Vigilance levels in European Wigeon – sexual differences

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Introduction

A higher level of alert behaviour in males compared with females has been reported in several bird species, primarily wildfowl. Most studies concern birds during the breeding season, either before or during laying (e.g. Fox and Madsen 1981; Kaminski and Prince 1981) or after nesting (e.g. Harwood 1975; Lazarus and Inglis 1978; Stroud 1982). The usual explanation for this male vigilance is that in the former period it allows female birds the more quickly to put on reserves for nesting and in the latter to restore them after long weeks of incubation. A further hypothesis for high male vigilance, especially during the pre-laying phase in ducks, is that it guards the female against rape attempts by other males (Kaminski and Prince 1981; McKinney and Stolen 1982; Lendrem 1983a; Goodburn 1984).

Apart from breeding wildfowl, only a few records of sexual differences in vigilance rates have been reported (Bertram 1980; Lendrem 1983b). Again, male vigilance is greater than female, but explanations are less clear. This paper provides some data on vigilance levels in European Wigeon *Anas penelope* outside of the breeding season and discusses the various hypotheses put forward to explain sex differences in vigilance. Results on the effect of flock size on vigilance are also reported.

Methods

Study site

This study was part of a three year (1980–1983) investigation of the feeding ecology and behaviour of Wigeon, carried out at the Wildfowl Trust's refuge at Caerlaverock on the Solway Firth, south-west Scotland. A population of up to 800 Wigeon regularly winter on this site from October to March. The refuge offered excellent facilities for the observation of grazing wildfowl (hides within 30 m of most grazing sites). Birds were observed using 8x40 binoculars and a 25–40x zoom telescope.

The Wigeon fed primarily on four cattle-grazed fields within the refuge. Along the edge of each field were two or three ponds. Since the Wigeon always fed in close proximity to water, each pond plus adjoining grassland comprised an individual Wigeon feeding site.

Vigilance measurement

Vigilance was measured as % time with head up in a grazing bird (i.e. grazing was its predominant activity). Wildfowl adopt several different postures when vigilant e.g. 'head up', 'extreme head up' (Lazarus 1978). In Wigeon, the most common vigilance posture when grazing was a 'rapid head up' similar to a head flick, but which clearly involved a scanning motion. No distinction was made between the various head up positions. Total vigilance time was cumulated on one stop-watch, while total observation time was recorded on another. Total observation time was never less than one minute and never more than six (the vast majority were in the 1.5–3 minutes range). No relationship was found between observation time and % time vigilant, i.e. the variable observation time did not bias the results.

Study details

Two main vigilance studies were undertaken. In the first study, which was carried out from December to March on a single large feeding site, vigilance was measured in relation to distance from water. The randomly selected focal bird's distance from water (the edge of the pond) was estimated on a scale of 0–10 m; 20–30 m; 50–70 m. If the bird moved out of its distance category during the observation the result was discarded. These distances were estimated by eye, but were considered to be reasonably accurate since the approximate length of the field was known and the distance categories were wide. The size of the flock in which the bird was grazing was also recorded.

In the second study, the effect of flock size on vigilance was assessed. Observa-

tions were carried out on six separate, but very similar, feeding sites during March only, since small flocks were more common at this time of year. Observations were only made when the focal bird was <10 m from water, in order to control for this variable.

In both studies the sex of the focal bird was recorded. Normally different sexes were observed alternately, so as to provide an approximately equal number of each sex in the sample. Thus, if the randomly selected individual was of the 'wrong' sex, then the nearest bird of correct sex to this random one was observed.

Results

Figure 1 shows the relationship between % time vigilant and distance from water, separated for sex. In order to control for the effect of flock size (see Figure 2), only birds in a flock size >18 were included in this analysis. Wigeon gradually become more vigilant as they move away from water, since feeding near to water seems primarily to be an anti-predator strategy. In all distance categories, males were more vigilant than females, significantly so in all but the final category (see Table 1). Covariance analysis showed the overall effect of sex to be highly significant ($F_{1,\ 155}=32.31$, $P<0.001$). The divergence in male and female vigilance tended to increase with distance from water, but decreased at 60 m from water (Table 1).

In the flock size/vigilance study, % time vigilant decreased exponentially with increasing flock size, asymptoting at about 18 birds (Figure 2 – $r_{s\ 200}= -0.720$, $P<0.001$). When sexual differences for each flock size were examined no significant difference was found except at a flock size of two (Table 2). Of the other flock sizes studied (16 in all),

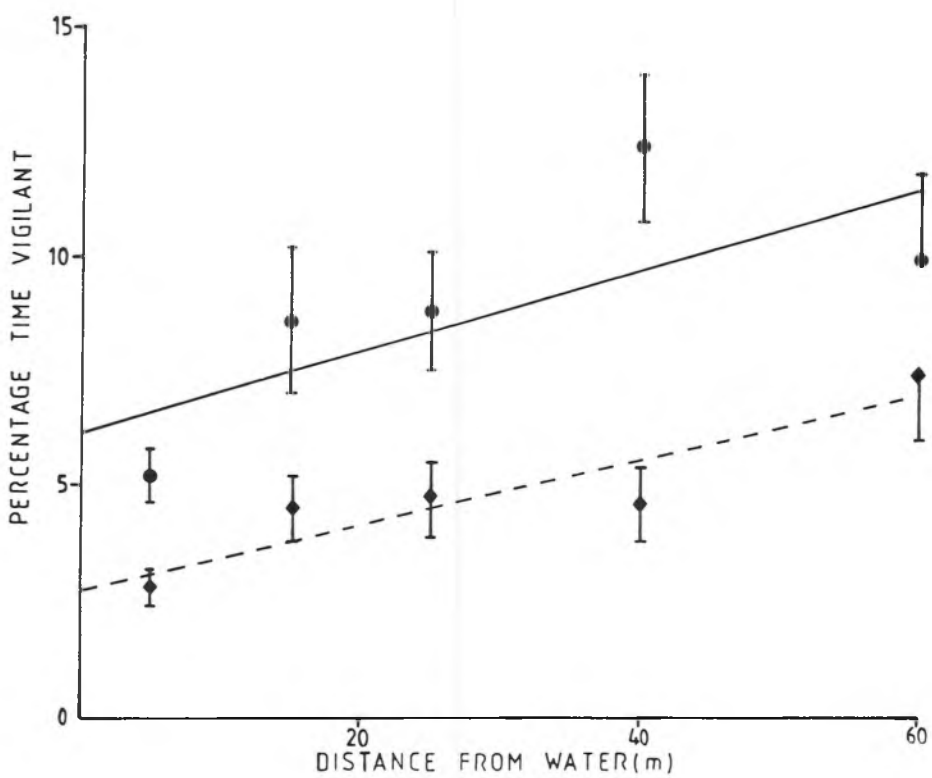

Figure 1. Regression of % time vigilant (mean ± 1 s.e.) on distance from water, separated for sex (flock size >18).

——— male (y=0.09x + 6.19)
_ _ _ _ _ _ _ _ female (y=0.07x + 2.76)

Table 1. Difference in % time vigilant (male – female) at increasing distances from water, plus results of t-tests on difference (see figure 1)

Distance from water (m)	5	15	25	40	60
% vigilance difference	2.41	4.11	4.10	7.82	2.61
t (d.f.)	3.14(44)	3.02(32)	2.77(25)	4.42(22)	1.02(25)
p	<0.005	0.005	0.01	<0.001	n.s.

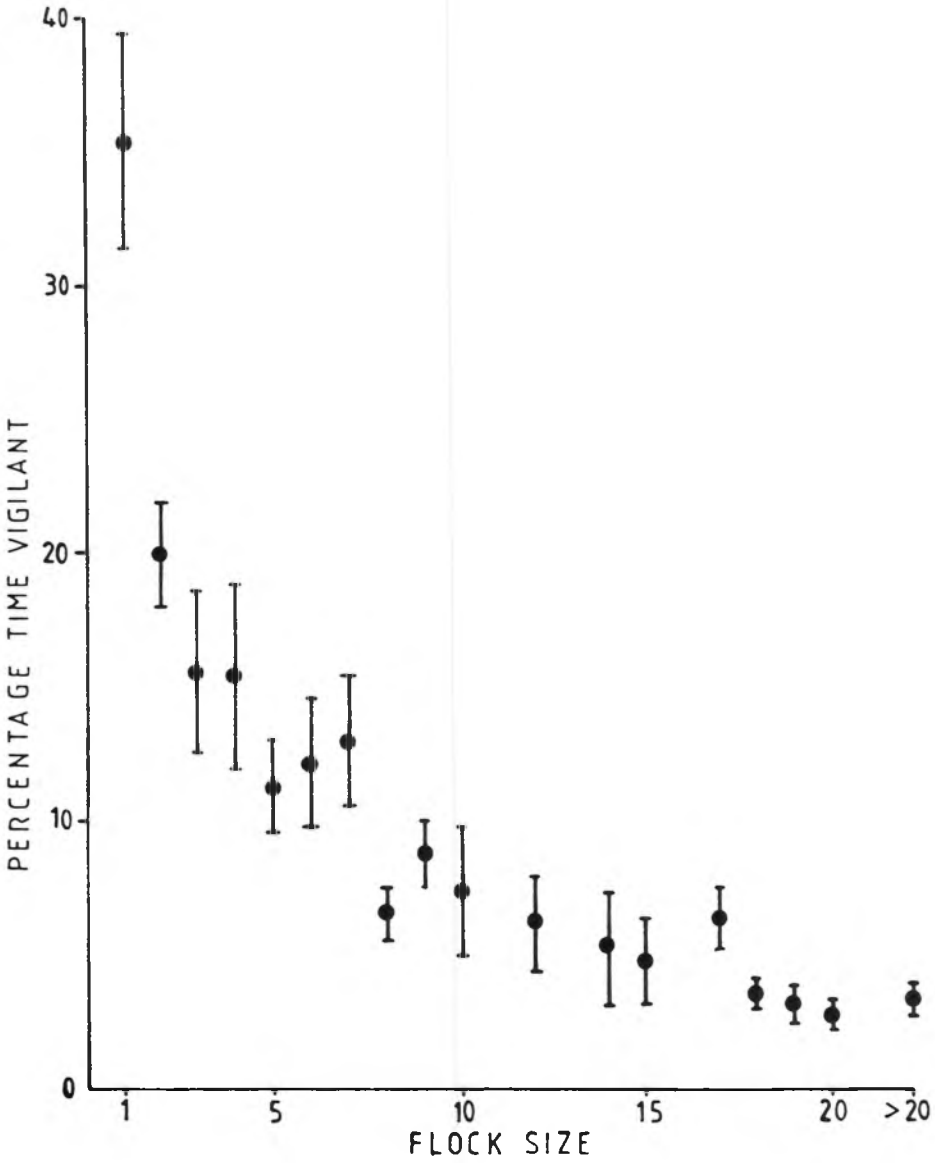

Figure 2. Effect of flock size in % time vigilant (mean ± 1 s.e.) (r_s 200 = −0.720, P<0.001).

males were more vigilant, but not significantly, in nine cases. Thus, outside a flock size of two, no clear sex difference is apparent.

Table 2. Changes in % time vigilant with flock size, separated for males and females.

Flock size	Male	Female
1	35.2	no data
2	26.3	12.2
3	10.4	19.1
4	9.7	21.2
5	10.6	12.0
6	13.1	10.9
7	15.3	9.5
8	8.7	5.2
9	7.9	9.7
10	5.6	9.2
12	4.9	9.0
14	6.2	4.7
15	3.7	5.4
17	6.9	5.8
18	4.2	2.7
19	4.0	2.5
20	3.7	2.1
>20	3.8	2.9

Note: Male/female differences only significant ($P<0.001$) at Flock size 2.

Discussion

Apart from mate-guarding (see Introduction), two hypotheses have been put forward to explain sex differences in vigilance (Lendrem 1983a). Firstly, males may be looking for females to rape and secondly, males (in many species) are far more conspicuous than females, and their higher vigilance levels reflect the greater risks they face from predatory attacks.

While these explanations are not mutually exclusive, certain results from other wildfowl studies lend support to the latter hypothesis. Fox and Madsen (1981) report that male Greenland White-fronted Geese *Anser albifrons flavirostris* spend very significantly more time alert than their mates, when feeding in solitary pairs on the breeding grounds. However, when the pair joins a flock of geese, the difference virtually disappears. They suggest that this is because vigilance can now be shared by all flock members. Thus, in species with no obvious sexual dimorphism in plumage colour, males and females show similar vigilance levels when the male is not mate-guarding.

Secondly, Lendrem (1983b) finds that male peeking rates in Mallard *Anas platyrhynchos* fall when the birds adopt eclipse plumage. This fall does not seem to be attributable to the absence of a mate who needs to be guarded, since in June high levels of vigilance are maintained even in the absence of a partner. He also reports that as predation risk increases (when birds on a river get closer to the bank and are thus more at risk from terrestrial predators) the male/female divergence in vigilance increases. He suggests that this is because males are inherently more at risk from predation and are, therefore, more wary in riskier situations. There is no reason why opportunities for rape should increase in riskier areas. This is very similar to the result reported in Table 1. Male/female vigilance divergence tends to increase as birds on land move to riskier areas further from water. The decrease in male vigilance at 60 m from water is an anomaly. In wet conditions a 'flash' pond did form in the centre of the field, approximately 80–100 m from the main pond edge. This safe retreat may have had more effect on the alertness of the high risk males than of the females.

The results from the flock size/vigilance study are initially confusing. One would expect high male vigilance to be found in all flock sizes, if males are inherently more at risk from predation. However, because it was difficult regularly to find specific flock sizes for study, sample sizes of each sex were small (average n=6). Thus, samples may simply not have been large enough to pick up a sex difference. At flock size two, however, a highly significant difference was found, with males being more than twice as vigilant as females. In virtually all cases, groups of this size contained a bird of each sex and it is very likely that, in early spring, they were paired birds. This suggests that the difference was due to mate-guarding, males protecting their partners from predators and rape attempts, and thus allowing them to put on reserves for breeding. In larger groups, birds are less likely to be paired, so that differences in vigilance levels are not so obvious. Interestingly, a similar result was found in Ostriches *Struthia camelus* by Bertram (1980). In a group size of two, he found a significant difference in male/female vigilance but not in other group sizes.

Head up postures could, of course, be less concerned with detecting danger than with assessing the location of neighbours and their success in foraging. Again, sex differences would not be expected.

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Summary

Male Wigeon *Anas penelope*, feeding on a reserve in south-west Scotland, are generally more vigilant than female birds. The divergence in vigilance rates tends to increase in riskier situations. In small flock sizes, no difference was detected except in solitary pairs, when males were more than twice as vigilant as their mates. Individual vigilance rates decrease exponentially with increasing flock size. The most likely reasons for the sex difference are the conspicuous male plumage and mate guarding.

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