Snowy Owl (*Bubo scandiacus*) males select the highest vantage points around nests

Os machos de coruja-das-neves (*Bubo scandiacus*) selecionam os poisos mais altos nas imediações dos ninhos

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ABSTRACT

In July 2007 we collected a total of 309 Snowy Owl (*Bubo scandiacus*) pellets from 35 vantage points in an area where we located four Snowy Owl territories in northern Norway. The number of pellets found at each vantage point ranged from 1 to 39 (mean: 8.8, median: 6, SD ± 1.8). While the four nests were situated 513, 522, 524 and 529 m asl respectively (mean 522 m, SD ± 4.1), the vantage points with pellets were situated from 515 to 590 m asl (mean: 550.2 m, median: 548 m, SD ± 16.3). We found the highest number of pellets at the highest vantage points. The increase of pellets with higher elevation above the nest site indicates that Snowy Owls spent more time on the highest vantage points in the territory. Although some pellets may have been cast by the females before they started incubating, the majority of pellets were most likely cast by males. We hypothesise that the presence of elevated mounds, rocks or heights around the nest site of Snowy Owls may be an important feature for the Snowy Owls when selecting the breeding territory, increasing the male´s ability to scrutinize his territory for both prey and possible threats to the nest and himself.

Keywords: breeding, *Bubo scandiacus*, hunting behaviour, pellets, vantage points

RESUMO

Em julho de 2007 recolhemos 309 regurgitações de coruja-das-neves (*Bubo scandiacus*) em 35 poisos, numa área no norte da Noruega onde localizámos quatro territórios da espécie. O número de regurgitações encontrado em cada poiso variou entre 1 e 39 (média: 8,8; mediana: 6,0). Enquanto os quatro ninhos estavam situados a 513, 522, 524 e 529 m de altitude, respectivamente (média: 522 m), os poisos com regurgitações situavam-se entre 515 e 590 m de altitude (média: 550,2 m; mediana: 548 m). Nos pontos mais elevados encontrámos um maior número de regurgitações. O aumento do número de regurgitações com o aumento da elevação do local relativamente ao ninho indica que os coruja-das-neves passaram mais tempo nos pontos mais elevados. Embora algumas regurgitações possam ter sido produzidas pelas fêmeas antes do início da incubação, a maioria das regurgitações foi mais provavelmente produzida pelos machos. A nossa hipótese é que a presença de montículos elevados, rochas ou outras elevações nas imediações dos ninhos de coruja-das-neves pode ser uma característica importante para a seleção do território de reprodução, aumentando a capacidade do macho observar o seu território, tanto para deteção de presas como de possíveis ameaças.

Palavras-chave: *Bubo scandiacus*, coruja-das-neves, distribuição de idades e sexo, identificação fotográfica, irrupção

Introduction

In a feeding study of captive owls and raptors Slagsvold et al. (2010) found that small mammalian prey were more likely to be swallowed whole than bird prey, and that large vole-specialists more often ate small mammals whole than did smaller raptors. Owls usually consume most of their prey, and subsequently regurgitate indigestible parts, such as bones, skin, fur and feathers as pellets (Mikkola 1983). Although some prey may be ripped apart, crania, bones, fur and feathers are usually also swallowed. Owls do not dispose of pellets at specific sites, but cast them wherever they happen to perch when it is time to regurgitate. Owls in general seem to produce two pellets per day (Mikkola 1983), while Snowy Owls (*Bubo scandiacus*) usually cast 1-3 pellets per day (Portenko 1972). The number of pellets at a specific site may thus reflect the time an individual owl spends at the site. On wintering grounds in farmland in Michigan, USA, Chamberlin (1980) observed a Snowy Owl continuously from prey capture to pellet casting and found that the owl required between 5 h 38 min and 7 h 11 min for pellet formation.

Snowy Owls usually place their nests at elevated mounds in the terrain (Watson 1957, Hagen 1960, Portenko 1972, Potapov & Sale 2012). According to Watson (1957), the female ensures that she has a commanding view of the area surrounding the nest site, while the male appears to keep the nest site in view when he is hunting. Sutton & Parmelee (1956) found that although Snowy Owls placed their nests on elevated mounds, nests were usually not situated at the highest points of the terrain. When Norwegian lemmings (*Lemmus lemmus*) peaked in 2007, we located four breeding pairs of Snowy Owls. In order to uncover the hunting behaviour by male Snowy Owls and their selection of vantage points during hunting, we thoroughly examined the surroundings of three of the

Figure 1 - Male Snowy Owl at a typical vantage point in the study area, photographed in 2011.

Figura 1 - Macho de coruja-das-neves num poiso típico na área de estudo, fotografado em 2011.

nest sites. The Snowy Owl male usually hunts within a couple of hundred m away from his nest site (e.g. Watson 1957). We therefore assume that it was the territorial Snowy Owl males belonging to the nearest nest that used the vantage points that we located. We hypothesize that the males select the highest vantage points around their nests when searching for prey.

Methods

In 2007, we located four Snowy Owl nests in a mountain area in Finnmark County, northern Norway (70°N 24°E). The study area is a barren tundra characterized by small valleys with lakes in the bottom surrounded by hilltops, and the nests were situated in rocky, undulating mountain terrain above the tree line. We located the nests based on information from locals observing Snowy Owls present in the area in May and June 2007, and the first nest was found on 14 June. We carried out fieldwork in the period 9-17 July after the eggs had hatched, and found three more nests by scanning the landscape with binoculars and telescopes in order to spot brooding female Snowy Owls, or males bringing food to the chicks (nest 4).

We collected pellets near nests 2, 3 and 4. All vantage points in the surrounding terrain of the nests where hunting Snowy Owl males had been observed were visited and searched for pellets. Our main goal during this fieldwork was to catch breeding Snowy Owls at these nest sites and equip them with satellite transmitters, and we did so with two females and one male at nest sites 2, 3 and 4 (Solheim et al. 2007, Jacobsen et al. 2008). We observed where males and females preferred to perch when hunting or watching while we were walking in the terrain, and we searched all mounds and rock hilltops where we either had observed Snowy Owls or expected them to have been perching (Fig. 1). We searched each elevated point for pellets, which we collected (Fig. 2). We further recorded the number of pellets at each vantage point, and stored

Figure 2 - Collecting pellets at a vantage point in the study area.

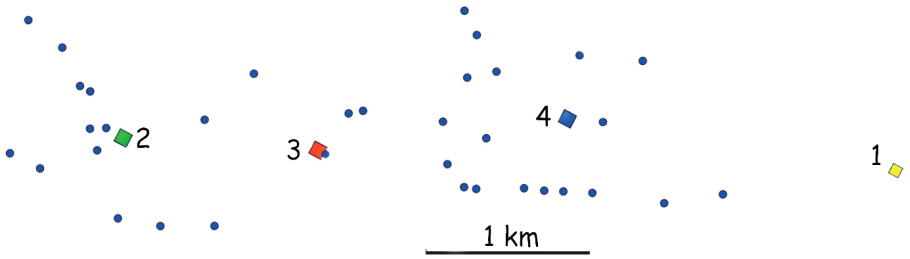
Figura 2 - Recolha de regurgitações num poiso na área de estudo.

Figure 3 - Snowy Owl pellets collected at a vantage point.

Figura 3 - Regurgitações de coruja-das-neves recolhidas num poiso..

Figure 4 - Nests and vantage points where pellets were collected.

Figura 4 - Ninhos e poisos onde as regurgitações foram recolhidas.



them separately. When we found broken pellets where parts fitted like bits in a jigsaw puzzle, they were counted as one pellet. All pellets were fresh without any mould, algae or indication of older age than that they had been cast during spring and summer 2007.

The size of owl pellets usually reflects the size of the species that produce the pellet (Mikkola 1983). While small owls obviously are not able to produce large pellets, large owls may sometimes produce small pellets. Pellets may also break when they dry up in the terrain, resulting in many small fragments from a single pellet. However, when collecting pellets in the terrain, it is usually possible to see if a pellet has broken into 2-3 separate pieces (see Fig. 3).

The length of Snowy Owl pellets are usually at least 7 cm (and often more than 9 cm) and the thickness is approximately 2-3 cm (Portenko 1972). Snowy Owl pellets are thus only surpassed in size by pellets from Eurasian Eagle Owls (*Bubo bubo*). Pellets from Short-eared Owls (*Asio flammeus*) and Rough-legged Buzzards (*Buteo lagopus*) may be similar in length to small or fragmented pellets from Snowy Owls, but are usually possible to distinguish from the latter species because they are thinner. However, we never encountered Short-Eared Owls or Rough-legged Buzzards in our study area, so we concluded that all collected pellets were cast by Snowy Owls. We were not able to separate pellets cast by male and female Snowy Owls. However, based on observations of males perched at the higher elevation sites during our fieldwork and that females spent almost all their time at the nest during the incubation and early nestling phase, we believe that the males had cast the majority if not all of the pellets collected.

We plotted the vantage points with pellets by using GPS (Garmin), and registered the altitude for each point (Fig. 3). We were not able to assign vantage points to specific nests, since no males at this time were equipped with transmitters. We only observed the male at nest 4 capturing a lemming and bringing the prey to his nest. The pellet data thus represent a pseudoreplication. However, since the four nests were located at almost the same elevation with only 11 m difference between highest and lowest location, and 33 of the 35 vantage points all were located at higher elevations than the highest nest, we believe that the data reflects that all males selected vantage points higher than their nest sites.

Results

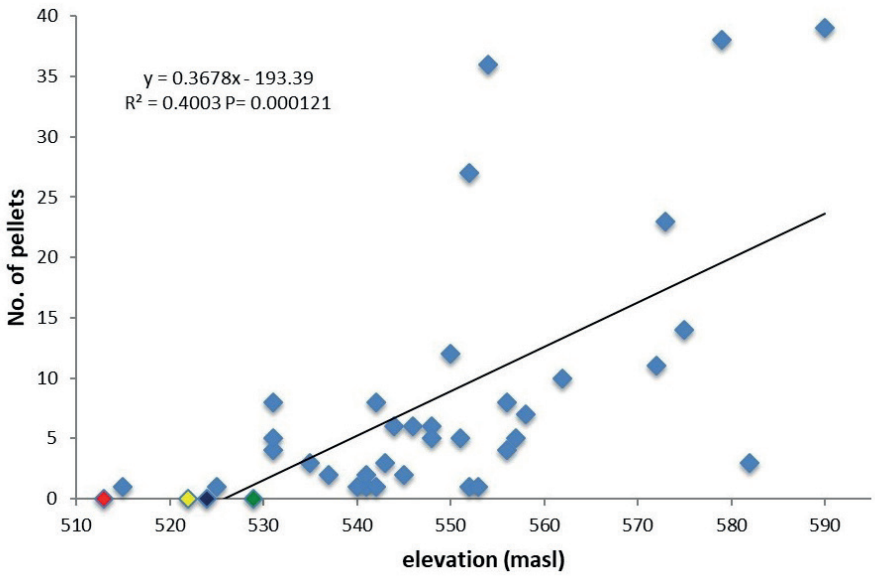
The four nests were located almost along a straight line, with 4.7 km between the two most distant nests (Fig. 4, 5). The neighbour distances were 1.2 km (nest 2 and 3), 1.5 km (nest 3 and 4), and 2.0 km (nest 1 and 4). The nests 1-4 were located at 513, 522, 524

Figure 5 - The central part of the Snowy Owl nesting area in 2007, showing structure of the terrain.

Figura 5 - Relevo da zona central da área de reprodução da coruja-das-neves em 2007.

Figure 6 - Number of pellets found at each vantage point in relation to the elevation of the vantage point above sea. The elevation of the four nest sites are shown by the differently coloured squares. Colours match colours of nest sites in figure 4.

Figura 6 - Número de regurgitações encontradas em cada poiso em relação à altitude do ponto. A altitude dos quatro locais de nidificação é expressa por quadrados com cores diferentes. As cores correspondem aos locais de nidificação na figura 4.



and 520 m asl respectively (mean: 522 m, SD ± 4.1). We collected 309 pellets from 35 vantage points (Fig. 4). The number of pellets found at vantage points ranged from 1 to 39 (mean 8.8 per point, median 6, SD ± 1.8). We collected the pellets at vantage points ranging from 515 to 590 m asl (mean 550.2 m, median 548 m, SD ± 16.3), and all collected pellets were within 1.1 km from nest sites 2-4. The majority of the pellets were located on vantage points at higher altitudes than these nest sites. The number of pellets at each vantage point increased with increasing altitude ($y = 0.36x - 193.39$, $R^2 = 0.40$, $P = 0.000121$; Fig. 6).

Discussion

Although the four nest sites were on top of elevated mounds or rock formations in the terrain, all but two vantage points where we found pellets were situated higher that the nests (Fig. 6). This implies that the males spent most of their time perching higher than their respective nest locations. The correlation between number of pellets and altitude of vantage points indicates that Snowy Owl males prefer to perch as high as possible in the territory when hunting or guarding the nest site. This is in accordance with the description of hunting behaviour of Snowy Owls on Baffin Island in Arctic Canada (Watson 1957). Hunting Snowy Owls can themselves fall prey to raptors like Golden Eagles (*Aquila chrysaethos*), and Gyrfalcons (*Falco rusticolus*). In a survival study of satellite tagged Snowy Owls only three of 28 individuals were confirmed predated by unknown species of raptors (Heggøy et al. 2017). In 2011 one male in our study area had been killed and partly eaten (presumably by a gyrfalcon) when we found his female on the nest (Jacobsen et al. 2011). Perching at the highest vantage points may give the Snowy Owls better possibilities to spot other predators, and thus reduce the risk of the Snowy Owl to be taken by surprise by another raptor.

Few other studies describe the hunting behaviour of Snowy Owls in the breeding period, but on wintering grounds in farmland near Edmonton, Canada, Höhn (1973) studied the choice of hunting perches and the attack distances for wintering Snowy Owls. Hunting Snowy Owls most frequently perched up to 5 m above ground on haystacks and secondly up to 7 m above ground on electricity poles. From these perches, hunting Snowy Owls could detect small mammal prey at distances of up to 160 m in flat farmland habitat. Höhn (1973) found that Snowy Owls did not hunt from the ground. Chamberlin (1980), however, described three hunting methods that were employed by one individual wintering Snowy Owl in Michigan, USA: still-hunting, ground-hunting and coursing. During still-hunting the owl scanned the surrounding area from a commanding perch on (in decreasing order of frequency) utility poles, fence posts and the tops of hillocks. Still-hunting was used most often (92.5%). Ground-hunting (6.8%) involved walking or hopping on the surface and breaking through the snow either with the talons or with the beak. Coursing is a low, search flight over the ground that allows the hunting of a large area with few high perches. Coursing was only registered rarely in winter (0.7% of total hunting time) and was limited to snow-free areas. However, according to Watson (1957), systematic quartering over the ground was a common hunting method of breeding owls in the summer on Baffin Island, Arctic Canada. In our study area, still-hunting would minimize energy expenditure considerably because a large area can be monitored from a single high vantage point. During our fieldwork still-hunting was the only hunting method observed, and we assume that it was overall the most common hunting method among the territorial Snowy Owls in our study area. By perching on the highest vantage points in the territory, the Snowy Owl´s view is considerably enhanced, as perching on the highest tops

often provides a 360 degree view that would otherwise be blocked from the hillsides in the territory. All the nests in the study area were surrounded by hilltops.

In 1993, in a similar habitat in another area in Finnmark, northern Norway, Solheim (2021) measured the distance a hunting Snowy Owl male could detect a moving lure mimicking a vole or a lemming to be at least 1 km distance (Solheim 2021). This is in line with our observation of the hunting Snowy Owl male belonging to nest 2 in our study area in 2007. It started a hunting flight from a high vantage point on one side of the territory, passed the nest site, made two small stops when waiting for a Norway Lemming to make another movement before finally catching its prey on the third flight. We measured the distance on the map to be > 1km. Perching on the most elevated vantage points in the territory may thus increase the area that the male can effectively scan during hunting, increasing his chance of spotting prey. This is in accordance with what Sonerud (1992) found for diurnal hunting Hawk Owls *Surnia ulula*, which also detects prey primarily by eyesight.

Using the most elevated vantage points would also provide the male a better view for spotting potential threats to the nesting female, such as Arctic Fox (*Vulpes lagopus*), Red Fox (*Vulpes vulpes*), Golden Eagles, Gyrfalcons or humans. The use of high vantage points would also increase the male´s view of adjacent territories to monitor neighbouring males´ movements, thus increasing his chances to prevent extra-pair copulations with his own female. We therefore assume that the presence of elevated mounds, rocks or heights around the nest site of Snowy Owls may be an important feature for the Snowy Owls when selecting the breeding territory. Both the male and the female may benefit from choosing such nest sites, however we have no observational data to support how the behaviour of the owls govern the selection process at the start of the breeding season.

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