Supplementary Material

Appendix 1

Here we provide representations of the distribution of filtered observation data over yearly and monthly scales (Figs. A1.1 & A1.2). Arctic geese are expected to begin arriving at the eastern end of the study site by late September, and are present on Dutch and northern German sites by early - mid October. The heatmaps shown reflect this pattern.

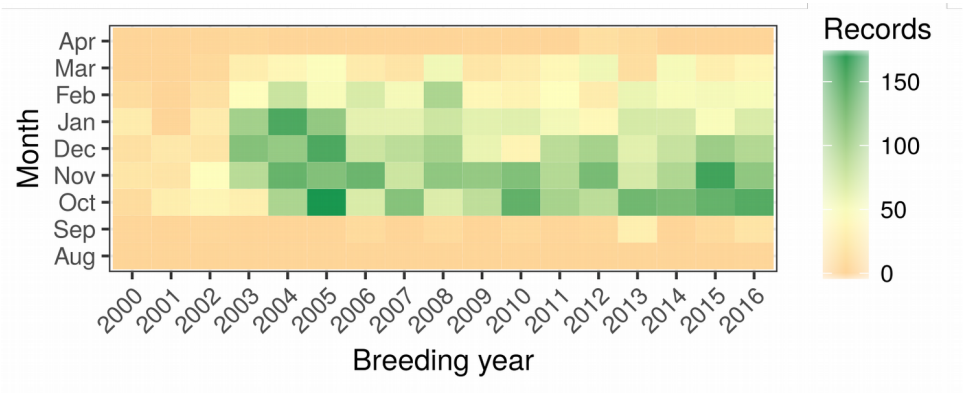

Fig. A1.1. Heatmap of number of flock counts per month in each calendar year. Data are sparse from the early 2000s. Data density is higher in the first three winter months (Oct, Nov,Dec) than the following ones (Jan, Feb, Mar). A mean of 47 flocks are censused per month (range: 0 - 177).

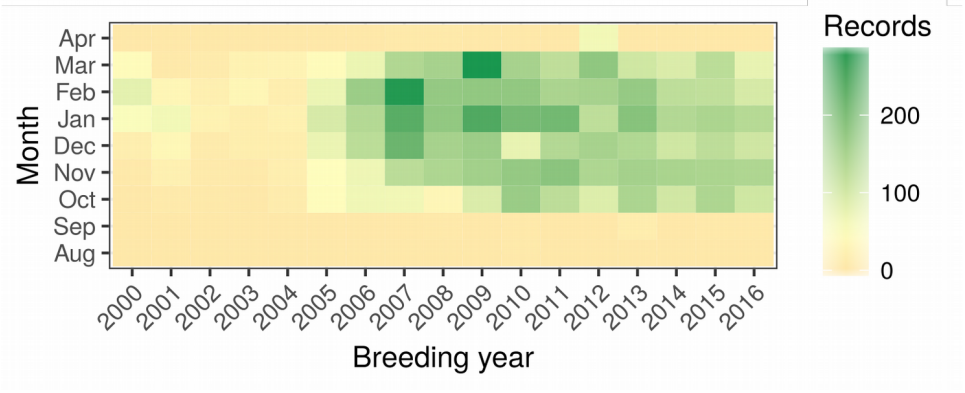

Fig.A

Fig. A1.2: Heatmap of number of observations of geese marked with numbered neckbands per month in each calendar year. Data are sparse until the mid 2000s. Marked geese are sighted in the study area earlier and later than censused flocks. On average, 49 marked geese are seen each month (range: 0 - 294).

Model	Type	Dataset	Response	Fixed effects	Random effects	Records used
1	LMM	Family size counts	Distance to breeding area	1, 5	8, 9, 10	20,160[a]; 14,018[b]
1	LMM	Ring-sighting data	Distance to breeding area	1, 5	8, 11	3,289[a]; 7,320[b]
2.a	GLMM	Family size counts	Number of juveniles	3, 5, 7	8, 9, 10	34,179
2.a	GLMM	Ring-sighting data	Number of juveniles	5, 7	8, 11	10,426
2.b	GAMM	Age-ratio counts	Number of families	3, 5, 7	8, 9, 10	837
2.c	GLM	Family sizes on Kolguyev	Number of juveniles	Dataset		2,615
3	GAMM	Age-ratio counts	Flock size	5, 6, 7	8, 9, 10	5,700
4	GAMM	Age-ratio counts	Juvenile proportion	5, 6, 7	8, 9, 10	5,659
5	GLMM	GPS tracking of families	Split occurrence	13 - 19	20	1,009

Effects: 1: Number of juveniles per family, 2: Number of families, 3: Flock size, 4: Proportion of juveniles, 5: Days since autumn arrival, 6: Distance to breeding grounds, 7: Predation index, 8: Breeding year, 9 Observer, 10: Habitat type, 11: Goose identity, 12: Split occurrence , 13: Family size, 14: Days since autumn arrival, 15: Daily number of flights, 16: Cumulative number of previous flights, 17: Daily distance travelled, 18: Cumulative distance previously travelled, 19: Time since last take-off, 20: Family identity

a: ≤ 60 days after arrival, b: ≥ 60 days after arrival, c: All families, d: Only successful families

Table A1: Statistical model responses, predictors, and data used.

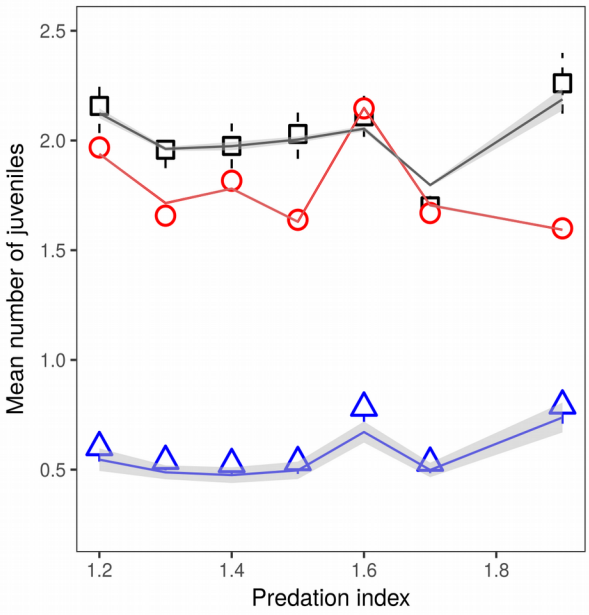

Fig. A2. GLMM fits (lines), mean number of juveniles per family at levels of pooled summer predation index, in increments of 0.1 (symbols), and 95% confidence intervals for data (vertical solid lines), and fits (shaded grey area), using family size counts (red circles and line), ring-resighting data including unsuccessful families (blue triangles and line), and ring-reisighting data without unsuccessful families (black squares and line).