A case of male nest sitting in the Greater White-fronted Goose *Anser albifrons*

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Abstract

Nest sitting by males is rare in the *Anserinae* subfamily and has never previously been reported for the Greater White-fronted Goose *Anser albifrons*. Here one case of a male repeatedly sitting on a nest is described, based on recordings from automatic camera traps used to study the behaviour of breeding pairs. The male attended the nest during the female's absence, and there was a positive correlation between the time that the female spent away from the nest and the duration of nest sitting by the male. The female's absent periods and the time spent nest sitting by the male both increased as incubation progressed but then decreased during the last five days before hatching. The female tended to leave the nest more frequently during the day, whereas the male's nest sitting was not affected by the time of day. Further studies with larger sample sizes are needed to ascertain how common nest sitting behaviour is in male Greater White-fronted Geese.

Key words: behaviour, breeding, geese, incubation, reproduction.

Males are involved in incubation for more than half of all avian species (Deeming & Reynolds 2015). Little is known, however, about whether and how frequently males of the *Anserinae* subfamily (swans *Cygnu*s sp. and the true geese *Anser* sp. and *Branta* sp.) also participate in incubation, an exception being the Black Swans *Cygnus atratus* which share incubation with their mates (Braithwaite 1977; Brugger & Taborsky 1994). Females have thermosensitive brood patches for efficient heat transfer from their

bodies to the eggs (Jones 1971), while the males generally lack such patches (Bowler 2005). Males of other swan species have however been seen sitting on the nest (*e.g.* Tundra Swans *Cygnus columbianus* and Trumpeter Swans *Cygnus buccinator*; Henson & Cooper 1992; Bowler 2005), and more recently Scheiber *et al.* (2025) have observed nest sitting behaviour in male Barnacle Geese *Branta leucopsis*. Henson and Cooper (1992) described this behaviour as "nest sitting" rather than "incubation" because the efficiency of heat transfer is reduced without brood patches. The study of Barnacle Geese also used this terminology (Scheiber *et al.* 2025).

Previous studies of the breeding biology of Greater White-fronted Geese *Anser albifrons* have not reported any cases of males sitting on eggs during the nesting period (Ely 1979; Stroud 1982; Kretschmar 1986; Fox & Stroud 2002; Zaynagutdinova 2010). In contrast, females spend 97.3–99.2% of their time on the nest, to incubate the eggs (Ely 1979; Kretschmar 1986; Fox & Stroud 2002; Zaynagutdinova 2010). They usually do not leave the nest during the first ten days of incubation and may be absent for up to 80 min per day during the second half of the incubation period (Stroud 1982). It should however be noted that, in these studies, individual birds were not identified, making it difficult to determine with certainty which partner is sitting on the clutch.

Nest attendance includes not only incubation of the eggs but also thermoregulation and defence of the clutch. When females are absent from the nest, the risk of predation on the eggs increases (Fox & Stroud 2002). Male geese remain near the nest most of the time (Barnacle Geese: Owen & Wells 1979; Ross's Geese *Chen rossi* and Lesser Snow Geese *Anser caerulensis caerulensis*: Leschack *et al.* 1998; Greater White-fronted Geese: Ely 1979; Kretschmar 1986; Fox & Stroud 2002; Zaynagutdinova 2010). Studies in Barnacle Geese have shown that the intensity of male aggression plays a crucial role in nest defence and clutch survival (Speelman *et al.* 2022; Scheiber *et al.* 2025). Thus, male behaviour during incubation significantly affects nesting success. However, other behaviours beyond nest protection remain unknown in male Greater White-fronted Geese.

We installed automatic camera traps near the nests of Greater White-fronted Geese as part of a study of the nesting behaviour of the species. Among the pairs observed, one of the females had a neckband with an individual code. This allowed us to identify the sex of both partners and observe their behaviour separately. As a result of we detected, and are able to describe, a case of nest sitting behaviour by the male.

Methods

The study was conducted on Kolguev Island (69°10.05'N, 48°54.583'E), in the Barents Sea, Russia during June–July 2019. Camera traps (RD 1003-720P-HD) were set 2 m from six nests 8–23 days before hatching, with a mean (± s.d.) of 15 ± 6 days. We selected nests that were not located along frequently used paths, to minimise disturbance to the breeding pair. Distances between the nests ranged from 143–1,551 m (mean ± s.d. = 940.8 ± 425.4 m). Photos were taken every 2 minutes for one nest,

every 3 minutes for another nest, and every 4 minutes for the remaining four nests. The mean (± s.d.) interval between photos was 3.5 ± 0.8 min. We counted the number of photos with and without birds for each nest. To compare bird behaviour between the nests, we analysed data recorded only for the last eight days before hatching. Thus, the number of photos included in the analysis ranged from 2,692–5,760 images per nest. The data are available at: https://figshare.com/s/b3f8f61416021b0ee742.

In most cases, the low resolution of the photos meant that individual birds could not be distinguished by the variation in their belly bar patterns. At one of the camera-equipped nests, however, the female had a neckband labelled "C2D", which made it possible to determine the male and the female in the pair. The female was ringed on 19 October 2018 in Eemnes, the Netherlands (https://submit.cr-birding.org/). For this nest, we analysed the presence and absence of the female and the male on the nest in each photograph. The goslings hatched on 30 June, so we included photographs taken up to that date in the analysis – a total of 6,897 photographs taken at 3 min intervals between 15–29 June 2019.

To analyse the influence of the time of day on the female's absence and the male's nest sitting behaviour, we divided the day into four 6 h time periods: 21:00–03:00 h, 03:00–09:00 h, 09:00–15:00 h and 15:00–21:00 h. These periods were chosen on the basis that the astronomical noon in the study area is very close to the actual noon (https://planetcalc.ru/320).

Statistical analysis was performed using R software version 2024.04.2 (R Core Team 2021). We used the Shapiro-Wilk tests to evaluate the distribution of the variables. The number of minutes per day in which the female was absent from the nest was normally distributed ($W = 0.92$, $P = 0.18$, n.s.), whereas the number of minutes that the male spent nest sitting was not ($W = 0.80$, $P < 0.01$). We calculated the Spearman correlation between the minutes the male spent nest sitting and the minutes the female was absent using the "cor.test" function with the argument method "spearman". Additionally, we calculated the percentage of time that the male spent nest sitting while the female was absent.

The female's absence time and the male's presence time on the nest were not normally distributed across time intervals ($W = 0.85$, $P < 0.001$ and $W = 0.67$, $P < 0.001$, respectively). Therefore, we used the Wilcoxon test to analyse the dependence of the female's absence and the male's presence on the nest on the time of day. To identify differences between groups after detecting a significant overall effect, we performed pairwise comparisons, testing each group against every other group separately, using Dunn's *post hoc* test from the packed "rstatix" with Holm's correction method.

Results

During the entire observation period (15 days), the male was observed sitting on the clutch 39 times, for a total of 726 min. This behaviour occurred 0–7 times per day (mean ± s.d. = 2.6 ± 2.8 times a day), for a total of 0–171 min (mean ± s.d. = 48 ± 60 min) per day. The mean duration of the male's nest sitting episode was 19 ± 13 min (range = 3–54 min). At the same time, the

female left the nest 83 times during the entire observation period (15 days), for a total of 1,656 min. Incubation recesses occurred 0–14 times per day (mean ± s.d. = 5.5 ± 4.6 occasions), for a total of 0–312 min (mean ± s.d. = 110 ± 100 min) per day. The mean duration of the female's time away from the nest was 20 ± 14 min (range = 3–90 min).

The time the male spent nest sitting correlated significantly with the time that the female was absent (r_{51} = 0.91, P < 0.001). The total time that the male spent on the nest accounted for 44% of the female's total absence periods. Notably, for 53% of the time in which the female was absent, the male was also absent from the nest.

The time that the female was absent from the nest and the time that the male spent nest sitting showed similar patterns during the incubation period (Fig. 1). Both behaviours reached their maxima six days prior to hatching and decreased during the last five days of incubation while remaining at high level.

In most cases of the male nest sitting, the male sat on the nest shortly after the female had disappeared from the camera's field of view. In 27 cases (69%), the male was observed sitting on the nest in the next photo after the female had left (*i.e.* within 3 min of her departure). In eleven cases, the nest remained unoccupied for between one and eleven consecutive images (for 3–33 min), and in one case the nest was vacant for 24 successive photographs (for 72 min).

In 32 cases (82%), the male left the nest as soon as the female returned. In five cases, the female was already in the camera's field of view while the male was still on the nest (Fig. 2). In one case, the female returned to the camera's field of view, then left again in the next photo and reappeared three photos later, after which the male left the nest. Only in one case did the male leave the nest before the female returned.

There were significant differences in the duration of the female's absence from the nest at different times of day (Wilcoxon test: W = 1320, P < 0.05), with recesses occurring more often during daytime than at night (Fig. 3). However, the pairwise comparisons using Dunn's *post hoc* test with Holm's correction method did not reveal statistically significant differences between any of the groups analysed. No significant differences were found in the male's presence on the nest at different times of day (Wilcoxon test: W = 2057.5, n.s.; Fig. 3).

The percent of time per day that all camera-monitored nests were attended by an adult goose during the eight days prior to hatching ranged from 93–99%, with a mean (± s.d.) of 96% ± 2%. The percent of nest attendance time for the focal nest (93%) therefore was below the mean value. Here we give only the percentage of total nest attendance time for the other nests, because we were unable to determine the sex of partners.

Discussion

Nest sitting by male Greater White-fronted Geese has not previously been reported, and we believe that our study presents the first photographic record of male nest sitting in this species. There have however been several other studies of this behaviour within the *Anserinae* subfamily, for swans (Hawkins 1986; Brugger & Taborsky 1994)

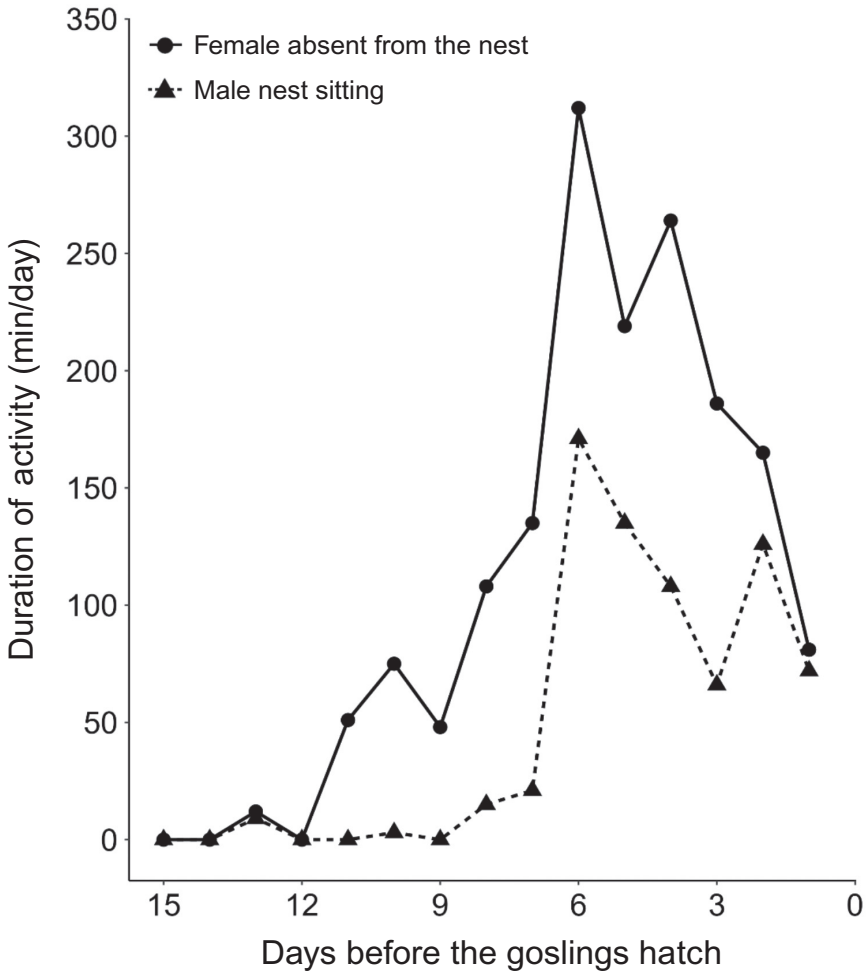

Figure 1. Nesting behaviour by the Greater White-fronted Goose pair, in relation to the number of days before hatching. Black line = female absent from the nest (minutes per day). Dotted line = male nest sitting (minutes per day).

as well as for geese (Inglis 1977; Scheiber *et al.* 2025). In Tundra Swans *Cygnus columbianus*, male nest sitting slowed the rate of heat loss from the nest by 2.5 times, and the incubation period was reduced by 6–7 days in pairs where the male assisted by nest sitting (Hawkins 1986). Reducing the incubation period may be highly advantageous in the short arctic breeding season. However, nest temperature did not decline significantly during the female's absence in Greater White-fronted Geese (Kretschmar 1986), indicating that in this case male nest sitting was not required for maintaining nest temperatures. Whether nest sitting by the male reduces incubation

Figure 2. Photograph of the Greater White-fronted Goose pair monitored during the study. The female (with a neckband) is near the nest, while the male (without a neckband) is sitting on the nest.

time in Greater White-fronted Geese remains a question for future research.

Another possible function of nest sitting in males might be to protect the eggs from predation (Samelius & Alisauskas 2001). The Kolguev ecosystem includes common generalist predators such as Arctic Fox *Vulpes lagopus*, Red Fox *Vulpes vulpes*, Rough-legged Buzzard *Buteo lagopus*, Arctic Skua *Stercorarius parasiticus*, Glaucous Gull *Larus hyperboreus* and Heuglin's Gull *Larus heuglini* (Kondratyev & Zaynagutdinova 2008; Pokrovsky *et al.* 2015; Glazov *et al.* 2021), so male nest attendance might be expected to decrease predation probability. On Svalbard, however, the nesting success of Barnacle Geese did not differ between pairs where the males undertook nest sitting and those where they did not (Scheiber *et al.* 2025). Male nest sitting may additionally protect the nest from intraspecies nest parasitism, as this behaviour is known to occur among the *Anserinae* (Syroechkovsky 2024).

In the pair monitored during our study, the duration of nest sitting by the male correlated with the duration of the female's absence from the nest, indicating that the male tended to spend more time sitting on the nest when the female was absent longer. Yet, for more than half of the time, the male and female were absent together, presumably when the male accompanied the female during her incubation breaks (Zaynagutdinova 2010).

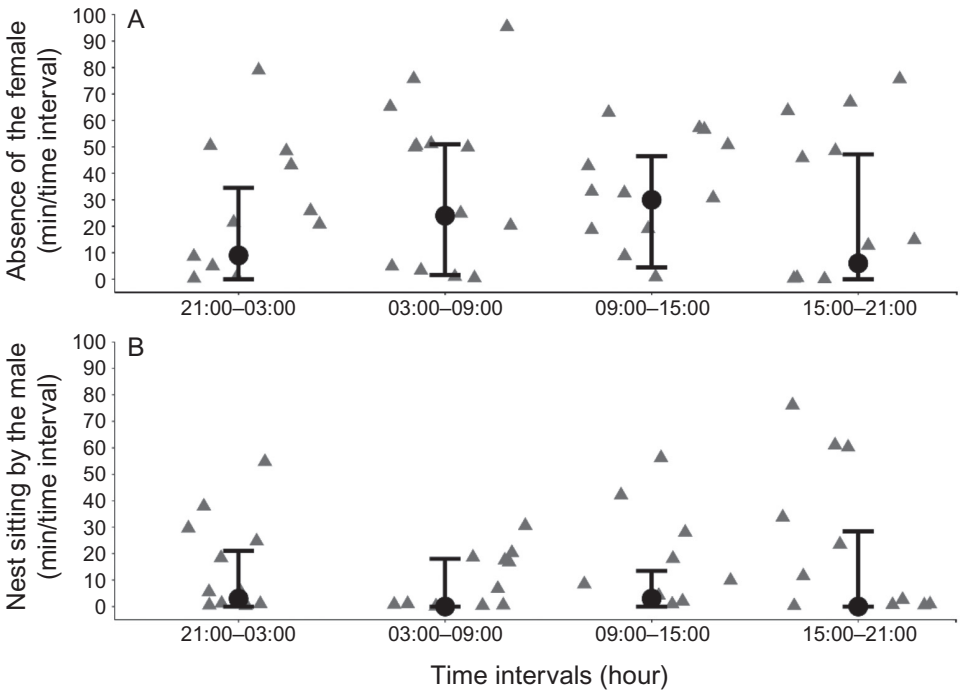

Figure 3. Nest attendance by the Greater White-fronted Goose pair. (A) = female absent from the nest (minutes per time interval). (B) = male nest sitting (minutes per time interval). Black circles = medians; vertical bars = Q1 and Q3; grey triangles = all observations.

The duration of the female's incubation recesses increased as incubation progressed (Fig. 1), which is consistent with other observations in Greater White-fronted Geese (Fox & Stroud 2002; Zaynagutdinova 2010) and other goose species such as Brent Geese *Branta bernicla* (Madsen *et al.* 1989; Spaans *et al.* 2007), Barnacle Geese (Prop *et al.* 1984), Pink-footed Geese *Anser brachyrhynchus* (Inglis 1977) and Greater Snow Geese *Anser caerulescens atlanticus* (Poussart *et al.* 2001). This pattern is thought to be linked to the gradual depletion of females' energy reserves during incubation (Spaans *et al.* 2007; Tombre *et al.* 2012), and an increase in resource availability (Prop & de Vries 1993), as well as being a response to prevailing wind conditions, air temperature and solar radiation (Poussart *et al.* 2001), or an abundance of ectoparasites in the nest (de Jong *et al.* 2019).

In our study, the female showed increased nest attendance in the five days prior to hatching, resulting in shorter incubation breaks, a pattern also reported for Emperor Geese *Anser canagicus* (Thompson & Raveling 1987), Greater Snow Geese (Reed *et al.* 1995) and Canada Geese *Branta canadensis* (Cooper 1978). This may be related to females beginning to communicate actively with their unhatched chicks as the hatching time approaches, thus promoting synchronised hatching (Lorenz 1979).

Several studies have shown that female geese leave the nest more often during the day than at night (Thompson & Raveling 1987; Poussart *et al.* 2001; de Jong *et al.* 2025). This was also the case for our pair, with the female similarly tending to make longer recesses during the day (Fig. 3), although the tendancy was not significant. The lack of significant differences between the groups is likely due to the small sample size, but may also be attributed to the high arctic latitude and the continuous daylight during the polar day in the study area. During the incubation period, the sun remains above the horizon 24 h a day, and at noon it is relatively low above the horizon (44.27°; https://planetcalc.ru/320). Nevertheless, at midnight, the sun is lower above the horizon and the air temperature is lower, while at midday, the sun is higher above the horizon and the air temperature is also higher. In our study, there were no daily variations in the male's nest sitting.

The total time of nest attendance for the six camera-monitored nests (mean ± s.d. = 96% ± 2%) was close to that reported in previous studies in Greater White-fronted Geese: 97.3% in Ely (1979), 98.8% in Fox (2003), 98–99% in Kretschmar (1986) and 99.2% in Zaynagutdinova (2010). This suggests that the cameras in this study did not have a significant influence on nest attendance behaviour by the geese. Although the percentage of nest attendance of the focal pair was below the mean, it was not an outlier.

In conclusion, a case of male nest sitting behaviour was recorded in the Greater White-fronted Goose during the female's absence from the nest. Similar behaviour has recently been described for the Barnacle Goose (Scheiber *et al.* 2025), suggesting that this phenomenon may be more common than previously appreciated. Further studies therefore should examine in greater detail the roles of female and male geese during the nesting period.

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Photograph: Pair of Greater White-fronted Goose on the Russian tundra, by Peter Glazov.