Activity patterns of collared pratincoles *Glareola pratincola* in a breeding colony

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Abstract

Activity patterns of collared pratincoles Glareola pratincola *in a breeding colony.*— The collared pratincole *Glareola pratincola* is a declining wader species, but most aspects of its biology are poorly known. In this study, an attempt is made to characterize the basic behavioural repertoire of the species, searching for differences between sexes. Focal observations of the most common activities were obtained in a breeding colony in southwestern Spain. Pratincoles did not equally distribute their time among types of activity, but spent more time in alert behaviour than feeding and moving, and more time preening than moving in the colony site. Males devoted more time to vigilance for predators than females, and both sexes increased the time spent resting and decreased the time for vigilance as the breeding season progressed. These sex–related and seasonal effects on the vigilance behaviour suggest that competition for females and ambient temperature influence the daily activity pattern of collared pratincoles during breeding.

Key words: Collared pratincole, Colonial breeding, Time budget, Vigilance, Waders

Resumen

Patrones de actividad de la canastera común Glareola pratincola *en una colonia de reproducción.*— La canastera común *Glareola pratincola* es una especie limícola en retroceso; no obstante, se conoce poco sobre la mayor parte de los aspectos relativos a su biología. En este estudio se pretende aportar información sobre los patrones de comportamiento básicos de la especie y se buscan diferencias entre sexos. Para ello se realizaron observaciones focales de las actividades más comunes observadas en una colonia de reproducción situada en el suroeste de España. Las canasteras no destinaron la misma cantidad de tiempo a todos los tipos de actividad, sino que dedicaron más tiempo a la vigilancia que a alimentación y desplazamiento, y más tiempo al atuse del plumaje que a desplazamiento en el interior de la colonia. Los machos invirtieron más tiempo a vigilar la presencia de depredadores que las hembras, y ambos sexos incrementaron el tiempo dedicado al descanso y redujeron el dedicado a la vigilancia a medida que avanzaba la época de reproducción. Los efectos que el sexo y la estacionalidad tienen en el comportamiento de vigilancia sugieren que la competencia por las hembras y la temperatura ambiental podrían influir en el patrón de actividad diaria de la canastera común durante la reproducción.

Palabras clave: Canastera común, Colonialidad, Organización del comportamiento, Vigilancia, Limícolas

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Introduction

The sequential organization of behaviour has evolved because its benefits favour maximization of individual fitness, as the time devoted to one activity limits the time available for other activities (McNamara et al., 1987). In social groups, the organization of behaviour of individual components (*i.e.* cooperation) allows each individual to decrease its contribution to vigilance, for example, and thus devote more time to other activities for its own benefit (Lima & Dill, 1990; Lima & Zollner, 1996; Domènech & Senar, 1999). Alternatively, these benefits may not depend on the existence of cooperation between group members but simply arise as a consequence of the optimization of vigilance behaviour that individuals show in response to the behaviour of others in a group (Childress & Lung, 2003). In any case, the organization of time within animal groups is poorly understood, probably because the amount of time that individuals devote to different activities depends on many factors, making it a highly complex process (*e.g.,* Martínez, 2000).

In social groups of birds, the time devoted to different activities may differ between sexes, as males and females may experience different constraints to conduct those activities, for example as a consequence of differences in thermal tolerance in certain environments (Alonso et al., 2016). Vigilance for predators directly affects the survival prospects of individuals in a group (Watson et al., 2007) and is one of the activities in which sex–related differences have most frequently been reported (Beauchamp, 2015), but the significance of such differences may change with the ecological context. Thus, females are normally subordinate to males and more vigilant than males when there are no social ties between group members (Domènech & Senar, 1999), but the situation can be reversed when males guard female mates in the presence of other males (Ridley & Hill, 1987; Guillemain et al., 2003).

The collared pratincole *Glareola pratincola* is an aerially feeding insectivorous wader (Galván, 2005) that breeds in colonies in open areas such as farmlands, steppes or salt marshes around the Mediterranean and the Middle East (Calvo et al., 1993; Calvo, 1994). Collared pratincoles are socially monogamous (Cramp & Simmons, 1983; Larsen, 1991), although polyandry has been reported (Pozhidaeva & Molodan, 1992). The world population of collared pratincoles is declining (BirdLife International, 2016), but there is an almost complete lack of knowledge of any behavioural aspect of this species (see however Galván, 2005, 2006). This is probably because of the difficulties that its study represents (*i.e.* the cryptic nature of the species makes small–medium size colonies difficult to locate; Calvo & Vázquez, 1995).

The aim of this study was to investigate the organization of basic behaviour in a breeding colony of collared pratincoles, with an emphasis on potential sex–related differences in activities. This constitutes the first description of the time budget of the species.

Material and methods

The study was conducted during the breeding season (April–July) of 2001 in a colony (15 breeding pairs) of collared pratincoles in Badajoz province, southwestern Spain (38º 53' N, 6º 51' W). The colony was located on an extensive plain on a rice stubble field surrounded by maize fields and other rotation cultivations, near the course of the Guadiana River.

The observations were carried out with a spotting scope from an irrigation ditch on the edge of the stubble, allowing observation of the colony from an elevated point and from a distance of ca. 30 m. Data recording took place in the five hours before sunset, when the collared pratincoles at the breeding site were most active (Tajuelo & Máñez, 2003). The sex of collared pratincoles was determined by plumage colour characteristics, as the lores of males are black whereas those of females are olive–brown (Cramp & Simmons, 1983; Hayman, 1986; Prater et al. 1997; see also http://aulaenred.ibercaja.es/wp–content/uploads/166_Glareola_pratincola.pdf).

To characterize the behavioural organization of collared pratincoles, we quantified the time devoted to the most common activities observed at the colony. We performed focal observations of behaviour every five minutes in each observation session. For each focal observation, an individual bird was chosen at random (Martin & Bateson, 1986). All pratincoles in the colony were clearly visible from the observation point, thereby avoiding pseudoreplication by choosing a different bird for each focal observation, always following a random selection process. The fact the colony was small allowed me to sample virtually all birds in the colony each day of observation, reducing the chance of a large bias in sampling between birds although they were not individually marked. The only activities considered in the study were those whose presence or absence in a given moment could be unambiguously determined (Martin & Bateson, 1986). Time devoted to sexual displays, aggressions and incubation was excluded from the analyses because the aim was to focus on activities that are not only performed during specific periods of time (*e.g.,* reproduction). We therefore considered only large classes of basic behavioural activities, without distinguishing possible subtypes of behaviour (Miller, 1988). The activities considered were: (1) feeding, as despite being mainly aerial foragers collared pratincoles also devote a significant amount of time to searching for invertebrates on the ground (Serle, 1950); (2) locomotion, when pratincoles walked through the colony without an apparent aim; (3) vigilance, when a clear alert attitude was observed, easily detected from their rigid position —upright and immobile— like many other species of birds in a vigilant position (Lazarus & Inglis, 1978); (4) preening; and (5) resting, when pratincoles were lying on the ground. Observations were made of adults only.

Behavioural data were obtained from a total of 13 observation sessions (days), comprising 317 focal observations (143 in May, 91 in June and 83 in July); 163 focal observations corresponded to males and 154 to females. The percentage of observations

devoted to each activity was calculated for males and females in each observation session. This was the variable response in a general linear model (GLM) with three fixed factors: (1) month in which the observations were made, (2) sex of birds and (3) type of activity. Interactions between factors were also considered. Inspections of residuals from the model confirmed that the normality assumption was fulfilled. Post hoc tests not assuming equal variances (Tamhane's T2) were used.

Results

Table 1 shows the results of the GLM. The model explained 34.8% of variance in the proportion of time devoted to the different activities and indicated that it did not vary between the three months of the breeding season. It also showed that both males and females devoted a similar time to the different activities in the colony, regardless of the month of observation. However, the effect of type of activity was significant, indicating that collared pratincoles devoted different amounts of time to the various basic behavioural classes considered, but the nature of these differences varied seasonally and depending on sex (table 1). Post hoc tests indicated that the proportion of time represented by vigilance was higher than that represented by feeding (P = 0.026) and walking (P = 0.002), and that the proportion of time preening was higher than the proportion of time walking (P = 0.012). Pratincoles also tended to spend more time resting than walking (P = 0.051).

On the other hand, the effect of the interaction between sex and type of activity was significant, indicating that males devoted more time to vigilance than females (P = 0.025; fig. 1), but there were no differences in the other activities (P > 0.05 for all activities). The effect of the interaction between month and type of activity was also significant, indicating that pratincoles devoted less time to vigilance at the end of the breeding season (July) than at the beginning (May, P = 0.001) and in the middle of the season (June, P = 0.017; fig. 2). The time spent resting followed a reversed pattern, as it was higher at the end of the season (July) than at the beginning (May, P = 0.011; fig. 2).

Table 1. Results of a general linear model (GLM) testing for the effects of type of activity, sex and month on the proportion of time spent by collared pratincoles in a breeding colony.

Tabla 1. Resultados del modelo lineal general utilizado para determinar los efectos del tipo de actividad, el sexo y el mes en la proporción de tiempo que las canasteras comunes destinan a las diferentes actividades en una colonia de reproducción.

Effects	F	df	P
Month	0.01	2	0.992
Sex	0.01	1	0.929
Type of activity	7.52	4	< 0.001
Month x sex	0.01	2	0.992
Month x type of activity	5.62	8	< 0.001
Sex x type of activity	2.79	4	0.030
Month x sex x type of activity	1.06	8	0.396
Total			130

Discussion

Collared pratincoles spent a high proportion of their time inside the colony on alert behaviour, indicating that vigilance was the main activity (followed by preening) of the species during the breeding season. This agrees with the consideration of vigilance for predators as one of the main constraints for the activity of birds living in social groups and especially in those like waders, for whom time spent vigilant significantly decreases the time available for foraging (Beauchamp, 2016). Few studies deal with basic activity budgets of waders during the breeding season, but the fact that the time pratincoles devoted to vigilance was much higher than that devoted to locomotion in the colony has been previously found in other species (Byrkjedal & Thompson, 1998). Accordingly, pratincoles also spent more time preening than walking through the colony. The low time devoted to walking in the colony is unlikely explained by the fact that collared pratincoles are mainly aerial foragers, as time devoted to walking has been reported as low relative to other activities in other species of waders that mainly forage on the ground and almost exclusively near the nesting sites (Cuervo, 2003). This suggests that waders limit the time devoted to walking through nesting sites, probably as a strategy to avoid predation risk as this decreases the conspicuousness of birds inside colonies.

The high proportion of time devoted to vigilance relative to feeding is not surprising, as collared pratincoles mainly feed on insects in the air outside the colonies (Cramp & Simmons, 1983; Galván, 2005). However, the time that pratincoles spent feeding on the ground inside the colony was not negligible and indicates that foraging on the ground represents a more important activity for the species than previously claimed (Cramp & Simmons, 1983; Tajuelo & Máñez, 2003) and probably constitutes a behavioural alternative that influences its aerial foraging pattern (Galván, 2005). This, together with the fact that breeding failure due to ploughing up farmlands is high in colonies of collared pratincoles (Calvo, 1994), suggests a stronger effect of soil conservation status in the species than previously thought on the basis that collared pratincoles are mainly aerial foragers. This should be considered in future actions for the conservation of collared pratincoles.

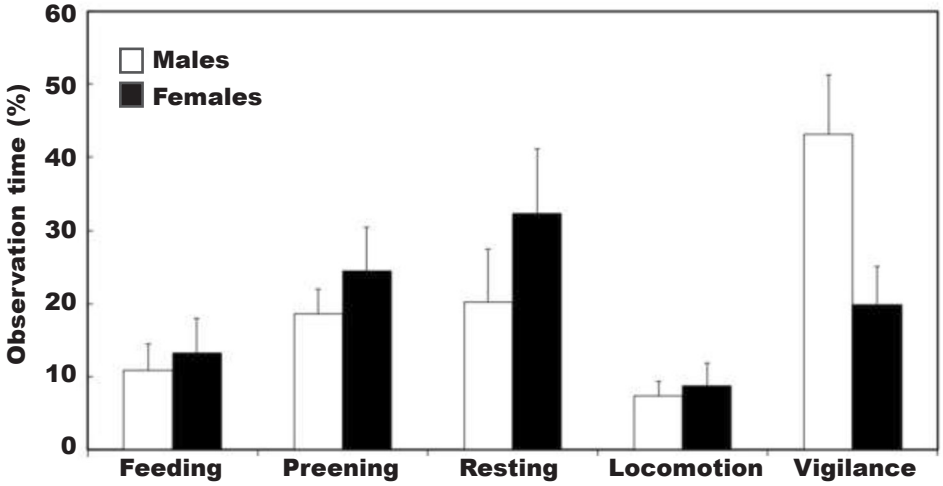

Fig. 1. Percentage of observation time (+ SE) devoted to different activities by male and female collared pratincoles.

Fig. 1. Porcentaje del tiempo de observación (+ DE) dedicado a las diferentes actividades por los machos y las hembras de canastera común.

Male and female collared pratincoles are very similar in size (Cramp & Simmons, 1983), suggesting that no differences between sexes in time devoted to foraging should be expected (van de Kam et al., 2004). However, females would be more vigilant than males and devote less time to feeding if a social hierarchy existed in the species (Breitwisch, 1989). Accordingly, we found no differences in the time that male and female pratincoles spent on different activities, except vigilance. However, and contrary to expectations, males devoted more time to vigilance than females. In other wader species, males spend more time alert than females but only in particular stages of the breeding cycle such as the incubation period (Byrkjedal & Thompson, 1998). In this study, male pratincoles spent more time alert than females during the whole breeding period. This could be due to the fact

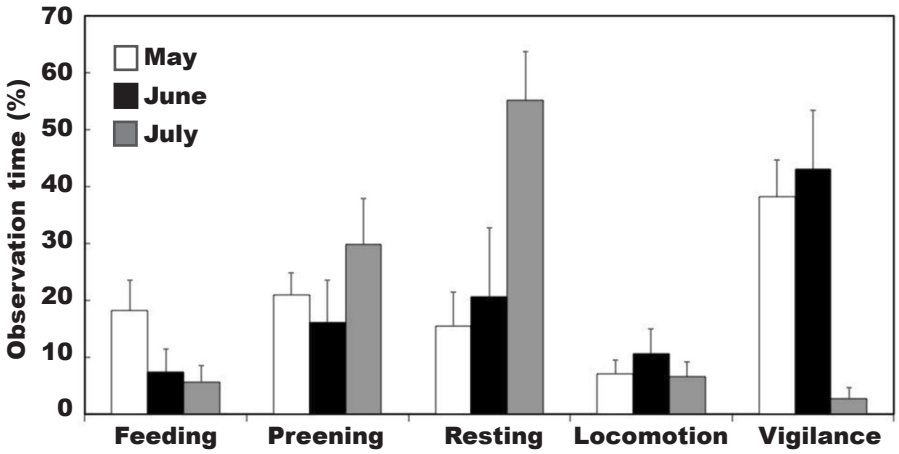

Fig. 2. Variation in percentage of observation time (+ SE) allocated to different activities by collared pratincoles during the course of the breeding season.

Fig. 2. Variación en el porcentaje del tiempo de observación (+ DE) dedicado a las diferentes actividades por la canastera común durante el curso de la época de reproducción.

that the vigilance activity does not respond to only one selective force, and vigilance in males is related to both predation pressures and social factors (male–male competition, *i.e.* mate guarding), which increases the time devoted to this activity when other males are present (Burger & Gochfeld, 1988; Domènech & Senar, 1999). Although aggression among collared pratincoles is rare (own unpublished data), forms of non–aggressive communication could be related to a possible competition for females (Senar, 1994). A higher conspicuousness of males (which is associated with a higher predation risk) and a compensation for the energy expenditure of females during reproduction have also been proposed to explain a higher investment of males in vigilance in other species of birds (Squires et al., 2007). However, these are not likely explanations for the results found here, as males and females are of similar appearance and the time devoted to activities other than vigilance did not differ, while differences in other activities such as foraging would be expected if females were recovering from their energetic investment in reproduction. Future research is needed to clarify why male collared pratincoles spend more time vigilant than females.

On the other hand, the decrease in the time spent alert and the increase in the time allocated to resting at the end of the breeding season could be related to the high temperatures in the study area in July (Silva et al., 1998). Thus, by the end of the breeding season, collared pratincoles could devote less time to high energy–demanding activities such as vigilance for the benefit of others with a low cost such as resting, as found for example in great bustards *Otis tarda* exposed to cold (Martínez, 2000) and hot (Alonso et al., 2016) weather. The high temperatures that birds such as collared pratincoles are exposed to in their habitat constitute major constraints for their activity, particularly in the case of species such as steppe–land birds that nest in arid environments. Such constraints would not only affect pratincoles, but also their potential predators, decreasing the need for vigilance (Amat & Masero, 2004; Brown & Brown, 2004; Alonso et al., 2016). Future studies are needed to investigate the physiological adaptive responses that have evolved in these species, allowing them to organize their behaviour in such a way that their fitness is maximized while coping with high ambient temperatures.

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