Supplementary information

Table S1: Sampling efforts for the 9 NRS used in this study. The Esperance and Ningaloo NRS were discontinued in 2013

NRS	Study time
Darwin	Jun 2011 – Feb 2016
Esperance	May 2011 – Jul 2013
Kangaroo Island	Oct 2008 – Sep 2016
Maria Island	Apr 2009 – Sep 2016
Ningaloo	Nov 2010 – Aug 2013
North Stradbroke Island	Sep 2009 – Sep 2016
Port Hacking Bay	Feb 2009 – Jul 2016
Rottnest Island	Oct 2009 – Jul 2016
Yongala	Sep 2009 – Aug 2016

Table S2: Parameters and statistics for Base Model 1: Modelling TA with S
*** low number of observations (based on 30x[number of explanatory variables])**
**** one outlier from the Esperance NRS was removed for this result**

NRS	R	a	b	n	RSE	MAE	AIC
General	0.93	511.61	51.13	1851	10.71	7.86	14035.6
Darwin	0.95	348.78	56.26	149	12.88	9.11	1188.5
Esperance	0.86	50.57	64.18	60	5.43	3.09**	377.3
Kangaroo Island	0.88	617.75	48.47	150	5.04	3.676	915.1
Maria Island	0.84	902.65	40.25	305	3.91	2.77	1700.5
Ningaloo	0.69	686.21	45.83	40	6.10	4.58	262.2
North Stradbroke Island	0.91	427.94	53.42	312	5.08	3.11	1903.5
Port Hacking Bay	0.95	157.34	61.15	231	2.72	2.13	1121.0
Rottnest Island	0.93	340.07	55.99	277	4.81	3.47	1660.1
Yongala	0.97	465.90	52.00	327	7.94	5.96	2287.3
C1	0.93	257.94	58.31	568	4.221	2.87**	3251.9

Table S3: Parameters for Base Model 2: Modelling TA with S and T
*** low number of observations (based on 30x[number of explanatory variables])**
**** one outlier from the Esperance NRS was removed for this result**

NRS	R	a	b	c	n	RSE	MAE	AIC
General	0.95	694.33	46.69	-1.25	1391	9.00	5.94	10066.2
Darwin	0.93	525.48	52.40	-1.6	87	13.6	9.85	706.0
Esperance	0.88	2.52	66.00	-0.93	46*	4.96	2.94**	282.0
Kangaroo Island	0.89	636.76	47.74	0.42	115	5.11	3.75	706.4
Maria Island	0.86	627.74	48.40	-0.89	229	3.56	2.47	1236.0
Ningaloo	0.93	217.92	60.55	-1.67	25*	3.38	2.61	136.6
North Stradbroke Island	0.90	613.47	48.20	-0.79	263	4.82	2.96	1578.5
Port Hacking Bay	0.95	185.41	60.60	-0.46	158	2.56	1.90	750.6
Rottnest Island	0.94	325.62	56.85	-0.77	191	4.71	3.39	1138.8
Yongala	0.97	454.07	52.14	0.27	277	7.78	5.77	1927.7
C1	0.94	267.8	58.3	-0.56	395	4.0	2.74**	2229.18
C2	0.92	418.37	54.2	-0.76	658	4.50	2.84**	3851.22

Table S4: Parameters for Base Model 3: Modelling TA with Sal, T and log(CHL)
*** low number of observations (based on 30x[number of explanatory variables])**
**** one outlier from the Esperance NRS was removed for this result**

NRS	R	a	b	c	d	n	RSE	MAE	AIC
General	0.95	631.4	48.39	-1.01	2.63	734	9.51	6.67	5395.1
Darwin	0.97	493.93	52.7	-0.83	-0.15	53*	7.97	5.77	376.2
Esperance	0.87	59.61	64.42	-0.94	0.59	37*	5.48	3.18**	236.6
Kangaroo Island	0.92	822.44	42.36	0.91	1.79	41*	5.00	3.54	935.9
Maria Island	0.89	391.85	55.27	-1.32	1.42	109	3.44	2.51	584.3
Ningaloo	0.92	263.74	59.09	-1.48	-0.30	20*	3.71	2.64	114.7
North Stradbroke Island	0.94	458.75	53.12	-0.82	0.47	91	3.77	2.69	505.6
Port Hacking Bay	0.95	148.53	61.57	-0.30	0.31	73*	2.61	1.86	353.3
Rottnest Island	0.92	194.57	60.64	-0.82	1.94	130	4.90	3.42	788.2
Yongala	0.97	432.95	52.17	0.88	-3.03	180	8.60	6.20	1291.6
C1	0.93	204.38	60.14	-0.54	0.41	395	4.41	2.88 **	1399.4
C2	0.93	266.38	58.44	-0.64	0.57	331	4.26	2.87 **	1905.2

Table S5: Parameters for Base Model 4: Modelling TA with Sal, T and log(N)
*** low number of observations (based on 30x[number of explanatory variables])**
**** one outlier from the Esperance NRS was removed for this result**

NRS	R	a	b	c	d	n	RSE	MAE	AIC
General	0.96	671.40	47.14	-0.86	0.33	826	8.20	5.20	5840.3
Darwin	0.93	417.00	59.52	-2.33	7.12	55*	15.06	11.78	460.2
Esperance	0.90	33.57	65.60	-1.07	6.36	37*	5.15	2.68**	232.1
Kangaroo Island	0.94	451.09	53.02	0.24	0.46	60*	3.81	2.95	336.6
Maria Island	0.89	530.27	51.26	-1.14	-0.47	195	3.23	2.15	1016.9
Ningaloo	0.95	382.73	55.68	-1.40	2.12	18*	3.422	2.55	100.84
North Stradbroke Island	0.80	1018.88	37.21	-0.68	0.95	130	5.24	3.24	817.7
Port Hacking Bay	0.93	161.94	61.41	-0.74	-0.51	134	2.59	1.89	641.27
Rottnest Island	0.93	344.91	56.27	-0.72	-0.00	141	4.99	3.54	859.2
Yongala	0.98	587.67	48.83	-0.21	2.68	56*	9.02	6.80	411.1
C3	0.97	371.2	45.0	-1.2	-0.06	250	2.37	2.97**	1372.0

Table S6: Relative probabilities of minimising information loss for all four base models

NRS	BM1	BM2	BM3	BM4
General	0.00	0.00	1.00	0.00
Darwin	0.00	0.00	1.00	0.00
Esperance	0.00	0.00	0.11	1.00
Kangaroo Island	0.00	0.00	0.00	1.00
Maria Island	0.00	0.00	1.00	0.00
Ningaloo	0.00	0.00	0.00	1.00
North Stradbroke Island	0.00	0.00	1.00	0.00
Port Hacking Bay	0.00	0.00	1.00	0.00
Rottnest Island	0.00	0.00	1.00	0.00
Yongala	0.00	0.00	0.00	1.00

Table S7: p-values for KS tests. KS test is a two-sided test so if pvalue < 0.025 then null hypothesis is rejected then significantly different result at the 95% confidence level.

NRS	BM1		BM2		BM3		BM4		Lee et al. (2006)
	Regional	General	Regional	General	Regional	General	Regional	General	
Darwin	0.773	0.000	0.435	0.009	0.164	0.000	0.198	0.015	0.003
Esperance	0.167	0.01	0.223	0.120	0.248	0.158	0.476	0.066	0.019
Kangaroo Island	0.579	0.000	0.644	0.000	1.000	0.001	0.343	0.000	0.870
Maria Island	0.035	0.000	0.226	0.071	0.982	0.258	0.062	0.162	0.00
Ningaloo	0.895	0.000	0.877	0.063	0.977	0.041	0.712	0.055	0.266
North Stradbroke Island	0.001	0.018	0.119	0.011	0.888	0.000	0.130	0.087	0.000
Port Hacking Bay	0.822	0.001	0.810	0.364	0.978	0.880	0.980	0.169	0.000
Rottnest Island	0.635	0.084	0.669	0.015	0.874	0.013	0.558	0.091	0.000
Yongala	0.000	0.000	0.002	0.000	0.147	0.000	0.440	0.006	0.000

Table S8: The p-value matrices developed in Section 2.4 of the manuscript that were used to construct Figure X. Shaded entries were replaced with a 1, whilst all other entries were forced to 0.

M_{BM1}									M_{BM2}								
0	0	0.187	0.011	0	0	0	0	0	0	0	0.06	0.021	0	0.012	0	0.002	0
0	0	0	0.026	0	0	0.304	0.165	0	0	0	0	0.124	0	0.126	0.445	0.126	0
0	0.003	0	0	0	0	0	0	0	0	0.247	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	0.145	0	0	0	0.001	0.027	0	0.002	0	0.011	0	0.002	0	0.016	0.864	0.885	0.057
0	0	0	0	0	0	0	0	0	0	0.941	0	0.402	0	0	0.049	0.073	0
0	0.123	0	0	0	0	0	0.265	0	0	0.808	0	0.065	0	0.062	0	0.254	0
0	0.906	0	0	0	0	0.826	0	0	0	0.252	0	0.065	0.018	0.024	0.833	0	0
0	0	0	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0

M_{BM3}									M_{BM4}								
0	0	0	0	0	0.002	0	0	0	0	0	0.369	0	0	0.018	0	0.001	0.001
0	0	0	0.337	0.008	0.299	0.67	0.11	0	0	0	0.673	0.424	0.431	0	0.426	0.411	0
0	0.565	0	0.09	0.16	0.012	0.26	0.548	0	0	0.007	0	0	0.182	0	0.114	0.014	0
0	0	0	0	0	0.321	0	0.395	0	0	0.041	0.608	0	0.749	0	0	0	0
0	0.061	0	0.52	0	0.491	0.963	0.96	0.069	0	0.986	0.001	0.395	0	0.004	0.759	0.75	0.429
0	0.945	0	0	0	0	0.073	0.984	0	0	0	0	0.11	0.72	0	0.113	0.113	0
0	0.988	0	0.993	0	0.958	0	0.121	0	0	0	0	0.257	0.01	0.013	0	0.19	0
0	0.266	0	0.022	0.05	0.449	0.944	0	0	0	0.075	0.005	0	0.009	0	0	0	0
0	0.01	0	0.005	0	0	0	0	0	0	0.024	0	0.003	0	0.01	0.006	0.014	0