Habitat selection by flocking wintering common cranes (*Grus grus*) at los Pedroches valley, Spain

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Abstract. The influence of food abundance and habitat complexity on the feeding habitat selection was studied in a wintering population of common crane at Pedroche Valley (South Spain). Crop lands presented higher amount of acorns along all the study period, while since December, acorns decreased very quickly at the fallow lands. However flocks size found in the crops or in the praires was similar along all the study period. Flock size in the crop lands seemed not to be influenced by the amount of seed sowed, although flock size increased with acorn abundance in both areas. Crane flock size were not correlated neither by the grass canopy height, nor the floor slope, nor the lowest distance of visibility, but it was positively correlated with the highest distance of visibility. Highest visibility was decreasing along the time suggesting that cranes selected first those areas allowed to conform largest groups.
Key words: Common crane, habitat selection, flock size, predation risk.

Resumen. *Selección de lugar de alimentación de bandos de grullas (*Grus grus*) en el Valle de los Pedroches.* Este trabajo analiza la influencia de la abundancia de alimento y de los atributos estructurales del medio en la selección de lugares de alimentación en una población invernante de grullas en las dehesas del Valle de los Pedroches al norte de la provincia de Córdoba. La cantidad de bellota disponible fue mayor en las zonas cultivadas frente a los pastizales donde declina rápidamene a partir de diciembre, a pesar de lo cual el tamaño de bando observado en ambas zonas fue similar en todo el período de estudio. La cantidad de semilla sembrada no pareció afectar al tamaño de bando, si bien en los puntos con más bellota los bandos fueron más numerosos, tanto en las praderas como en los cultivos. No se apreció ningún efecto sobre el tamaño de bando de la altura del estrato herbáceo, de la pendiente del terreno ni de la distancia al horizonte más próximo. Sin embargo el tamaño de bando sí estuvo positivamente correlacionado con la distancia al horizonte más lejano que además disminuyó significativamente con la fecha. Estos datos sugieren que las grullas utilizan preferentemente lugares de horizontes amplios donde pueden alimentarse en grandes grupos y sólo cuando escasea el alimento van utilizando progresivamente zonas de menor visibilidad.

Introduction

According with optimal foraging theory, animals may use more extensively those areas offering a higher food quality (Krebs et al, 1983; Stephens & Krebs, 1986). By using the most productive patches, birds may have a high ingestion rate, allowing to reduce the time exposed to predators and having more time to other activities. However, some authors have obtained contradictories results since it was not found a clear relationship between birds abundance and food availability (Pullian & Parker, 1979; Wiens, 1984; Herrera, 1988). If a situation of equilibrium between bird abundance and habitat charge capacity occurs, then must exists an interaction between food availability and habitat complexity, and thus other factors such as predation risk may have a higher influence on birds distribution (Folse, 1982; Wiens, 1984; Pullian & Dunning, 1987; Smith & Shugart, 1987).

Crane species have been shown as species with a high pre-adaptation to respond quickly to habitat changes or food resources (Krapu et al, 1984; Bautista et al, 1992). Common cranes (*Grus grus*) are very abundant wintering in the pastures of the oaklands of Central West Spain, since their main food resource are the acorns (Fernández-Cruz, 1981; Alonso & Alonso, 1988). However, their spatial distribution is not clearly related with the acorn abundance, since cranes are often more abundant in farmlands where oaks are more sparse. The aim of this paper is to study the influence

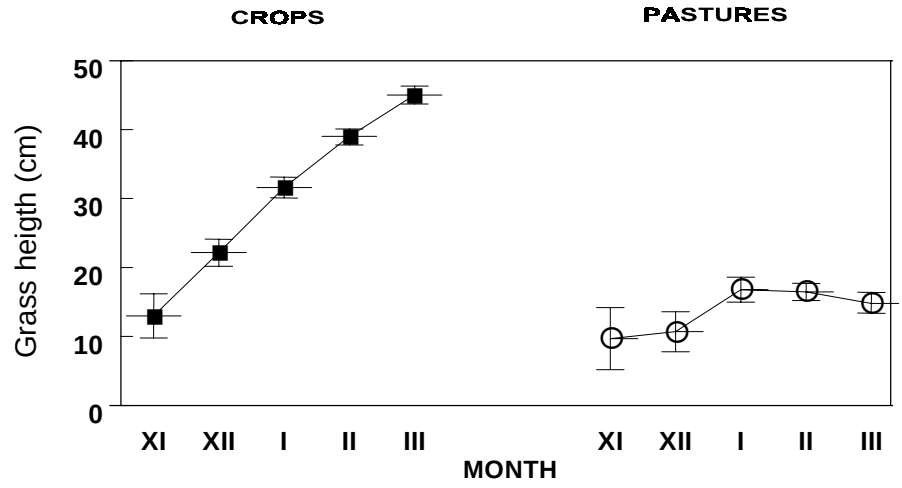

Figure 1.- Monthly average (and 95 % SD), of grass height in crops and pastures of the Pedroches' Valley.

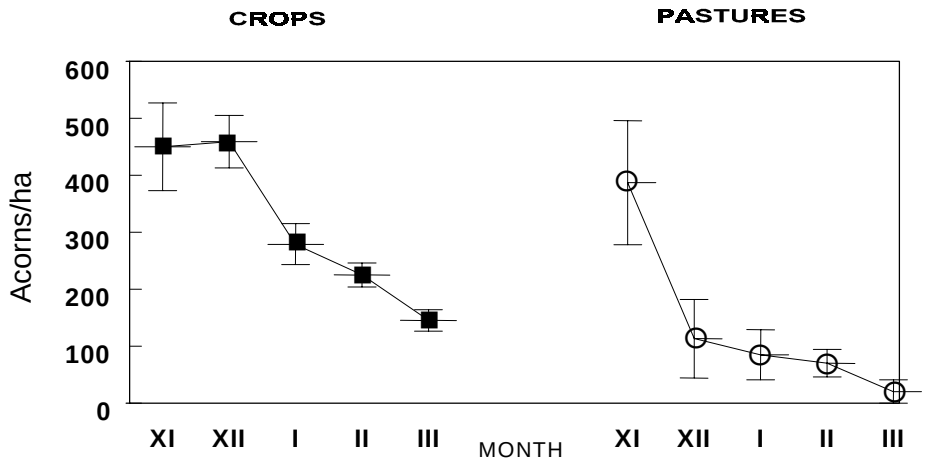

Figure 2.- Monthly average (and 95% SD) of the amount of acorns in crops and pastures of the Pedroches' Valley.

of food abundance and habitat complexity on the feeding habitat selection by common cranes.

Material and Methods

The study was carried out in the Valle de los Pedroches (North Andalucía), a valley conformed by oaklands mainly dedicated to the cereals crops and shepherd, rotating annually the croplands with the preparation lands (prairies), being the area covered by each type about the same. Because a different history and traditional use of the area, the eastern section of the valley presents stone walls delimiting the farmlands, and a higher density of oaks (40-50 oaks/ha vs 10-20 oaks/ha).

From 11-1-89 to 3-15-90 surveys were realized between 8 to 10 am each two weeks. In each survey it was noted the number of animals conformed each crane flock observed, plotting their position in aerial phonographs (scale 1:5000). For each group, it was determined: 1) the type of habitat (crop or pasture), 2) the estimated slope of the surface (ranged from 1 to 4), 3) the estimated height of the grass, 4) the position respect the oak canopy (beneath or out the oak canopy), and 5) the average distance to the nearest and farthest horizon (by estimating the shorter and longest distance in which cranes may loose both horizons). Additional monthly surveys were carried out to estimate the total abundance of cranes by censussing all the animals resting in the roosts. The surface covered by cranes were calculated by the 95% ellipse technique (McPAAL software).

It was estimated the amount of acorns available each two weeks, by dividing the whole area in 2x2 km quadrants and weighting all the acorns in the proximity of five oaks selected at random. The availability of acorns/ha was obtained by multiplying the average of acorns/oak with the number of oaks in each quadrant by using the mentioned aerial photographs. With this photographs it was estimated the area covered by the oak canopy in each of the 2x2 km² squares. The amount of grains of cereal available in the crops was obtained interviewing the farmers.

To compare the influence of habitat structure on number of cranes, multiple correlation analyses were used. The Ivlev's index of eligibility (Ivlev, 1961) was used to analyze the feeding selection by cranes beneath or outside the oak canopy.

Table 1. Monthly area used (95% probability ellipse), number of cranes censused, mean flock number observed, and density (cranes/ha), along the study period.

Month	XI	XII	I	II	III
Area used (ha)	1000	1100	2190	4600	3424
Mean Flock size (SE) Total	54.7 (24.5) 12	45.2 (17.7) 32	20.2 (3.7) 61	35.8 (6.2) 116	16.4 (2.1) 84
Nº Cranes	500	2550	6500	4200	700
Density	0.5	2.27	2.97	0.91	0.2

Table 2. Correlation coefficients between the flock size and the habitat variables measured in this study.

	Acorns	Slope
Grass heith	lowest visibility	Highest visibility
Crops N=176	0.152*	0.030
0.067	-0.052	0.412***
Prairies N=129	0.338***	0.089
0.146	-0.076	0.376***

*P <0.05; ***P <0.001

Results and discussion

In the western area of the valley, no crane was detected within any of the crop lands surrounded by stone walls, and thus, all the results correspond to the eastern area of the valley. During sowing time (early november), crops lands were sowed with 97 kg of seed per hectare (SD=7, n=27). Since sowing, the height of the grass canopy increased quickly in the crops, while in the fallows the grass height was shorter and showed a s-shaped curve (fig 1). Probably because the absence of livestock, crop lands presented higher amount of acorns along all the study period, while since December, acorns decreased very quickly at the fallow lands (fig 2). In spite of these differences in food abundance, flocks size found in the crops or in the prairies was similar along all the study period, although flock size changed along time, as shown in Table 1 (MANOVA: F(land type)= 0.565, p=0.461; F(month)= 2.895, p=0.022; F(interaction)= 0.138; p=0.968).

Oaks canopy covered 11.2% of the study area (SD=1.7, N=19). As a whole, the area beneath the oaks were selected by cranes more frequently (χ^2=69, d.f.=42, p<0.01). However, when compared the Ivlev's eligibility index obtained at the crops (I=0.35, SD= 0.09; n=52) and the prairies (I= 0.15, SD= 0.06, n=43), areas beneath oaks were less selected in the crops (t-test=4.7, d.f.=94, p<0.001), probably because the presence of seeds.

As previously reported in other wintering areas of Spain (Alonso et al, 1984), number of cranes in the Valley increased quickly up to the maximum in January, decreasing again in March, although the area covered by cranes were not related with this increase in number. Alonso et al (1987) found that cranes must fly further distances to find areas with higher quality after depleting the areas surrounding their roosts, and this habitat quality was influencing the flock size. As showed in our study, flock size in the crop lands seemed not to be influenced the amount of seed sowed (r=0.12, N=78, ns), although flock size increased with acorn abundance in both areas (Table 2). Crane flock size were not correlated neither by the grass canopy height, nor the floor slope, nor the lowest distance of visibility, but it was positively correlated with the highest distance of visibility (Table 2).

Highest visibility is a indirect measurement of an animal's perception risk, but also areas with large visibility may allow a larger flock size. By increasing the group size, animals acute some advantages such as a higher feeding time since vigilance time decreases in its component member of a group (Bertram, 1978; Hoogland, 1979; Lagory, 1986), also decreases the probability of being hunted (dilution effect, Vine, 1971), and it is more efficiently detected an oncoming predator (many eyes effect, Bertram, 1978; Lima & Dill, 1990). Although during this study is was not detected any predation on cranes, predators (mainly foxes) are very abundant in the area.

Highest visibility were decreasing along the time either in the crops (r=-0.21, p<0.05, n=176) or in the prairies (r=-0.25, p<0.05, n=129), suggesting that cranes selected first those areas allowed to conform largest groups, rather than those where food were abundant, although both variables were involved. In the same way, the presence of wall stones at the eastern areas of the Pedroches' Valley, probably reduce the crane' visibility what could be the reason because of cranes avoid these areas, in spite of a higher abundance of acorns.

At the sight of the results, the spatial distribution of cranes was depending on food abundance and habitat structure. Although the food distribution is one of the most important factors influencing the feeding areas selection by birds (Grzybowsky, 1982; Grant & Grant, 1987), habitat structure and complexity, at least these affecting the group size, are modulating this selection.

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