TOP RESULTS FOR SENSITIVITY AND ROBUSTNESS TESTS:

Model outputs were compared to all of the sighting reports from Ireland (All of Ireland) and only those from the model area itself (Inishowen). Model output includes Total aggregations (All aggregations of two or more sharks) and Pseudo Sighting Reports (Each day, 20 random patches are sample and any shark sighting of one or more is reported).

Table 1: Statistical Results for Total Aggregations

Submodel	Inishowen			All of Ireland			Parameter Settings							
	ME	RMSE	MAE	ME	RMSE	MAE	Cal (Calanus copepods)	Otherzp (Psuedo calanus)	Threshold ZP (Population size)	Sense Distance (km)	Swim Speed (km)	Friend Min (# sharks)	No Eat (# Days)	Return (# Days)
Food/Social	0.13	0.25	0.17	0.12	0.24	0.16	10	11	1.E+11	10	9	5	4	20
Random	0.18	0.27	0.20	0.16	0.24	0.18	10	11	1.E+11	10	9	5	4	20
Food	0.15	0.27	0.19	0.14	0.26	0.18	10	11	1.E+11	10	9	5	4	20
Social	0.26	0.37	0.29	0.24	0.33	0.26	10	11	1.E+11	10	9	5	4	20
Food	0.16	0.29	0.20	0.14	0.28	0.19	10	10	1.E+11	10	8	5	14	20
Food/Social	0.17	0.29	0.21	0.16	0.28	0.21	10	10	1.E+11	10	8	5	14	20
Random	0.41	0.51	0.42	0.40	0.49	0.40	10	10	1.E+11	10	8	5	14	20
Social	0.64	0.73	0.65	0.63	0.71	0.63	10	10	1.E+11	10	8	5	14	20
Food	0.09	0.21	0.13	0.07	0.20	0.13	10	10	1.E+11	10	9	5	14	20
Food/Social	0.16	0.28	0.20	0.15	0.27	0.20	10	10	1.E+11	10	9	5	14	20
Random	0.39	0.49	0.41	0.38	0.47	0.39	10	10	1.E+11	10	9	5	14	20
Social	0.63	0.72	0.64	0.61	0.70	0.62	10	10	1.E+11	10	9	5	14	20
Food	0.17	0.29	0.20	0.15	0.28	0.20	10	10	1.E+11	10	9	5	14	20
Food/Social	0.17	0.29	0.21	0.16	0.28	0.21	10	10	1.E+11	10	9	5	14	20
Food/Social	0.20	0.32	0.24	0.18	0.31	0.23	10	10	1.E+11	10	9	5	14	20
Random	0.39	0.50	0.40	0.38	0.48	0.38	10	10	1.E+11	10	9	5	14	20

Social	0.62	0.71	0.62	0.60	0.69	0.60	10	10	1.E+11	10	9	5	14	20
Food	0.16	0.27	0.20	0.14	0.26	0.19	17	10	1.E+11	10	9	5	14	20
Food/Social	0.22	0.34	0.25	0.20	0.33	0.24	17	10	1.E+11	10	9	5	14	20
Random	0.50	0.60	0.50	0.48	0.59	0.49	17	10	1.E+11	10	9	5	14	20
Social	0.73	0.81	0.73	0.71	0.79	0.71	17	10	1.E+11	10	9	5	14	20
Food	0.15	0.28	0.19	0.14	0.27	0.19	10	11	1.E+11	10	9	5	14	20
Food/Social	0.20	0.31	0.23	0.18	0.31	0.23	10	11	1.E+11	10	9	5	14	20
Random	0.39	0.48	0.40	0.37	0.46	0.38	10	11	1.E+11	10	9	5	14	20
Social	0.64	0.73	0.64	0.62	0.70	0.62	10	11	1.E+11	10	9	5	14	20
Food	0.15	0.28	0.19	0.14	0.27	0.19	10	10	1.E+11	10	9	5	14	20
Social	0.63	0.73	0.64	0.61	0.71	0.62	10	10	1.E+11	10	9	5	14	20
Random	0.43	0.53	0.44	0.41	0.52	0.43	10	10	1.E+11	10	9	5	14	20
Food/Social	0.12	0.22	0.15	0.10	0.21	0.14	10	10	3.E+12	10	9	5	14	20
Food	0.28	0.34	0.30	0.27	0.33	0.28	10	10	3.E+12	10	9	5	14	20
Random	0.50	0.59	0.51	0.49	0.57	0.49	10	10	3.E+12	10	9	5	14	20
Social	0.59	0.66	0.59	0.57	0.64	0.57	10	10	3.E+12	10	9	5	14	20
Food	0.07	0.20	0.12	0.05	0.19	0.12	10	10	1.E+11	20	9	5	14	20
Food/Social	0.15	0.27	0.19	0.13	0.27	0.19	10	10	1.E+11	20	9	5	14	20
Random	0.40	0.49	0.41	0.38	0.47	0.39	10	10	1.E+11	20	9	5	14	20
Social	0.65	0.75	0.66	0.64	0.73	0.64	10	10	1.E+11	20	9	5	14	20
Food	0.16	0.28	0.19	0.14	0.27	0.19	10	10	1.E+11	10	10	5	14	20
Food/Social	0.19	0.31	0.23	0.17	0.31	0.22	10	10	1.E+11	10	10	5	14	20
Random	0.42	0.52	0.43	0.40	0.50	0.41	10	10	1.E+11	10	10	5	14	20
Social	0.64	0.73	0.64	0.62	0.71	0.62	10	10	1.E+11	10	10	5	14	20
Food	0.13	0.26	0.17	0.12	0.25	0.17	10	10	1.E+11	10	9	9	14	20
Food/Social	0.21	0.33	0.24	0.19	0.33	0.24	10	10	1.E+11	10	9	9	14	20
Random	0.41	0.51	0.42	0.39	0.49	0.40	10	10	1.E+11	10	9	9	14	20
Social	0.65	0.74	0.66	0.63	0.72	0.64	10	10	1.E+11	10	9	9	14	20

The average aggregation size per month was calculated and normalized via min-max normalization. Note that Total Aggregations only include groups of two or more sharks. These tests included a total of 200 sharks and were each run for ten trials. This table shows the results of each submodel, for the 10 lowest RMSE scores for each setting.

Table 2: Statistics for Pseudo Sightings Reports

	All of Ireland			Inishowen			Parameter Settings							
Submodel	ME	RMSE	MAE	ME	RMSE	MAE	Cal (Calanus copepods)	Otherzp (Psuedo calanus)	Threshold ZP (Population size)	Sense Distance (km)	Swim Speed (km)	Friend Min (# sharks)	No Eat (# Days)	Return (# Days)
Food	0.02	0.15	0.09	0.04	0.16	0.09	10	10	1.00E+11	10	**8**	5	14	20
Food/Social	0.05	0.19	0.12	0.07	0.20	0.12	10	10	1.00E+11	10	**8**	5	14	20
Random	0.47	0.54	0.47	0.49	0.57	0.50	10	10	1.00E+11	10	**8**	5	14	20
Social	0.48	0.56	0.49	0.51	0.59	0.52	10	10	1.00E+11	10	**8**	5	14	20
Food/Social	0.03	0.16	0.10	0.05	0.17	0.10	10	10	**9.50E+10**	10	9	5	14	20
Food	0.09	0.23	0.15	0.12	0.24	0.16	10	10	**9.50E+10**	10	9	5	14	20
Random	0.44	0.52	0.45	0.46	0.54	0.47	10	10	**9.50E+10**	10	9	5	14	20
Social	0.49	0.56	0.49	0.51	0.59	0.52	10	10	**9.50E+10**	10	9	5	14	20
Food	0.01	0.15	0.09	0.04	0.16	0.09	10	10	1.00E+11	10	9	5	14	20
Food	0.05	0.17	0.10	0.07	0.18	0.11	10	10	1.00E+11	10	9	5	14	20
Food/Social	0.07	0.22	0.13	0.09	0.23	0.13	10	10	1.00E+11	10	9	5	14	20
Food/Social	0.08	0.23	0.14	0.10	0.24	0.15	10	10	1.00E+11	10	9	5	14	20
Random	0.47	0.54	0.47	0.49	0.56	0.50	10	10	1.00E+11	10	9	5	14	20
Social	0.47	0.54	0.47	0.49	0.57	0.50	10	10	1.00E+11	10	9	5	14	20
Random	0.47	0.54	0.47	0.49	0.57	0.50	10	10	1.00E+11	10	9	5	14	20
Social	0.48	0.54	0.48	0.50	0.57	0.51	10	10	1.00E+11	10	9	5	14	20
Food	0.02	0.14	0.08	0.04	0.15	0.09	**17**	10	1.00E+11	10	9	5	14	20
Food/Social	0.06	0.21	0.13	0.09	0.22	0.14	**17**	10	1.00E+11	10	9	5	14	20
Random	0.54	0.62	0.55	0.56	0.64	0.57	**17**	10	1.00E+11	10	9	5	14	20
Social	0.54	0.61	0.55	0.56	0.64	0.57	**17**	10	1.00E+11	10	9	5	14	20

Food/Social	0.02	0.17	0.10	0.05	0.17	0.10	10	**11**	1.00E+11	10	9	5	14	20
Food	0.04	0.17	0.10	0.06	0.17	0.11	10	**11**	1.00E+11	10	9	5	14	20
Random	0.45	0.52	0.45	0.47	0.54	0.48	10	**11**	1.00E+11	10	9	5	14	20
Social	0.45	0.52	0.46	0.48	0.55	0.49	10	**11**	1.00E+11	10	9	5	14	20
Food/Social	0.01	0.15	0.08	0.03	0.15	0.08	10	10	**3.00E+12**	10	9	5	14	20
Food	0.10	0.21	0.15	0.12	0.22	0.16	10	10	**3.00E+12**	10	9	5	14	20
Random	0.28	0.35	0.30	0.30	0.37	0.32	10	10	**3.00E+12**	10	9	5	14	20
Social	0.36	0.42	0.37	0.38	0.44	0.39	10	10	**3.00E+12**	10	9	5	14	20
Food/Social	0.00	0.16	0.09	0.02	0.16	0.08	10	10	1.00E+11	**20**	9	5	14	20
Food	0.01	0.16	0.09	0.04	0.17	0.09	10	10	1.00E+11	**20**	9	5	14	20
Social	0.46	0.54	0.46	0.48	0.56	0.49	10	10	1.00E+11	**20**	9	5	14	20
Random	0.47	0.54	0.48	0.50	0.57	0.50	10	10	1.00E+11	**20**	9	5	14	20
Food	0.04	0.17	0.11	0.06	0.18	0.11	10	10	1.00E+11	10	**10**	5	14	20
Food/Social	0.08	0.23	0.14	0.10	0.24	0.15	10	10	1.00E+11	10	**10**	5	14	20
Random	0.48	0.56	0.49	0.51	0.59	0.52	10	10	1.00E+11	10	**10**	5	14	20
Social	0.50	0.58	0.50	0.52	0.60	0.53	10	10	1.00E+11	10	**10**	5	14	20
Food/Social	0.04	0.18	0.11	0.06	0.18	0.11	10	10	1.00E+11	10	9	**9**	14	20
Food	0.09	0.23	0.15	0.11	0.24	0.15	10	10	1.00E+11	10	9	**9**	14	20
Random	0.49	0.56	0.50	0.52	0.59	0.53	10	10	1.00E+11	10	9	**9**	14	20
Social	0.50	0.57	0.50	0.52	0.60	0.53	10	10	1.00E+11	10	9	**9**	14	20
Food/Social	0.03	0.18	0.10	0.06	0.19	0.11	10	11	1.00E+11	10	9	5	**4**	20
Social	0.30	0.37	0.32	0.32	0.40	0.34	10	11	1.00E+11	10	9	5	**4**	20
Food	0.04	0.17	0.10	0.06	0.18	0.11	10	11	1.00E+11	10	9	5	**4**	20
Random	0.26	0.33	0.27	0.28	0.36	0.31	10	11	1.00E+11	10	9	5	**4**	20

Statistical results for total aggregations for the ten settings that gave the most realistic results out of the sensitivity and robustness tests for the pseudo sightings reports. Pseudo sightings reports are randomly sample 10 patches every day and report how many shark(s) were found in each patch. The average aggregation size per month was calculated and normalized via min-max normalization.

PRELIMINARY TEST RESULTS:

Model outputs were compared to all of the sighting reports from Ireland (All of Ireland) and only those from the model area itself (Inishowen). Model output includes Total aggregations (All aggregations of two or more sharks) and Pseudo Sighting Reports (Each day, 20 random patches are sample and any shark sighting of one or more is reported).

Table 3: Statistical Results for preliminary tests. Each test was run for ten trials and contained a total of 100 sharks.

							Total Aggregations							
	Inisowen			All of Ireland			Parameter Settings							
Submodel	ME	RMSE	MAE	ME	RMSE	MAE	Cal (Calanus copepods)	Otherzp (Psuedo calanus)	Threshold ZP (Population size)	Sense Distance (km)	Swim Speed (km)	Friend Min (# sharks)	No Eat (# Days)	Return (# Days)
Food/Social	0.33	0.40	0.35	0.32	0.37	0.32	50	20	3E+12	10	9	5	14	20
Food/Social	0.35	0.42	0.36	0.33	0.39	0.34	50	20	3E+12	20	9	5	14	20
Food/Social	0.26	0.37	0.28	0.24	0.36	0.28	10	10	1.00E+11	10	8	5	14	20
Food/Social	0.19	0.30	0.22	0.18	0.29	0.21	10	10	1.00E+11	10	9	5	4	20
Food/Social	0.13	0.21	0.16	0.11	0.20	0.14	17	17	3E+12	10	9	5	14	20
Food/Social	0.14	0.22	0.17	0.12	0.21	0.15	10	10	3.00E+12	10	9	5	14	20
Food	0.32	0.38	0.33	0.30	0.36	0.31	50	20	3E+12	10	9	5	14	20
Food	0.31	0.38	0.33	0.30	0.35	0.31	50	20	3E+12	20	9	5	14	20
Food	0.19	0.30	0.22	0.17	0.29	0.21	10	10	1.00E+11	10	8	5	14	20
Food	0.16	0.25	0.19	0.14	0.24	0.18	10	10	1.00E+11	10	9	5	4	20
Food	0.28	0.35	0.29	0.26	0.34	0.27	17	17	3E+12	10	9	5	14	20
Food	0.28	0.36	0.29	0.26	0.35	0.28	10	10	3.00E+12	10	9	5	14	20

Note that submodels Random and Social were not run for this test, due to the statical results in Table 12, which indicated low correlation with IBSG/IWDG data. Total Aggregations compare groups of two or more sharks. The average aggregation size per month was calculated and normalized via min-max normalization.

Table 4 Statistical Results for pseudo sightings reports from preliminary tests.

	Inishowen			All of Ireland			Parameter Settings							
Submodel	ME	RMSE	MAE	ME	RMSE	MAE	Cal (Calanus copepods)	Otherzp (Psuedo calanus)	Threshold ZP (Population size)	Sense Distance (km)	Swim Speed (km)	Friend Min (# sharks)	No Eat (# Days)	Return (# Days)
Food/Social	0.08	0.17	0.12	0.06	0.16	0.11	17	17	3.E+12	10	9	5	14	20
Food/Social	0.08	0.17	0.12	0.06	0.16	0.11	10	10	3.E+12	10	9	5	14	20
Food	0.12	0.20	0.15	0.10	0.18	0.14	17	17	3.E+12	10	9	5	14	20
Food	0.10	0.20	0.14	0.08	0.18	0.12	10	10	1.E+11	10	8	5	14	20
Food/Social	0.11	0.21	0.15	0.09	0.20	0.14	10	10	1.E+11	10	8	5	14	20
Food	0.16	0.27	0.19	0.14	0.26	0.18	10	10	1.E+11	10	9	5	4	20
Food/Social	0.16	0.28	0.20	0.14	0.26	0.18	10	10	1.E+11	10	9	5	4	20
Food	0.19	0.28	0.22	0.17	0.27	0.20	10	10	3.E+12	10	9	5	14	20
Food/Social	0.24	0.32	0.27	0.22	0.30	0.24	50	20	3.E+12	10	9	5	14	20
Food/Social	0.30	0.38	0.32	0.28	0.36	0.30	50	20	3.E+12	20	9	5	14	20
Food	0.30	0.38	0.32	0.28	0.36	0.30	50	20	3.E+12	10	9	5	14	20
Food	0.32	0.41	0.35	0.30	0.39	0.32	50	20	3.E+12	20	9	5	14	20

Each test was run for ten trials and contained a total of 100 sharks. Note that submodels Random and Social were not run for this test, due to the statical results in Table 12, which indicated low correlation with IBSG/IWDG data. Pseudo Sightings compare any sighting (1+) of sharks. The highlighted results are the same settings used for Test A. The average aggregation size per month was calculated and normalized via min-max normalization.