Appendix A: Tables and figures describing parameter values used for simulations, convergence diagnostics, and forecast performance of all methods.

Table A1. Parameter value ranges used in the simulations. All parameters were sampled uniformly from the specified ranges.

Parameter	Values
a_1	3.5 to 6.5
a_2	0.07 to 0.13
b_1	2.1 to 3.9
b_2	1.4 to 2.6
d_1	0.28 to 0.52
d_2	0.007 to 0.013
F	0.025 to 0.075
σ	0.05 to 0.15
θ	0 to 500
dt	0.1

Table A2. Average forecast percent error of all simulation runs, for all forecasting methods and treatment types. The number in the parentheses is the number of species used to fit the model.

Forecast method	Overall	No noise	Low noise	High noise	Short series	Long series	Low harvest	High harvest
MS-Map (1)	29.6%	12.7%	23.9%	33.8%	29.6%	28.2%	29.6%	28.2%
MS-Map (2)	18.3%	11.3%	14.1%	22.5%	19.7%	15.5%	19.7%	15.5%
MS-Map (3)	15.5%	9.9%	11.3%	21.1%	16.9%	14.1%	16.9%	14.1%
Schaefer (1)	45.1%	40.8%	40.8%	49.3%	45.1%	45.1%	45.1%	45.1%
LV3 (1)	45.1%	49.3%	46.5%	45.1%	46.5%	45.1%	45.1%	46.5%
LV3 (2)	45.1%	49.3%	46.5%	43.7%	46.5%	43.7%	43.7%	45.1%
LV3 (3)	40.8%	38.0%	39.4%	43.7%	40.8%	42.3%	40.8%	42.3%
HP (1)	32.4%	0.0%	22.5%	39.4%	33.8%	31.0%	31.0%	33.8%
HP (2)	29.6%	0.0%	19.7%	38.0%	28.2%	28.2%	28.2%	29.6%
HP (3)	16.9%	0.0%	8.5%	25.4%	8.5%	22.5%	16.9%	18.3%

Table A3. Initial parameter values used for the LV5 MCMC fitting routine. Initial conditions for species X_1, X_2, X_3 were set to the correct values. The standard deviation of the observation error and process noise were initiated at 0.3.

Parameter	X_1	X_2	X_3	X_4	X_5
$x_{i,1}$	*	*	*	3	3
$a_{j\neq i}$	1.0	1.0	1.0	1.0	1.0
$a_{j=i}$	4.0	4.0	4.0	4.0	4.0
r	1.0	1.0	1.0	1.0	1.0
K	5	5	14	5	5

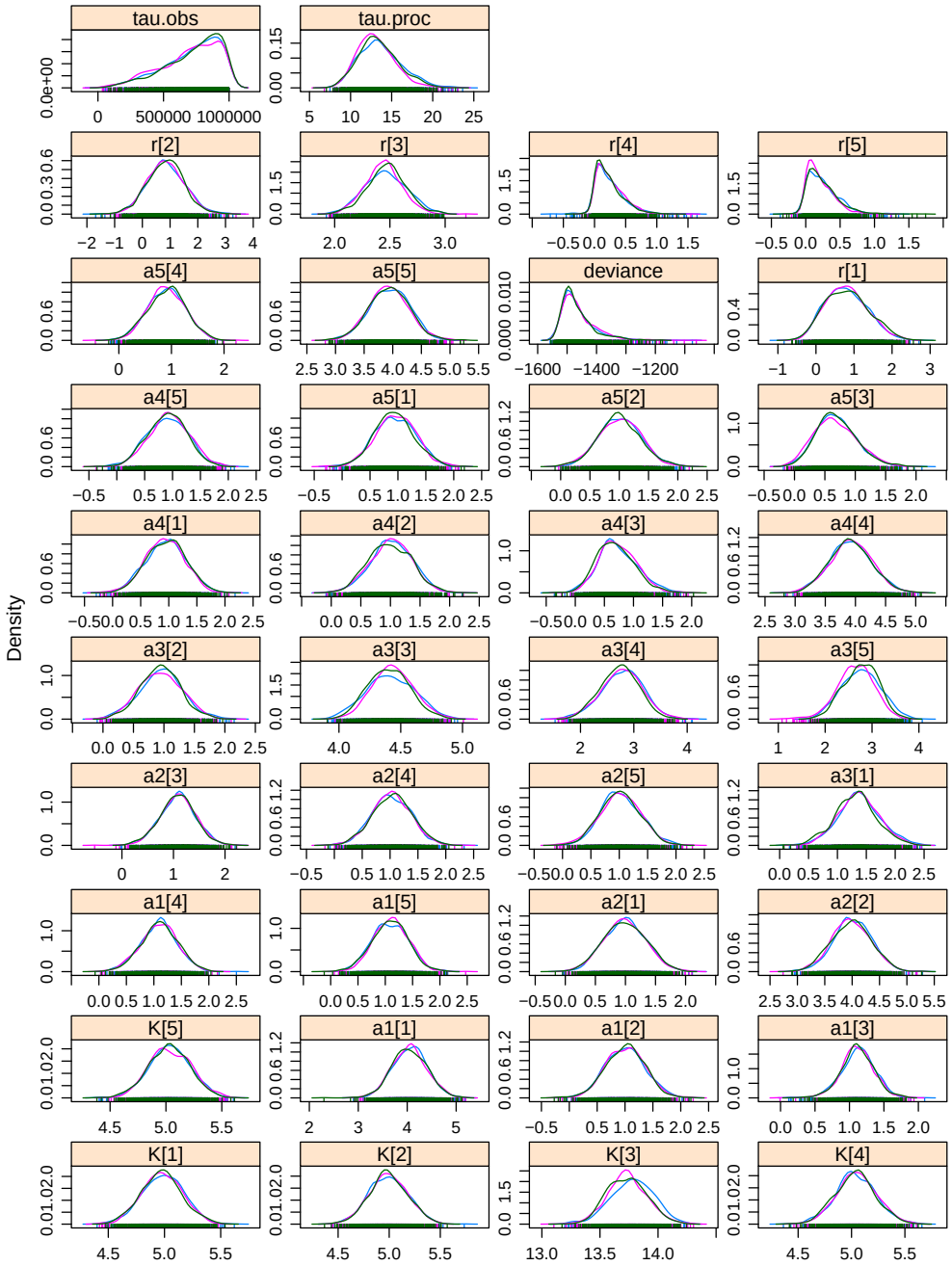

Figure A1. Example of posterior probability distributions for all parameters in the LV5 state-space model. The three lines in each plot represent the three MCMC chains.

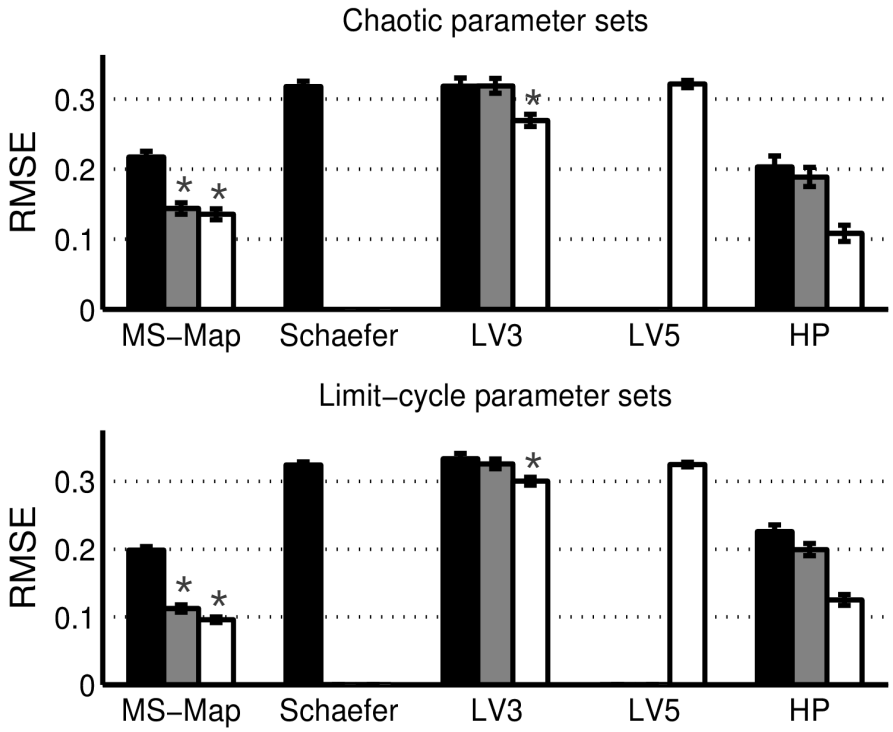

Figure A2. Average 3-step ahead RMSE of all forecasting methods for all simulations with noise, partitioned by chaotic parameter sets (top-panel) and limit-cycle parameter sets (bottom-panel). Significant differences in median RMSE were tested using a Mann-Whitney U-test and are denoted by an asterisk ($p < 0.05$). Using Levene's test, no significant differences were found in RMSE variance across chaotic vs limit cycle parameter sets. LV3 is the Lotka-Volterra three-species model, LV5 is the Lotka-Volterra five-species model, and HP is the Hastings-Powell (control) model. Black, gray and white bars are the model fit using time series from one, two, and three species, respectively.