

Goose families project

Background

The Whitefronted goose *Anser albifrons* is a circumpolar migrant with a number of subspecies proposed (Ely et al. 2005). The population that migrates to western continental Europe originates from around the Barents Sea, and has been studied since at least the '60s reeding success is apparently high, with (Boyd 1965) reporting that around a third of Barents Sea birds overwintering in England were first-winter geese. These historical data are backed up in a comprehensive report by A. Kondratyev and Zaynagutdinova (2008) in which the breeding biology of the species is reported from Kolguyev, an offshore Russian island. This study simultaneously casts Kolguyev as the spring arrival point of 30% of the total Western European wintering population - around 500,000 birds - and thus an important breeding and stop-over site.

The following is known of the species: that geese live and migrate in family groups, and that parent-offspring relationships are strong and may continue beyond the first migration in the form of alloparenting (Warren et al. 1993; Miller and Dzubin 1965); that winter site fidelity is high at least for the Greenland population Wilson et al. (1991); and that geese use favourable environmental conditions to migrate, following the band of emerging spring vegetation (A. D. . Fox, Glahder, and Walsh 2003; Wijk et al. 2012).

Family structure appears to be preferred in larger geese such as the White-fronted goose (Jónsson and Afton 2008). However, in some species, this structure is subsumed by foraging or collective defence requirements, and is not always strongly expressed, especially on wintering grounds (Johnson and Raveling 1988).¹

Observations²

Field observations of geese wintering in The Netherlands suggest that:

¹On the whole, it would seem that the Greenland geese are better studied.

²These statements are modified from the master's project document. I hope I understood them correctly.

1. Family groups are identified as those having a higher proportion of juveniles;
2. Geese arrive in groups of non-breeders or families; non-breeders arrive a few weeks earlier than family groups;
3. Some family groups are maintained through winter and the succeeding spring migration, while some juvenile geese leave these groups and become independent;
4. Goose family sizes appear to decrease through winter, but larger families are seen in the west, where;
5. Numbers of geese are lower, leading to agglomeration, making it difficult to distinguish large families from small groups.

Questions³

Knowledge of anserine natural history, coupled with field observations of White-fronted geese, prompt these questions:

1. Do family and group sizes differ between the breeding and wintering grounds? How are the two related?
2. How are family and group size related to environmental predictors?
3. Is there a seasonal difference?
4. How are large families to be differentiated from small groups of non-breeders at their wintering grounds?⁴

General expectations

1. Family and group size variation with season
 - In summer on Kolguyev, A. Kondratyev and Zaynagutdinova (2008) report a nesting success of 78%, which should boost family sizes. Additionally, migration related mortality has not yet occurred. In winter, juveniles might become independent and leave family units. On the whole, families are hypothesised to be larger in summer than in winter.
 - In summer, predation pressure is higher on Kolguyev than it is in the wintering grounds. Food is likely more abundant due to spring growth. Bigger groups benefit from collective defence while avoiding resource competition. Groups are similarly hypothesised to be larger in summer than in winter.⁵

³I wonder if questions related to mixed species flocking might be interesting. It seems from the literature that geese of other species do form mixed species flocks. I wonder whether these geese do so, and if the proportions of heterospecifics are significant.

⁴Question 3 might not be particularly interesting except for practical purposes. On wintering grounds, a low proportion of first-winter birds might indicate a small group of mostly non-breeders rather than a large family.

⁵Other species of geese are reported to dissolve family groups and opt for larger, denser feeding groups. I'm not really sure what to expect here. I know wintering ducks move in huge groups, so perhaps this prediction is not well founded.

- The benefit of living in groups should outweigh the costs during summer in a high predation environment, while the advantages of foraging as a smaller unit are more evident in a low-risk, low-resource wintering area.
 - The relation of family size to group size should probably be season dependent: positively related in the summer, negatively in the winter.⁶
2. Family and group size and environmental predictors
- Both families and groups probably benefit from similar environmental conditions. This section is likely to be more exploratory.
 - I expect numbers to be well explained by vegetation and/or snow cover.
 - The observation that families to the west are larger could be tested by including longitude as a predictor, and perhaps small groups could be differentiated from large families by using a cut-off threshold of first-winter bird proportion (the literature suggests 0.33 as the expected proportion of first-winter birds).⁷

Using track data

The way I see of using the data from the satellite transmitters would be to use their positions at the breeding and wintering grounds to extract environmental variable values of the corresponding coordinates from a raster layer. The flight path in between seems quite valuable, but I'm not sure what one could do with it. I see that migration tracks have been used to determine the conditions constraining spring migration (Wijk et al. 2012). From work on schooling fish I suspect that cohesion is one parameter that could be extracted from the migration tracks, but I think the summer school will give me a better idea of what's possible here.

Possible analysis

At the moment, I can mostly only guess at what the analysis should be like. I would use GLMs, but I'm not sure if there isn't a better option. I could potentially use `adehabitat`'s R package functions to determine the ecological niche given the position data and environmental rasters, and this would likely differ across seasons. It would be one way of determining what impacts goose habitat choice, but I haven't found a way to include group size as a response variable here. This section needs serious expansion.

⁶Again, I'm not very sure that this works. It could also be that potential inter-family competition keeps group sizes low. If families are accompanied by alloparents, group defence might not be an incentive.

⁷I'm not sure which variables should be considered here. For a grazer, NDVI seems most relevant. I don't expect temperature to vary much within the two-week observation periods. I also suspect between season temp differences might be less important than grass/snow cover. I hope rasters for Kolguyev are available.

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