Supporting Information S4: Detailed results

Supporting Information for *How do MAR(1) models cope with hidden nonlinearities in ecological dynamics?* Grégoire Certain, Frédéric Barraquand and Anna Gårdmark, ***Methods in Ecology and Evolution***.

1 Correlations between MAR(1) fitted parameters and mechanistic parameters

For each simulation experiment, correlations between the mechanistic parameters of the data-generating model on the one hand, and both fitted **B** matrix elements as well as Granger causality measures (e.g., Detto et al. 2012) on the other hand have been systematically computed and plotted. Scatterplots of these relationships can be seen by running the code in Supporting Information S3, and the Figure S4.1 below provides one example.

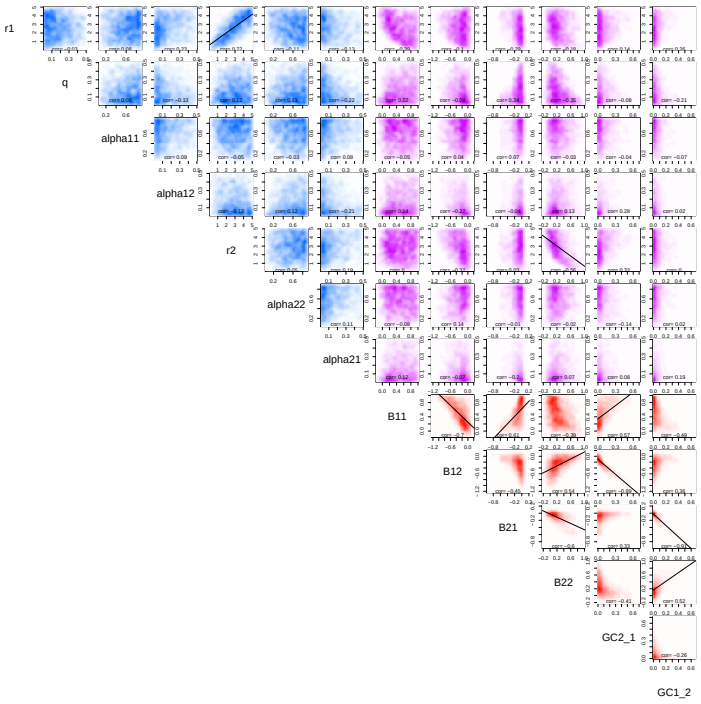

Figure S4.1: Correlations between MAR(1) fitted parameters and 1000 simulations obtained with a Beverton-Holt data generating model. Each simulation has a unique parameter set, and process error on species 1, σ_1^2, equals 0.1. Shade intensity corresponds to point density, and color indicates the type of correlation (blue: among mechanistic parameters; red: among fitted parameters, and purple, mechanistic parameters vs fitted parameters). Regression lines have been drawn when Pearson correlation coefficient was >0.5.

2 Approximation of the Jacobian matrix J by B

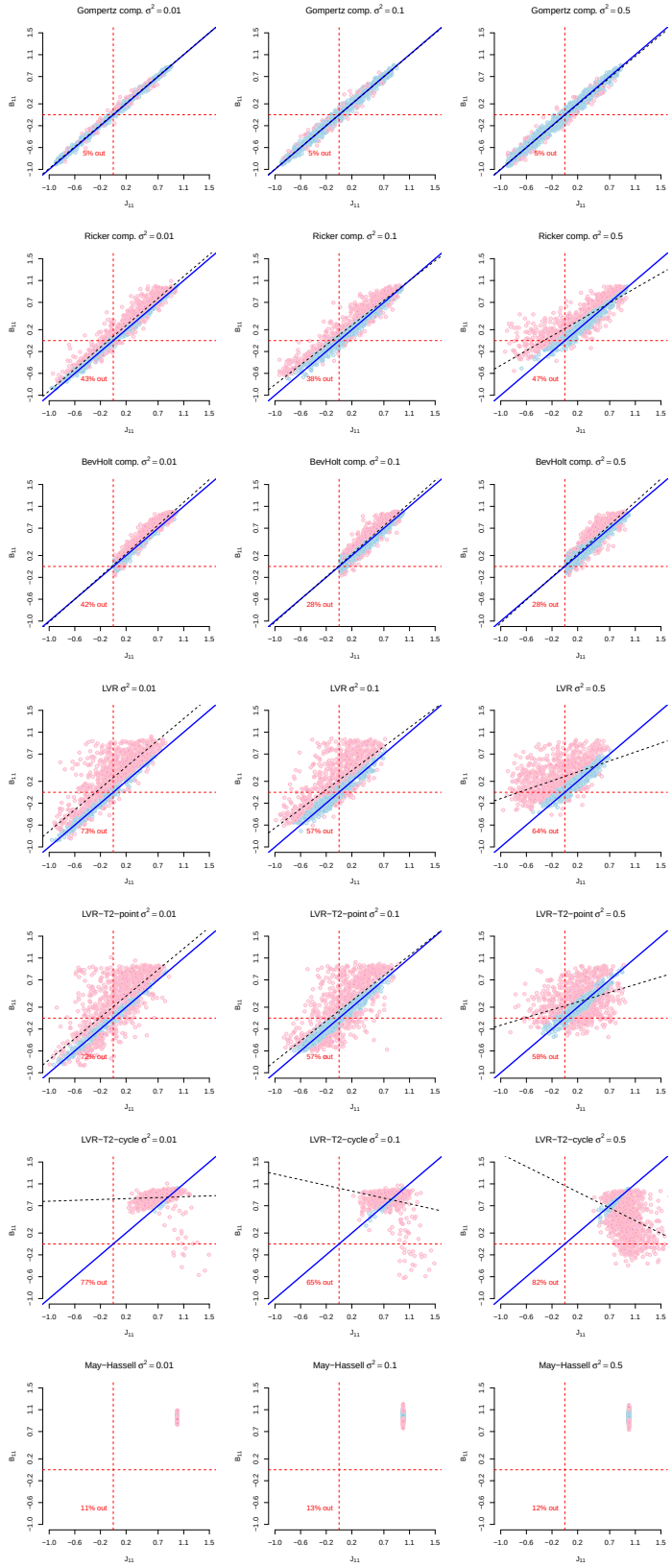

Figure S4.2: Relationship between **J** (x-axis) versus **B** (y-axis) upper-left element across 1000 simulations, for all data generating models (rows) and process error intensities (columns). A dot corresponds to a simulation with a unique parameter set. Dot color indicates whether the true value of the **J** element lies within (blue) or outside (red) the confidence interval provided by the **B** estimate. The blue thick line shows perfect match, while the dashed line shows actual regression between **B** and **J.** Red dashed lines intersect at the origin.

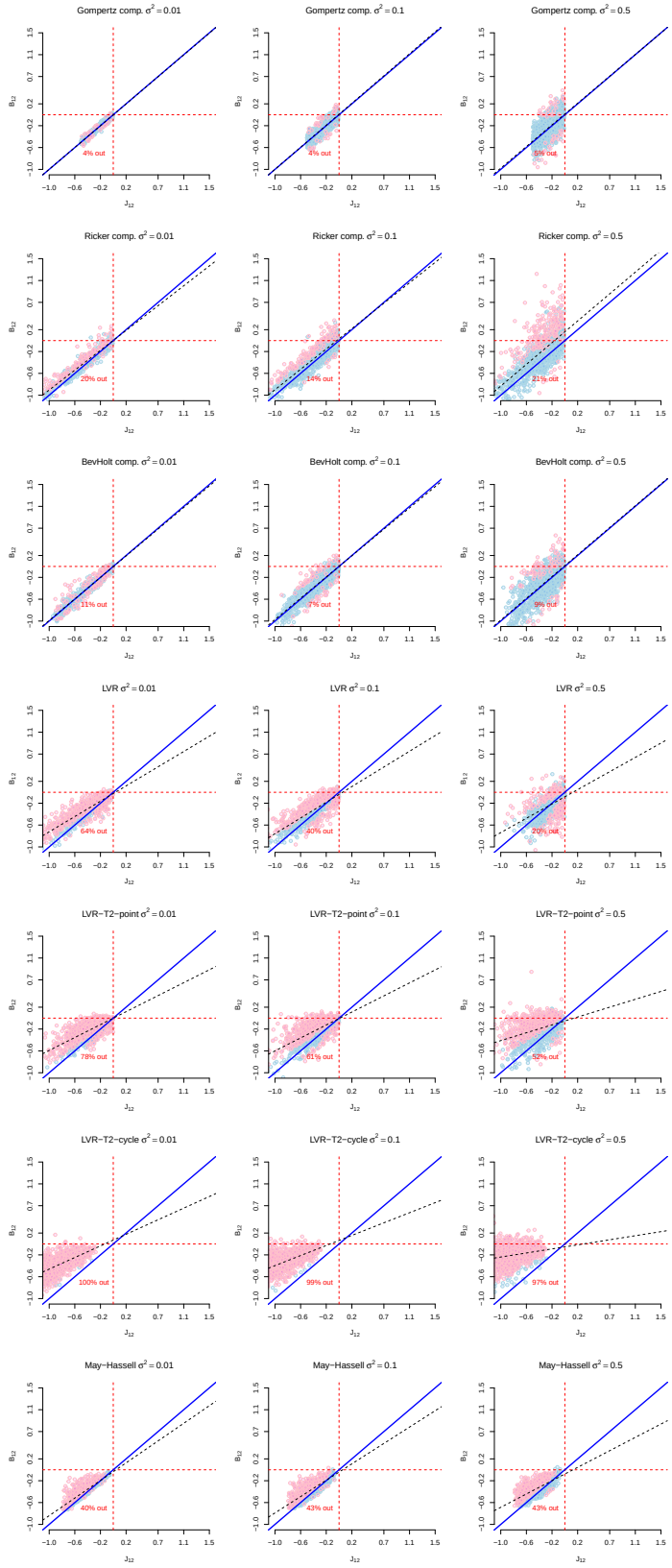

Figure S4.3: Relationship between **J** (x-axis) versus **B** (y-axis) upper-right element across 1000 simulations, for all data generating models (rows) and process error intensities (columns). A dot corresponds to a simulation with a unique parameter set. Dot color indicates whether the true value of the **J** element lies within (blue) or outside (red) the confidence interval provided by the **B** estimate. The blue thick line shows perfect match, while the dashed line shows actual regression between **B** and **J.** Red dashed lines intersect at the origin.

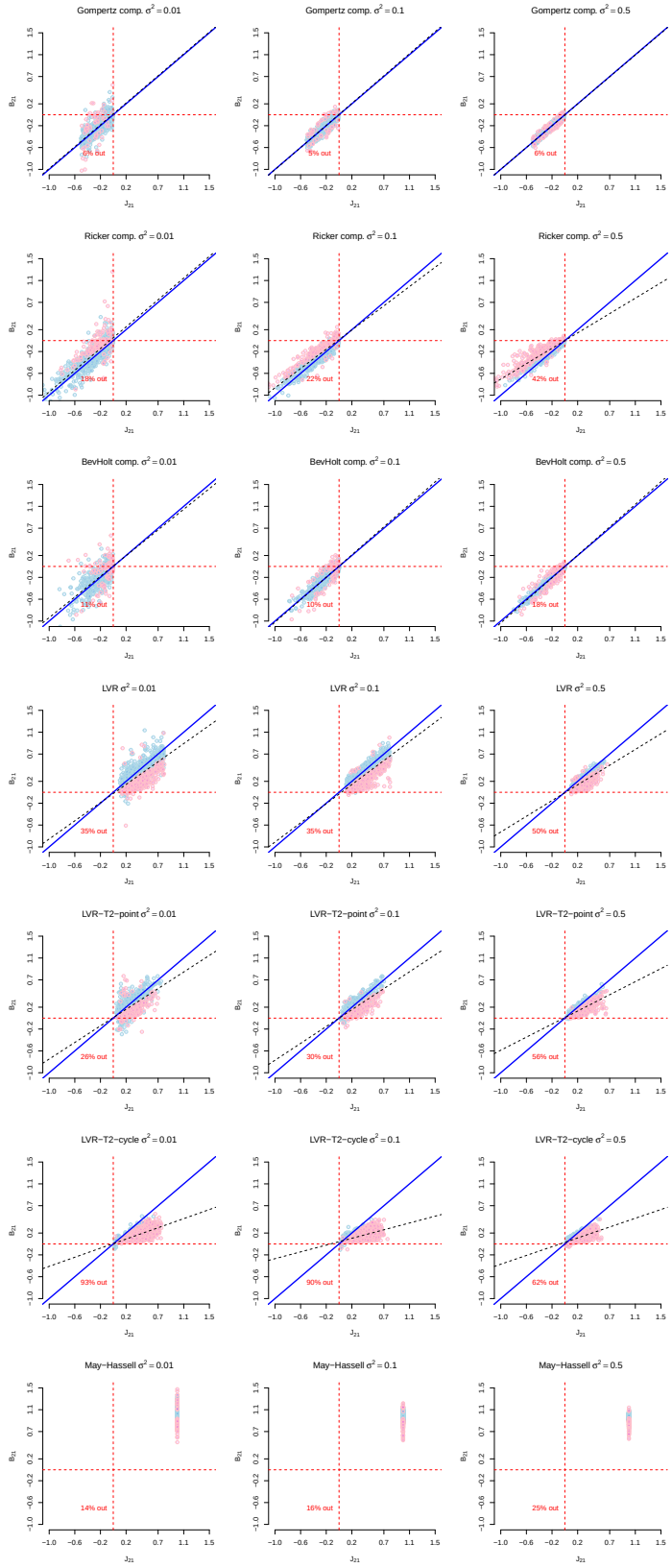

Figure S4.4: Relationship between **J** (x-axis) versus **B** (y-axis) lower-left element across 1000 simulations, for all data generating models (rows) and process error intensities (columns). A dot corresponds to a simulation with a unique parameter set. Dot color indicates whether the true value of the **J** element lies within (blue) or outside (red) the confidence interval provided by the **B** estimate. The blue thick line shows perfect match, while the dashed line shows actual regression between **B** and **J.** Red dashed lines intersect at the origin.

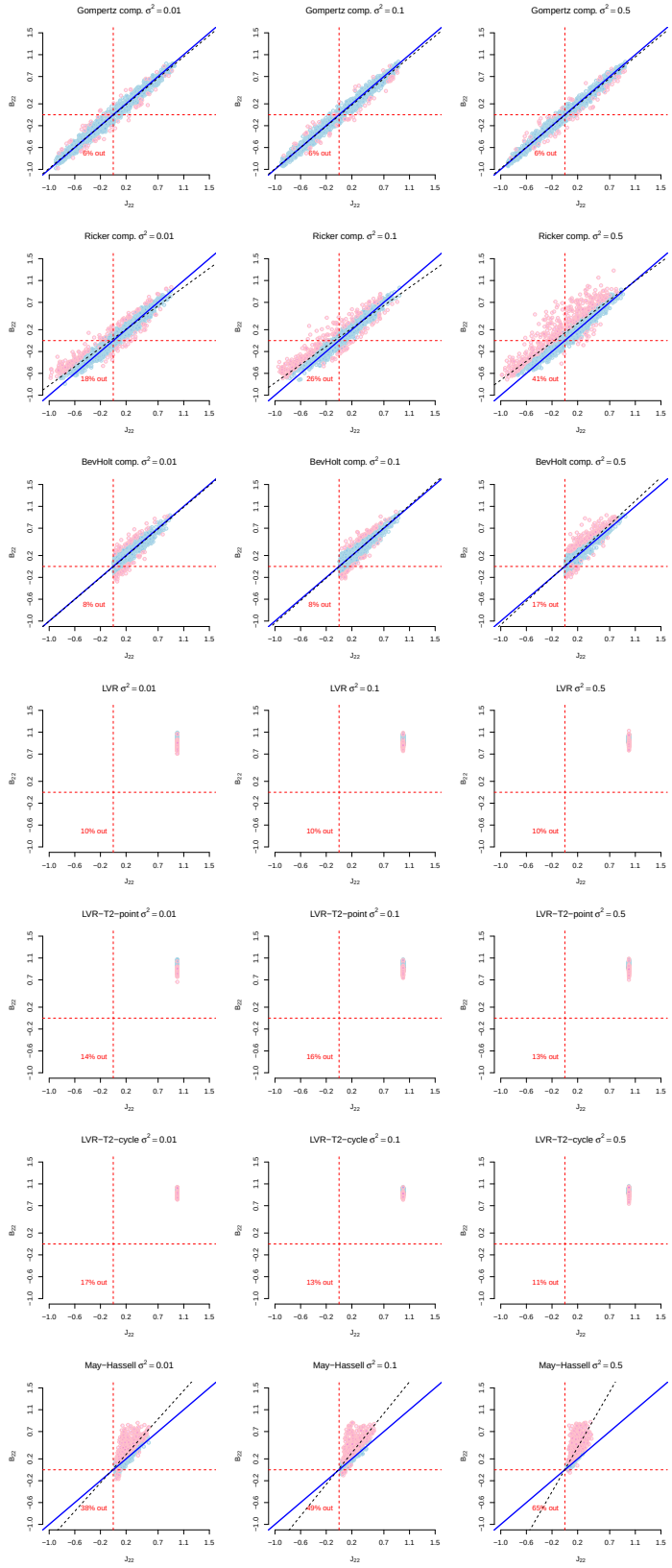

Figure S4.5: Relationship between **J** (x-axis) versus **B** (y-axis) lower-right element across 1000 simulations, for all data generating models (rows) and process error intensities (columns). A dot corresponds to a simulation with a unique parameter set. Dot color indicates whether the true value of the **J** element lies within (blue) or outside (red) the confidence interval provided by the **B** estimate. The blue thick line shows perfect match, while the dashed line shows actual regression between **B** and **J.** Red dashed lines intersect at the origin.

3 Long-term PRESS predictions

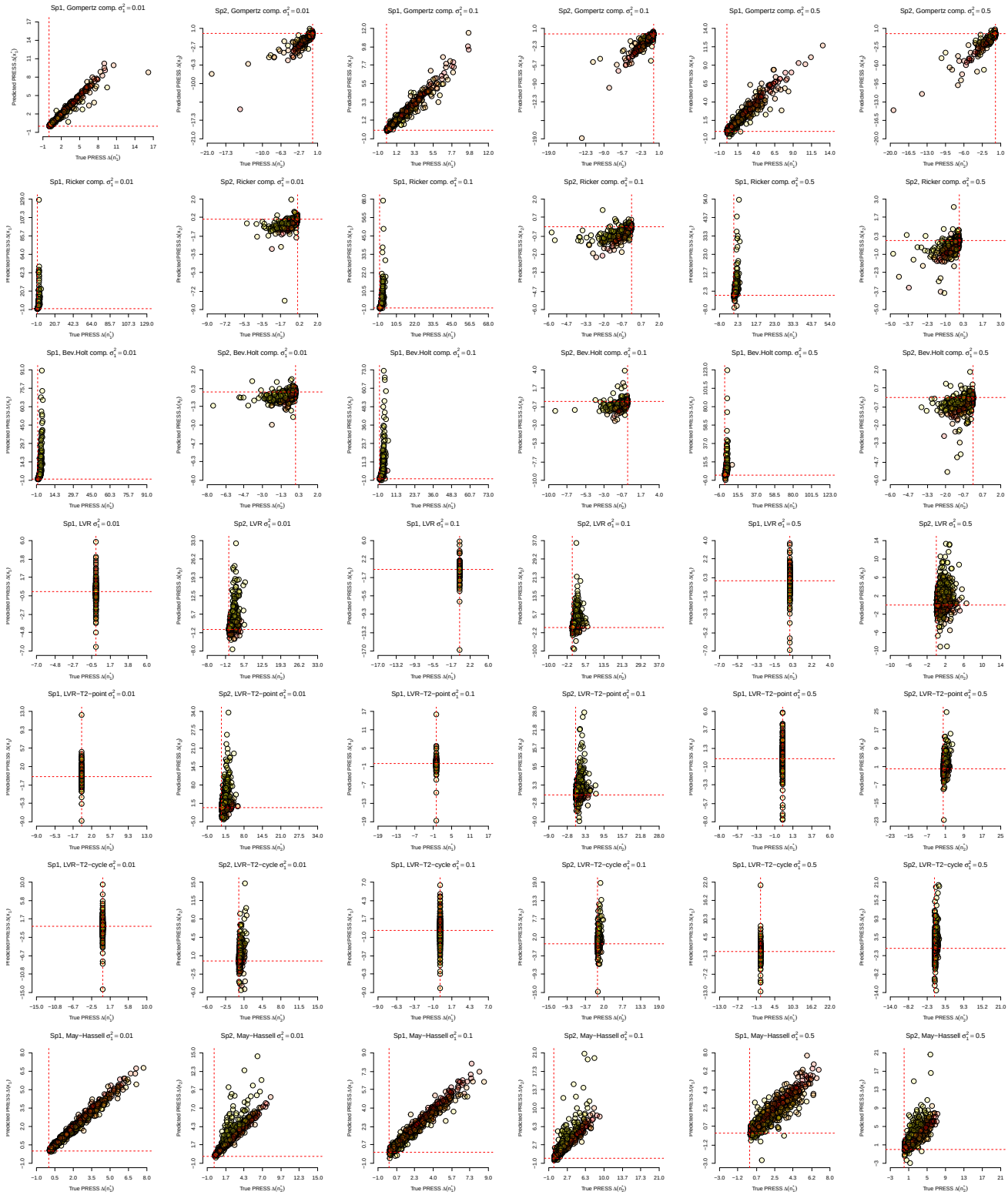

Figure S4.6: The figure shows, for all species (Sp), process error intensities (columns) and all data generating models (rows), the relationship between the true change triggered by a PRESS perturbation (x-axis) and the predicted change from a fitted MAR(1) model according to eq. 3 in the main paper (y-axis). The colorscale for dots is the same as Fig. 4 of the article. It illustrates the distance between the true change and the median prediction in terms of inter-quantile range: yellow corresponds to 0.5, which means that the true change lies beyond the 95% prediction interval derived from the bootstrapped distribution of the predictions and red corresponds to 0.5, which means that the median of the boostrapped predictions and the true change are the same.

4 Process error estimate across the data-generating models

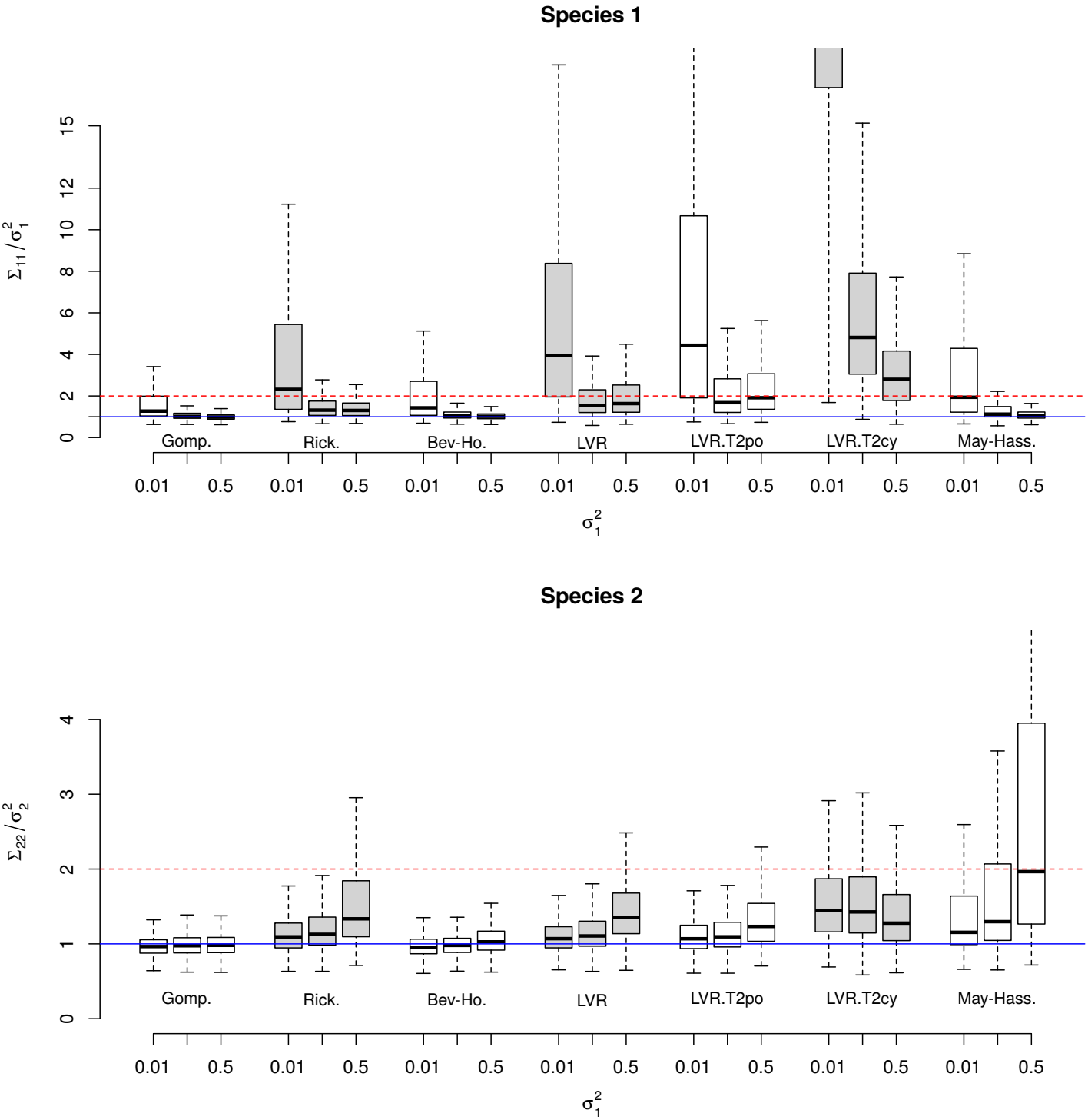

Figure S4.7: These boxplots display, for each data-generating model and each intensity of simulated process error on species 1 (σ_1^2, x-axis), the distribution range across 1000 simulations of the ratio of fitted versus simulated process error (Σ_{xx}/σ_x^2). The blue horizontal line corresponds to a ratio of 1, that is, perfect estimate. The red dashed line corresponds to a ratio of 2, that is, when fitted process error is twice as high as the one used to simulate the data. Inflated (>1) ratio is observed when (i) the simulated dynamics is other than Gompertz and (ii) the focal species has lower simulated process error than the non-focal species (recall that in our simulation setting, σ_1^2varies from 0.01 to 0.5 but $\sigma_2^2$is kept constant at 0.1).

5 Sensitivity analysis with respect to Time Series Length

Time Series Length = 25

Data-generating model:		Gompertz			Ricker			Beverton-Holt			LVR-simple			LVR-T2-point			LVR-T2-cycle			May-Hassell		
process error on species 1:		*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*
evaluation criterion																						
Corr. between b_{11} and j_{11}		0.98	0.95	0.93	0.91	0.88	0.76	0.89	0.84	0.74	0.78	0.73	0.47	0.73	0.69	0.41	-0.03	-0.18	-0.21	constant Jacobian value		
Corr. between b_{12} and j_{12}		0.87	0.60	0.32	0.91	0.78	0.56	0.89	0.71	0.47	0.78	0.59	0.24	0.66	0.53	0.27	0.51	0.38	0.16	0.89	0.77	0.61
Corr. between b_{21} and j_{21}		0.48	0.66	0.86	0.66	0.80	0.85	0.48	0.69	0.82	0.45	0.60	0.60	0.40	0.55	0.66	0.48	0.52	0.69	constant Jacobian value		
Corr. between b_{22} and j_{22}		0.93	0.93	0.95	0.84	0.85	0.80	0.62	0.67	0.67	constant Jacobian value									0.66	0.69	0.68
median of b_{11} - j_{11}		0.02	0.00	-0.03	0.04	0.01	0.00	0.03	-0.02	-0.05	0.09	0.06	0.10	0.00	-0.05	-0.16	0.03	-0.06	-0.76	-0.01	-0.04	-0.07
median of b_{12} - j_{12}		0.00	0.02	0.06	0.02	0.07	0.17	-0.01	0.00	0.01	0.05	-0.02	-0.15	0.09	0.06	0.03	0.32	0.36	0.47	0.02	0.05	0.06
median of b_{21} - j_{21}		0.02	0.00	0.01	0.07	0.06	0.05	0.03	0.02	0.00	-0.06	-0.07	-0.07	-0.04	-0.05	-0.06	-0.17	-0.13	-0.07	0.01	-0.01	-0.02
median of b_{22} - j_{22}		-0.07	-0.04	-0.04	-0.03	0.01	0.05	-0.10	-0.09	-0.06	-0.11	-0.13	-0.12	-0.14	-0.13	-0.12	-0.05	-0.04	-0.09	0.03	0.04	0.06
% of j_{11} out of c.i.95% of b_{11}		5.20	5.90	8.80	30.20	23.20	21.00	19.80	15.20	15.40	37.60	26.70	27.60	40.70	31.50	39.60	38.90	40.90	78.60	3.20	6.40	7.90
% of j_{12} out of c.i.95% of b_{12}		3.30	7.00	8.20	10.40	9.40	14.60	6.20	8.40	10.30	41.00	22.70	19.00	48.10	27.90	18.60	71.60	63.00	43.40	17.30	19.40	18.70
% of j_{21} out of c.i.95% of b_{21}		7.50	7.70	5.90	13.40	14.60	20.30	12.40	12.50	16.60	15.10	15.70	24.10	11.60	14.30	22.30	53.90	47.80	29.20	5.30	5.20	3.00
% of j_{22} out of c.i.95% of b_{22}		8.80	8.00	8.00	12.20	10.80	21.00	12.30	10.90	11.40	15.10	13.80	17.70	21.60	19.70	16.40	8.10	7.60	16.70	18.00	22.00	29.20
% of j11 correctly ranked		77.90	75.50	67.50	72.20	70.10	65.10	79.50	75.20	69.60	60.10	61.40	47.70	55.50	57.60	48.10	69.10	67.60	38.10	Ties in the Jacobian		
% of j12 correctly ranked		67.00	61.70	47.40	68.70	66.20	49.90	77.00	69.30	59.10	82.30	78.50	64.40	71.70	72.90	72.90	95.20	92.10	78.30	96.80	97.90	98.50
% of j21 correctly ranked		61.40	62.70	60.00	61.40	62.50	60.50	53.90	56.80	56.10	64.60	76.10	65.00	63.50	70.60	60.80	83.20	80.60	60.00	Ties in the Jacobian		
% of j22 correctly ranked		72.00	72.90	69.50	63.40	66.20	54.40	58.10	57.00	52.20	91.20	96.70	96.50	91.90	96.50	96.80	83.20	83.50	64.80	96.30	97.10	98.10
% of j11 correctly signed		95.10	92.60	89.90	91.70	86.60	81.70	95.70	89.20	87.00	80.20	77.90	68.20	80.30	77.10	65.60	96.20	90.60	67.50	100.00	100.00	100.00
% of j12 correctly signed		93.90	83.70	67.80	92.60	82.80	66.10	93.60	82.20	68.70	92.50	92.70	84.10	88.30	84.20	82.20	98.30	95.60	83.30	99.80	98.30	97.80
% of j21 correctly signed		83.80	90.00	94.70	68.40	77.90	86.90	62.00	69.00	80.00	93.00	95.70	95.80	85.70	89.80	94.80	96.70	95.90	93.40	100.00	100.00	100.00
% of j22 correctly signed		88.50	88.90	91.30	83.60	84.00	82.60	69.80	67.40	69.60	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.90	83.40	89.00	93.70
% fitted **B** having a stable equilibrium		99.20	99.30	99.30	99.60	99.10	99.40	98.50	99.00	99.50	97.00	97.20	97.30	95.40	96.70	96.90	85.70	88.10	93.70	99.50	99.60	99.60
Corr. between max. eigen. of **B** and **J**		0.78	0.75	0.71	0.61	0.55	0.49	0.70	0.70	0.62	0.24	0.21	0.04	0.11	0.15	0.07	0.13	0.03	-0.05	0.81	0.69	0.59

Subjective color scale:	Best performing cases	Fairly Good	Some Issues	Less performing cases	irrelevant

Table S4.1: Same as Table 3 in the main manuscript, but with Time Series Length = 25 points

Time Series Length = 50

Data-generating model:		Gompertz			Ricker			Beverton-Holt			LVR-simple			LVR-T2-point			LVR-T2-cycle			May-Hassell		
process error on species 1:		*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*
evaluation criterion																						
Corr. between b_{11} and j_{11}		0.99	0.98	0.97	0.96	0.92	0.81	0.94	0.90	0.84	0.83	0.78	0.45	0.73	0.69	0.36	-0.13	-0.24	-0.27	constant Jacobian value		
Corr. between b_{12} and j_{12}		0.95	0.76	0.50	0.95	0.89	0.66	0.94	0.84	0.58	0.85	0.77	0.41	0.70	0.67	0.28	0.53	0.55	0.25	0.88	0.81	0.70
Corr. between b_{21} and j_{21}		0.72	0.84	0.94	0.80	0.87	0.87	0.64	0.82	0.91	0.62	0.74	0.72	0.51	0.68	0.76	0.53	0.53	0.67	constant Jacobian value		
Corr. between b_{22} and j_{22}		0.97	0.97	0.97	0.91	0.93	0.85	0.79	0.82	0.81	constant Jacobian value									0.68	0.73	0.76
median of b_{11} - j_{11}		0.01	0.00	-0.02	0.06	0.05	0.07	0.03	0.02	0.01	0.15	0.13	0.21	0.08	0.02	-0.04	0.08	0.04	-0.55	-0.01	-0.03	-0.05
median of b_{12} - j_{12}		0.00	0.00	0.02	0.03	0.06	0.16	-0.01	0.01	0.04	0.05	0.03	-0.05	0.09	0.10	0.14	0.42	0.43	0.57	0.03	0.05	0.08
median of b_{21} - j_{21}		0.01	0.00	0.00	0.05	0.04	0.06	0.01	0.01	0.00	-0.08	-0.06	-0.07	-0.06	-0.05	-0.06	-0.19	-0.18	-0.06	-0.02	-0.02	-0.03
median of b_{22} - j_{22}		-0.02	-0.02	-0.02	0.01	0.03	0.12	-0.04	-0.03	-0.01	-0.07	-0.06	-0.06	-0.07	-0.06	-0.06	-0.03	-0.03	-0.05	0.05	0.06	0.08
% of j_{11} out of c.i.95% of b_{11}		3.90	5.90	6.80	37.70	27.70	32.10	29.40	23.10	20.40	54.20	39.70	46.70	55.30	45.60	49.20	57.90	51.90	81.10	4.50	7.60	7.80
% of j_{12} out of c.i.95% of b_{12}		2.00	5.20	6.40	11.70	12.00	16.10	7.40	6.50	9.00	50.60	27.60	17.30	61.40	41.00	32.50	93.90	90.50	79.30	28.90	28.90	28.90
% of j_{21} out of c.i.95% of b_{21}		6.90	6.30	6.20	15.60	16.50	32.00	8.80	11.00	15.00	22.70	23.10	35.20	17.40	19.20	34.90	77.80	75.80	43.90	7.70	7.40	8.00
% of j_{22} out of c.i.95% of b_{22}		7.70	6.20	6.50	12.30	15.90	33.30	9.60	9.40	12.70	10.60	13.40	14.70	17.70	17.00	15.00	9.60	7.60	12.60	28.70	33.90	44.60
% of j11 correctly ranked		81.90	84.50	77.90	80.60	78.40	68.10	86.40	83.80	77.90	61.30	62.90	45.20	58.50	56.70	53.90	74.40	77.00	45.00	Ties in the Jacobian		
% of j12 correctly ranked		77.90	70.10	58.50	77.20	75.20	57.20	84.00	79.30	67.50	86.50	85.70	67.10	76.50	75.70	79.80	97.30	95.70	85.90	99.40	99.30	99.50
% of j21 correctly ranked		72.10	72.10	65.60	70.50	73.20	66.70	66.80	70.90	66.30	69.00	75.20	63.70	67.00	72.20	61.30	83.90	87.70	69.70	Ties in the Jacobian		
% of j22 correctly ranked		81.50	82.10	78.80	73.40	74.50	62.10	70.60	72.50	66.80	98.00	99.60	99.30	98.10	98.80	99.30	88.70	86.40	62.00	98.40	99.00	98.30
% of j11 correctly signed		96.80	94.90	93.00	93.20	91.30	83.20	96.60	95.50	93.70	83.00	82.90	63.10	80.50	78.10	67.80	97.60	95.50	81.00	100.00	100.00	100.00
% of j12 correctly signed		97.60	90.10	76.30	95.00	87.80	69.60	96.50	87.60	73.00	95.00	93.80	87.50	89.20	88.30	84.90	98.70	98.80	89.30	99.90	99.10	98.80
% of j21 correctly signed		87.70	92.60	96.20	80.30	83.80	89.10	70.70	78.50	86.40	96.10	98.90	98.80	89.80	96.20	98.10	98.40	99.00	97.90	100.00	100.00	100.00
% of j22 correctly signed		92.90	93.30	93.50	88.60	91.00	85.10	79.60	80.90	82.90	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	90.80	93.70	96.60
% fitted **B** having a stable equilibrium		99.70	99.80	99.80	99.30	99.80	99.90	99.30	99.70	99.50	97.90	98.10	98.30	96.80	98.10	97.80	94.70	95.90	96.00	100.00	99.80	100.00
Corr. between max. eigen. of **B** and **J**		0.90	0.88	0.84	0.71	0.68	0.54	0.83	0.83	0.76	0.46	0.46	0.25	0.30	0.33	0.20	0.01	-0.05	0.09	0.87	0.83	0.76

Subjective color scale:	Best performing cases	Fairly Good	Some Issues	Less performing cases	irrelevant

Table S4.2: Same as Table 3 in the main manuscript, but with Time Series Length = 50 points

Time Series Length = 200

Data-generating model:		Gompertz			Ricker			Beverton-Holt			LVR-simple			LVR-T2-point			LVR-T2-cycle			May-Hassell		
process error on species 1:		*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*
evaluation criterion																						
Corr. between b_{11} and j_{11}		1.00	1.00	0.99	0.98	0.96	0.86	0.97	0.96	0.95	0.81	0.79	0.47	0.77	0.72	0.46	0.11	-0.22	-0.29	constant Jacobian value		
Corr. between b_{12} and j_{12}		0.99	0.93	0.78	0.98	0.95	0.85	0.97	0.94	0.82	0.91	0.87	0.71	0.82	0.77	0.49	0.73	0.65	0.28	0.87	0.84	0.73
Corr. between b_{21} and j_{21}		0.87	0.96	0.99	0.91	0.96	0.92	0.84	0.96	0.97	0.74	0.81	0.67	0.70	0.79	0.78	0.71	0.64	0.64	constant Jacobian value		
Corr. between b_{22} and j_{22}		0.99	0.99	0.99	0.97	0.96	0.92	0.93	0.93	0.92	constant Jacobian value									0.77	0.81	0.80
median of b_{11} - j_{11}		0.00	0.00	0.00	0.08	0.09	0.14	0.04	0.04	0.07	0.31	0.24	0.38	0.26	0.15	0.14	0.13	0.10	-0.26	-0.01	-0.02	-0.04
median of b_{12} - j_{12}		0.00	0.00	0.01	0.03	0.05	0.14	0.00	0.01	0.02	0.09	0.07	0.03	0.14	0.14	0.23	0.50	0.55	0.69	0.03	0.05	0.08
median of b_{21} - j_{21}		0.00	0.00	0.00	0.05	0.05	0.06	0.01	0.01	0.00	-0.11	-0.09	-0.09	-0.07	-0.06	-0.08	-0.24	-0.23	-0.09	-0.03	-0.03	-0.05
median of b_{22} - j_{22}		-0.01	0.00	0.00	0.05	0.06	0.14	0.01	0.01	0.03	-0.03	-0.02	-0.01	-0.02	-0.02	-0.02	-0.03	-0.02	-0.01	0.05	0.07	0.13
% of j_{11} out of c.i.95% of b_{11}		6.20	4.40	5.10	59.00	51.20	61.30	49.40	38.10	38.70	85.00	73.60	82.50	81.70	70.60	68.10	85.10	82.20	84.20	22.60	21.20	23.10
% of j_{12} out of c.i.95% of b_{12}		3.40	5.70	5.80	29.70	21.70	30.10	14.80	8.40	8.10	79.80	59.00	30.50	87.00	79.70	74.30	100.00	100.00	99.70	51.30	48.20	51.60
% of j_{21} out of c.i.95% of b_{21}		7.10	4.80	5.60	29.80	32.90	56.50	11.10	12.80	21.40	48.90	50.90	72.20	39.90	42.20	72.30	98.70	95.90	75.70	22.40	27.90	44.40
% of j_{22} out of c.i.95% of b_{22}		5.30	5.00	5.90	25.80	33.10	57.60	8.90	11.20	21.40	19.70	14.80	12.50	16.60	14.70	13.10	35.10	28.90	10.20	44.60	59.00	75.70
% of j11 correctly ranked		91.00	91.60	88.60	87.90	87.00	79.80	93.90	92.80	92.40	53.60	57.80	35.00	58.00	58.70	54.80	78.30	81.30	59.60	Ties in the Jacobian		
% of j12 correctly ranked		85.40	83.50	76.30	87.90	84.40	72.20	92.20	90.10	84.10	88.70	88.70	65.80	85.70	84.60	87.70	99.30	98.20	95.00	100.00	99.90	100.00
% of j21 correctly ranked		82.50	84.70	80.00	83.70	84.10	73.90	87.20	85.50	82.60	63.00	68.00	49.70	65.50	71.70	59.70	87.50	90.60	90.80	Ties in the Jacobian		
% of j22 correctly ranked		90.90	90.70	88.50	85.70	83.40	78.30	89.30	88.10	89.70	97.80	98.90	99.90	98.00	99.60	100.00	90.20	89.60	63.30	98.50	98.70	97.00
% of j11 correctly signed		98.70	98.40	97.70	95.10	93.80	79.60	99.70	98.00	98.30	75.90	78.10	51.80	77.60	81.10	73.40	99.30	98.40	96.00	100.00	100.00	100.00
% of j12 correctly signed		99.50	95.60	89.90	97.50	92.20	74.10	98.40	95.50	87.80	97.90	97.80	92.30	94.30	92.30	88.30	99.70	99.00	94.00	100.00	99.90	99.90
% of j21 correctly signed		94.20	96.60	99.00	87.50	93.20	95.10	86.70	89.30	94.50	99.70	99.90	100.00	97.60	99.70	100.00	99.70	99.30	99.80	100.00	100.00	100.00
% of j22 correctly signed		96.10	97.20	96.90	95.10	92.60	89.40	92.60	91.90	93.40	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	98.30	98.30	99.50
% fitted **B** having a stable equilibrium		99.90	100.00	100.00	100.00	100.00	100.00	99.90	99.90	100.00	99.00	99.30	98.30	99.10	98.90	98.60	99.10	99.80	99.20	100.00	100.00	100.00
Corr. between max. eigen. of **B** and **J**		0.97	0.97	0.96	0.71	0.71	0.68	0.93	0.93	0.92	0.68	0.71	0.61	0.63	0.68	0.41	0.07	0.12	0.15	0.96	0.94	0.87

Subjective color scale:	Best performing cases	Fairly Good	Some Issues	Less performing cases	irrelevant

Table S4.3: Same as Table 3 in the main manuscript, but with Time Series Length = 200 points

Time Series Length = 25

Data-generating model:	Gompertz			Ricker			Beverton-Holt			LVR-simple			LVR-T2-point			LVR-T2-cycle			May-Hassell		
process error on species 1:	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*
evaluation criterion																					
% of q_{11} out of c.i.95% of c_{11}	29.80	20.10	13.10	23.80	15.40	8.90	21.20	15.30	10.10	22.10	11.90	9.40	22.80	13.80	9.40	16.80	12.40	10.50	21.80	15.00	11.80
% of q_{21} out of c.i.95% of c_{21}	8.00	5.90	7.10	6.70	6.50	6.90	8.70	7.90	6.50	10.10	8.60	10.60	8.70	10.00	10.90	10.80	10.60	10.10	8.30	8.50	9.40
% of q_{11} correctly signed	99.60	96.00	92.60	98.50	94.70	81.20	98.60	93.70	87.30	94.50	89.90	65.20	95.60	87.80	72.90	67.40	69.70	64.30	98.60	95.40	86.80
median of c_{11} - q_{11}	-0.02	-0.03	-0.03	-0.02	-0.02	-0.01	-0.01	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.03	-0.01	-0.02	-0.01
median of c_{21} - q_{21}	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
% of well predicted next trend, sp1	84.60	78.60	77.40	85.00	76.80	68.50	83.50	71.00	66.50	80.40	76.80	67.70	78.60	73.80	68.70	73.90	69.00	67.10	87.90	80.50	72.60
% of well predicted next trend, sp2	74.40	77.00	78.60	72.00	73.80	76.30	71.60	67.60	68.60	60.60	61.30	61.90	54.20	58.10	59.60	73.10	67.80	60.50	83.40	85.60	87.50
% ASE >1, sp1	10.10	17.50	20.10	12.70	26.30	36.30	15.60	28.40	37.20	19.00	28.90	35.10	19.80	29.50	34.20	33.80	35.60	36.40	11.30	20.70	31.20
%ASE >1, sp2	25.30	26.30	20.10	28.70	27.90	26.80	35.20	35.80	35.80	41.20	40.80	42.20	45.40	42.30	41.10	35.00	38.00	42.00	15.30	13.00	6.80
Correlation between Δx_1^* and Δn_1^*	0.94	0.88	0.68	0.66	0.60	0.49	0.65	0.64	0.56	Species 1 equilibrium is not affected by the press perturbation									0.90	0.82	0.67
Correlation between Δx_2^* and Δn_2^*	0.69	0.72	0.59	0.44	0.46	0.33	0.25	0.32	0.24	0.16	0.23	0.03	0.14	0.16	0.15	0.15	0.07	0.05	0.80	0.71	0.61
Slope of the linear regression $\Delta x_1^* \sim \Delta n_1^*$	0.85	0.76	0.64	4.05	3.48	2.15	2.97	2.47	2.04	Species 1 equilibrium is not affected by the press perturbation									0.74	0.71	0.68
Slope of the linear regression $\Delta x_2^* \sim \Delta n_2^*$	0.51	0.50	0.42	0.36	0.38	0.37	0.21	0.21	0.27	0.27	0.37	0.04	0.30	0.34	0.41	1.22	0.66	0.42	0.87	0.84	0.79
% of Δn_1^* out of c.i.95% of Δx_1^*	7.16	7.35	9.67	30.02	17.15	7.85	20.10	13.74	9.95	19.18	10.60	3.70	27.78	10.86	4.64	10.71	6.77	2.98	2.81	4.32	6.43
% of Δn_2^* out of c.i.95% of Δx_2^*	5.85	6.04	7.15	9.74	8.78	6.64	15.64	13.64	13.27	13.09	11.63	15.31	15.62	10.76	8.88	8.54	7.10	9.57	7.04	7.13	8.33
% of Δn_1^* correctly signed	99.40	95.67	92.55	97.99	93.54	80.08	97.16	93.43	86.53	Species 1 equilibrium is not affected by the press perturbation									97.49	94.38	87.05
% of Δn_2^* correctly signed	79.74	78.55	78.45	68.78	68.42	65.90	58.78	64.95	63.22	77.01	71.19	58.99	70.65	68.87	61.40	68.34	63.60	55.96	98.79	94.98	86.25

Subjective color scale:	Best performing cases	Fairly Good	Some Issues	Less performing cases	irrelevant

Table S4.4: Same as Table 4 in the main manuscript, but with Time Series Length = 25 points

Time Series Length = 50

Data-generating model:	Gompertz			Ricker			Beverton-Holt			LVR-simple			LVR-T2-point			LVR-T2-cycle			May-Hassell		
process error on species 1:	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*
evaluation criterion																					
% of q_{11} out of c.i.95% of c_{11}	24.40	14.90	8.40	18.50	10.20	7.10	19.60	10.80	7.60	22.30	10.90	8.20	22.30	11.10	8.50	18.10	15.10	8.60	19.40	12.40	8.60
% of q_{21} out of c.i.95% of c_{21}	5.70	6.60	5.00	5.60	6.70	5.30	5.20	6.30	7.20	8.10	7.30	8.70	8.70	7.50	8.40	10.20	8.00	7.70	7.20	7.30	7.60
% of q_{11} correctly signed	99.60	98.90	94.80	99.50	96.60	85.50	99.70	97.00	89.20	96.60	92.90	72.60	96.90	92.10	73.80	72.50	72.10	71.30	99.50	97.20	91.70
median of c_{11} - q_{11}	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.03	-0.01	-0.02	-0.02	-0.01	-0.01	-0.01
median of c_{21} - q_{21}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
% of well predicted next trend, sp1	90.40	83.60	78.70	84.70	76.10	69.70	82.80	77.30	69.30	79.10	75.00	73.70	78.10	73.30	68.80	75.20	69.10	66.20	86.90	78.00	73.20
% of well predicted next trend, sp2	74.90	77.40	78.90	73.20	74.00	74.20	69.60	71.00	70.90	62.00	65.20	63.50	57.60	60.20	62.50	72.90	70.40	63.20	82.20	85.10	87.80
% ASE >1, sp1	3.10	11.80	18.40	11.10	22.50	30.70	10.40	26.60	36.20	18.20	26.90	33.10	17.30	26.30	32.40	28.60	31.10	33.00	6.80	20.30	28.20
%ASE >1, sp2	25.40	19.20	17.80	25.20	23.40	23.70	33.40	31.30	30.20	39.00	38.90	38.20	42.50	40.00	39.00	31.50	32.90	39.70	14.00	9.40	6.30
Correlation between Δx_1^* and Δn_1^*	0.97	0.95	0.86	0.59	0.65	0.64	0.55	0.62	0.60	Species 1 equilibrium is not affected by the press perturbation									0.97	0.93	0.82
Correlation between Δx_2^* and Δn_2^*	0.83	0.80	0.79	0.54	0.45	0.45	0.42	0.46	0.31	0.41	0.40	0.21	0.26	0.24	0.20	0.23	0.29	0.17	0.84	0.83	0.62
Slope of the linear regression $\Delta x_1^* \sim \Delta n_1^*$	0.88	0.90	0.73	6.83	5.08	3.34	5.52	4.22	3.41	Species 1 equilibrium is not affected by the press perturbation									0.86	0.84	0.81
Slope of the linear regression $\Delta x_2^* \sim \Delta n_2^*$	0.62	0.69	0.60	0.39	0.36	0.37	0.26	0.32	0.34	1.13	0.96	0.43	0.70	0.75	0.80	1.96	2.47	1.73	1.11	1.03	0.93
% of Δn_1^* out of c.i.95% of Δx_1^*	6.52	4.31	4.81	45.02	29.06	12.51	34.84	24.07	15.68	17.88	9.99	5.19	25.52	14.99	3.58	10.67	8.86	3.54	1.60	2.00	2.80
% of Δn_2^* out of c.i.95% of Δx_2^*	4.61	4.41	4.01	8.56	7.42	5.31	15.81	15.45	13.57	10.62	7.54	8.44	11.67	10.81	6.95	10.98	8.97	7.50	14.30	9.82	9.30
% of Δn_1^* correctly signed	99.30	98.60	94.69	99.09	96.19	84.38	98.99	96.59	89.05	Species 1 equilibrium is not affected by the press perturbation									98.20	97.19	91.70
% of Δn_2^* correctly signed	85.46	86.17	85.57	76.54	75.85	74.17	70.19	71.52	73.27	85.90	81.65	63.38	77.38	75.03	66.67	71.81	70.80	59.90	99.40	97.09	92.10

Subjective color scale:	Best performing cases	Fairly Good	Some Issues	Less performing cases	irrelevant

Table S4.5: Same as Table 4 in the main manuscript, but with Time Series Length = 50 points

Time Series Length = 200

Data-generating model:	Gompertz			Ricker			Beverton-Holt			LVR-simple			LVR-T2-point			LVR-T2-cycle			May-Hassell		
process error on species 1:	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*	*0.01*	*0.1*	*0.5*
evaluation criterion																					
% of q_{11} out of c.i.95% of c_{11}	18.40	9.00	7.10	30.10	16.10	9.60	26.10	10.90	7.10	45.80	19.10	9.90	45.20	21.30	12.70	27.10	21.70	14.30	10.60	8.90	8.60
% of q_{21} out of c.i.95% of c_{21}	5.30	5.50	4.60	8.00	7.60	6.70	5.00	5.20	6.10	9.90	10.60	6.70	8.50	8.10	8.20	10.50	10.10	6.90	5.70	6.30	8.30
% of q_{11} correctly signed	100.00	99.60	98.30	100.00	98.50	91.50	100.00	98.20	96.20	98.10	96.40	81.10	98.30	95.60	83.00	78.60	77.30	78.10	100.00	99.40	96.50
median of c_{11} - q_{11}	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.03	0.00	0.00	0.00
median of c_{21} - q_{21}	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
% of well predicted next trend, sp1	92.20	84.50	79.80	85.90	77.40	69.80	84.50	77.10	70.20	80.30	73.30	67.60	76.70	73.50	68.20	70.70	70.50	64.60	90.30	81.80	74.90
% of well predicted next trend, sp2	80.70	77.90	81.10	72.20	78.40	78.10	69.40	72.70	73.20	62.60	63.90	64.70	59.60	61.60	67.40	75.90	74.60	68.10	84.60	83.70	87.80
% ASE >1, sp1	2.80	13.70	18.60	8.10	20.20	32.70	9.70	23.50	33.20	17.00	23.00	32.40	20.80	25.20	30.90	28.70	30.40	34.90	5.10	16.60	27.10
%ASE >1, sp2	20.30	20.20	15.70	25.80	21.50	20.70	33.30	30.40	29.70	35.60	34.70	37.50	39.30	37.70	36.20	29.40	30.30	34.00	13.50	7.80	5.00
Correlation between Δx_1^* and Δn_1^*	0.99	0.99	0.97	0.64	0.65	0.70	0.54	0.58	0.61	Species 1 equilibrium is not affected by the press perturbation									1.00	0.99	0.95
Correlation between Δx_2^* and Δn_2^*	0.97	0.96	0.95	0.72	0.77	0.67	0.63	0.61	0.54	0.58	0.54	0.37	0.42	0.49	0.37	0.60	0.51	0.31	0.90	0.88	0.83
Slope of the linear regression Δx_1^* ~ Δn_1^*	0.96	0.99	0.93	9.56	7.15	5.56	6.34	7.20	6.38	Species 1 equilibrium is not affected by the press perturbation									0.93	0.92	0.91
Slope of the linear regression Δx_2^* ~ Δn_2^*	0.95	0.97	0.91	0.34	0.41	0.61	0.27	0.29	0.35	3.51	3.51	1.21	2.08	2.73	2.25	4.77	4.49	4.39	1.13	1.10	1.18
% of Δn_1^* out of c.i.95% of Δx_1^*	3.80	2.50	3.70	68.60	53.40	29.80	58.86	49.35	36.90	11.41	10.37	4.88	20.79	14.46	6.29	12.01	11.12	5.34	0.60	0.90	2.70
% of Δn_2^* out of c.i.95% of Δx_2^*	2.10	2.50	4.10	14.60	12.70	5.00	25.93	23.32	17.70	28.18	22.16	4.88	24.12	20.73	9.84	19.07	13.93	10.28	37.90	26.90	20.30
% of Δn_1^* correctly signed	100.00	99.60	98.20	99.90	98.30	90.50	99.90	98.50	96.00	Species 1 equilibrium is not affected by the press perturbation									99.80	99.20	96.70
% of Δn_2^* correctly signed	91.19	93.30	91.50	85.70	87.80	83.30	84.79	86.59	85.70	94.95	91.74	77.21	90.01	86.75	75.56	80.73	78.26	70.67	100.00	99.40	96.60

Subjective color scale:	Best performing cases	Fairly Good	Some Issues	Less performing cases	irrelevant

Table S4.6: Same as Table 4 in the main manuscript, but with Time Series Length = 200 points