

# AUTO

POPULATION SIZE, MIGRATION, DIVERGENCE, ASSIGNMENT, HISTORY

Bayesian inference using the structured coalescent

Migrate-n version 5.0.0a [May-20-2017]

Using Intel AVX (Advanced Vector Extensions)

Compiled for PARALLEL computer architectures

One master and 100 compute nodes are available.

Program started at Sun Aug 13 04:32:36 2017

Program finished at Sun Aug 13 05:45:34 2017 [Runtime:0000:01:12:58]



## Options

Datatype:

DNA sequence data

Inheritance scalers in use for Thetas:

All loci use an inheritance scaler of 1.0

[The locus with a scaler of 1.0 used as reference]

Random number seed:

(with internal timer)

2408667578

Start parameters:

Theta values were generated

Using a percent value of the prior

M values were generated

Using a percent value of the prior

Connection matrix:

m = average (average over a group of Thetas or M,

s = symmetric migration M, S = symmetric 4Nm,

0 = zero, and not estimated,

\* = migration free to vary, Thetas are on diagonal

d = row population split off column population, D = split and then migration

Population 1

1 Romanshorn\_0 \*

Order of parameters:

1  $\Theta_1$

<displayed>

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

Analysis strategy: Bayesian inference  
 -Population size estimation: Exponential Distribution

#### Proposal distributions for parameter

Parameter	Proposal
Theta	Metropolis sampling
M	Metropolis sampling
Divergence	Metropolis sampling
Divergence Spread	Metropolis sampling
Genealogy	Metropolis-Hastings

#### Prior distribution for parameter

Parameter	Prior	Minimum	Mean	Maximum	Delta	Bins	UpdateFreq
1	Theta -11 Uniform	0.000000	0.050	0.100	0.010	1500	0.20000

[-1 -1 means priors were set globally]

Markov chain settings: Long chain

Number of chains	1
Recorded steps [a]	50000
Increment (record every x step [b])	200
Number of concurrent chains (replicates) [c]	2
Visited (sampled) parameter values [a*b*c]	20000000
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.0.9  
 Haplotyping is turned on: NO  
 Output file: outfile\_0.9\_1.0  
 Posterior distribution raw histogram file: bayesfile  
 Raw data from the MCMC run: bayesallfile\_0.9\_1.0  
 Print data: No  
 Print genealogies [only some for some data type]: None

## *Data summary*

Data file:	infile.0.9
Datatype:	Sequence data
Number of loci:	100

Mutationmodel:

Locus	Sublocus	Mutationmodel	Mutationmodel parameters
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1	1	Jukes-Cantor	[Basefreq: =0.25]
2	1	Jukes-Cantor	[Basefreq: =0.25]
3	1	Jukes-Cantor	[Basefreq: =0.25]
4	1	Jukes-Cantor	[Basefreq: =0.25]
5	1	Jukes-Cantor	[Basefreq: =0.25]
6	1	Jukes-Cantor	[Basefreq: =0.25]
7	1	Jukes-Cantor	[Basefreq: =0.25]
8	1	Jukes-Cantor	[Basefreq: =0.25]
9	1	Jukes-Cantor	[Basefreq: =0.25]
10	1	Jukes-Cantor	[Basefreq: =0.25]
11	1	Jukes-Cantor	[Basefreq: =0.25]
12	1	Jukes-Cantor	[Basefreq: =0.25]
13	1	Jukes-Cantor	[Basefreq: =0.25]
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35	1	Jukes-Cantor	[Basefreq: =0.25]
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40	1	Jukes-Cantor	[Basefreq: =0.25]
41	1	Jukes-Cantor	[Basefreq: =0.25]
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44	1	Jukes-Cantor	[Basefreq: =0.25]
45	1	Jukes-Cantor	[Basefreq: =0.25]
46	1	Jukes-Cantor	[Basefreq: =0.25]
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50	1	Jukes-Cantor	[Basefreq: =0.25]
51	1	Jukes-Cantor	[Basefreq: =0.25]
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72	1	Jukes-Cantor	[Basefreq: =0.25]
73	1	Jukes-Cantor	[Basefreq: =0.25]
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75	1	Jukes-Cantor	[Basefreq: =0.25]
76	1	Jukes-Cantor	[Basefreq: =0.25]
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78	1	Jukes-Cantor	[Basefreq: =0.25]
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80	1	Jukes-Cantor	[Basefreq: =0.25]
81	1	Jukes-Cantor	[Basefreq: =0.25]
82	1	Jukes-Cantor	[Basefreq: =0.25]
83	1	Jukes-Cantor	[Basefreq: =0.25]
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86	1	Jukes-Cantor	[Basefreq: =0.25]
87	1	Jukes-Cantor	[Basefreq: =0.25]
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89	1	Jukes-Cantor	[Basefreq: =0.25]
90	1	Jukes-Cantor	[Basefreq: =0.25]
91	1	Jukes-Cantor	[Basefreq: =0.25]
92	1	Jukes-Cantor	[Basefreq: =0.25]
93	1	Jukes-Cantor	[Basefreq: =0.25]
94	1	Jukes-Cantor	[Basefreq: =0.25]
95	1	Jukes-Cantor	[Basefreq: =0.25]
96	1	Jukes-Cantor	[Basefreq: =0.25]
97	1	Jukes-Cantor	[Basefreq: =0.25]
98	1	Jukes-Cantor	[Basefreq: =0.25]
99	1	Jukes-Cantor	[Basefreq: =0.25]
100	1	Jukes-Cantor	[Basefreq: =0.25]

#### Sites per locus

Locus	Sites
1	10000
2	10000
3	10000
4	10000
5	10000
6	10000
7	10000
8	10000
9	10000
10	10000
11	10000
12	10000
13	10000
14	10000
15	10000
16	10000
17	10000
18	10000
19	10000
20	10000

21	10000
22	10000
23	10000
24	10000
25	10000
26	10000
27	10000
28	10000
29	10000
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31	10000
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35	10000
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37	10000
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42	10000
43	10000
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46	10000
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48	10000
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89	10000
90	10000
91	10000
92	10000
93	10000
94	10000
95	10000
96	10000
97	10000
98	10000
99	10000
100	10000

Site rate variation and probabilities:

Locus	Sublocus	Region	type	Rate of change	Probability	Patch size
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1	1	1		1.000	1.000	1.000
2	1	1		1.000	1.000	1.000
3	1	1		1.000	1.000	1.000
4	1	1		1.000	1.000	1.000
5	1	1		1.000	1.000	1.000
6	1	1		1.000	1.000	1.000

7	1	1	1.000	1.000	1.000
8	1	1	1.000	1.000	1.000
9	1	1	1.000	1.000	1.000
10	1	1	1.000	1.000	1.000
11	1	1	1.000	1.000	1.000
12	1	1	1.000	1.000	1.000
13	1	1	1.000	1.000	1.000
14	1	1	1.000	1.000	1.000
15	1	1	1.000	1.000	1.000
16	1	1	1.000	1.000	1.000
17	1	1	1.000	1.000	1.000
18	1	1	1.000	1.000	1.000
19	1	1	1.000	1.000	1.000
20	1	1	1.000	1.000	1.000
21	1	1	1.000	1.000	1.000
22	1	1	1.000	1.000	1.000
23	1	1	1.000	1.000	1.000
24	1	1	1.000	1.000	1.000
25	1	1	1.000	1.000	1.000
26	1	1	1.000	1.000	1.000
27	1	1	1.000	1.000	1.000
28	1	1	1.000	1.000	1.000
29	1	1	1.000	1.000	1.000
30	1	1	1.000	1.000	1.000
31	1	1	1.000	1.000	1.000
32	1	1	1.000	1.000	1.000
33	1	1	1.000	1.000	1.000
34	1	1	1.000	1.000	1.000
35	1	1	1.000	1.000	1.000
36	1	1	1.000	1.000	1.000
37	1	1	1.000	1.000	1.000
38	1	1	1.000	1.000	1.000
39	1	1	1.000	1.000	1.000
40	1	1	1.000	1.000	1.000
41	1	1	1.000	1.000	1.000
42	1	1	1.000	1.000	1.000
43	1	1	1.000	1.000	1.000
44	1	1	1.000	1.000	1.000
45	1	1	1.000	1.000	1.000
46	1	1	1.000	1.000	1.000
47	1	1	1.000	1.000	1.000
48	1	1	1.000	1.000	1.000
49	1	1	1.000	1.000	1.000
50	1	1	1.000	1.000	1.000
51	1	1	1.000	1.000	1.000



52	1	1	1.000	1.000	1.000
53	1	1	1.000	1.000	1.000
54	1	1	1.000	1.000	1.000
55	1	1	1.000	1.000	1.000
56	1	1	1.000	1.000	1.000
57	1	1	1.000	1.000	1.000
58	1	1	1.000	1.000	1.000
59	1	1	1.000	1.000	1.000
60	1	1	1.000	1.000	1.000
61	1	1	1.000	1.000	1.000
62	1	1	1.000	1.000	1.000
63	1	1	1.000	1.000	1.000
64	1	1	1.000	1.000	1.000
65	1	1	1.000	1.000	1.000
66	1	1	1.000	1.000	1.000
67	1	1	1.000	1.000	1.000
68	1	1	1.000	1.000	1.000
69	1	1	1.000	1.000	1.000
70	1	1	1.000	1.000	1.000
71	1	1	1.000	1.000	1.000
72	1	1	1.000	1.000	1.000
73	1	1	1.000	1.000	1.000
74	1	1	1.000	1.000	1.000
75	1	1	1.000	1.000	1.000
76	1	1	1.000	1.000	1.000
77	1	1	1.000	1.000	1.000
78	1	1	1.000	1.000	1.000
79	1	1	1.000	1.000	1.000
80	1	1	1.000	1.000	1.000
81	1	1	1.000	1.000	1.000
82	1	1	1.000	1.000	1.000
83	1	1	1.000	1.000	1.000
84	1	1	1.000	1.000	1.000
85	1	1	1.000	1.000	1.000
86	1	1	1.000	1.000	1.000
87	1	1	1.000	1.000	1.000
88	1	1	1.000	1.000	1.000
89	1	1	1.000	1.000	1.000
90	1	1	1.000	1.000	1.000
91	1	1	1.000	1.000	1.000
92	1	1	1.000	1.000	1.000
93	1	1	1.000	1.000	1.000
94	1	1	1.000	1.000	1.000
95	1	1	1.000	1.000	1.000
96	1	1	1.000	1.000	1.000

97	1	1	1.000	1.000	1.000	
98	1	1	1.000	1.000	1.000	
99	1	1	1.000	1.000	1.000	
100	1	1	1.000	1.000	1.000	
Population			Locus		Gene copies	
1 Romanshorn_0			1		10	
			2		10	
			3		10	
			4		10	
			5		10	
			6		10	
			7		10	
			8		10	
			9		10	
			10		10	
			11		10	
			12		10	
			13		10	
			14		10	
			15		10	
			16		10	
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			39		10	
			40		10	

41	10
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	86	10
	87	10
	88	10
	89	10
	90	10
	91	10
	92	10
	93	10
	94	10
	95	10
	96	10
	97	10
	98	10
	99	10
	100	10
Total of all populations	1	10
	2	10
	3	10
	4	10
	5	10
	6	10
	7	10
	8	10
	9	10
	10	10
	11	10
	12	10
	13	10
	14	10
	15	10
	16	10
	17	10
	18	10
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92	10
93	10
94	10
95	10
96	10
97	10
98	10
99	10
100	10

## *Bayesian Analysis: Posterior distribution table*

Locus	Parameter	2.5%	25.0%	Mode	75.0%	97.5%	Median	Mean
1	$\Theta_1$	0.00127	0.00420	0.00583	0.00773	0.01560	0.00657	0.00704
2	$\Theta_1$	0.00187	0.00433	0.00597	0.00793	0.01360	0.00677	0.00724
3	$\Theta_1$	0.00247	0.00493	0.00557	0.00627	0.01000	0.00630	0.00673
4	$\Theta_1$	0.00027	0.00227	0.00357	0.00480	0.00780	0.00383	0.00398
5	$\Theta_1$	0.00107	0.00327	0.00483	0.00633	0.01073	0.00530	0.00564
6	$\Theta_1$	0.00000	0.00080	0.00183	0.00267	0.00433	0.00203	0.00187
7	$\Theta_1$	0.00407	0.00613	0.00737	0.00880	0.01247	0.00850	0.00912
8	$\Theta_1$	0.00040	0.00240	0.00377	0.00500	0.00820	0.00403	0.00419
9	$\Theta_1$	0.00067	0.00280	0.00417	0.00560	0.00927	0.00457	0.00480
10	$\Theta_1$	0.00373	0.00680	0.00903	0.01187	0.02067	0.01043	0.01128
11	$\Theta_1$	0.00100	0.00393	0.00443	0.00487	0.00913	0.00483	0.00509
12	$\Theta_1$	0.00067	0.00280	0.00423	0.00560	0.00933	0.00463	0.00484
13	$\Theta_1$	0.00173	0.00420	0.00583	0.00780	0.01327	0.00663	0.00708
14	$\Theta_1$	0.00040	0.00240	0.00383	0.00507	0.00833	0.00410	0.00427
15	$\Theta_1$	0.00327	0.00613	0.00697	0.00780	0.01280	0.00790	0.00850
16	$\Theta_1$	0.00007	0.00200	0.00330	0.00447	0.00713	0.00350	0.00362
17	$\Theta_1$	0.00133	0.00367	0.00523	0.00693	0.01173	0.00583	0.00619
18	$\Theta_1$	0.00340	0.00633	0.00850	0.01113	0.01940	0.00977	0.01052

19	$\Theta_1$	0.00367	0.00547	0.00690	0.00853	0.01160	0.00783	0.00844
20	$\Theta_1$	0.00053	0.00260	0.00403	0.00533	0.00887	0.00437	0.00458
21	$\Theta_1$	0.00047	0.00247	0.00383	0.00513	0.00847	0.00417	0.00433
22	$\Theta_1$	0.00033	0.00120	0.00223	0.00327	0.00393	0.00243	0.00237
23	$\Theta_1$	0.00227	0.00293	0.00590	0.01020	0.01167	0.00670	0.00713
24	$\Theta_1$	0.00213	0.00467	0.00643	0.00847	0.01447	0.00730	0.00778
25	$\Theta_1$	0.00033	0.00233	0.00363	0.00493	0.00800	0.00397	0.00409
26	$\Theta_1$	0.00327	0.00647	0.00870	0.01140	0.02093	0.01003	0.01081
27	$\Theta_1$	0.00033	0.00227	0.00363	0.00480	0.00787	0.00390	0.00401
28	$\Theta_1$	0.00033	0.00227	0.00363	0.00487	0.00800	0.00390	0.00405
29	$\Theta_1$	0.00200	0.00447	0.00623	0.00820	0.01407	0.00703	0.00754
30	$\Theta_1$	0.00013	0.00200	0.00330	0.00447	0.00720	0.00350	0.00362
31	$\Theta_1$	0.00327	0.00620	0.00830	0.01093	0.01913	0.00957	0.01034
32	$\Theta_1$	0.00013	0.00207	0.00337	0.00453	0.00740	0.00363	0.00375
33	$\Theta_1$	0.00460	0.00800	0.01057	0.01387	0.02440	0.01230	0.01335
34	$\Theta_1$	0.00080	0.00293	0.00437	0.00580	0.00980	0.00483	0.00508
35	$\Theta_1$	0.00047	0.00253	0.00390	0.00520	0.00853	0.00423	0.00439
36	$\Theta_1$	0.00047	0.00253	0.00390	0.00520	0.00867	0.00423	0.00444
37	$\Theta_1$	0.00013	0.00200	0.00330	0.00447	0.00720	0.00357	0.00365
38	$\Theta_1$	0.00013	0.00200	0.00330	0.00440	0.00707	0.00350	0.00358
39	$\Theta_1$	0.00053	0.00253	0.00397	0.00527	0.00873	0.00430	0.00448
40	$\Theta_1$	0.00113	0.00340	0.00490	0.00647	0.01087	0.00543	0.00575
41	$\Theta_1$	0.00040	0.00240	0.00377	0.00507	0.00840	0.00410	0.00426



Locus	Parameter	2.5%	25.0%	Mode	75.0%	97.5%	Median	Mean
42	$\Theta_1$	0.00040	0.00247	0.00383	0.00513	0.00840	0.00417	0.00432
43	$\Theta_1$	0.01500	0.01907	0.02530	0.03393	0.04600	0.02843	0.03216
44	$\Theta_1$	0.00133	0.00367	0.00523	0.00693	0.01180	0.00590	0.00624
45	$\Theta_1$	0.00000	0.00080	0.00170	0.00260	0.00413	0.00197	0.00177
46	$\Theta_1$	0.00107	0.00333	0.00483	0.00640	0.01080	0.00537	0.00564
47	$\Theta_1$	0.00887	0.01507	0.01697	0.01893	0.03527	0.01963	0.02155
48	$\Theta_1$	0.00333	0.00633	0.00843	0.01107	0.01927	0.00970	0.01049
49	$\Theta_1$	0.00400	0.00720	0.00943	0.01247	0.02173	0.01097	0.01187
50	$\Theta_1$	0.00100	0.00320	0.00463	0.00620	0.01033	0.00510	0.00541
51	$\Theta_1$	0.00080	0.00293	0.00437	0.00587	0.00980	0.00483	0.00508
52	$\Theta_1$	0.00453	0.00647	0.00817	0.01007	0.01380	0.00937	0.01012
53	$\Theta_1$	0.00007	0.00187	0.00317	0.00427	0.00673	0.00337	0.00342
54	$\Theta_1$	0.00187	0.00380	0.00543	0.00713	0.01100	0.00610	0.00648
55	$\Theta_1$	0.00287	0.00427	0.00590	0.00780	0.01040	0.00670	0.00715
56	$\Theta_1$	0.00020	0.00213	0.00350	0.00467	0.00753	0.00370	0.00384
57	$\Theta_1$	0.00073	0.00287	0.00430	0.00573	0.00953	0.00470	0.00492
58	$\Theta_1$	0.00007	0.00187	0.00317	0.00427	0.00687	0.00337	0.00346
59	$\Theta_1$	0.00007	0.00193	0.00323	0.00433	0.00693	0.00343	0.00351
60	$\Theta_1$	0.00013	0.00193	0.00323	0.00433	0.00693	0.00343	0.00351
61	$\Theta_1$	0.00013	0.00200	0.00330	0.00447	0.00720	0.00357	0.00365

62	$\Theta_1$	0.00087	0.00300	0.00450	0.00593	0.00993	0.00490	0.00517
63	$\Theta_1$	0.00140	0.00373	0.00537	0.00707	0.01193	0.00597	0.00634
64	$\Theta_1$	0.00460	0.00940	0.01230	0.01613	0.03587	0.01430	0.01558
65	$\Theta_1$	0.00000	0.00033	0.00110	0.00187	0.00333	0.00157	0.00113
66	$\Theta_1$	0.00133	0.00367	0.00523	0.00693	0.01173	0.00583	0.00622
67	$\Theta_1$	0.00000	0.00173	0.00297	0.00407	0.00627	0.00317	0.00317
68	$\Theta_1$	0.00127	0.00360	0.00510	0.00680	0.01153	0.00570	0.00606
69	$\Theta_1$	0.01380	0.01907	0.02530	0.03180	0.04800	0.02777	0.03121
70	$\Theta_1$	0.00000	0.00167	0.00290	0.00393	0.00620	0.00310	0.00311
71	$\Theta_1$	0.00000	0.00080	0.00177	0.00267	0.00427	0.00203	0.00184
72	$\Theta_1$	0.00273	0.00553	0.00743	0.00987	0.01720	0.00857	0.00924
73	$\Theta_1$	0.00200	0.00447	0.00617	0.00813	0.01407	0.00703	0.00750
74	$\Theta_1$	0.00093	0.00313	0.00463	0.00613	0.01027	0.00510	0.00538
75	$\Theta_1$	0.00047	0.00253	0.00390	0.00520	0.00860	0.00423	0.00440
76	$\Theta_1$	0.00140	0.00367	0.00523	0.00693	0.01180	0.00590	0.00624
77	$\Theta_1$	0.00060	0.00273	0.00410	0.00553	0.00913	0.00450	0.00472
78	$\Theta_1$	0.00033	0.00227	0.00363	0.00487	0.00800	0.00390	0.00408
79	$\Theta_1$	0.00140	0.00467	0.00643	0.00853	0.01887	0.00737	0.00788
80	$\Theta_1$	0.00020	0.00207	0.00337	0.00453	0.00733	0.00363	0.00372
81	$\Theta_1$	0.00000	0.00147	0.00263	0.00367	0.00567	0.00283	0.00279
82	$\Theta_1$	0.00020	0.00207	0.00337	0.00453	0.00727	0.00363	0.00370
83	$\Theta_1$	0.00100	0.00320	0.00463	0.00620	0.01033	0.00517	0.00541
84	$\Theta_1$	0.00353	0.00527	0.00717	0.00947	0.01327	0.00823	0.00890

Locus	Parameter	2.5%	25.0%	Mode	75.0%	97.5%	Median	Mean
85	$\Theta_1$	0.00007	0.00193	0.00323	0.00433	0.00693	0.00343	0.00351
86	$\Theta_1$	0.00247	0.00513	0.00697	0.00913	0.01580	0.00797	0.00854
87	$\Theta_1$	0.00000	0.00180	0.00303	0.00413	0.00653	0.00323	0.00330
88	$\Theta_1$	0.00807	0.01280	0.01643	0.02153	0.03720	0.01917	0.02098
89	$\Theta_1$	0.00147	0.00387	0.00543	0.00720	0.01227	0.00610	0.00649
90	$\Theta_1$	0.00067	0.00280	0.00423	0.00560	0.00940	0.00463	0.00487
91	$\Theta_1$	0.00013	0.00207	0.00337	0.00453	0.00727	0.00357	0.00369
92	$\Theta_1$	0.00127	0.00353	0.00510	0.00680	0.01153	0.00570	0.00606
93	$\Theta_1$	0.00087	0.00307	0.00450	0.00600	0.01007	0.00497	0.00523
94	$\Theta_1$	0.00613	0.00787	0.01037	0.01373	0.01760	0.01210	0.01316
95	$\Theta_1$	0.00120	0.00347	0.00497	0.00660	0.01120	0.00557	0.00589
96	$\Theta_1$	0.00533	0.00893	0.01163	0.01533	0.02713	0.01363	0.01484
97	$\Theta_1$	0.00060	0.00267	0.00410	0.00547	0.00913	0.00450	0.00468
98	$\Theta_1$	0.00000	0.00187	0.00317	0.00427	0.00680	0.00337	0.00345
99	$\Theta_1$	0.00167	0.00440	0.00610	0.00807	0.01527	0.00697	0.00742
100	$\Theta_1$	0.03087	0.04167	0.04757	0.04913	0.05120	0.04317	0.06287
All	$\Theta_1$	0.00193	0.00313	0.00410	0.00500	0.00620	0.00417	0.00408

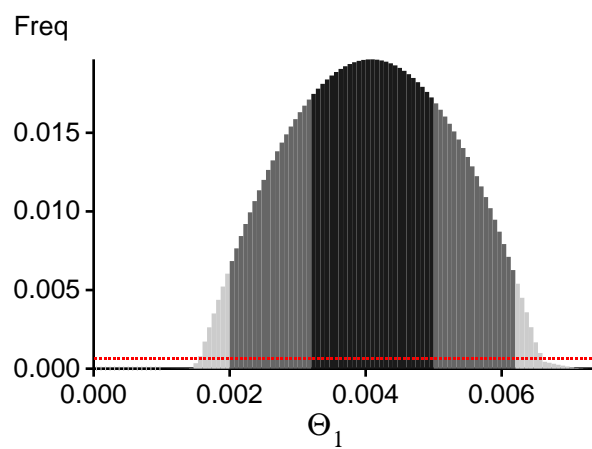
Citation suggestions:

Beerli P., 2006. Comparison of Bayesian and maximum-likelihood inference of population genetic parameters. *Bioinformatics* 22:341-345

Beerli P., 2007. Estimation of the population scaled mutation rate from microsatellite data, *Genetics*, 177:1967-1968.

Beerli P., 2009. How to use MIGRATE or why are Markov chain Monte Carlo programs difficult to use?  
 In Population Genetics for Animal Conservation, G. Bertorelle, M. W. Bruford, H. C. Hauffe, A. Rizzoli,  
 and C. Vernesi, eds., vol. 17 of Conservation Biology, Cambridge University Press, Cambridge UK, pp. 42-79.

# *Bayesian Analysis: Posterior distribution over all loci*



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

Use this value for Bayes factor calculations:

$BF = \text{Exp}[\ln(\text{Prob}(D \mid \text{thisModel}) - \ln(\text{Prob}(D \mid \text{otherModel}))]$

or as  $LBF = 2 (\ln(\text{Prob}(D \mid \text{thisModel}) - \ln(\text{Prob}(D \mid \text{otherModel})))$

shows the support for thisModel]

Locus	TI(1a)	BTI(1b)	SS(2)	HS(3)
1	-16860.30	-16016.02	-15992.17	-16043.57
2	-16313.08	-15844.72	-15892.20	-15943.28
3	-15692.25	-15140.09	-15161.61	-15214.12
4	-15438.58	-14933.10	-14956.90	-15013.38
5	-16169.97	-15408.26	-15392.06	-15445.29
6	-14490.95	-14115.74	-14148.08	-14210.92
7	-16055.64	-15463.82	-15486.30	-15536.23
8	-15178.66	-14730.79	-14765.01	-14820.55
9	-15227.48	-14830.79	-14876.32	-14931.80
10	-16846.72	-16192.19	-16211.77	-16263.12
11	-15015.46	-14616.81	-14658.94	-14714.12
12	-15390.38	-14908.92	-14939.65	-14993.86
13	-15557.17	-15099.38	-15140.50	-15190.56
14	-15191.24	-14773.91	-14815.15	-14871.22
15	-15809.21	-15295.89	-15329.07	-15379.01
16	-14954.27	-14526.93	-14559.93	-14617.26
17	-15462.03	-15061.23	-15110.76	-15163.39
18	-17530.18	-16459.19	-16400.48	-16449.35
19	-16381.21	-15810.87	-15840.64	-15888.85
20	-15454.65	-14936.61	-14959.24	-15013.72
21	-15020.43	-14614.03	-14653.75	-14709.82
22	-14755.17	-14326.27	-14353.99	-14414.10
23	-15947.16	-15344.09	-15359.45	-15409.99
24	-16574.55	-15897.14	-15906.56	-15955.57
25	-15309.54	-14838.09	-14868.91	-14923.46
26	-16887.50	-16110.29	-16105.88	-16152.26
27	-15928.73	-15165.40	-15143.34	-15199.26
28	-14905.43	-14542.27	-14588.80	-14644.41
29	-15974.20	-15437.10	-15467.04	-15518.06

30	-14837.32	-14425.16	-14460.05	-14516.94
31	-15615.40	-15179.31	-15227.42	-15274.92
32	-14999.44	-14543.22	-14572.39	-14629.01
33	-16827.51	-16150.92	-16167.67	-16214.38
34	-15242.96	-14805.86	-14842.78	-14898.40
35	-15075.59	-14630.28	-14662.74	-14719.51
36	-15084.43	-14636.12	-14668.76	-14723.36
37	-14904.44	-14478.35	-14512.22	-14569.38
38	-15151.05	-14651.24	-14672.83	-14729.45
39	-15625.53	-15021.85	-15028.20	-15083.12
40	-16562.14	-15715.94	-15686.19	-15738.62
41	-14715.55	-14352.91	-14396.60	-14452.47
42	-14810.01	-14449.00	-14493.10	-14552.37
43	-18305.36	-17702.22	-17759.03	-17799.54
44	-15359.73	-14883.33	-14915.62	-14968.60
45	-14632.29	-14221.62	-14247.70	-14311.05
46	-15108.04	-14699.79	-14740.32	-14794.72
47	-22928.62	-19898.53	-19510.88	-19552.63
48	-16886.46	-16267.13	-16294.24	-16342.55
49	-19158.60	-17333.25	-17142.25	-17187.52
50	-15978.83	-15268.33	-15260.55	-15313.25
51	-15164.73	-14712.28	-14744.86	-14800.61
52	-15566.81	-15145.35	-15193.60	-15243.32
53	-15382.47	-14884.95	-14909.47	-14966.22
54	-15480.57	-15087.84	-15140.41	-15191.00
55	-16368.42	-15738.70	-15754.52	-15804.86
56	-15211.42	-14770.61	-14805.13	-14864.12
57	-15146.19	-14694.25	-14727.35	-14781.33
58	-14809.25	-14437.28	-14480.04	-14537.56
59	-14953.31	-14524.70	-14557.89	-14614.43
60	-15174.03	-14773.76	-14815.00	-14871.81
61	-14904.95	-14533.28	-14577.50	-14635.36
62	-15888.77	-15231.36	-15233.48	-15286.07
63	-15423.61	-14946.64	-14980.04	-15032.50
64	-18960.38	-18194.21	-18219.97	-18262.77
65	-14400.37	-14025.38	-14051.39	-14119.85
66	-15958.99	-15341.39	-15352.44	-15404.85
67	-14865.73	-14448.19	-14481.32	-14539.79
68	-15280.52	-14872.96	-14917.56	-14969.94
69	-28494.21	-22311.79	-21346.00	-21384.06
70	-15123.10	-14626.35	-14645.74	-14705.69
71	-14494.13	-14120.97	-14153.06	-14216.54
72	-16090.95	-15565.42	-15600.88	-15648.72
73	-15874.11	-15367.86	-15402.50	-15452.87
74	-15637.42	-15131.22	-15159.60	-15213.10

75	-14908.89	-14509.19	-14549.45	-14604.56
76	-16111.32	-15399.62	-15393.05	-15444.43
77	-15026.81	-14604.59	-14640.54	-14698.20
78	-15163.62	-14686.51	-14713.65	-14769.33
79	-16187.93	-15535.86	-15545.54	-15594.56
80	-15249.70	-14738.86	-14759.98	-14815.95
81	-14991.50	-14494.79	-14512.45	-14571.07
82	-15262.38	-14737.03	-14754.52	-14810.98
83	-15559.00	-15043.11	-15069.36	-15122.30
84	-15648.31	-15184.36	-15227.19	-15275.45
85	-14736.41	-14358.43	-14398.07	-14456.41
86	-18504.37	-16813.29	-16636.09	-16689.31
87	-15204.66	-14673.33	-14688.30	-14745.68
88	-18022.99	-17343.13	-17375.33	-17416.72
89	-15562.94	-15149.51	-15198.58	-15250.58
90	-15084.79	-14672.59	-14713.42	-14766.46
91	-15093.57	-14678.27	-14715.76	-14775.48
92	-15196.07	-14779.77	-14822.29	-14876.03
93	-15305.45	-14860.11	-14898.09	-14952.45
94	-15793.72	-15397.07	-15454.38	-15504.08
95	-15562.74	-15033.94	-15057.15	-15111.84
96	-15928.86	-15492.24	-15543.91	-15590.84
97	-15037.87	-14612.68	-14650.73	-14705.19
98	-14673.95	-14317.98	-14360.92	-14418.67
99	-16402.15	-15658.92	-15650.10	-15705.29
100	-20675.52	-19853.63	-19897.96	-19929.24
All	-1589475.62	-1527664.05	-1528616.86	-1533944.95
(1a) TI: Thermodynamic integration: log(Prob(D Model)): Good approximation with many temperatures				
(1b) BTI: Bezier-approximated Thermodynamic integration: when using few temperatures USE THIS!				
(2) SS: Steppingstone Sampling (Xie et al 2011)				
(3) HS: Harmonic mean approximation: Overestimates the marginal likelihood, poor variance				
[Scaling factor = 205.816611]				
Citation suggestions:				
Beerli P. and M. Palczewski, 2010. Unified framework to evaluate panmixia and migration direction among multiple sampling locations, Genetics, 185: 313-326.				
Palczewski M. and P. Beerli, 2014. Population model comparison using multi-locus datasets. In M.-H. Chen, L. Kuo, and P. O. Lewis, editors, Bayesian Phylogenetics: Methods, Algorithms, and Applications, pages 187-200. CRC Press, 2014.				
Xie W., P. O. Lewis, Y. Fan, L. Kuo, and M.-H. Chen. 2011. Improving marginal likelihood estimation for Bayesian phylogenetic model selection. Systematic Biology, 60(2):150â 160, 2011.				



*Acceptance ratios for all parameters and the genealogies*

Parameter	Accepted changes	Ratio
$\Theta_1$	209421912/400016459	0.52353
Genealogies	95556957/1599983541	0.05972

### *MCMC-Autocorrelation and Effective MCMC Sample Size*

Parameter	Autocorrelation	Effective Sample Size
$\Theta_1$	0.06309	8931068.88
Genealogies	0.22420	6405821.77

## *Average temperatures during the run*

Chain	Temperatures
-------	--------------

1	0.00000
2	0.00000
3	0.00000
4	0.00000

Adaptive heating often fails, if the average temperatures are very close together try to rerun using static heating! If you want to compare models using marginal likelihoods then you **MUST** use static heating

## *Potential Problems*

This section reports potential problems with your run, but such reporting is often not very accurate. With 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 whether 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.

No warning was recorded during the run