Disturbance of Dark-bellied Brent Geese by helicopters in a spring staging area

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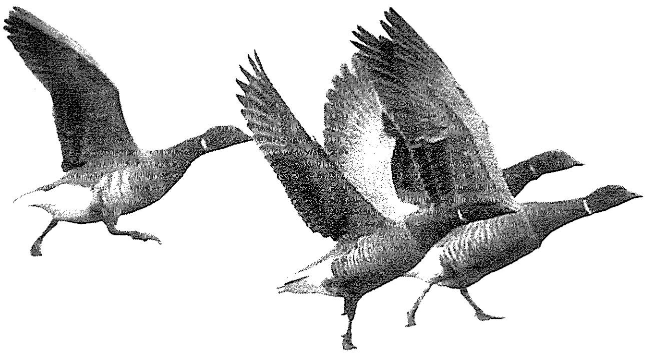
Foto: Lone Eg Nissen.



(Med et dansk resumé: Helikoptere forstyrrer Mørkbugede Knortegæs på forårsrasteplads)

Introduction

Dark-bellied Brent Geese *Branta bernicla bernicla* winter in the Dutch Wadden Sea, on the French Atlantic coast and in southern England (Charman 1979, Prokosch 1984). In early March they migrate to spring staging areas in the Dutch, German and Danish parts of the Wadden Sea (Ebbinge et al. 1982, Madsen et al. 1990). Here they forage in the salt marshes, increasing their weight considerably (Ebbinge et al. 1982, Prokosch 1984, Ebbinge 1989). This study describes reactions of Brent Geese to helicopter traffic during spring staging.

Methods

The study took place on the island Langli in the Danish part of the Wadden Sea where, since the early 1980s, up to 1500 Dark-bellied Brent Geese stage during spring (Madsen et al. 1990). The island is approximately 2.5×1 km, has a tidal range of about 1 m and is a reserve with no public access in spring. The study area includes the salt marsh at the southern end with surrounding tidal flats and shallow waters, approximately 5 km^2. Helicopters frequently pass or cross the island, and since 1983 wardens at the field station on the island have reported that helicopter flights disturbed the Brent.

Observations were made on 50 days between 15 March and 31 May in 1993, covering all daylight hours. 1992 was a non-breeding year (Madsen 1994b), so no juvenile Brent were present in the flocks during the study period.

Maersk Helicopters are using two types of helicopters when transporting goods from Esbjerg Airport to oil drilling platforms in the North Sea, the Super Puma MK1 and the Bell 212. The two helicopter types can not always be distinguished in the field and are here treated as one.

During the study period 4-6 westward going departures were scheduled between 07:30 and 18:30 on workdays and Saturdays, according to Maersk Helicopters' Flight Schedule. Helicopters followed one of two fixed routes (Fig. 1), a southerly route when flying west and, usually, a northerly route when flying east. Pilots occasionally chose not to follow the scheduled route and/or elevation.

Helicopters flew at a standard elevation of 500 m when flying west, 650 m when flying east in good visibility, and 300 m when flying east in poor visibility. Bell air speed was c. 185 km/h and Puma air speed c. 250 km/h, depending on weather conditions (helicopter information: Børge Ahm, Maersk Helicopters, pers. comm.).

Nonscheduled helicopter flights in the area consisted of extra Maersk transport flights, Maersk pilot training flights, and military traffic from a

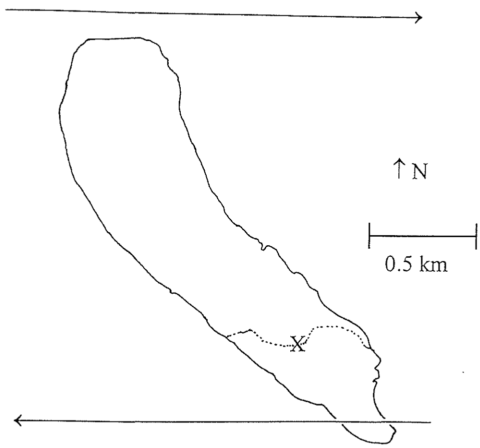


Fig. 1. Map of Langli showing the study area (south of the dotted line) and the hide (cross). The arrows indicate the fixed Maersk helicopter routes.
Kort over Langli. Observationsområdet er området syd for den stiplede linie, mens X er skjulet. Pilene viser de normale Maersk flyveruter.

nearby military camp. Maersk training flights were not scheduled and did not follow the fixed route or elevation. Army helicopters were Hughes 500, Fennec, and Sikorsky S-61 helicopters. Military traffic was not scheduled, occurred rarely and is not here distinguished from Maersk helicopter flights (military traffic information: E. S. Levandowsky, Oksbøl camp, pers. comm.).

In cooperation with Maersk Helicopters eight experimental flights were arranged. These were scheduled flights with altered flight elevation and route: they would follow the fixed route at an elevation of 100 m, and then fly south along the island at either standard or at low elevation.

Helicopter flights were divided into the following categories:

1) Helicopter E-W: Helicopter following the southern route at standard elevation in the usual direction (east-west).

2) Helicopter W-E: Helicopter following the southern route at standard elevation but in the opposite direction (west-east).

3) Helicopter, different route: Helicopter flying across the study area at standard elevation but outside fixed routes.

4) Helicopter, low elevation: Helicopter flying across the study area along the southern route but at an elevation of 100 m.

5) Helicopter, both: Helicopter flying across the study area outside fixed routes and at a low elevation.

Helicopter flights of category 1-2 were scheduled, whereas flights of category 3-5 were either unscheduled Maersk flights, experimental flights, or army helicopter flights.

At each helicopter flight the date, time, number of Brent Geese present and the helicopter route and elevation were noted. The number of geese flying up and the number assuming vigilance posture were recorded when the helicopter was overhead. On some occasions recording of vigilance was not possible because upflights caused a confused picture. A goose was termed vigilant when it was standing or lying with its neck stretched and its head raised above shoulder level (Inglis & Isaacson 1978, Inglis & Lazarus 1981, White-Robinson 1982, Black et al. 1992).

Between helicopter flights the number of geese present and the number of geese standing in vigilance posture was scan-sampled every 15 minutes (Altmann 1974).

Results

The number of Brent Geese flying up in response to 120 helicopter flights was recorded. The num-

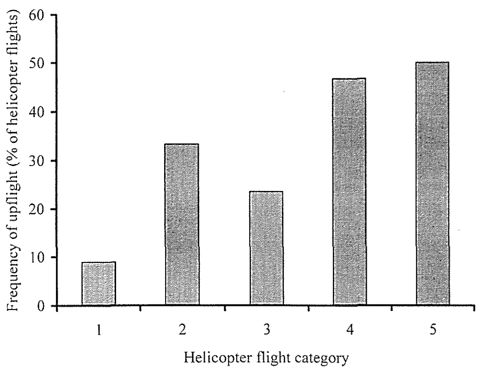


Fig. 2. Frequency of upflight in Brent Goose flocks in relation to helicopter flight categories. For categories, see Tab. 1.
Hyppighed af opflyvninger ved de forskellige kategorier af helikopteroverflyvninger (jf. Tab. 1).

Tab. 1. Number of helicopter flights occurring in the study area, and number and percentage of these causing upflights in the flocks of Brent Geese. The average percentage of geese flying up is for the helicopter flights that caused upflights.
Antal helikopteroverflyvninger i observationsområdet, og antal og procent af disse, der forårsagede opflyvninger i flokkene af Knortegæs. Den gennemsnitlige procentdel af Knortegæssene, der fløj op, gælder de helikopteroverflyvninger, der forårsagede opflyvninger.

Helicopter flight category *Helikopterkategori*	No. of flights *Antal overflyvninger*	Upflights[a] *Opflyvninger*[a]		Average upflight percentage[b] *Gennemsnitlig opflyvningsprocent*[b]	
		N	pct	pct	SE
1. Fixed route, standard elevation, E-W *Normal rute, normal flyvehøjde, Ø-V*	67	6	9	54	12
2. Fixed route, standard elevation, W-E *Normal rute, normal flyvehøjde, V-Ø*	15	5	33	29	13
3. Other route, standard elevation *Anden rute, normal flyvehøjde*	17	4	24	72	23
4. Fixed route, low elevation *Normal rute, lav flyvehøjde*	15	7	47	83	14
5. Other route, low elevation *Anden rute, lav flyvehøjde*	6	3	50	72	14
Total	120	25	21	62	7

[a] χ_4^2=16.4, p<0.0025
[b] Kruskal-Wallis test, p=0.18

ber of geese being vigilant was recorded in 111 of these flights. 1526 scan samples were made of undisturbed Brent. The upflight percentage and vigilance percentage were calculated as the maximum number of geese taking flight and assuming vigilance posture, respectively, during a helicopter flight, divided by the number of geese in the study area when the helicopter arrived. In the case of upflight, vigilance percentage was calculated with reference to the remaining part of the flock and not to the entire flock.

A Spearman rank correlation coefficient was calculated on the data to test if upflight percentage or vigilance was correlated to flock size. (In one observation flock size was accidentally not recorded and the observation was omitted from the correlation analysis.) None of these correlations was statistically significant (upflight percentage and flock size: p=0.20, N=119; vigilance percentage and flock size: p=0.88, N=110).

Brent Geese flew up in response to 25 (21%) of the 120 passing helicopters (Tab. 1). On average 62% (SE=7.3%, N=25) of the flock took flight in these cases. The frequency with which different helicopter flight categories caused upflights varied significantly (Fig. 2; χ_4^2=16.4, p<0.0025, N=120). Upflight percentage varied significantly between helicopter flight categories (Kruskal-Wallis test, p=0.0017, N=120, df=4); if only helicopter flights that did cause upflights were included, however, this effect did not attain statistical significance (Kruskal-Wallis test, p=0.18, df=4, N=25).

During all helicopter flights, an average of 23% of the Brent Goose flock (SE=2.6%, N=111) assumed the vigilance posture, significantly more than the average vigilance percentage of 10.3% (SE=0.26%, N=1526) in undisturbed flocks (χ_1^2=23.8, p<0.0001, N=1637). With reference to this, a helicopter flight that caused more than 10.3% of the flock to be vigilant was said to have caused increased vigilance; 73 out of 111 helicopter flights (66%) caused increased vigilance in the flock.

When all helicopter flights were included, vigilance did not vary between helicopter flight categories (Kruskal-Wallis test, p=0.53, df=4, N=111). If only helicopter flights that did not cause upflights were included, the average vigilance percentage was 22% (SE=2.6%, N=94) and differed significantly between helicopter flight categories

(Fig. 3; Kruskal-Wallis test, p=0.015, df=4, N=94). Vigilance percentage in flocks did not depend on whether helicopters caused upflights or not (χ_1^2=1.22, p=0.27).

When helicopter flights did cause upflights, the vigilance percentage was 27% (SE=2.6%, N=17) and did not differ significantly between helicopter flight categories (Kruskal-Wallis test, p=0.57, df=4, N=17). In the case of upflight, a vigilance percentage of 0 was due to an upflight percentage of 100 and thus no geese left to be vigilant. When no upflights occurred, a vigilance percentage of 0 would mean no vigilance at all. If only observations where the upflight percentage was greater than 0 and less than 100 were included, the vigilance percentage during upflights was 45% (SE=13.1%, N=10), not significantly different from the vigilance percentage when no upflights occurred (χ_1^2=3.6, p=0.059, N=104).

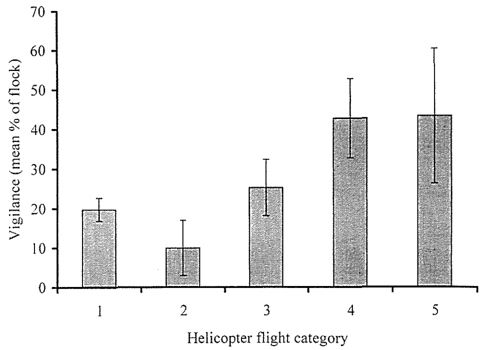


Fig. 3. The average vigilance percentage in Brent Goose flocks during helicopter flights of different categories. Only flights not causing upflight of geese are included. Vertical bars are standard errors. For categories see Tab. 1.

Gennemsnitlig vagtsomhedsprocent i Knortegåseflokke under helikopteroverflyvninger af forskellige kategorier (jf. Tab. 1). Kun overflyvninger, der ikke udløste opflyvning af gæs, er medtaget. De lodrette linier angiver standardafvigelsen på gennemsnittet.

Discussion

In 25 out of 120 occurrences, helicopters put almost two thirds of the Brent Goose flock to flight. When helicopters did not cause upflights, they caused about twice as many geese to be vigilant as in undisturbed situations (see also Henson & Grant 1991). It may accordingly be concluded that the passing helicopters disturbed the Brent Geese. As long as helicopters followed the fixed route, the direction did not seem to matter: helicopters that flew in the more unusual direction of west-east caused upflights more often than those flying east-west, but the upflight percentage did not differ, and the vigilance percentage was lower (Tab. 1, Fig. 2 and 3). Helicopters flying outside the fixed route but at the standard elevation did not cause more disturbance than helicopters following the fixed route. Low-flying helicopters, however, caused upflights more often than helicopters flying at normal elevation regardless of route, and they caused more geese to be vigilant than any other category (Fig. 3), indicating that flight elevation is a key factor to eliciting disturbance reactions (see also Owens 1977, Madsen 1994a, Miller et al. 1994, Stock & Hofeditz 1994, Ward et al. 1994).

When upflights occurred, some helicopter flight categories caused upflights more often than others, but once an upflight was elicited, the upflight percentage did not vary (Tab. 1). The vigilance percentage during upflights did not differ from the percentage in flocks where no upflights occurred, suggesting that the geese that did react took flight and the rest were unaffected.

When helicopter flights did not cause upflight, the vigilance percentage did vary between helicopter flight categories, apparently because the level of vigilance varied and, at least in part, depended on the intensity of the disturbance. Low-flying helicopters on average caused a higher vigilance percentage than other helicopter flight categories, confirming the importance of flight altitude as a disturbance factor.

Vigilance was a gradual response while upflight was not, and upflight affected a larger part of the flock than vigilance did. This corroborates the assumption that it takes a stronger stimulus to cause upflight than to cause vigilance (see also Owens 1977, Madsen 1988, Miller et al. 1994, Ward et al. 1994) and, again, confirms the particularly severe disturbance caused by low-flying helicopters.

Acknowledgments

The study took place under supervision of Dr Jesper Madsen, National Environment Research Institute, Denmark, and Dr Torben Dabelsteen, Department of Population Biology, University of Copenhagen, Denmark. Observers at Langli Field Station, Michael Bjerregaard and Finn Bergstroem Mogensen, assisted in the field work. Jo Holland, Department of Population Biology, University of Copenhagen, Denmark, assisted with and proofread the manuscript, which was further improved by valuable comments and suggestions from Per de Place Bjørn, Zoological Museum, University of Copenhagen, Denmark.

Resumé

Helikoptere forstyrrer Mørkbugede Knortegæs på forårsrasteplads

Øen Langli i det danske Vadehav har fungeret som forårs- og efterårsrasteplads for ca 1500 Mørkbugede Knortegæs *Branta b. bernicla* siden starten af 1980erne. Maersk Helicopters' faste rute krydser Langli på vej til boreplatformene i Nordsøen, og enkelte helikopterflyvninger udgår fra Oksbøllejren i nærheden af Langli. Observatørerne på Langli Feltstation har siden 1983 rapporteret, at helikopterne skræmte Knortegæssene op. I foråret 1993 udførtes en undersøgelse af Knortegæssenes adfærd under helikopteroverflyvninger.

Knortegæssenes reaktion på helikopterne i form af opflyvning og vagtsomhedspositurer blev observeret og sammenholdt med vagtsomhedsadfærden i uforstyrrede flokke. Helikopteroverflyvningerne inddeltes i 5 kategorier: Maersk rute, normal retning (øst-vest), flyvehøjde 300-650 m; Maersk rute, retning vest-øst, flyvehøjde 300-650 m; anden rute, flyvehøjde 300-650 m; Maersk rute, flyvehøjde 100 m; og anden rute, flyvehøjde 100 m.

Helikopteroverflyvningerne skræmte gæs op i 21% af tilfældene og forårsagede øget vagtsomhed i 66%. Lavtflyvende helikoptere skræmte gæs op hyppigere og forårsagede større vagtsomhed i flokken end helikoptere i normal flyvehøjde. Det konkluderes derfor, at lavtflyvende helikoptere har den største forstyrrelseseffekt.

Opflyvningsprocenten (den del af flokken, der fløj op) afhang hverken af flokstørrelsen eller af helikopterens flyverute eller -højde. Det tyder på, at opflyvningsadfærden er ensartet uanset hvor kraftig den udløsende stimulus er. Vagtsomhedsprocenten (den del af flokken, der antog vagtsomhedspositur) var derimod højst under overflyvning med lavtflyvende helikoptere, hvilket viser, at vagtsomhedsadfærd kan udløses i større eller mindre grad.

Undersøgelsen er udført som et specialeprojekt på Københavns Universitet, afd. f. Populationsbiologi, i samarbejde med Danmarks Miljøundersøgelser, afd. f. Kystzoneøkologi.

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Accepted 3 December 1996

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