

Article

Error Distribution Model to Standardize LPUE, CPUE and Survey-Derived Catch Rates of Target and Non-Target Species

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Table S4. Analyses of alternative hurdle–lognormal GLMM formulations for thornback ray *Raja clavata* (RJC), blackbelly rosefish *Helicolenus dactylopterus* (BRF), and common mora *Mora moro* (RIB) catch rates (LPUE, CPUE and RPN). Likelihood ratio tests the difference of –2 Restricted Maximum log likelihood (–2 REML) between two nested models. AIC: Akaike’s information criterion; BIC: Bayesian information criterion; LRT: Likelihood ratio test.

LPUE (kg landing ⁻¹ vessel ⁻¹)						CPUE (kg days at sea ⁻¹ vessel ⁻¹)					RPN (ind. 10 ⁻³ hooks)				
RJC						RJC					RJC				
–2 REML	AIC	BIC	LRT			–2 REML	AIC	BIC	LRT		–2 REML	AIC	BIC	LRT	
Binomial (proportion of positive catches)						Binomial (proportion of positive catches)					Binomial (proportion of positive catches)				
Year Métier Vessel	2119.6	2213.6	2509.7			Year Vessel Gear Target	18369.1	18445.1	18762.7		Year Area	4656.7	4712.7	4910.5	
Year Métier Vessel Year × Vessel *	2111.4	2207.4	2509.8	8.2	0.004	Year Vessel Gear Target Year × Gear *	18194.2	18272.2	18598.1	174.9 < 0.001	Year Area Year × Area *	4646.1	4704.1	4908.9	10.6 0.001
Lognormal (positive catches)						Lognormal (positive catches)					Lognormal (positive catches)				
Year Vessel Métier *	4666.7	4760.7	5007.8			Year Vessel Gear Target Quarter *	12435.7	12517.7	12779.3		Year Area Depth Month Moon *	1953.3	2047.3	2259.4	
Year Vessel Métier Year × Vessel	4728.8	4824.8	5077.2	62.1	< 0.001	Year Vessel Gear Target Quarter Year × Quarter	12537.5	12621.5	12889.5	101.8 < 0.001	Year Area Depth Month Moon Year × Month	2022.9	2118.9	2335.5	69.6 < 0.001



LPUE (kg landing ⁻¹ vessel ⁻¹)							CPUE (kg days at sea ⁻¹ vessel ⁻¹)							RPN (ind. 10 ⁻³ hooks)					
RJC							RJC							RJC					
-2 REML AIC BIC LRT							-2 REML AIC BIC LRT							-2 REML AIC BIC LRT					
Year Vessel Métier	4685.5	4783.5	5041.1	43.4	< 0.001		Year Vessel Gear	12471.6	12557.6	12831.9	65.9	< 0.001		Year Area Depth	2022.1	2120.1	2341.2	0.8	0.374
Year × Vessel Year × Métier							Target Quarter Year × Quarter Year × Vessel							Month Moon Year × Month Year × Moon Year × Area Depth Month Moon Year × Month Year × Moon Year × Area	2015.3	2115.3	2340.9	6.8	0.009
BRF							BRF							BRF					
Binomial (proportion of positive catches)							Binomial (proportion of positive catches)							Binomial (proportion of positive catches)					
Year Métier Vessel	2654.9	2748.9	3045.0				Year Gear Target *	23316.2	23384.2	23668.3				Year Depth Soak time*	6569.9	6665.9	6991.0		
Year Métier Vessel Year × Vessel	2653.6	2749.6	3052.0	1.32	0.251		Year Gear Target Year × Target	23316.2	23386.2	23678.7	0.0	0.993		Year Depth Soak time Year × Soak time	6569.9	6667.9	6999.8	0.0	0.997
Year Métier Vessel Year × Vessel Year × Métier *	2565.4	2663.4	2972.1	88.2	< 0.001														
Lognormal (positive catches)							Lognormal (positive catches)							Lognormal (positive catches)					
Year Vessel Métier *	5560.3	5656.3	5915.9				Year Vessel Gear Target *	26472.1	26550.1	26827.7				Year Area Depth *	10578.5	10676.5	10979.0		
														Year Area Depth Year × Area	10660.7	10760.7	11069.4	82.2	< 0.001
RIB							RIB							RIB					
Binomial (proportion of positive catches)							Binomial (proportion of positive catches)							Binomial (proportion of positive catches)					
Year Métier Vessel	1060.1	1154.1	1450.2				Year Vessel Gear Depth Target *	6583.2	6663.2	6993.6				Year Depth Area	4296.9	4398.9	4759.0		
Year Métier Vessel Year × Vessel	1057.5	1153.5	1455.9	2.5	0.111									Year Depth Area Year × Area*	4117.7	4221.7	4588.9	179.2	< 0.001
Year Métier Vessel Year × Vessel Year × Métier *	1002.7	1100.7	1409.4	54.9	< 0.001														
Lognormal (positive catches)							Lognormal (positive catches)							Lognormal (positive catches)					
Year Vessel Métier	2137.5	2211.5	2370.6				Year Vessel Depth Target *	5944.6	6014.6	6206.5				Year Area Depth Moon*	4414.7	4514.7	4785.2		

LPUE (kg landing ⁻¹ vessel ⁻¹)							CPUE (kg days at sea ⁻¹ vessel ⁻¹)							RPN (ind. 10 ⁻³ hooks)									
RJC							RJC							RJC									
		-2 REML	AIC	BIC	LRT				-2 REML	AIC	BIC	LRT				-2 REML	AIC	BIC	LRT				
Year	Vessel	Métier	2125.1	2201.1	2364.5	12.4	< 0.001	Year	Vessel	Depth	5968.6	6040.6	6237.9	24.0	< 0.001	Year	Area	Depth	4507.4	4609.4	4885.4	92.7	< 0.001
<i>Year × Vessel</i>								<i>Target Year × Vessel</i>								<i>Moon Year × Moon</i>							
Year	Vessel	Métier						Year	Vessel	Depth						Year	Area	Depth					
<i>Year × Vessel</i>			2067.9	2145.9	2313.6	57.2	< 0.001	<i>Year × Vessel</i>								<i>Moon Year × Moon</i>			4474.2	4578.2	4859.6	33.2	< 0.001
<i>Métier *</i>								<i>Métier *</i>								<i>Year × Area</i>							

The factors in normal typeface are treated as fixed effects and those in italics are random interactions. * the best fitted model.