Abstract

Many species live in family groups where juveniles receive parental care. The families of some large migrating species often stay together through one or more migration events. How the social status of families, pairs and single animals influences their migration timing and space-use is not yet well understood. Here we focus on the family size dynamics of greater white-fronted geese *Anser a. albifrons* on their wintering grounds. We gathered 17 years of observation data on foraging flocks of wintering geese in the Netherlands and northern Germany, and tracked 13 complete families with GPS transmitters. Taking into account effects carried over from the summer, we explored how the distance of the wintering site from the breeding grounds, number of juveniles in a family, number of individuals in a flock and the age-ratio of flocks develop over time. We related the probability of a family splitting to the number of flight events. Sixty days after the first autumn arrivals, families with more juveniles winter farther west, where flocks are smaller. The number of juveniles in a family, flock size, age-ratio, and the number of families in flocks is correlated with the number of days since first arrival. Families that undertake more flights in winter are more likely to split. Our data suggest that many juvenile white-fronted geese separate from their parents during the winter, and that this species is differentially migratory by age and social class in both autumn and spring. These findings are important for further investigation of the influence of

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23   climate and habitat change on large migrants that subsist in families long

24   after hatching, and their conservation and management.

25   **Keywords** *Anser albifrons*, family size, differential migration, foraging flocks,

26   family separation

Introduction

28   Most species' young receive direct or indirect parental care, which improves

29   their own survival and provides inclusive fitness gains to their relatives

30   (Hamilton 1964). Such care is usually in the form of food, shelter and

31   protection (Clutton-Brock 1991). The duration of care varies strongly between

32   and within species (Clutton-Brock 1991). Large migratory species often stay

33   in family groups throughout the first or later migration events (see Warren et

34   al. 1993, Kruckenberg 2005). This has direct survival and fitness benefits for

35   both young and parents in terms of shared vigilance and higher social status

36   within larger aggregations (Black and Owen 1989, Roberts (1996)).

37   Many large waterbirds, such as the geese *Anserini*, live in groups composed

38   of families throughout much of the year. Flocking behaviour is most apparent

39   in winter, when goose families gather to form often enormous feeding flocks

40   (Elder and Elder 1949). Maintaining family bonds within flocks confers

41   benefits as larger social units are dominant over smaller ones, and

42   dominance rank increases with the number of members in the unit (e.g. in

43   Canada geese *Branta canadensis*; Hanson 1953 and barnacle geese *B.*

44   *leucopsis*, Loonen et al. 1999). The size advantage allows larger families to

2

occupy optimal foraging positions in flocks at lesser cost and win access to

better resources (Black and Owen 1989, Black et al. 1992). In addition,

parents of some species benefit in summer from the presence of nest-

attending sub-adults (Fox and Stroud 1988).

Over the course of a year, goose family bonds are affected by a number of

factors. The success of a pair hatching and fledging young is often

determined by a combination of weather conditions and levels of summer

predation on the breeding grounds (Summers 1986, Dhondt 1987, Bêty et al.

2002). The impact of summer predation linked to the abundance of lemmings

and voles *Arvicolinae* has historically been significant in some species, as to

be detectable at the population level in winter (Summers 1986, Nolet et al.

2013). Autumn migration takes a further toll in long-distance migrants,

especially on juvenile birds (Owen and Black 1989, Francis et al. 1992). In

spring, juvenile geese often become independent of parents (Prevett and

MacInnes 1980, Johnson and Raveling 1988, Black and Owen 1989), but some

juveniles may remain associated with parents through the spring migration

and on the breeding grounds, where they help to fend off predators and

competitors (Ely 1979). Some even remain associated with their parents the

following winter (Kruckenberg 2005). The mechanistic causes underlying

family separation might be of either accidental nature (Prevett and MacInnes

1980), or the result of adults chasing off juveniles prior to spring migration

(Black and Owen 1989, Poisbleau et al. 2008).

The development of family bonds in winter appears to be variable between

species and populations. In general, smaller species that are observed in

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mixed flocks tend to dissolve families in winter (Johnson and Raveling 1988, Jónsson and Afton 2008), whereas larger species tend to maintain families for longer (Warren et al. 1993, Kruckenberg 2005). Moreover, migration speed and spatial distribution may differ between population classes, such as pairs with and without offspring (Cooke et al. 1975, Cristol et al. 1999, Green and Alerstam 2000, Schamber et al. 2007). Previous studies have noted a change in goose distribution in winter in response to severe cold (Philippona 1966, Lok et al. 1992). Such distributional changes serve as a convenient starting point for an examination of climatic factors affecting spatial patterns in goose flocks and families, especially in light of drastic changes observed in the spatial and migration ecology of similar species sharing the wintering site.

Greater white-fronted geese *Anser a. albifrons*, hereafter white-fronted geese, are among the most abundant geese wintering in continental Western Europe and occupy a wide wintering range (Madsen et al. 1999), thus offering an interesting opportunity to investigate the wintertime dynamics of goose families. We draw on long-term field observations and high frequency GPS tracks of whole families of white-fronted geese from their wintering grounds in the Netherlands and northern Germany to test the following observational hypotheses: 1. Families with more juveniles winter closer to the breeding grounds, 2. Larger families winter in smaller flocks, 3. Families decrease in size over the winter and 4. Family separation is triggered by flight related disturbances.

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Methods

Age ratios and family size

We and others observed flocks of feeding geese in winter, and determined age-ratios by counting the number of adult and juvenile birds in each flock. Both age classes of white-fronted geese are told apart by their plumage throughout winter and into early spring Koffijberg (2006). In a sub-sample of flocks, the number of juveniles per pair was assessed (and defined as one family), making use of characteristic behaviour and social interactions. Most counts were carried out at a large number of sites within the core wintering range (Fig. 1A) from October to January (81%), gradually declining in February (11%) and March (7%). April and September had many fewer counts, as most geese had not then arrived, or had already departed the wintering grounds. We obtained 7,149 flock counts from 75 observers at 123 geocoded sites. Of these, 1,884 flocks counted by 17 observers at 65 sites held 51,037 successful families (Tab. 1).

Additionally, we gathered pair status and the number of young from sightings of neck-banded geese submitted by observers to the *www.geese.org* portal. In contrast with age-ratio counts, these included records of pairs without accompanying juveniles (defined as unsuccessful families). Observations of marked geese did not include details on habitat type, flock size and observer. Data from 10,635 marked individuals, observed at 8,416 sites, were obtained

112   after filtering for data from single geese with unknown pair status or without

113   data on offspring (Tab. 1).

114   To estimate the effect of autumn migration mortality, we determined family

115   sizes on the breeding grounds on Kolguyev Island, Russia (approx. 69°N,

116   49°E, Fig. 1B) in August 2016, approximately one month prior to the autumn

117   migration. On Kolguyev Island, 116 records of successful and unsuccessful

118   families were collected (Tab. 1).

119   ## Family tracking

120   We collected half-hourly positions of a total of 13 complete goose families (13

121   adult pairs, 38 juveniles) fitted with GPS transmitters in the core wintering

122   range within the Netherlands, between November and January (2013, n = 3,

123   2014, n = 4: e-obs GmbH, backpacks with Teflon harness, weight 45 g; 2016,

124   n = 6: madebytheo, integrated into neckband, weight 35 g). These selectively

125   large families were tracked within the study site (2 - 10°E, 50 - 54°N) during

126   winter (before 1 April) for 34 – 135 days. A reference bird was identified in

127   each family as the parent with the greater number of GPS fixes within the

128   study period, which was the male in all cases except one. For all families, we

129   identified the day and position where splits were first detected as a decrease

130   in the number of family members within a 1000m radius of the reference bird

131   (see Fig. 1A). We then determined the daily split probability by a binomial fit

132   on the classification of each day as a success or failure (1 or 0) depending on

133   whether a split occurred or not. We defined 'flights' as displacements >1 km

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134 over the 30 minute sampling interval, and counted their number and daily

135 frequency.

Context data

137 To relate our observations to the timing of migration we extracted peaks of

138 daily counts (n = 6,266) of visible migration in the Netherlands

139 (*www.trektellen.nl*; Van Turnhout et al. 2009) to determine yearly arrival

140 dates in autumn and departure dates in spring. Data were pooled for 84

141 spring and 180 autumn counting sites. We excluded counts from sites close

142 to night roosts, and records which did not match the direction of migration

143 appropriate to the season; both in order to avoid bias by local movements.

144 Following previous work (Jongejans et al. 2015) we estimated an index of

145 summer predation for the breeding grounds of this population from rodent

146 abundance data (*www.arcticbirds.net*). We calculated a pooled mean of 0 - 2

147 (low - high) lemming indices for all available sites in the region, taking care to

148 always include a value of 0 to reflect the absence of lemming cycles in the

149 core breeding area on Kolguyev Island. The predation index takes into

150 account the cyclical change in lemming abundance, with higher values when

151 lemming abundance has decreased from the previous year, reflecting the

152 increased predation pressure on Arctic birds due to abundant predators

153 switching to alternative prey (see Dhondt 1987).

154 To test whether spatial patterns in this population could be explained by

155 environmental effects, we gathered daily data from 51 sites (Koninklijk

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156   Nederlands Meteorologisch Instituut, Netherlands; Deutscher Wetterdienst,

157   Germany) for minimum temperature, total precipitation, and mean wind-

158   speed. Sites were on average 20km (range: 4 - 83km) from the positions at

159   which flocks were observed.

Analyses

161   We first tested whether (1.) the number of juveniles, which determines family

162   size, was correlated with the distance from the breeding grounds at which

163   families were observed (family size counts and ring-sighting data; Tab. 1,

164   Supplementary Material Tab. A1). Further, we tested whether (2.a.) the

165   number of juveniles in a family and (2.b.) the total number of successful

166   families was explained by flock size, the number of days since the arrival of

167   geese in autumn or the level of summer predation (using family size counts;

168   Tab. 1). To test for an effect of climate on the number of successful families

169   in flocks, we added daily minimum temperature, daily total precipitation, and

170   daily mean wind-speed as variables in model 2.b. Further, we tested whether

171   (2.c) the number of juveniles in families was different on the breeding

172   grounds one month prior, and up to two months after autumn migration in

173   2016 (using family size counts in the wintering region, and from Kolguyev

174   Island, and ring-sighting data).

175   To place our results in the wider context of migration and the social and

176   physical environment of geese, we examined (3.) how flock size (from age-

177   ratio counts) was related to distance from the breeding grounds, the number

178   of days since arrival, summer predation, climatic variables, and examined

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179   whether (4.) the proportion of juveniles in flocks was explained by the flock

180   size, distance from the breeding grounds, number of days since arrival, and

181   summer predation (using age-ratio counts; see Supplementary material Tab.

182   A1). Finally, we examined whether (5.) daily split probability was predicted by

183   the family size, the number of flights on each day, the distance travelled each

184   day, and the time since winter arrivals (using GPS tracking data;

185   Supplementary Material Tab. A1).

186   All analyses were performed in the R environment (R Core Team 2017, see

187   Supplementary Material Tab. A1). We used Poisson lme4 (Bates et al. 2015)

188   linear and generalised linear mixed models (LMMs & GLMMs) to test 1 and

189   2.a, a simple Poisson-error generalised linear model to test 2.c and a

190   binomial-error GLMM for 5. In 2.b, 3, and 4, we used mgcv (Wood 2013)

191   Poisson (2.b) and binomial (4) generalised additive mixed models (GAMMs) to

192   include smooth functions of the flock size (in 2.b) and the number of days

193   since winter (in 4) as predictors. We included the breeding year, the observer

194   identity, the goose identity if known, and the habitat type as independent

195   random effects. Effects included in models were dependent on their

196   availability in the datasets used (see Supplementary Material Tab. A1).

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Results

Age ratios and family sizes

The mean flock size was 712 birds (range: 2 - 20,000), with a mean proportion of first-winter birds of 0.18 (range: 0 - 0.87). Flocks in which families were counted (family size counts) held on average 540 birds (range: 3 - 11,000), with an average of 27 families (range: 1 - 333) accompanied by a mean of 1.78 juveniles (range: 1 - 10). On average, the family status of marked geese (ring-sighting data) was recorded 626 times each year (range: 62 - 1143), and these were accompanied by 0.59 juveniles (range: 0 - 11) (see Appendix 1, Supplementary material Figs. A1.1, A1.2). The 116 observed families on Kolguyev Island in 2016 had a mean of 2.26 juveniles (range: 0 – 6).

Context data

Autumn migrants arrived between 26 September and 30 October, and departed between 3 March to 1 April, resulting in a wintering period for geese of on average 165 days (range: 124 – 183). Lemming abundance from the breeding grounds transformed into a predation index ranged between 1.17 and 1.9, with very low variance between years ($\sigma 2 = 0.048$).

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Juveniles and wintering site choice

We found no influence of the number of juveniles in a family on how far from the breeding grounds that family wintered in the first sixty days after arrival, in either age-ratio data ($\chi^2 = 3.27$, p = 0.071), or in ring-sighting data ($\chi^2 = 2.18$, p = 0.134, Fig. 2). Later in winter, age-ratio data indicated that larger families winter somewhat farther west ($\chi^2 = 6.026$, p = 0.014), while ring-sighting data did not reveal any difference ($\chi^2 = 0.023$, p = 0.879). Even among only the successful families in the ring-sighting data, no effect could be found ($\chi^2 = 0.892$, p = 0.345). This difference is likely due to lower sample size and fewer observed random effects in the ring-sighting data. The proportion of successful pairs, assessed by ring-sighting data, was not related to the distance of their wintering site from the breeding grounds ($\chi^2 = 1.071$, p = 0.301).

Family size in winter

The number of juveniles in a family (successful families counted in flocks, model 2.a) decreased through the winter ($\chi^2 = 74.166$, p < 0.001, see Fig. 3), but was insensitive to flock size ($\chi^2 = 0.270$, p = 0.6033) and summer predation ($\chi^2 = 0.337$, p = 0.562, see Supplementary material Fig. A2). Family sizes of ringed geese (model 2.a adapted) decreased over time as well ($\chi^2 = 19.936$, p = < 0.001, see Fig. 3); flock sizes of this dataset were not available.

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236   Surprisingly, family sizes of ringed geese increased with the level of summer

237   predation (x^2 = 12.935, p < 0.001, see Supplementary material Fig. A2).

238   However, this increase was very low with on average 0.78 additional juveniles

239   per family per unit increase in the predation index. When excluding

240   unsuccessful pairs from the ring-resighting data, the relation with summer

241   predation became insignificant (x^2 = 0.1321, p = 0.716, see Supplementary

242   material Fig. A2), indicating a qualitative rather than quantitative effect of

243   predation on nest success.

244   The number of successful families in flocks (model 2.b) increased with flock

245   size (x^2 = 7250, p < 0.001) and the number of days since goose arrival in

246   autumn (x^2 = 158.3, p < 0.001, see Fig. 4A), but was unaffected by summer

247   predation (x^2 = 0, p = 0.98). Further, there were more successful families in

248   flocks farther from the breeding grounds (x^2 = 11.253, p = 0.0008, see Fig.

249   5A). Also, the number of successful families in a flock was higher when daily

250   minimum temperatures were higher (x^2 = 7.318, p = 0.007), and decreased

251   weakly with rising daily precipitation (x^2 = 3.931, p = 0.047). Wind speed

252   was not an important predictor (x^2 = 2.644, p = 0.104).

253   ## Flock size in winter

254   Flocks (model 3) were significantly smaller farther from the breeding grounds

255   (x^2 = 93,629, p = < 0.001, see Fig. 5A), and grew slightly over the winter (x^2

256   = 4,824, p < 0.001). Flock size was affected by each of the climatic

257   predictors, decreasing with worsening weather: increasing precipitation (x^2 =

258   3193, p < 0.001) and increasing daily wind speed (x^2 = 25,906, p < 0.001).

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259 However, flock sizes increased with decreasing daily minimum temperatures

260 (χ^2 = 365, p < 0.001).

261 Within flocks, juvenile proportions increased through the winter (χ^2 = 18.82, p

262 = 0.001, see Fig. A4b), and decreased with increasing flock size (χ^2 = 5.921,

263 p = 0.015, see Fig. A4c), but did not show any effect of distance from the

264 breeding grounds (χ^2 = 0.979, p = 0.323), or of summer predation (χ^2 =

265 0.013, p = 0.908).

Family size prior to autumn migration

267 Families of geese observed approximately one month prior to the onset of

268 migration in the breeding area on Kolguyev Island had significantly more

269 juveniles than successful families (family size count) in flocks (GLM, z =

270 -4.285, p < 0.001) and families of marked geese (ring-sighting data) (GLM, z

271 = -14.511, p < 0.001) recorded in the first two months following the

272 population's arrival on the wintering grounds (model 2.c).

Probability of family splits

274 Families fitted with GPS transmitters travelled on average 11 km each day

275 (range: 0 - 306). On average, they travelled a distance > 1km twice per day

276 (range: 0 - 10) and in total 98 times (range: 63 - 367) over the tracking

277 period. 21 family split events were recorded in our 13 families; they were not

278 restricted to juveniles.

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279   The correlation of time in winter and family size as fixed effects was high

280   (0.728). To avoid this multi-collinearity, we chose to omit time in winter in the

281   final model, reasoning thus: first, that we had adequately characterised the

282   development of family sizes over the course of winter. Further, including a

283   predictor whose value increased monotonically in the data would imply non-

284   independence of the response (split probability) across days, i.e., that the

285   probability of a family separating on any given day was a function of the

286   probability of splitting on prior days.

287   The daily split probability of families (model 5) was significantly lower in

288   larger families (χ^2 = 5.522, p = 0.019, see Fig. 6). While the number of flights

289   per day was not important (X^2 = 1.057, p = 0.304), the distance covered

290   influenced the likelihood of splitting (X^2 = 3.939, p = 0.047).

Discussion

292   We quantified the spatial-temporal distribution and size dynamics of white-

293   fronted goose families in wintering flocks in the context of winter climate,

294   predation risk in summer, and mortality during autumn migration. In support

295   of our hypothesis, we found that large families wintered farther from the

296   breeding grounds, but only during the second half of winter. Larger families

297   did not select for smaller flocks, but flocks were generally smaller in the west.

298   As expected, family size decreased over the winter, but our results indicate

299   that larger families were less likely to split accidentally.

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Spatial dynamics of family size

Our baseline result that flock sizes are smaller in the west of the wintering region — further from the breeding sites — can be explained by metabolic constraints that determine maximum flight distances and durations, even during migration (Klaassen 1996). This is supported by the fact that family sizes do not vary spatially during the early winter months. However, once all geese have arrived and wintering sites begin filling up, food becomes more limited, and it seems that large, socially dominant families (Vangilder and Smith 1985, Schamber et al. 2007) make further movements to occupy climatically milder sites. This supports the earlier suggestion of differential use of wintering sites (Jongejans et al. 2015) according to social status.

Contrary to expectations, larger families were generally not associated with smaller flocks. Rather, larger families as well as small flocks are coincidentally found further from the breeding sites. Furthermore, spatial differences in family wintering areas might have led to the finding that larger flocks appeared to have a lower proportion of juveniles (Jongejans et al. 2015). Large goose families selecting for optimal sites seem to be one driver of the variation in juvenile proportion between wintering sites (Schamber et al. 2007), but independent juveniles observed in wintering flocks (Hanson 1953, Loonen et al. 1999) may dampen this variation.

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Temporal dynamics of family size

The finding that family size decreased through the winter points towards a steady reduction in the number of juveniles associated with families, and to high variation in the age at which young geese leave their parents. Some young geese may be found associated with parents even in their second or third winter (Ely 1979, Warren et al. 1993, Kruckenberg 2005). While juvenile independence from parents should result in concurrently steady reduction in the number of apparently successful families in flocks over the winter, our findings went against this expectation. We suggest two possible explanations, first, that most pairs do not become dissociated from all their young over a single winter, i.e., that split events are accidental rather than triggered by the parents (Prevett and MacInnes 1980). Furthermore, families with juveniles likely begin spring migration later than pairs without young, mirroring their differential autumn migration arrival, which is later than that of other adult geese (Jongejans et al. 2015).

This proposed differential migration timing is further supported by the strong, non-linear temporal increases in proportions of juveniles in foraging flocks. We hypothesise that in spring, it is adults without young that leave the wintering grounds for Arctic breeding and moulting sites, followed by families with young, with indpendent juveniles bringing up the rear. While this is contrary to previous studies on the spring migration of pink-footed *A. brachyrhynchus* and snow geese (Bêty et al. 2001), it is interestingly similar to the migration of juvenile snow geese, which appear to arrive somewhat

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343   later that adults on the spring breeding grounds (Prevett and MacInnes

344   1980).

345   Data from our 13 GPS tracked goose families support the suggestion that

346   winter dissociations of first-year juveniles from their families are accidental

347   (Prevett and MacInnes 1980), taking place when geese make long-distance

348   movements, but not necessarily when the number of flights is high. This may

349   indicate that only disturbances sufficient to compel geese to relocate to

350   distant sites prompt family splitting. In most cases, juveniles split off one at a

351   time, and not all at once. In the chaotic take-off conditions hypothesised to

352   promote accidental separation of individuals from their families (Prevett and

353   MacInnes 1980), larger families might be easier to adhere to, possibly

354   explaining why they are less likely to split.

Effects of winter climate conditions

356   The negative responses of the number of successful families in flocks, and of

357   flock size to cold and wet weather are in line with current knowledge of goose

358   foraging preferences (Fox and Madsen 2017). Geese will tolerate snow depths

359   of about 15 cm before relocating to areas with better access to forage

360   (Philippona 1966). Such conditions have become rare over the past decade,

361   and usually do not occur in the Netherlands before midwinter. This ties in

362   with spatial differences in family size only being observed in late winter.

363   Large, dominant families thus seek to occupy the rather limited westerly,

364   coastal sites with moderate temperatures. Limited habitat availability in the

365   west of the Netherlands and Belgium — combined with high hunting pressure

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366 in France, and the high energetic costs of long flights — seems to lead to

367 geese aggregating in large flocks on the remaining accessible grassland sites

368 on cold, snowy days.

Relation to summer conditions

370 Our result that families were significantly larger prior to migration than in the

371 first two months on the wintering grounds is in line with previous findings of

372 high juvenile mortality on autumn migration (Owen and Black 1989, Francis

373 et al. 1992). We suspect that mortality in our population is also mainly due to

374 strong density-driven competition for resources prior to and during autumn

375 migration. Previously, juvenile survival of Arctic-breeding birds — geese

376 included — was understood to be indirectly driven by the cyclical abundance

377 of Arctic rodents, and concomitant levels of predation (Summers and

378 Underhill 1987).

379 However, our study supports the idea that the breeding success of white-

380 fronted geese on the Baltic-North Sea flyway has been unrelated to summer

381 predation in recent years (Jongejans et al. 2015). This may possibly be due to

382 faltering lemming cycles (Nolet et al. 2013), or because an increasing

383 proportion of the population breeds in areas like Kolguyev Island, that

384 altogether lack Arctic rodents and associated phenomena (Kruckenberg et al.

385 2008). On the other hand, our finding that the number of juveniles seen with

386 marked geese is higher during years of increased predation suggests a

387 qualitative rather than quantitative response, to wit that in years of high

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388   predation, some geese succeed in raising large families, but many more

389   suffer total brood failure.

General conclusion

391   Based on the spatial and temporal patterns of wintering goose families, we

392   argue that management actions (Stroud et al. 2017) must consider that the

393   proportion of juvenile geese in foraging flocks is higher in some areas, and at

394   some times of the year. It is crucial to distinguish between adult survival and

395   recruitment for population control (Madsen 2010), as well as conservation.

396   Climate, habitat change, and change in feeding habits are suggested to have

397   led to increased goose densities, range expansion, and range shifts (Fox et al.

398   2005). As high densities lead to low recruitment in the Arctic breeding

399   grounds (Owen and Black 1989, Francis et al. 1992), goose populations might

400   become less flexible and highly vulnerable to rapidly changing conditions.

401   Our results show that increased disturbances on the wintering sites and

402   migration stopovers, *e.g.* as a result of increased management actions, would

403   induce more goose family splits, possibly altering population structure and

404   survival rates. Such disruption of the mechanisms of cultural transmission of

405   space use could cause levels of adaptability to changing environmental

406   conditions to change in unpredictable ways.

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515   Supplementary material provided as Appendix 1.

Tables

Type	Records	Sites	Spatial extent
Age-ratio counts	7,149	123	4.0° - 8.8°E, 51.1° - 53.4°N
Family sizes	51,037	65	4.8° - 7.3°E, 51.1° - 53.4°N
Ring-sighting data	10,635	8,416	2.7° - 9.7°E, 50.9° - 53.9°N
Familie sizes on Kolguyev	116	26	49°E, 69°N
GPS tracking of families	32,630[a], 13[b]	32,630	3.9° - 7.9°E, 51.3° - 54.3°N
a: Half-hourly family positions, b: Number of families tracked			

Table 1: Datasets of goose observations and tracking.