

# Ecological preferences, behavior observations of Cattle Egret *Bubulcus ibis* and their interactions with the cattle in the Maremma Regional Park (Tuscany, central Italy)

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**Abstract** – From April 2001-April 2003, we studied Cattle Egret *Bubulcus ibis* in the territory of the Maremma Regional Park (Tuscany, central Italy). The purpose of this work was: to define the selection preferences for varied feeding habitats, to describe Cattle Egret interactions with the livestock in the park, to investigate time budgets for various activities of the species through use of punctuated episodic (30 second) observations of individuals. The punctuated observations (1455) allowed delineation of relative amounts of time spent in various activities in an average day. We found 54% of time was spent in movements associated with the search for food, roughly 25% was spent rest and care of the plumage, 20% in actual feeding, and 1% involved flight activity. This evidence confirmed that the Maremma Regional Park is an important area for feeding by the species. Plumage patterns of all individuals in April to June suggested they were adult birds in reproductive stages of the annual life cycle. Our data indicated 80% of Cattle Egrets were observed feeding in the dry pastures with livestock and 75% of these were feeding less than 5 m from such livestock. This indicated Cattle Egrets have a strong preference for feeding in pastures frequented by livestock and they have a close association with the herds as they feed.

**Key-words:** selection preferences, feeding habitat, pasture, livestock.

## INTRODUCTION

Cattle Egret *Bubulcus ibis* was first reported in Europe in the late 20<sup>th</sup> century and this constituted a major expansion of the species breeding range (Farinha 1997). In Italy, the first record occurred in Sardinia in 1985 (Grussu & Secci 1986, Fasola *et al.* 2007). Two years after the first report of this species being present in Tuscany, in 1999 the species was also observed in Grosseto province, in the Diaccia Botrona Regional Nature Reserve's heronrie, inside the *Pinus pinea* forest of Marze (Castiglione della Pescaia), with 4-6 pairs (Giovacchini *et al.* 2001, Puglisi *et al.* 2012). The diet of Cattle Egret is largely comprised of invertebrates from the Class Insecta, particularly grasshoppers (*Orthoptera*), but small vertebrates are also consumed as an essential part too (Kopij 1999, Setbel *et al.* 2004). It is common knowledge that foraging activity efficacy of Cattle Egret benefits from the presence of herds of sheep, cows, horses and asses, particularly in extended and open fields, where the Cattle Egret adopt a well spaced distribu-

tion and slow gait necessary for brief motion and flight to better attempt capture of insects and other prey displaced by livestock movement (Hafner & Fasola 1992). This increase in foraging success, and foraging rate, occurs mainly when large numbers of individuals of both Cattle Egrets and livestock are present and provide a primary reason for greater abundance of these herons observed in agricultural spaces (Lombardini *et al.* 2001). Cattle Egrets appear to demonstrate an ecological plasticity in feeding and resting habitat choice and in Italy studies about this species and its behavior are generally scarce.

The aim of this research was therefore improving the knowledge about feeding habitats of Cattle Egrets and their behavior within a valley area in the southern region of Tuscany. Thus, the interactions with cattle were studied through collecting data about this activity, using accurate observation of single individuals, the condition of plumage (breeding or non-breeding) recording numerical populations observed for the species throughout the year and across the two years of study.

## MATERIALS AND METHODS

Roughly 10 km to the south of Marze's heronrie, in Grosseto province, the pine forest and open spaces of the Alberese Regional Farm's exist, inside of the Maremma Regional Park (central coordinates: latitude 42°40' N; longitude 11°03' E), and are in part used also for zootechnical activities, involving agricultural environments interested in crops grown under restricted treatment with pesticides. The livestock, partially wild cows and horses of races of Maremma, are pastured here according to seasonal necessities, with herd movement done by herdsman "buttero". Agricultural cultivation areas are interspersed with natural areas of native vegetation and these areas represent a strong lure for many consumers in the natural ecosystems.

Our study extended from April 2001-April 2003 and focused on approximately 800 ha located within the protected area of the Park. For the Cattle Egret surveys' basic itinerary we used a fixed study transect about 12 km long, considering this to be the appropriate length and method for assuring adequate sampling of birds in all areas and in proportion to ecotypes present (Lombardini *et al.* 2001). This included pastures, uncultivated, cultivated and, for the residual part (about 30%), pine forests of *Pinus pin- ea*. The last area is characterized by a modest renewal of the undergrowth (Arrigoni *et al.* 1985). Each study transect was run on a bike or by car, twice a day three times a month (beginning one hour after dawn and three hours before sunset), for a total of 143 inspections in 75 different days. The number initially expected (150) was subject to modest variations due to meteorological conditions. Each survey was carried out with appropriate optical equipment consisting of 7x42 Swarovski binoculars and 20-60x80 Swarovski spotting scopes, allowing us to accurately estimate the total numbers of the Cattle Egrets observed, and determine a monthly average of the actual number of Cattle Egrets observed each of the controlled areas even at a distance.

At each observation point along the transect we collected information about the preponderance of each activity via precise observations of individuals, using the instantaneous observation method (Altmann 1974). This method adheres to a few simple rules or practical considerations: the use of the spotting scopes, relative closeness of the subject to the observer, especially in open areas, and the low probability of escape due to the use of locomotion equipment which has minimal impact on the comfort level of the species being observed, such as to reduce the risk of underestimation and to mitigate some of the effects of human disturbance on bird populations (Meriggi 1989, Gill *et al.* 1996). With an average observation duration of 30

seconds per animal, the following data was collected: Id - progressive number of observation; Schedules - solar observation time; Group/Solitary - for each specimen it was recorded whether it was in group or not at the time of observation; Environment - ecotype of environment where the individual was observed, including feeding area, and where observation took place on the transect. Categories of environments within the study area divided into the following: "pasture with livestock", "pasture without livestock", "cultivated", "uncultivated with livestock", "pine forests with livestock" and "cattle fences in Spergolaia". For the categories "pasture with livestock" and "pasture without livestock", the presence of water or not of water was specified since it occasionally submerged portions of the study territory; Cattle Distance - for each individual Cattle Egret observed with livestock, we estimated the distance from the livestock animal to be one of three categories: "up to 5 m", "up to 30 m", "over 30 m"; Horses/Cattles - were indicated by the abbreviation E, B or both; Activities - have been cataloged with specific acronyms of activities that were occurring at the time of observation: "flight", "rest", "plumage care", "feeding on the move", "catching in the air", "catching on livestock", "cleptoparasitism", "movement," "aggression" and "drinking". Plumage: 1- breeding plumage; 0- non breeding plumage. We found the characteristics of the fields used by the Cattle Egrets were constantly changing according to the needs of agricultural and zootechnical practices (with the exception of cultivated pastures), making it impossible to map crops accurately. The division of the categories is derived from our personal experience and on the basis of bibliographic information (Cramp & Simmons 1977, Voisin 1991).

Our final data base amounted to 1455 instantaneous observations of individuals, results were not distributed normally and featured uneven variances, and were subjected to analysis by using non-parametric classical Kruskal Wallis' tests for comparison of multiple groups. For couples comparisons, in the case of significance of the Kruskal Wallis' test, the U test of Mann Whitney was used (Fowler & Cohen 1993).

## RESULTS AND DISCUSSION

On an annual basis, we observed a first clear increase in the number of Cattle Egrets observed on the study area occurred during April, followed by a peak population recorded in August (average of about 82 individuals at that time). For the latter, when in feeding areas, we observed many recently fledged young were present and explained the late summer increase in the population. Dry pastures with live-

stock evidenced the highest total number of Cattle Egrets observed for the study, with 1168 individuals (80.3%). The remaining individuals of the total number of Cattle Egrets counted were observed in areas as follows: within the Spergolaia fences with livestock 111 (7.6%), in wet pasture with livestock 90 (6.2%), in the crops 41 (2.8%), in the pine forest with cattle 16 (1.1%), in the pasture without livestock 14 (1.0%), in the wet pasture without livestock 11 (0.7%), in the uncultivated land with livestock 4 individuals (0.3%) were observed. Contrary to what we expected, this latter category evidenced the lowest attendance of all land types throughout the year. We believe that this probably resulted from the fact that cattle were only sporadically present located in these areas. Although they constituted only a limited area within the study as a whole, Spergolaia fences were frequented by a significantly higher number of Cattle Egrets than the other categories of environments. However, this occurs only in the winter months (Tab. 1).

Statistical comparisons using the Kruskal Wallis' test indicated distribution of individuals between all environments was a highly significant result and not random ( $H=172$ ,  $p<0.001$ ). Comparison to pairs of "pasture with livestock" with all others, through the U test of Mann Whitney, provided highly significant results ( $p<0.001$ ). Therefore, it is possible that preferential use may not be random and there exists a relationship between the ecotype of environment and the greater number of the herons present. In this framework, even if with a limited number of samples, wet pastures with livestock were regularly frequented by

Cattle Egrets. A further comparison, using the same U test of Mann Whitney, was conducted between cattle fences in Spergolaia and all other categories: significant in comparison with only pine forests with livestock/livestock/pasture without cattle ( $p<0.05$ ). It is interesting to note that the choice of dry grazing with livestock was particularly associated with the breeding season and the preference did not change until September when we recorded the highest mean numbers of herons on our study areas, as also happens along the Latium Coast (Castaldi & Guerrieri 2011). It is not surprising that the xeric environments, with high exposure to sunlight, at this time of the year are able to satisfy the energy needs of Cattle Egrets, since they host the majority of our Orthopteran species (Massa *et al.* 2012). We observed no difference in the use of the various study environments throughout the day; in fact, during the morning and afternoon observations, the average number of herons in the various environments appeared almost the same.

Foraging work, during which the animal pecks on the ground and move, was observed to be the predominant activity of Cattle Egrets in our study. Using the Kruskal Wallis' test the result was highly significant, with a relationship that has shown no randomness between the number of individuals and the type of activity practiced ( $H=301$ ,  $p<0.001$ ). Approximately 54% of the time was spent in walking related to food search, about 25% in rest and plumage care, 20% in strictly feeding, and about 1% in shifting activity in flight. Less than 0.4% of our observations included individuals searching for food from the mammalian abdomen in resting position (when the cow or

**Table 1.** Seasonal attendance of Cattle Egret during the period April 2001-April 2003. In February and March the species was absent.

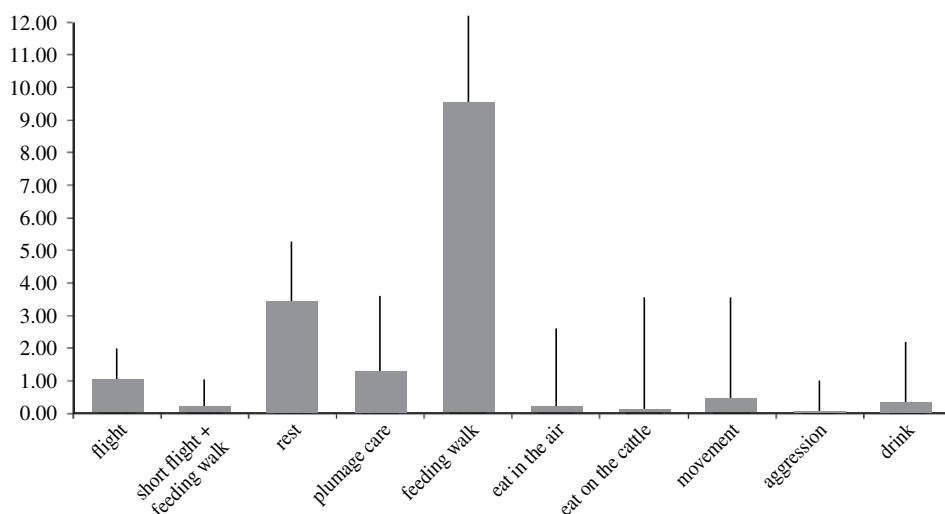
	dry pasture with livestock	wet pasture with livestock	pasture without livestock	wet pasture without livestock	crops	uncultivated land with livestock	pine forest with livestock	fences with livestock in Spergolaia
January	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
February	/	/	/	/	/	/	/	/
March	/	/	/	/	/	/	/	/
April	12.6	0.3	0.6	0.0	0.0	0.1	0.5	0.3
May	11.5	1.1	0.3	0.6	0.0	0.0	0.0	0.2
June	12.6	0.1	0.0	0.4	1.4	0.2	0.0	0.0
July	13.7	2.3	0.2	0.0	1.4	0.0	0.0	0.3
August	19.8	3.7	0.0	0.0	0.0	0.0	0.0	0.2
September	23.6	0.0	0.0	0.0	0.8	0.0	0.0	1.1
October	6.2	0.0	0.0	0.0	0.0	0.0	0.0	1.8
November	2.0	0.0	0.0	0.0	0.0	0.0	1.8	0.6
December	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5
<b>n. observations</b>	<b>1168</b>	<b>90</b>	<b>14</b>	<b>11</b>	<b>41</b>	<b>4</b>	<b>16</b>	<b>111</b>
<b>% on total</b>	<b>80.3</b>	<b>6.2</b>	<b>1.0</b>	<b>0.7</b>	<b>2.8</b>	<b>0.3</b>	<b>1.1</b>	<b>7.6</b>

horse was lying on the ground), or individuals feeding directly from cattle grazing; absent those attributable to cleptoparasitism episodes (Fig. 1). In this case, it is also important to point out that the data collected takes into account a situation related to two distinct periods of the day and not the whole day, although this profile does not change significantly during the day (morning or afternoon) nor with winter months. This is probably due to the fact that during the months of increased energy requirements (reproductive season), the duration of the light period is significantly longer than that of the winter time.

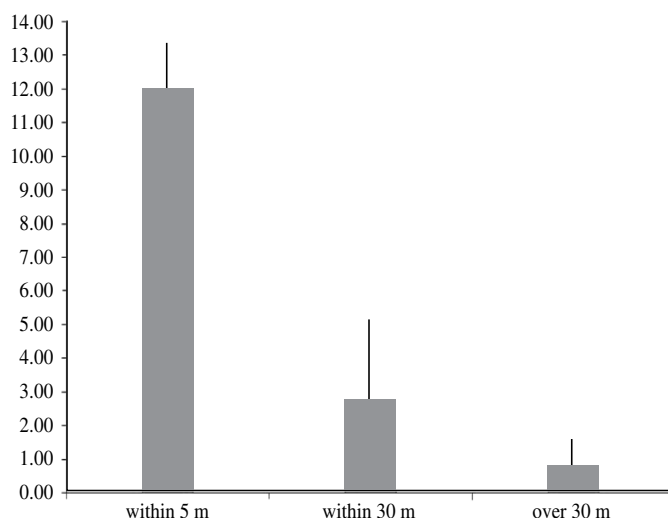
Our collected data indicated that 96.5% of the Cattle Egrets observed in our study from April 2001 to April 2003 were following the cattle. A different zootechnical management, defined to satisfy every type of livestock farming, may be the cause of the difference observed between our results and Latium Coast's data, where the figure reaches only 53% (Castaldi & Guerrieri 2011). A significant number of Cattle Egrets were observed to be feeding within the range of 5 m of cattle with 75% (average of about 12 individuals), followed by those feeding within 30 m or less, being 18.5% (average of about 3 individuals) and both higher than the number observed feeding more than 30 m from the nearest cow, about 6.5% (average of about one individual). Kruskal Wallis' test results highly significant, with a relationship that has shown no randomness between the average number of individuals and three categories of distance from livestock ( $H=132$ ,  $p<0.001$ ) (Fig. 2). The preponderance of heron observations within a radius of a few meters from pasturing animals show

the importance of a very close association with the herds. In particular, for distances under 2 m from livestock it is ascertained that the heron is more easily able to achieve real energy savings than a Cattle Egret hunting by itself (Grubb 1976).

From our instantaneous observation data we were able to harvest information about the trend and duration of the two types of plumage (breeding and non-breeding) and their overlapping in time. The overlap is due to the simultaneous presence of individuals whose moult has already occurred and others who have not moulted as well as the presence of young individuals joining the flock in late summer. From April to August the prevailing plumage is the breeding one among adults. From June on it is possible to find non-breeding plumage, with young herons recently fledged too (Dragonetti & Giovacchini 2009). The breeding plumage is lost by Cattle Egrets in this area by the beginning of August, when non-breeding plumage reaches its peak. The results of our plumage survey indicate that almost all subjects who attend the spring-summer study area are adults in a reproductive plumage. This confirms that the Maremma Regional Park is an important feeding area for breeding Egrets from Marze's heronrie. Thus, it appears that the numerical presence of Cattle Egret in the park is affected by the relative proximity of Marze's heronrie and the study area is, therefore, important for supporting a large number of breeding Cattle Egrets in the region. In the winter, there is a little presence of the species in the park; this is likely due to the use of other close areas in the territory, at a time when the species exhibits greater



**Figure 1.** Average number of individuals performing various activities and their standard error in the period April 2001-April 2003. Kruskal Wallis test among all the groups  $H=301$ ,  $p<0.001$ , Test U-Mann Whitney  $p<0.001$  cat. feeding walk vs. all the others, Test U-Mann Whitney  $p<0.01$  cat. rest vs. plumage care.



**Figure 2.** Average number of individuals following livestock in the three categories of distance with relative standard error. Kruskal Wallis  $H=132$ ,  $p<0.001$ , test U-Mann Whitney  $p<0.001$  dist 1 vs. dist.2/dist.3, test U-Mann Whitney  $p<0.001$  dist 2 vs. dist.3.

plasticity both from the food and the ecological point of view (Brichetti & Fracasso 2003, Grattini 2009, Guglielmi 2012). During the winter, Spergolaia fenced areas easily host the cattle; the herons are therefore concentrated in enclosed spaces, although they cover a small area. Among other things, within these fences there is an anthropic disturbance that is well tolerated by this species.

Many of the factors that support the local increase of the Cattle Egret's breeding range confirm its adaptability to different environmental contexts (Lombardini *et al.* 2001). Among these, the preference for dry cattle grazing and limited mistrust of humans, along with the decisive increase in the last ten years of the number of heronries hosting the species, offer a clear representation of the favorable degree of protection and clever agronomic management found in the park and its surrounding area (Giovacchini *et al.* 2017).

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