two (fake) Swiss towns

POPULATION SIZE, MIGRATION, DIVERGENCE, ASSIGNMENT, HISTORY
Bayesian inference using the structured coalescent
Migrate-n version 5.0.2(git:v5.0.2-0-gb89fa60-dirty) [December-1-2021]
  Compiled for PARALLEL computer architectures
  One master and 7 compute nodes are available.
Program started at   Sun Feb 13 00:03:22 2022
Program finished at   Sun Feb 13 00:04:13 2022 [Runtime:0000:00:00:51]
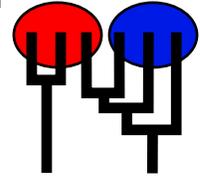
Options

Inheritance multipliers in use for Thetas:
All loci use an inheritance multiplier of 1.0
Random number seed: (with internal timer)   2812632011
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	2
1 Aadorf	*	0
2 Bern	*	*

 Order of parameters:
 1   Θ_1 <displayed>
 2   Θ_2 <displayed>
 3            $M_{1\to2}$ <displayed>

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

Analysis strategy: Bayesian inference
 -Population size estimation: Exponential Distribution
 -Geneflow 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	**Exponent.	0.000000	0.010	0.100	-	1500	0.13889
2	Theta	**Exponent.	0.000000	0.010	0.100	-	1500	0.13889
3	M	** Gamma	0.000000	100.0	10000	1000.	2000	0.13889

[* * means priors were set globally]

Markov chain settings: Long chain
Number of chains   1
   Recorded steps [a]   10000
   Increment (record every x step [b]   50
   Number of concurrent chains (replicates) [c]   1
   Visited (sampled) parameter values [a*b*c]   500000
   Number of discard trees per chain (burn-in)   5000

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: twoswisstowns.assign
                                                                                             parmfile.assign
   Haplotyping is turned on: NO
   Output file: outfile-twoswisstowns-assign
   Posterior distribution raw histogram file: bayesfile
   Raw data from the MCMC run: bayesallfile.gz
   Print data: No
   Print genealogies [only some for some data type]:   Yes, only the best

Data summary

Data file: twoswisstowns.assign
Datatype: Haplotype data
Number of loci: 3

Mutationmodel:

Locus	Sublocus	Mutationmodel	Mutationmodel parameters
1	1	Tamura-Nei	[Bf:0.30 0.25 0.24 0.22, k1=1.300, k2=0.800]
1	2	Felsenstein 84	[Bf:0.24 0.28 0.22 0.27, t/t ratio=2.000]
2	1	Tamura-Nei	[Bf:0.27 0.23 0.24 0.26, k1=1.300, k2=2.000]
3	1	Jukes-Cantor	[Basefreq: =0.25]

Sites per locus

Locus	Sites	
1	200	800
2	500	
3	500	

Site rate variation and probabilities:

Locus	Sublocus	Region type	Rate of change	Probability	Patch size
1	1	1	1.000	1.000	1.000
1	2	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

Population	Locus	Gene copies data	(missing)
1 Aadorf	1	9	
	2	9	
	3	9	
2 Bern	1	11	
	2	11	
	3	11	
Total of all populations	1	20	(0)
	2	20	(0)
	3	20	(0)

Bayesian Analysis: Posterior distribution table

| Locus	Parameter	2.5%	25.0%	Mode	75.0%	97.5%	Median	Mean
1	Θ_1	0.00000	0.00267	0.00490	0.00753	0.01460	0.00610	0.00667
1	Θ_2	0.00740	0.01413	0.01930	0.02533	0.04240	0.02190	0.02331
1	$M_{1->2}$	0.000	40.000	117.500	190.000	340.000	152.500	66.881
2	Θ_1	0.00000	0.00267	0.00443	0.00627	0.01093	0.00503	0.00532
2	Θ_2	0.00627	0.01287	0.01743	0.02420	0.04133	0.02090	0.02243
2	$M_{1->2}$	0.000	65.000	152.500	235.000	395.000	182.500	129.281
3	Θ_1	0.00087	0.00413	0.00657	0.00973	0.01907	0.00817	0.00905
3	Θ_2	0.01280	0.02227	0.03337	0.03747	0.06007	0.03277	0.03425
3	$M_{1->2}$	0.000	45.000	122.500	195.000	345.000	157.500	78.365
All	Θ_1	0.00180	0.00420	0.00570	0.00720	0.01060	0.00603	0.00612
All	Θ_2	0.01680	0.02533	0.03283	0.03573	0.04807	0.03150	0.03192
All	$M_{1->2}$	0.000	100.000	177.500	270.000	390.000	202.500	177.661

Citation suggestions:

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

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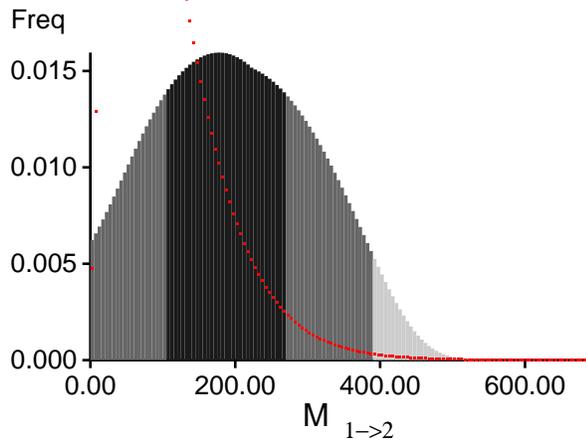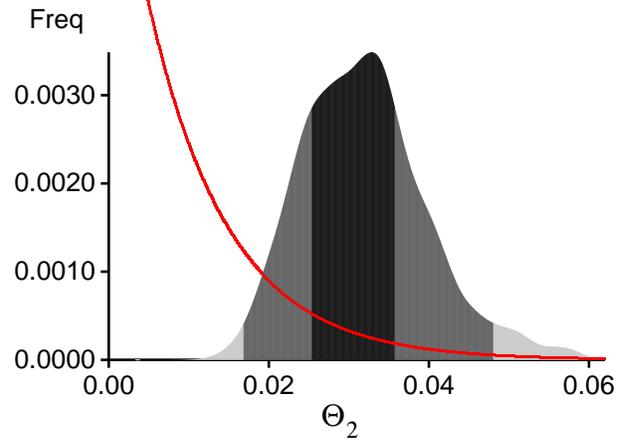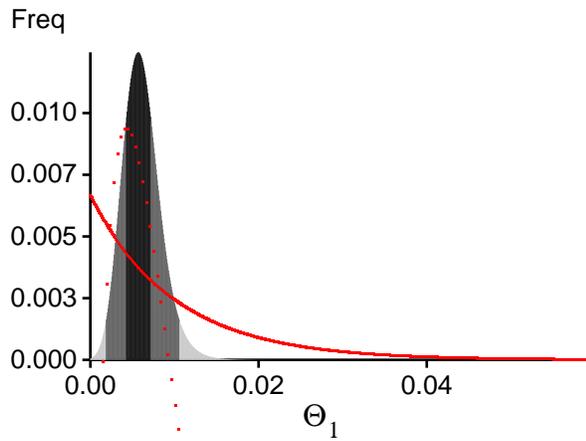
Log-Probability of the data given the model (marginal likelihood)

Use this value for Bayes factor calculations:
BF = 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	TI(1a)	BTI(1b)	HS(3)
1	-2572.20	-2280.28	-2250.30
2	-1402.21	-1225.34	-1201.20
3	-1548.58	-1312.83	-1278.90
All	-5536.20	-4831.67	-4743.61

(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 = -13.214321]
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
Θ_1	58981/208700	0.28261
Θ_2	42577/208692	0.20402
$M_{1->2}$	114746/208802	0.54954
Genealogies	102868/873806	0.11772

MCMC-Autocorrelation and Effective MCMC Sample Size

Parameter	Autocorrelation	Effective Sampe Size
Θ_1	0.49814	10066.71
Θ_2	0.47444	11068.82
$M_{1->2}$	0.17411	21145.22
Genealogies	0.49814	10066.71

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. Whith many parameters in a multilocus analysi   s, it is very common that some parameters for some loci will not be very informative, triggering suggestions (for example to increase the prior ran   ge) that are not sensible. This suggestion tool will improve with time, therefore do not blindly follow its suggestions. If some parameters are fla gged, inspect the tables carefully and judge wether an action is required. For example, if you run a Bayesian inference with sequence data, for mac   roscopic 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 rou tes 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

Summary Assignment of Individuals to Populations

Individual	Population	
	1	2
?BAH0	0.997	0.003
?BAG1	0.004	0.996
?BAJ1	0.018	0.982
?BAH1	0.000	1.000
?BAI1	0.000	1.000
?BAF1	0.000	1.000
?BAF0	0.969	0.031

Detailed Assignment of Individuals to Populations

Individual	Locus	Population 1	2
?BAH0	1	0.948	0.052
?BAH0	2	0.779	0.221
?BAH0	3	0.833	0.167
?BAH0	All	0.997	0.003
?BAG1	1	0.077	0.923
?BAG1	2	0.129	0.871
?BAG1	3	0.224	0.776
?BAG1	All	0.004	0.996
?BAJ1	1	0.322	0.678
?BAJ1	2	0.125	0.875
?BAJ1	3	0.213	0.787
?BAJ1	All	0.018	0.982
?BAH1	1	0.411	0.589
?BAH1	2	0.001	0.999
?BAH1	3	0.006	0.994
?BAH1	All	0.000	1.000
?BAI1	1	0.385	0.615
?BAI1	2	0.000	1.000
?BAI1	3	0.003	0.997
?BAI1	All	0.000	1.000
?BAF1	1	0.279	0.721
?BAF1	2	0.004	0.996
?BAF1	3	0.039	0.961
?BAF1	All	0.000	1.000
?BAF0	1	0.812	0.188
?BAF0	2	0.715	0.285
?BAF0	3	0.740	0.260
?BAF0	All	0.969	0.031