Table S1. Geographic location and sample size information for each North Sea black-legged kittiwake colony tracked in the current study. Colonies ordered from north to south. Breeding stage for individual birds was classified as late-stage incubation, early chick-rearing or unknown. Dates tracked covers the period from the date recorded at the start of the first foraging trip recorded to the date recorded at the end of the last foraging trip recorded at each colony that year.

Colony	Site Code	Latitude	Longitude	Colony Size	Year	Dates Tracked	N birds			
							Chick-rearing	Incubating	Unknown	Total
Fair Isle	FAI	59.5505	-1.61876	8204	2010	5th July – 9th July	1	0	0	1
					2011	21st June – 22nd June	1	0	0	1
					2012	14th June – 27th June	1	1	1	3
					2014	6th July – 11th July	0	0	2	2
Copinsay	COP	58.90039	-2.66647	4256	2010	14th June – 13th July	11	0	0	11
					2011	2nd July – 6th July	7	0	0	7
					2012	26th June – 17th July	7	1	0	8
					2014	16th June – 11th July	2	0	2	4
Muckle Skerry	MKS	58.69165	-2.92292	219	2010	5th June – 23rd June	7	1	0	8
					2011	10th June – 30th June	4	3	0	7
					2012	19th June – 5th July	7	5	0	12
					2013	12th July – 15th July	6	0	0	6
					2014	2nd July – 4th July	12	0	0	12
Bullers of Buchan	BOB	57.43668	-1.81139	2701	2012	4th June – 7th June	2	3	0	5
Whinnyfold	WIN	57.38163	-1.87336	2363	2012	5th June – 8th July	14	6	0	20
Fowlsheugh	FOW	56.91488	-2.18537	18337	2012	18th June – 26th June	12	2	0	12
St Abbs	SAB	55.91406	-2.13191	3394	2012	16th May – 31st May	0	15	0	15
Coquet Island	COQ	55.33476	-1.53479	51	2011	14th June – 16th June	13	0	0	13
					2012	23rd May – 6th July	13	10	0	23
Filey	FIL	54.22081	-0.27132	5120	2013	4th June – 4th July	12	3	0	15
					2014	24th June – 30th June	16	0	0	16
					2015	22nd June – 29th June	12	0	2	14
Flamborough	BEM	54.10876	-0.08009	4198	2010	6th June – 4th July	15	5	0	20
					2011	2nd June – 23rd June	7	5	5	17
					2012	27th June – 4th July	8	0	0	8
					2013	5th June – 3rd July	14	4	0	18
					2014	23rd June – 30th June	16	0	1	17
					2015	22nd June – 29th June	14	0	1	15

Table S2. Model coefficients for Resource Selection Function models examined. Non-linear responses to environmental covariates were modelled using Radial Basis Functions using basis functions with $m = 5$ centres initially based on a set of data quantiles (m_1 = 5% quantile; m_2 = 25% quantile; m_3 = 50% quantile; m_4 = 75% quantile; m_5 = 95% quantile). However, models with simpler basis functions performed better in some cases. Here, coefficients are taken from the best performing model for each covariate with model performance assessed via AIC scores. In addition, the mean of a given covariate across the area judged available to each individual tracked was included and allowed to interact with basis functions for that covariate to allow responses to be conditioned on habitat availability. The model presented included environmental covariates for Chlorophyll concentration, distance to nearest front and SST. Models also included random intercepts for colony and individual ID, but these were set at fixed values following Muff et al. (2020). A model including front strength rather than distance to nearest front is displayed in Table S3. However, models that included distance to nearest front had a higher AIC score. The number of individuals tracked is displayed in Table S1.

Model	Parameter	Coefficient	SE
~ Distance from the colony (m = 5 centres) × log_{10} colony size + Chlorophyll Concentration (m = 5 centres) × Mean Chlorophyll Concentration + Distance to Nearest Front (m = 3 centres) × Mean Distance to Nearest Front + SST (m = 5 centres) × Mean SST	Intercept	-17.22	3.26
	Distance from Colony, RBF m = 1	114.71	20.34
	Distance from Colony, RBF m = 2	-178.76	29.40
	Distance from Colony, RBF m = 3	96.05	18.48
	Distance from Colony, RBF m = 4	-27.63	6.72
	Distance from Colony, RBF m = 5	10.96	5.80
	log_{10} Colony Size	1.04	0.35
	log_{10} Colony Size × Distance from Colony, RBF m = 1	-23.65	4.70
	log_{10} Colony Size × Distance from Colony, RBF m = 2	36.79	6.98
	log_{10} Colony Size ×Distance from Colony, RBF m = 3	-19.88	4.34
	log_{10} Colony Size × Distance from Colony, RBF m = 4	5.36	1.58
	log_{10} Colony Size × Distance from Colony, RBF m = 5	-2.18	0.16
	Chlorophyll Concentration, RBF m = 1	0.49	0.21

Model	Parameter	Coefficient	SE
	Chlorophyll Concentration, RBF $m = 2$	-0.43	0.31
	Chlorophyll Concentration, RBF $m = 3$	0.33	0.20
	Chlorophyll Concentration, RBF $m = 4$	-0.22	0.10
	Chlorophyll Concentration, RBF $m = 5$	0.28	0.074
	Mean Chlorophyll Concentration	0.16	0.041
	Mean Chlorophyll Concentration × Chlorophyll Concentration, RBF $m = 1$	-1.18	0.38
	Mean Chlorophyll Concentration × Chlorophyll Concentration, RBF $m = 2$	2.75	0.56
	Mean Chlorophyll Concentration × Chlorophyll Concentration, RBF $m = 3$	-2.29	0.38
	Mean Chlorophyll Concentration × Chlorophyll Concentration, RBF $m = 4$	1.33	0.19
	Mean Chlorophyll Concentration × Chlorophyl Concentration, RBF $m = 5$	-0.90	0.17
	Distance to Nearest Front, RBF $m = 2$	0.37	0.12
	Distance to Nearest Front, RBF $m = 3$	-0.46	0.14
	Distance to Nearest Front, RBF $m = 4$	0.16	0.075
	Mean Distance to Nearest Front	0.048	0.026

Model	Parameter	Coefficient	SE
	Mean Distance to Nearest Front × Distance to Nearest Front, RBF $m = 2$	-0.57	0.20
	Mean Distance to Nearest Front × Distance to Nearest Front, RBF $m = 3$	0.79	0.32
	Mean Distance to Nearest Front × Distance to Nearest Front, RBF $m = 4$	-0.22	0.092
	SST, RBF $m = 1$	5.82	2.01
	SST, RBF $m = 2$	-7.78	2.11
	SST, RBF $m = 3$	8.26	2.37
	SST, RBF $m = 4$	-4.91	1.59
	SST, RBF $m = 5$	3.22	1.07
	Mean SST	-0.37	0.19
	Mean SST × SST, RBF $m = 1$	1.98	0.70
	Mean SST × SST, RBF $m = 2$	-0.67	0.21
	Mean SST × SST, RBF $m = 3$	0.54	0.26
	Mean SST × SST, RBF $m = 4$	0.31	0.18
	Mean SST × SST, RBF $m = 5$	-0.12	0.13

Table S3. Model coefficients for Resource Selection Function models examined. Non-linear responses to environmental covariates were modelled using Radial Basis Functions using basis functions with $m = 5$ centres initially based on a set of data quantiles (m_1 = 5% quantile; m_2 = 25% quantile; m_3 = 50% quantile; m_4 = 75% quantile; m_5 = 95% quantile). However, models with simpler basis functions performed better in some cases. Here, coefficients are taken from the best performing model for each covariate with model performance assessed via AIC scores. In addition, the mean of a given covariate across the area judged available to each individual tracked was included and allowed to interact with basis functions for that covariate to allow responses to be conditioned on habitat availability. The model presented included environmental covariates for Chlorophyll concentration, front strength and SST. A model including front strength rather than distance to nearest front is displayed in Table S3. However, models that included distance to nearest front had a higher AIC score. The number of individuals tracked is displayed in Table S1.

Model	Parameter	Coefficient	SE
~ Distance from the colony (m = 5 centres) × log_{10} colony size + Chlorophyll Concentration (m = 5 centres) × Mean Chlorophyll Concentration + Front Strength (m = 2 centres) × Mean Front Strength + SST (m = 5 centres) × Mean SST	Intercept	-16.45	3.04
	Distance from Colony, RBF m = 1	115.26	21.36
	Distance from Colony, RBF m = 2	-189.48	29.23
	Distance from Colony, RBF m = 3	99.91	19.03
	Distance from Colony, RBF m = 4	-26.56	6.91
	Distance from Colony, RBF m = 5	4.04	2.20
	log_{10} Colony Size	0.97	0.34
	log_{10} Colony Size × Distance from Colony, RBF m = 1	-22.17	4.51
	log_{10} Colony Size × Distance from Colony, RBF m = 2	37.49	6.77
	log_{10} Colony Size ×Distance from Colony, RBF m = 3	-22.25	3.95
	log_{10} Colony Size × Distance from Colony, RBF m = 4	5.68	1.56
	log_{10} Colony Size × Distance from Colony, RBF m = 5	-0.74	0.23
	Chlorophyll Concentration, RBF m = 1	0.45	0.19
	Chlorophyll Concentration, RBF m = 2	-0.47	0.35

Model	Parameter	Coefficient	SE
	Chlorophyll Concentration, RBF $m = 3$	0.35	0.19
	Chlorophyll Concentration, RBF $m = 4$	-0.23	0.096
	Chlorophyll Concentration, RBF $m = 5$	0.28	0.077
	Mean Chlorophyll Concentration	0.13	0.041
	Mean Chlorophyll Concentration × Chlorophyll Concentration, RBF $m = 1$	-0.84	0.48
	Mean Chlorophyll Concentration × Chlorophyll Concentration, RBF $m = 2$	2.27	0.65
	Mean Chlorophyll Concentration × Chlorophyll Concentration, RBF $m = 3$	-2.05	0.42
	Mean Chlorophyll Concentration × Chlorophyll Concentration, RBF $m = 4$	1.18	0.22
	Mean Chlorophyll Concentration × Chlorophyl Concentration, RBF $m = 5$	-0.80	0.12
	Front Strength, RBF $m = 3$	-0.14	0.063
	Front Strength, RBF $m = 4$	0.11	0.079
	Mean Front Strength	-0.14	0.063
	Mean Front Strength × Front Strength, RBF $m = 3$	0.31	0.14
	Mean Front Strength × Front Strength, RBF $m = 4$	0.15	0.081
	SST, RBF $m = 1$	5.61	1.25

Model	Parameter	Coefficient	SE
	SST, RBF $m = 2$	-6.93	2.34
	SST, RBF $m = 3$	7.58	2.57
	SST, RBF $m = 4$	-4.16	1.84
	SST, RBF $m = 5$	2.76	1.22
	Mean SST	-0.34	0.19
	Mean SST × SST, RBF $m = 1$	1.78	0.16
	Mean SST × SST, RBF $m = 2$	-0.82	0.18
	Mean SST × SST, RBF $m = 3$	0.77	0.16
	Mean SST × SST, RBF $m = 4$	0.31	0.15
	Mean SST × SST, RBF $m = 5$	-0.18	0.12

Fig. S1. Summary of step lengths (a) and turning angles (b) for each behavioural category (resting, foraging and transit) identified via Hidden Markov Models of kittiwake tracking data.

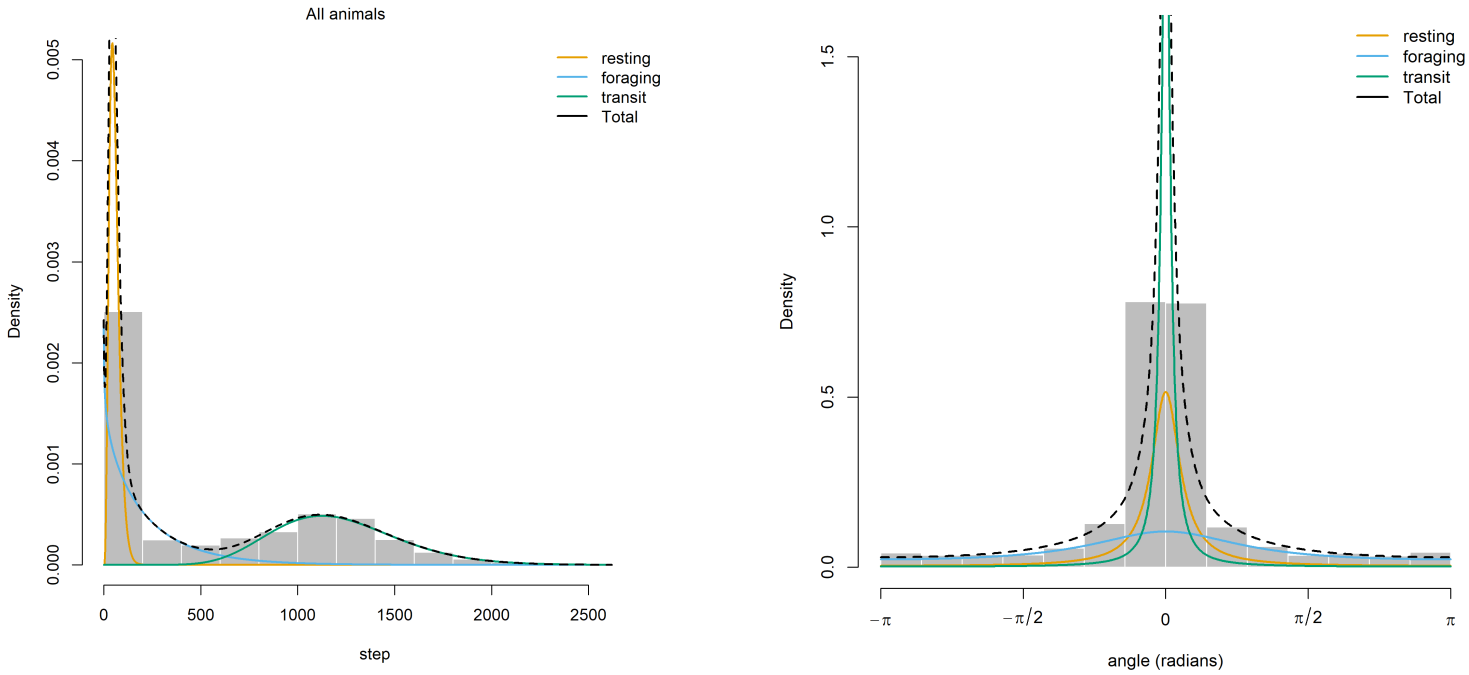


Fig. S2. Effect of the hour of the day on the stationary state probabilities of being in each of the three behavioural categories identified by Hidden Markov Models on kittiwake tracking data. Vertical error bars denote upper and lower 95% confidence intervals.

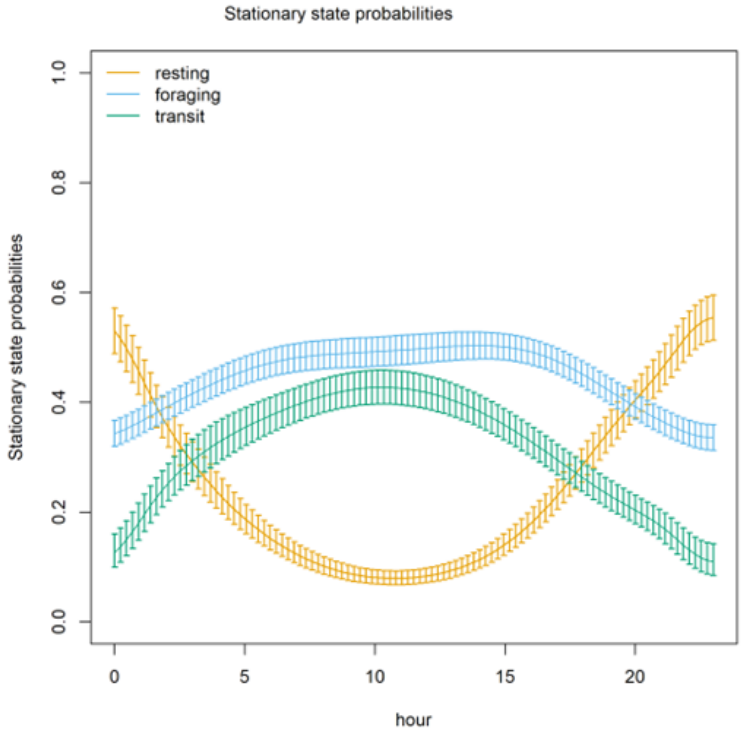
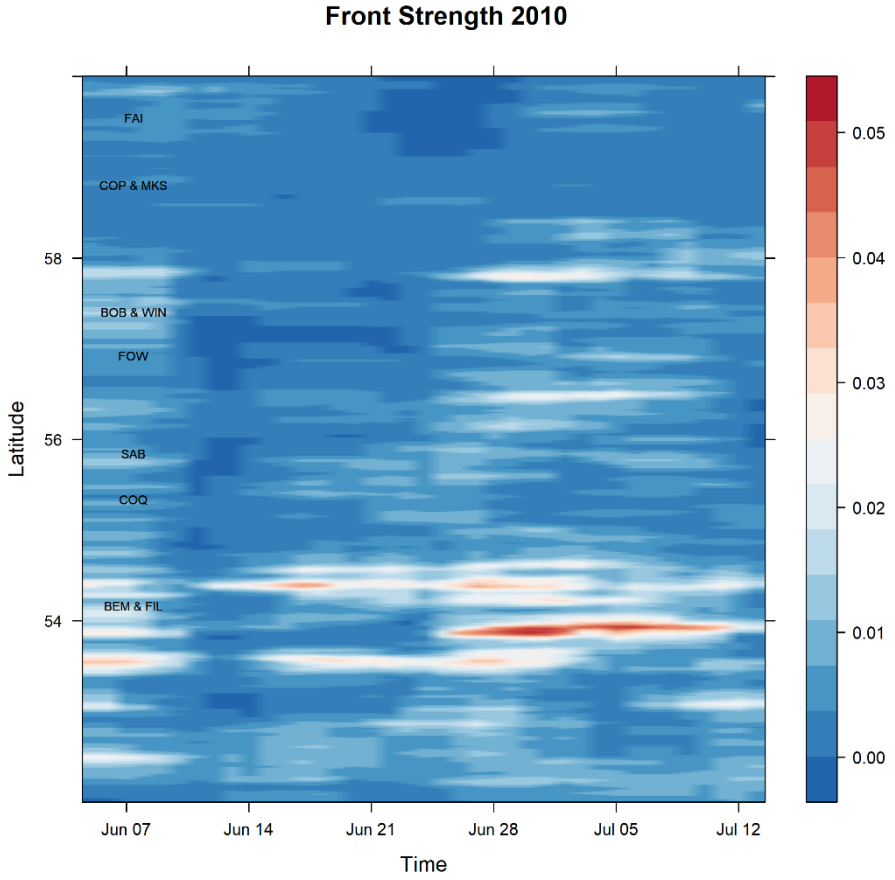
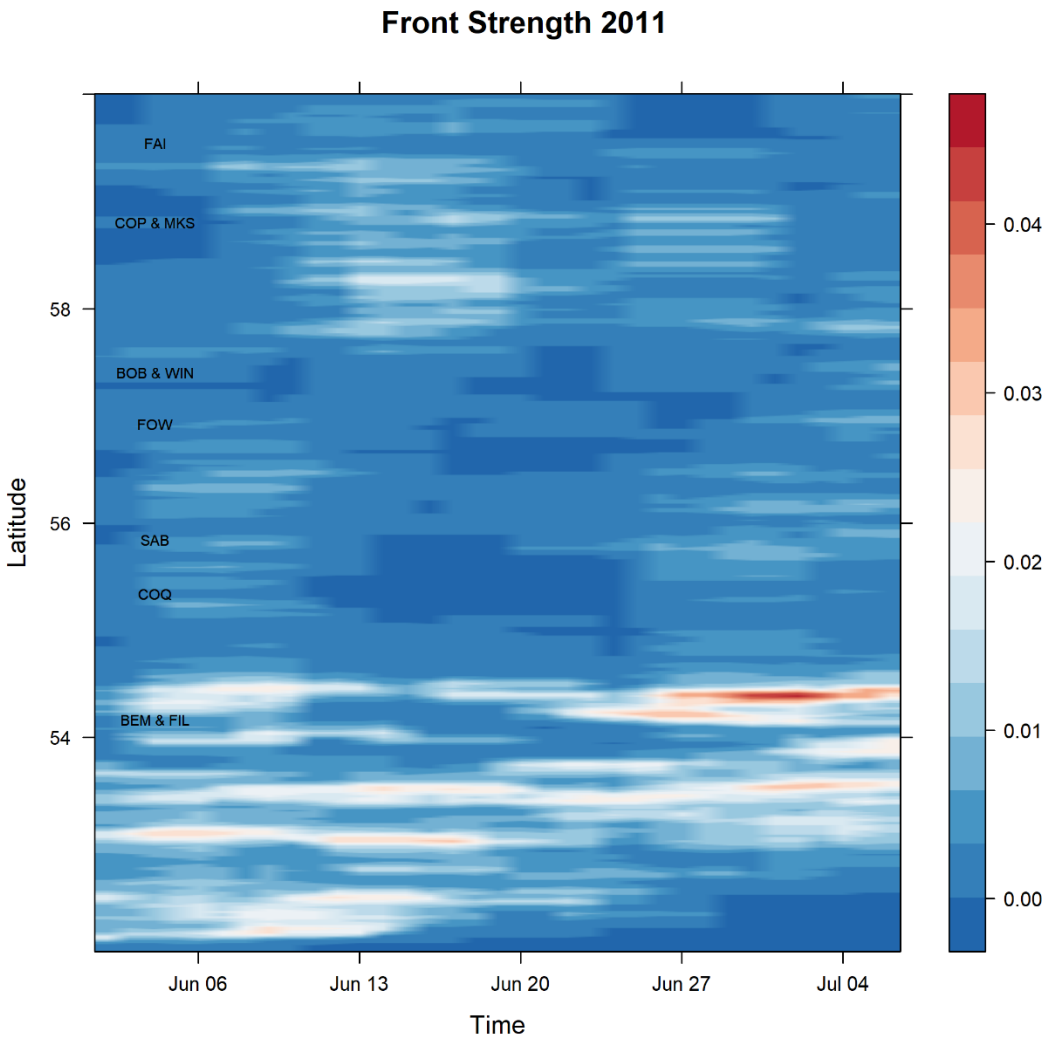
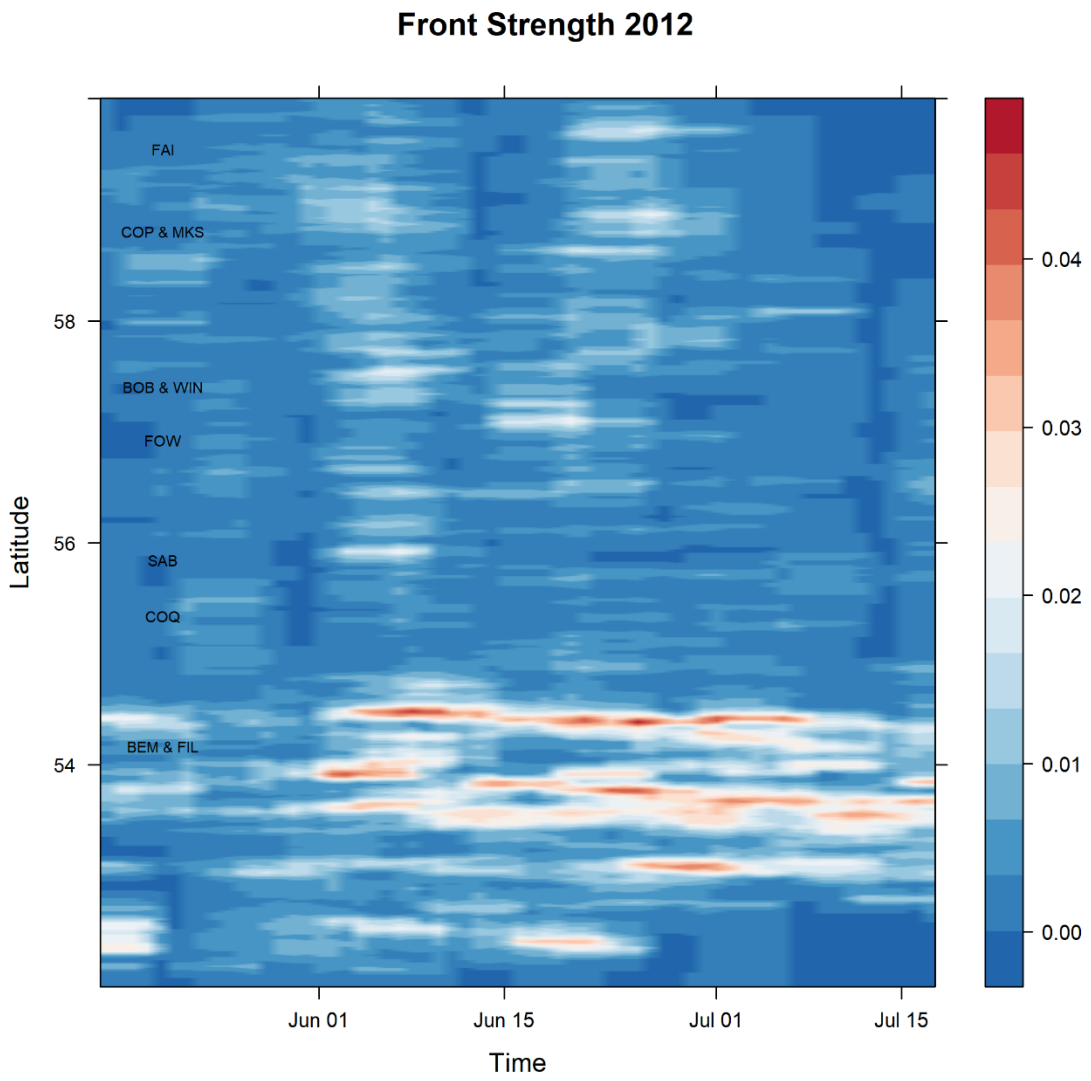


Fig. S3. Hovmöller diagrams showing the development of front strength (°C / 1.2 km) during the period tracking data was collected in each year of the study (2010 – 2015). The tracking period for each year ranges from the earliest to the latest date on which tracking data was available in a given year. Plots show time on the x-axis and front strength on the y-axis. Front strength was averaged across all spatial pixels for each latitudinal strip. Colony names are displayed on the plot at their approximate latitude.




Front Strength 2011
FAI
COP & MKS
BOB & WIN
FOW
SAB
COQ
BEM & FIL
58
56
54
Latitude
Jun 06
Jun 13
Jun 20
Jun 27
Jul 04
Time
0.04
0.03
0.02
0.01
0.00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BOB & WIN
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COQ
BEM & FIL
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Jul 15
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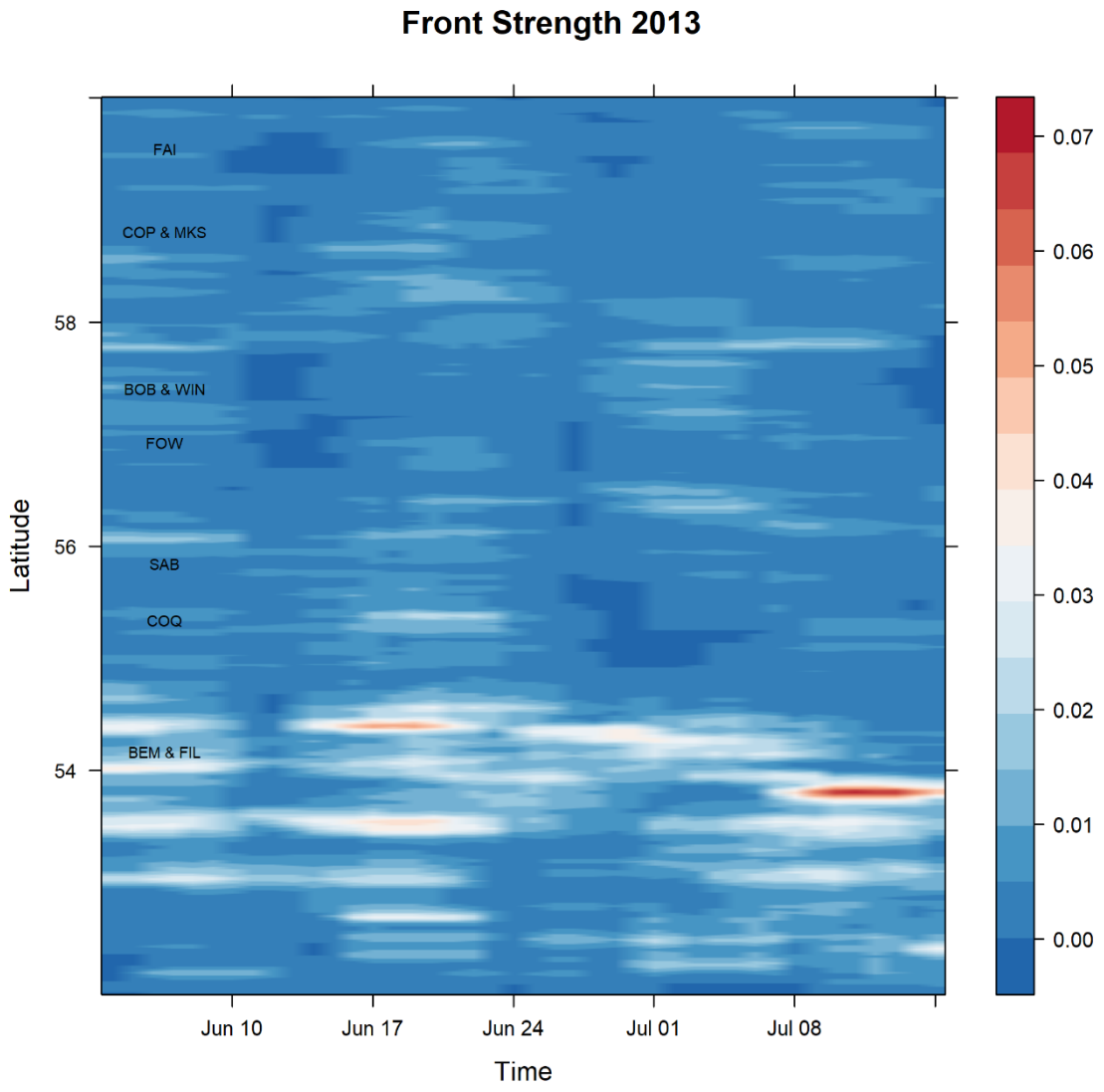
0.01
0.00


Front Strength 2013
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COP & MKS
BOB & WIN
FOW
SAB
COQ
BEM & FIL
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56
54
Latitude
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Jul 01
Jul 08
Time
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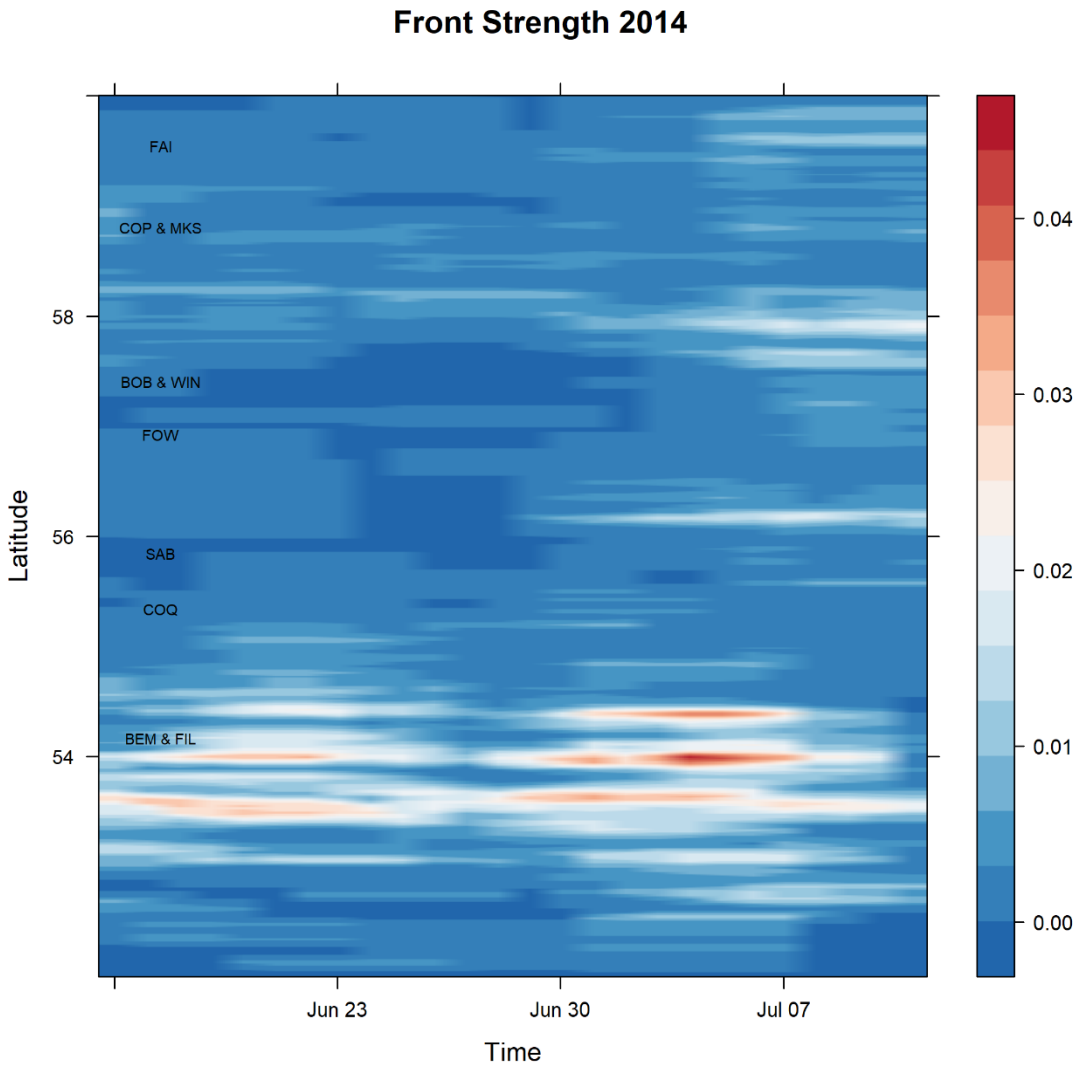
0.01
0.00


Front Strength 2014
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COP & MKS
BOB & WIN
FOW
SAB
COQ
BEM & FIL
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56
54
Latitude
Jun 23
Jun 30
Jul 07
Time
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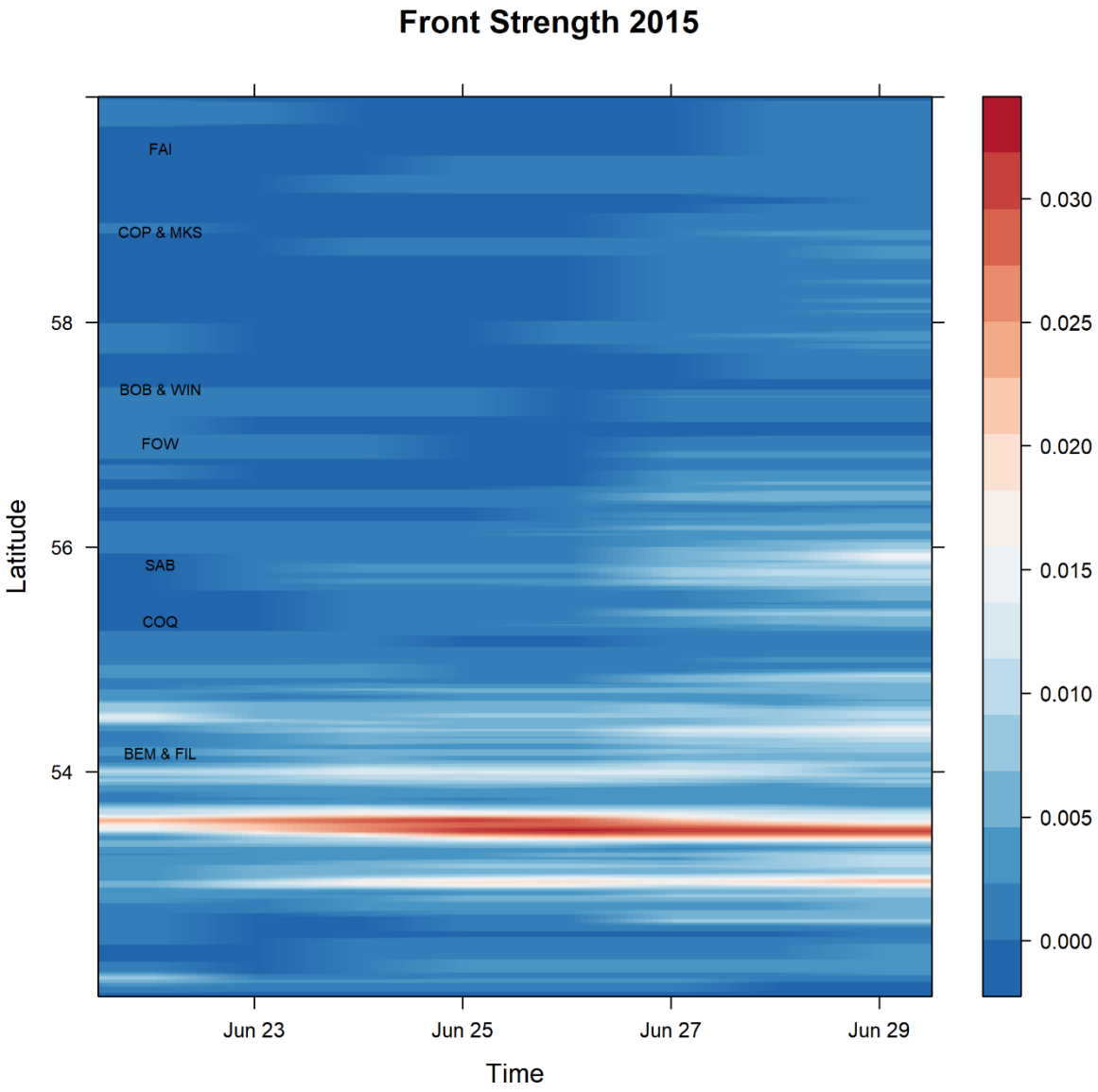
0.03
0.02
0.01
0.00


Front Strength 2015
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COP & MKS
BOB & WIN
FOW
SAB
COQ
BEM & FIL
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56
54
Latitude
Jun 23
Jun 25
Jun 27
Jun 29
Time
0.030
0.025
0.020
0.015
0.010
0.005
0.000

Fig. S4. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging at each colony in each year for which data was available. Availability is summarised using data from all individuals tracked within the specified year. Colonies arranged from North (top line) to South (bottom line). Box shows median, hinges represent inter-quartile range, whiskers extend from the hinge to the largest or smallest values no further than 1.5 * IQR from the upper or lower hinge, data points that lie beyond whiskers not displayed.

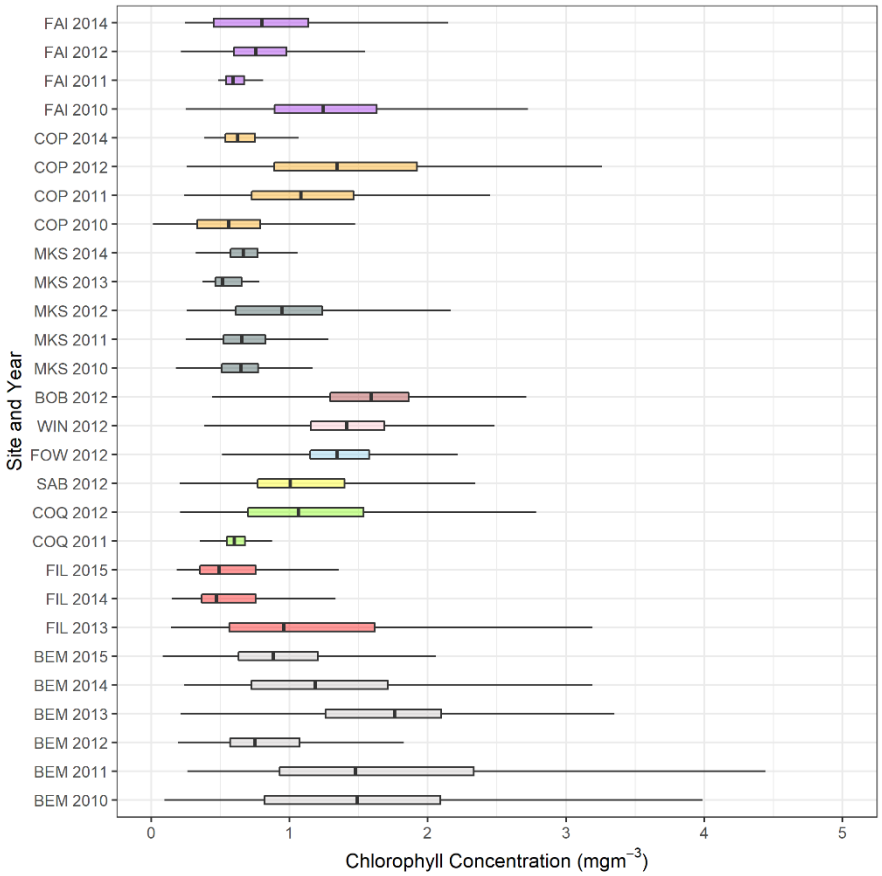


Fig. S5. Boxplot showing front strength across all points deemed available for foraging at each colony in each year for which data was available. Availability is summarised using data from all individuals tracked within the specified year. Colonies arranged from North (top line) to South (bottom line).

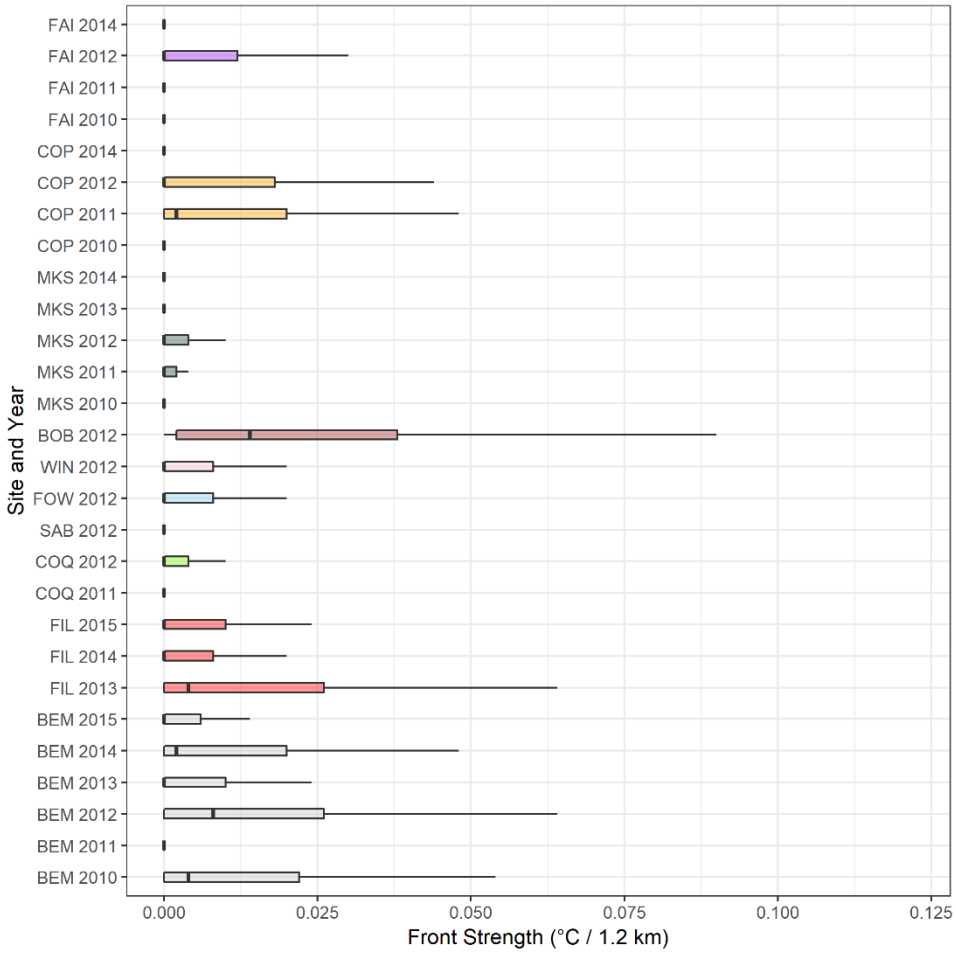


Fig. S6. Boxplot showing distance to the nearest front across all points deemed available for foraging at each colony in each year for which data was available. Availability is summarised using data from all individuals tracked within the specified year. Colonies arranged from North (top line) to South (bottom line).

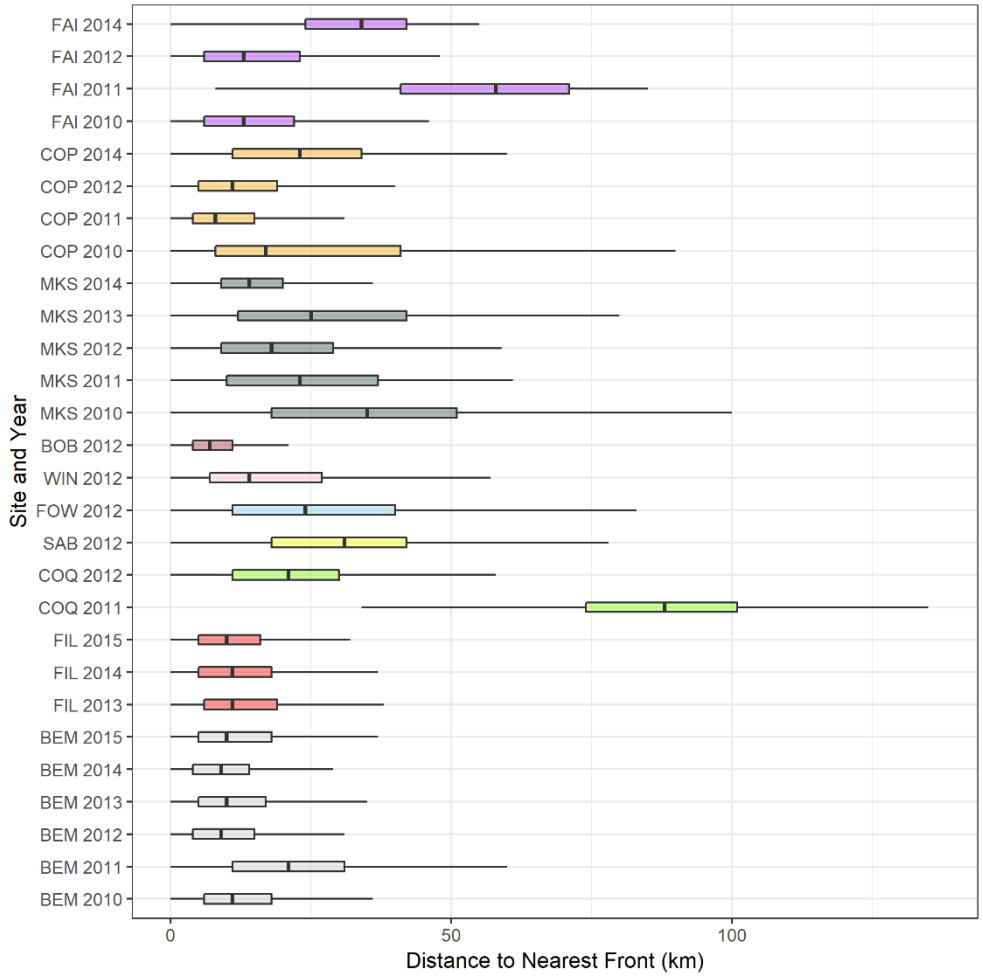


Fig. S7. Boxplot showing sea surface temperature across all points deemed available for foraging at each colony in each year for which data was available. Availability is summarised using data from all individuals tracked within the specified year. Colonies arranged from North (top line) to South (bottom line).

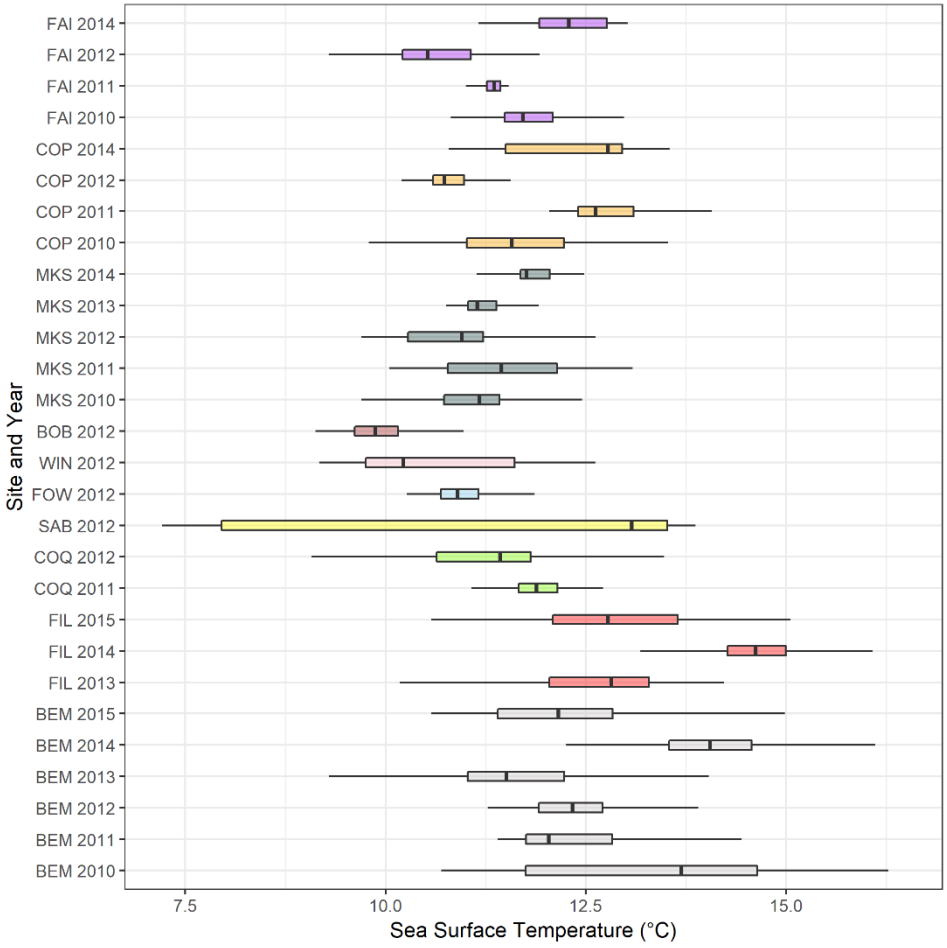


Fig. S8. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging for each individual clack-legged kittiwake tracked at Flamborough / Bempton. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

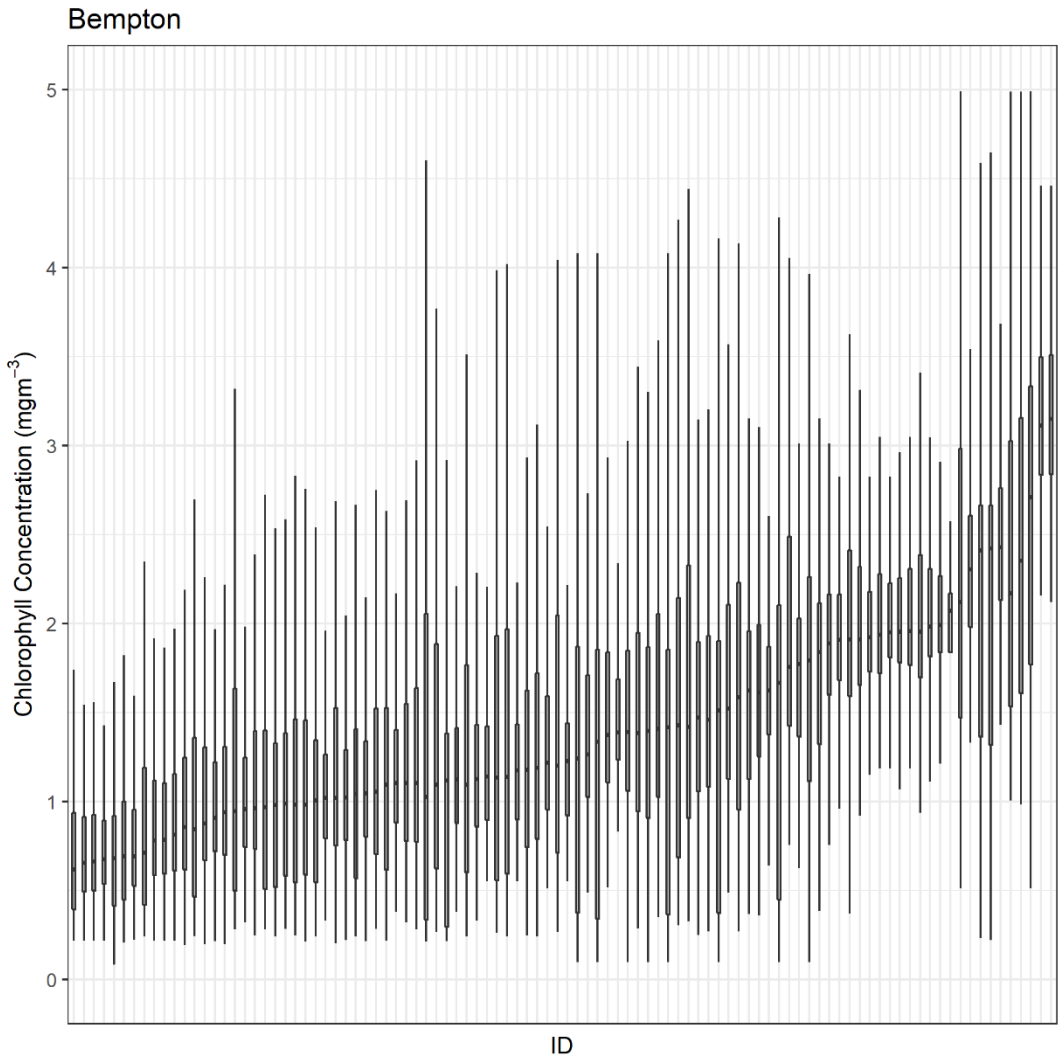


Fig. S9. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging for each individual black-legged kittiwake tracked at the Bullers of Buchan. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

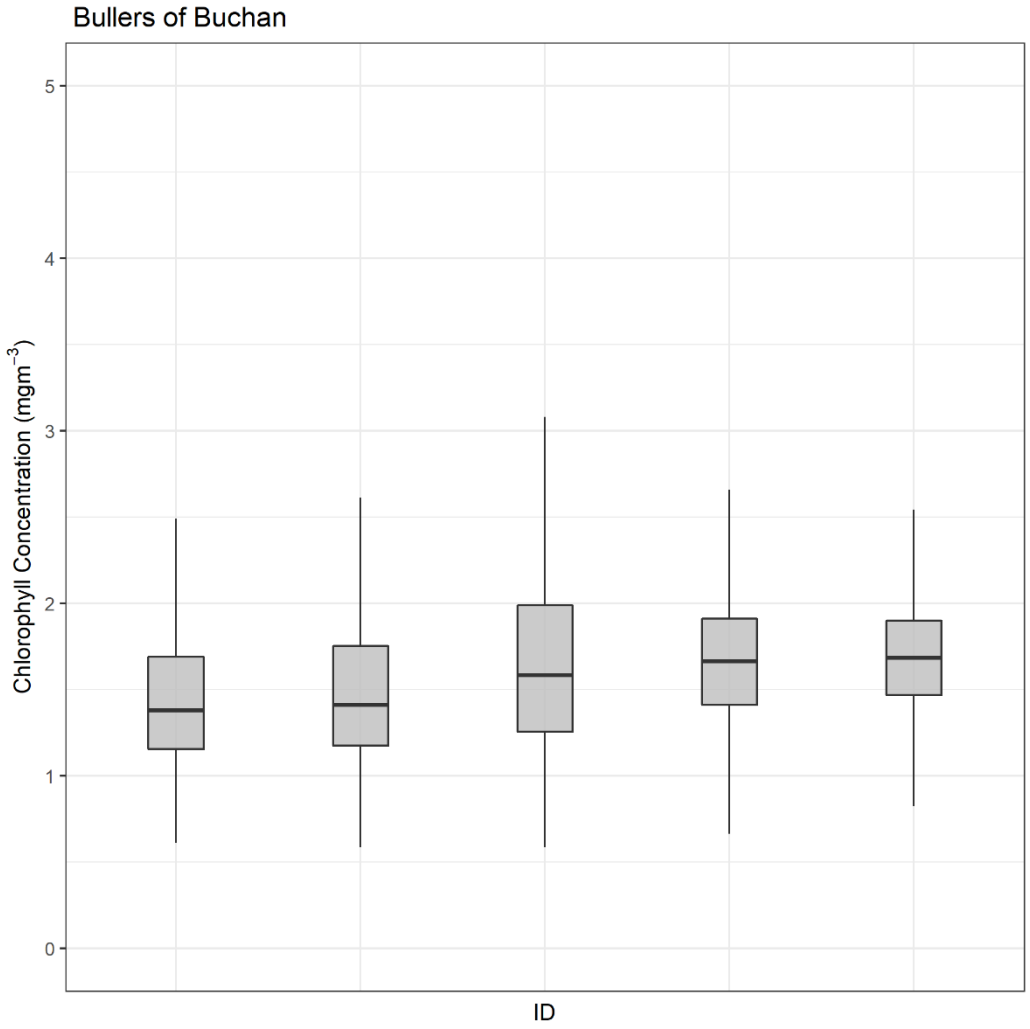


Fig. S10. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging for each individual black-legged kittiwake tracked at Copinsay. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

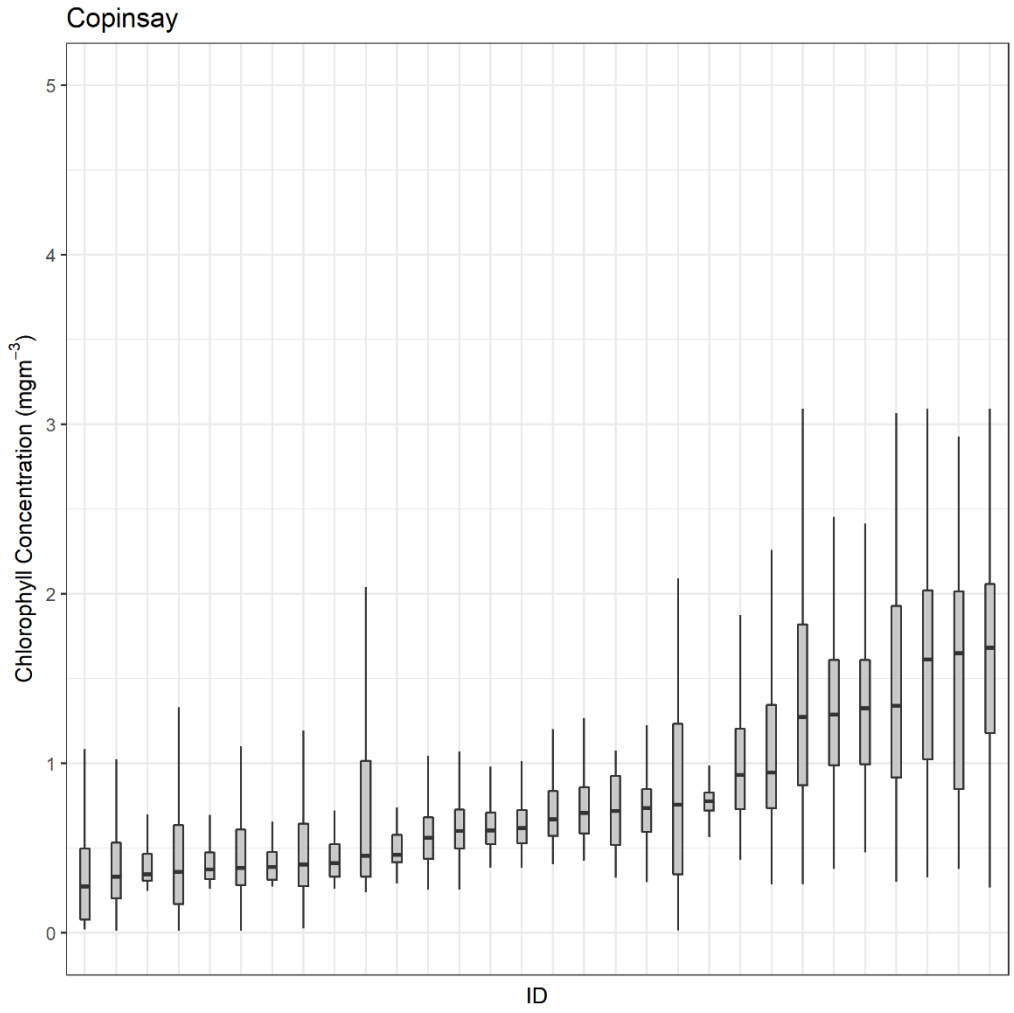


Fig. S11. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging for each individual black-legged kittiwake tracked at Coquet Island. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

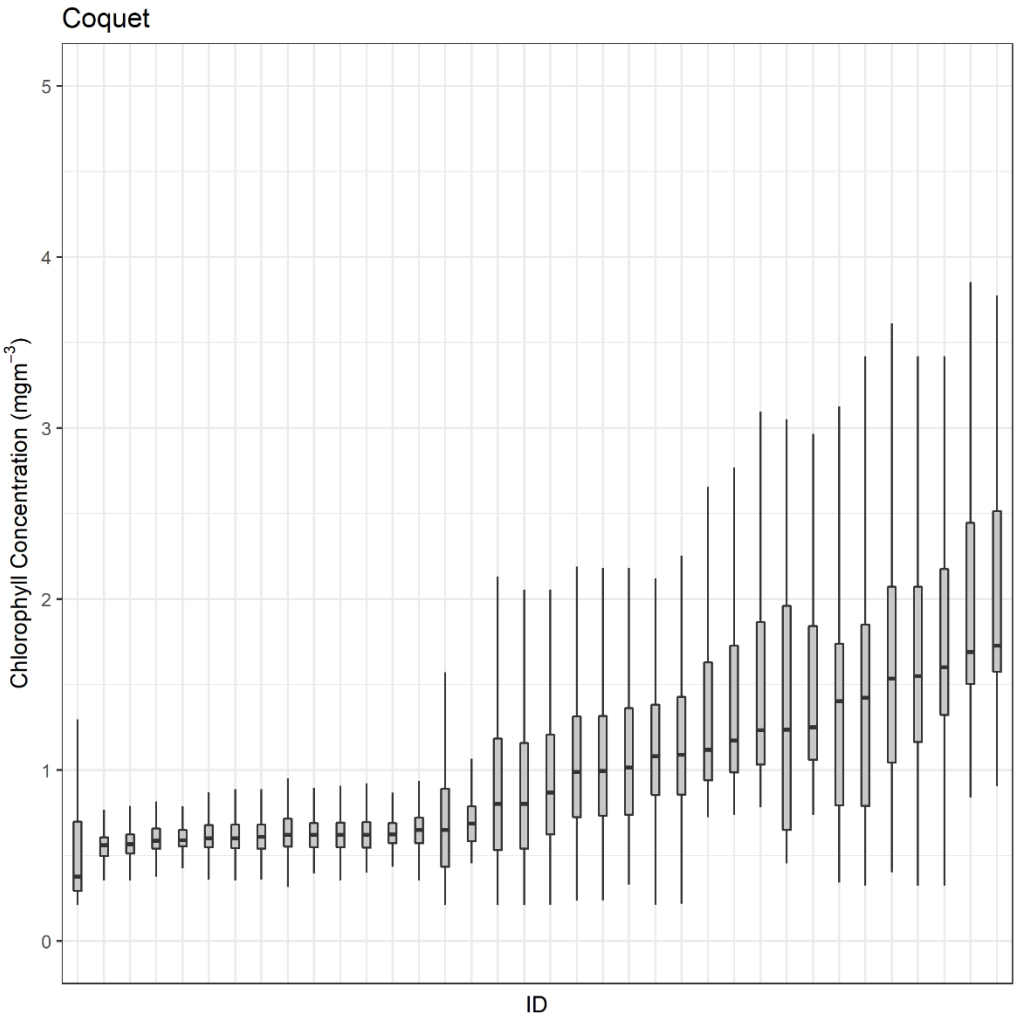


Fig. S12. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging for each individual black-legged kittiwake tracked at Fair Isle. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

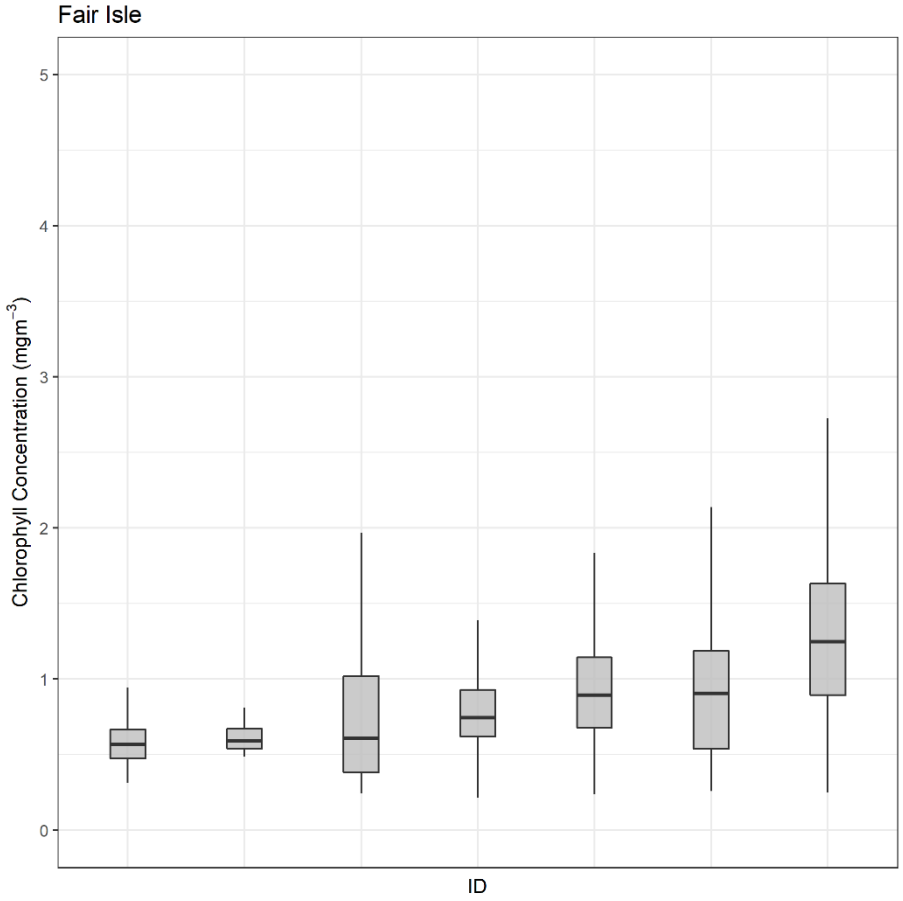


Fig. S13. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging for each individual black-legged kittiwake tracked at Filey. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

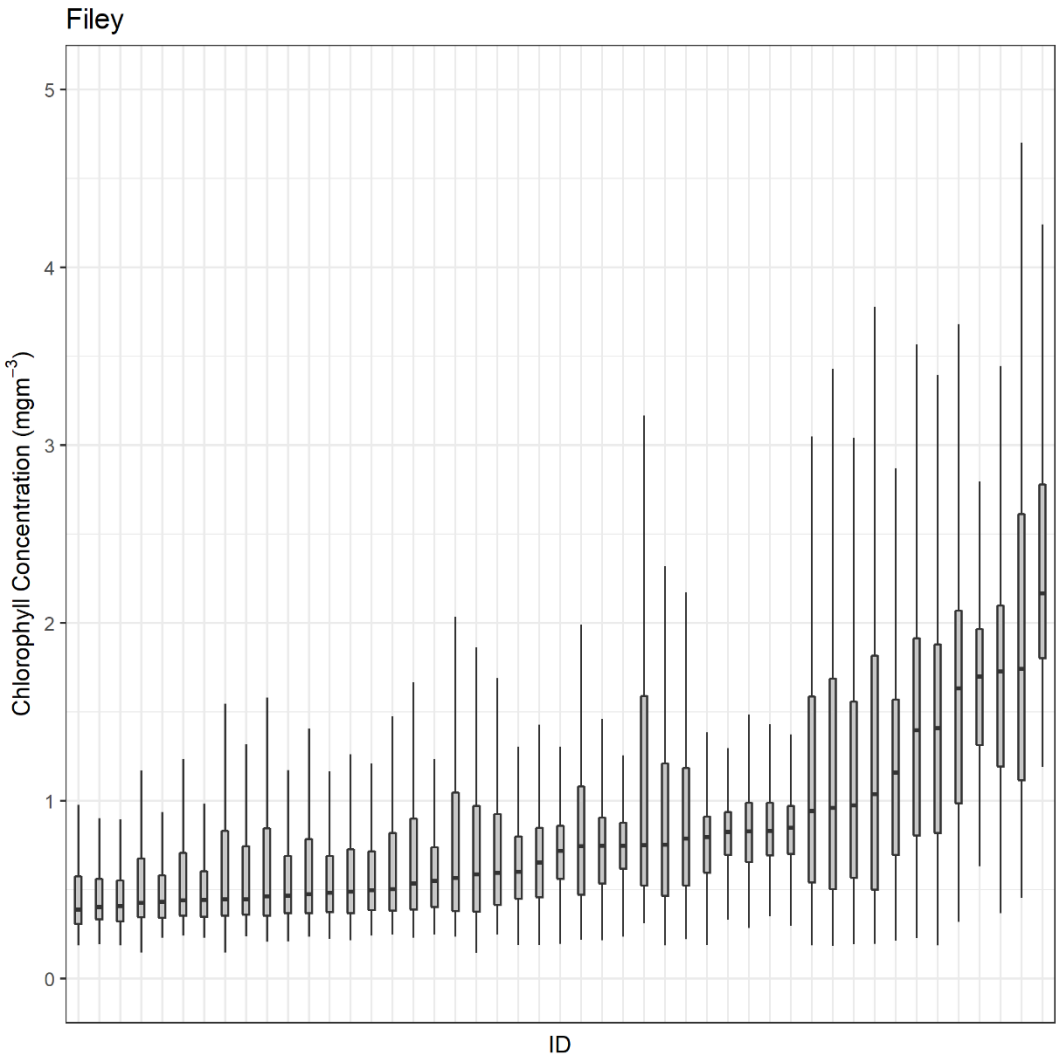


Fig. S14. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging for each individual black-legged kittiwake tracked at Fowlsheugh. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

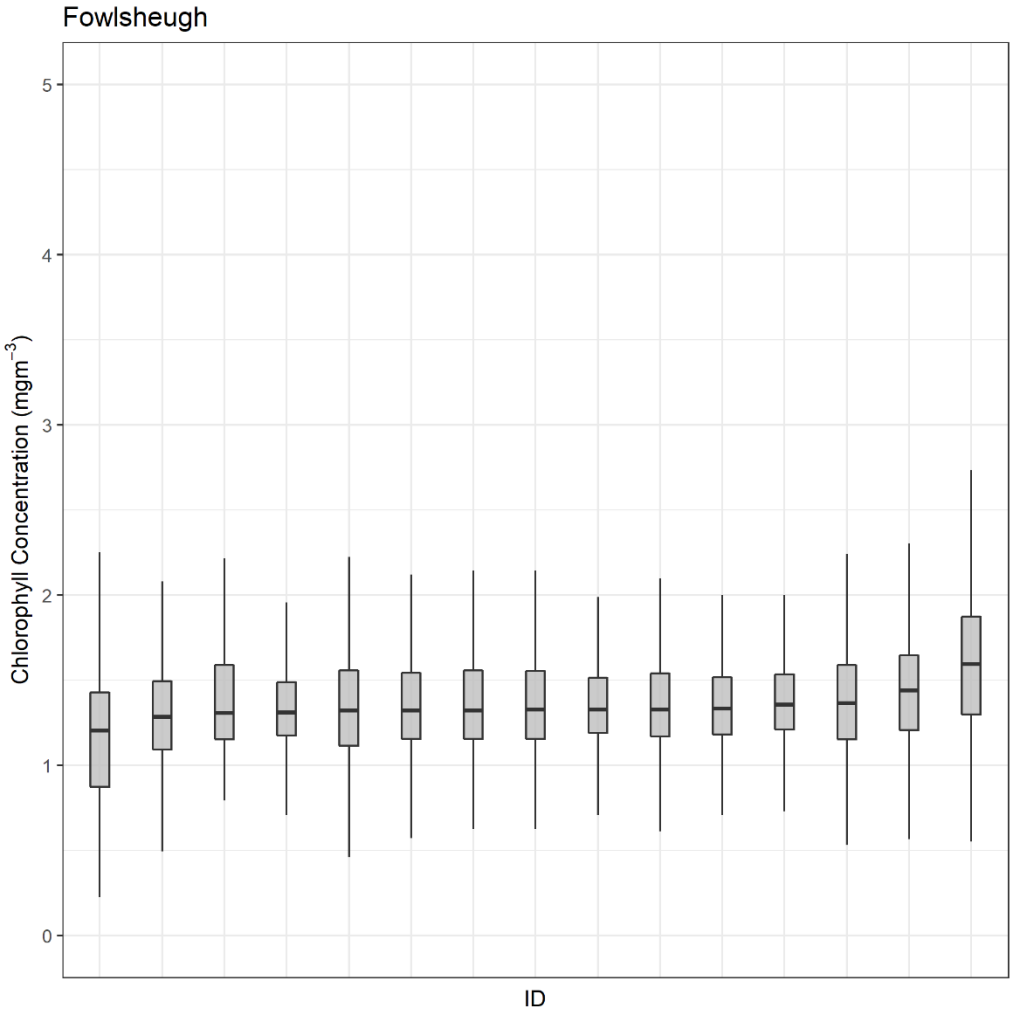


Fig. S15. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging for each individual black-legged kittiwake tracked at Muckle Skerry. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

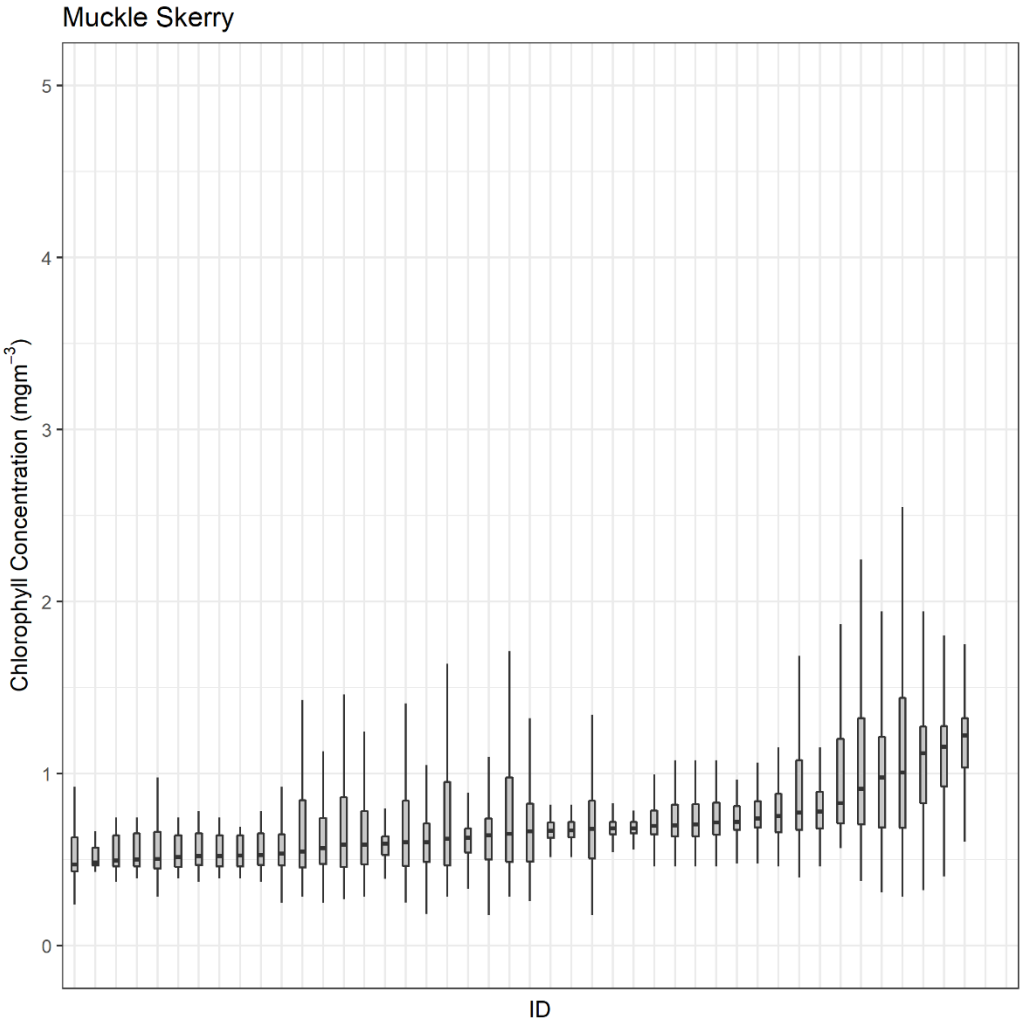


Fig. S16. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging for each individual black-legged kittiwake tracked at St Abbs. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

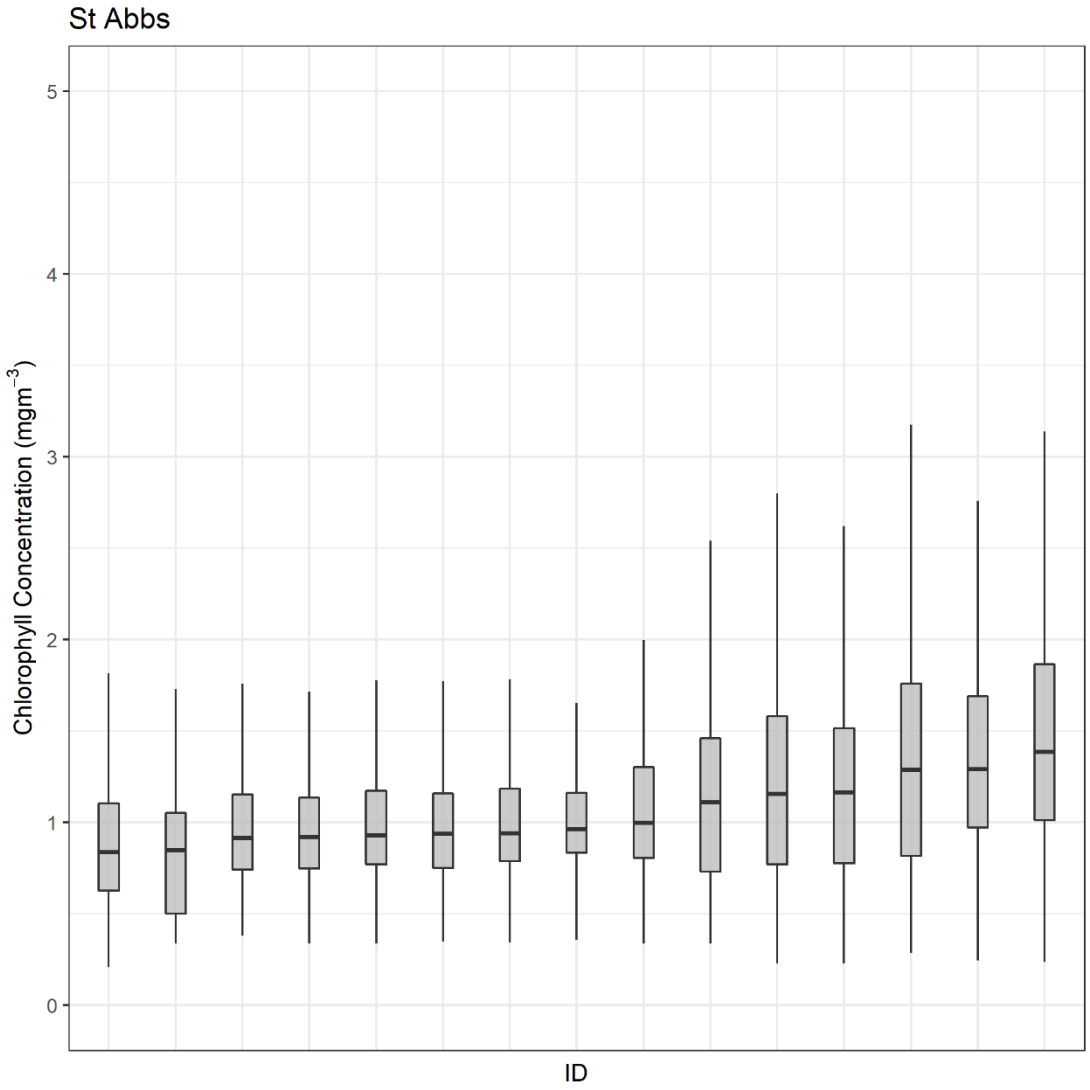


Fig. S17. Boxplot showing surface chlorophyll concentration across all points deemed available for foraging for each individual black-legged kittiwake tracked at Whinnyfold. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

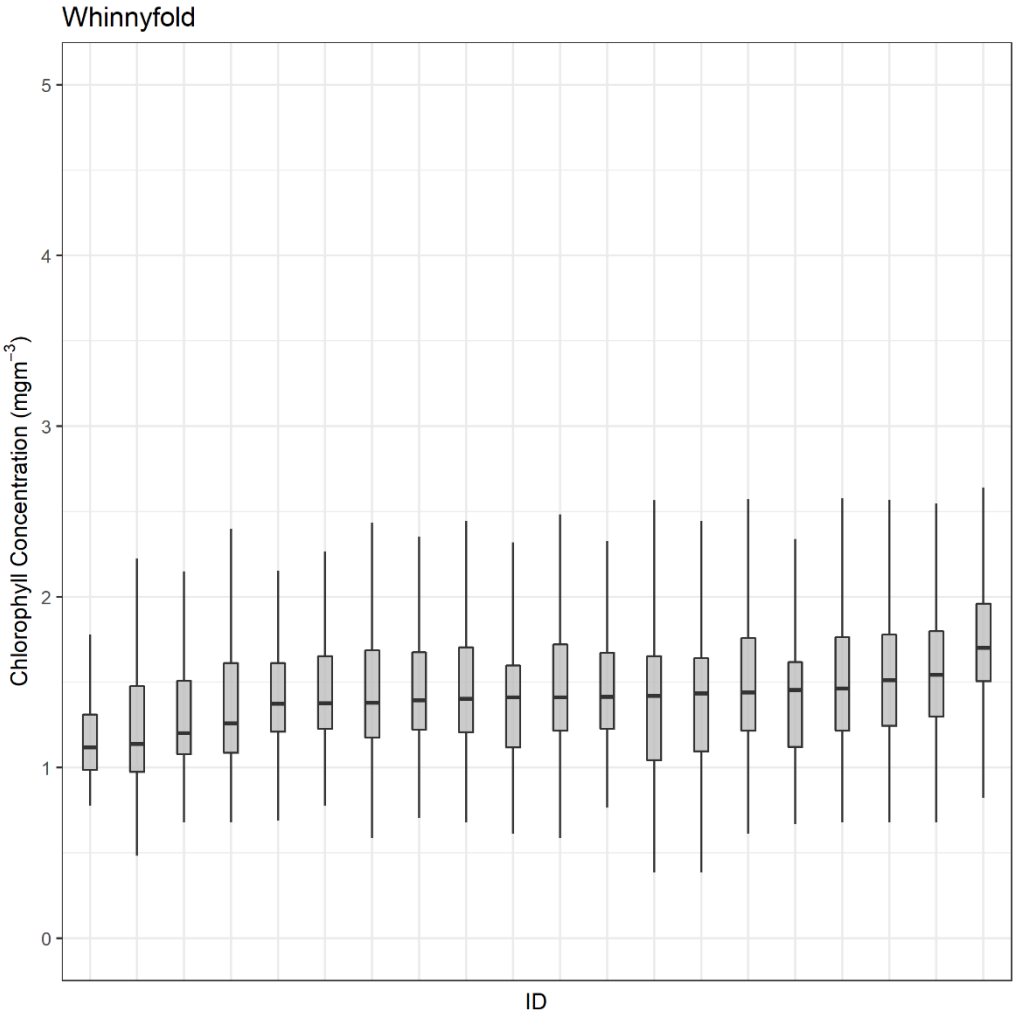


Fig. S18. Boxplot showing front strength across all points deemed available for foraging for each individual black-legged kittiwake tracked at Flamborough / Bempton. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

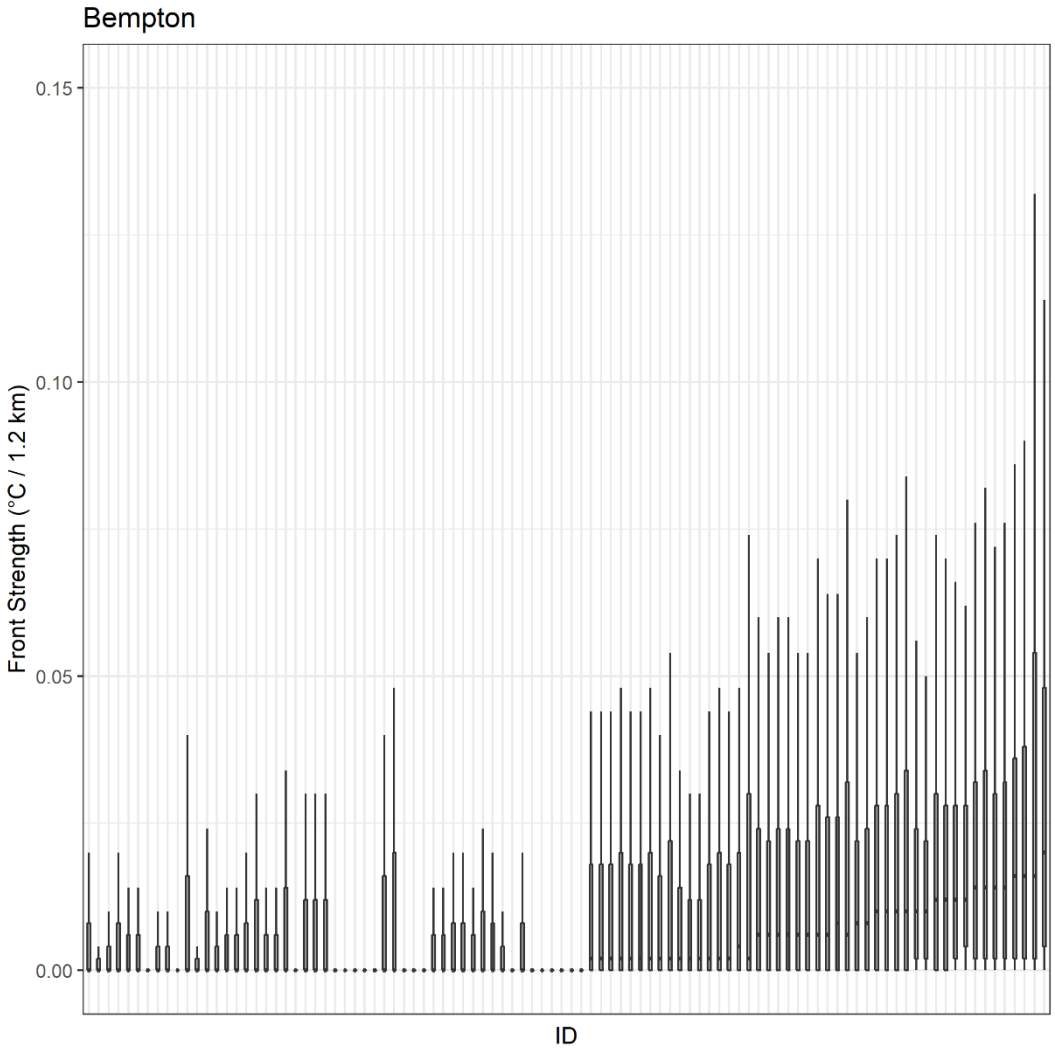


Fig. S19. Boxplot showing front strength across all points deemed available for foraging for each individual black-legged kittiwake tracked at the Bullers of Buchan. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

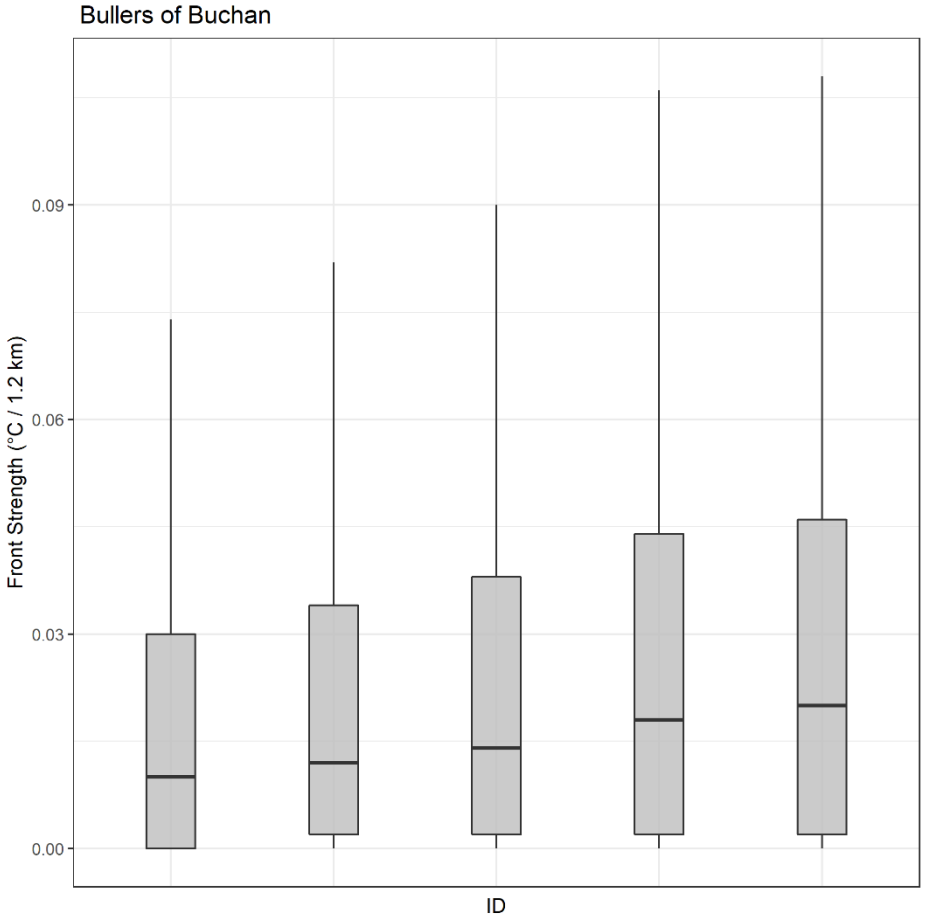


Fig. S20. Boxplot showing front strength across all points deemed available for foraging for each individual black-legged kittiwake tracked at Copinsay. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

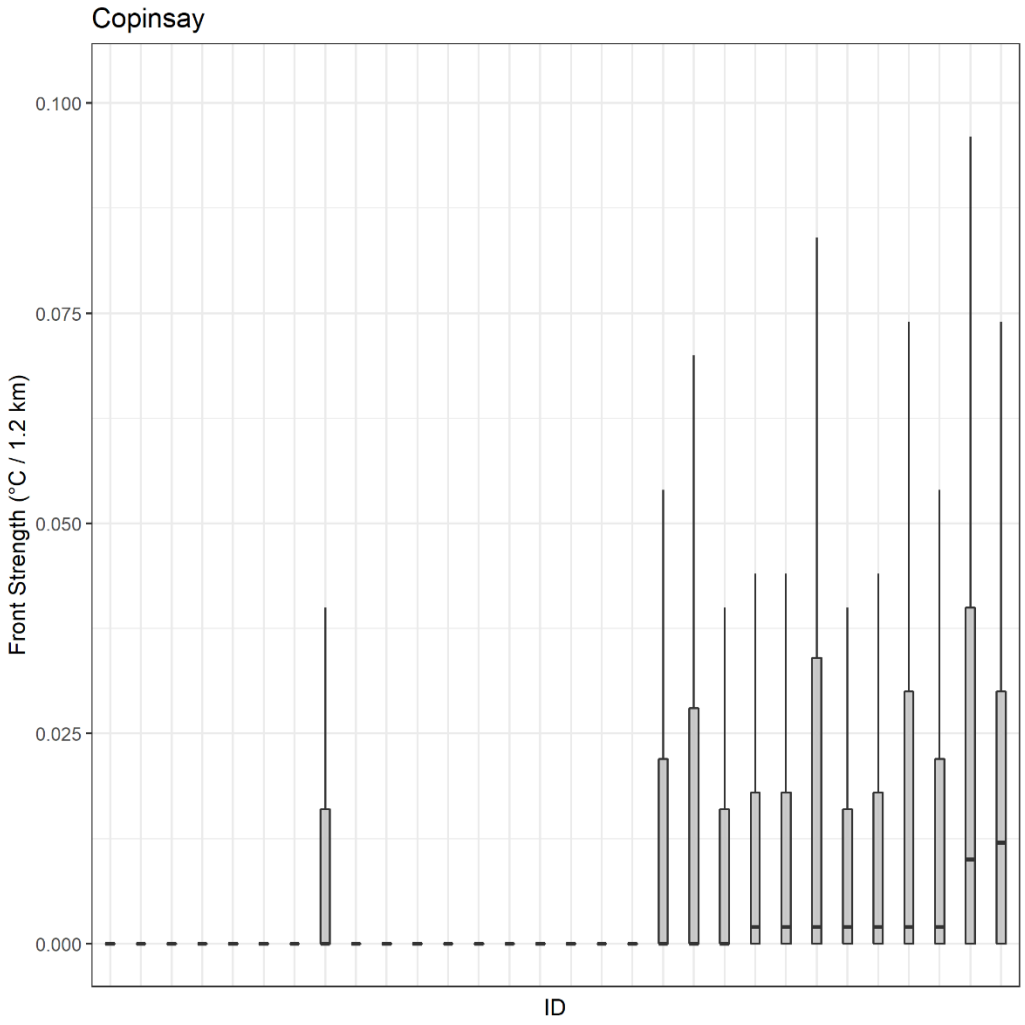


Fig. S21. Boxplot showing front strength across all points deemed available for foraging for each individual black-legged kittiwake tracked at Coquet Island. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

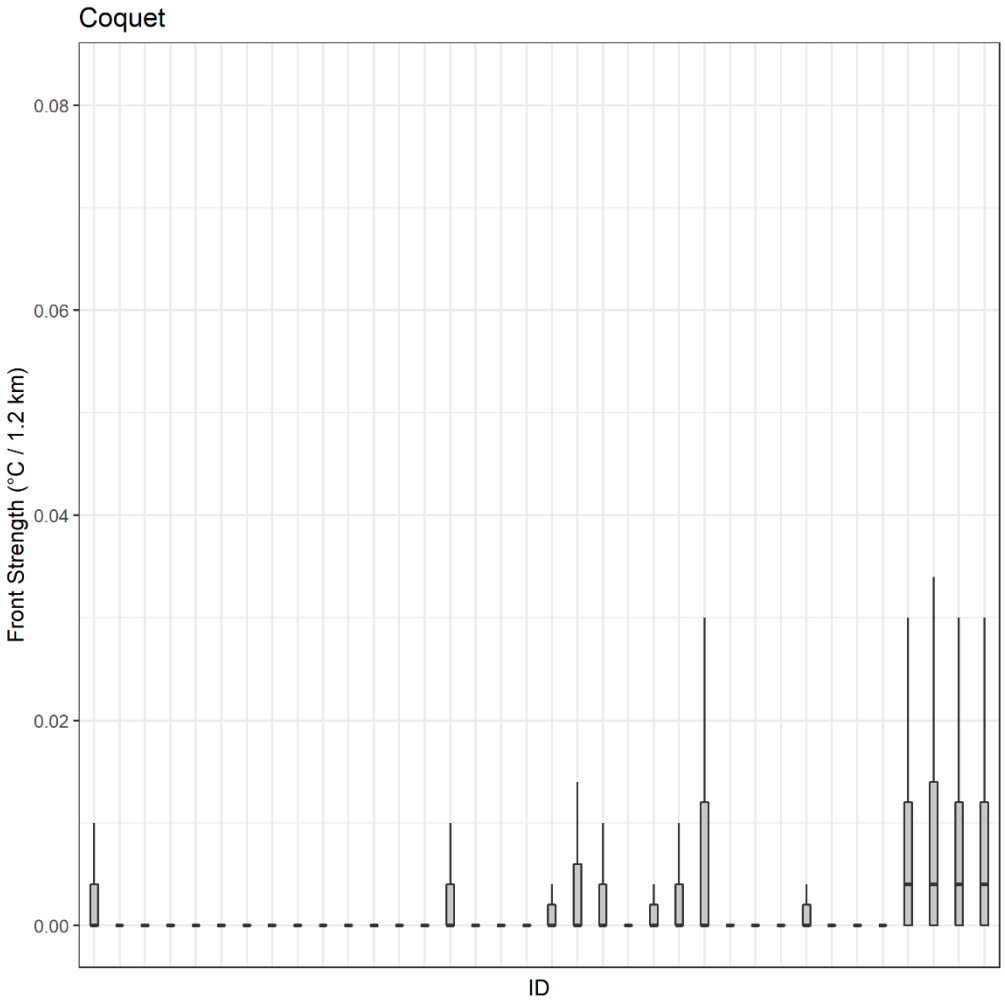


Fig. S22. Boxplot showing front strength across all points deemed available for foraging for each individual black-legged kittiwake tracked at Fair Isle. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

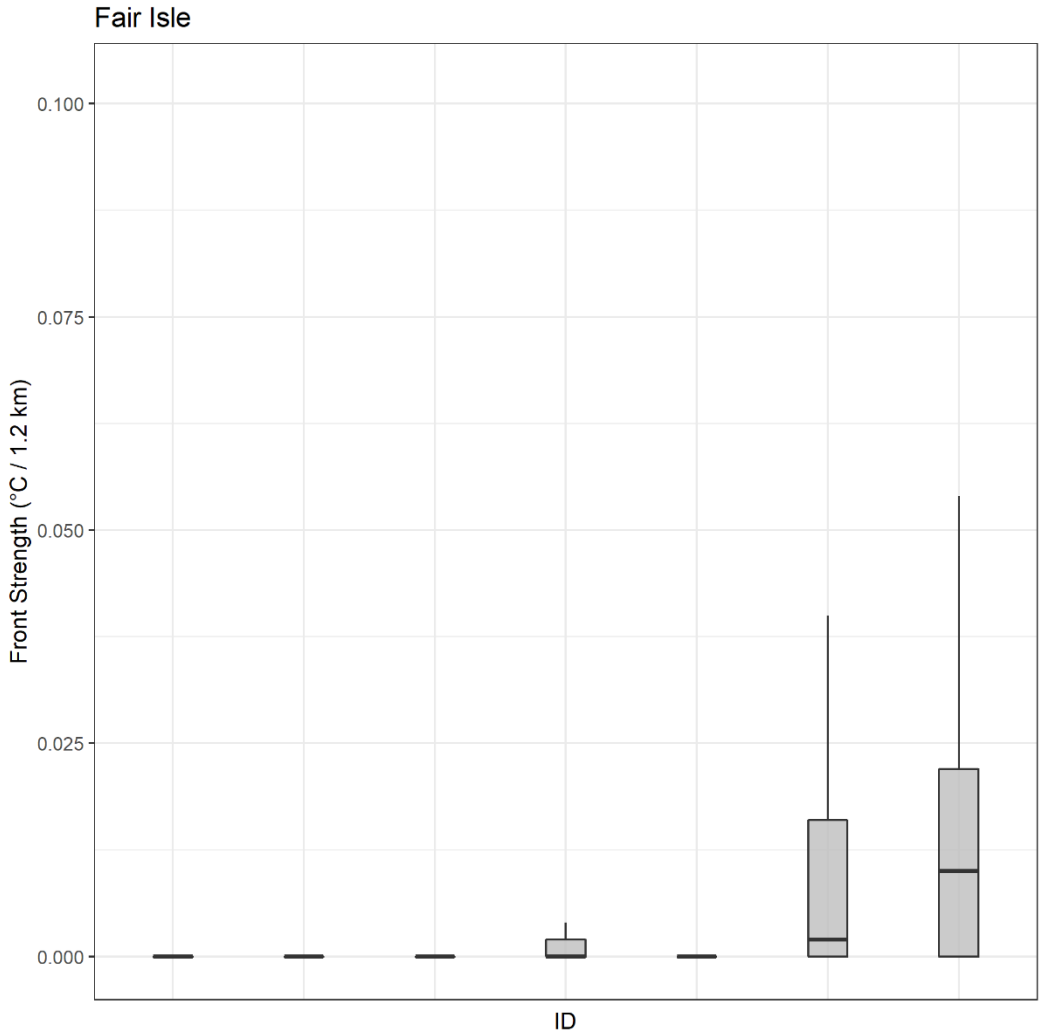


Fig. S23. Boxplot showing front strength across all points deemed available for foraging for each individual black-legged kittiwake tracked at Filey. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

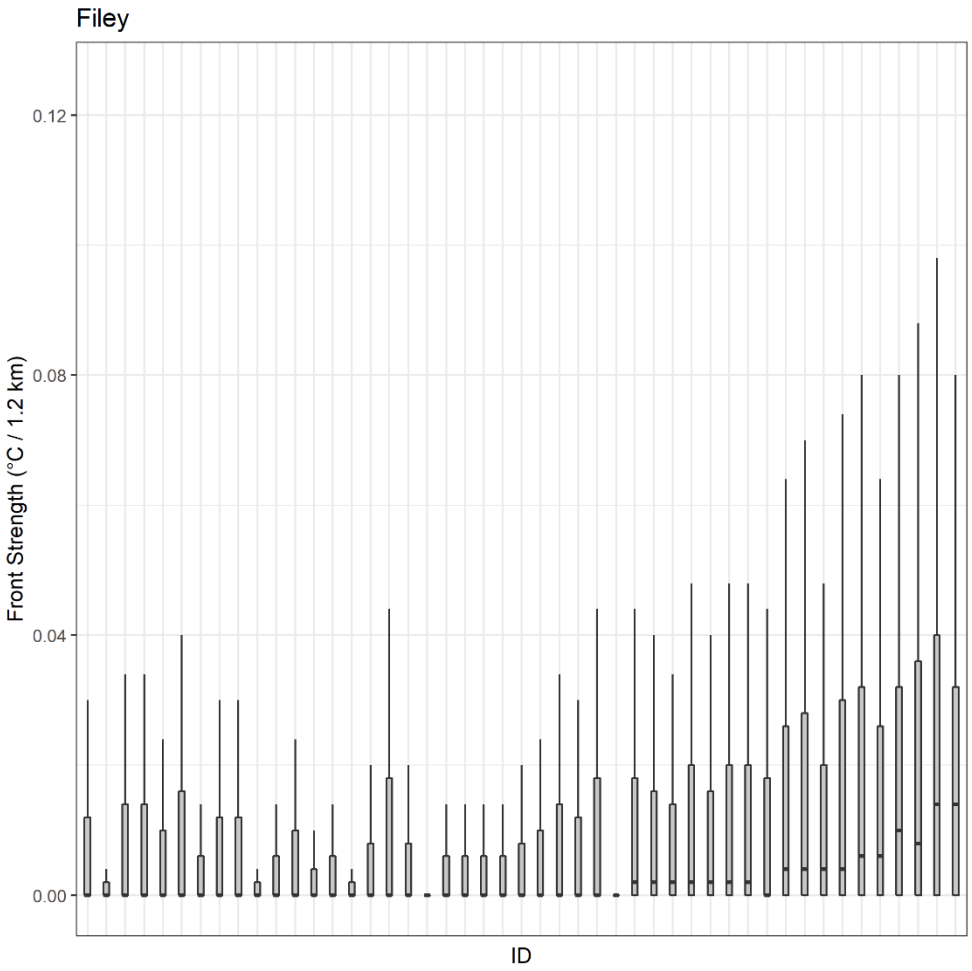


Fig. S24. Boxplot showing front strength across all points deemed available for foraging for each individual black-legged kittiwake tracked at Fowlsheugh. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

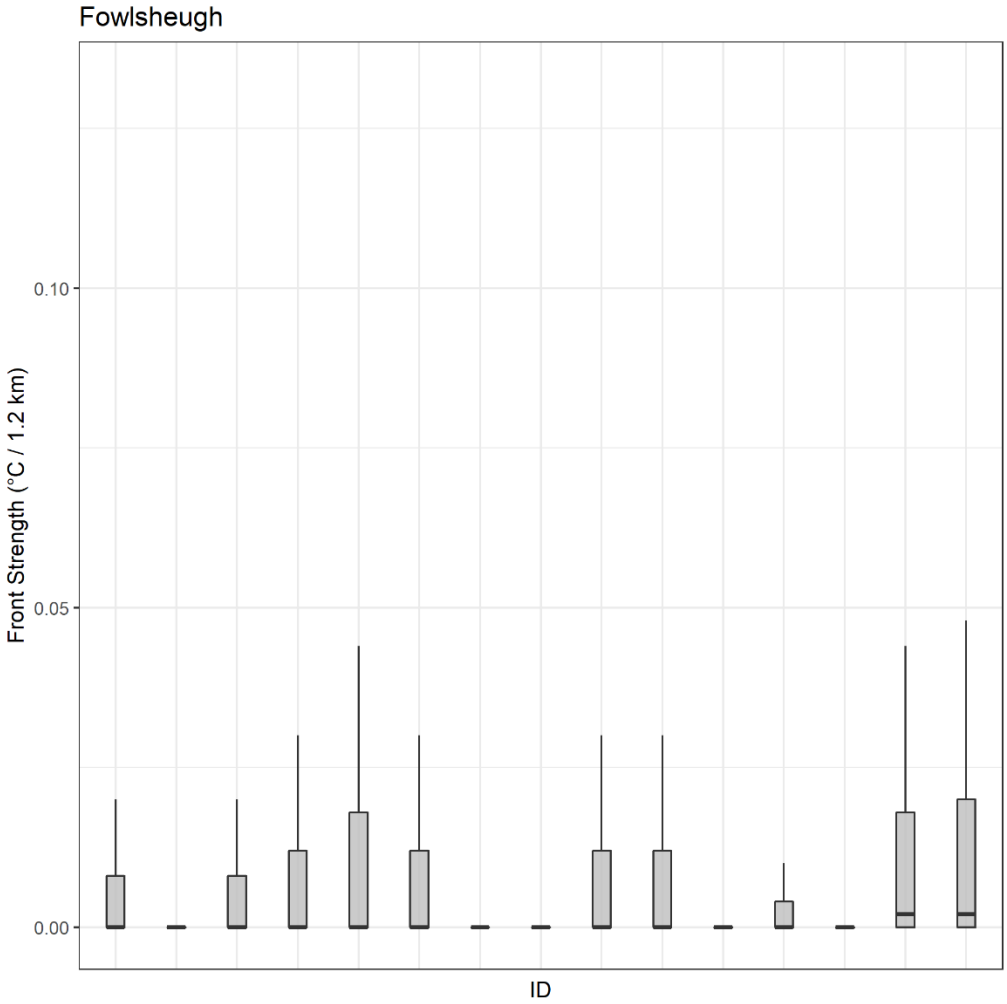


Fig. S25. Boxplot showing front strength across all points deemed available for foraging for each individual black-legged kittiwake tracked at Muckle Skerry. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

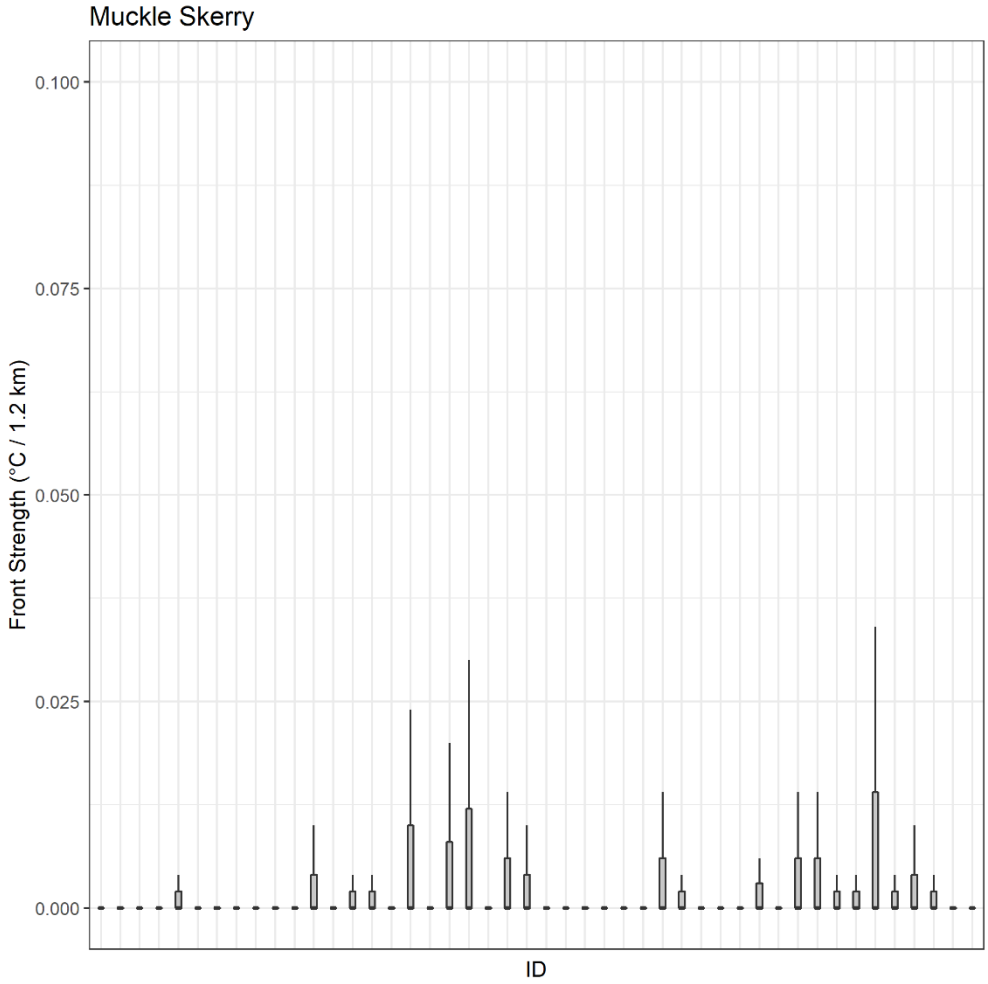


Fig. S26. Boxplot showing front strength across all points deemed available for foraging for each individual black-legged kittiwake tracked at St Abbs. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

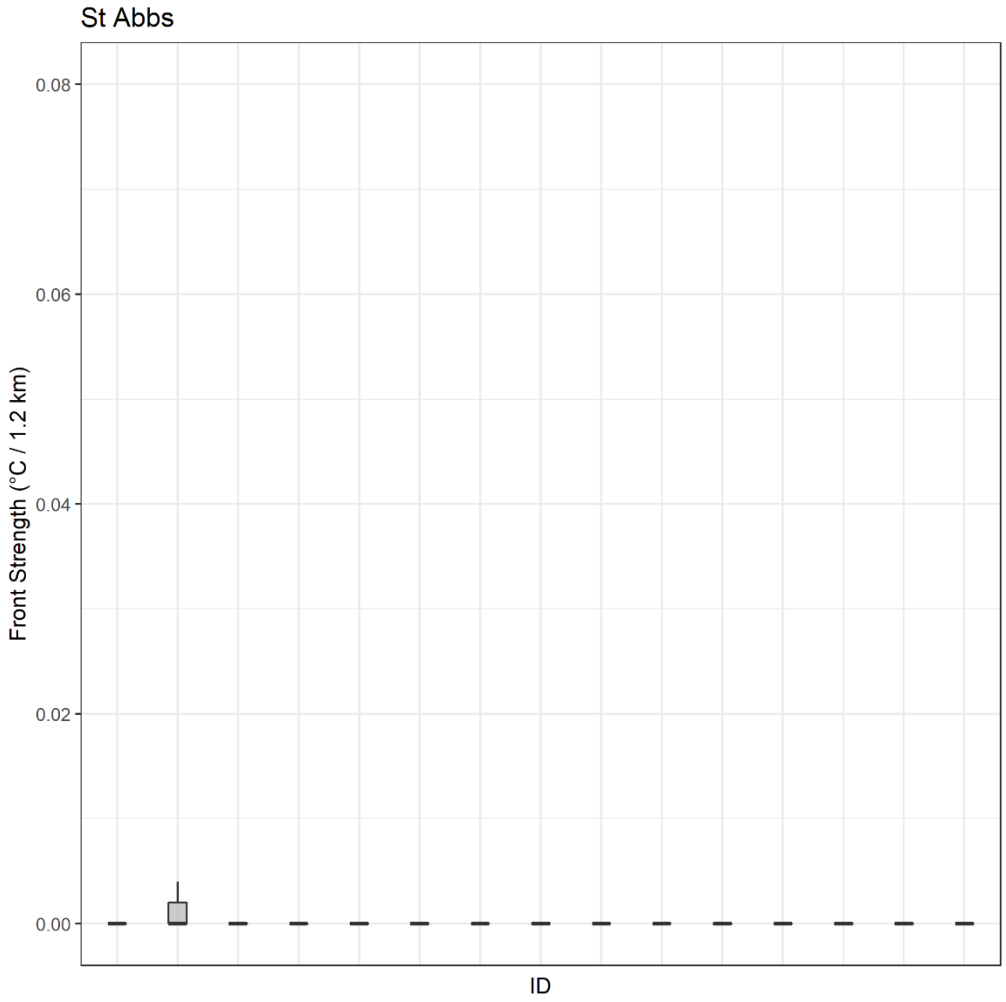


Fig. S27. Boxplot showing front strength across all points deemed available for foraging for each individual black-legged kittiwake tracked at Whinnyfold. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

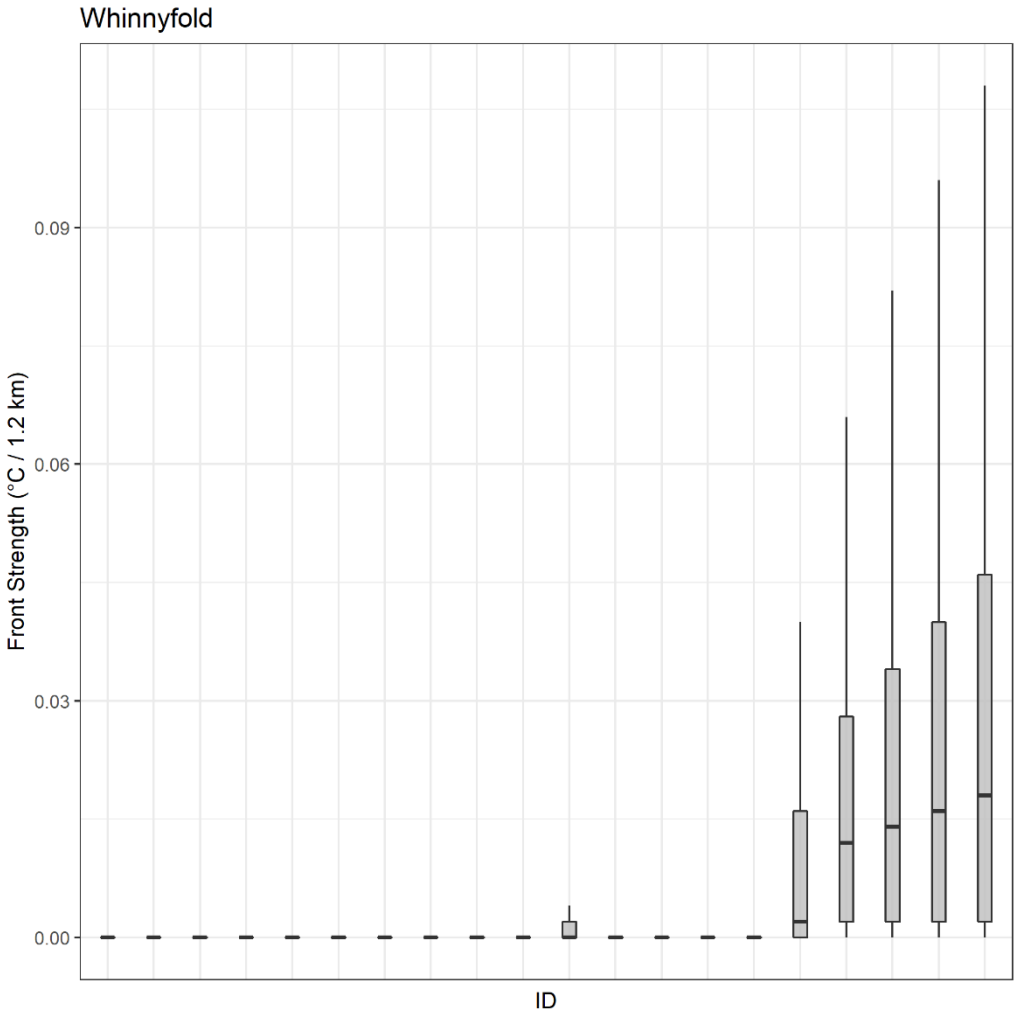


Fig. S28. Boxplot showing distance to the nearest front across all points deemed available for foraging for each individual black-legged kittiwake tracked at Bempton / Flamborough. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

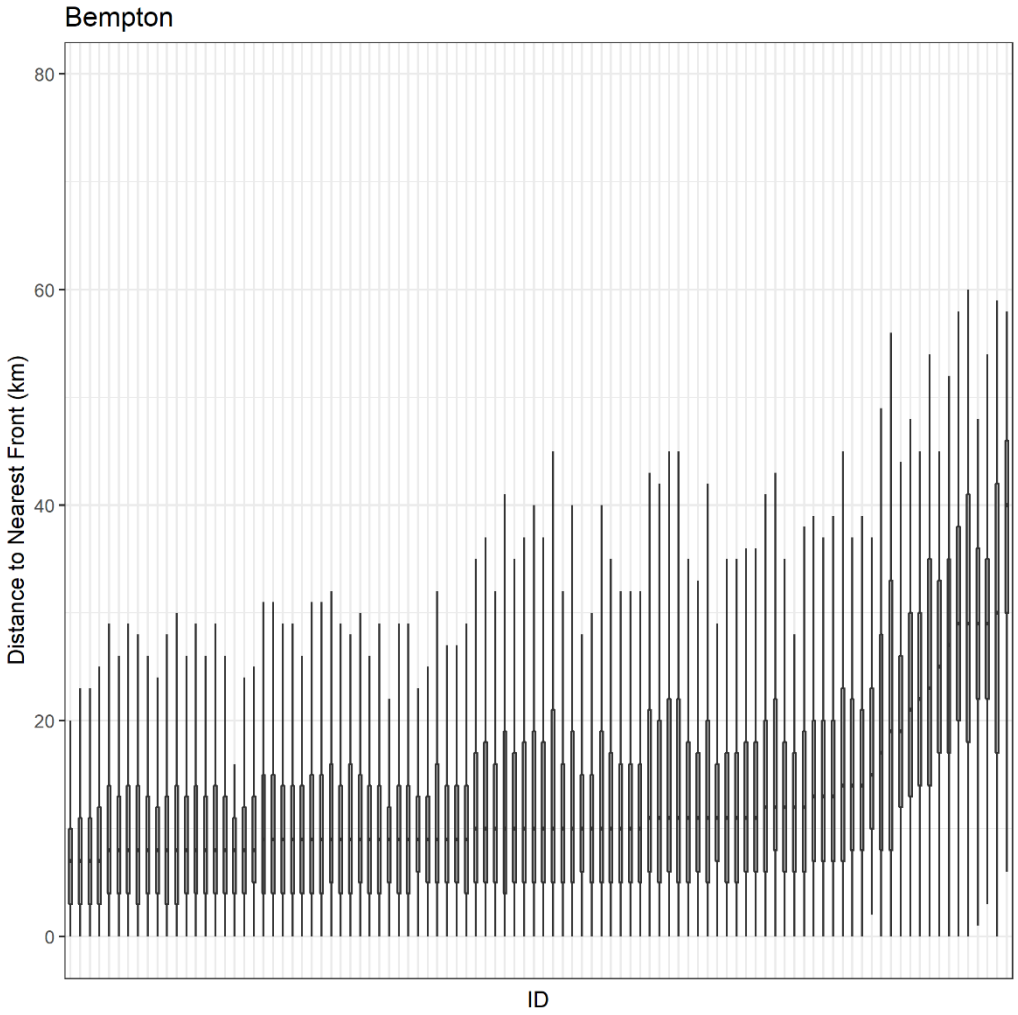


Fig. S29. Boxplot showing distance to the nearest front across all points deemed available for foraging for each individual black-legged kittiwake tracked at the Bullers of Buchan. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

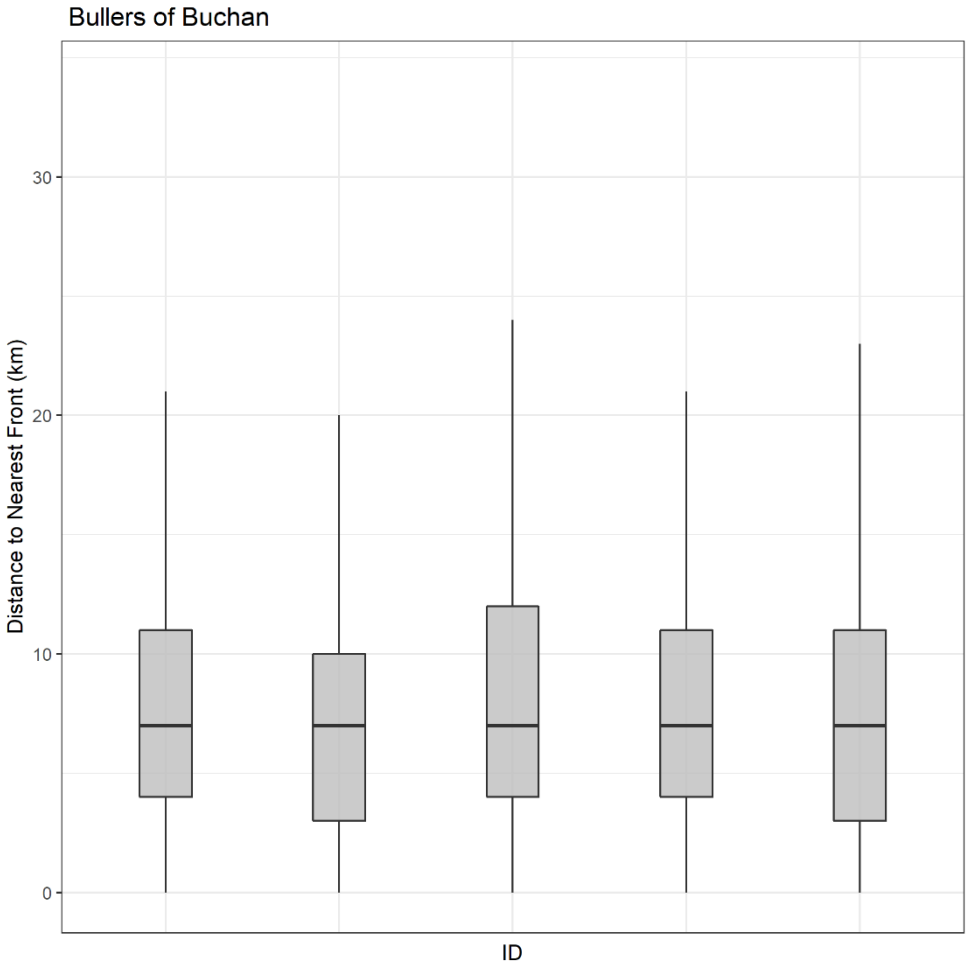


Fig. S30. Boxplot showing distance to the nearest front across all points deemed available for foraging for each individual black-legged kittiwake tracked at Copinsay. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

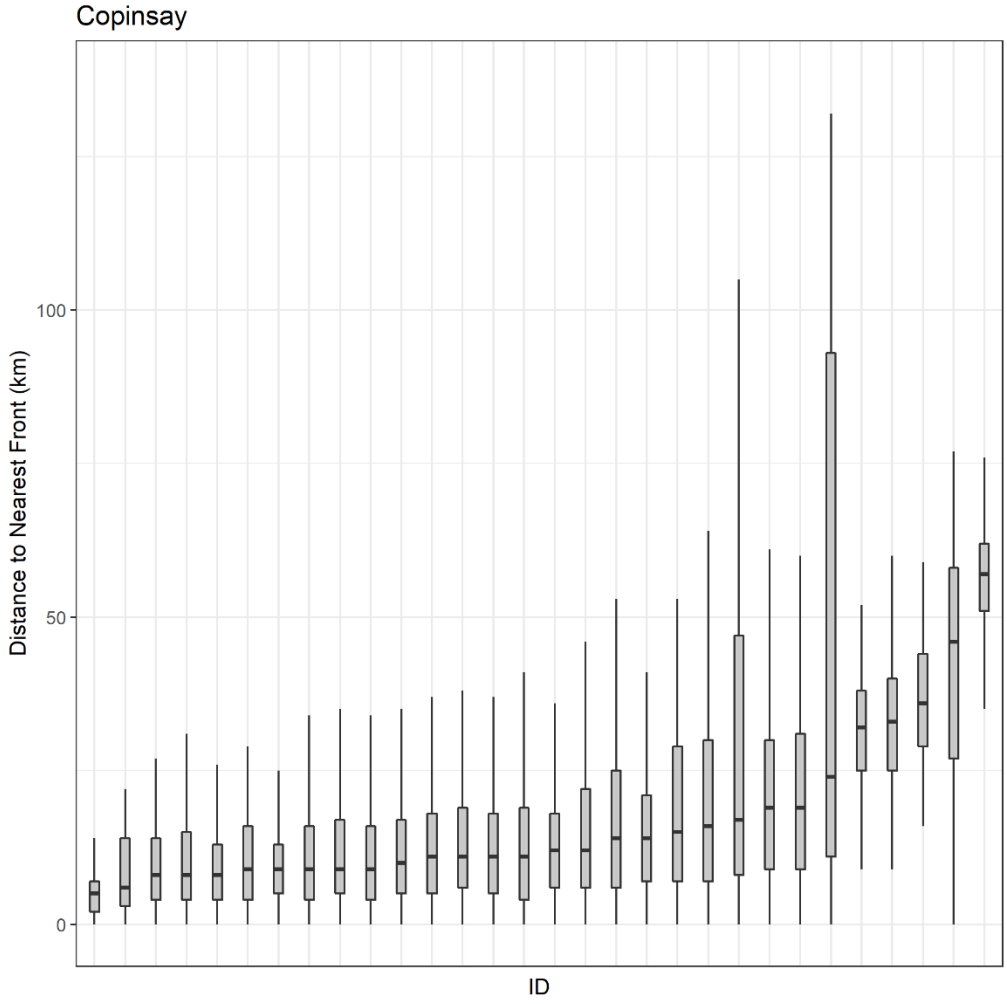


Fig. S31. Boxplot showing distance to the nearest front across all points deemed available for foraging for each individual black-legged kittiwake tracked at Coquet Island. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

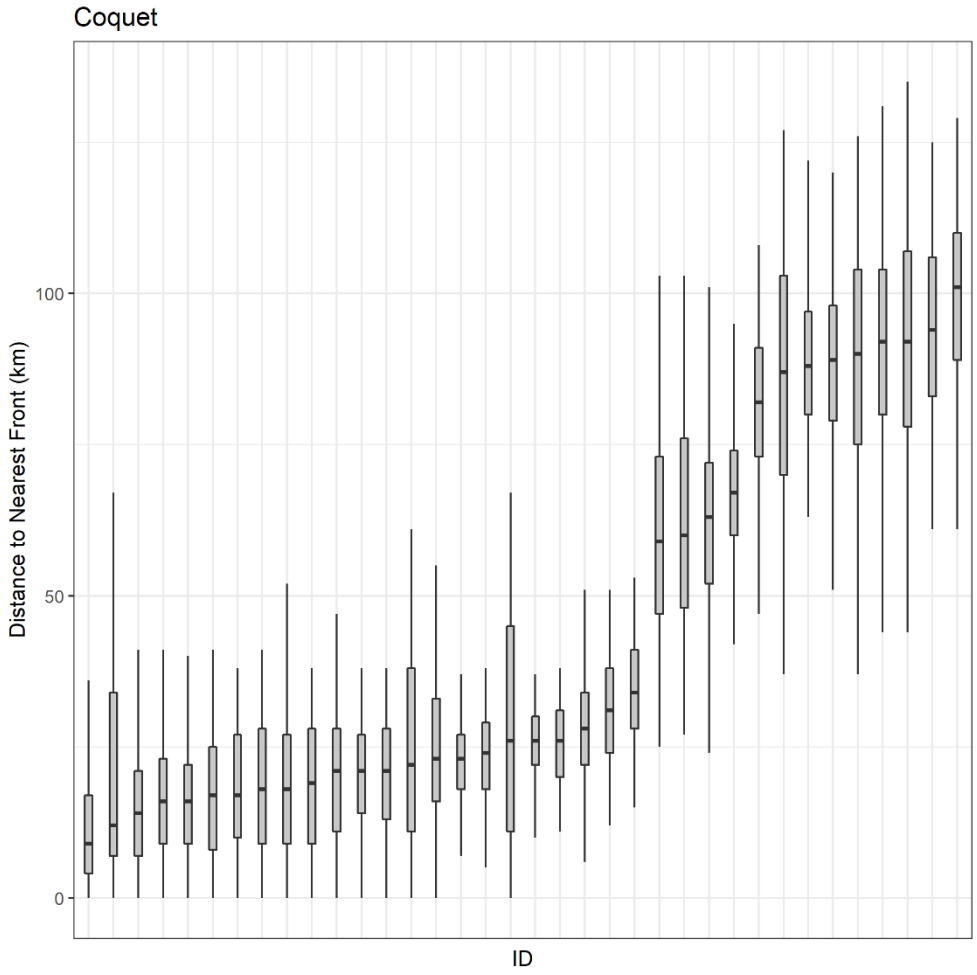


Fig. S32. Boxplot showing distance to the nearest front across all points deemed available for foraging for each individual black-legged kittiwake tracked at Fair Isle. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

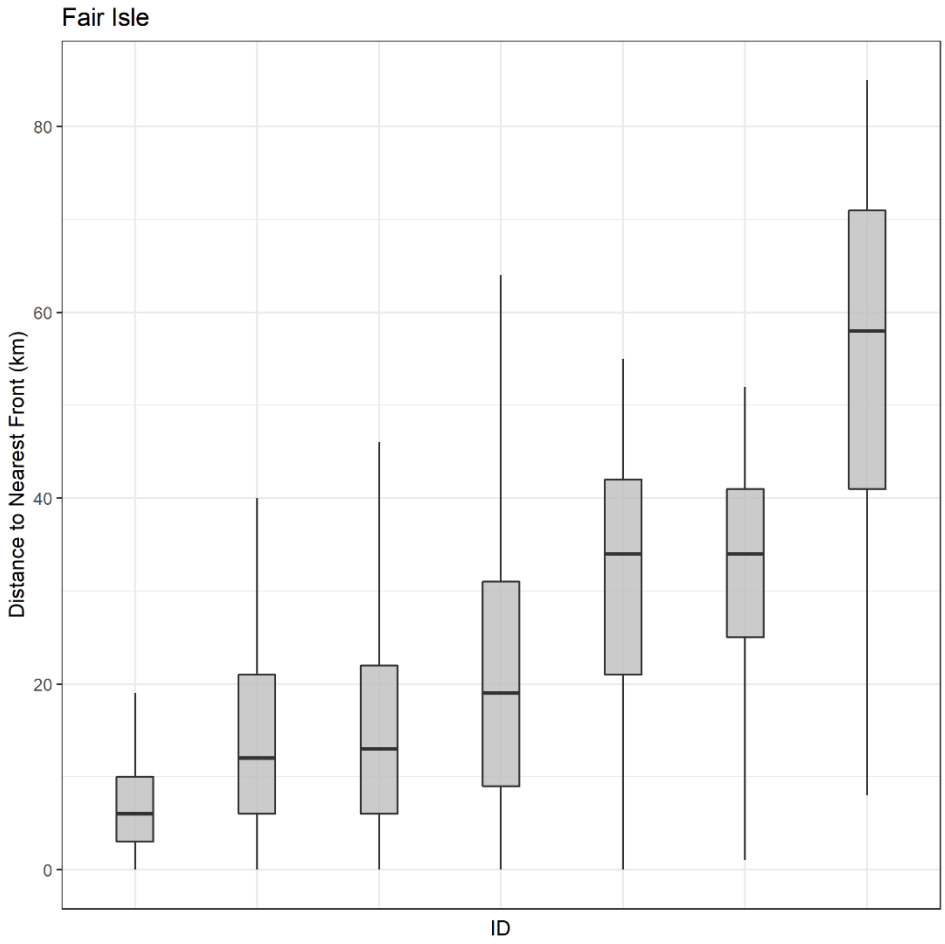


Fig. S33. Boxplot showing distance to the nearest front across all points deemed available for foraging for each individual black-legged kittiwake tracked at Filey. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

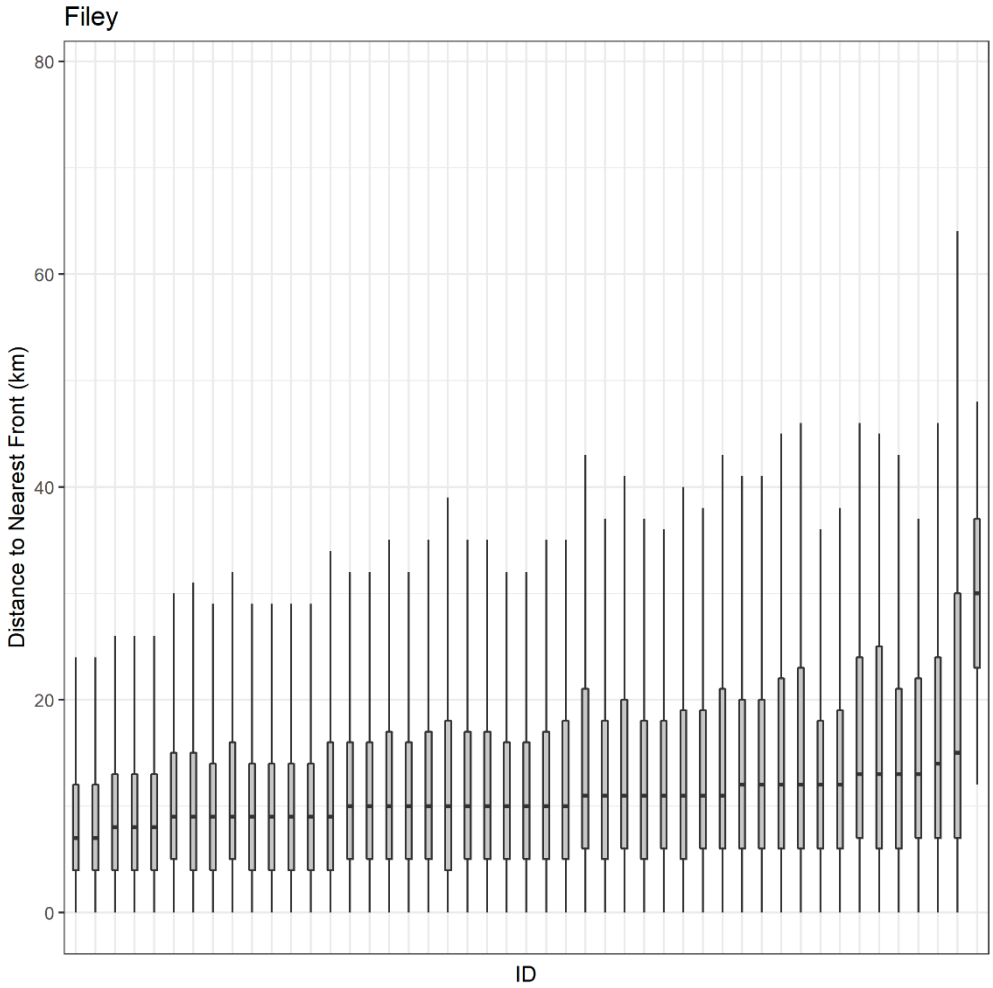


Fig. S34. Boxplot showing distance to the nearest front across all points deemed available for foraging for each individual black-legged kittiwake tracked at Fowlsheugh. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

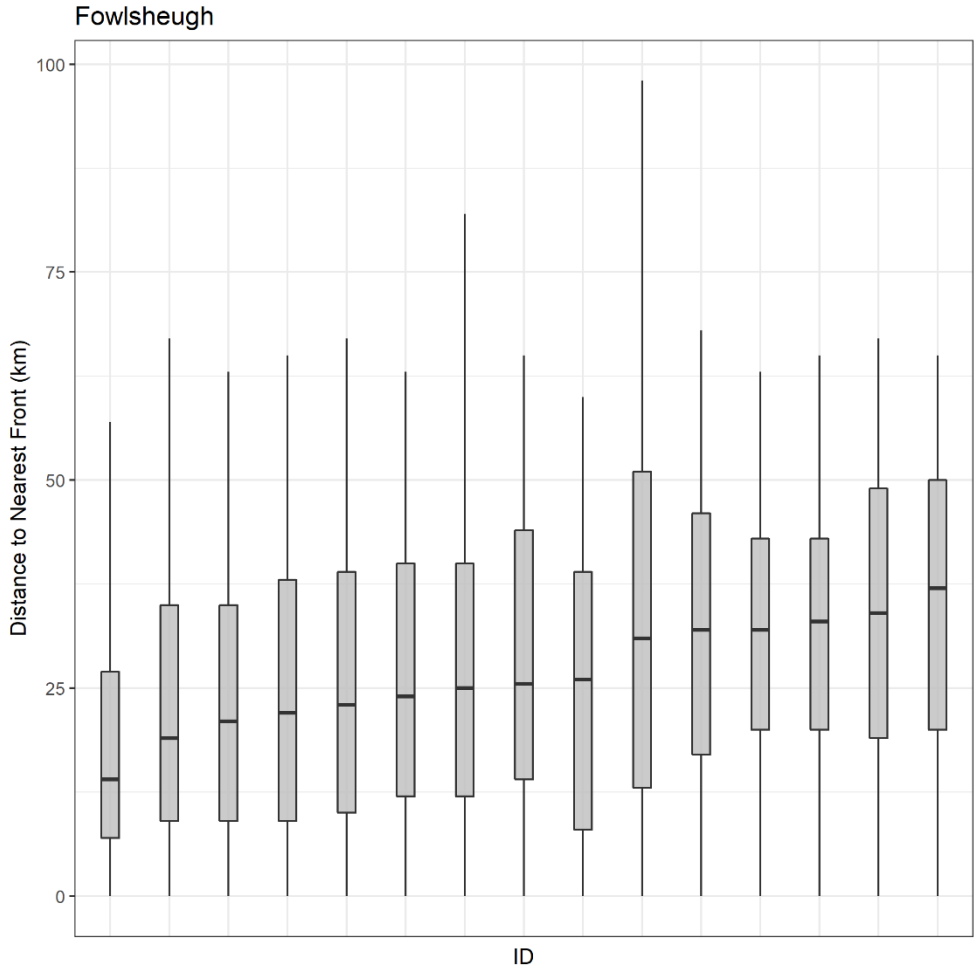


Fig. S35. Boxplot showing distance to the nearest front across all points deemed available for foraging for each individual black-legged kittiwake tracked at Muckle Skerry. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

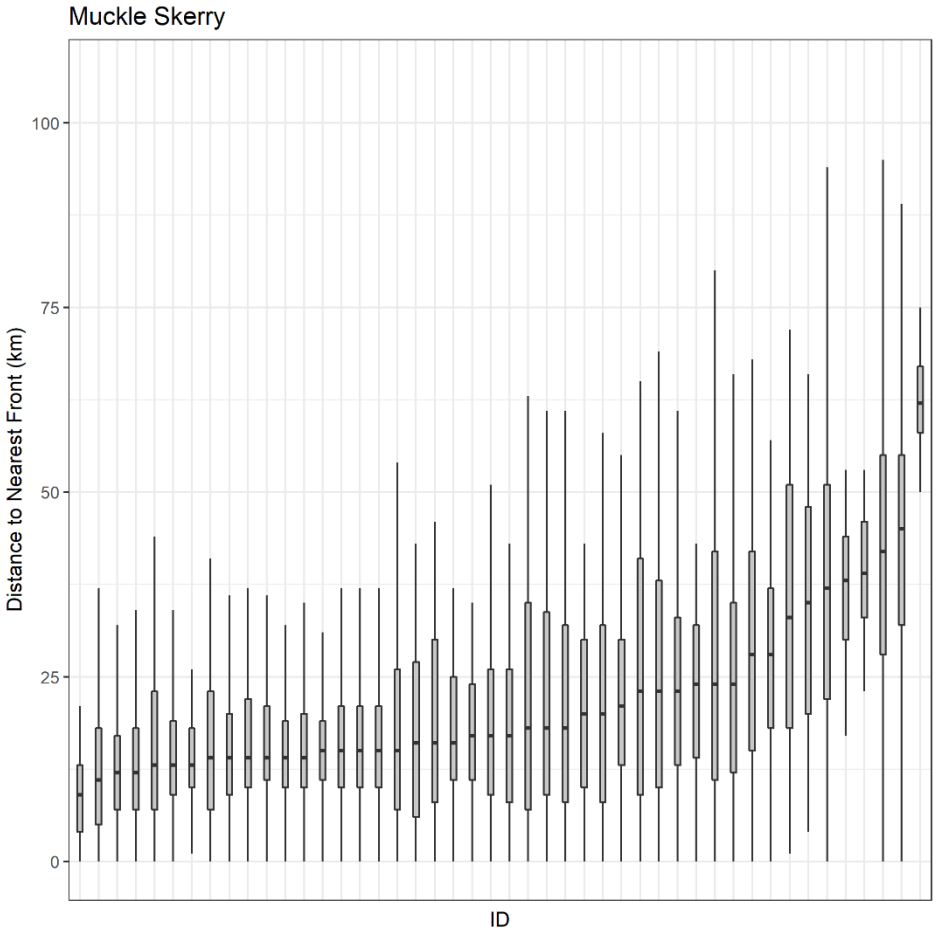


Fig. S36. Boxplot showing distance to the nearest front across all points deemed available for foraging for each individual black-legged kittiwake tracked at St Abbs. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

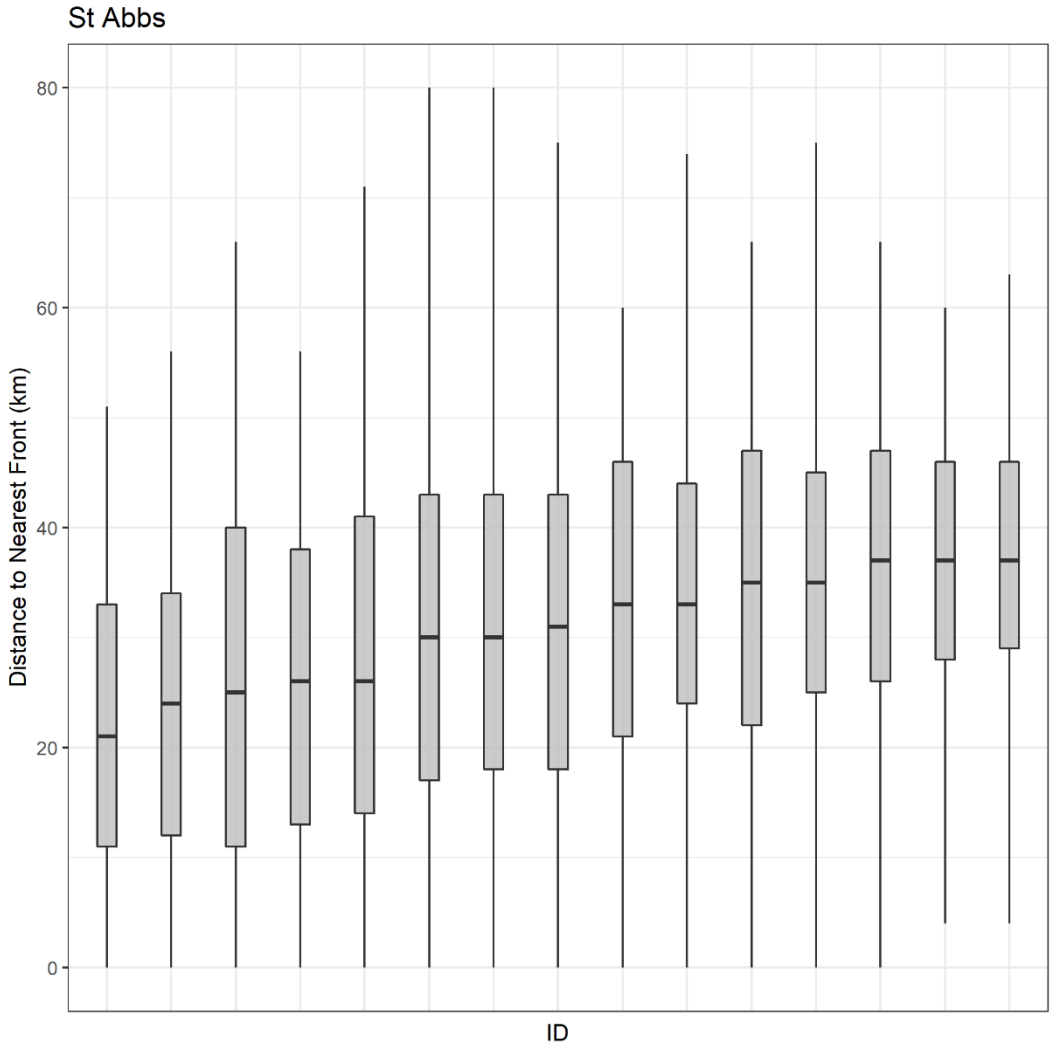


Fig. S37. Boxplot showing distance to the nearest front across all points deemed available for foraging for each individual black-legged kittiwake tracked at Whinnyfold. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

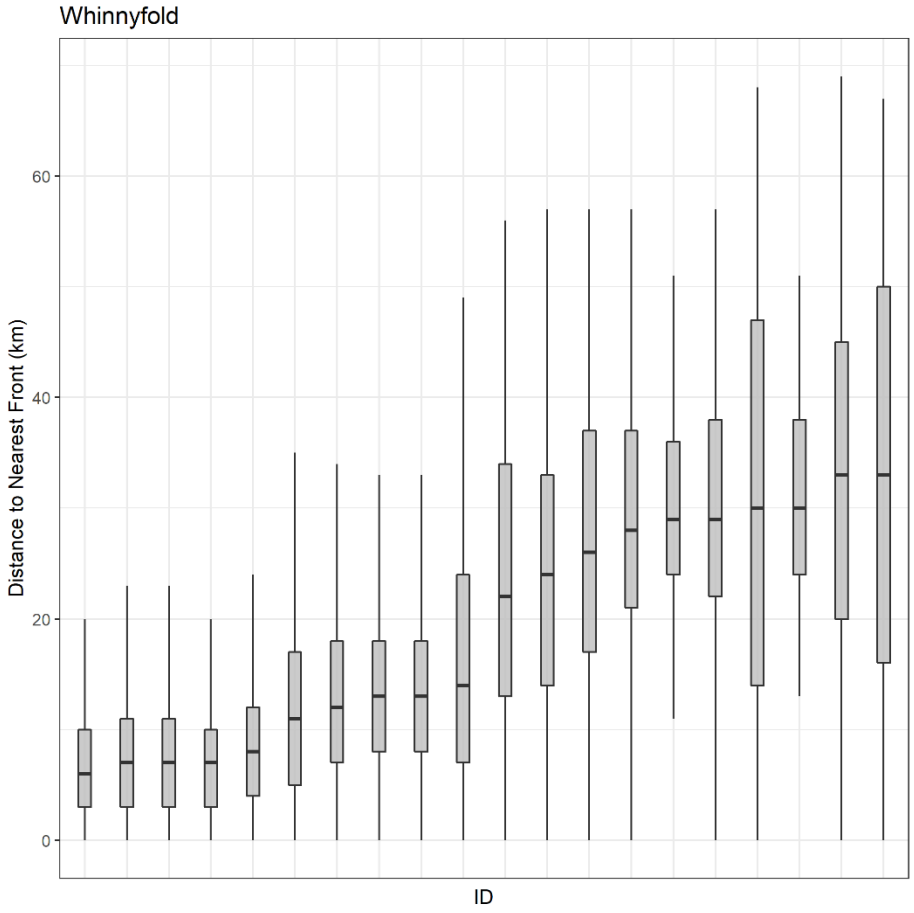


Fig. S38. Boxplot showing sea surface temperature across all points deemed available for foraging for each individual black-legged kittiwake tracked at Bempton / Flamborough. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

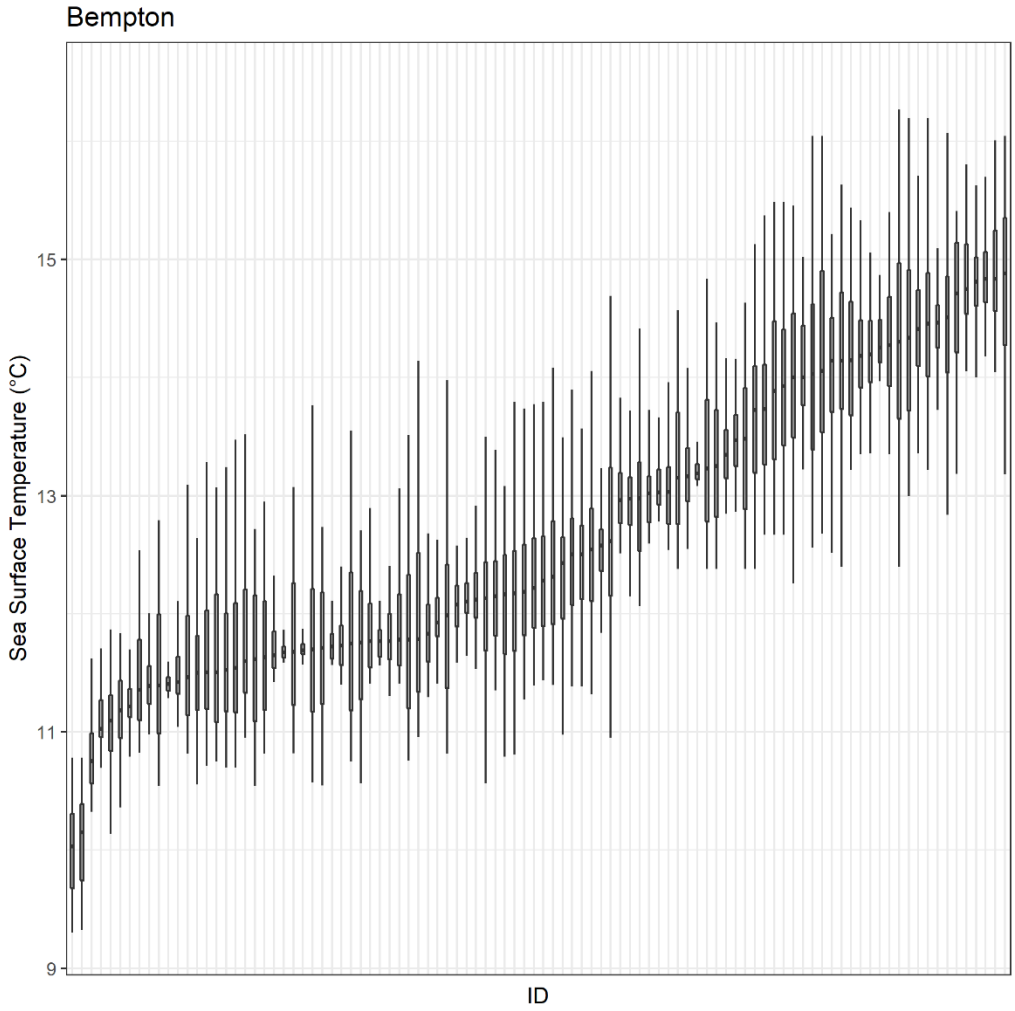


Fig. S39. Boxplot showing sea surface temperature across all points deemed available for foraging for each individual black-legged kittiwake tracked at the Bullers of Buchan. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

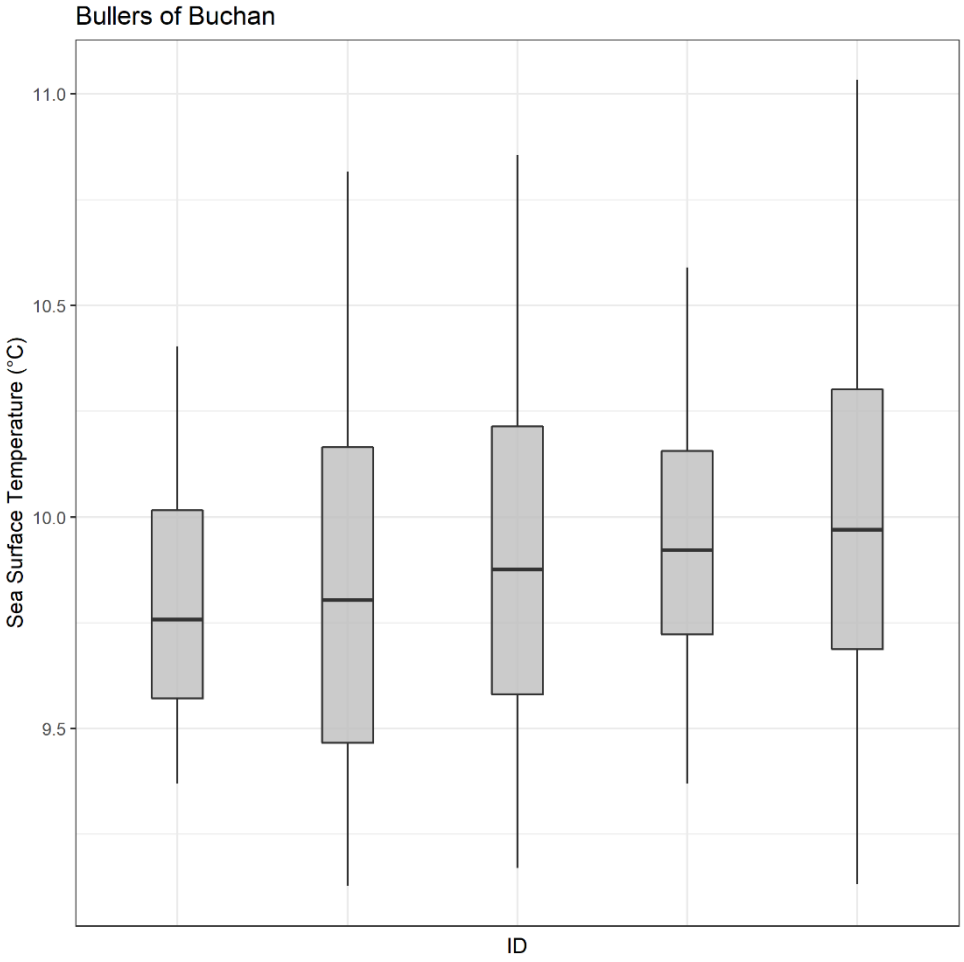


Fig. S40. Boxplot showing sea surface temperature across all points deemed available for foraging for each individual black-legged kittiwake tracked at Copinsay. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

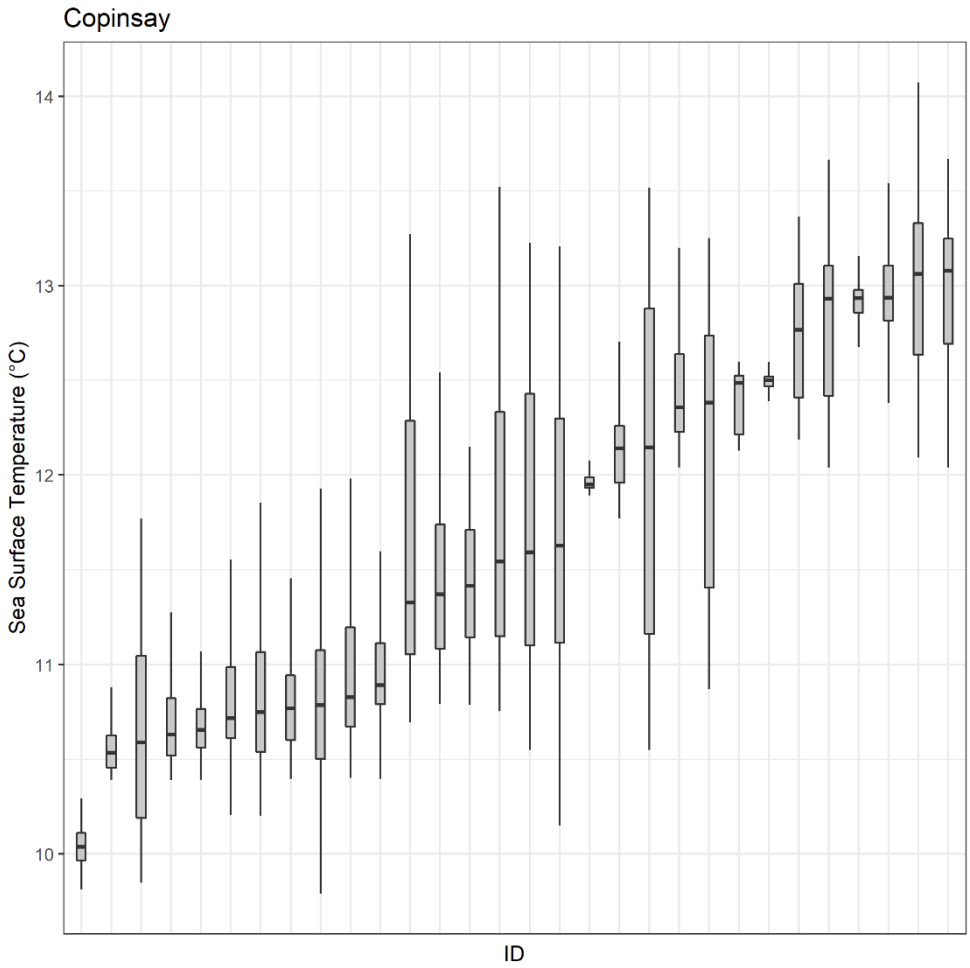


Fig. S41. Boxplot showing sea surface temperature across all points deemed available for foraging for each individual black-legged kittiwake tracked at Coquet Island. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

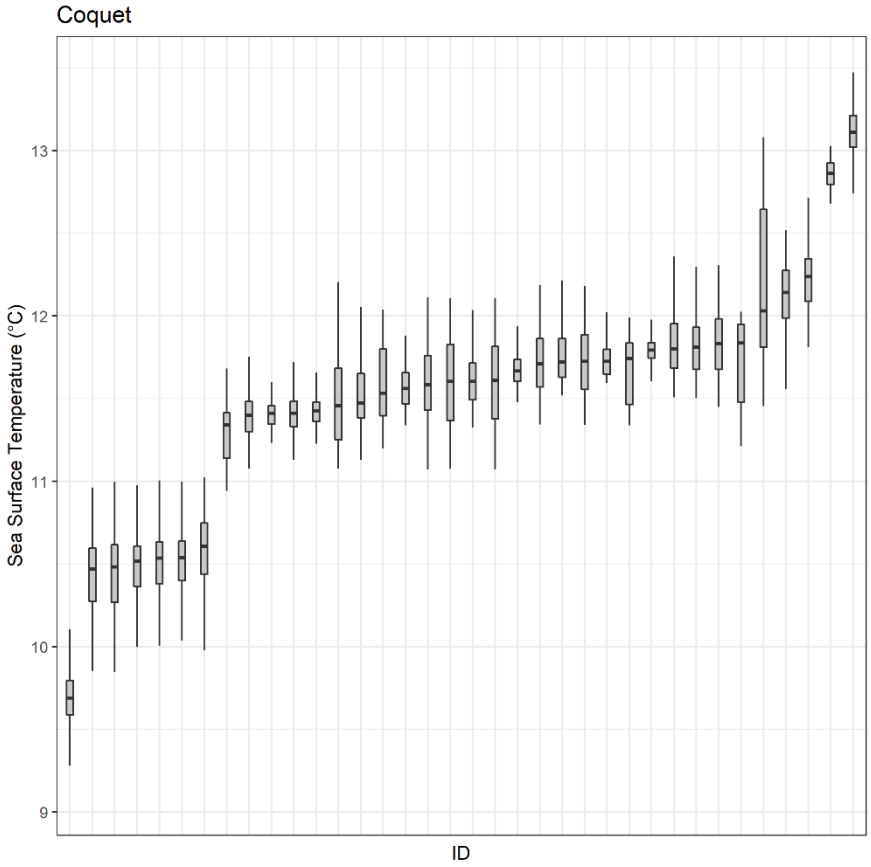


Fig. S42. Boxplot showing sea surface temperature across all points deemed available for foraging for each individual black-legged kittiwake tracked at Fair Isle. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

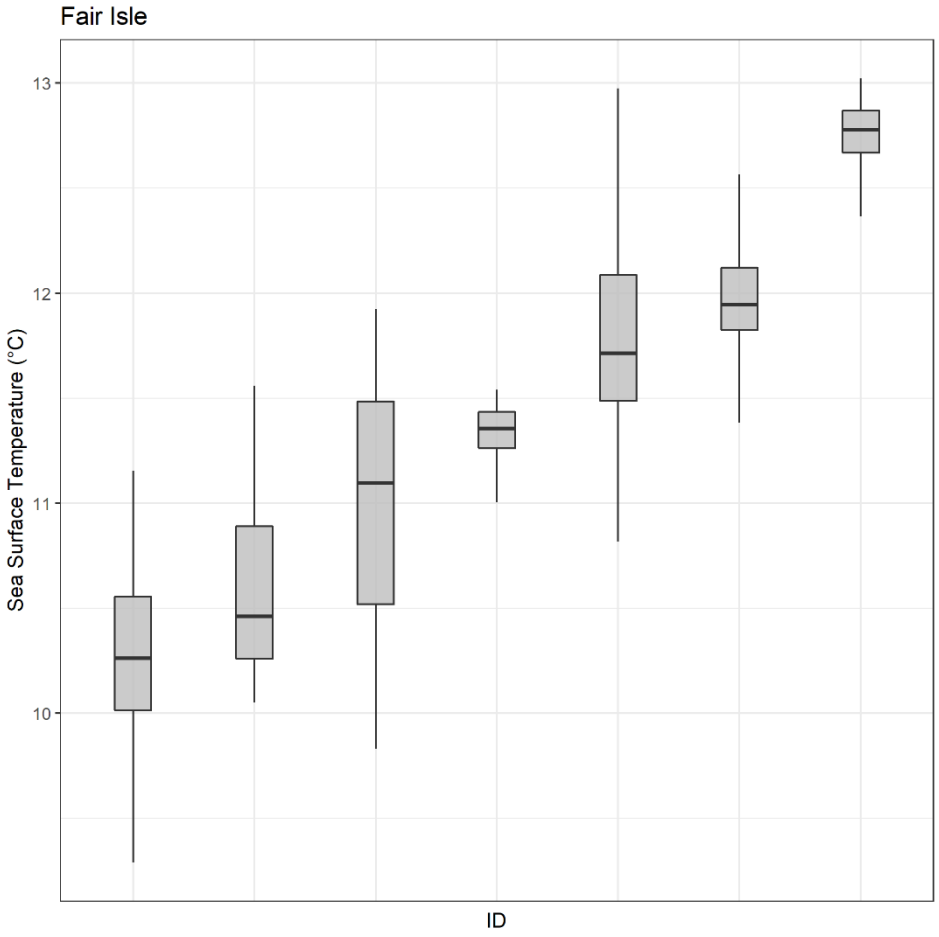


Fig. S43. Boxplot showing sea surface temperature across all points deemed available for foraging for each individual black-legged kittiwake tracked at Filey. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

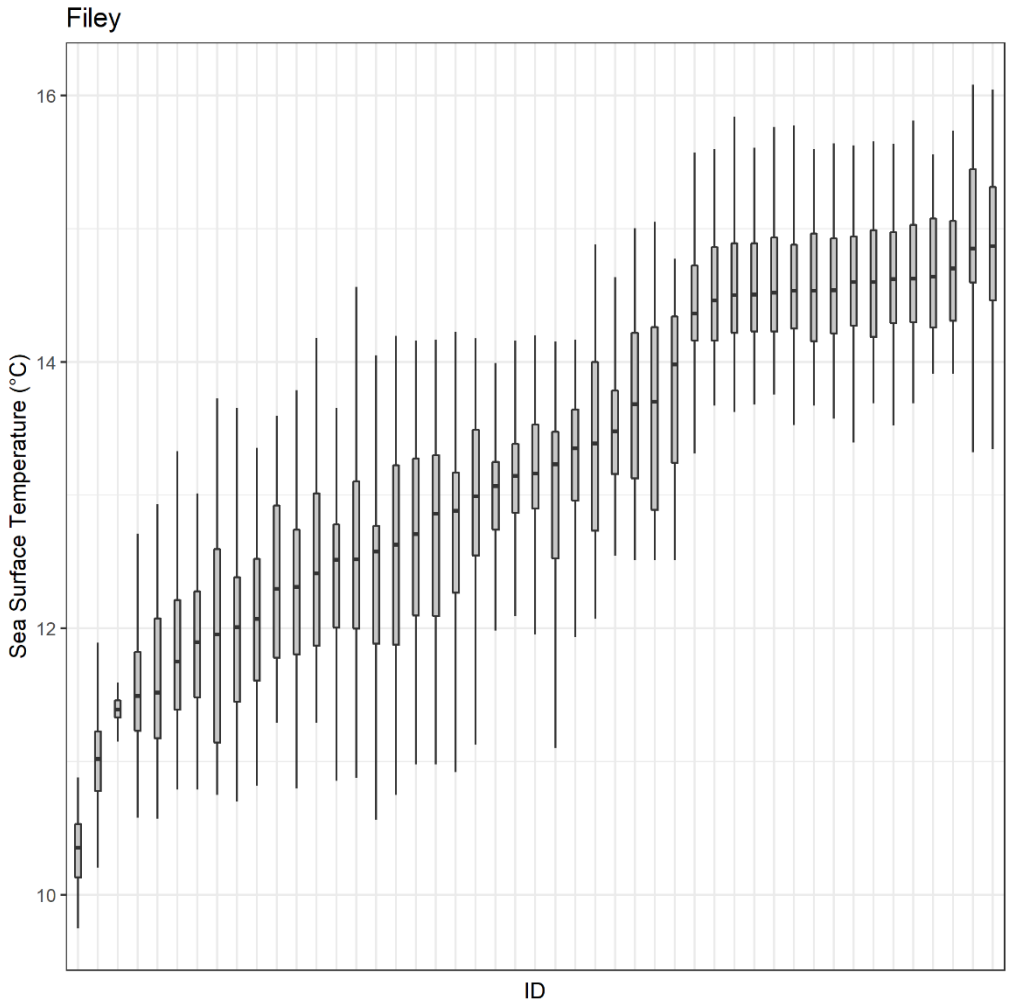


Fig. S44. Boxplot showing sea surface temperature across all points deemed available for foraging for each individual black-legged kittiwake tracked at Fowlsheugh. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

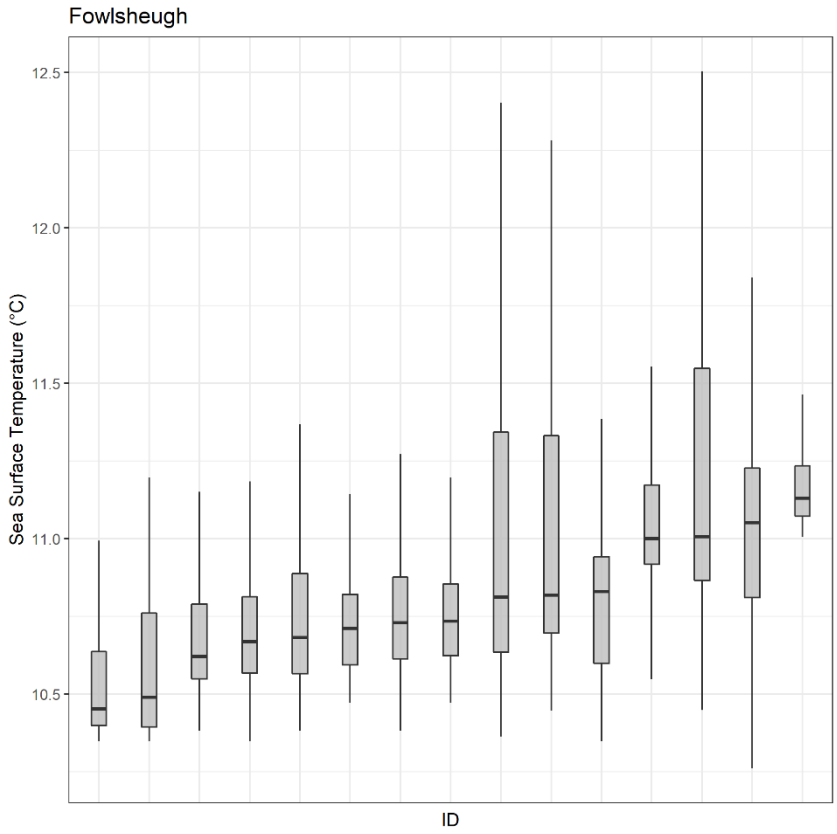


Fig. S45. Boxplot showing sea surface temperature across all points deemed available for foraging for each individual black-legged kittiwake tracked at Muckle Skerry. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

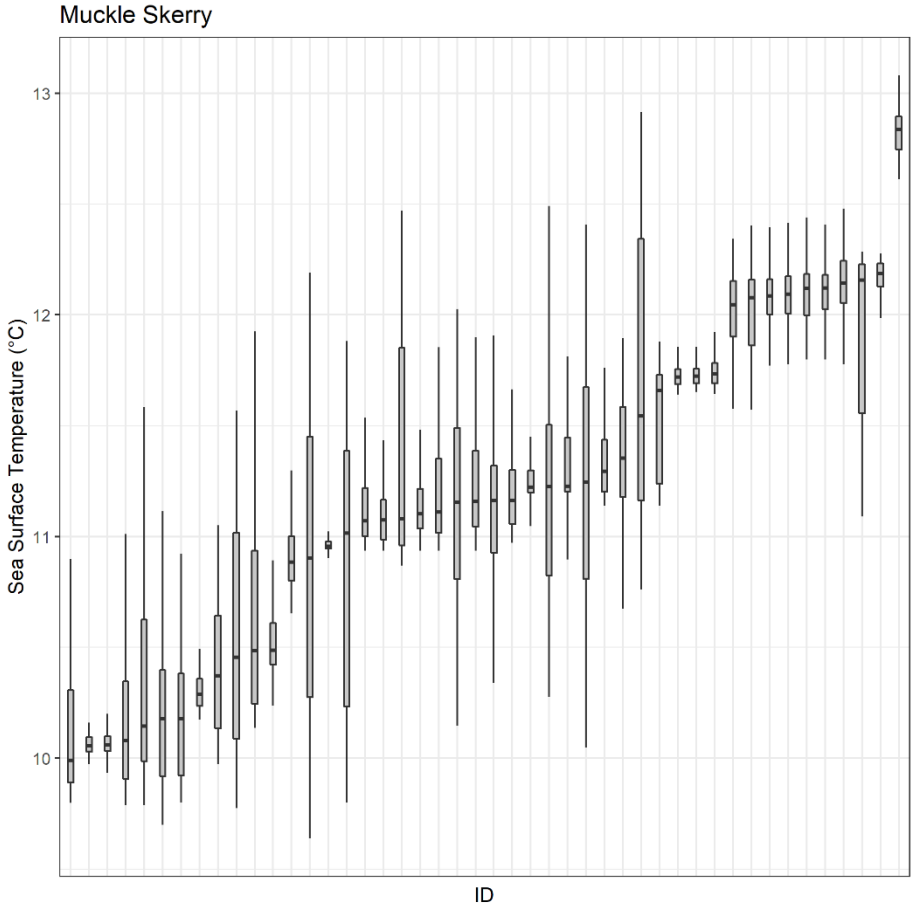


Fig. S46. Boxplot showing sea surface temperature across all points deemed available for foraging for each individual black-legged kittiwake tracked at St Abbs. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

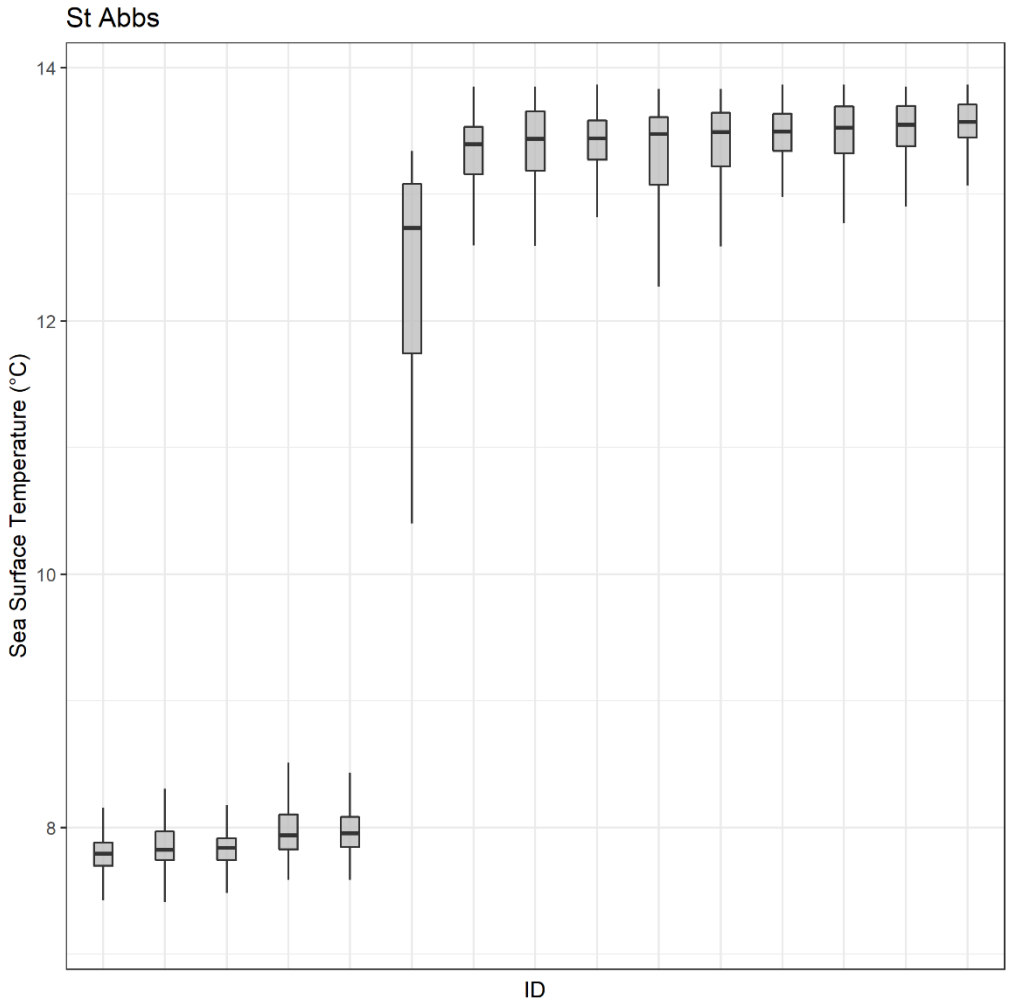


Fig. S47. Boxplot showing sea surface temperature across all points deemed available for foraging for each individual black-legged kittiwake tracked at Whinnyfold. For each individual the area judged available was based on an individual-level MCP based on all observations recorded during GPS plus a 10 km buffer (see Methods in main section). Individuals are arranged from right to left ordered by the median value of points available to them to highlight individual variation in foraging conditions experienced.

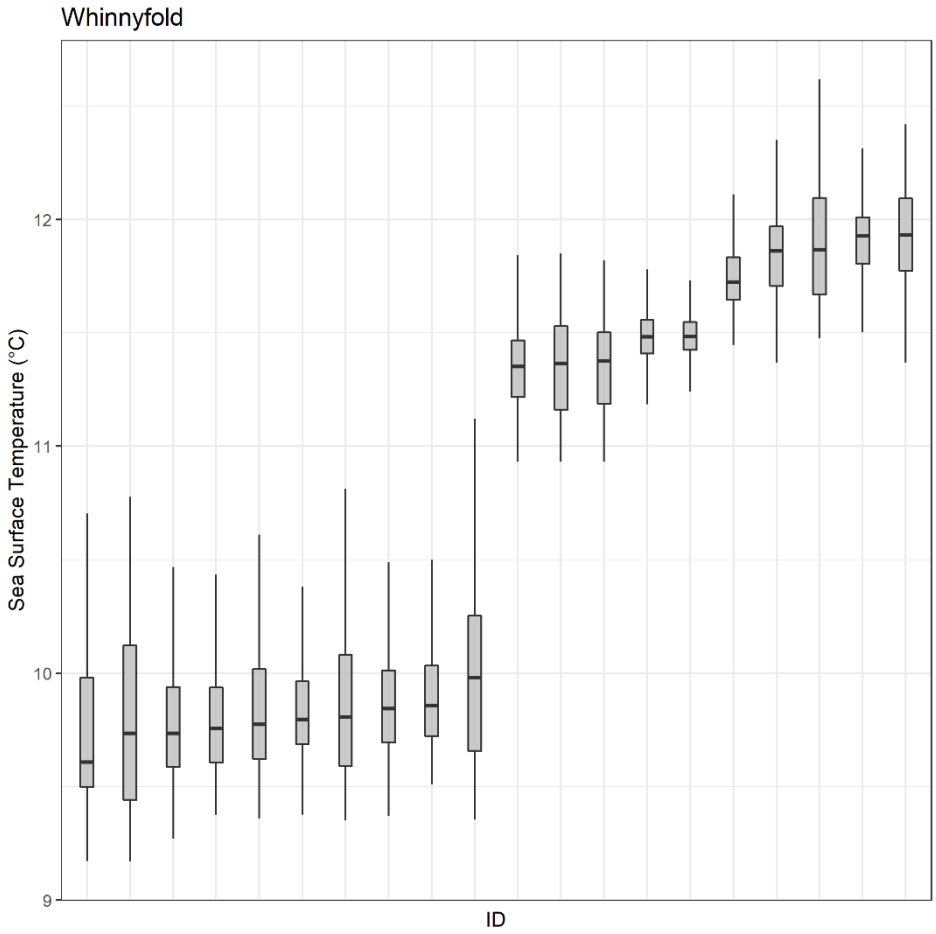


Fig. S48. Histogram displaying the mean chlorophyll concentration estimated for each individual tracked in the study. Mean chlorophyll concentration was used to estimate habitat availability and was calculated based on a random sample of available points that fell within an individual-level MCP plus 10 km buffer for each individual using a 1:40 ratio of observed to available points. The solid red line represents the average of this distribution and dashed lines represent this average ± 1 standard deviation.

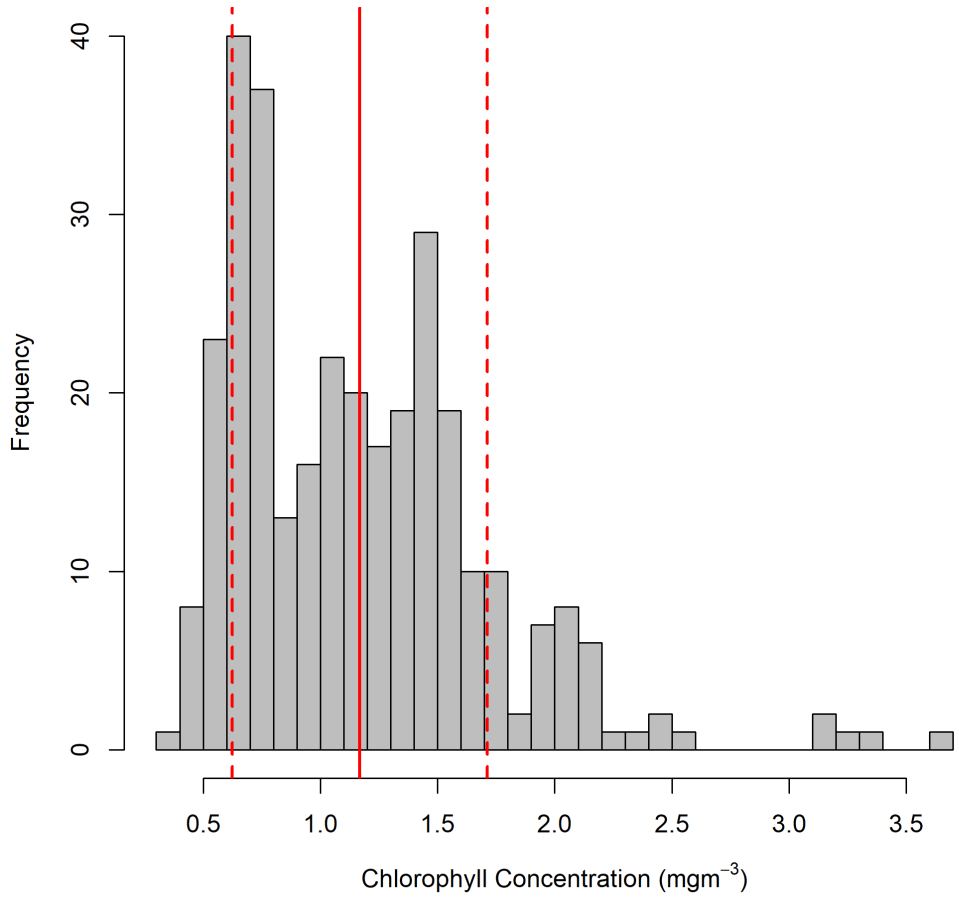


Fig. S49. Histogram displaying the mean front strength estimated for each individual tracked in the study. Mean front strength was used to estimate habitat availability and was calculated based on a random sample of available points that fell within an individual-level MCP plus 10 km buffer for each individual using a 1:40 ratio of observed to available points. The solid red line represents the average of this distribution and dashed lines represent this average ± 1 standard deviation.

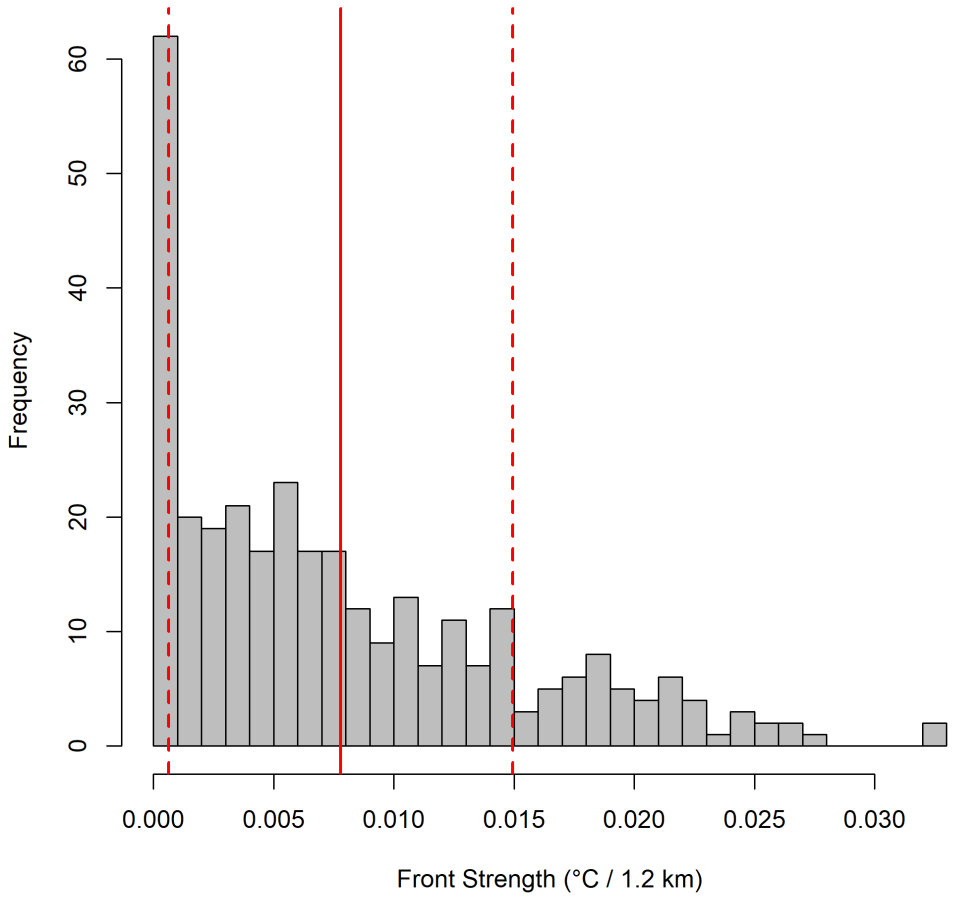


Fig. S50. Histogram displaying the mean distance to the nearest front estimated for each individual tracked in the study. Mean distance to the nearest front was used to estimate habitat availability and was calculated based on a random sample of available points that fell within an individual-level MCP plus 10 km buffer for each individual using a 1:40 ratio of observed to available points. The solid red line represents the average of this distribution and dashed lines represent this average ± 1 standard deviation.

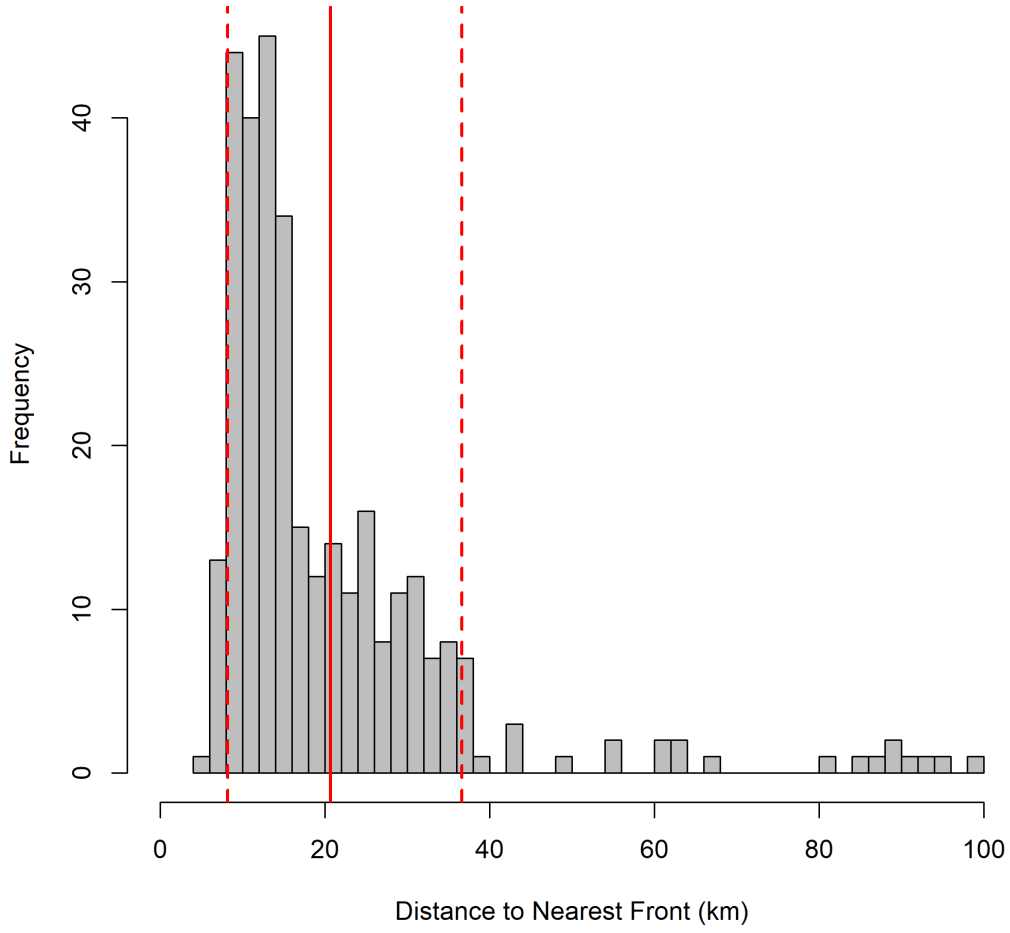


Fig. S51. Histogram displaying the mean sea surface temperature estimated for each individual tracked in the study. Mean sea surface temperature was used to estimate habitat availability and was calculated based on a random sample of available points that fell within an individual-level MCP plus 10 km buffer for each individual using a 1:40 ratio of observed to available points. The solid red line represents the average of this distribution and dashed lines represent this average ± 1 standard deviation.

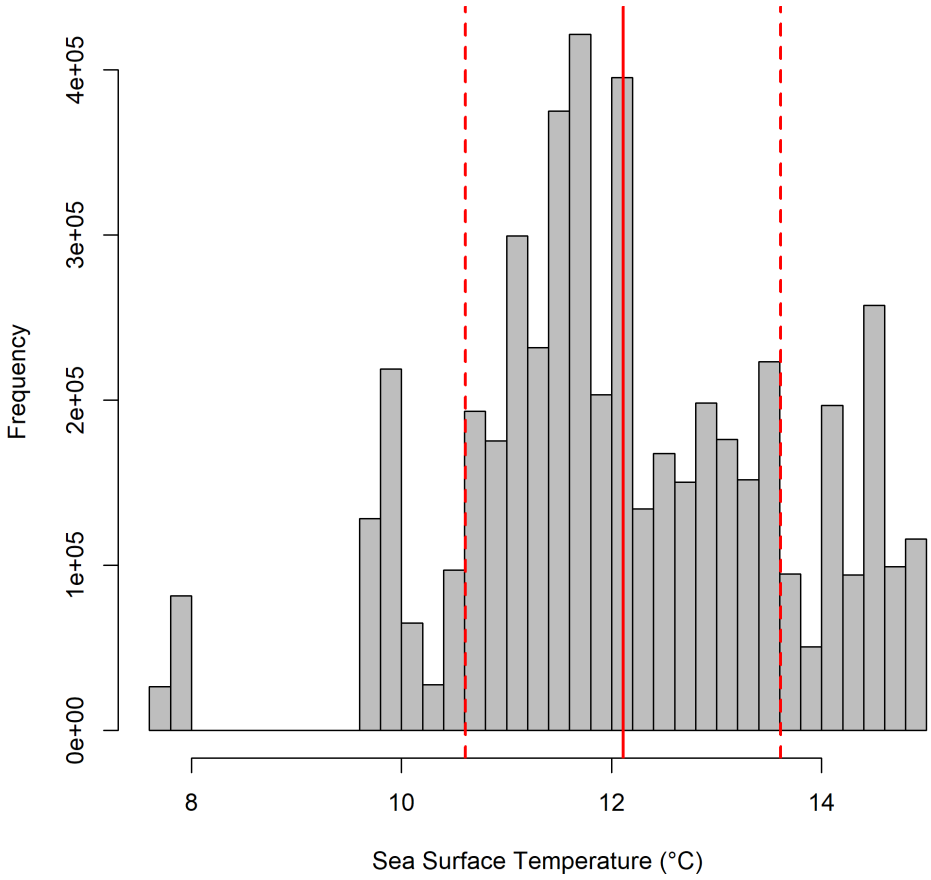
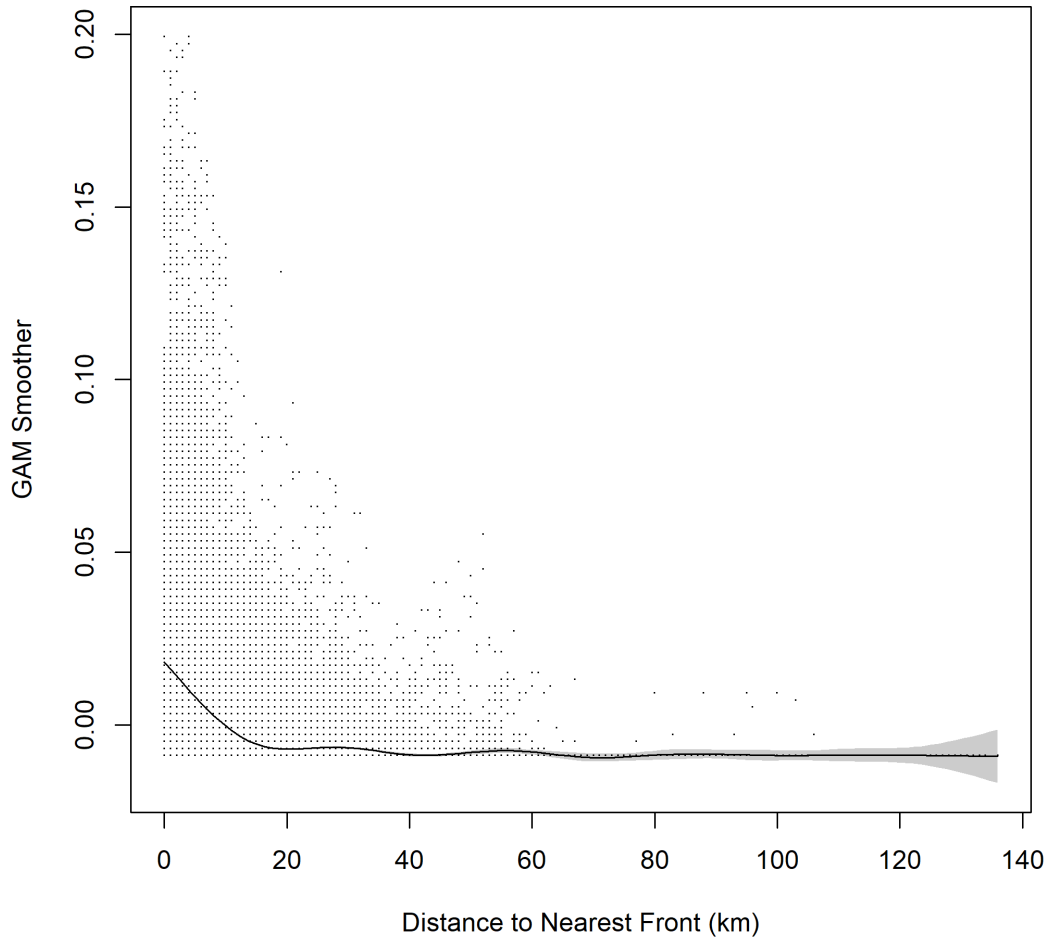


Fig. S52. Plot showing the relationship between front strength and distance to the nearest front. Front strength was modelled as a response variable as a function of distance from the nearest front using a generalised additive model (gam) using cubic shrinkage splines via the R package mgcv (Wood 2011). The dataset used was restricted to using only random sampled 'available' data points pooling data across all colonies and individuals tracked. The gam smoother is shown together with 95% CI (shaded envelope). Data points displayed as grey dots.



Text S1. Used-Habitat Calibration plots

UHC plots are created by using fitted RSFs to assign weights to new locations and generate a predictive distribution of used habitat (Fieberg et al. 2018). For each environmental covariate predictive distributions can then be compared to observed values in a test dataset (e.g. via cross-validation). If the model performs well then observed habitat in the testing dataset with fall primarily with the 95% confidence bounds of the predictive distribution of used habitat. In general, models for each environmental covariate appear well calibrated. However, we did observe slight discrepancies in the location of peak densities between predictive and observed data.

Fig. S53. UHC density plots for surface chlorophyll concentration. Density of values in real, observed data in black lines. The density of available values depicted as a red dashed line. A 95% Confidence Interval around expectations of usage based on simulated datasets using K-fold cross validation is displayed using a grey envelope. Optimal model calibration occurs when observed values fall within the 95% CI envelope. Below we display two plots where a) the x-axis extends across the range of observed data and b) where the x-axis is zoomed in to the region of the covariate where most data points were located for ease of visualization.

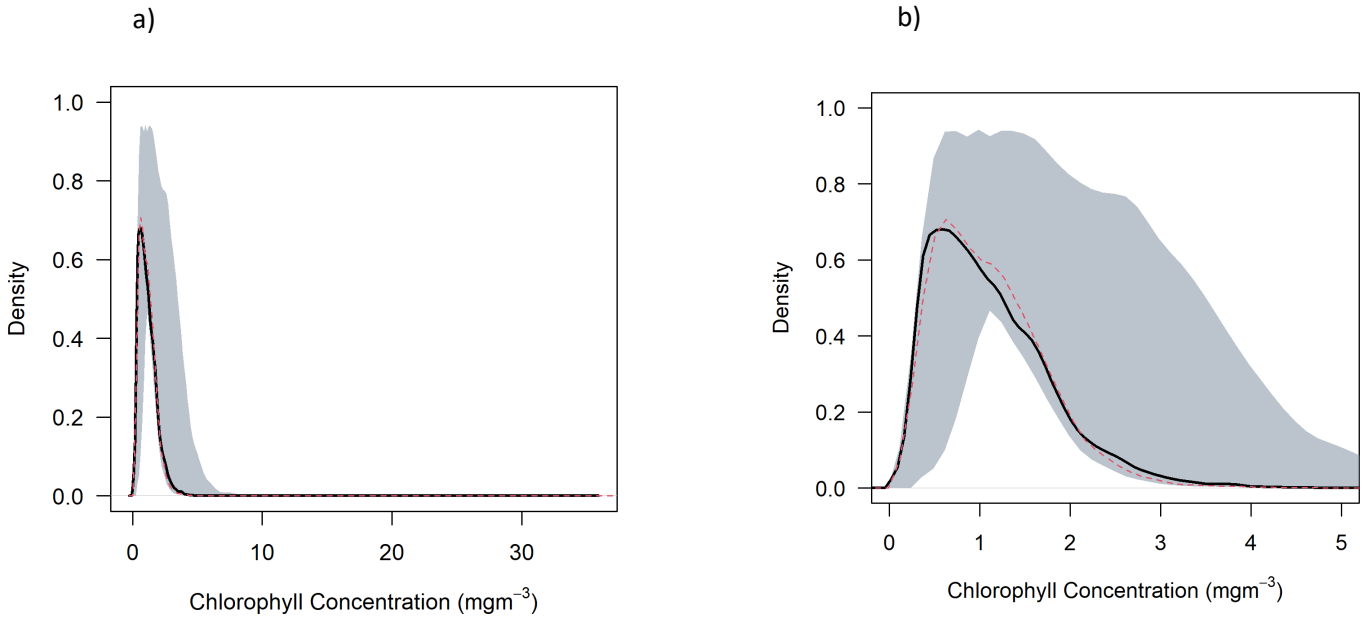
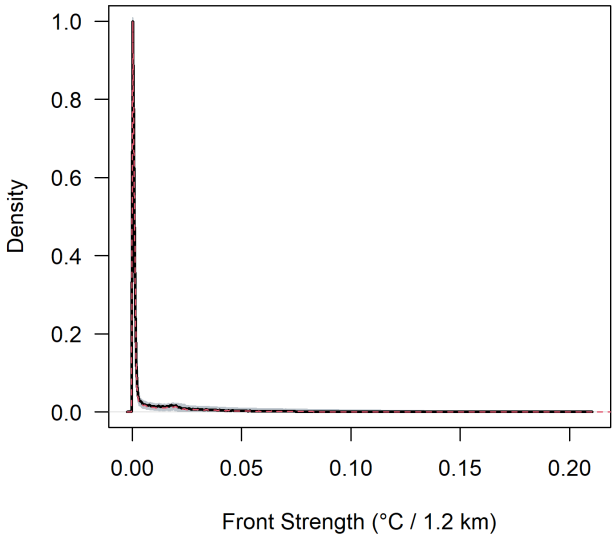


Fig. S54. UHC density plots for front density. Density of values in real, observed data in black lines. The density of available values depicted as a red dashed line. A 95% Confidence Interval around expectations of usage based on simulated datasets using K-fold cross validation is displayed using a grey envelope. Optimal model calibration occurs when observed values fall within the 95% CI envelope. Below we display two plots where a) the x-axis extends across the range of observed data and b) where the x-axis is zoomed in to the region of the covariate where most data points were located for ease of visualization.

a)



b)

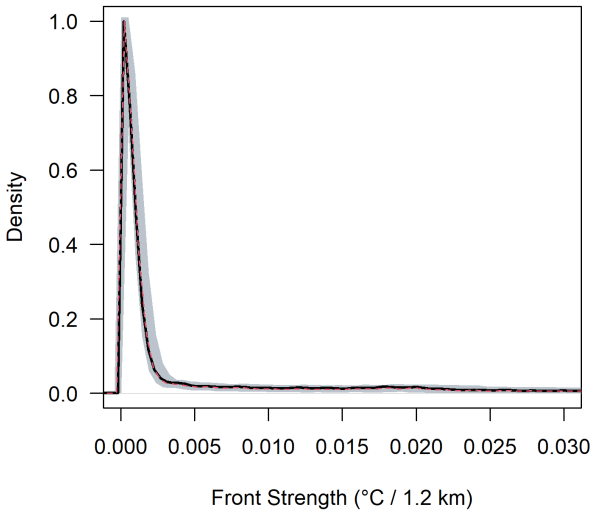


Fig. S55. UHC density plots for distance to the nearest front. Density of values in real, observed data in black lines. The density of available values depicted as a red dashed line. A 95% Confidence Interval around expectations of usage based on simulated datasets using K-fold cross validation is displayed in grey. Optimal model calibration occurs when observed values fall within the 95% CI envelope.

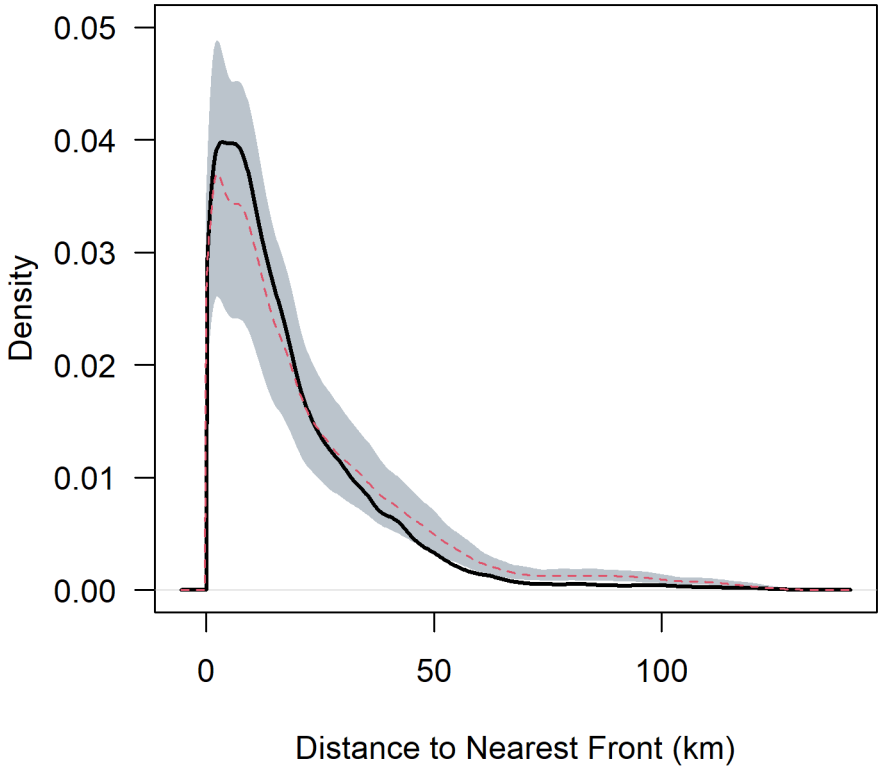


Fig. S56. UHC density plots for Sea Surface Temperature. Density of values in real, observed data in black lines. The density of available values depicted as a red dashed line. A 95% Confidence Interval around expectations of usage based on simulated datasets using K-fold cross validation is displayed using a grey envelope. Optimal model calibration occurs when observed values fall within the 95% CI envelope.

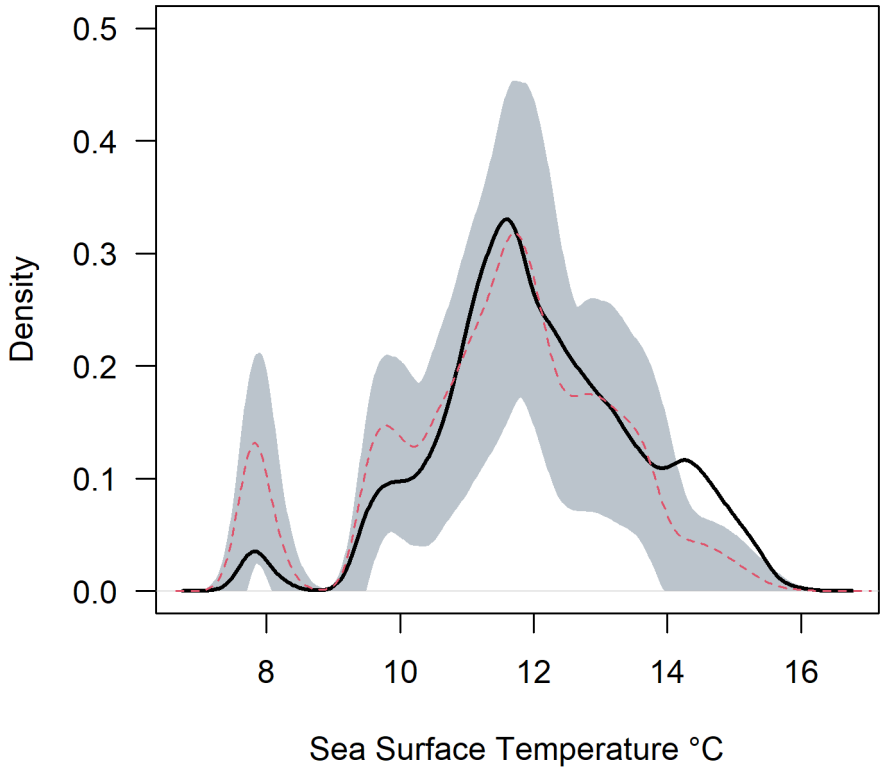


Fig. S57. UHC density plots for distance from the colony. Density of values in real, observed data in black lines. The density of available values depicted as a red dashed line. A 95% Confidence Interval around expectations of usage based on simulated datasets using K-fold cross validation is displayed using a grey envelope. Optimal model calibration occurs when observed values fall within the 95% CI envelope.

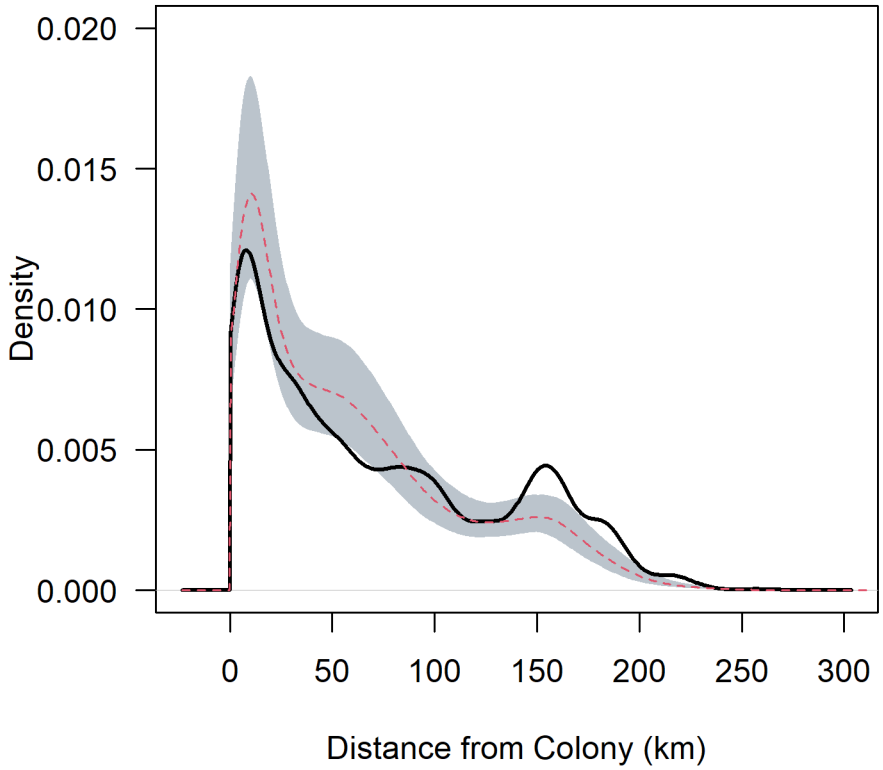


Fig. S58. Generalised functional responses of breeding black-legged kittiwake to sea surface temperature with a modified y-axis. RSS was calculated by comparing selection strength between a putative location (x_1) when sea surface temperature was set at its mean value across all available points within the current study to a vector of locations (x_2) over which sea surface temperature ranged from the minimum observed to the maximum observed. The value of all other covariates in the model was held constant at their mean value. RSS responses are shown at different levels of habitat availability to visualise the interaction between habitat availability and nonlinear basis functions. Curves show response when average sea surface temperature was set at the average level observed across all individual-level MCPs in the study or ± 1 standard deviation (Fig. S51). Curves based on fitted model coefficients with a corresponding 95% confidence envelope. Here the y-axis has been modified and limited to an upper limit of 2.0 to allow better visualisation of RSS curves at higher SST.

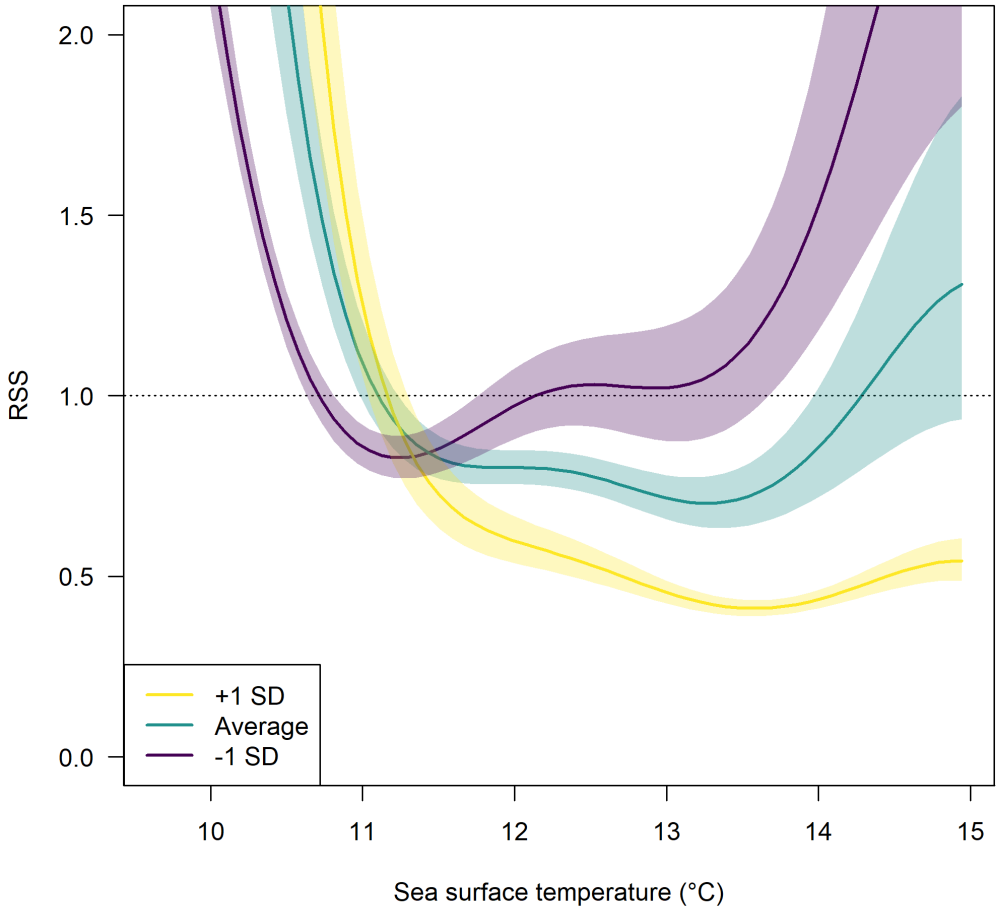
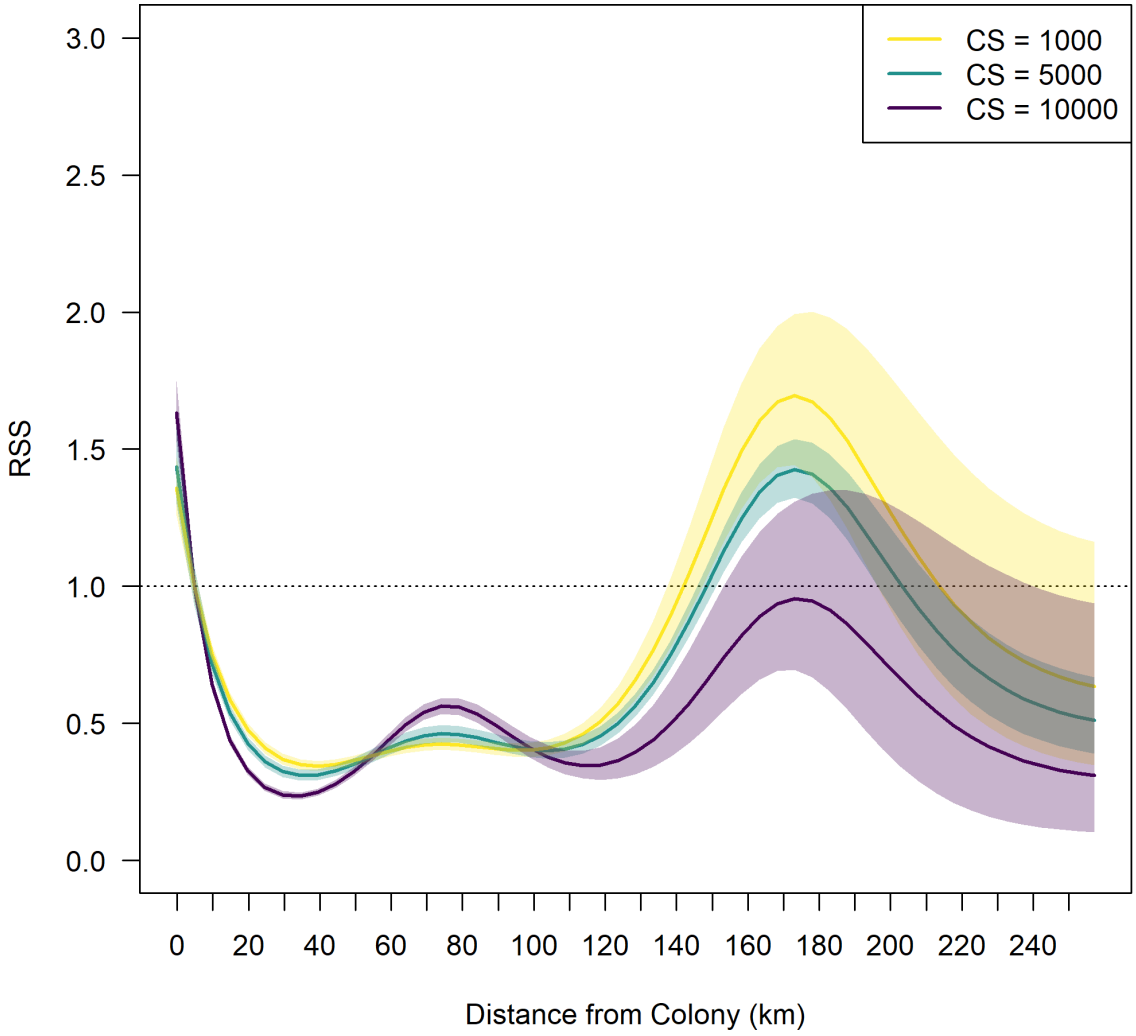


Fig. S59. Plot showing influence of distance from colony on patterns of habitat usage in breeding black-legged kittiwake. RSS was calculated by comparing selection strength between a putative location (x_1) when distance from the colony was set at a value of 1 km representing an individual departing from the colony to a vector of locations (x_2) over which distance from the colony ranged from the minimum observed to the maximum observed. The value of all other covariates in the model was held constant at their mean value. Because distance from the colony was included alongside a two-interaction with log_{10} colony size RSS responses are shown for three different colony sizes.



References

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Wood SN (2011) Fast stable restricted maximum likelihood and marginal likelihood estimation of semiparametric generalized linear models. J Roy Stat Soc B 73:3-36 https://doi.org/10.1111/j.1467-9868.2010.00749.x