

Supporting information for

**Assessing the impact of incomplete species sampling
on estimates of speciation and extinction rates**

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Table S1: **Performance of the FBD model assuming the number of fossil samples is known and the number of extant samples is not known ($\rho = 0$).** For speciation, extinction and sampling the true parameter value is shown, along with the average median estimate (indicated by the $\hat{}$ symbol), percentage (%) error, coverage and precision. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

speciation					extinction					sampling				
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S	\hat{P}_S	% error	coverage	precision
1	1.05	13.86	0.97	0.73	0.1	0.12	37.54	0.95	0.23	0.10	0.11	20.26	0.98	0.11
1	1.02	9.38	0.96	0.45	0.1	0.11	29.47	0.98	0.14	0.50	0.51	4.32	0.96	0.10
1	1.00	7.93	0.96	0.38	0.1	0.11	24.37	0.96	0.12	0.99	0.99	0.15	0.85	0.00
1	1.04	13.29	0.95	0.66	0.5	0.51	18.49	0.93	0.48	0.10	0.12	31.13	0.93	0.14
1	1.02	8.37	0.92	0.37	0.5	0.51	10.80	0.94	0.26	0.50	0.51	3.60	0.99	0.10
1	1.00	5.95	0.97	0.29	0.5	0.50	7.72	0.97	0.21	0.99	0.99	0.10	0.89	0.00
1	1.00	16.97	0.93	0.74	0.9	0.88	18.02	0.91	0.73	0.10	0.15	54.81	0.85	0.18
1	1.03	6.51	0.93	0.30	0.9	0.91	6.26	0.95	0.28	0.50	0.53	7.00	0.81	0.13
1	1.01	3.15	0.96	0.16	0.9	0.89	3.33	0.94	0.14	0.99	0.99	0.09	0.93	0.00

Table S2: **Performance of the FBD model assuming the number of fossil and extant samples are known ($\rho = 1$).** For speciation, extinction and sampling the true parameter value is shown, along with the average median estimate (indicated by the $\hat{}$ symbol), percentage (%) error, coverage and precision. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

speciation					extinction					sampling				
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S	\hat{P}_S	% error	coverage	precision
1	1.06	13.00	0.98	0.67	0.1	0.12	37.64	0.95	0.23	0.10	0.10	15.79	0.94	0.08
1	1.03	8.58	0.96	0.41	0.1	0.11	29.40	0.98	0.14	0.50	0.50	4.11	0.93	0.09
1	1.00	7.86	0.93	0.37	0.1	0.11	24.45	0.95	0.12	0.99	0.99	0.15	0.84	0.00
1	1.06	14.25	0.96	0.65	0.5	0.51	18.03	0.93	0.47	0.10	0.11	18.32	0.94	0.08
1	1.02	7.54	0.91	0.35	0.5	0.51	10.78	0.94	0.26	0.50	0.50	3.34	0.96	0.10
1	1.00	5.89	0.96	0.29	0.5	0.50	7.69	0.96	0.21	0.99	0.99	0.10	0.89	0.00
1	0.97	16.04	0.95	0.73	0.9	0.84	16.66	0.92	0.70	0.10	0.12	20.98	0.93	0.10
1	1.03	6.56	0.93	0.30	0.9	0.90	6.06	0.94	0.28	0.50	0.52	5.75	0.87	0.12
1	1.01	3.15	0.96	0.15	0.9	0.89	3.33	0.94	0.14	0.99	0.99	0.09	0.93	0.00

Table S3: **Performance of the BD model assuming the number of fossil samples is known.** For speciation, extinction and sampling the true parameter value is shown, along with the average median estimate (indicated by the $\hat{}$ symbol), percentage (%) error, coverage and precision. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

speciation					extinction					sampling				
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S	\hat{P}_S	% error	coverage	precision
1	0.64	35.68	0.30	0.51	0.1	0.08	34.15	0.94	0.15	0.10	0.22	117.87	0.00	0.14
1	0.80	19.75	0.46	0.36	0.1	0.09	25.29	0.90	0.11	0.50	0.54	8.07	0.58	0.09
1	0.95	8.72	0.88	0.36	0.1	0.10	22.73	0.96	0.11	0.99	0.99	0.13	0.86	0.00
1	0.85	17.81	0.78	0.62	0.5	0.45	22.11	0.85	0.42	0.10	0.38	278.88	0.00	0.19
1	0.82	18.19	0.41	0.31	0.5	0.41	18.17	0.64	0.21	0.50	0.60	20.64	0.01	0.09
1	0.93	8.55	0.78	0.27	0.5	0.47	8.90	0.93	0.19	0.99	0.99	0.10	0.93	0.00
1	2.40	140.09	0.17	1.46	0.9	2.21	146.60	0.22	1.38	0.10	0.90	804.46	0.00	0.09
1	1.16	18.15	0.53	0.30	0.9	1.03	19.92	0.46	0.28	0.50	0.89	77.15	0.00	0.05
1	0.89	10.80	0.22	0.14	0.9	0.79	12.35	0.07	0.13	0.99	0.99	0.49	0.07	0.00

Table S4: **Performance of the FBD model assuming the number of fossil and extant samples are not known** (presence/absence sampling, $\rho = 0$). For speciation, extinction and sampling the true parameter value is shown, along with the average median estimate (indicated by the $\hat{}$ symbol), percentage (%) error, coverage and precision. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

speciation					extinction					sampling				
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S	\hat{P}_S	% error	coverage	precision
1	1.02	13.01	0.96	0.72	0.1	0.12	42.55	0.97	0.22	0.10	0.10	21.06	0.96	0.11
1	1.01	8.74	0.96	0.45	0.1	0.11	28.94	0.94	0.14	0.50	0.36	28.14	0.00	0.10
1	1.00	8.20	0.95	0.40	0.1	0.10	26.14	0.95	0.13	0.99	0.57	42.14	0.00	0.08
1	1.02	13.00	0.97	0.64	0.5	0.49	16.17	0.94	0.46	0.10	0.09	25.38	0.93	0.12
1	0.97	8.11	0.91	0.36	0.5	0.47	10.85	0.94	0.25	0.50	0.33	33.73	0.00	0.11
1	0.94	8.91	0.83	0.30	0.5	0.46	10.28	0.89	0.21	0.99	0.53	46.14	0.00	0.09
1	0.94	15.50	0.94	0.70	0.9	0.82	17.74	0.94	0.69	0.10	0.12	32.03	0.98	0.17
1	0.87	13.96	0.55	0.29	0.9	0.75	16.57	0.41	0.27	0.50	0.30	40.90	0.00	0.12
1	0.79	20.68	0.08	0.19	0.9	0.69	23.72	0.02	0.17	0.99	0.44	55.61	0.00	0.10

Table S5: **Performance of the FBD model assuming the number of fossil samples is not known and the number of extant samples is known** (presence/absence sampling, $\rho = 1$). For speciation, extinction and sampling the true parameter value is shown, along with the average median estimate (indicated by the $\hat{}$ symbol), percentage (%) error, coverage and precision. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

speciation					extinction					sampling				
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S	\hat{P}_S	% error	coverage	precision
1	1.03	12.16	0.96	0.65	0.1	0.12	41.85	0.97	0.23	0.10	0.09	13.91	0.97	0.07
1	0.95	8.17	0.93	0.39	0.1	0.11	29.03	0.93	0.14	0.50	0.37	26.01	0.00	0.09
1	0.92	10.09	0.83	0.35	0.1	0.10	26.12	0.95	0.13	0.99	0.58	41.06	0.00	0.08
1	1.01	12.10	0.96	0.62	0.5	0.49	16.24	0.94	0.46	0.10	0.10	15.30	0.93	0.08
1	0.92	10.13	0.78	0.33	0.5	0.48	10.79	0.95	0.25	0.50	0.35	29.93	0.00	0.10
1	0.87	13.58	0.47	0.27	0.5	0.46	10.09	0.90	0.21	0.99	0.55	44.52	0.00	0.08
1	0.93	15.18	0.91	0.70	0.9	0.80	17.57	0.89	0.67	0.10	0.11	18.71	0.96	0.09
1	0.87	13.72	0.53	0.29	0.9	0.78	14.29	0.56	0.27	0.50	0.33	34.44	0.00	0.11
1	0.79	21.50	0.07	0.19	0.9	0.71	21.32	0.05	0.18	0.99	0.48	51.92	0.00	0.09

Table S6: **Performance of the FBD model assuming the number of fossil and extant samples are not known** (presence/absence sampling, $\rho = 0$) **ensuring fossil ages do not conflict with true species durations**. For speciation, extinction and sampling the true parameter value is shown, along with the average median estimate (indicated by the $\hat{}$ symbol), percentage (%) error, coverage and precision. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

speciation					extinction					sampling				
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S	\hat{P}_S	% error	coverage	precision
1	1.03	13.16	0.96	0.65	0.5	0.50	16.49	0.94	0.47	0.10	0.09	25.70	0.94	0.12
1	1.00	7.75	0.94	0.37	0.5	0.49	10.37	0.96	0.26	0.50	0.34	32.22	0.00	0.11
1	0.98	7.08	0.95	0.31	0.5	0.48	8.50	0.94	0.22	0.99	0.55	44.48	0.00	0.09

Table S7: **Performance of the BD model assuming the number of fossil samples is not known** (presence/absence sampling). For speciation, extinction and sampling the true parameter value is shown, along with the average median estimate (indicated by the $\hat{}$ symbol), percentage (%) error, coverage and precision. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

speciation					extinction					sampling				
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S	\hat{P}_S	% error	coverage	precision
1	0.62	38.11	0.16	0.50	0.1	0.08	35.81	0.88	0.15	0.10	0.21	106.23	0.01	0.13
1	0.75	25.45	0.22	0.35	0.1	0.08	28.24	0.89	0.11	0.50	0.41	17.50	0.07	0.10
1	0.81	18.84	0.39	0.33	0.1	0.09	24.04	0.89	0.10	0.99	0.60	39.52	0.00	0.08
1	0.83	20.17	0.74	0.60	0.5	0.43	22.94	0.82	0.41	0.10	0.36	258.18	0.00	0.19
1	0.75	24.97	0.14	0.30	0.5	0.37	25.07	0.35	0.20	0.50	0.47	7.03	0.67	0.10
1	0.75	25.14	0.07	0.25	0.5	0.37	26.17	0.15	0.17	0.99	0.61	38.34	0.00	0.08
1	2.09	109.18	0.24	1.30	0.9	1.92	115.28	0.29	1.23	0.10	0.89	787.37	0.00	0.10
1	1.06	15.51	0.54	0.31	0.9	0.95	18.52	0.44	0.29	0.50	0.82	63.41	0.01	0.07
1	0.80	20.06	0.11	0.17	0.9	0.71	21.39	0.16	0.16	0.99	0.80	19.15	0.00	0.05

Table S8: **Performance of the FBD model under non-uniform fossil recovery assuming the number of fossil and extant samples are known ($\rho = 1$).** For speciation and extinction the true parameter value is shown, along with the average median estimate (indicated by the $\hat{}$ symbol), percentage (%) error, coverage and precision. The sampling scenario is shown with the arrow indicating increased or decreased sampling towards the present, along with average median estimate and precision.

speciation					extinction					sampling		
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S	\hat{P}_S	precision
1	1.09	10.43	0.81	0.33	0.5	0.52	10.25	0.95	0.23	0.01 \rightarrow 0.99	0.92	0.03
1	1.05	10.98	0.94	0.48	0.5	0.51	14.13	0.95	0.34	0.99 \rightarrow 0.01	0.28	0.11

Table S9: **Performance of the FBD model under non-uniform fossil recovery assuming the number of fossil samples is known and the number of extant samples is not known ($\rho = 0$).** For speciation and extinction the true parameter value is shown, along with the average median estimate (indicated by the $\hat{}$ symbol), percentage (%) error, coverage and precision. The sampling scenario is shown with the arrow indicating increased or decreased sampling towards the present, along with average median estimate and precision.

speciation					extinction					sampling		
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S	\hat{P}_S	precision
1	1.14	14.02	0.65	0.35	0.5	0.52	10.27	0.95	0.23	0.01 \rightarrow 0.99	0.92	0.03
1	0.75	25.23	0.34	0.42	0.5	0.54	17.12	0.95	0.35	0.99 \rightarrow 0.01	0.40	0.14

Table S10: **Performance of the BD model under non-uniform fossil recovery assuming the number of fossil samples is known and the number of extant samples is not known ($\rho = 0$).** For speciation and extinction the true parameter value is shown, along with the average median estimate (indicated by the $\hat{}$ symbol), percentage (%) error, coverage and precision. The sampling scenario is shown with the arrow indicating increased or decreased sampling towards the present, along with average median estimate and precision.

speciation					extinction					sampling		
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S	\hat{P}_S	precision
1	1.00	6.69	0.91	0.31	0.5	0.45	11.21	0.85	0.20	0.01 \rightarrow 0.99	0.93	0.03
1	0.63	36.81	0.04	0.36	0.5	0.47	16.11	0.82	0.30	0.99 \rightarrow 0.01	0.51	0.13

Table S11: **Performance of the per-taxon rates method.** For speciation and extinction the true parameter value is shown, along with the average point estimate (indicated by the $\hat{}$ symbol), percentage (%) error, consistency and precision. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

speciation					extinction					P_S
λ	$\hat{\lambda}$	% error	consistency	precision	μ	$\hat{\mu}$	% error	consistency	precision	
1	0.96	12.78	1.00	0.57	0.1	0.10	45.45	1.00	0.19	0.10
1	0.89	12.56	1.00	0.35	0.1	0.09	26.82	1.00	0.12	0.50
1	0.87	13.92	1.00	0.35	0.1	0.09	23.75	1.00	0.10	0.99
1	1.08	14.23	1.00	0.55	0.5	0.54	19.26	1.00	0.48	0.10
1	0.88	13.07	1.00	0.34	0.5	0.43	15.34	1.00	0.23	0.50
1	0.80	20.03	0.00	0.30	0.5	0.39	22.02	0.00	0.16	0.99
1	0.69	33.29	1.00	0.73	0.9	0.60	33.95	1.00	0.61	0.10
1	0.59	40.97	0.00	0.55	0.9	0.52	42.51	0.00	0.39	0.50
1	0.53	47.07	0.00	0.43	0.9	0.46	48.58	0.00	0.31	0.99

Table S12: **Performance of the boundary-crosser method.** For speciation and extinction the true parameter value is shown, along with the average point estimate (indicated by the $\hat{}$ symbol), percentage (%) error, consistency and precision. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

speciation					extinction					P_S
λ	$\hat{\lambda}$	% error	consistency	precision	μ	$\hat{\mu}$	% error	consistency	precision	
1	1.05	15.48	1.00	0.71	0.1	0.03	73.33	0.00	0.09	0.10
1	1.01	8.73	1.00	0.42	0.1	0.07	35.01	1.00	0.12	0.50
1	1.01	8.21	1.00	0.40	0.1	0.09	29.94	1.00	0.13	0.99
1	1.04	16.84	1.00	0.79	0.5	0.15	70.61	0.00	0.32	0.10
1	1.01	8.93	1.00	0.42	0.5	0.37	27.28	1.00	0.28	0.50
1	1.00	7.19	1.00	0.32	0.5	0.44	14.94	1.00	0.24	0.99
1	1.02	23.13	1.00	1.06	0.9	0.42	56.50	1.00	0.94	0.10
1	0.99	12.27	1.00	0.56	0.9	0.71	22.97	1.00	0.50	0.50
1	1.00	8.30	1.00	0.41	0.9	0.80	13.03	1.00	0.38	0.99

Table S13: **Performance of the three-timer method.** For speciation, extinction and sampling the true parameter value is shown, along with the average point estimate (indicated by the $\hat{}$ symbol), percentage (%) error, consistency (consist.) and precision. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

speciation					extinction					sampling				
λ	$\hat{\lambda}$	% error	consist.	precision	μ	$\hat{\mu}$	% error	consist.	precision	P_S	\hat{P}_S	% error	consist.	precision
1	1.24	101.10	1.00	3.72	0.1	0.17	232.70	1.00	1.47	0.10	0.10	90.73	1.00	0.30
1	0.97	24.85	1.00	1.23	0.1	0.19	185.41	1.00	0.74	0.50	0.49	10.84	1.00	0.24
1	1.01	8.76	1.00	0.44	0.1	0.11	45.22	1.00	0.20	0.99	0.95	4.03	0.00	0.05
1	1.01	61.29	1.00	2.82	0.5	0.30	76.17	1.00	1.30	0.10	0.11	102.63	1.00	0.40
1	0.99	19.56	1.00	0.93	0.5	0.51	49.44	1.00	1.03	0.50	0.48	12.05	1.00	0.29
1	0.99	7.34	1.00	0.36	0.5	0.50	15.85	1.00	0.31	0.99	0.92	7.04	0.00	0.08
1	1.32	54.44	1.00	2.63	0.9	0.47	63.11	1.00	1.31	0.10	0.10	160.74	1.00	1.00
1	0.97	13.86	1.00	0.62	0.9	0.85	21.90	1.00	1.03	0.50	0.44	24.92	1.00	0.65
1	1.00	8.30	1.00	0.37	0.9	0.89	10.75	1.00	0.39	0.99	0.84	15.16	1.00	0.29

Table S14: **Performance of the per-taxon rates method under non-uniform fossil recovery.** For speciation and extinction the true parameter value is shown, along with the average point estimate (indicated by the $\hat{}$ symbol), percentage (%) error, consistency and precision. The sampling scenario is shown with the arrow indicating increased or decreased sampling towards the present.

speciation					extinction					sampling
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S
1	0.74	25.78	0.00	0.37	0.5	0.53	15.74	1.00	0.33	0.01 \rightarrow 0.99
1	0.88	13.45	1.00	0.36	0.5	0.39	21.17	0.00	0.17	0.99 \rightarrow 0.01

Table S15: **Performance of the boundary-crosser method under non-uniform fossil recovery.** For speciation and extinction the true parameter value is shown, along with the average point estimate (indicated by the $\hat{}$ symbol), percentage (%) error, consistency and precision. The sampling scenario is shown with the arrow indicating increased or decreased sampling towards the present.

speciation					extinction					sampling
λ	$\hat{\lambda}$	% error	coverage	precision	μ	$\hat{\mu}$	% error	coverage	precision	P_S
1	0.68	31.84	0.00	0.41	0.5	0.39	26.92	1.00	0.41	0.01 \rightarrow 0.99
1	1.11	12.03	1.00	0.37	0.5	0.43	16.12	1.00	0.25	0.99 \rightarrow 0.01

Table S16: **Performance of the three-timer method under non-uniform fossil recovery.** For speciation and extinction the true parameter value is shown, along with the average point estimate (indicated by the $\hat{}$ symbol), percentage (%) error, consistency and precision. The sampling scenario is shown with the arrow indicating increased or decreased sampling towards the present, along with average point estimate and precision.

speciation					extinction					sampling		
λ	$\hat{\lambda}$	% error	consistency	precision	μ	$\hat{\mu}$	% error	consistency	precision	P_S	\hat{P}_S	precision
1	0.51	54.22	1.00	1.29	0.5	0.54	58.01	1.00	1.28	0.01 \rightarrow 0.99	0.48	0.51
1	1.18	18.34	1.00	0.47	0.5	0.45	20.89	1.00	0.45	0.99 \rightarrow 0.01	0.87	0.11

Table S17: **Proportion of the total number of species included in the estimation of speciation and extinction rates.** Results are shown for different turnover (r) and sampling scenarios (P_S) averaged across 100 simulation replicates. Grey shaded cells highlight results obtained at the lowest sampling level (per interval sampling probability $P_S = 0.1$).

Simulations		Proportion of total diversity					
r	P_S	FBD ($\rho = 1$)	FBD ($\rho = 0$)	BD	Per-taxon rates	Boundary-rates	Three-timer
0.1	0.10	1.00	0.29	0.29	0.29	0.27	0.16
0.1	0.50	1.00	0.71	0.71	0.71	0.69	0.64
0.1	0.99	1.00	0.87	0.87	0.87	0.86	0.86
0.5	0.10	1.00	0.33	0.33	0.33	0.19	0.13
0.5	0.50	1.00	0.73	0.73	0.73	0.54	0.51
0.5	0.99	1.00	0.88	0.88	0.88	0.73	0.73
0.9	0.10	1.00	0.41	0.41	0.41	0.06	0.06
0.9	0.50	1.00	0.79	0.79	0.79	0.21	0.20
0.9	0.99	1.00	0.89	0.89	0.89	0.33	0.33

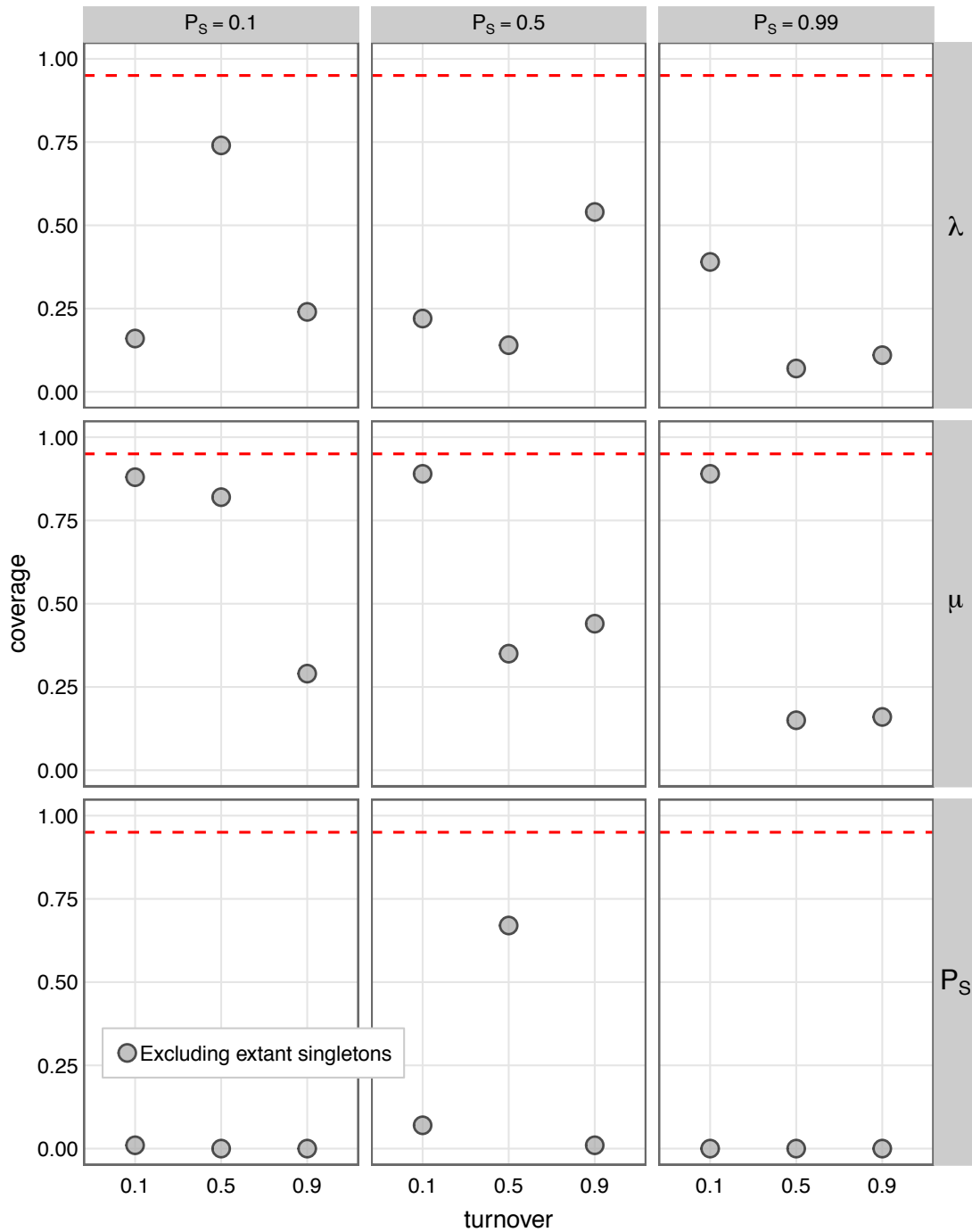


Figure S1: **Performance of the BD model obtained for different turnover and sampling scenarios assuming only sampled-in-bin data is available.** This model assumes that each species has been sampled at least once; in addition sampled-in-bin data is a violation of the Poisson sampling process. Analysis using this model always excludes extant singletons ($\rho = 0$). Each row shows results obtained for speciation (λ), extinction (μ) and sampling (P_S). Each column shows results obtained at different levels (per interval sampling probability $P_S = 0.1, 0.5$ or 0.99). For each box the x-axis represents turnover and the y-axis represents coverage (the proportion simulation replicates out of 100 that contain the true value). The dashed line highlights the 0.95 coverage level.

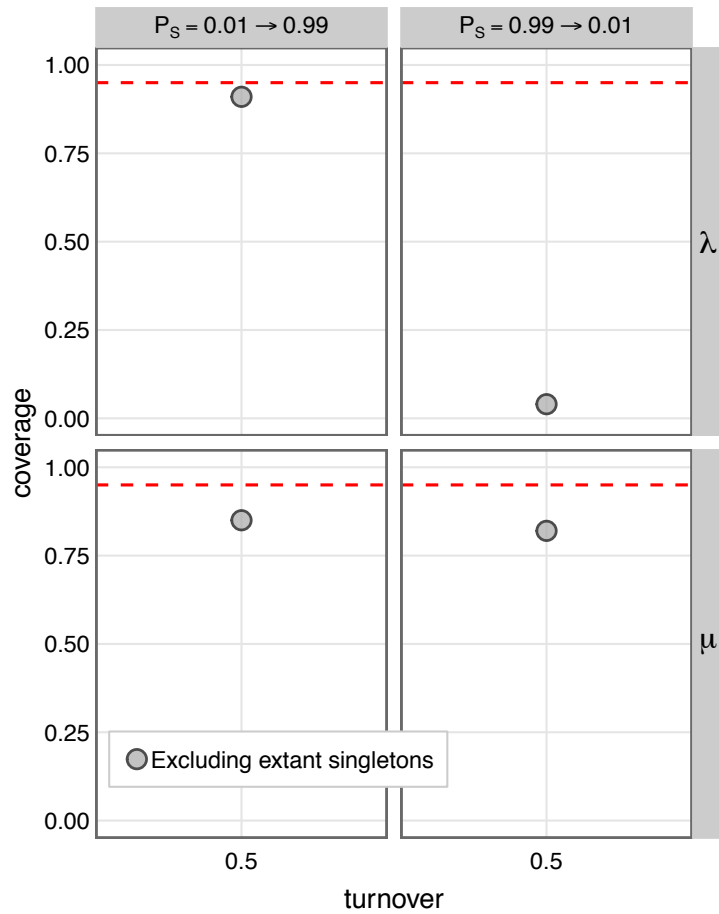


Figure S2: **Performance of the BD model obtained under non-uniform fossil recovery assuming the number of fossil samples is known.** This model assumes that each species has been sampled at least once; in addition non-uniform fossil sampling is a violation of the constant Poisson sampling process. Analysis using this model always excludes extant singletons ($\rho = 0$). Rows show results obtained for speciation (λ) and extinction (μ). Columns show results obtained under different non-uniform sampling scenarios (sampling increases ($0.01 \rightarrow 0.99$) or decreases ($0.99 \rightarrow 0.01$) linearly towards present). In each box the x-axis represents turnover and the y-axis represents coverage (the proportion simulation replicates out of 100 that contain the true value). The dashed line highlights the 0.95 coverage level.

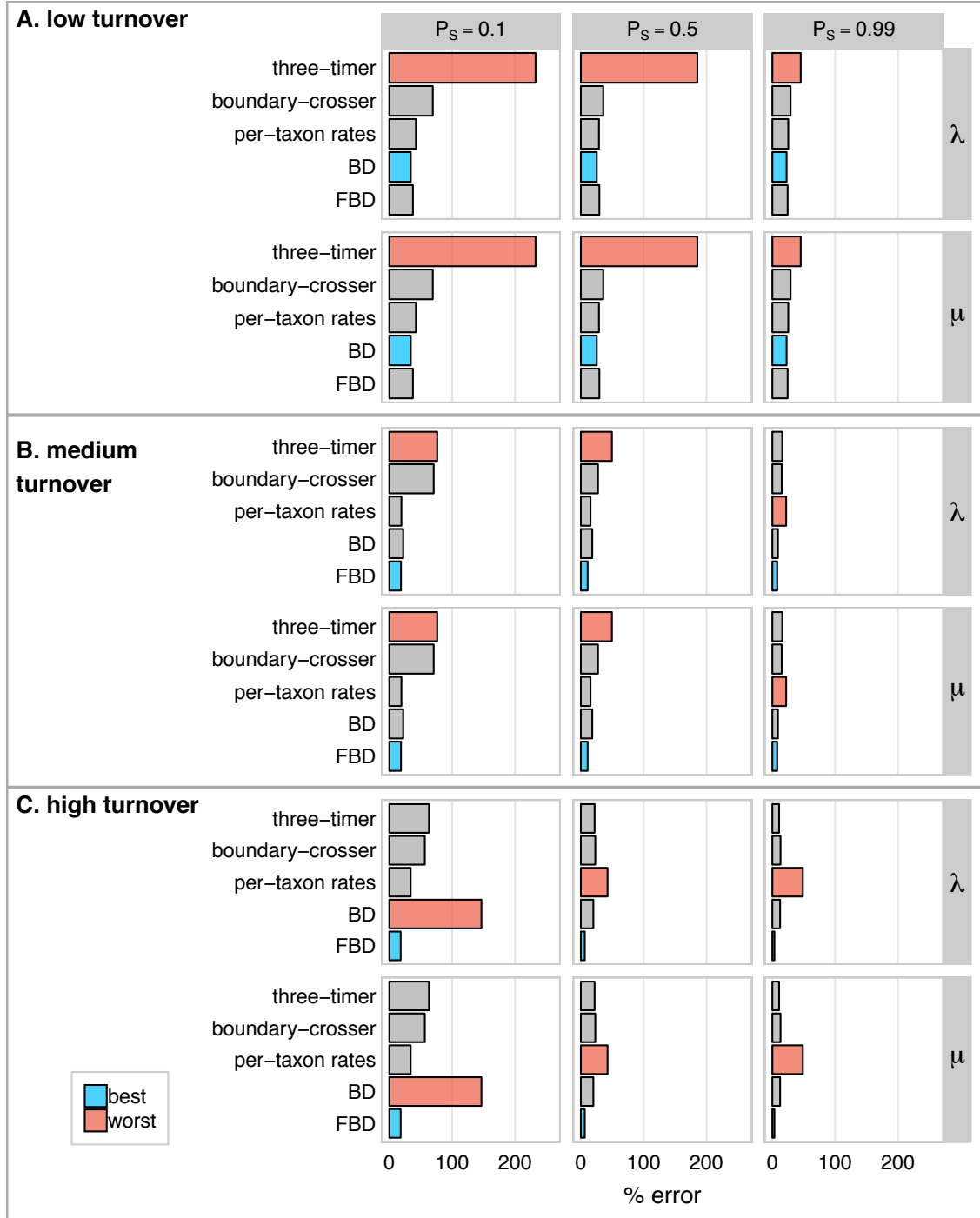


Figure S3: **Comparison between different methods assuming the number of fossil samples is known.** Results are shown for low (**A.** $r = 0.1$), medium (**B.** $r = 0.5$) and high (**C.** $r = 0.9$) turnover. Each column shows results obtained at different sampling probabilities (per interval sampling probability $P_S = 0.1, 0.5$ or 0.99). For each box the y-axis represents the percentage error of the median estimate (BD and FBD approaches) or the point estimate (all other approaches) averaged across 100 replicates. The best (lowest) and worst (highest) percentage error are highlighted for each turnover and sampling scenario. Analysis using the FBD model excludes extant singletons ($\rho = 0$). Results obtained including extant singletons are shown in Fig. [7](#)

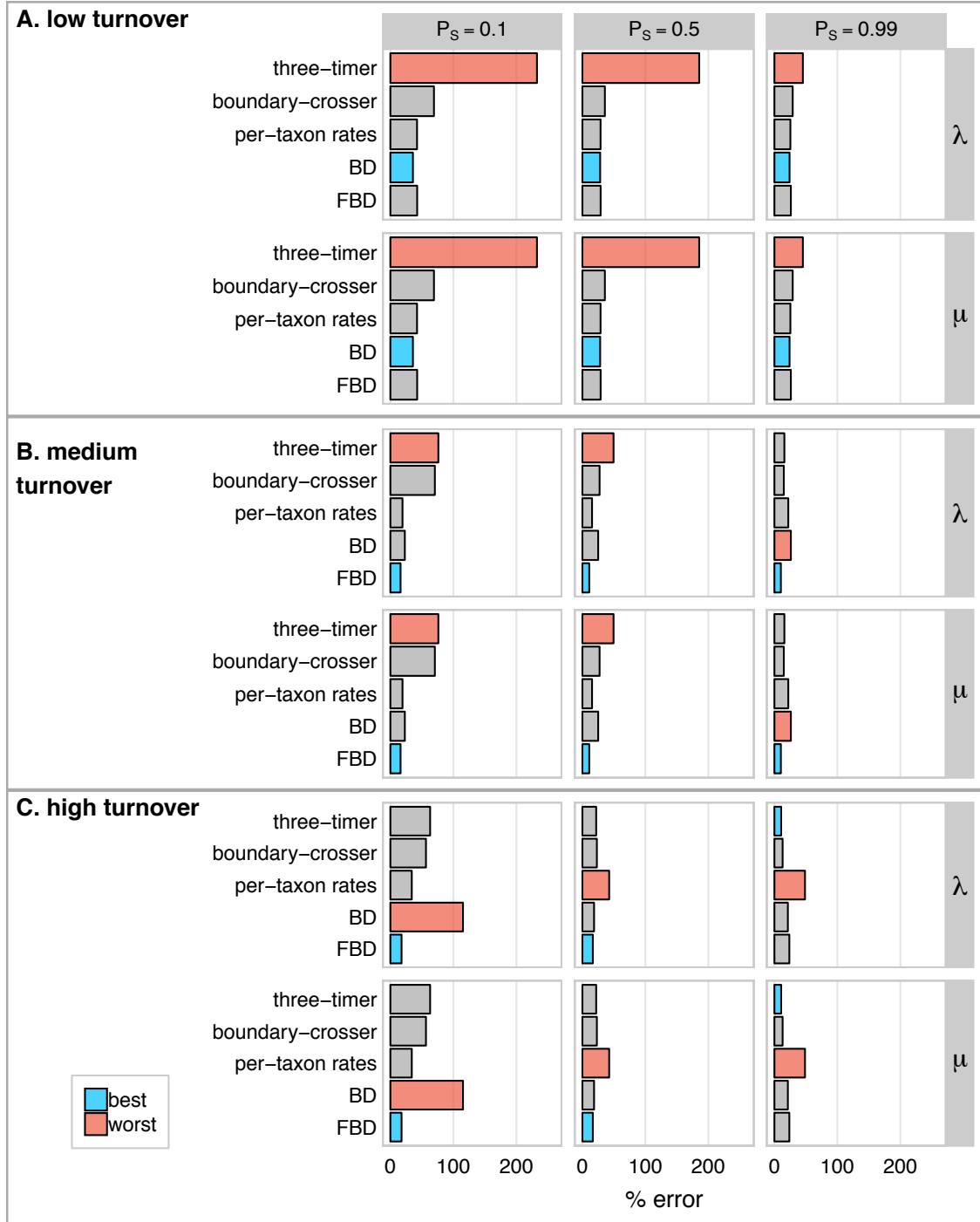


Figure S4: **Comparison between different methods assuming the number of fossil samples not known.** Results are shown for low (**A.** $r = 0.1$), medium (**B.** $r = 0.5$) and high (**C.** $r = 0.9$) turnover. Each column shows results obtained at different sampling probabilities (per interval sampling probability $P_S = 0.1, 0.5$ or 0.99). For each box the y-axis represents the percentage error of the median estimate (BD and FBD approaches) or the point estimate (all other approaches) averaged across 100 replicates. The best (lowest) and worst (highest) percentage error are highlighted for each turnover and sampling scenario. Analysis using the FBD model excludes extant singletons ($\rho = 0$). Results obtained including extant singletons are shown in Fig. [8](#).

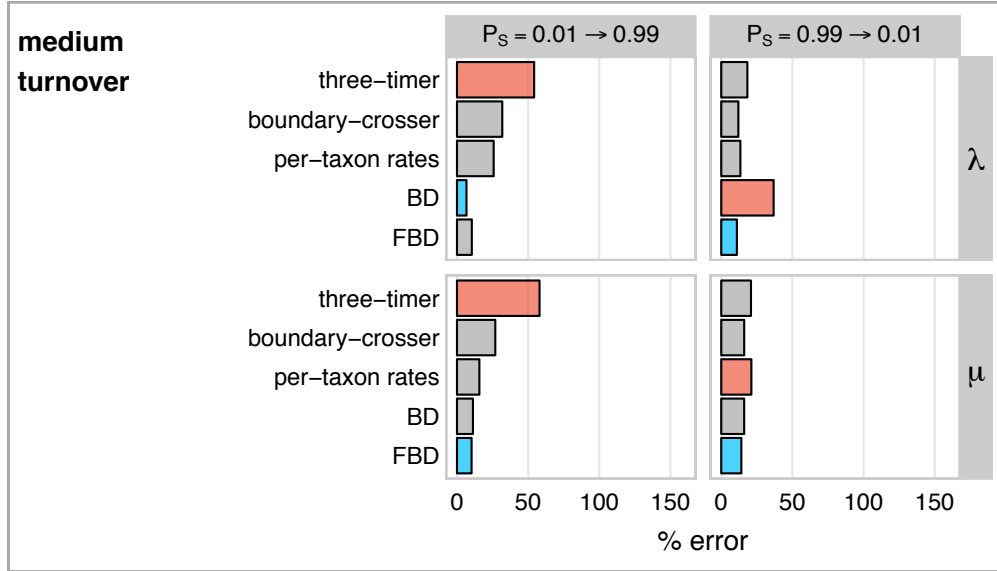


Figure S5: **Comparison between different approaches to estimating speciation (λ) and extinction (μ) rates under non-uniform fossil recovery assuming the number of fossil samples is known.** Results are shown for medium ($r = 0.5$) turnover. Each column shows results obtained obtained under different non-uniform sampling scenarios (sampling increases ($0.01 \rightarrow 0.99$) or decreases ($0.99 \rightarrow 0.01$) linearly towards present). For each box the y-axis represents the percentage error of the median estimate (BD and FBD approaches) or the point estimate (all other approaches) averaged across 100 simulation replicates. The best (lowest) and worst (highest) percentage error are highlighted for each turnover and sampling scenario. Analysis using the FBD model excludes extant singletons ($\rho = 0$).