

Supplement B: Model Selection Results and Projections Based on Alternative Sea Surface Temperatures

Table S.B.1. Stepwise model selection results for the right whale distribution off North Carolina. Predictor variables include the distance to the shoreline, mean winter sea surface temperature (SST), bathymetric depth, and bathymetric slope. Survey effort (the number of flights) was included as an offset in all candidate models. Smoothed covariates are denoted by $s(\cdot)$. The evaluation criteria included the proportion of deviance explained, generalized cross-validation score (GCV), and mean average squared prediction error (ASPE) from a fivefold cross validation. The best model at each step is indicated by bold italic type.

Step	Model	% Deviance	GCV	Mean ASPE
<i>1</i>	<i>Null</i>	<i>0.0</i>	<i>0.3003</i>	<i>0.03032</i>
2	$s(\log[\text{depth}])$	1.84	0.2962	0.03031
<i>2</i>	<i>$s(\text{distance to shore})$</i>	<i>3.74</i>	<i>0.2904</i>	<i>0.03031</i>
2	$s(\log[\text{slope}])$	3.61	0.2920	0.03029
2	$s(\text{avg SST})$	2.93	0.2940	0.03031
3	$s(\text{distance to shore}) + s(\log[\text{depth}])$	4.38	0.2907	0.03030
<i>3</i>	<i>$s(\text{distance to shore}) + s(\log[\text{slope}])$</i>	<i>6.88</i>	<i>0.2844</i>	<i>0.03028</i>
3	$s(\text{distance to shore}) + s(\text{avg SST})$	5.17	0.2885	0.03031
4	$s(\text{distance to shore}) + s(\log[\text{slope}]) + s(\log[\text{depth}])$	8.05	0.2817	0.03027
<i>4</i>	<i>$s(\text{distance to shore}) + s(\log[\text{slope}]) + s(\text{avg SST})$</i>	<i>8.42</i>	<i>0.2812</i>	<i>0.03028</i>
5	$s(\text{distance to shore}) + s(\log[\text{slope}]) + s(\text{avg SST}) + s(\log[\text{depth}])$	9.11	0.2800	0.03027

Table S.B.2. Results of analysis of deviance tests comparing North Carolina right whale distribution models at each step of the stepwise selection procedure. Each model shown is the best model for that step from Table S.B.1. The reductions in deviance, F -statistics, and P -values compare each model with the one in the previous step.

Model/step	Estimated df	Residual deviance	Reduction in deviance	F	P
Null	1.00	186.3			
Step 2	2.00	179.3	6.96	24.1	<0.001
Step 3	4.67	173.5	5.86	7.8	<0.001
Step 4	5.89	170.6	2.87	8.5	<0.01
Step 5	6.57	169.3	1.28	6.8	<0.05

Alt7c				Alt8a				Alt8b				Alt9a				Alt9b				Alt10				Alt11				Alt12			
S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
10/2	9/6	10/1	10/2	12/1	10/2	12/1	12/1	10/2	9/6	10/1	10/2	10/3	9/2	10/1	10/2	10/1	8/2	10/7	10/1	10/2	9/6	10/1	10/1	12/2	12/1	12/1	12/2	12/2	12/1	12/1	12/2
3	6	6	0	2	7	12/1	1	3	9/6	6	0	1	0	5	7	4	3	10/7	1	3	9/6	6	9	8	8	3	7	3	0	1	2
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
48	48	48	48	7	6	7	7	48	48	48	48	26	26	26	26	54	54	54	54	6	6	6	6	3	3	3	3	3	3	3	3
74	74	74	74	14	13	14	14	73	73	73	73	46	46	46	46	79	79	79	79	13	13	13	13	1	1	1	1	2	2	2	2
10/2	9/1	10/2	10/2	12/9	10/2	11/2	12/8	10/2	9/1	10/2	10/2	11/9	9/2	10/1	11/3	10/1	8/3	10/1	10/1	10/2	9/1	10/2	10/2	12/2	12/1	12/1	12/2	12/1	12/4	12/9	12/1
6	1	1	4	8	8	5	12/8	6	1	1	4	7	7	9	11/3	9	0	1	5	6	1	1	4	3	1	0	4	9	12/4	12/9	8
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
50	50	50	50	26	20	24	26	50	50	50	50	51	48	48	49	63	63	63	63	20	20	20	20	15	15	15	15	14	13	13	14
61	61	61	61	16	15	15	16	61	61	61	61	31	30	30	30	65	65	65	65	15	15	15	15	2	2	2	2	2	2	2	2
10/2	9/6	10/1	10/2	12/7	10/2	11/9	12/6	10/2	9/6	10/1	10/2	10/2	9/1	10/1	10/2	10/1	8/2	10/6	10/1	10/2	9/6	10/1	10/2	12/1	12/3	12/6	12/1	12/1	11/2	12/5	12/1
3	6	6	0	0	0	11/9	12/6	3	9/6	6	0	8	5	3	4	5	4	10/6	1	3	9/6	6	0	8	12/3	12/6	12/1	5	1	12/5	4
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
46	46	46	46	11	9	9	11	46	46	46	46	35	35	35	35	57	57	57	57	9	9	9	9	8	7	7	8	6	4	5	6
76	76	76	76	13	12	12	13	75	75	75	75	41	41	41	41	80	80	80	80	12	12	12	12	1	1	1	1	2	2	2	2

Table S.B.4. Projected commercial Black Sea Bass closure dates, percent of annual catch limit (ACL) reached, and risk (in relative risk units) of right whale entanglement in pot gear under various proposed closure alternatives, with whale distribution based on below-average sea surface temperatures. See Table S.B.3 for additional information.

Scenario and condition		Alt 1	Alt2				Alt3				Alt4				Alt5				Alt6				Alt7a				Alt7b			
			S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
A	Closure date		10/2	8/4	9/2	9/2	12/5	10/1	10/2	12/3	12/3	12/2	12/1	12/3	12/2	12/1	12/1	12/2	12/2	12/2	12/1	12/2	10/1	8/1	10/1	10/1	10/1	8/1	10/6	10/7
	%ACL	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Risk (North Carolina)	0	100	100	100	14	10	10	14	2	2	2	2	2	2	2	2	2	2	2	2	74	74	74	74	74	74	74	74	74
	Risk (Florida-South Carolina)	0	100	100	100	52	51	51	52	0	0	0	0	52	52	52	52	0	0	0	0	95	95	95	95	86	86	86	86	86
B	Closure date		10/2	8/4	9/2	9/2	12/3	10/1	11/4	12/2	12/2	12/1	12/1	12/2	12/1	12/2	12/8	12/1	n/a	12/2	12/2	n/a	10/1	8/2	10/1	10/1	10/1	8/2	10/1	10/9
	%ACL	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Risk (North Carolina)	0	100	100	100	26	21	21	26	8	8	8	8	2	1	1	2	8	8	8	8	69	69	69	69	69	69	69	69	69
	Risk (Florida-South Carolina)	0	100	100	100	37	36	36	37	3	3	3	3	58	57	58	58	0	0	0	0	82	82	82	82	71	71	71	71	71
C	Closure date		10/2	8/4	9/2	9/2	11/2	10/4	10/2	11/1	12/2	12/7	12/1	12/1	12/1	12/1	12/6	12/1	12/2	12/7	12/1	12/1	10/1	8/1	10/1	10/1	10/1	8/1	10/6	10/7
	%ACL	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Risk (North Carolina)	0	100	100	100	17	13	13	16	4	3	3	3	2	2	2	2	4	3	3	3	71	71	71	71	71	71	71	71	71
	Risk (Florida-South Carolina)	0	100	100	100	51	51	51	51	1	1	1	1	48	48	48	48	0	0	0	0	87	87	87	87	81	81	81	81	81

Alt7c				Alt8a				Alt8b				Alt9a				Alt9b				Alt10				Alt11				Alt12				
S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	
10/2	9/6	10/1	10/2	12/1	10/2	12/1	12/1	10/2	9/6	10/1	10/2	10/3	9/2	10/1	10/2	10/1	8/2	10/7	10/1	10/2	9/6	10/1	10/1	12/2	12/1	12/1	12/2	12/2	12/1	12/1	12/2	
3		6	0	2	7		1	3		6	0	1	0	5	7	4	3		1	3		6	9	8	8	3	7	3	0	1	2	
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
48	48	48	48	7	6	7	7	48	48	48	48	26	26	26	26	54	54	54	54	6	6	6	6	3	3	3	3	3	3	3	3	
76	76	76	76	54	53	54	54	77	77	77	77	72	72	72	72	83	83	83	83	53	53	53	53	5	5	5	5	5	7	7	7	7
10/2	9/1	10/2	10/2	12/9	10/2	11/2	12/8	10/2	9/1	10/2	10/2	11/9	9/2	10/1	11/3	10/1	8/3	10/1	10/1	10/2	9/1	10/2	10/2	12/2	12/1	12/1	12/2	12/1	12/4	12/9	12/1	
6	1	1	4		8	5		6	1	1	4		7	9		9	0	1	5	6	1	1	4	3	1	0	4	9			8	
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
50	50	50	50	26	20	24	26	50	50	50	50	51	48	48	49	63	63	63	63	20	20	20	20	15	15	15	15	14	13	13	14	
64	64	64	64	58	57	58	58	68	68	68	68	69	68	68	69	73	73	73	73	58	58	58	58	12	12	12	12	7	7	7	7	
10/2	9/6	10/1	10/2	12/7	10/2	11/9	12/6	10/2	9/6	10/1	10/2	10/2	9/1	10/1	10/2	10/1	8/2	10/6	10/1	10/2	9/6	10/1	10/2	12/1	12/3	12/6	12/1	12/1	11/2	12/5	12/1	
3		6	0		0			3		6	0	8	5	3	4	5	4		1	3		6	0	8		7		5	1		4	
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
46	46	46	46	11	9	9	11	46	46	46	46	35	35	35	35	57	57	57	57	9	9	9	9	8	7	7	8	6	4	5	6	
71	71	71	71	50	49	49	50	71	71	71	71	67	67	67	67	76	76	76	76	50	50	50	50	8	8	8	8	9	9	9	9	