

Supplementary Material for

Shifting Elasmobranch Community Assemblage at an Isolated Marine Protected Area

Easton R. White, Mark C. Myers, Joanna Mills Flemming, and Julia K. Baum

*To whom correspondence should be addressed. E-mail: eastonrwhite@gmail.com (ERW)

This PDF file includes: Diet information, dive effort, explanatory variables, species information, distribution of counts, residual analysis, model ranking, robustness analysis

The code for these plots and those found in the manuscript is available at <https://github.com/baumlab>.

Table S1: Summary of the consumer-prey relationships among the Cocos Island study species. Since dietary literature is not always species-specific, prey are listed by class, family and then specie. Numbers are references listed below.

		Consumers										
<i>Cocos Species</i>		<i>Hammerhead shark, Sphyrna lewini</i>	<i>Whitetip reef shark, Triaenodon obesus</i>	<i>Marbled ray, Taeniuра meyeni</i>	<i>Spotted eagle ray, Aetobatus narinari</i>	<i>Giant manta ray, Manta birostris</i>	<i>Sicklefin devil ray, Mobula tarapacana</i>	<i>Silky shark, Carcharhinus falciformis</i>	<i>Silvertip shark, C. albimarginatus</i>	<i>Blacktip shark, C. limbatus</i>	<i>Galapagos shark, C. galapagensis</i>	<i>Tiger shark, Galeocerdo cuvier</i>
	Chondrichthyes	1,4,5						1	1,6	1,7	1,2	
	Rays	2,5							2, 3	8	10	
	Myliobatidae (Mantas and eagle rays)								2		10	
	<i>Aetobatus</i> species (eagle rays)							2	2		10	
	Spotted eagle ray, <i>A. narinari</i>											
	<i>Mobula</i> species (devil rays)											
	Sicklefin devil ray, <i>M. tarapacana</i>											
	<i>Manta</i> species (manta rays)											
	Giant manta ray, <i>M. birostris</i>											
	Dasyatidae (Stingrays)									9,10		
	<i>Taeniuра</i> Species (ribbontail stingrays)											
	Marbled ray, <i>T. meyenii</i>											
	Sharks	2,4,5							2,3,4,11	8	10	
	Sphyrnidae (Hammerhead sharks)								3,4			
	<i>Sphyrna</i> species								3,4			
	Scalloped hammerhead shark, <i>S. lewini</i>								11			
	Carcharhinidae (Requiem sharks)	2,4,5							2,3,4			
	<i>Triaenodon</i> species											
	Whitetip reef shark, <i>T. obesus</i>											
	<i>Carcharhinus</i> species	2							4			
	Silky shark, <i>C. falciformis</i>											
	Silvertip shark, <i>C. albimarginatus</i>											
	Blacktip shark, <i>C. limbatus</i>											
	Galapagos shark, <i>C. galapagensis</i>											

Table 1 Literature Cited

¹ Cortés, E. 1999. Standardized diet compositions and trophic levels of sharks. ICES Journal of Marine Science 56: 707-717.

² Compango, L.J.V. 1984. Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Carcharhiniformes. FAO Fisheries Synopsis, Rome. No. 125, Vol. 4, Part 2. pp. 251-633.

- ³ Castro, J.I. 1996. Biology of the blacktip shark, *Carcharhinus limbatus*, off the southeastern United States. *Bulletin of Marine Science* 59(3): 508-522.
- ⁴ Dudley, S.F.J. and G. Cliff. 1993. Some effects of shark nets in the Natal nearshore environment. *Environmental Biology of Fishes* 36: 243-255.
- ⁵ de Bruyn, P., S.F.J. Dudley, G. Cliff and M.J. Smale. 2005. Sharks caught in the protective gill nets off KwaZulu-Natal, South Africa. 11. The scalloped hammerhead shark *Sphyrna lewini* (Griffith and Smith). *African Journal of Marine Science* 27(3): 517-528.
- ⁶ Hoffmayer, E.R. and G.R. Parsons. 2003. Food habits of three shark species from the Mississippi Sound in the Northern Gulf of Mexico. *Southeastern Naturalist* 2(2): 271-280.
- ⁷ Wetherbee, B.M., G.L. Crow and C.G. Lowe. 1996. Biology of the Galapagos shark, *Carcharhinus galapagensis*, in Hawai'i. *Environmental Biology of Fishes* 45: 299-310.
- ⁸ Papastamatiou, Y.P., B.M. Wetherbee, C.G. Lowe and G.L. Crow. 2006. Distribution and diet of four species of carcharhinid shark in the Hawaiian Islands: evidence for resource partitioning and competitive exclusion. *Marine Ecology Progress Series* 320: 239-251.
- ⁹ Heithaus, M. R. 2001. The biology of tiger sharks, *Galeocerdo cuvier*, in Shark Bay, Western Australia: Sex ratio, size distribution, diet, and seasonal changes in catch rates. *Environmental Biology of Fishes* 61:25-36.
- ¹⁰ Simpfendorfer, C. A., A. B. Goodreid, and R. B. McAuley. 2001. Size, sex and geographic variation in the diet of the tiger shark, *Galeocerdo cuvier*, from Western Australian waters. *Environmental Biology of Fishes* 61:37-46.
- ¹¹ Clarke, T.A. 1971. The ecology of the scalloped hammerhead shark, *Sphyrna lewini*, in Hawaii. *Pacific Science* 25: 133-144.

Dive effort

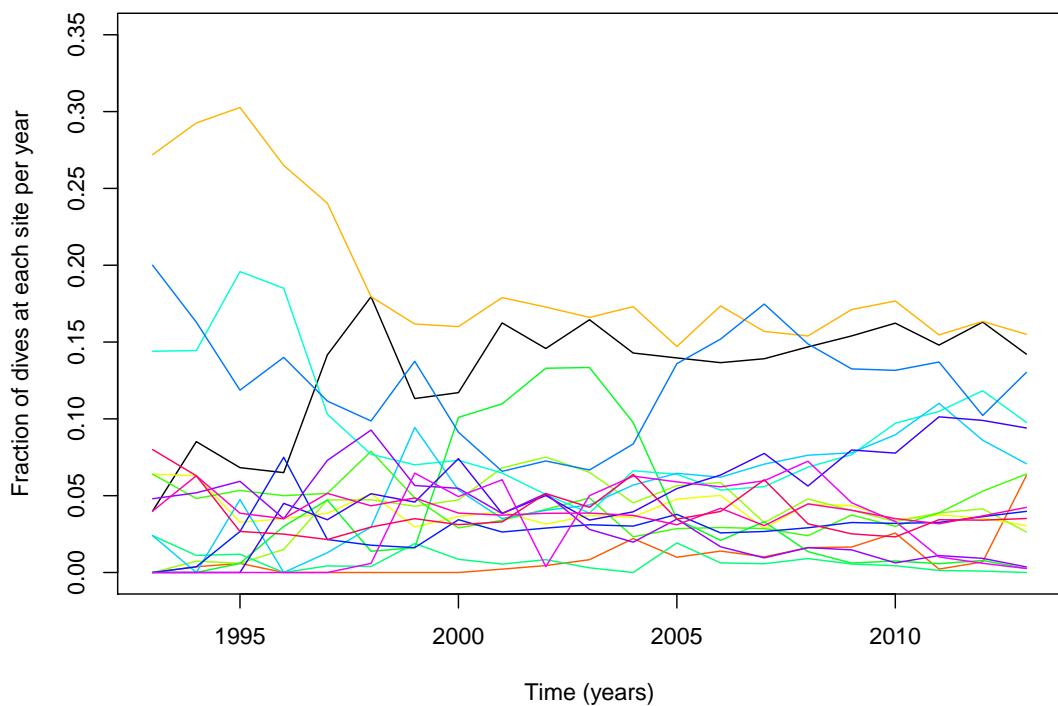


Figure S1: Fraction of dives recorded at each site for each year. Each line represents a different site.

Explanatory variables

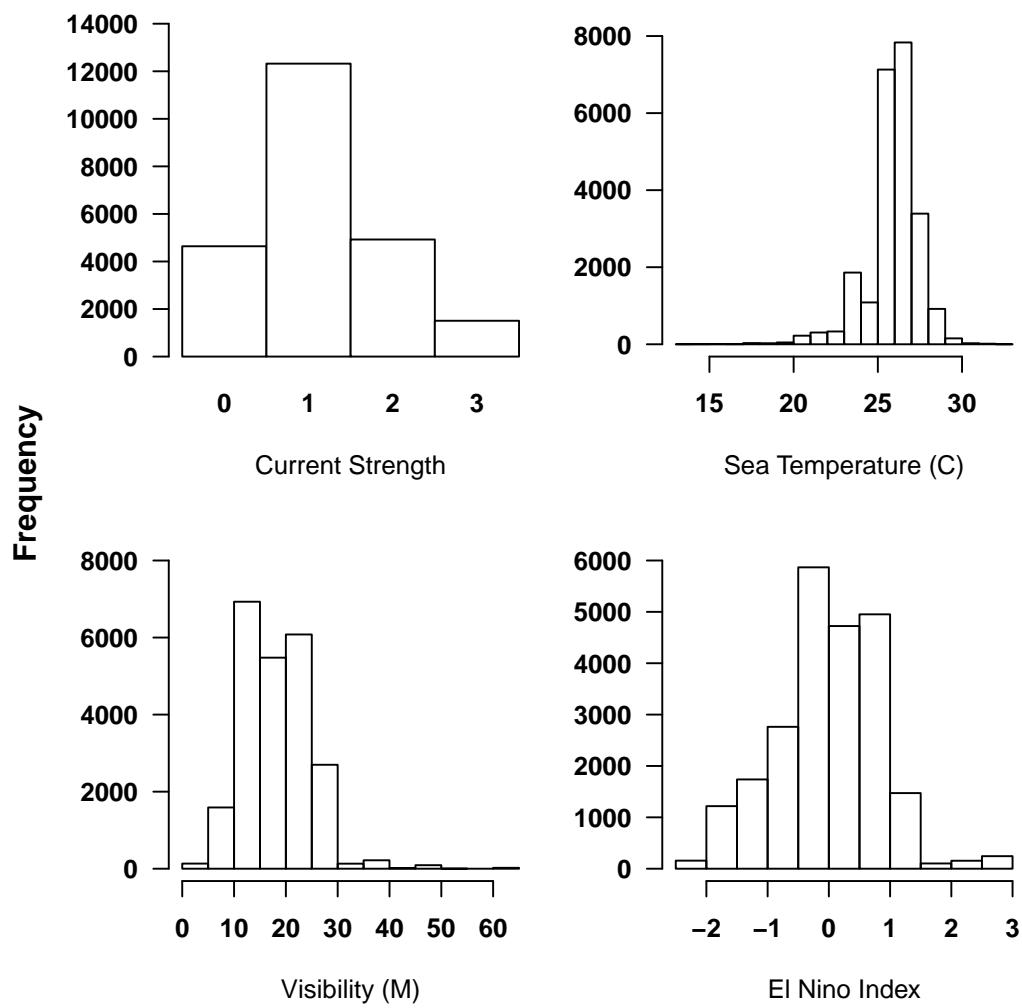


Figure S2: Distributions of explanatory variables.

Species information

NAME	#RECORDS	MEAN	MEDIAN	VAR	ZEROS	FRAC_NOT_ZERO
scalloped hammerhead	23391	33.97	10	4663.97	5367	0.77
tiger	23391				22821	0.02
silky	23391				22570	0.04
whitetip reef	23391	25.55	20	667.82	670	0.97
blacktip	23391				22444	0.04
Galapagos	23391				21262	0.09
silvertip	23391				22777	0.03
eagle ray	23391	0.63	0	2.93	17130	0.27
marble ray	21534	8.5	5	96.49	3400	0.84
whale shark	23391				22956	0.02
mobula ray	23391	0.13	0	0.79	21779	0.07
manta ray	23391	0.05	0	0.1	22520	0.04

Table S2: Species specific record information. Blanks are present for species in which only presence-absence was noted.

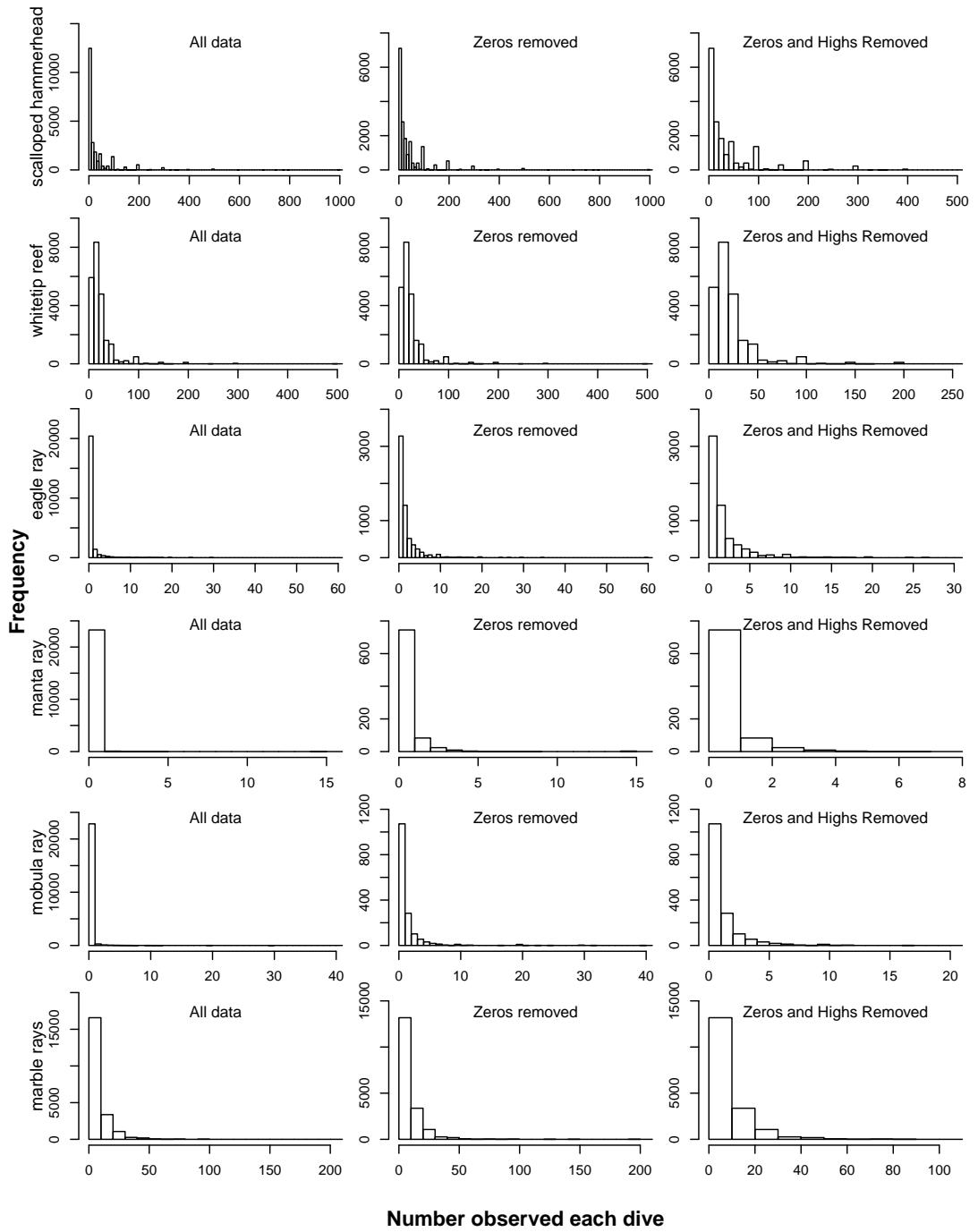


Figure S3: Distribution of counts for each species.

Distribution of counts

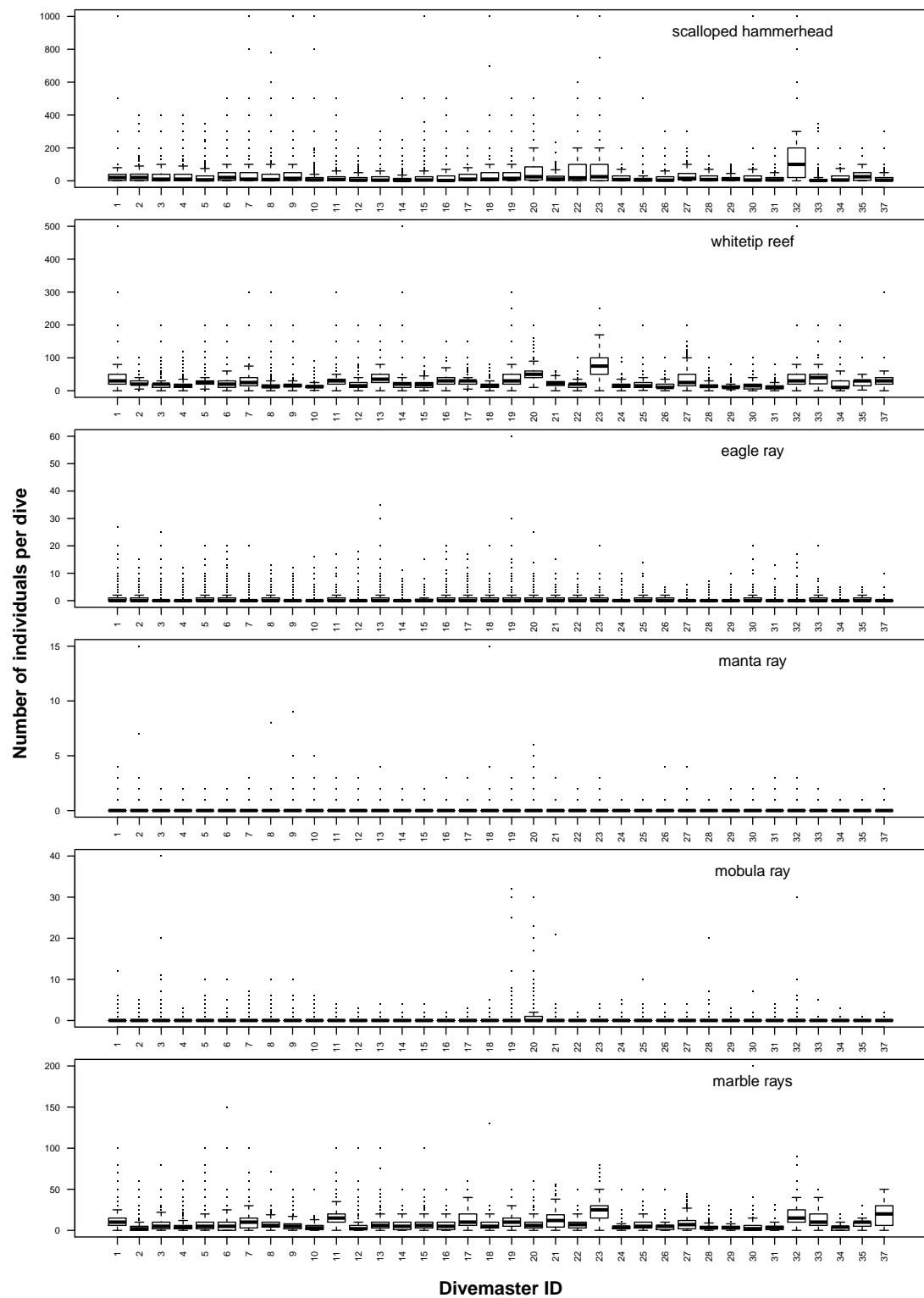


Figure S4: Number of individuals of each species observed for each divemaster.

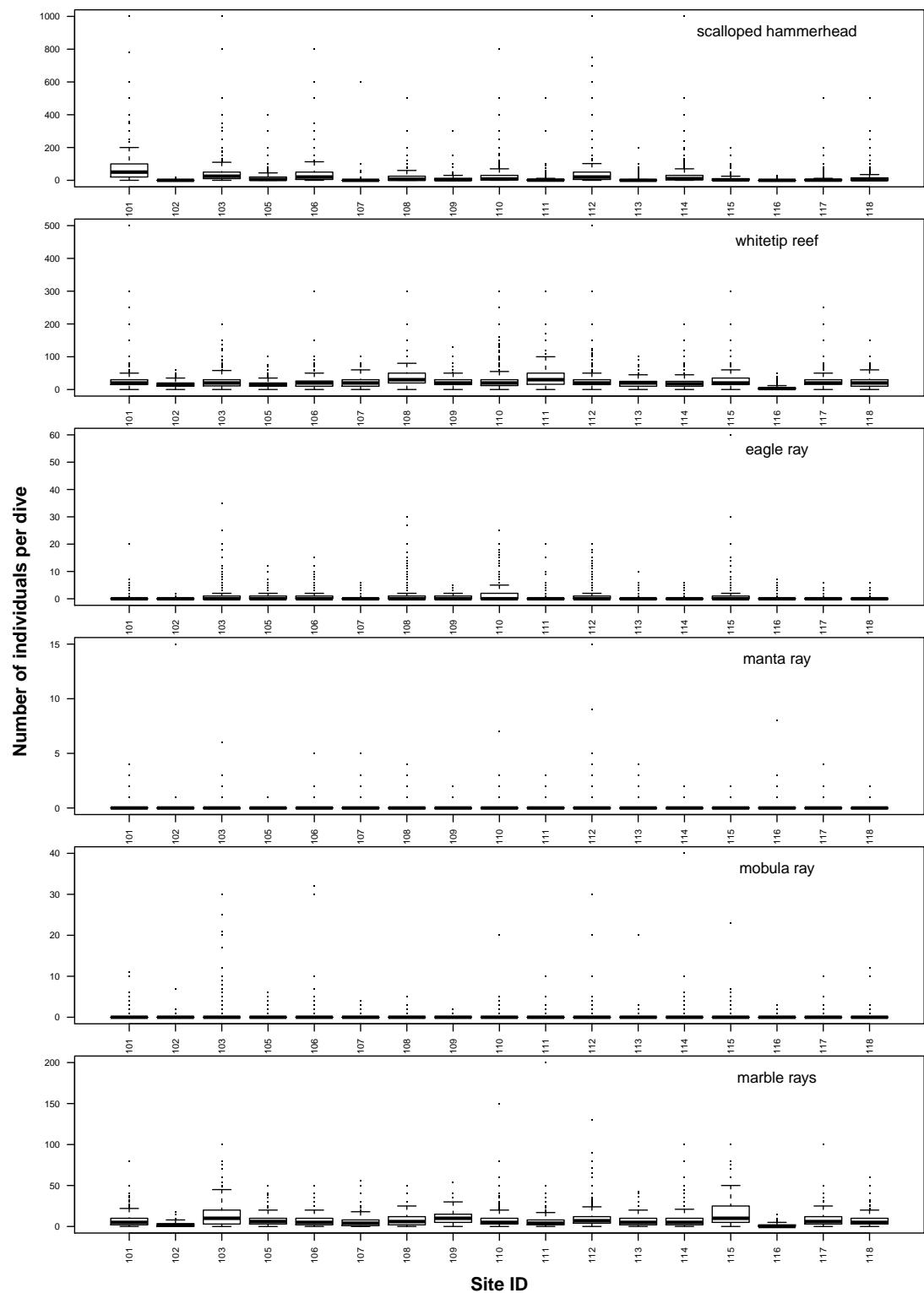


Figure S5: Number of individuals of each species observed at each dive site.

Residual analysis

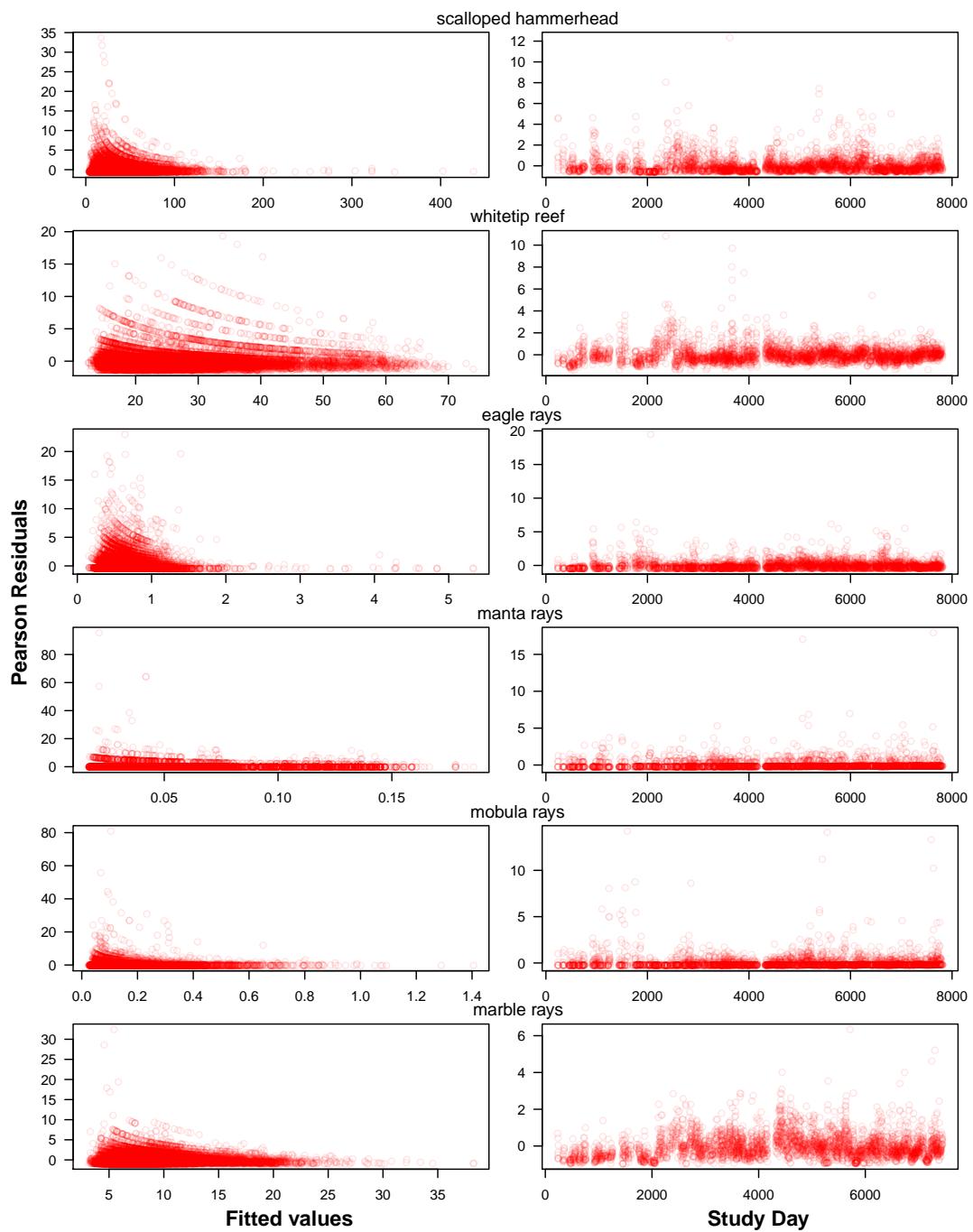


Figure S6.1: Residual plots for species with count data.

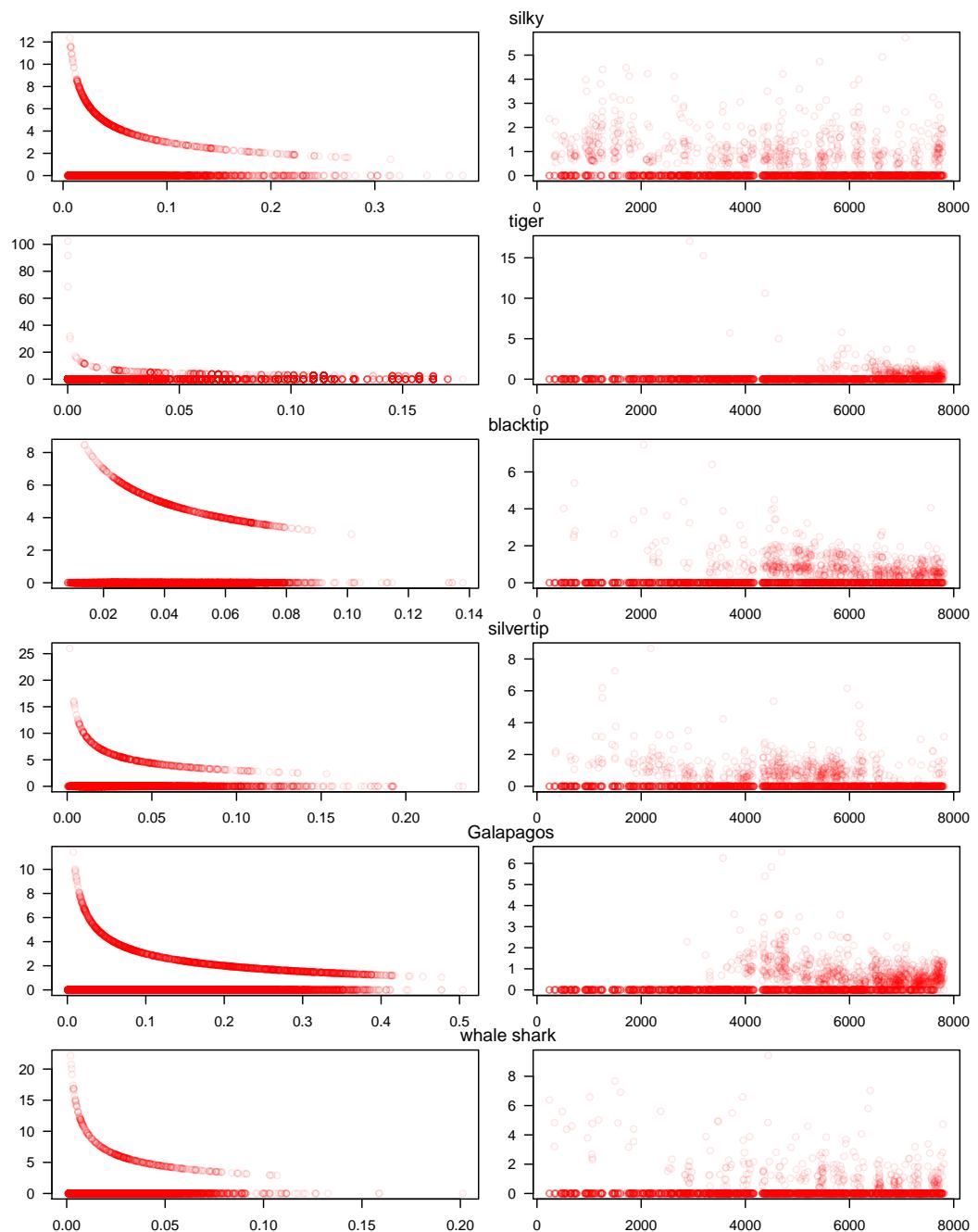


Figure S6.2: Residual plots for species with only presence-absence data.

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
5.204	0.598	+		-0.333	-0.111	-0.096	-0.028	0.038	11.000	-94893.900	189809.800	0.000	1.000

Table S3.1: Top models for scalloped hammerheads

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-16.052	+				0.047	0.583		6.000	-2122.680	4257.360	0.000	0.330
-14.674	+				0.577			5.000	-2124.140	4258.280	0.920	0.208
-16.129	+			-0.059	0.047	0.586		7.000	-2122.260	4258.520	1.160	0.185
-16.120	-0.070	+		0.072	0.050	0.583		8.000	-2121.450	4258.900	1.540	0.153
-16.088		+			0.046	0.584	0.002	7.000	-2122.650	4259.300	1.940	0.125

Table S3.2: Top models for tiger sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
1.957	0.525	+		-0.200	-0.158	-0.114		8.000	-3307.600	6631.200	0.000	0.315	
1.857	0.530	+		-0.199	-0.161	-0.111	0.007	9.000	-3306.850	6631.700	0.500	0.245	
1.837	0.536	+		-0.058	-0.207	-0.152	-0.116	9.000	-3306.880	6631.760	0.560	0.238	
1.724	0.542	+		-0.061	-0.207	-0.155	-0.113	0.007	10.000	-3306.040	6632.080	0.880	0.203

Table S3.3: Top models for silky sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
5.036	0.049	+		-0.031	0.028	-0.025	-0.070	-0.006	11.000	-95765.900	191533.800	0.000	1.000

Table S3.4: Top models for whitetip reef sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-5.226	0.020	+		0.100		0.087	0.025	8.000	-3883.410	7782.820	0.000	0.239
-4.350		+			-0.032	0.086	0.026	7.000	-3884.530	7783.060	0.240	0.212
-4.532	0.017	+		0.091	-0.026	0.086	0.026	9.000	-3882.680	7783.360	0.540	0.182
-5.213		+			0.087	0.087	0.024	6.000	-3885.710	7783.420	0.600	0.177
-5.235	0.017	+	0.021	0.102	0.088	0.025	9.000	-3883.290	7784.580	1.760	0.099	
-4.318		+	0.023	-0.034	0.087	0.025	8.000	-3884.370	7784.740	1.920	0.091	

Table S3.5: Top models for blacktip sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-7.147	0.347	+		0.463	-0.039	0.278	0.032	9.000	-6036.590	12091.180	0.000	1.000

Table S3.6: Top models for Galapagos sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-0.155	0.107	+		-0.170		-0.096	-0.085	8.000	-2685.110	5386.220	0.000	0.500
0.495	0.107	+		-0.180	-0.025	-0.096	-0.084	9.000	-2684.690	5387.380	1.160	0.280
-0.143	0.113	+	-0.032	-0.175		-0.097	-0.085	9.000	-2684.930	5387.860	1.640	0.220

Table S3.7: Top models for silvertip sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-3.001	0.165	+		-0.062	-0.056	0.068	-0.020	0.039	12.000	-23052.100	46128.200	0.000

Table S3.8: Top models for eagle rays

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
4.338	0.110	+		-0.057	0.018	-0.063	-0.066	0.011	11.000	-67707.100	135436.200	0.000

Table S3.9: Top models for marble rays

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
-5.990	1.133	+		-0.380	-0.556	0.044	0.034	9.000	-2021.990	4061.980	0.000	0.727	
-5.819	1.132	+		-0.380	-0.559	-0.006	0.044	0.034	10.000	-2021.970	4063.940	1.960	0.273

Table S3.10: Top models for whale sharks

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
1.205	-0.263	+		-0.130	-0.279	-0.113	-0.073	0.023	12.000	-7695.320	15414.640	0.000	1.000

Table S3.11: Top models for mobula rays

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
-0.418				-0.167		-0.046	-0.104	6.000	-4160.170	8332.340	0.000	0.330	
-0.600	0.054			-0.169	0.078	-0.039	-0.104	8.000	-4158.570	8333.140	0.800	0.221	
-1.640	0.057			-0.187	0.091		-0.104	7.000	-4159.880	8333.760	1.420	0.162	
-0.463				-0.169		-0.047	-0.103	0.004	7.000	-4159.990	8333.980	1.640	0.145
-1.630				-0.189			-0.104	5.000	-4162.020	8334.040	1.700	0.141	

Table S3.12: Top models for manta rays

(Intercept)	COS_TIME	CurrentCode	EINNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
5.204	0.598	+	-0.333	-0.111	-0.096	-0.028	0.038	11.000	-94893.900	189809.800	0.000	1.000

Table S4.1: Top models for scalloped hammerheads

(Intercept)	COS_TIME	CurrentCode	EINNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
4.817	0.530	+	-0.304	0.003	-0.071	-0.029	0.025	11.000	-21256.300	42534.600	0.000	1.000

Table S4.2: Top models for scalloped hammerheads for subset of divemasters

(Intercept)	COS_TIME	CurrentCode	EINNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
5.916	0.492	+	-0.260	-0.117	-0.096	-0.033	0.027	11.000	-63042.800	126107.600	0.000	1.000

Table S4.3: Top models for scalloped hammerheads for subset of dive sites

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-16.052	+				0.047	0.583		6.000	-2122.680	4257.360	0.000	0.330
-14.674	+				0.047	0.577		5.000	-2124.140	4258.280	0.920	0.208
-16.129	+		-0.059		0.050	0.586		7.000	-2122.260	4258.520	1.160	0.185
-16.120	-0.070	+		0.072	0.050	0.583		8.000	-2121.450	4258.900	1.540	0.153
-16.088		+			0.046	0.584	0.002	7.000	-2122.650	4259.300	1.940	0.125

Table S4.4: Top models for tiger sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-14.925	-0.540			0.321		0.590		4.000	-179.594	367.188	0.000	0.309
-15.945	-0.566			0.368		0.602		5.000	-178.941	367.882	0.694	0.219
-15.198	-0.473		-0.246	0.277		0.599		5.000	-179.010	368.020	0.832	0.204
-16.206	-0.504		-0.247	0.325		0.609		6.000	-178.330	368.660	1.472	0.148
-15.760	-0.541		-0.347	0.029	0.596			5.000	-179.540	369.080	1.892	0.120

Table S4.5: Top models for tiger sharks for subset of divemaster

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-16.008	-0.193	+		0.084		0.631		8.000	-1537.400	3090.800	0.000	0.346
-17.265	-0.185	+		0.102	0.044	0.636		9.000	-1536.460	3090.920	0.120	0.326
-16.119	-0.182	+		0.077	0.056	0.635		9.000	-1537.120	3092.240	1.440	0.168
-17.380	-0.175	+		0.095	0.044	0.640		10.000	-1536.170	3092.340	1.540	0.160

Table S4.6: Top models for tiger sharks for subset of dive sites

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
1.957	0.525	+		-0.200	-0.158	-0.114		8.000	-3307.600	6631.200	0.000	0.315
1.857	0.530	+		-0.199	-0.161	-0.111	0.007	9.000	-3306.850	6631.700	0.500	0.245
1.837	0.536	+		-0.058	-0.152	-0.116		9.000	-3306.880	6631.760	0.560	0.238
1.724	0.542	+		-0.061	-0.207	-0.155	0.007	10.000	-3306.040	6632.080	0.880	0.203

Table S4.7: Top models for silky sharks

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
1.548	0.450	+		-0.379	-0.220	-0.094	-0.168	9.000	-1092.850	2203.700	0.000	0.715	
1.450	0.456	+		-0.383	-0.222	-0.094	-0.167	0.004	10.000	-1092.770	2205.540	1.840	0.285

Table S4.8: Top models for silky sharks for subset of divemaster

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
2.268	0.535	+		-0.084	-0.176	-0.156	-0.120	9.000	-2213.940	4445.880	0.000	0.358	
2.426	0.519	+		-0.164	-0.163	-0.116		8.000	-2215.010	4446.020	0.140	0.334	
2.334	0.532	+		-0.083	-0.176	-0.155	-0.121	-0.004	10.000	-2213.770	4447.540	1.660	0.156
2.497	0.516	+		-0.164	-0.162	-0.118	-0.118	-0.004	9.000	-2214.800	4447.600	1.720	0.152

Table S4.9: Top models for silky sharks for subset of dive sites

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
5.036	0.049	+	-0.031	0.028	-0.025	-0.070	-0.006	11.000	-95765.900	191553.800	0.000	1.000

Table S4.10: Top models for whitetip reef sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
5.060	0.102	+	-0.105	0.055	-0.038	-0.059	-0.005	11.000	-20743.800	41509.600	0.000	1.000

Table S4.11: Top models for whitetip sharks for subset of divemaster

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
5.158	0.039	+	-0.038	0.029	-0.019	-0.074	-0.009	11.000	-56149.100	112320.200	0.000	1.000

Table S4.12: Top models for whitetip sharks for subset of dive sites

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-5.226	0.020	+		0.100	0.087		0.025	8.000	-3883.410	7782.820	0.000	0.239
-4.350		+			-0.032	0.086	0.026	7.000	-3884.530	7783.060	0.240	0.212
-4.532	0.017	+		0.091	-0.026	0.086	0.026	9.000	-3882.680	7783.360	0.540	0.182
-5.213		+				0.087	0.024	6.000	-3885.710	7783.420	0.600	0.177
-5.235	0.017	+		0.021	0.102	0.088	0.025	9.000	-3883.290	7784.580	1.760	0.099
-4.318		+		0.023	-0.034	0.087	0.025	8.000	-3884.370	7784.740	1.920	0.091

Table S4.13: Top models for blacktip sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-5.980		+			0.133		0.053	6.000	-756.426	1524.852	0.000	0.469
-6.028		+		0.115		0.138	0.052	7.000	-755.697	1525.394	0.542	0.358
-6.056		+			0.003	0.133	0.053	7.000	-756.424	1526.848	1.996	0.173

Table S4.14: Top models for blacktip sharks for subset of divemaster

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
-4.282	-0.084	+		0.163		0.060	0.017	8.000	-2640.570	5297.140	0.000	0.347	
-3.347	-0.087	+		0.151	-0.035	0.059	0.019	9.000	-2639.600	5297.200	0.060	0.337	
-4.271	-0.078	+		-0.037	0.159	0.058	0.018	9.000	-2640.280	5298.560	1.420	0.171	
-3.394	-0.082	+		-0.028	0.148	-0.033	0.058	0.019	10.000	-2639.440	5298.880	1.740	0.145

Table S4.15: Top models for blacktip sharks for subset of dive sites

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
	-7.147	0.347	+	0.463	-0.039	0.278	0.032	9.000	-6036.590	12091.180	0.000	1.000

Table S4.16: Top models for Galapagos sharks

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
	-6.071	0.571	0.015	0.484	-0.111	0.318	0.061	6.000	-873.881	1759.762	0.000	0.728
	-6.079	0.567	0.015	0.487	-0.111	0.319	0.061	7.000	-873.864	1761.728	1.966	0.272

Table S4.17: Top models for Galapagos sharks for subset of divemaster

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
	-5.721	0.364	+	0.546	-0.068	0.271	8.000	-3491.840	6999.680	0.000	0.368	
	-5.839	0.365	+	0.549	-0.070	0.274	9.000	-3491.030	7000.060	0.380	0.305	
	-5.734	0.369	+	-0.029	0.542	-0.067	0.270	9.000	-3491.580	7001.160	1.480	0.176
	-5.856	0.369	+	-0.031	0.544	-0.070	0.273	9.000	-3490.730	7001.460	1.780	0.151

Table S4.18: Top models for Galapagos sharks for subset of dive sites

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-0.155	0.107	+		-0.170		-0.096	-0.085	8.000	-2685.110	5386.220	0.000	0.500
0.495	0.107	+		-0.180	-0.025	-0.096	-0.084	9.000	-2684.690	5387.380	1.160	0.280
-0.143	0.113	+		-0.032	-0.175	-0.097	-0.085	9.000	-2684.930	5387.860	1.640	0.220

Table S4.19: Top models for silvertip sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-0.025		+				-0.035	-0.103	6.000	-662.750	1337.500	0.000	0.560
-0.010		+				-0.038	-0.102	7.000	-662.629	1339.258	1.758	0.233
0.136		+				-0.006	-0.103	7.000	-662.744	1339.488	1.988	0.207

Table S4.20: Top models for silvertip sharks for subset of divemaster

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-0.688				-0.106	-0.163	0.024	4.000	-442.938	893.876	0.000	0.133	
-3.398			-0.207		-0.170	0.024	4.000	-442.986	893.972	0.096	0.127	
-0.257			-0.098		-0.175	3.000	-444.040	894.080	0.204	0.120		
-2.878					-0.172	2.000	-445.055	894.110	0.234	0.119		
-2.760			-0.188		-0.181	3.000	-444.102	894.204	0.328	0.113		
-3.463					-0.162	0.021	3.000	-444.132	894.264	0.388	0.110	
-1.244			-0.083		-0.168	0.025	5.000	-442.337	894.674	0.798	0.089	
-0.752			-0.158		-0.181	4.000	-443.559	895.118	1.242	0.072		
-0.855		+	-0.142		-0.148	0.028	7.000	-440.682	895.364	1.488	0.063	
-3.643		+	-0.147		-0.147	0.026	6.000	-441.843	895.686	1.810	0.054	

Table S4.21: Top models for silvertip sharks for subset of dive sites

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-3.001	0.165	+	-0.062	-0.056	0.068	-0.020	0.039	12.000	-23052.100	46128.200	0.000	1.000

Table S4.22: Top models for eagle rays

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-7.646	0.238	+	-0.060	0.009	0.242	0.032	0.021	12.000	-5408.230	10840.460	0.000	0.530
-7.406	0.218	+	0.018	0.034	0.232	0.034	0.020	11.000	-5409.350	10840.700	0.240	0.470

Table S4.23: Top models for eagle rays for subset of divemaster

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-3.536	0.180	+	-0.073	-0.020	0.095	-0.014	0.036	12.000	-14812.600	29649.200	0.000	1.000

Table S4.24: Top models for eagle rays for subset of dive sites

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
4.338	0.110	+	-0.057	0.018	-0.063	-0.066	0.011	11.000	-67707.100	135436.200	0.000	1.000

Table S4.25: Top models for marble rays

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight		
3.264	0.086	+		-0.068	-0.037	-0.049	9.000	-14791.900	29601.800	0.000	0.363			
3.188	0.094	+		-0.028	-0.071	-0.034	10.000	-14791.200	29602.400	0.600	0.269			
3.303	0.083	+		-0.069	-0.036	-0.050	-0.003	10.000	-14791.400	29602.800	1.000	0.220		
3.228	0.091	+		-0.026	-0.072	-0.033	-0.050	-0.003	11.000	-14790.800	29603.600	1.800	0.148	

Table S4.26: Top models for marble rays for subset of divemaster

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
4.621	0.100	+	-0.019	0.025	-0.058	-0.071	0.004	11.000	-40593.700	81209.400	0.000	0.574	
4.660	0.095	+		0.028	-0.060	-0.070	0.004	10.000	-40595.000	81210.000	0.600	0.426	

Table S4.27: Top models for marble rays for subset of dive sites

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
-5.990	1.133	+		-0.380	-0.556	0.044	0.034	9.000	-2021.390	4061.980	0.000	0.727	
-5.819	1.132	+		-0.380	-0.559	-0.006	0.044	0.034	10.000	-2021.970	4063.940	1.960	0.273

Table S4.28: Top models for whale sharks

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-5.045	0.874		0.255	-0.382			0.033	5.000	-388.670	787.340	0.000	0.161
-7.859	0.883		-0.302	-0.354	0.110		0.030	6.000	-387.907	787.814	0.474	0.127
-7.593	0.859		-0.278	-0.361	0.124		5.000	-389.063	788.126	0.786	0.109	
-4.349	0.849		-0.218	-0.398			4.000	-390.079	788.158	0.818	0.107	
-4.946	0.798			-0.331			0.028	4.000	-390.095	788.190	0.850	0.105
-4.353	0.781			-0.352			3.000	-391.131	788.262	0.922	0.102	
-5.154	0.859	+		-0.259	-0.396		0.034	8.000	-386.332	788.664	1.324	0.083
-8.951	0.877			-0.363	-0.356	0.139	0.033	7.000	-387.466	788.932	1.592	0.073
-5.228	0.869			-0.229	-0.387		0.012	6.000	-388.539	789.078	1.738	0.068
-5.313	0.803			-0.351			0.022	5.000	-389.579	789.158	1.818	0.065

Table S4.29: Top models for whale sharks for subset of divemaster

(Intercept)	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-5.085	1.179		-0.409	-0.583	0.028	0.020	6.000	-1490.900	2993.800	0.000	0.648	
-4.215	1.177		-0.409	-0.595	-0.033	0.027	0.021	7.000	-1490.510	2995.020	1.220	0.352

Table S4.30: Top models for whale sharks for subset of dive sites

	COS_TIME	CurrentCode	ElNinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
(Intercept)	1.205	-0.263	+	-0.130	-0.279	-0.113	-0.073	0.023	12.000	-7695.320	15414.640	0.000

Table S4.31: Top models for mobula rays. Top models for other data subsets are not available because of function maximizer failure in `glmmADMB()`

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight	
-0.418			-0.167		-0.046	-0.104		6.000	-4160.170	8332.340	0.000	0.330	
-0.600	0.054		-0.169	0.078	-0.039	-0.104		8.000	-4158.570	8333.140	0.800	0.221	
-1.640	0.057		-0.187	0.091		-0.104		7.000	-4159.880	8333.760	1.420	0.162	
-0.463			-0.169		-0.047	-0.103		0.004	7.000	-4159.990	8333.980	1.640	0.145
-1.630			-0.189			-0.104		5.000	-4162.020	8334.040	1.700	0.141	

Table S4.32: Top models for manta rays

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight		
-1.144	0.207	+		-0.298	0.273		-0.114		10.000	-1160.260	2340.520	0.000	0.372	
-1.528	0.205			-0.289	0.279		-0.111		7.000	-1163.470	2340.940	0.420	0.301	
-0.902	0.194	+		-0.288	0.274		-0.118		-0.009	11.000	-1159.940	2341.880	1.360	0.188
-0.955	0.207	+		-0.295	0.270		-0.115		11.000	-1160.250	2342.500	1.980	0.138	

Table S4.33: Top models for manta rays for subset of divemaster

(Intercept)	COS_TIME	CurrentCode	EINinoIndex	SIN_TIME	SeaTempCelsius	StudyYear	VisibilityMeters	df	logLik	AIC	delta	weight
-1.599			-0.212			-0.105		5.000	-2439.320	4888.640	0.000	0.466
-1.831			-0.220			-0.102		6.000	-2438.600	4889.200	0.560	0.352
-1.291			-0.207			-0.012		6.000	-2439.260	4890.520	1.880	0.182

Table S4.34: Top models for manta rays for subset of dive sites