

**Appendix II. Log-linear model results of black sea bass reporting rates using SAS CATMOD.**

Response	type*region*fate	Response Levels	17
Weight Variable	count	Populations	1
Data Set	NEWFATE	Total Frequency	5672
Frequency Missing	0	Observations	30

Type 1= regular tags  
 2= High reward tags

Sample	Sample Size
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1	5672

Region 1= MA - NY  
 2= NJ - DE  
 3= MD - NC

Fate 1= not removed  
 2= Recreational killed  
 3= Commercial killed

Response Profiles

Response	type	region	fate
-----			
1	1	1	1
2	1	1	2
3	1	1	3
4	1	2	1
5	1	2	2
6	1	2	3
7	1	3	1
8	1	3	2
9	1	3	3
10	2	1	1
11	2	1	2
12	2	1	3
13	2	2	1
14	2	2	2
15	2	3	1
16	2	3	2
17	2	3	3

\_Response\_ Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1	1	0	1	0	1	0	1	0	1	0	0	0	1	0	0	0
2	1	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	0
3	1	1	0	1	0	-1	-1	-1	-1	-1	-1	0	0	-1	-1	0	0
4	1	0	1	0	1	1	0	1	0	0	0	1	0	0	0	1	0
5	1	0	1	0	1	0	1	0	1	0	0	0	1	0	0	0	1
6	1	0	1	0	1	-1	-1	-1	-1	0	0	-1	-1	0	0	-1	-1
7	1	-1	-1	-1	-1	1	0	1	0	-1	0	-1	0	-1	0	-1	0
8	1	-1	-1	-1	-1	0	1	0	1	0	-1	0	-1	0	-1	0	-1
9	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
10	-1	1	0	-1	0	1	0	-1	0	1	0	0	0	-1	0	0	0
11	-1	1	0	-1	0	0	1	0	-1	0	1	0	0	0	-1	0	0
12	-1	1	0	-1	0	-1	-1	1	1	-1	-1	0	0	1	1	0	0
13	-1	0	1	0	-1	1	0	-1	0	0	0	1	0	0	0	-1	0
14	-1	0	1	0	-1	0	1	0	-1	0	0	0	1	0	0	0	-1
15	-1	-1	-1	1	1	1	0	-1	0	-1	0	-1	0	1	0	1	0
16	-1	-1	-1	1	1	0	1	0	-1	0	-1	0	-1	0	1	0	1
17	-1	-1	-1	1	1	-1	-1	1	1	1	1	1	1	-1	-1	-1	-1

The CATMOD Procedure

Maximum Likelihood Analysis

Iteration	Sub Iteration	-2 Log Likelihood	Convergence Criterion	Parameter Estimates						
				1	2	3	4	5	6	7
0	0	32139.972	1.0000	0	0	0	0	0	0	0
1	0	28815.127	0.1034	1.0383	0.1561	-0.8102	-0.2790	0.0859	1.9389	-0.6516
2	3	20076.527	0.3033	1.3433	0.5228	-1.0404	-0.4736	1.0372	3.0646	-0.9324
3	1	17004.075	0.1530	1.2685	0.4945	-0.5834	-0.1467	0.0624	2.6155	-0.9882
4	0	16836.472	0.009857	1.2551	0.4798	-0.3948	-0.2055	0.0595	2.5373	-1.0366
5	0	16831.238	0.000311	1.2677	0.4950	-0.4155	-0.2055	0.0496	2.5308	-1.0236
6	0	16831.235	1.9593E-7	1.2680	0.4953	-0.4159	-0.2055	0.0493	2.5306	-1.0232
7	0	16831.235	3.009E-13	1.2680	0.4953	-0.4159	-0.2055	0.0493	2.5306	-1.0232

Maximum Likelihood Analysis

Iteration	Parameter Estimates									
	8	9	10	11	12	13	14	15	16	17
0	0	0	0	0	0	0	0	0	0	0
1	1.3170	-0.9698	-0.3634	-0.2051	-0.3951	0.9111	0.0397	0.2330	-1.1135	0
2	-0.2602	-0.3856	-0.7323	-1.1457	-0.1741	2.3430	-0.2280	-0.0979	-0.3736	0
3	0.0339	-0.0404	-0.3696	-0.8414	-0.3318	1.6768	0.1070	-0.1112	0.0871	0
4	0.1272	-0.1088	-0.4156	-0.6869	-0.1882	1.5067	0.1077	-0.1987	0.0679	0
5	0.1264	-0.1048	-0.3951	-0.7218	-0.1868	1.5375	0.0964	-0.1791	0.0510	0
6	0.1266	-0.1049	-0.3946	-0.7227	-0.1864	1.5381	0.0961	-0.1785	0.0503	0
7	0.1266	-0.1049	-0.3946	-0.7227	-0.1864	1.5381	0.0961	-0.1785	0.0503	0

Maximum likelihood computations converged.

Maximum Likelihood Analysis of Variance

Source	DF	Chi-Square	Pr > ChiSq
type	1	213.55	<.0001
region	2	13.86	0.0010
type*region	2	3.17	0.2054
fate	2	681.20	<.0001
type*fate	2	2.70	0.2588
region*fate	4	178.46	<.0001
type*region*fate	3*	1.22	0.7480
Likelihood Ratio	0	.	.

NOTE: Effects marked with '\*' contain one or more redundant or restricted parameters.

Analysis of Maximum Likelihood Estimates

Effect	Parameter	Estimate	Standard Error	Chi-Square	Pr > ChiSq
type	1	1.2680	0.0868	213.55	<.0001
region	2	0.4953	0.1344	13.59	0.0002

Analysis of Maximum Likelihood Estimates

Effect	Parameter	Estimate	Standard Error	Chi-Square	Pr > ChiSq
region	3	-0.4159	0.2433	2.92	0.0874
type*region	4	-0.2055	0.1262	2.65	0.1035
	5	0.0493	0.2229	0.05	0.8250
fate	6	2.5306	0.1096	533.07	<.0001
	7	-1.0232	0.2069	24.45	<.0001
type*fate	8	0.1266	0.0903	1.97	0.1609
	9	-0.1049	0.2051	0.26	0.6091
region*fate	10	-0.3946	0.1383	8.14	0.0043
	11	-0.7227	0.2166	11.14	0.0008
	12	-0.1864	0.2488	0.56	0.4539
	13	1.5381	0.1405	119.82	<.0001
type*region*fate	14	0.0961	0.1306	0.54	0.4622
	15	-0.1785	0.2051	0.76	0.3842
	16	0.0503	0.2293	0.05	0.8265
	17	.	.	.	.

Maximum Likelihood Predicted Values for Response Functions

Sample	Function Number	-----Observed-----		-----Predicted-----		Residual
		Function	Standard Error	Function	Standard Error	
1	1	6.63922203	0.707569	6.63922203	0.707569	0
	2	2.2512918	0.743392	2.2512918	0.743392	0
	3	3.95124372	0.713874	3.95124372	0.713874	0
	4	6.14525802	0.707864	6.14525802	0.707864	0
	5	4.03424064	0.713337	4.03424064	0.713337	0
	6	0.69314718	0.866025	0.69314718	0.866025	0
	7	7.1592919	0.707382	7.1592919	0.707382	0
	8	2.30258509	0.74162	2.30258509	0.74162	0
	9	2.74084002	0.72956	2.74084002	0.72956	0
	10	4.06902675	0.713125	4.06902675	0.713125	0
	11	0.69314718	0.866025	0.69314718	0.866025	0
	12	1.70474809	0.768706	1.70474809	0.768706	0
	13	3.15700042	0.721995	3.15700042	0.721995	0
	14	1.60943791	0.774597	1.60943791	0.774597	0
	15	4.35027794	0.711654	4.35027794	0.711654	0
	16	-0.6931472	1.224745	-0.6931472	1.224745	0

Maximum Likelihood Predicted Values for Frequencies

Sample	type	region	fate	Function Number	-----Observed-----		-----Predicted-----		Residual
					Frequency	Standard Error	Frequency	Standard Error	
1	1	1	1	F1	1529	33.41897	1529	33.41898	6.3665E-10
	1	1	2	F2	19	4.351592	19	4.351593	0
	1	1	3	F3	104	10.10411	104	10.10411	0
	1	2	1	F4	933	27.92004	933	27.92004	3.8904E-10
	1	2	2	F5	113	10.52372	113	10.52373	0
	1	2	3	F6	4	1.999295	4	1.999294	0
	1	3	1	F7	2572	37.49283	2572	37.49283	1.07775E-9
	1	3	2	F8	20	4.464244	20	4.464245	0
	1	3	3	F9	31	5.552528	31	5.552529	0
	2	1	1	F10	117	10.70451	117	10.70451	0
	2	1	2	F11	4	1.999295	4	1.999294	0
	2	1	3	F12	11	3.313407	11	3.313408	0
	2	2	1	F13	47	6.827191	47	6.827192	0
	2	2	2	F14	10	3.159489	10	3.159489	0
	2	3	1	F15	155	12.27861	155	12.27858	-2.3067E-9
	2	3	2	F16	1	0.999912	1	0.999912	0
	2	3	3	F17	2	1.413964	2	1.413964	0

**Reduced Model**

Sample	Sample Size
1	5672

Response Profiles

Response	type	region	fate
1	1	1	1
2	1	1	2
3	1	1	3
4	1	2	1
5	1	2	2
6	1	2	3
7	1	3	1
8	1	3	2
9	1	3	3
10	2	1	1
11	2	1	2
12	2	1	3
13	2	2	1
14	2	2	2
15	2	3	1
16	2	3	2
17	2	3	3

\_Response\_ Matrix

	1	2	3	4	5	6	7	8	9
1	1	1	0	1	0	1	0	0	0
2	1	1	0	0	1	0	1	0	0
3	1	1	0	-1	-1	-1	-1	0	0
4	1	0	1	1	0	0	0	1	0
5	1	0	1	0	1	0	0	0	1
6	1	0	1	-1	-1	0	0	-1	-1
7	1	-1	-1	1	0	-1	0	-1	0
8	1	-1	-1	0	1	0	-1	0	-1
9	1	-1	-1	-1	-1	1	1	1	1
10	-1	1	0	1	0	1	0	0	0
11	-1	1	0	0	1	0	1	0	0
12	-1	1	0	-1	-1	-1	-1	0	0
13	-1	0	1	1	0	0	0	1	0
14	-1	0	1	0	1	0	0	0	1
15	-1	-1	-1	1	0	-1	0	-1	0
16	-1	-1	-1	0	1	0	-1	0	-1
17	-1	-1	-1	-1	-1	1	1	1	1

Maximum Likelihood Analysis

Iteration	Sub Iteration	-2 Log Likelihood	Convergence Criterion
0	0	32139.972	1.0000
1	0	19481.248	0.3939
2	0	17709.493	0.0909
3	0	16865.254	0.0477
4	0	16844.48	0.001232
5	0	16844.447	1.9744E-6
6	0	16844.447	6.5E-12



Maximum Likelihood Analysis

Iteration	Parameter Estimates								
	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0
1	0.9317	0.0496	-0.5972	1.8324	-0.7582	-0.2569	-0.0985	-0.6082	0.6981
2	1.2471	0.1873	-0.1005	2.7003	-1.1659	-0.3565	-0.6109	0.1685	0.9777
3	1.3539	0.2969	-0.3181	2.6611	-1.1362	-0.3696	-0.8444	-0.0942	1.4985
4	1.3649	0.3298	-0.3811	2.6374	-1.1017	-0.3262	-0.8576	-0.1290	1.5281
5	1.3650	0.3302	-0.3822	2.6362	-1.1012	-0.3256	-0.8588	-0.1317	1.5303
6	1.3650	0.3302	-0.3822	2.6362	-1.1012	-0.3256	-0.8588	-0.1318	1.5304

Maximum likelihood computations converged.

Maximum Likelihood Analysis of Variance

Source	DF	Chi-Square	Pr > ChiSq
type	1	2427.99	<.0001
region	2	16.48	0.0003
fate	2	1761.35	<.0001
region*fate	4	296.29	<.0001
Likelihood Ratio	7	13.21	0.0671

Analysis of Maximum Likelihood Estimates

Effect	Parameter	Estimate	Standard Error	Chi-Square	Pr > ChiSq
type	1	1.3650	0.0277	2427.99	<.0001
region	2	0.3302	0.0823	16.10	<.0001
	3	-0.3822	0.1201	10.13	0.0015
fate	4	2.6362	0.0699	1420.76	<.0001
	5	-1.1012	0.0922	142.79	<.0001
region*fate	6	-0.3256	0.0832	15.34	<.0001
	7	-0.8588	0.1236	48.27	<.0001
	8	-0.1318	0.1208	1.19	0.2756
	9	1.5304	0.1378	123.30	<.0001

Maximum Likelihood Predicted Values for Response Functions

Sample	Function Number	-----Observed-----		-----Predicted-----		Residual
		Function	Standard Error	Function	Standard Error	
1	1	6.63922203	0.707569	6.63968757	0.184338	-0.0004655
	2	2.2512918	0.743392	2.36907841	0.277221	-0.1177866
	3	3.95124372	0.713874	3.97851632	0.205106	-0.0272726
	4	6.14525802	0.707864	6.12113676	0.185454	0.02412126
	5	4.03424064	0.713337	4.04576855	0.203723	-0.0115279
	6	0.69314718	0.866025	0.68305362	0.531986	0.01009356
	7	7.1592919	0.707382	7.14454158	0.183683	0.01475033
	8	2.30258509	0.74162	2.27810663	0.284591	0.02447846
	9	2.74084002	0.72956	2.73009175	0.055406	0.01074827
	10	4.06902675	0.713125	3.90959582	0.175814	0.15943093
	11	0.69314718	0.866025	-0.3610133	0.271628	1.05416053
	12	1.70474809	0.768706	1.24842457	0.197481	0.45632353
	13	3.15700042	0.721995	3.39104501	0.176985	-0.2340446
	14	1.60943791	0.774597	1.31567679	0.196044	0.29376112
	15	4.35027794	0.711654	4.41444982	0.175128	-0.0641719
	16	-0.6931472	1.224745	-0.4519851	0.279146	-0.2411621

Maximum Likelihood Predicted Values for Frequencies

Sample	type	region	fate	Function Number	-----Observed-----		-----Predicted-----		Residual
					Frequency	Standard Error	Frequency	Standard Error	
1	1	1	1	F1	1529	33.41897	1545.23042	32.51361	-16.230416
	1	1	2	F2	19	4.351592	21.5919195	4.493692	-2.5919195
	1	1	3	F3	104	10.10411	107.959598	9.971438	-3.9595977
	1	2	1	F4	933	27.92004	920.003529	26.91074	12.9964714
	1	2	2	F5	113	10.52372	115.469831	10.30551	-2.4698306
	1	2	3	F6	4	1.999295	4	1.999298	0
	1	3	1	F7	2572	37.49283	2560.05064	36.37653	11.9493649
	1	3	2	F8	20	4.464244	19.7143613	4.294582	0.28563867
	1	3	3	F9	31	5.552528	30.9797107	5.378199	0.02028934
	2	1	1	F10	117	10.70451	100.769584	5.643677	16.2304164
	2	1	2	F11	4	1.999295	1.40808045	0.302024	2.59191955
	2	1	3	F12	11	3.313407	7.04040226	0.74591	3.95959774
	2	2	1	F13	47	6.827191	59.9964714	3.574457	-12.996471
	2	2	2	F14	10	3.159489	7.53016937	0.77744	2.46983063
	2	3	1	F15	155	12.27861	166.949365	8.984007	-11.949365
	2	3	2	F16	1	0.999912	1.28563867	0.287904	-0.2856387
	2	3	3	F17	2	1.413964	2.02028934	0.36607	-0.0202893