Supplementary Material

Arctic migratory raptor selects nesting location during the previous breeding season

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Ethics statement

To carry out the work for this study, Pokrovsky Ivan applied for and obtained permit No. 77-18/0854/4388 from The General Radio Frequency Centre, permit No. RU/2018/406 from Federal Service for Supervision of Communications, Information Technology and Mass Media (Roskomnadzor), and permit No. RU0000045099 from Federal Security Service. No specific permissions were required from Federal Service for Supervision of Natural Resources (Rosprirodnadzor) according to §44 and §6 of the Federal Law of the Russian Federation No. 52 from 24.04.1995 (last update 24.04.2020) "On Wildlife", and from Federal Service for Technical and Export Control (FSTEC/FSTEK) according to Russian Federation government decree No. 633 from 29.08.2001 and Letter from FSTEK No. 240/33/1373 from 06.04.2015. There were no Special Protected Natural Territories in our study area, and our activities did not include withdrawal of investigated species from nature. In Nenetsky, the work was carried out in agreement with the Nenetsky Nature Reserve in a buffer zone.

Supplementary Tables

Supplementary Table 1. Linear mixed model with departure day as a response variable, nesting success as a fixed effect and bird ID as a random effect. CIs (95%) of predictors were computed using the bootstrapping method and 500 simulations in R package "lmer".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**t value**	**p value**
Intercept	278.6	1.9	274.6	282.2	143.1	
Nesting success	-2.6	2.1	-7.0	1.6	-1.2	0.223
Random effects	**Variance**			**Std. Dev.**		
Bird ID	60.2			7.8		
Residual	37.0			6.1		
Observations	56					
$N_{individual}$	30					
Marginal R^2	0.02					
Conditional R^2	0.63					

Supplementary Table 2. The result of the model averaging with included ten LMs using departure day as a response variable and nesting duration as a predictor. Each model contained a random sample of rows so that only one year per bird ID was included. The output of the conditional and full average of the models was identical. CIs (95%) of predictors were computed by the bootstrapping method and 500 simulations using generic R function "confint". "Observations" is the sample size included in one model.

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**z value**	**p value**
Intercept	282.4	5.5	270.7	294.1	47.5	
Nesting duration	-0.1	0.2	-0.5	0.2	0.6	0.552
Observations	19					

Supplementary Table 3. Linear mixed model with departure day as a response variable, year as a fixed effect and bird ID as a random effect. CIs (95%) of predictors were computed by bootstrapping method and 500 simulations using generic R function "confint".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**t value**	**p value**
Intercept	269.6	4.9	260.8	278.9	54.3	
year2014	-0.6	5.0	-9.3	8.0	-0.1	0.909
year2015	-0.2	4.9	-9.3	9.1	-0.0	0.975
year2016	11.2	5.3	2.1	20.7	2.1	0.04*
year2017	6.6	5.4	-2.3	16.0	1.2	0.224
year2018	10.2	5.3	0.2	19.1	1.9	0.064.
year2019	6.2	5.5	-3.8	16.0	1.1	0.270
year2020	19.3	6.4	7.1	31.7	3.0	0.005**
Random effects	**Variance**			**Std. Dev.**		
Bird ID	48.8			7.0		
Residual	32.5			5.7		
Observations	71					
$N_{individual}$	35					
Marginal R^2	0.27					
Conditional R^2	0.75					

Supplementary Table 4. Linear mixed model with log cumulative distance as a response variable, an interaction between the Julian date and nesting success as a fixed effect and bird ID as a random effect. Only data for stable resources are included. CIs (95%) of predictors were computed using the bootstrapping method and 500 simulations in R package "lmer".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**z value**	**p value**
Intercept	-1.0	0.4	-1.7	-0.2	2.5	
Julian date	0.0	0.0	0.0	0.0	42.1	<0.001***
Nesting success	1.0	0.5	0.1	2.0	2.3	0.024*
Jul.date:Nest.suc.	-0.0	0.0	-0.0	-0.0	10.1	<0.001***
Observations	1834					
$N_{individual}$	14					

Supplementary Table 5. Linear mixed model with log cumulative distance as a response variable, an interaction between the Julian date and nesting success as a fixed effect and bird ID as a random effect. Only data for variable resources are included. CIs (95%) of predictors were computed using the bootstrapping method and 500 simulations in R package "lmer".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**t value**	**p value**
Intercept	-0.8	0.3	-1.5	-0.2	2.7	
Julian date	0.0	0.0	0.0	0.0	64.5	<0.001***
Nesting success	-3.3	0.5	-4.3	-2.4	7.1	<0.001***
Jul.date:Nest.suc.	0.0	0.0	0.0	0.0	10.1	<0.001***
Observations	2225					
$N_{individual}$	13					

Supplementary Table 6. Linear mixed model with log MCP as a response variable, an interaction between the Julian date and nesting success as a fixed effect and bird ID as a random effect. Only data for stable resources are included. CIs (95%) of predictors were computed using the bootstrapping method and 500 simulations in R package "lmer".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**z value**	**p value**
Intercept	-4.6	0.5	-5.7	-3.6	8.9	
Julian date	0.0	0.0	0.0	0.0	30.7	<0.001***
Nesting success	3.3	0.6	2.2	4.5	5.5	<0.001***
Jul.date:Nest.suc.	-0.0	0.0	-0.0	-0.0	17.2	<0.001***
Observations	1855					
$N_{individual}$	14					

Supplementary Table 7. Linear mixed model with log MCP as a response variable, an interaction between the Julian date and nesting success as a fixed effect and bird ID as a random effect. Only data for variable resources are included. CIs (95%) of predictors were computed using the bootstrapping method and 500 simulations in R package "lmer".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**z value**	**p value**
Intercept	-6.1	1.1	-8.2	-3.9	5.6	
Julian date	0.1	0.0	0.0	0.1	31.3	<0.001***
Nesting success	-2.2	1.4	-4.9	0.5	1.6	0.108
Jul.date:Nest.suc.	-0.0	0.0	-0.0	-0.0	4.3	<0.001***
Observations	2254					
$N_{individual}$	13					

Supplementary Table 8. Linear mixed model with log nest distance as a response variable, an interaction between the Julian date and nesting success as a fixed effect and bird ID as a random effect. Only data for stable resources are included. CIs (95%) of predictors were computed using the bootstrapping method and 500 simulations in R package "lmer".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**z value**	**p value**
Intercept	-0.3	0.2	-0.6	0.1	1.6	
Julian date	0.0	0.0	0.0	0.0	12.4	<0.001***
Nesting success	-0.0	0.3	-0.5	0.5	0.1	0.898
Jul.date:Nest.suc.	-0.0	0.0	-0.0	-0.0	7.9	<0.001***
Observations	1835					
$N_{individual}$	14					

Supplementary Table 9. Linear mixed model with log nest distance as a response variable, an interaction between the Julian date and nesting success as a fixed effect and bird ID as a random effect. Only data for variable resources are included. CIs (95%) of predictors were computed using the bootstrapping method and 500 simulations in R package "lmer".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**z value**	**p value**
Intercept	-5.0	0.3	-5.6	-4.3	15.0	
Julian date	0.0	0.0	0.0	0.0	44.3	<0.001***
Nesting success	0.5	0.5	-0.4	1.4	1.0	0.304
Jul.date:Nest.suc.	-0.0	0.0	-0.0	-0.0	14.1	<0.001***
Observations	2271					
$N_{individual}$	13					

Supplementary Table 10. The result of the model averaging with included ten LMs using cumulative distance as a response variable and prey variability as a predictor. CIs (95%) of predictors were computed by the bootstrapping method and 500 simulations using generic R function "confint".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**z value**	**p value**
Intercept	346736	103201	213654.8	493985.3	3.2	
Prey variability	229126	140010	97349.2	501348.5	1.6	0.117
Observations	54					

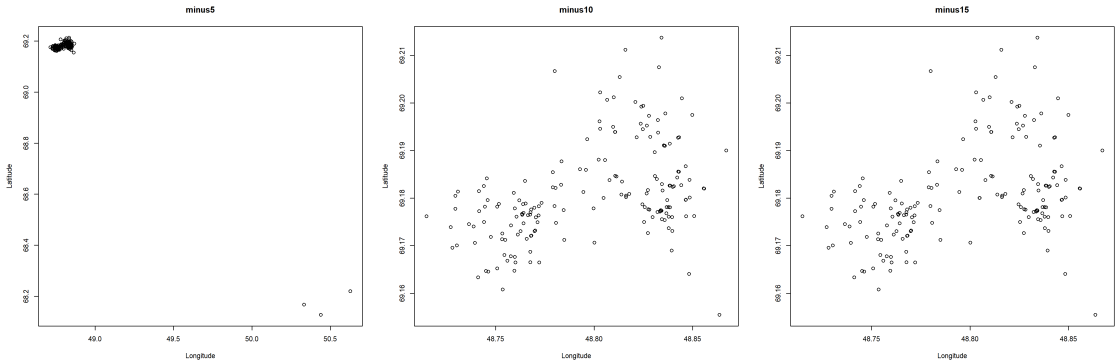
Supplementary Table 11. Linear mixed model with log MCP as a response variable, an prey variability as a fixed effect and bird ID as a random effect. CIs (95%) of predictors were computed using the bootstrapping method and 500 simulations in R package "lmer".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**t value**	**p value**
Intercept	17.2	0.7	15.8	18.8	23.3	
Prey variability	2.4	1.0	0.5	4.6	2.5	<0.001***
Random effects	**Variance**			**Std. Dev.**		
Bird ID	5.1			2.2		
Residual	4.5			2.1		
Observations	54					
$N_{individual}$	29					
Marginal R^2	0.14					
Conditional R^2	0.57					

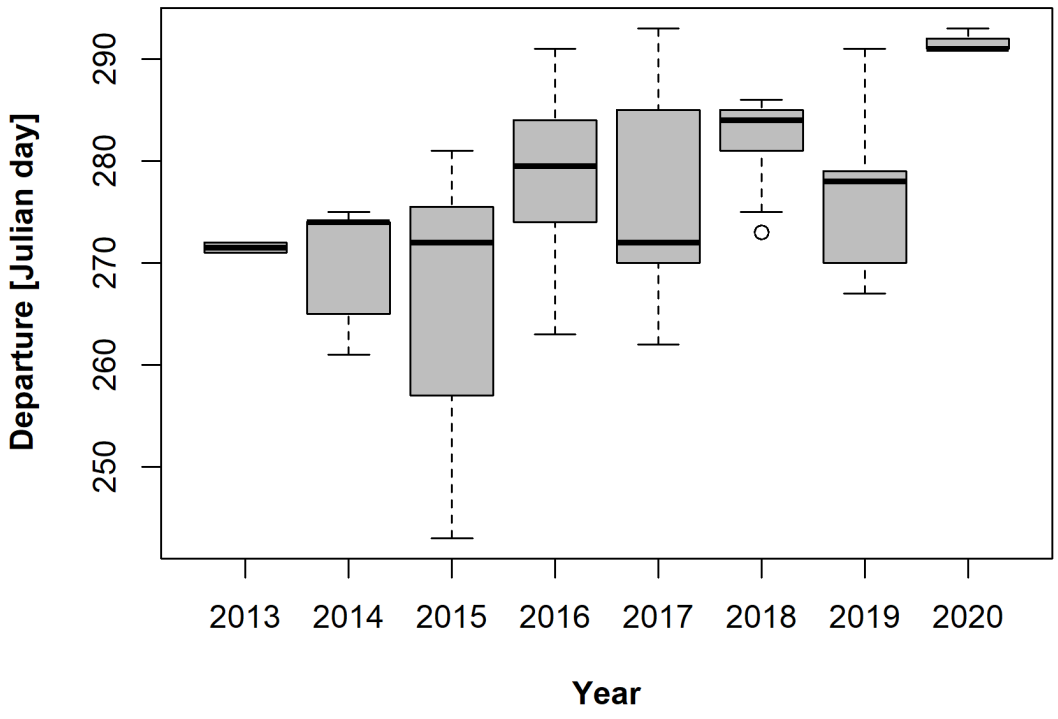
Supplementary Table 12. Linear mixed model with log trajectory-to-nest distance as a response variable, an prey variability as a fixed effect and bird ID as a random effect. CIs (95%) of predictors were computed using the bootstrapping method and 500 simulations in R package "lmer".

Term	**Estimate**	**Std. Error**	**lower CI**	**upper CI**	**t value**	**p value**
Intercept	7.6	0.4	6.9	8.2	20.8	
Prey variability	1.6	0.5	0.6	2.6	3.2	0.004**
Random effects	**Variance**			**Std. Dev.**		
Bird ID	0.9			1.0		
Residual	1.6			1.3		
Observations	54					
$N_{individual}$	29					
Marginal R^2	0.21					
Conditional R^2	0.46					

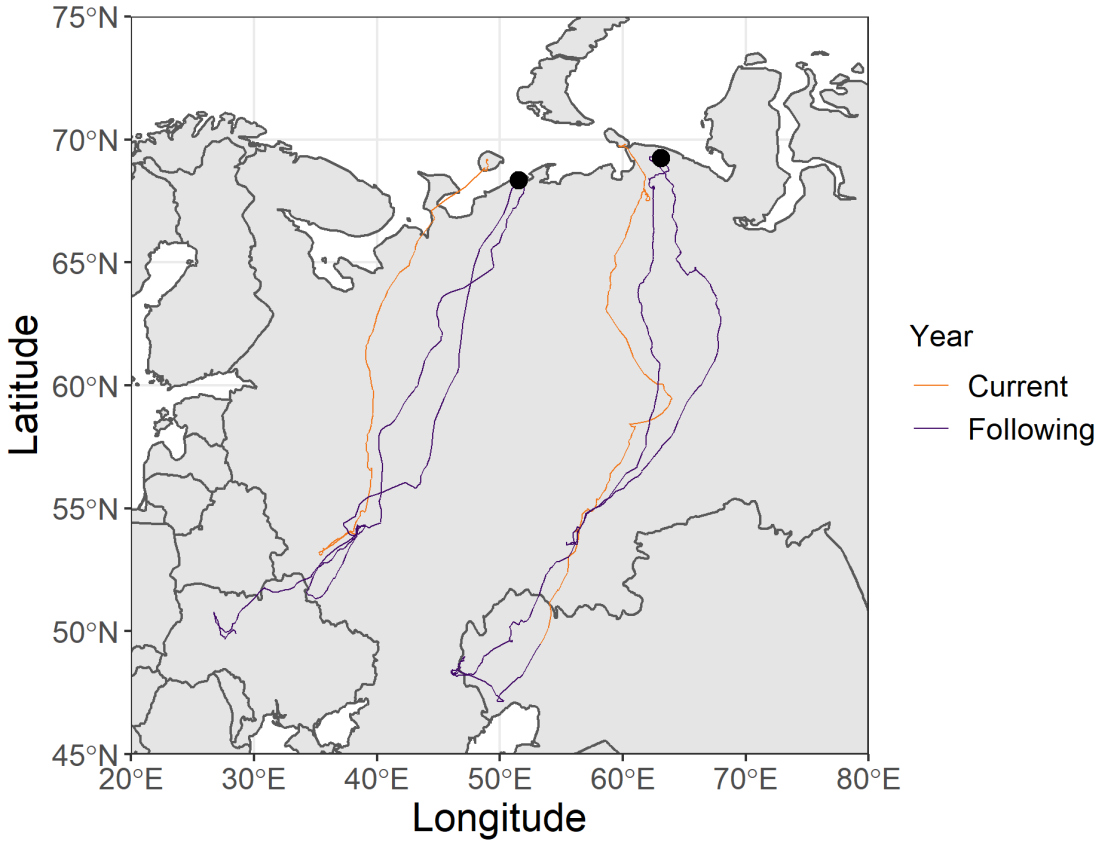
Supplementary Figures



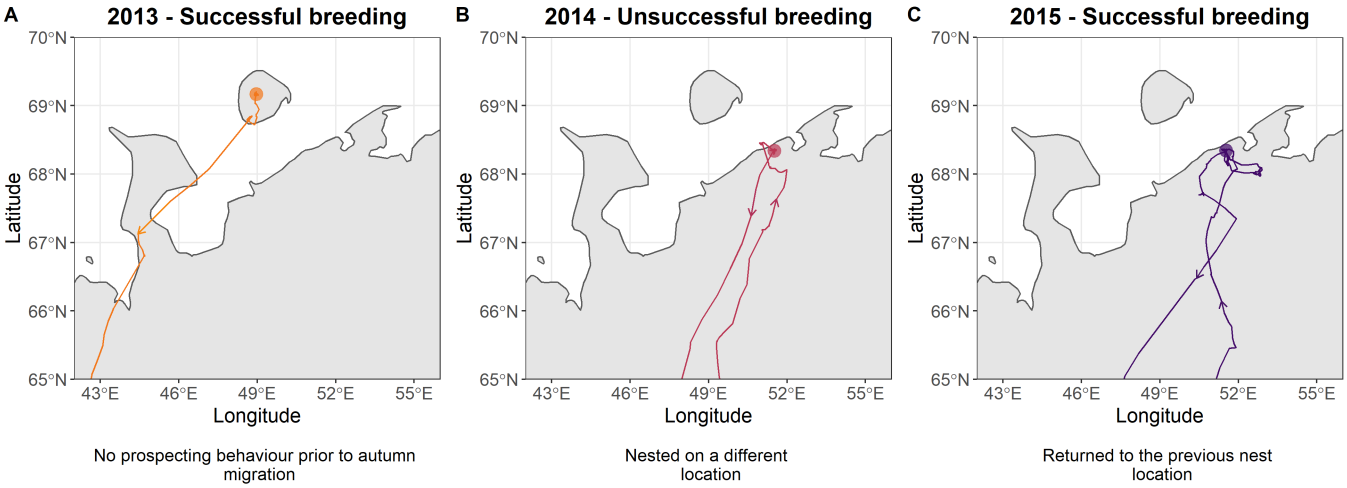
Supplementary Figure 1. The threshold of 10 days was selected based on visual inspection of different thresholds (excluding 15, 10 and five days from departure date).



Supplementary Figure 2. Departure day from the breeding grounds as a function of year.



Supplementary Figure 3. Two individual trajectories with distance from the trajectory of the current year and nest location of the following year of more than 15km.



Supplementary Figure 4. Exemplary trajectories of one individual for three consecutive years (A, B, C). Nest locations are marked with dots and arrows represent movement direction.