Prob(D|G)]	0.97011	907.46

Potential Problems

This section reports potential problems with your run, but such reporting is often not very accurate. Whith many parameters in a multilocus analysis, it is very common that some parameters for some loci will not be very informative, triggering suggestions (for example to increase the prior range) that are not sensible. This suggestion tool will improve with time, therefore do not blindly follow its suggestions. If some parameters are flagged, inspect the tables carefully and judge wether an action is required. For example, if you run a Bayesian inference with sequence data, for macroscopic species there is rarely the need to increase the prior for Theta beyond 0.1; but if you use microsatellites it is rather common that your prior distribution for Theta should have a range from 0.0 to 100 or more. With many populations (>3) it is also very common that some migration routes are estimated poorly because the data contains little or no information for that route. Increasing the range will not help in such situations, reducing number of parameters may help in such situations.

Param 10 (Locus 2): Upper prior boundary seems too low!
Param 11 (Locus 3): Upper prior boundary seems too low!
Param 2 (Locus 4): Upper prior boundary seems too low!
Param 3 (Locus 4): Upper prior boundary seems too low!
Param 8 (Locus 5): Upper prior boundary seems too low!
Param 8 (Locus 7): Upper prior boundary seems too low!
Param 3 (Locus 8): Upper prior boundary seems too low!
Param 2 (Locus 9): Upper prior boundary seems too low!
Param 2 (Locus 10): Upper prior boundary seems too low!