

File S4. Supporting Tables

Table S1 – Overview of the (marginal) accuracy $\hat{\psi}$ when assuming independent sites. Each cell shows the mean difference (first row), the mean squared error (second row) and the median difference (third row) of $\hat{\psi}$ calculated over 10,000 data sets assuming independent sites. Colors within each sub-table range from light yellow to dark red and scale between the minimal and the maximal absolute value to aid interpretation.

	$s = 100$					$s = 1,000$					$s = 10,000$									
$k = 20$	Mean deviation ψ					Mean deviation ψ					Mean deviation ψ									
	100	1.651×10^{-2}	6.872×10^{-2}	1.994×10^{-1}	2.946×10^{-1}	2.226×10^{-1}	2.913×10^{-1}	5.245×10^{-1}												
	10	1.471×10^{-1}	1.042×10^{-1}	3.195×10^{-1}	2.358×10^{-1}	1.528×10^{-1}	8.201×10^{-2}	2.756×10^{-1}												
$k = 50$	Mean deviation ψ					Mean deviation ψ					Mean deviation ψ									
	100	6.065×10^{-3}	1.833×10^{-2}	4.483×10^{-2}	1.089×10^{-1}	1.869×10^{-1}	1.38×10^{-1}	-1.38×10^{-1}												
	10	5.694×10^{-3}	2.055×10^{-2}	6.731×10^{-2}	1.645×10^{-1}	1.408×10^{-1}	1.55×10^{-1}	4.33×10^{-1}												
$k = 100$	Mean deviation ψ					Mean deviation ψ					Mean deviation ψ									
	100	1.377×10^{-4}	6.289×10^{-4}	2.832×10^{-3}	3.471×10^{-2}	3.504×10^{-2}	2.608×10^{-2}	1.113×10^{-1}												
	10	1.172×10^{-3}	2.601×10^{-3}	1.498×10^{-2}	1.497×10^{-1}	2.74×10^{-1}	2.375×10^{-1}	9.374×10^{-1}												
$k = 200$	Mean deviation ψ					Mean deviation ψ					Mean deviation ψ									
	100	1.081×10^{-1}	4.287×10^{-1}	7.295×10^{-1}	4.881×10^{-1}	3.005×10^{-1}	1.086×10^{-1}	-8.809×10^{-1}												
	10	2.653×10^{-1}	1.134×10^{-1}	4.511×10^{-1}	3.609×10^{-1}	2.32×10^{-1}	9.201×10^{-1}	-2.217×10^{-1}												

Table S2 – Overview of the (marginal) accuracy $\hat{\rho}$ when assuming independent sites. Each cell shows the mean difference (first row), the mean squared error (second row) and the median difference (third row) of $\hat{\rho}$ (right column) calculated over 10,000 data sets assuming independent sites. Colors within each sub-table range from light yellow to dark red and scale between the minimal and the maximal absolute value to aid interpretation.

	$s = 100$						$s = 1,000$						$s = 10,000$					
$k = 20$	Mean deviation $\hat{\rho}$																	
	100						100						100					
	0						0						0					
$k = 50$	Mean deviation $\hat{\rho}$																	
	100						100						100					
	0						0						0					
$k = 100$	Mean deviation $\hat{\rho}$																	
	100						100						100					
	0						0						0					
$k = 200$	Mean deviation $\hat{\rho}$																	
	100						100						100					
	0						0						0					

(Note: The above table structure represents the layout of the data in the image, with numerical values and color coding for each cell. The full table contains 180 sub-tables, each corresponding to a combination of k and s values.)

Table S3 – Comparison of the (marginal) accuracy of $\hat{\psi}$ (left column) and $\hat{\rho}$ (right column) for $k = 100$ (i.e., the reference) and $k = 200$ when assuming independent sites. Each cell shows the difference of the absolute mean difference ($|MD_{k=100}| - |MD_{k=200}|$; first row), the difference of the mean absolute difference ($MAD_{k=100} - MAD_{k=200}$; third row) and the difference of the mean squared error ($MSE_{k=100} - MSE_{k=200}$; third row) each calculated over 10,000 data sets assuming independent sites and θ (eq. 45) with $s = 10,000$. Colors within each sub-table range from light yellow to dark red and scale between the minimal and the maximal absolute value to aid interpretation.

Mean deviation ψ						Mean deviation ρ							
100	0.	-3.1 × 10 ⁻⁶	-5.2 × 10 ⁻⁵	8.3 × 10 ⁻⁵	1.1 × 10 ⁻⁵	100	-1.2 × 10 ⁻³	2.44	4.12	1.109 × 10 ¹	2.208 × 10 ¹	3.881 × 10 ¹	4.789 × 10 ¹
10	0.	-1.57 × 10 ⁻⁴	-2.39 × 10 ⁻⁴	7.7 × 10 ⁻⁵	1.28 × 10 ⁻⁴	10	3 × 10 ⁻⁴	9.78 × 10 ⁻²	1.485 × 10 ⁻¹	1.983 × 10 ⁻¹	3.33 × 10 ⁻¹	8.583 × 10 ⁻¹	1.866
1	0.	-1.32 × 10 ⁻⁴	-2.83 × 10 ⁻⁴	3.9 × 10 ⁻⁵	-7 × 10 ⁻⁵	1	0.	8.7 × 10 ⁻³	9.1 × 10 ⁻³	1.99 × 10 ⁻²	4.13 × 10 ⁻²	6.61 × 10 ⁻²	7.35 × 10 ⁻²
0	0.	3.37 × 10 ⁻⁵	-7.1 × 10 ⁻⁵	-2.47 × 10 ⁻⁴	-1 × 10 ⁻⁵	0	0.	0.	0.	0.	0.	3 × 10 ⁻⁴	8 × 10 ⁻³
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9						
Mean absolute deviation ψ						Mean absolute deviation ρ							
100	0.	7.31 × 10 ⁻⁴	-6.68 × 10 ⁻⁴	-8.41 × 10 ⁻⁴	-3.57 × 10 ⁻⁴	100	-3.595 × 10 ⁻¹	4.916	7.299	1.567 × 10 ¹	2.781 × 10 ¹	4.425 × 10 ¹	5.699 × 10 ¹
10	0.	7.59 × 10 ⁻⁴	-5.51 × 10 ⁻⁴	-8.55 × 10 ⁻⁴	-5.46 × 10 ⁻⁴	10	-6.3 × 10 ⁻¹	2.796 × 10 ⁻¹	2.567 × 10 ⁻¹	4.943 × 10 ⁻¹	7.464 × 10 ⁻¹	1.252	2.421
1	0.	5.48 × 10 ⁻⁴	5.63 × 10 ⁻⁴	-5.61 × 10 ⁻⁴	-4.87 × 10 ⁻⁴	1	0.	8.7 × 10 ⁻³	9.1 × 10 ⁻³	1.99 × 10 ⁻²	4.13 × 10 ⁻²	6.63 × 10 ⁻²	8.77 × 10 ⁻²
0	0.	3.37 × 10 ⁻⁴	5.71 × 10 ⁻⁴	-3.31 × 10 ⁻⁴	-4.86 × 10 ⁻⁴	0	0.	0.	0.	0.	0.	3 × 10 ⁻⁴	8 × 10 ⁻³
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9						
Mean squared error ψ						Mean squared error ρ							
100	0.	1.191 × 10 ⁻³	-9.92 × 10 ⁻³	-1.653 × 10 ⁻²	-7.35 × 10 ⁻³	100	-3.933	4.399 × 10 ²	1.211 × 10 ³	4.327 × 10 ³	1.277 × 10 ⁴	2.974 × 10 ⁴	4.507 × 10 ⁴
10	0.	9.53 × 10 ⁻⁴	-9.29 × 10 ⁻⁴	-1.355 × 10 ⁻³	-7.34 × 10 ⁻⁴	10	-8.1 × 10 ⁻³	1.158	3.582	9.222	2.806 × 10 ¹	2.07 × 10 ²	2.07 × 10 ²
1	0.	6.76 × 10 ⁻⁴	8.83 × 10 ⁻⁴	-7.57 × 10 ⁻⁴	-5.31 × 10 ⁻⁴	1	0.	8.7 × 10 ⁻³	9.1 × 10 ⁻³	1.99 × 10 ⁻²	4.13 × 10 ⁻²	7.61 × 10 ⁻²	2.003 × 10 ⁻¹
0	0.	3.37 × 10 ⁻⁴	7.11 × 10 ⁻⁴	-3.71 × 10 ⁻⁴	-5.06 × 10 ⁻⁴	0	0.	0.	0.	0.	0.	3 × 10 ⁻⁴	8 × 10 ⁻³
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9						

Table S4 – Comparison of the (marginal) accuracy of $\hat{\psi}$ (left column) and $\hat{\rho}$ (right column) for $k = 100$ (i.e., the reference) and $k = 50$ when assuming independent sites. Each cell shows the difference of the absolute mean difference ($|MD_{k=100}| - |MD_{k=50}|$; first row), the difference of the mean absolute difference ($MAD_{k=100} - MAD_{k=50}$; third row) and the difference of the mean squared error ($MSE_{k=100} - MSE_{k=50}$; third row) each calculated over 10,000 data sets assuming independent sites and θ (eq. 45) with $s = 10,000$. Colors within each sub-table range from light yellow to dark red and scale between the minimal and the maximal absolute value to aid interpretation.

Mean deviation ψ						Mean deviation ρ							
100	0.	-4 × 10 ⁻⁶	-2.4 × 10 ⁻⁵	-4.85 × 10 ⁻⁵	-2.3 × 10 ⁻⁵	100	-1.075 × 10 ⁻¹	1.451	3.588	4.329	8.194	1.389 × 10 ¹	2.93 × 10 ¹
10	0.	-5 × 10 ⁻⁶	3.9 × 10 ⁻⁵	5 × 10 ⁻⁵	1.03 × 10 ⁻⁴	10	-4.9 × 10 ⁻²	2.36 × 10 ⁻²	6.37 × 10 ⁻²	1.118 × 10 ⁻¹	2.437 × 10 ⁻¹	3.124 × 10 ⁻¹	7.841 × 10 ⁻¹
1	0.	3 × 10 ⁻⁶	-6.1 × 10 ⁻⁶	-1.61 × 10 ⁻⁵	-1.7 × 10 ⁻⁵	1	0.	2.3 × 10 ⁻³	9.1 × 10 ⁻³	2.21 × 10 ⁻²	3.55 × 10 ⁻²	6.63 × 10 ⁻²	1.1 × 10 ⁻¹
0	0.	-2 × 10 ⁻⁶	4.5 × 10 ⁻⁶	-6.2 × 10 ⁻⁶	2.9 × 10 ⁻⁵	0	0.	0.	0.	0.	0.	0.	1.1 × 10 ⁻¹
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9						
Mean absolute deviation ψ						Mean absolute deviation ρ							
100	0.	-4 × 10 ⁻⁶	7.5 × 10 ⁻⁵	3.2 × 10 ⁻⁵	-1.349 × 10 ⁻⁴	100	-4.677 × 10 ⁻¹	4.008	5.534	7.753	1.259 × 10 ¹	1.904 × 10 ¹	3.482 × 10 ¹
10	0.	-5 × 10 ⁻⁶	6.83 × 10 ⁻⁵	1.82 × 10 ⁻⁴	-1.181 × 10 ⁻⁴	10	-3.01 × 10 ⁻²	2.264 × 10 ⁻¹	1.869 × 10 ⁻¹	2.874 × 10 ⁻¹	4.997 × 10 ⁻¹	7.032 × 10 ⁻¹	1.259
1	0.	1.41 × 10 ⁻⁶	7.89 × 10 ⁻⁵	-1.95 × 10 ⁻⁴	-4.93 × 10 ⁻⁴	1	0.	2.3 × 10 ⁻³	7.3 × 10 ⁻³	9.1 × 10 ⁻³	2.21 × 10 ⁻²	3.55 × 10 ⁻²	5.75 × 10 ⁻²
0	0.	-2 × 10 ⁻⁶	3 × 10 ⁻⁶	5.18 × 10 ⁻⁶	-1.93 × 10 ⁻⁴	0	0.	0.	0.	0.	0.	0.	1.1 × 10 ⁻³
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9						
Mean squared error ψ						Mean squared error ρ							
100	0.	-4 × 10 ⁻⁶	9.36 × 10 ⁻⁵	3.84 × 10 ⁻⁵	-3.323 × 10 ⁻⁴	100	-7.165	2.603 × 10 ²	6.41 × 10 ²	1.159 × 10 ³	2.942 × 10 ³	7.269 × 10 ³	2.311 × 10 ⁴
10	0.	-5 × 10 ⁻⁶	7.35 × 10 ⁻⁵	4.98 × 10 ⁻⁵	-2.335 × 10 ⁻⁴	10	-3.39 × 10 ⁻²	7.926 × 10 ⁻¹	9.461 × 10 ⁻¹	1.597	3.897	7.94	3.048 × 10 ¹
1	0.	1.69 × 10 ⁻⁶	1.89 × 10 ⁻⁵	-4.25 × 10 ⁻⁵	-6.65 × 10 ⁻⁵	1	0.	2.3 × 10 ⁻³	7.3 × 10 ⁻³	9.1 × 10 ⁻³	2.21 × 10 ⁻²	3.69 × 10 ⁻²	8.55 × 10 ⁻²
0	0.	-2 × 10 ⁻⁶	3 × 10 ⁻⁶	5.88 × 10 ⁻⁶	-2.35 × 10 ⁻⁵	0	0.	0.	0.	0.	0.	0.	1.1 × 10 ⁻³
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9						

Table S5 – Comparison of the (marginal) accuracy of $\hat{\psi}$ (left column) and $\hat{\rho}$ (right column) for θ (eq. 45) with $s = 10,000$ (i.e., the reference) and $s = 1,000$ when assuming independent sites. Each cell shows the difference of the absolute mean difference ($|MD_{s=10,000}| - |MD_{s=1,000}|$; first row), the difference of the mean absolute difference ($MAD_{s=10,000} - MAD_{s=1,000}$; third row) and the difference of the mean squared error ($MSE_{s=10,000} - MSE_{s=1,000}$; third row) each calculated over 10,000 data sets assuming independent sites and $k = 100$. Colors within each sub-table range from light yellow to dark red and scale between the minimal and the maximal absolute value to aid interpretation.

Mean deviation ψ						Mean deviation ρ							
100	0.	-1.85 × 10 ⁻⁴	-1.318 × 10 ⁻³	-5.122 × 10 ⁻³	9.42 × 10 ⁻⁴	100	-5.183 × 10 ⁻¹	-4.269 × 10 ¹	-1.022 × 10 ²	-1.505 × 10 ²	-1.752 × 10 ²	-1.878 × 10 ²	-1.939 × 10 ²
10	0.	-1.8 × 10 ⁻⁴	-7.23 × 10 ⁻⁴	-1.2 × 10 ⁻³	1.978 × 10 ⁻³	10	-6.99 × 10 ⁻²	-1.214	-3.859	-1.013 × 10 ¹	-1.734 × 10 ¹	-2.804 × 10 ¹	-7.122 × 10 ¹
1	0.	-1.06 × 10 ⁻⁴	2.145 × 10 ⁻³	3.872 × 10 ⁻³	2.989 × 10 ⁻³	1	-3.24 × 10 ⁻²	-1.903 × 10 ⁻¹	-2.88 × 10 ⁻¹	-3.472 × 10 ⁻¹	-4.143 × 10 ⁻¹	-6.447 × 10 ⁻¹	-4.015
0	0.	-2.08 × 10 ⁻⁴	-3.4 × 10 ⁻⁴	1.084 × 10 ⁻³	4.89 × 10 ⁻⁴	0	0.	-8.9 × 10 ⁻³	-2.63 × 10 ⁻²	-2.81 × 10 ⁻²	-4.07 × 10 ⁻²	-8.57 × 10 ⁻²	-2.359 × 10 ⁻¹
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9						
Mean absolute deviation ψ						Mean absolute deviation ρ							
100	0.	-1.85 × 10 ⁻⁴	-1.148 × 10 ⁻²	-2.683 × 10 ⁻²	-2.55 × 10 ⁻²	100	-1.025 × 10 ¹	-6.374 × 10 ¹	-1.282 × 10 ²	-1.744 × 10 ²	-2.004 × 10 ²	-2.152 × 10 ²	-2.228 × 10 ²
10	0.	-1.8 × 10 ⁻⁴	-9.249 × 10 ⁻³	-1.973 × 10 ⁻²	-1.877 × 10 ⁻²	10	-9.499 × 10 ⁻¹	-2.874	-6.814	-1.203 × 10 ¹	-1.954 × 10 ¹	-3.041 × 10 ¹	-7.379 × 10 ¹
1	0.	-1.06 × 10 ⁻⁴	-8.285 × 10 ⁻³	-1.638 × 10 ⁻²	-1.488 × 10 ⁻²	1	-3.3 × 10 ⁻²	-2.177 × 10 ⁻¹	-3.472 × 10 ⁻¹	-3.95 × 10 ⁻¹	-4.851 × 10 ⁻¹	-8.077 × 10 ⁻¹	-4.385
0	0.	-2.08 × 10 ⁻⁴	-5.996 × 10 ⁻³	-1.112 × 10 ⁻²	-1.26 × 10 ⁻²	0	0.	-9.9 × 10 ⁻³	-2.63 × 10 ⁻²	-2.81 × 10 ⁻²	-4.07 × 10 ⁻²	-8.57 × 10 ⁻²	-2.359 × 10 ⁻¹
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9						
Mean squared error ψ						Mean squared error ρ							
100	0.	-1.85 × 10 ⁻⁶	-4.095 × 10 ⁻⁴	-2.648 × 10 ⁻³	-2.541 × 10 ⁻³	100	-3.267 × 10 ²	-2.37 × 10 ⁴	-8.025 × 10 ⁴	-1.284 × 10 ⁵	-1.607 × 10 ⁵	-1.85 × 10 ⁵	-2.079 × 10 ⁵
10	0.	-1.8 × 10 ⁻⁶	-2.38 × 10 ⁻⁴	-1.343 × 10 ⁻³	-1.396 × 10 ⁻³	10	-2.374	-3.349 × 10 ¹	-3.964 × 10 ¹	-4.08 × 10 ¹	-9.157 × 10 ¹	-1.562 × 10 ²	-5.389 × 10 ²
1	0.	-1.06 × 10 ⁻⁶	-1.574 × 10 ⁻⁴	-7.705 × 10 ⁻⁴	-7.355 × 10 ⁻⁴	1	-3.3 × 10 ⁻²	-2.535 × 10 ⁻¹	-5.708 × 10 ⁻¹	-1.107	-3.145	-1.018 × 10 ¹	-1.688 × 10 ¹
0	0.	-2.08 × 10 ⁻⁶	-8.522 × 10 ⁻⁴	-3.748 × 10 ⁻³	-4.979 × 10 ⁻³	0	0.	-8.9 × 10 ⁻³	-2.65 × 10 ⁻²	-2.85 × 10 ⁻²	-4.37 × 10 ⁻²	-8.03 × 10 ⁻²	-4.651 × 10 ⁻¹
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9						

Table S6 – Overview of the (marginal) accuracy $\hat{\psi}$ estimated from whole-genome simulations with $l = 100$. Each cell shows the mean difference (first row), the mean squared error (second row) and the median difference (third row) of $\hat{\psi}$ calculated over 10,000 data sets assuming independent sites. Colors within each sub-table range from light yellow to dark red and scale between the minimal and the maximal absolute value to aid interpretation.

	$s = 100$						$s = 1,000$						$s = 10,000$					
$k = 20$	Mean deviation ψ																	
	100						10						100					
	10						1						10					
Mean squared error ψ																		
Median deviation ψ																		
$k = 50$	Mean deviation ψ																	
	100						10						100					
	10						1						10					
Mean squared error ψ																		
Median deviation ψ																		
$k = 100$	Mean deviation ψ																	
	100						10						100					
	10						1						10					
Mean squared error ψ																		
Median deviation ψ																		
$k = 200$	Mean deviation ψ																	
	100						10						100					
	10						1						10					
Mean squared error ψ																		
Median deviation ψ																		

Table S7 – Overview of the (marginal) accuracy $\hat{\rho}$ estimated from whole-genome simulations with $\ell = 100$. Each cell shows the mean difference (first row), the mean squared error (second row) and the median difference (third row) of $\hat{\rho}$ calculated over 10,000 data sets assuming independent sites. Colors within each sub-table range from light yellow to dark red and scale between the minimal and the maximal absolute value to aid interpretation.

		$s = 100$						$s = 1,000$						$s = 10,000$											
$k = 20$	Mean deviation ρ	100	-3.273	3.394	5.368	7.794	1.5×10^1	2.462×10^1	5.645×10^1	100	-2.702	2.908	5.409	8.645	1.562×10^1	3.974×10^1	100	-2.738	1.914	3.003	5.216	9.132	1.475×10^1	3.655×10^1	
	Mean squared error ρ	10	2.824×10^{-1}	1.061×10^{-1}	3.021×10^{-1}	4.576×10^{-1}	6.911×10^{-1}	1.078×10^0	1.683×10^0	10	2.44×10^{-1}	1.469×10^{-1}	2.143×10^{-1}	3.071×10^{-1}	5.223×10^{-1}	9.704×10^{-1}	10	2.288×10^{-1}	1.387×10^{-1}	2.065×10^{-1}	3.025×10^{-1}	4.94×10^{-1}	8.374×10^{-1}	1.756×10^0	
	Median deviation ρ	1	3.9×10^{-1}	4.45×10^{-1}	8.97×10^{-2}	1.488×10^{-1}	1.983×10^{-1}	2.483×10^{-1}	3.581×10^{-1}	1	1.8×10^{-1}	3.08×10^{-1}	6.98×10^{-1}	1.253×10^0	1.785×10^0	2.248×10^0	1	1.1×10^{-1}	2.87×10^{-1}	6.68×10^{-1}	1.224×10^0	1.794×10^0	2.231×10^0	3.348×10^0	
	$\rho \neq \psi$	0	0	5×10^{-4}	3.8×10^{-2}	2.83×10^{-1}	4.56×10^{-1}	1.157×10^1	0	0	2×10^{-4}	2×10^{-3}	8.2×10^{-1}	2.08×10^0	3.99×10^0	1.063×10^1	0	0	2×10^{-4}	2.1×10^{-3}	8.5×10^{-1}	2.01×10^0	4.05×10^0	1.065×10^1	
$k = 50$	Mean deviation ρ	100	1.569 $\times 10^0$	6.065×10^0	1.142×10^1	2.21×10^1	3.965×10^1	8.787×10^1	1.194×10^2	100	9.752 $\times 10^0$	3.67×10^1	6.18×10^1	1.181×10^2	2.273×10^2	4.371×10^2	100	9.165 $\times 10^0$	3.412×10^1	6.743×10^1	1.086×10^2	2.141×10^2	4.015×10^2	1.130×10^3	
	Mean squared error ρ	10	1.22	3.307	5.677	1.099×10^1	1.899×10^1	3.279×10^1	5.194×10^1	10	9.166 $\times 10^0$	2.424×10^1	3.886	7.101	1.248×10^1	2.204×10^1	10	8.778 $\times 10^0$	2.303	3.733	6.708	1.214×10^1	2.184×10^1	5.741×10^1	
	Median deviation ρ	1	3.9×10^{-1}	4.49×10^{-1}	8.93×10^{-2}	1.852×10^{-1}	2.455×10^{-1}	3.983×10^{-1}	1.054×10^0	1	1.8×10^{-1}	3.08×10^{-1}	7.11×10^{-1}	1.393×10^0	2.187×10^0	3.348×10^0	1	1.1×10^{-1}	2.87×10^{-1}	6.78×10^{-1}	1.333×10^0	2.002×10^0	3.249×10^0	8.52×10^0	
	$\rho \neq \psi$	0	0	5×10^{-4}	3.8×10^{-2}	1.25×10^{-1}	2.83×10^{-1}	4.56×10^{-1}	1.155×10^1	0	0	2×10^{-4}	2×10^{-3}	8.2×10^{-1}	2.08×10^0	3.99×10^0	1.063×10^1	0	0	2×10^{-4}	2.1×10^{-3}	8.5×10^{-1}	2.01×10^0	4.05×10^0	1.065×10^1
$k = 100$	Mean deviation ρ	100	-2.67×10^{-1}	3.602	8.147	1.584×10^1	3.835×10^1	3.085×10^1	5.675×10^1	100	1.017×10^1	1.884	3.192	6.391	8.08	1.582×10^1	2.394×10^1	100	8.65×10^0	1.384	2.523	5.229	7.122	1.097×10^1	1.655×10^1
	Mean squared error ρ	10	6.3×10^{-1}	1.697×10^1	3.251×10^1	4.899×10^1	6.839×10^1	1.142×10^2	2.525×10^2	10	3×10^0	9×10^0	1.702×10^1	3.281×10^1	3.87×10^1	6.715×10^1	10	2×10^0	8.2×10^0	1.606×10^1	2.927×10^1	3.649×10^1	6.374×10^1	1.229×10^2	
	Median deviation ρ	1	1.4×10^{-1}	3.12×10^{-1}	8.32×10^{-2}	1.153×10^{-1}	1.484×10^{-1}	2.059×10^{-1}	3.351×10^{-1}	1	4×10^{-1}	1.32×10^{-1}	5.22×10^{-1}	8.75×10^{-1}	1.182×10^0	1.872×10^0	1	1×10^{-1}	1.18×10^{-1}	4.83×10^{-1}	8.28×10^{-1}	1.136×10^0	1.635×10^0	2.874×10^0	
	$\rho \neq \psi$	0	0	0	1.1×10^{-2}	3.9×10^{-2}	5.9×10^{-2}	1.8×10^{-1}	7.8×10^{-2}	0	0	0	2×10^{-4}	1.6×10^{-3}	3.4×10^{-3}	1.18×10^{-2}	0	0	1×10^{-4}	1.5×10^{-3}	3.8×10^{-3}	1.17×10^{-2}	5.68×10^{-2}	6.7×10^{-2}	
$k = 200$	Mean deviation ρ	100	6.629×10^0	6.862×10^0	1.555×10^1	2.853×10^1	5.222×10^1	1.196×10^2	3.547×10^2	100	2.659×10^1	3.064×10^1	5.896×10^1	1.013×10^2	1.698×10^2	2.891×10^2	7.69×10^2	100	2.279×10^1	2.635×10^1	6.083×10^1	9.24×10^1	1.403×10^2	2.438×10^2	5.920×10^2
	Mean squared error ρ	10	6.686×10^0	3.182	6.209	9.239	2.732×10^1	9.208×10^1	1.947×10^2	10	6.686×10^0	1.92	3.224	5.539	8.14	1.436×10^1	3.474×10^1	10	5.268×10^0	1.792	3.034	5.215	7.761	1.319×10^1	3.178×10^1
	Median deviation ρ	1	1.4×10^{-1}	3.12×10^{-1}	8.44×10^{-2}	1.197×10^{-1}	1.55×10^{-1}	2.491×10^{-1}	6.301×10^{-1}	1	4×10^{-1}	1.32×10^{-1}	5.22×10^{-1}	8.75×10^{-1}	1.182×10^0	1.872×10^0	1	1×10^{-1}	1.18×10^{-1}	4.83×10^{-1}	8.28×10^{-1}	1.136×10^0	1.635×10^0	2.874×10^0	
	$\rho \neq \psi$	0	0	0	1.1×10^{-2}	3.9×10^{-2}	5.9×10^{-2}	1.8×10^{-1}	7.8×10^{-2}	0	0	0	2×10^{-4}	1.6×10^{-3}	3.4×10^{-3}	1.18×10^{-2}	0	0	1×10^{-4}	1.5×10^{-3}	3.8×10^{-3}	1.17×10^{-2}	5.68×10^{-2}	6.7×10^{-2}	

Table S9 – Overview of the (marginal) accuracy $\hat{\rho}$ estimated from whole-genome simulations with $\ell = 1,000$. Each cell shows the mean difference (first row), the mean squared error (second row) and the median difference (third row) of $\hat{\rho}$ calculated over 10,000 data sets assuming independent sites. Colors within each sub-table range from light yellow to dark red and scale between the minimal and the maximal absolute value to aid interpretation.

	$s = 100$				$s = 1,000$				$s = 10,000$															
$k = 20$	Mean deviation ρ				Mean deviation ρ				Mean deviation ρ															
	100	-1.66×10^{-1}	3.66×10^{-1}	5.64×10^{-1}	1.155	1.316	2.187	4.259	100	5.2×10^{-2}	1.69×10^{-1}	2.34×10^{-1}	6.46×10^{-1}	9.46×10^{-1}	1.437	2.146	100	-1.2×10^{-3}	1.80×10^{-1}	1.85×10^{-1}	5.28×10^{-1}	8.88×10^{-1}	1.346	2.007
	10	-2.2×10^{-1}	2.83×10^{-1}	6.99×10^{-1}	5.72×10^{-2}	5.5×10^{-1}	1.05×10^{-1}	2.426×10^{-1}	10	2.5×10^{-2}	2.54×10^{-1}	4.03×10^{-1}	4.83×10^{-1}	8.7×10^{-1}	1.647×10^{-1}	1.976×10^{-1}	10	3.6×10^{-3}	2.28×10^{-1}	4.41×10^{-1}	4.2×10^{-1}	8.68×10^{-1}	1.045×10^{-1}	1.81×10^{-1}
	1	0	0	0	6×10^{-4}	3.5×10^{-3}	1.2×10^{-2}	6.52×10^{-2}	1	0	0	0	1×10^{-4}	1.6×10^{-3}	9×10^{-3}	5.17×10^{-2}	1	0	0	0	1×10^{-4}	1.3×10^{-3}	7.8×10^{-3}	4.96×10^{-2}
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9
$k = 50$	Mean squared error ρ				Mean squared error ρ				Mean squared error ρ															
	100	1.62×10^{-1}	6.11×10^{-1}	1.00×10^0	1.705×10^0	2.44×10^0	3.788×10^0	8.60×10^0	100	7.971	3.449×10^1	6.879×10^1	1.112×10^2	1.704×10^2	2.807×10^2	5.51×10^2	100	7.609	3.194×10^1	6.124×10^1	1.052×10^2	1.61×10^2	2.427×10^2	5.18×10^2
	10	1.25×10^{-1}	3.647×10^{-1}	6.82×10^{-1}	1.007	1.485	2.138	4.532	10	5.91×10^{-1}	2.416×10^1	5.013×10^1	8.083×10^1	1.214	1.711	3.463	10	5.2×10^{-1}	2.226×10^1	4.883×10^1	7.7×10^1	1.186	1.68	3.341
	1	0	0	0	6×10^{-4}	3.5×10^{-3}	1.2×10^{-2}	6.52×10^{-2}	1	0	0	0	1×10^{-4}	1.6×10^{-3}	9×10^{-3}	5.17×10^{-2}	1	0	0	0	1×10^{-4}	1.3×10^{-3}	7.8×10^{-3}	4.96×10^{-2}
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9
$k = 100$	Median deviation ρ				Median deviation ρ				Median deviation ρ															
	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
	10	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9

Mean deviation ψ						Mean deviation ρ									
100	0.	-7.104×10^{-3}	-4.435×10^{-2}	-5.599×10^{-2}	-5.365×10^{-2}	-4.04×10^{-2}	-5.625×10^{-2}	100	2×10^{-4}	-1.455×10^1	-1.532×10^2	-2.159×10^2	-2.167×10^2	-1.719×10^2	6.548×10^1
10	0.	-4.676×10^{-3}	-4.175×10^{-2}	-3.283×10^{-2}	-1.369×10^{-2}	3.921×10^{-3}	-2.135×10^{-2}	10	-3.2×10^{-3}	-6.417×10^{-1}	-1.25×10^1	-4.546×10^1	-7.281×10^1	-8.314×10^1	-1.309×10^2
1	0.	-1.734×10^{-3}	-1.64×10^{-2}	2.939×10^{-3}	1.397×10^{-2}	5.69×10^{-2}	2.731×10^{-3}	1	0.	-1.175×10^{-1}	-1.136	-4.147	-6.834	-9.952	-7.571×10^{-1}
0	0.	1.14×10^{-4}	2.138×10^{-2}	5.896×10^{-2}	8.471×10^{-2}	8.712×10^{-2}	1.423×10^{-2}	0	0.	-3.2×10^{-3}	-2.988×10^{-1}	-9.28×10^{-1}	-1.8	-2.185	-1.789×10^{-1}
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9

Mean absolute deviation ψ						Mean absolute deviation ρ									
100	0.	-1.804×10^{-3}	-9.674×10^{-2}	-1.424×10^{-1}	-1.575×10^{-1}	-1.336×10^{-1}	-7.916×10^{-2}	100	3×10^{-3}	-2.104×10^{-1}	-4.002×10^1	-1.224×10^2	-1.418×10^2	-6.335×10^1	-7.009×10^1
10	0.	-1.507×10^{-2}	-1.01×10^{-1}	-1.434×10^{-1}	-1.539×10^{-1}	-1.371×10^{-1}	-5.207×10^{-2}	10	-1.12×10^{-2}	-8.42×10^{-2}	-2.421	-7.039	-9.535	-6.267	-3.542×10^1
1	0.	-9.932×10^{-3}	-7.733×10^{-2}	-1.244×10^{-1}	-1.382×10^{-1}	-1.047×10^{-1}	-2.857×10^{-2}	1	0.	-5.1×10^{-3}	-1.858×10^{-1}	-5.43×10^{-1}	-5.8×10^{-1}	-2.645×10^{-1}	-2.322
0	0.	-3.18×10^{-4}	-2.144×10^{-2}	-5.987×10^{-2}	-8.863×10^{-2}	-9.293×10^{-2}	-2.057×10^{-2}	0	0.	0.	-1×10^{-3}	-4.46×10^{-2}	-1.006×10^{-1}	-1.91×10^{-1}	-3.919×10^{-1}
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9

Mean squared error ψ						Mean squared error ρ									
100	0.	-1.144×10^{-3}	-2.133×10^{-2}	-3.625×10^{-2}	-3.627×10^{-2}	-2.398×10^{-2}	-7.472×10^{-3}	100	-4.058×10^{-1}	-7.101×10^1	-1.355×10^2	-2.096×10^2	-2.266×10^2	-2.056×10^2	-2.273×10^2
10	0.	-7.316×10^{-2}	-2.092×10^{-2}	-3.297×10^{-2}	-3.295×10^{-2}	-2.933×10^{-2}	-5.476×10^{-3}	10	-4.86×10^{-2}	-2.757×10^1	-1.428×10^1	-2.029×10^1	-4.815×10^1	-6.248×10^1	-1.16×10^2
1	0.	-4.698×10^{-4}	-8.935×10^{-3}	-2.134×10^{-2}	-2.785×10^{-2}	-2.333×10^{-2}	-2.421×10^{-3}	1	0.	-3.277×10^{-1}	-1.014×10^1	-1.292×10^1	-7.836×10^1	-2.839×10^1	-2.058×10^2
0	0.	-7.58×10^{-4}	-2.1×10^{-3}	-1.094×10^{-2}	-2.187×10^{-2}	-2.459×10^{-2}	-2.193×10^{-3}	0	0.	-3.2×10^{-3}	-3.892×10^{-1}	-4.678	-3.102×10^1	-1.047×10^2	-4.275×10^2
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9

Table S14 – Comparison of the (marginal) accuracy of $\hat{\psi}$ (left column) and $\hat{\rho}$ (right column) for the maximum likelihood estimate based on the full SFS (i.e., the reference) and the lumped SFS where the $i = 15$ entry in the SFS contains the aggregate of the higher frequency classes when assuming independent sites.. Each cell shows the difference of the absolute mean difference ($|MD_{i=0}| - |MD_{i=15}|$; first row), the difference of the mean absolute difference ($MAD_{i=0} - MAD_{i=15}$; third row) and the difference of the mean squared error ($MSE_{i=0} - MSE_{i=15}$; third row) each calculated over 10,000 data sets assuming independent sites, $k = 100$, and θ (eq. 45) with $s = 10,000$. Colors within each sub-table range from light yellow to dark red and scale between the minimal and the maximal absolute value to aid interpretation.

Mean deviation ψ						Mean deviation ρ									
100	0.	-8.9×10^{-5}	-7.793×10^{-3}	-1.807×10^{-2}	-4.014×10^{-2}	-8.249×10^{-2}	-7.883×10^{-3}	100	8×10^{-4}	1.96×10^{-1}	-1.899×10^1	-8.785×10^1	-9.507×10^1	-2.532	-3.133×10^1
10	0.	-1.02×10^{-4}	-4.438×10^{-3}	-7.786×10^{-3}	-8.974×10^{-3}	-3.399×10^{-2}	1.876×10^{-2}	10	2×10^{-4}	7×10^{-3}	-5.581×10^{-1}	-3.813	-6.43	-1.991	-3.359×10^1
1	0.	1.01×10^{-4}	1.903×10^{-3}	3.985×10^{-3}	2.064×10^{-2}	7.852×10^{-2}	2.682×10^{-2}	1	0.	-5.1×10^{-3}	-1.208×10^{-1}	-3.394×10^{-1}	-5.264×10^{-1}	-2.145×10^{-1}	-2.223
0	0.	-2.1×10^{-5}	5.1×10^{-5}	5.61×10^{-5}	1.49×10^{-2}	2.39×10^{-3}	2.098×10^{-2}	0	0.	0.	-1×10^{-3}	-4.46×10^{-2}	-1.006×10^{-1}	-1.91×10^{-1}	-3.919×10^{-1}
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9

Mean absolute deviation ψ						Mean absolute deviation ρ									
100	0.	-1.27×10^{-4}	-2.519×10^{-3}	-7.137×10^{-3}	-1.014×10^{-1}	-9.353×10^{-2}	-4.608×10^{-2}	100	3×10^{-3}	-2.104×10^{-1}	-4.002×10^1	-1.224×10^2	-1.418×10^2	-6.335×10^1	-7.009×10^1
10	0.	-3.18×10^{-4}	-1.939×10^{-2}	-5.674×10^{-2}	-6.939×10^{-2}	-6.557×10^{-2}	-4.57×10^{-2}	10	-1.12×10^{-2}	-8.42×10^{-2}	-2.421	-7.039	-9.535	-6.267	-3.542×10^1
1	0.	-1.25×10^{-4}	-9.675×10^{-3}	-3.673×10^{-2}	-3.444×10^{-2}	-2.095×10^{-2}	-3.629×10^{-2}	1	0.	-5.1×10^{-3}	-1.858×10^{-1}	-5.43×10^{-1}	-5.8×10^{-1}	-2.645×10^{-1}	-2.322
0	0.	-5.5×10^{-5}	-8.63×10^{-4}	-8.544×10^{-3}	-2.117×10^{-2}	-9.636×10^{-3}	-2.6×10^{-2}	0	0.	0.	-1×10^{-3}	-4.46×10^{-2}	-1.006×10^{-1}	-1.91×10^{-1}	-3.919×10^{-1}
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9

Mean squared error ψ						Mean squared error ρ									
100	0.	-1.81×10^{-4}	-1.845×10^{-3}	-1.068×10^{-2}	-1.907×10^{-2}	-1.607×10^{-2}	-4.656×10^{-3}	100	8×10^{-4}	-1.3×10^1	-9.289×10^1	-7.059×10^1	-1.926×10^2	-4.002×10^2	-5.47×10^2
10	0.	-3.74×10^{-4}	-1.079×10^{-3}	-5.946×10^{-3}	-1.02×10^{-2}	-1.01×10^{-2}	-6.738×10^{-3}	10	-1.1×10^{-2}	-3.286×10^1	-2.313×10^1	-2.029×10^1	-7.475×10^1	-8.405×10^1	-2.005×10^2
1	0.	-2.13×10^{-4}	-6.9×10^{-4}	-3.929×10^{-3}	-3.339×10^{-3}	-1.511×10^{-2}	-5.75×10^{-3}	1	0.	-5.1×10^{-3}	-1.952×10^{-1}	-9.908×10^{-1}	-1.99	-9.893×10^{-1}	-1.277×10^2
0	0.	-5.5×10^{-5}	-1.569×10^{-4}	-7.567×10^{-4}	-2.463×10^{-3}	-5.216×10^{-3}	-4.653×10^{-3}	0	0.	0.	-1×10^{-3}	-4.46×10^{-2}	-1.038×10^{-1}	-2.15×10^{-1}	-2.175
ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9	ρ/ψ	0	0.15	0.3	0.45	0.6	0.75	0.9