

Supplementary material

Appendix 1.

Table A1. Dates and locations of data collection from land-based vantage points and from boats at sea.

Observation type	Site	Location [†]	Date	Sunrise	Sunset	Start	End	Effort (h:m)
Land-based	Fife Ness	56.28° N, 2.59° W	10-Jun-2014	03:24	20:55	16:40	19:02	1:20
			12-Jun-2014	03:24	20:57	16:24	17:59	1:20
			14-Jun-2014	03:23	20:58	19:30	20:55	1:20
			28-Aug-2018	05:06	19:15	17:11	18:46	1:20
			29-Aug-2018	05:08	19:13	17:50	19:15	1:20
	Isle of May	56.18° N, 2.55° W	11-Jun-2014	03:24	20:56	13:18	19:58	1:40
			12-Jun-2014	03:24	20:57	05:24	13:45	5:20
			09-Jun-2014	03:25	20:54	17:30	20:01	1:20
	St Abbs Head	55.92° N, 2.14° W	10-Jun-2014	03:24	20:55	09:43	11:54	1:20
			15-Jun-2014	03:23	20:59	09:47	11:32	1:20
09-Jun-2014			03:25	20:54	17:30	20:01	1:20	
At sea	Buchan Deep	57.45° N, 1.33° W	09-Jun-2013	03:09	21:00	06:09	14:37	8:28
			08-Jul-2013	03:19	21:00	06:01	14:58	8:57
			09-Jul-2013	03:21	20:58	06:07	14:50	8:43
			05-Aug-2013	04:09	20:11	05:11	13:53	8:42
			09-Sep-2013	05:23	18:40	05:39	15:49	10:10
			11-May-2013	04:09	20:11	10:09	17:56	7:47
	Pentland Firth	58.75° N, 3.21° W	03-Jun-2013	03:11	21:12	08:30	14:53	6:23
			25-Jun-2013	04:09	20:11	07:50	14:15	6:25
			10-Jul-2013	03:19	21:16	07:33	13:50	6:17
			09-Sep-2013	05:28	18:49	07:08	14:14	7:06
			26-Jun-2013	04:09	20:11	07:41	15:02	7:21
	Westray Sound	59.24° N, 3.07° W	25-Aug-2013	04:09	20:11	07:33	11:35	4:02
			26-Aug-2013	04:09	20:11	06:47	12:20	5:33
			12-Sep-2013	04:09	20:11	09:45	14:21	4:36
			20-Aug-2013	05:01	19:14	06:33	13:33	7:00
	English Channel	50.55° N, 1.28° W	03-Sep-2013	05:22	18:45	06:34	13:05	6:31

The Minch	58.1° N, 5.92° W	12-Jun-2015	04:09	20:11	05:30	16:38	11:08
		14-Jun-2015	04:09	20:11	06:00	15:52	9:52
		15-Jun-2015	04:09	20:11	06:18	09:19	3:01
		20-Jun-2015	04:09	20:11	06:22	17:23	11:01
		21-Jun-2015	04:09	20:11	05:50	14:48	8:58
		23-Jun-2015	04:09	20:11	06:10	16:25	10:15
West of Orkney	59.35° N, 3.38° W	11-Jul-2013	04:09	20:11	11:53	16:50	4:57
		27-Aug-2013	04:09	20:11	06:42	12:48	6:06
		11-Sep-2013	04:09	20:11	09:04	12:33	3:29

† Latitudes and longitudes for sites at sea indicate the center of the survey area.

Table A2. Relative performance of negative binomial GLMMs of the size of gannet flocks observed from land travelling towards or away Bass Rock.

Model [‡]	Log (likelihood)	Deviance	χ^2	p^{\dagger}
1 Intercept + Direction + Headwind + Direction x Headwind	-358.0	715.9	-	-
2 Intercept + Direction + Headwind	-358.0	716.1	0.139	0.709
3 Intercept + Direction	-358.3	716.6	0.473	0.492
4 Intercept	-361.5	723.0	6.461	0.011

Minimum adequate model highlighted in **bold**.

[‡] Probability that the model differs from the one above based on their likelihood ratio.

Table A3. Relative performance of Binomial GLMMs of the proportion of gannets observed from land in the vicinity of Bass Rock travelling in flocks.

Model	log(likelihood)	Deviance	χ^2	p^\dagger
1 Intercept + Direction + Headwind + Age + Direction x Headwind + Age x Headwind + Direction x Age + Direction x Headwind x Age	-599.0	1198.0	-	-
2 Intercept + Direction + Headwind + Age + Direction x Headwind + Age x Headwind + Direction x Age	-599.5	1198.9	0.856	0.355
3 Intercept + Direction + Headwind + Age + Direction x Headwind + Direction x Age	-600.6	1201.1	2.199	0.138
4 Intercept + Direction + Headwind + Age + Direction x Headwind	-602.0	1203.9	2.839	0.092
5 Intercept + Direction + Headwind + Age	-609.0	1217.9	13.977	<0.001

Minimum adequate model highlighted in **bold**.

† Probability that the model differs from the one above based on their likelihood ratio.

Table A4. Relative performance of Binomial GLMMs of the probability of immature gannets following rather than leading when travelling with one adult.

Model	log(likelihood)	Deviance	χ^2	p^\dagger
1 Intercept + Direction + Headwind + Immature age + Direction x Headwind + Immature Age x Headwind + Direction x Immature Age + Direction x Headwind x Immature Age	-28.7	57.4	-	-
2 Intercept + Direction + Headwind + Immature age + Direction x Headwind + Immature Age x Headwind + Direction x Immature Age	-30.0	60.2	2.522	0.112
3 Intercept + Direction + Headwind + Immature age + Direction x Headwind + Immature Age x Headwind	-30.0	60.1	0.132	0.716
4 Intercept + Direction + Headwind + Immature age + Direction x Headwind	-30.1	60.3	0.180	0.672
5 Intercept + Direction + Headwind + Immature age	-30.2	60.4	0.090	0.764
6 Intercept + Headwind + Immature age	-30.3	60.6	0.201	0.654
7 Intercept + Immature age	-30.9	61.8	0.216	0.270
8 Intercept	-31.0	62.1	0.300	0.584

Minimum adequate model highlighted in **bold**.

\dagger Probability that the model differs from the one above based on their likelihood ratio.