

Individual vigilance in male Greylag Geese (*Anser anser*) depends on flock density and social status

Das individuelle Sicherverhalten bei männlichen Graugänsen (*Anser anser*)
ist von der Schardichte und vom sozialen Status abhängig

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Key words: communication, dominance, predator avoidance, signal.

Summary

WALDENBERGER, F. & K. KOTRSCHAL (1993): Individual vigilance in male Greylag Geese (*Anser anser*) depends on flock density and social status. Ecol. Birds 15: 193-199.

The function of vigilance behaviour in mammals and birds is generally assumed to be predator avoidance. The present study was performed on different gander categories in a flock of semitame Greylag Geese. We show, that vigilance duration and frequency depend on social status, flock density and behavioural background. High ranking individuals invest more in vigilance than low ranking individuals. At both, high and low flock density-situations the vigilance frequencies of all social categories are highest, whereas at intermediate flock densities vigilance frequencies are relatively low. High ranking Ganders are significantly more vigilant during feeding than in non-feeding situations. These results suggest, that in addition to predator avoidance the conspicuous vigilance posture advertises the position of dominant individuals to other flock members.

Zusammenfassung

WALDENBERGER, F. & K. KOTRSCHAL (1993): Das individuelle Sicherverhalten bei männlichen Graugänsen (*Anser anser*) ist von der Schardichte und vom sozialen Status abhängig. Ökol. Vögel 15: 193-199. Säugetiere und Vögel die sichern, nehmen eine recht auffällige Körperhaltung ein, indem sie bewegungslos stehen, den Hals durchstrecken und den Kopf hochhalten. Bei gruppenlebenden Tieren ist eine Abnahme der individuellen Sicheraktivität mit zunehmender Schargröße zu beobachten, daher wird Sicherverhalten allgemein im Zusammenhang mit Raubfeindvermeidung gedeutet.

Nicht anonyme Tiergruppen bestehen aus Mitgliedern mit unterschiedlichem sozialen Status und Rang. In Gänsescharen sind Paare mit Nachwuchs am Ranghöchsten, Paare ohne Nachwuchs nehmen mittlere Ränge ein und unverpaarte Gänse stehen in der Rangordnung ganz unten. Frühere Untersuchungen haben gezeigt, daß in Gänsefamilien eine Rollenverteilung zwischen den Mitgliedern herrscht, was die Zeit, welche für bestimmte Verhaltensweisen (Fressen, Sichern, Aggression...) aufgewendet wird, betrifft. Da Ganter nicht nur signifikant mehr Sichern, sondern auch hauptsächlich für den Rang der Familie verantwortlich sind, besteht die Möglichkeit, daß Sichern zusätzlich zur Raubfeindvermeidung eine soziale Funktion hat.

Diese Untersuchung wurde an der halbzahmen und freifliegenden Graugänseschar der Konrad-Lorenz-Forschungsstelle im September 1992 durchgeführt. Alle Mitglieder dieser Schar sind individuell markiert. Die Datenaufnahme wurde auf Ganter beschränkt, welche signifikant mehr sichern als Gänse.

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Folgende vier Ganterkategorien wurden berücksichtigt: verpaarte Ganter mit Nachwuchs (Familienganter), verpaarte Ganter ohne Nachwuchs, Ganter in Ganterpaaren und unverpaarte Ganter. Von jeder Kategorie wurden 50 Protokolle genommen, davon 30 in der Freßsituation und 20 bei anderen Aktivitäten (Ruhcn, Komfort). Ein Protokoll bestand aus fünf Minuten Dauerbeobachtung, wobei die Frequenzen und Dauer der Extreme-head-ups (Sicherhaltung) aufgezeichnet wurden.

Ranghohe Familienganter und heterosexuell verpaarte Ganter sichern im Vergleich zu den rangniedrigeren homosexuell verpaarten und unverpaarten Ganter in der Freßsituation signifikant mehr als in anderen Situationen. Während bei anderen Aktivitäten als Fressen keine signifikanten Unterschiede zwischen den sozialen Kategorien bei Sicherfrequenz und -Dauer auftreten, gilt für die Freßsituation die Reihung: Familienganter sichern mehr als Paarganter ohne Nachwuchs, diese sichern mehr als Ganter in Ganterpaaren welche wiederum mehr sichern als unverpaarte Ganter. Außerdem gibt es in Abhängigkeit von der Schardichte eine bimodale Verteilung der Sicherfrequenz in allen sozialen Kategorien. Bei hoher und geringer Schardichte wird häufiger gesichert als bei mittlerer Schardichte.

Wie erwartet investieren Familienganter am meisten in Sichern und damit in das Überleben ihrer Nachkommen, und unverpaarte Ganter, welche nicht einmal einen Reproduktionspartner zu bewachen haben am wenigsten. Die höhere Sicherfrequenz bei geringer Schardichte ist mit einem größeren Gefahrenbereich für das Individuum zu erklären, wogegen die hohe Sicherfrequenz bei hoher Schardichte und die höhere Sicheraktivität der ranghohen Ganter in der Freßsituation eine soziale Funktion des Sicherns nahelegen, nämlich den anderen Scharmmitgliedern die eigene Dominanz anzuzeigen.

1. Introduction

Vigilant mammals and birds are generally conspicuous by stretching their necks, holding their head in a high-up position. All dispensable body movements are suspended in favour of increasing the sensitivity of the animals or environmental stimuli. It is therefore generally assumed, that the major function of vigilance is predator avoidance. A decrease in individual vigilance with increasing group size was found by whole-group scans (BERTRAM 1980, LAZARUS 1978), suggesting a function of group living in predator avoidance (CURIO 1975, KENWARD 1978). However, non-anonymos groups are socially heterogeneous. Therefore it is unlikely that individuals of different status invest equally into vigilance.

In geese, pairs with offspring rank generally highest in the dominance hierarchy, pairs without offspring assume intermediate positions and sigles are lowest (LAMPRECHT 1986). Preceding studies have shown behavioural role-differentiation in geese families; males (ganders), females (geese) and offspring are distinct, with significant differences in time allocated to feeding, vigilance or aggression towards other flock members (LAZARUS & INGLIS 1978, BLACK & OWEN 1989, OWEN own unpubl. observations). This behavioural differentiation reflects different strategies of fitness maximisation of family members depending on life history state and gender. As ganders are not only significantly more vigilant than the other family members, but seem mainly responsible for the families rank (LAMPRECHT 1986), vigilance may also in addition to predator avoidance have a social function.

We therefore intend to relate male vigilance patterns with social status of individuals (pairbond, accompanied by offspring, pair-bond with a female, with another male or single) and with social context as well as genaral behavioural background. We include feeding in a dense flock versus feeding in a more spaced situation, versus activities other than feeding, such as walking, preening, etc. By comparing vigilance patterns of different gander categories at varying flock densities we present evidence for a social function of vigilance, which may be distinct from predator avoidance.

2. The Goose Flock and Methods

In 1973, KONRAD LORENZ and co-workers established a flock of semitame Greylag Geese in the Upper Austrian Almtal, which forms a relatively stable, non-migratory population ever since (LORENZ 1988). All geese are individually marked with coloured rings on their legs. Continuous records are kept on the life history and social relationships of each individual. This social transparency paired with tolerance of geese to the close presence of humans makes this flock a prime model for the observation of individual behaviour. Geese stay close to the research station where they are supplementally fed twice a day, but spend the night at a lake 8 km south (LORENZ 1988).

To avoid seasonal effects on social relationships, all observations were performed within a single week in September 1992, on the early winter flock, which staged at the meadows close to the research station. Males are generally the more vigilant sex (LAMPRECHT 1989). As we were predominately interested in differences related to social status, not to gender, observations were restricted to males. Four distinctly different social categories of ganders were present in the flock, family males (high ranking), heterosexually paired males, males paired with another gander (both of intermediate rank) and singles (generally low-ranking) (Tab. 1). Most of the older singles are widowed males which have lost their mates mainly to Red Foxes (*Vulpes vulpes*).

Fifty samples of each of these 4 categories were taken, 30 in feeding situations, 20 during other activities. Each sample consisted of a five minute focal observation period of one individual gander. Frequency and duration of extreme head up (vigilance posture, LAZARUS & INGLIS 1978, FISCHER 1965) were protocolled as well as general activity, size and density of the flock present, using the following density codes: 1: flock closely together, average distance between individuals < 1 m, 2: flock together, 1-2 m average distance between individuals,

Table 1. The sozial organisation of the Greylag goose flock in September 1992. — Die soziale Zusammensetzung der Graugansschar im September 1992.

	Male	Female
Pairs with goslings	4	4
Single goose with goslings	—	1
Pairs with last years goslings	1	1
Pairs without goslings	37*	19
Trios**	4	2
Singles	38	9
Sum	84	36
Total adults		120
Goslings		28
Total flock size		148

* Includes 9 gander-gander pairs

** Trios consist of two male and one female geese

3: flock tends to disintegrate into sub-clusters, 2-3 m average distance between individuals,

4: flock disintegrated into sub-clusters, 3-5 m average distance between sub-clusters,

5: flock widely dispersed into small subgroups, > 5 m average distance between subgroups.

Differences between gander-groups were tested for significance with a Mann-Whitney U test.

3. Results

Family ganders and heterosexually paired ganders are in the feeding situation significantly more vigilant than in the non-feeding situation (family ganders: $p < 0,001$; heterosexually paired ganders: $p < 0,05$), whereas gander-pairs and singles do not differ significantly.

Table 2. Differences of vigilance frequencies between the social categories in the feeding high density flock (top) and low density flock (below). Values given show average number of extreme head-ups per five minutes $\pm$ standard deviation. — Unterschiede in den Sicherfrequenzen zwischen den sozialen Kategorien in der fressenden Schar bei hoher Schardichte (oben) und bei geringer Schardichte (unten). Die Werte zeigen die durchschnittliche Sicherfrequenz pro fünf Minuten $\pm$ Standardabweichung.

High density of the feeding flock				
	Family ganders	Heterosexually paired ganders	Ganders paired with ganders	Singles
	6.23 $\pm$ 3.83	3.00 $\pm$ 2.83	1.40 $\pm$ 1.69	1.13 $\pm$ 1.75
Family ganders 1.86 $\pm$ 2.15		$p < 0.05$	$p < 0.001$	$p < 0.001$
Heterosexually paired ganders 1.62 $\pm$ 1.46	$p < 0.05$		ns	ns
Ganders paired with ganders 1.6 $\pm$ 0.92	ns	ns		ns
Singles 1.00 $\pm$ 1.59	$p < 0.05$	ns	$p < 0.05$	
Low density of the feeding flock				

Vigilance frequencies of family ganders significantly exceed those of all others in the high flock density feeding situation (Tab. 2), whereas no significant differences were detected between the other gander categories. The same pattern applies for vigilance duration (Tab. 3).

At low flock densities, family ganders are still significantly more vigilant than heterosexually paired males or singles (Tab. 2). Also, ganders in gander-pairs significantly exceed singles in vigilance frequency. In the low flock density feeding situation, vigilance duration of family ganders is significantly higher than in all other categories (Tab. 3).

Table 3. Differences of vigilance duration between social categories in the feeding hight density flock (top) and low density flock (below). Valurs given show average total duration of vigilance (in seconds) per five minutes $\pm$ standard deviation. — Unterschiede in der Sicherdauer zwischen den sozialen Kategorien in der fressenden Schar bei hoher Schardichte (oben) und bei geringer Schardichte (unten). Die Werte zeigen die durchschnittliche Gesamtsicherdauer (in Sekunden) je fünf Minuten $\pm$ Standardabweichung.

High density of the feeding flock				
	Family ganders	Heterosexually paired ganders	Ganders paired with ganders	Singles
	47.31 $\pm$ 32.65	17.00 $\pm$ 15.67	10.95 $\pm$ 18.85	6.80 $\pm$ 10.39
Family ganders 28.03 $\pm$ 48.16		p < 0,05	p < 0,001	p < 0,001
Heterosexually paired ganders 10.90 $\pm$ 12.81	p < 0,05		ns	ns
Ganders paired with ganders 12.50 $\pm$ 14.91	p < 0.05	ns		ns
Singles 12.53 $\pm$ 21.91	p < 0.05	ns	ns	
Low density of the feeding flock				

Even though frequency and duration of vigilance during activities other than feeding appeared higher in family ganders as compared to others, no significant differences were detected (Tab. 4).

Table 4. Vigilance frequency and duration in activities other than feeding. — Sicherfrequenz und -Dauer bei anderen Aktivitäten als Fressen.

	Frequency	Duration in s per 5 min
Family ganders	4.16 $\pm$ 10.82	20.15 $\pm$ 30.68
Heterosexually paired ganders	0.70 $\pm$ 1.00	6.35 $\pm$ 13.61
Ganders paired with ganders	1.05 $\pm$ 1.28	12.60 $\pm$ 23.51
Singles	1.05 $\pm$ 1.75	17.25 $\pm$ 28.02

When comparing within the gander categories, vigilance frequencies within family ganders, but not within any of the other categories are significantly higher in the high, as compared to the low flock density feeding situation. Even though differences were not significant, the same trend appeared for vigilance duration (Tab. 2, 3). Relative to flock density during feeding, vigilance frequency of all gander categories shows a bimodal distribution, with vigilance maxima at high and low flock densities (Fig. 1). Vigilance frequencies of family ganders and paired ganders are highest at

high and low flock densities, but lowest at intermediate flock densities. Such a bimodal distribution of vigilance frequencies is only valid for feeding situations. At the other activities monitored, vigilance frequencies tend to increase just with decreasing flock density.

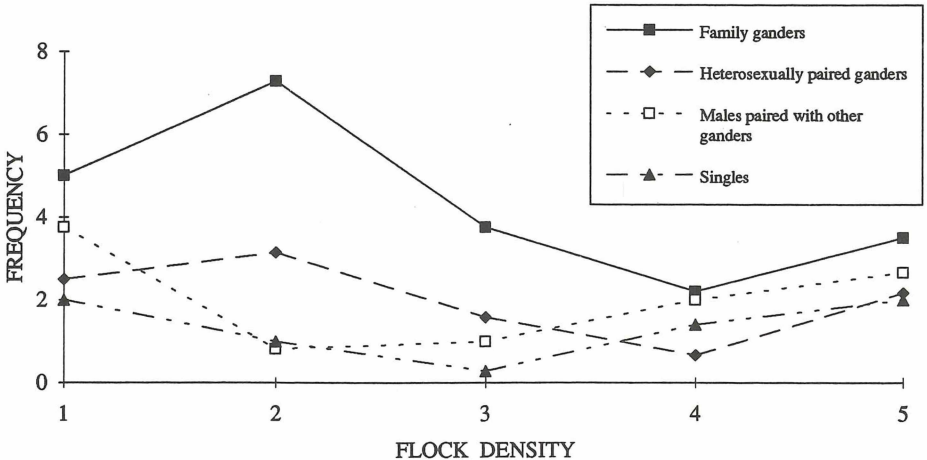


Fig. 1. Vigilance frequencies of family ganders are much higher than those of other gander categories at high flock densities, but only slightly higher at low flock densities. — Die Sicherfrequenzen der Familienganter sind bei hoher Schardichte um viel, bei geringer Schardichte nur um wenig höher als jene der anderen Ganterkategorien.

4. Discussion

From the present results it seems clear, that the investment into vigilance depends on social status, ambient flock density and behavioural background.

If vigilance behaviour is functional at all, one ought to expect the highest investment in family ganders, where the survival of offspring is at stake, the lowest in singles, which do not even have to guard a mate. This agrees with our present findings.

More surprising was the bimodal, density-dependent distribution of vigilance frequencies in feeding situations, particularly in the high-status male categories. According to the literature (LAZARUS 1978, BERTRAM 1980) and our own observations (KOTRSCHAL et al. 1992), individual vigilance frequencies tend to decrease with increasing flock size. A density dependence is hitherto undescribed, probably because these observations depended on natural fluctuations of the number of individuals of wild flocks, but flock densities could not be manipulated and individuals were not individually marked. In case of the semitame Grünau flock, number of individuals varies only slightly, whereas densities can be manipulated by supplemental food.

Remarkable, the highest vigilance frequencies in the family as well as paired ganders do not occur at highest flock density, but at a slightly decreased density. This may be explained by relatively high grain densities (KOTRSCHAL et al. 1994), where feeding prevails all other activities, even in family ganders.

Whereas increasing vigilance with decreasing flock size and density may be plausibly explained with increasing domains of danger (LAZARUS 1978), the high vigilance frequencies at the high-density feeding situations is open to a number of alternative explanations:

1. The increase of background noise at high flock densities necessitates an increase in predator-related vigilance. Even though this hypothesis was not rigorously tested, it is an unlikely explanation, because in activities other than feeding, no high flock-density related increase of vigilance frequencies occurs.
2. Individuals monitor the flock for the position of other individuals.
3. Dominant individuals advertise their presence to other flock members, keep them at a distance and thus prevent unnecessary agonistic interactions.

Hypotheses 2 and 3 are in agreement with our present data where at high flock densities vigilance frequencies increased only in feeding situations, but not in non-feeding situations. According to hypothesis 2, all individuals irrespective of social status should equally monitor their surrounding, or high-ranking ganders should do even less than low-ranking. This is not the case. Therefore advertising one's own dominance in high flock density feeding situations remains the most likely explanation for the patterns presently found.

Literature

- BERTRAM, B. C. R. (1980): Vigilance and group size in Ostriches. *Anim. Behav.* 28: 278-286. — BLACK, J. M. & OWEN, M. (1989): Parent-offspring relationships in wintering Barnacle Geese. *Anim. Behav.* 37: 187-198. — FISCHER, H. (1965): Das Triumphgeschrei der Graugans (*Anser anser*). *Z. f. Tierpsychol.* 22: 247-304. — KENWARD, R. E. (1978): Hawks and doves: factors affecting success and selection in goshawk attacks on Wood-pigeons. *J. Anim. Ecol.* 47: 449-60. — KOTRSCHAL, K., HEMETSBERGER, J. & DITTAMI, J. (1992): Vigilance in a flock of semi-tame Greylag Geese *Anser anser* in response to approaching eagles *Haliaeetus albicilla* and *Aquila chrysaetos*. *Wildfowl* 43: 215-219. — KOTRSCHAL, K., J. HEMETSBERGER & J. DITTAMI (1994): Food exploitation by a winter flock of Greylag Geese: behavioural dynamics, competition and social status. *Behav. Ecol. Sociobiol.* In press. — LAMPRECHT, J. (1986): Structure and causation of the dominance hierarchy in a flock of Barheaded Geese (*Anser indicus*). *Behaviour* 96: 28-48. — LAMPRECHT, J. (1989): Mate guarding in Geese: Awaiting female receptivity, protection of paternity or support of female feeding. In: *The Sociobiology of Sexual and Reproductive Strategies*. (RASA, A.E., VOGEL, C. & VOLAND, E., eds.). New York, pp. 48-60. — LAZARUS, J. (1978): Vigilance, flock size and domain of danger size in the White-fronted Goose. *Wildfowl* 29: 135-145. — LAZARUS, J. & INGLIS, I. R. (1978): The breeding behaviour of the Pink-footed Goose: Parental care and vigilant behaviour during the fledging period. *Behaviour* 65: 62-88. — LORENZ, K. (1988): *Hier bin ich — wo bist Du?* Ethologie der Graugans. Piper, München.

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