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Ralph Mac Nally, James R. Thomson, Wim J. Kimmerer, Frederick Feyrer, Ken B. Newman, Andy Sih, William A. Bennett, Larry Brown, Erica Fleishman, Steven D. Culberson, and Gonzalo Castillo. 2010. Analysis of pelagic species decline in the upper San Francisco Estuary using multivariate autoregressive modelling (MAR). *Ecological Applications* 20:1417–1430.

Appendix A. Details of parameter estimates for the multivariate autoregressive (MAR) model including credible intervals of odds ratios (all model parameters are listed).

In Table A1, we provide explicit details for model parameters and for quantities used for inference on parameter importance; see Table 1 in main manuscript for definitions of variables.

TABLE A1. Parameter details for Bayesian estimation of the multivariate autoregressive (MAR) model. "Expected" denotes direction of relationship derived from the expert model, while the odds ratio (posterior odds : prior odds) is expressed as 1/*G* for results that were contrary to expectation (where *G* = odds ratio for the unanticipated result).

Response variable	Covariate	Mean ± SD	2.50% – 97.50%	Post-odds	Expected	Odds ratio
Delta smelt	Inland silverside	0.008 ± 0.078	-0.145 – 0.165	1.2	–	1/3.5
Delta smelt	Largemouth bass	-0.075 ± 0.092	-0.256 – 0.109	4.1	–	1.4
Delta smelt	X2 (autumn)	0.055 ± 0.106	-0.156 – 0.263	2.4	–	1/7.1
Delta smelt	Water clarity	-0.026 ± 0.126	-0.292 – 0.209	1.3	–	0.4
Delta smelt	Exports winter	-0.089 ± 0.102	-0.292 – 0.108	4.5	–	1.5
Delta smelt	Exports spring	-0.083 ± 0.079	-0.240 – 0.076	6.2	–	2.1
Delta smelt	Spawning window	0.081 ± 0.081	-0.073 – 0.245	5.5	+	1.8
Delta smelt	Warm summer waters	-0.132 ± 0.075	-0.280 – 0.017	26.0	–	8.7
Longfin smelt	X2 (spring)	-0.694 ± 0.199	-1.066 – -0.286	1399.0	–	466.3
Longfin smelt	X2 (autumn)	-0.046 ± 0.225	-0.518 – 0.359	1.3	–	0.4
Longfin smelt	Water clarity	-0.094 ± 0.225	-0.551 – 0.335	1.9	–	0.6
Longfin smelt	Exports winter	0.031 ± 0.177	-0.343 – 0.359	1.4	–	1/4.2
Longfin smelt	Exports spring	0.055 ± 0.143	-0.232 – 0.334	1.9	–	1/5.7
Striped bass	Largemouth bass	-0.027 ± 0.089	-0.203 – 0.149	1.6	–	0.5
Striped bass	X2 (spring)	0.040 ± 0.103	-0.174 – 0.234	2.0	–	1/5.9
Striped bass	X2 (autumn)	-0.265 ± 0.128	-0.512 – 0.004	37.3	–	12.4
Striped bass	Water clarity	-0.217 ± 0.129	-0.471 – 0.041	21.8	–	7.3
Striped bass	Exports spring	0.031 ± 0.075	-0.122 – 0.178	2.1	–	1/6.2
Threadfin shad	"Other zooplankton" in spring	0.192 ± 0.149	-0.094 – 0.485	9.7	+	3.2
Threadfin shad	Largemouth bass	-0.267 ± 0.161	-0.582 – 0.043	20.5	–	6.8
Threadfin shad	Water clarity	-0.245 ± 0.187	-0.628 – 0.122	10.3	–	3.4
Threadfin shad	Exports spring	-0.078 ± 0.119	-0.318 – 0.153	3.0	–	1.0
Spring calanoids	Anchovy	-0.068 ± 0.192	-0.488 – 0.302	1.8	–	0.6
Spring calanoids	Spring chlorophyll *a* (freshwater)	0.134 ± 0.200	-0.252 – 0.542	3.0	+	1.0
Spring calanoids	Spring chlorophyll *a* (low salinity)	0.026 ± 0.189	-0.329 – 0.416	1.2	+	0.4
Spring calanoids	Inland silverside	-0.042 ± 0.177	-0.406 – 0.294	1.4	–	0.5
Spring calanoids	X2 (spring)	-0.498 ± 0.156	-0.756 – -0.159	258.3	+/–	258.3
Spring calanoids	*Corbula*	-0.263 ± 0.291	-0.845 – 0.270	4.2	–	1.4
Summer calanoids	Anchovy	0.013 ± 0.115	-0.217 – 0.256	1.2	–	1/3.6
Summer calanoids	Summer chlorophyll *a* (low salinity)	-0.049 ± 0.134	-0.307 – 0.216	1.8	+	1/5.5
Summer calanoids	*Limnoithona*	0.080 ± 0.165	-0.267 – 0.387	2.3	–	1/7.0
Summer calanoids	Inland silverside	-0.004 ± 0.110	-0.220 – 0.212	1.0	–	0.3
Summer calanoids	*Corbula*	-0.262 ± 0.222	-0.694 – 0.125	7.0	–	2.3
Mysid	Anchovy	-0.010 ± 0.187	-0.451 – 0.305	1.2	–	0.4
Mysid	Spring chlorophyll *a* (low salinity)	0.180 ± 0.174	-0.154 – 0.532	5.8	+	1.9
Mysid	Summer chlorophyll *a* (low salinity)	0.109 ± 0.190	-0.252 – 0.496	2.5	+	0.8

Mysid	X2 (spring)	-0.346 ± 0.150	-0.640 – -0.049	75.1	–	25.0
Delta smelt	Spring calanoids	-0.025 ± 0.092	-0.198 – 0.161	1.6	+	1/4.9
Delta smelt	Summer calanoids	0.110 ± 0.161	-0.207 – 0.439	3.1	+	1.0
Longfin smelt	Spring calanoids	0.085 ± 0.198	-0.286 – 0.511	1.9	+	0.6
Longfin smelt	Summer calanoids	0.271 ± 0.254	-0.235 – 0.771	6.0	+	2.0
Longfin smelt	Mysids	0.085 ± 0.203	-0.283 – 0.508	1.9	+	0.6
Striped bass	Spring calanoids	0.000 ± 0.092	-0.182 – 0.187	1.0	+	1/3.1
Striped bass	Summer calanoids	0.472 ± 0.157	0.158 – 0.780	Inf.	+	Inf.
Striped bass	Mysids	0.073 ± 0.095	-0.108 – 0.274	3.8	+	1.3
Spring calanoids	Delta smelt	-0.062 ± 0.306	-0.722 – 0.435	1.2	–	0.4
Spring calanoids	Longfin smelt	-0.246 ± 0.177	-0.585 – 0.111	10.8	–	3.6
Spring calanoids	Striped bass	-0.227 ± 0.289	-0.811 – 0.294	3.4	–	1.1
Summer calanoids	Delta smelt	-0.235 ± 0.274	-0.815 – 0.261	4.1	–	1.4
Summer calanoids	Longfin smelt	-0.119 ± 0.102	-0.322 – 0.080	7.3	–	2.4
Summer calanoids	Striped bass	-0.122 ± 0.204	-0.518 – 0.270	2.6	–	0.9
Mysids	Longfin smelt	-0.349 ± 0.159	-0.656 – -0.026	57.3	–	19.1
Mysids	Striped bass	0.077 ± 0.227	-0.419 – 0.450	1.9	–	1/5.7
Mysids	Summer calanoids	0.054 ± 0.237	-0.388 – 0.530	1.4	+	0.5
Declining taxon	*Parameter*					
Delta smelt	Lag 1	-0.807 ± 0.271	-1.305 – -0.228	290.6		290.6
Delta smelt	Lag 2	0.296 ± 0.274	-0.262 – 0.824	6.0		6.0
Longfin smelt	Lag 1	-1.034 ± 0.183	-1.408 – -0.682	–Inf.		–Inf.
Longfin smelt	Lag 2	0.300 ± 0.159	-0.024 – 0.607	29.0		29.0
Longfin smelt	Lag 3	-0.103 ± 0.148	-0.392 – 0.197	3.2		3.2
Striped bass	Lag 1	-0.792 ± 0.215	-1.204 – -0.342	2332.2		2332.2
Striped bass	Lag 2	-0.052 ± 0.204	-0.460 – 0.355	1.6		1.6
Striped bass	Lag 3	0.048 ± 0.172	-0.302 – 0.385	1.6		1.6
Striped bass	Lag 4	-0.213 ± 0.166	-0.541 – 0.111	9.2		9.2
Striped bass	Lag 5	-0.007 ± 0.132	-0.259 – 0.261	1.1		1.1
Threadfin shad	Lag 1	-0.786 ± 0.262	-1.273 – -0.250	367.5		367.5
Threadfin shad	Lag 2	-0.025 ± 0.249	-0.510 – 0.468	1.2		1.2
Spring calanoids	Lag 1	-0.001 ± 0.010	-0.021 – 0.019	1.3		1.3
Summer calanoids	Lag 1	-0.001 ± 0.010	-0.021 – 0.018	1.2		1.2
Mysids	Lag 1	-0.001 ± 0.010	-0.021 – 0.018	1.3		1.3
Delta smelt	γ intercept	0.270 ± 0.532	-0.783 – 1.268	2.3		2.3
Delta smelt	γ slope	-0.004 ± 0.012	-0.026 – 0.020	1.9	–	0.6
Longfin smelt	γ intercept	0.932 ± 0.774	-0.525 – 2.494	7.7		7.7
Longfin smelt	γ slope	-0.023 ± 0.022	-0.064 – 0.021	5.6	–	1.9
Striped bass	γ intercept	0.557 ± 0.701	-0.789 – 1.815	3.2		3.2
Striped bass	γ slope	-0.011 ± 0.017	-0.043 – 0.023	2.9	–	1.0
Threadfin shad	γ intercept	0.309 ± 0.487	-0.621 – 1.293	2.9		2.9
Threadfin shad	γ slope	0.052 ± 0.022	0.005 – 0.098	1/57.8	–	1/73.4
Spring calanoids	γ intercept	1.126 ± 0.777	-0.335 – 2.664	12.8		12.8
Spring calanoids	γ slope	-0.018 ± 0.025	-0.068 – 0.030	3.2	–	1.1
Summer calanoids	γ intercept	0.884 ± 0.643	-0.326 – 2.208	12.7		12.7
Summer calanoids	γ slope	-0.016 ± 0.020	-0.057 – 0.023	3.6	–	1.2
Mysids	γ intercept	0.251 ± 0.731	-1.240 – 1.672	1.7		1.7
Mysids	γ slope	0.001 ± 0.019	-0.037 – 0.040	1.1	–	0.4

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