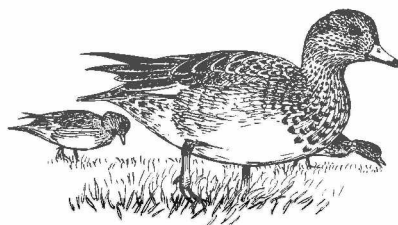


Grazing and vigilance behaviour of breeding Eurasian Wigeon *Anas penelope* in relation to distance from water



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Grazing and vigilance behaviour in breeding Eurasian Wigeon at various distances from water were studied in 1983 and 1984 in western Norway. Females performed longer grazing bouts, pecked with a higher rate and were vigilant for shorter periods than males. The length of grazing bouts and peck rate in males decreased, whereas their length of vigilance bouts increased, with distance from water. In females, length of grazing and vigilance bouts and peck rate were independent of distance from water. We conclude that Wigeon generally feed close to water because they may be in more riskier areas when they move further ashore. The decreasing length of grazing bouts and increasing length of vigilance bouts in males with increasing distance from water, is explained by potential differences in predation pressure between the sexes.

Keywords: Wigeon, *Anas penelope*, Grazing, Vigilance, Predation, Sexual Difference

Optimal foraging theory predicts that animals forage so as to maximize their net rate of energy intake per unit time (Pyke *et al.* 1977, Krebs 1978). This strategy is often modified by conflicting demands, such as defending a territory, attracting a mate and avoiding predators (Barnard 1983).

In birds, feeding and scanning for predators are considered mutually exclusive activities (Caraco 1982, Pöysä 1987, Desportes *et al.* 1991). Both protection against predators and the rate of food intake can be improved by joining a flock, because many eyes may help to detect an approaching predator earlier and thus increase an individual's probability of escaping attacks (e.g. Powell 1974). On the other hand, studies in which vigilance increases with distance to cover have interpreted the greater vigilance as an adaptive response to an increased predation risk away from the protection afforded by vegetation (e.g. Barnard 1980, Caraco *et al.* 1980, Hogstad 1988). Less attention has been paid to the differential effect that distance from safety may have on the grazing and vigilance behaviour of the two sexes of one particular species. We collected data on grazing bouts, vigilance bouts and peck rates of male and female Eurasian Wigeon *Anas penelope* (hereafter called Wigeon) at various distances from water. Wigeon are good subjects for such studies, because their

feeding and vigilant postures are easily distinguishable, and because they prefer to graze on grasslands with low vegetation, making them easily detectable. To compensate for a greater risk of predation with increasing distance from safety, we predicted that Wigeon should be more vigilant and graze with a lower intensity if they moved away from water. The most likely avian and ground predators on Wigeon and other dabbling ducks in our study area, are Goshawk *Accipiter gentilis* and red fox *Vulpes vulpes* (J. Stenersen pers comm., own obs.).

Methods

We collected data on six pairs of Wigeon between 10 April and 23 May in 1983, and from four pairs of Wigeon between 20 April and 22 May in 1984 in Sveio (59°33'N, 5°21'E), western Norway. Details of the study area and the breeding population of Wigeon are given elsewhere (Jacobsen & Ugelvik 1992). The pairs studied each year constituted about 20% and 15% respectively of the entire breeding population in an area of about 150 square km. This is the largest single population of breeding Wigeon in Hordaland county, and it is mainly restricted to lakes and ponds surrounded by agricultural fields, heather *Cal-*

luna vulgaris and patches of mixed forest.

Immediately after arrival, the pairs spaced out among breeding lakes and occupied parts of a lake where all activities, e.g. feeding, resting and courtship occurred (Ugelvik 1986).

We watched different pairs from vantage points at distances approaching 200 m, using binoculars (8x40) and a telescope (25-40x). Individuals were easily recognized by variation in plumage characteristics (Cramp & Simmons 1977).

Grazing distance from water

Grazing distance (m) from the shoreline was estimated by using specific objects (trees, stones) on agricultural fields as approximate measurements from the water's edge. Data on one pair's grazing and vigilance behaviour were recorded on agricultural fields randomly between 05.00 and 23.00 h when no other birds there (ducks, waders, gulls) were visible to the observer. Data on grazing and vigilance behaviour were not affected by the variable observation time.

Grazing bouts, vigilance periods and peck rates

We defined length(s) of a grazing bout as the period when a Wigeon lowered its head into terrestrial vegetation and until grazing was interrupted by another activity, e.g. preening or vigilance. Although vigilance could be terminated by different behavioural activities, we defined a vigilance bout as a Wigeon standing upright looking around itself before grazing was continued. To compare the length of grazing and vigilance bouts between the sexes, we followed one pair continuously for between 1 and 10 min. Since the members of a Wigeon pair are closely associated and rarely graze more than 5 m from each other, both individuals could be watched simultaneously.

The lengths of grazing bouts and vigilance periods of both sexes at different distances from water were dictated onto a portable tape recorder. Later, we calculated the average length of grazing and vigilance bouts in male and female Wigeon. All time measurements were made with a precision of ± 0.5 s.

We recorded the peck rate for each sex during 1-min intervals using a hand counter (see Jacobsen 1992 for details). Peck rates were correlated with the birds' grazing distances from water.

Statistical analyses

We used regression analysis to examine whether length of grazing and vigilance bouts and peck rates varied at different distances from water for each sex. Wilcoxon matched-pairs signed-ranks tests were used to measure intrasexual differences in length of grazing and vigilance bouts and peck rates. Tests are two-tailed.

Results

Grazing bouts, vigilance periods and peck rates

The average duration of grazing bouts was longer in females than in males, whereas the average duration of vigilance bouts was longer in males than in females (Table 1). Females pecked with a higher rate than males (Table 1).

The average length of grazing bouts was inversely correlated with increasing distance from water in males ($r^2=0.36$, $df=55$, $P=0.018$), but not in females ($r^2=0.03$, $df=61$, n.s.) (Figure 1A). Males were vigilant for longer periods when they moved ashore ($r^2=0.46$, $df=53$, $P<0.001$), whereas females were not ($r^2=0.02$, $df=55$, n.s.) (Figure 1B). Peck rate decreased with distance from water in males ($r^2=0.63$, $df=57$, $P<0.001$), but

Table 1. Average length of grazing and vigilance bouts, and average peck rate from male and female Eurasian Wigeon. Numbers in parenthesis refer to total no. of observations.

Behaviour	Males ($\bar{X} \pm SE$)	Females ($\bar{X} \pm SE$)	<i>P</i>
Grazing bouts (s)	10.4 \pm 0.58 (57)	21.5 \pm 0.84 (63)	***
Vigilance bouts (s)	31.4 \pm 1.99 (55)	4.3 \pm 0.46 (57)	***
Peck rate (pecks/min)	22.6 \pm 0.86 (57)	68.8 \pm 1.04 (59)	***

NOTE: *** = $P<0.001$, Wilcoxon matched-pairs signed-ranks tests comparing between-sex grazing and vigilance behaviour.

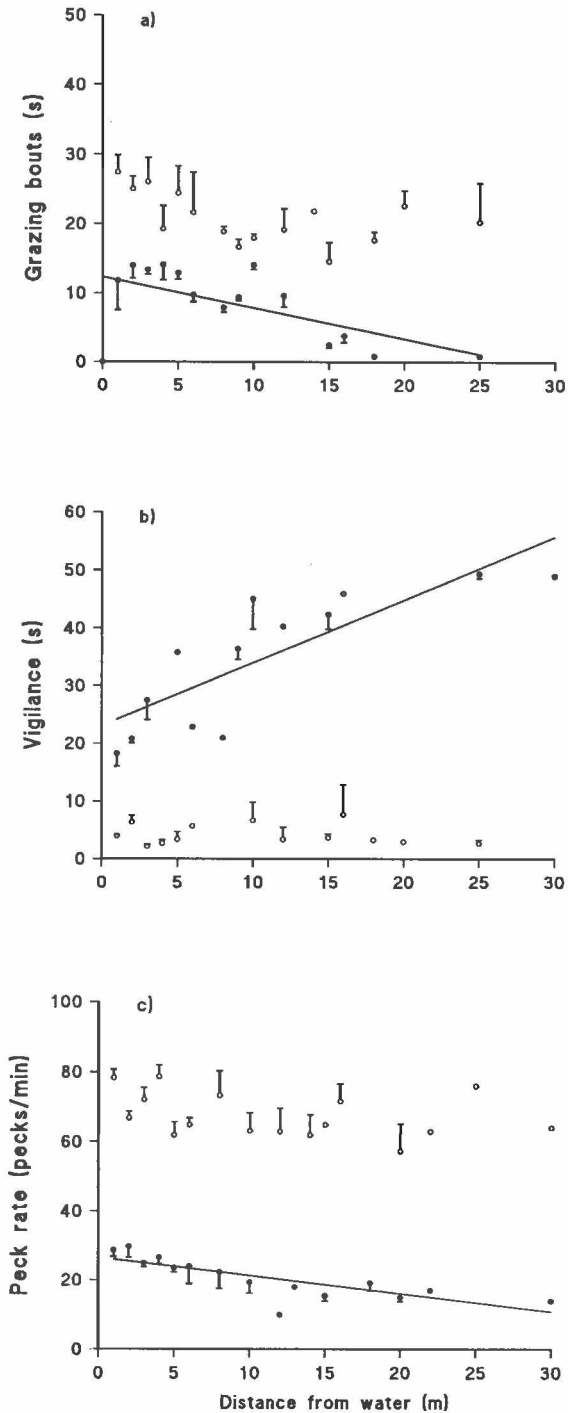


Figure 1. Relationship between average length (\pm SE) of grazing bouts (A), vigilance bouts (B) and average (\pm SE) peck rate (C) of male (closed circles) and female Eurasian Wigeon (open circles) with increasing distance from water. The regression lines are drawn for significant data.

not in females ($r^2=0.01$, $df=55$, n.s.) (**Figure 1C**).

Discussion

Previous studies have shown that Wigeon select feeding sites close to water (Jacobsen 1986, Mayhew & Houston 1989), and that they are more vigilant in terrestrial habitats than in aquatic habitats (Jacobsen & Ugelvik 1992). This behaviour is interpreted as an anti-predator response. The fact that the male's vigilance increases and length of grazing bout decreases with distance from water, supports the hypothesis that Wigeon may be in riskier areas when they move away from water.

Wigeon males grazed with a lower intensity (lower peck rates and shorter grazing bouts) and were more vigilant when they moved away from water, whereas grazing intensity in females was not affected by distance from water (**Figure 1**). It seems likely that scanning should increase with distance to safety only if a bird has a greater risk of being predated while feeding further from safety (Elgar 1989). Our data suggest that male Wigeon face a greater risk of predation than females, partly due to the males' more conspicuous plumage. Similar arguments have been outlined by Mayhew (1987). Lendrem (1983) found that the di-

vergence in vigilance of male and female Mallard *Anas platyrhynchos* increased if they moved to an area where the risk from terrestrial predators increased. He argued that this behaviour was reflected by the male's greater risk of being predated, due to its more conspicuous plumage.

The fact that females graze with a higher intensity and are vigilant for shorter periods than males, strongly suggests that females are increasing their food intake prior to breeding. During parts of the breeding season, a female is closely associated with its more vigilant mate (Ugelvik 1986). A male accompanying its female affords her greater undisturbed feeding time, guards against encounters with predators, and reduces the probability of being raped by male conspecifics (McKinney *et al.* 1983).

From our study it is difficult to evaluate the most efficient anti-predator strategies of grazing male and female Wigeon, because we lack data on attack rates and the ducks' ability to respond effectively as a function of distance to safety. It seems, however, reasonable to consider vigilance behaviour in a more general sense as the means by which the birds continuously receive information from the environment (Elgar 1989, Lazarus & Symonds 1992). The selection pressures that affect vigilance behaviour should therefore be a subject for future research.

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