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Advantages of Foraging in Flocks in African Mourning Dove *Streptopeliadecipiens*

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Abstract: ***Field Observations were made on the Mourning Dove Streptopeliadecipiens, under natural conditions at Hantub and Khartoum, Sudan. Data are provided on vigilance and pecking in individuals foraging alone, as members of pairs and as members of flocks. Measurements were also made on reaction and flight distances for different flock sizes. The result obtained tends to support the hypothesis that birds gain feeding and anti-predator advantages by formation of flocks.***

Keywords: Foraging, Predators, Vigilance, Flock size, Reaction distance and Flight distance

1. Introduction

There has been considerable speculation on the function of flocking in birds. One possible explanation is that individual birds increase their enhance of locating rich sources of food and/ or enhance their food intake by feeding in flocks (Murton, 1971, Ward and Zahavi, 1973, Hamed and Evans, 1984, Krebs*et al.*, 1972). Baker *et al*., 1981 found that it was only dominant individuals in captive groups of junco – finch, *Junco hyemalis*, which increase their food intake by being in a flock.

Another hypothesis is that by flocking, individuals increase their protection from attack by predators, (e.g. Vine, 1971, Elgar, 1989, Elgar *etal.*, 1984). Flocking, functions in this way by providing earlier warning of predator attack and reducing the risk of capture once an encounter between predator and prey has been initiated by mobbing or confusion. Several studies have shown that birdsin flocks spent less time looking around for predators than those feeding alone (e.g. Powell, 1974, Siegfried and Underfull, 1975, Lazarus, 1978 ,1979). Jennings and Evans, 1980, found that individuals on the periphery of flocks of Starlings spend more time vigilant than those in the center. A number of field studies have shown that birds in a flock spend less time vigilant and more time feeding than individuals on their own (Murton, 1986, *et al.*, 1971, Smith and Evans, 1973, Feare*etal.*, 1974). Some predation is, however still likely to occur, if individuals on the periphery of a flock are more likely to be preyed upon than those in the center (Hamilton, 1971); they might be expected to spend more time vigilant.

The object of this study is to investigate the difference of behavior of individual, of *Streptopeliadecipiens* foraging in different flock sizes. Particular attention was given to head-up posture, which was used as a measure of vigilance, and pecking rate, which may be related to food intake. Estimates were also made of reaction to the predation (reaction distance) and flight distance of birds foraging in different flock sizes.

2. Materials and Methods

The study was carried out at two sites in Wad Medani and Sunut Forest (Khartoum), Sudan. The fieldwork was carried out from April to June 1983 at Hantub secondary school play fields, and adjacent agricultural land, in Sunut Forest on March to April 2015. The secondary school play fields and the adjacent agricultural land measured approximately 1.5 x 2.5 Km. The play fields were divided into six open areas, parts of which were used as football pitches. They were separated from one another by double rows of Neem, *Azadirachtaindica*, Mahogany *KheyaSenegalensis* trees. There was little interference, from pupilsfrom the school, who used the areas infrequently during the period of the study. Between these play fields and the Blue Nile River there are scattered Tuntub shrubs *Capparisdeciduas*, Hina*Lawsonia interims* hedges, thorn trees *Acacia* Spp., and several shrubs. The agricultural land is devoted to the growth of banana *Musca indica* and lime *Citrus aurnantifolia*, and some of which was devoted to various rootcrops vegetables and cereals.

The climate of Wad Medani is seasonal with rains falling from June to September, mostly in July and August. Grazing was prevented in the play fields and surrounding areas, as well as in the cultivated parts of the study site. This is an important advantage to seed eating birds like the Mourning Dove, because grass in this area will seed and provide food (in the form of fallen seeds) for the birds during the dry season.

The Sunut Forest is a site bordering the White Nile at Khartoum State on latitudes 15 35^{o} and longitudes 32 30^{o}. It covers an area of 482, 335 Feddans. There is an open area between the river and the Sunut Forest, where farming and grazing take place. The area lies in a shallow basin almost on the same level of the river. Most of the area is inundated during the rainy season. Then it dries up, after the flood season, except for few depressions that stagnant for longer periods. The area is semi-desert. The natural vegetation is dominated by *Acacia nilotica* and *A. syal* (Talih) (Mergani&Hamed, 2003).

Observations were made using binoculars (8x40), of birds, which were approximately 35 meters from the observer to avoid undue disturbance. The possibility that birds gain anti-predator and or feeding advantages by foraging in pairs or large groups was investigated into two ways. First, comparisons were made of the number of times individuals adopted head-up posture (scanning) number of scans per

minute (presumably on the look-out for predators); second the number of times they peck at the ground (presumably for food) when they were foraging in these situations: (I) on their own, (II) as members of pairs, (III) as members of large groups (number of birds in the flock ranging from 3 to 32 individuals). The head is held in an upright position in the head-up posture and the bird sometimes looks around, apparently scanning the surroundings.

Chosen subjects were observed continuously for 60 seconds and the numbers of pecks and occurrence of head-ups were recorded by speaking the information on portable tape recorder. Second, estimates were made of the distance at which birds, foraging in the three situations described above, reacted to approaching danger. A subject was chosen and the observer walked towards it, as far as possible, at uniform rate of one pace per second. He estimated the distance at which the subject first showed signs of detecting his presence (it invariably, did so by hoping away from him). This the reaction distance. The distance at which the bird flew off (flight distance) was also estimated.

Observations of vigilance and pecking were also made of birds foraging at the center of the flocks and at the periphery (number of birds the flock vary from 3 to 27).

The results were statistically analyzed. Means were presented throughout this paper as ± their standard errors. Data from the two sites were pooled together.

3. Results

3.1 Vigilance and pecking:

a) Flock size

Observation of the behavior of birds foraging in different social situations suggested that they gain anti-predators advantages by foraging in groups. Individual groups of two or more birds adopted the vigilance (head-up) posture less often than those foraging on their own (Table 1). The head-up posture was encountered significantly (P=0.0001, U-test) more often in birds foraging on their own (n = 230). This difference in behavior was enhanced in large flocks.

Feeding (pecking) difference between birds foraging alone and in medium and large flecks (Flock size 1-32) is highly significant (p = 0.001, U-test).

The difference in feeding behavior (Pecking), between small flocks and large flocks is shown in (fig. 1) and that of vigilance (Head-up) is shown in (fig. 2).

b) Influence of position in flock on feeding (pecking) and vigilance (head-up)

There is evidence that the position of the bird in the flocks affects its feeding behavior. Thus, birds at the periphery were found to take head-up posture significantly more than those in the center of small and medium size flocks (p < 0.005 U-test) and (fig. 4). In larger flocks (flock size 20, 22, 25, and 27) individual members do not seem to be affected by being in the periphery or in the center in relation to vigilance behavior (in both situations the frequency of head-up is zero (fig. 3). There appears to be an optimal group size at which point any additional members would not add to the efficiency of group's vigilance.

3.2 Reaction distance and flight distance:

Birds in flock of more than three individuals reacted earlier to the predator (observer) than those in flocks of three. Presumably, birds foraging in their own or in pairs detect the predator later than those in big flocks, generally the reaction distance increases with increase of flock size (fig. 5). The situation for flight distance is more complex. Here the difference in flight distance for different flock sizes was found to be not significant (p = 0.888 U-test) and (fig. 5), that is flock size and flight distance are not correlated (Table 1), and (fig. 6).

Table 1: Mean head-up and pecking rates, and reaction and flight distances in Mourning Doves foraging in their own, as members of pairs, and as members of larger groups (flock size 3 – 32 for head-up and pecking, and 4 – 28 for reaction and flight distances).

Subject	n	Head-up (per minute)	Pecks (per minute)	n	Reach on distance (m)	Flight distance (m)
Foraging alone	54	3.15±1.82	20.48±12.66	-	-	-
Foraging as member of pairs	62	2.0±1.31	19.53±16.52	11	21.53	23.80
Foraging as member of group	230	0.50±0.37	66.73±17.17	91	32.31	23.27

Notes: Significance differences (p > 0.04) or higher significance level; Spearman Rank correlation coefficient, except flight distance and flock size, which is not correlated (p = 0.948).

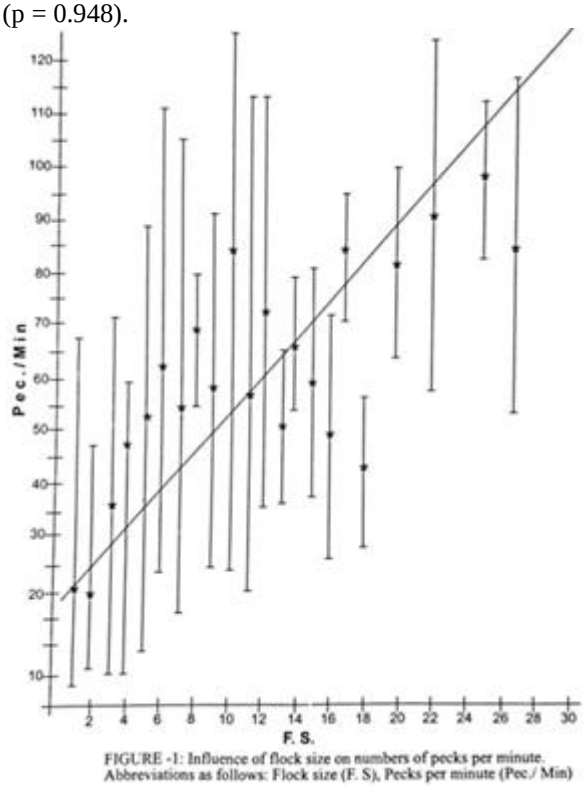

FIGURE -1: Influence of flock size on numbers of pecks per minute. Abbreviations as follows: Flock size (F. S), Pecks per minute (Pec./ Min)

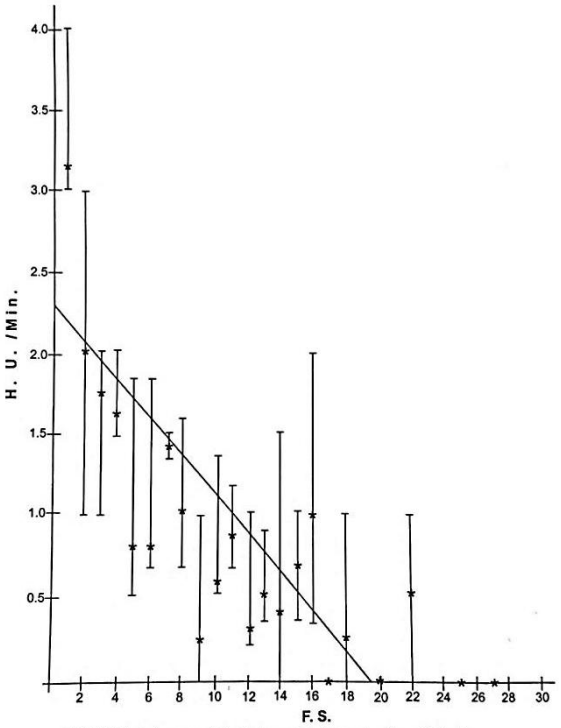

FIGURE-2: Influence of flock size on vigilance (anti-predation).
Abbreviation as follows: Head-up per minute (H .U. /Min), Flock size (F. S).

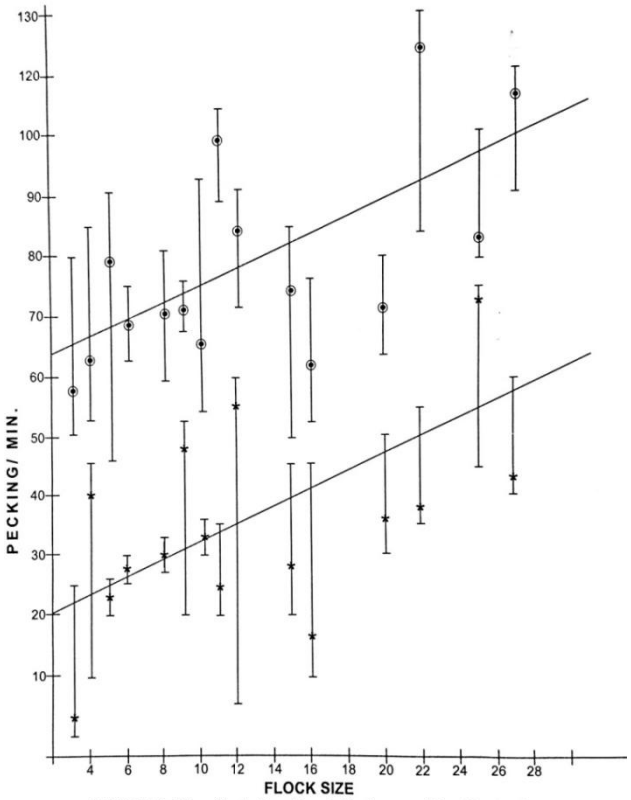

FIGURE-4: The effect of position in flock on pecking (feeding).
⊙: At the centre,*: at the periphery.

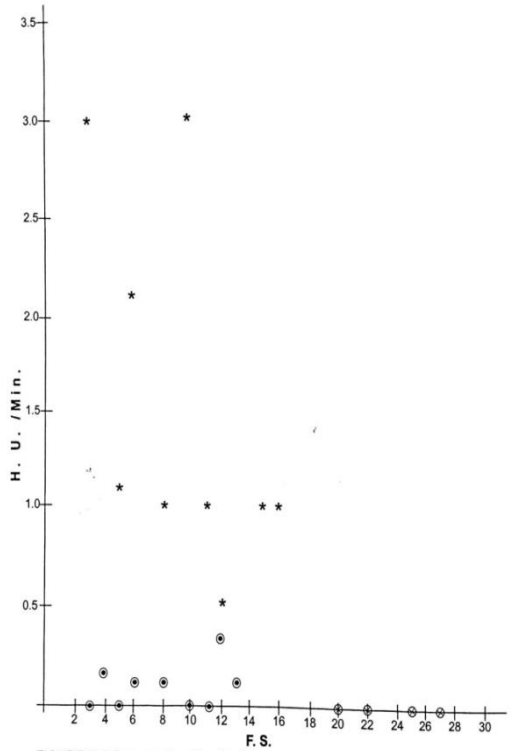

FIGURE-3: Influence of position (periphery-centre) in flock on vigilance.
Abbreviation as follows: Head-up per minute (H .U. /Min), Flock size (F. S).

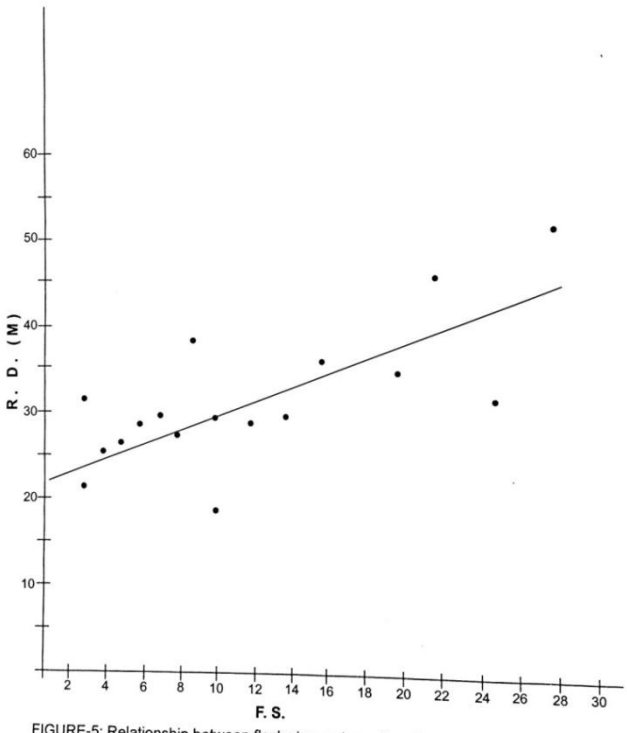

FIGURE-5: Relationship between flock size and reaction distance (R. D) (in meters).
Abbreviation as follows: Head-up per minute (H .U. /Min), Flock size (F. S).

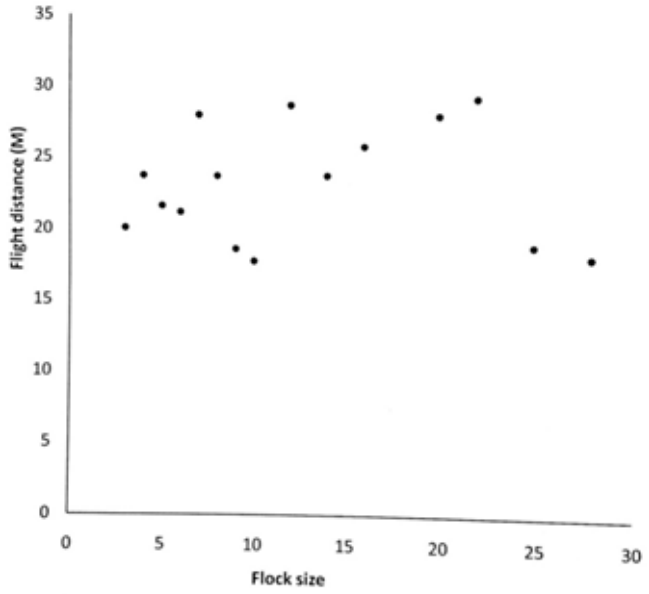

Fig 6: Relationship between flock size and flight distance

4. Discussion

a) Vigilance and pecking:

Flock Size

The present study has shown that *Streptopelia d. decipiens* enhance their food intake by being in a flock. The larger, the flock size, the greater, the frequency of pecking rate (Table 1). They also probably gained anti-predator advantages by forming larger flocks. Birds foraging alone, in pairs or in small flocks (3, 4 individuals) spent more time head-ups, and consequently less time feeding (used as measure of vigilance), than birds in medium and large size (10 – 32 individuals). They did nevertheless react to approaching danger soon than birds foraging in small flocks (3 – 5 birds), they also detect the approach of a predator later than those in big flocks. This presumably occurs because the flock as a whole stands a better chance detecting the approach of a predator than solitary and birds in small flocks. It's literary a case of several eyes (or ears) being better than one pair. Similar relationships between the time spent vigilant and flock size have been described in Red-cheeked Cordon bleus *Uraeginthusbengalus* by Hamed and Evans (1982), in Starlings *Sturnus vulgaris* by Jennings and Evans (1980), between flight distances and flock size in Starling by Powell (1974), in Barred Ground Doves *Geopeliastriata* by Greig-Smith (1981), in Western Evening Grosbeaks *Cocothraustervespertinus* by Bekoff (1995, 1996), and in birds generally, by Maynuts (2006) and Lazarus (1979). Earlier investigations have shown that birds devote more time to feeding when they are in groups (Alee 1938, Tolman 1967,1968).

The present study has shown that *Streptopeliadecipiens* enhance their food intake by being in a flock. The larger the flock size, the greater the frequency of pecking (Table 1).

Influence of position in flock

The hypothesis that individuals on the periphery of the flock are more likely to be preyed upon than those in the center (Hamilton 1971), is more or less supported by this study. Individuals on the periphery of a flock were found to spend more time looking around (and consequently less time feeding) than those in the center. However, this was not in the case of large flocks (n.f. 20, 22, 25, and 27) (fig. 4). Being at the periphery of the flock didn't put the bird at a disadvantage as far as vigilance is concerned. Furthermore the presence of a bird in the center maximized it feeding chance.

The periphery – center relationship to vigilance and pecking in small and medium flocks as one moves from the center to the periphery does not seem to hold in vigilance albeit in the case of large flocks. In the later the effect of being at the periphery (risk at predation) is reduced to a large extent. If this hypothesis is true, it may explained the following suggestion reported by Lazarus (1972): "gregariousness evolved as selfish behavior acting as a form of cover – seeking in which each animal tries to reduce its chance of being caught by a predator, in addition, predation pressure would further accelerate the evolution of gregariousness to produce denser flocks, since marginal predation puts peripheral animals at greater risk than their mere central fellows".

b) Reaction distance and flight distance:

The results of this investigation suggest that individual Mourning Dove gain predation defense advantages by foraging in a flocks. Birds foraging in a small flocks (3 – 5 birds) and probably solitary birds as well, detect the approach a predator (at least the observer in this case) later than those in big flocks. In other words, small flocks have shorter reaction distance than larger flocks. This presumably occurs because the flock as a whole stands a better chance of detecting the approach of a predator than solitary birds or birds in small flocks. It is literary a case of more pairs of eyes being better than one pair. However, the data related to flight distance failed to show significant difference in behavior of members foraging in smaller flocks than those foraging in larger ones. In conclusion it may be that those foraging alone might be in a disadvantage.

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