SOCIAL NESTING HABITS OF *GUIRA GUIRA*

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INTRODUCTION

THE life history of *Guira guira* was studied as part of a series of researches on the social nesting habits of the Crotophaginae, a subfamily of cuckoos. *Guira* belongs to a monotypic genus, whose range extends from the mouth of the Amazon, the campos of Brazil, south to Bahia Blanca in Argentina. Davis (1940) gives a brief summary of the Crotophaginae and of the little which was known of the habits of *Guira*. The primary problems in this study are the consideration of the development of the flock habit and of the manifestation of territorialism. These two problems are discussed briefly in this paper; a correlation with the other members of the subfamily is reserved for a future time.

The greater part of the work was done in the province of Entre Rios, Argentina, with some observations at Saladas in Corrientes and at Formosa. Through the kindness of Mr. C. H. Smyth, whose knowledge of the birds and eggs was invaluable in my work, I was able to stay at several *estancias* belonging to the Bovril Company. I am greatly indebted to Messrs. C. H. Smyth, Cecil Holland, R. J. Stirling, A. S. Dean, and M. Kelly for their generous hospitality, an art among the Anglo-Argentines.

The land in Entre Rios, called '*campo*,' is gently rolling and, where not cleared for cultivation, is covered with leguminous trees, spaced at intervals and having the characteristic mushroom shape and lacy foliage of savanna vegetation. In the *campo* there is no undergrowth but a lush growth of grasses. Through this savanna the investigator may easily walk for miles, but, unless the sun is kept in view, may get lost because in every direction the vegetation and topography are identical.

SOCIAL BEHAVIOR

Flock behavior.—Like other members of the subfamily, the birds habitually live in flocks, spend the day together and sleep at night in the same tree. Shortly after dawn they file out from the sleeping tree to sun themselves in preparation for the day's activities. Soon the flock, looking for food, scatters about over a wide area, although in most instances the various members are within calling distance of one another. In the evening the birds return singly or in small groups to the sleeping place, usually a tall thickly foliaged tree. Fre-

quently before entering the sleeping tree, even as late as after sunset, the birds collect in one particular tree just outside the sleeping place and then all fly in together, using the rattling call and hopping about until settled for the night.

These flocks, however, are not exclusive organizations of fixed composition. The number of birds composing the flock varies, as is shown for example by the data on Stirling's group. From the 11th to the 19th of November, 1939, the daily count of the birds which slept in the sleeping tree was as follows: 8, 10, ?, 7, 8, 9, 6, 8, 6. These changes in composition of the flock are not entirely due to newcomers for sometimes certain birds may sleep out in the woods as shown by the observation of November 29: "Two birds feeding in 'campo' about half-way to the windmill. Eventually one went to the corral (the sleeping place for the group). The other was joined by a third from the northwest. They sat around, then flew to the north and were joined by a fourth bird which came from near the corral but was not the first bird. The three birds sat for a long time and then one went into the corral. The other two slept outside. This explains the irregularity in numbers sleeping in the pareiso trees."

Changes in composition of the flock can also take place by the addition of newcomers as shown by the following observations, giving the field data concerning the appearance of wandering strangers. November 9, at dawn, "one bird went directly from the sleeping tree to the south and far over the *'arroyo'* to the other side, at least a mile, non-stop flight." November 10: "Three birds out by the windmill, flew from tree to tree, sometimes together, often separated, apparently looking for a place to sleep. One carried a snake (ten inches long) all the time. After sunset the birds were still flying from tree to tree. I suspect that they were looking for a place to establish themselves." December 5: "Two birds of the Golf Course group ignored a stranger which sat in the top of a tree and called."

A further point concerning the organization of the flock is that there is a definite tendency for the birds to remain together in pairs, although since the sexes are indistinguishable in the field, no conclusions can be drawn as to the sexes. Thus, on November 12, "two went out of the sleeping tree long before the others and went in a different direction (from the others)." November 18: "Two pairs went out, followed by four birds." Later that day "I found two birds near the highway. They went about one-half mile to the west and were joined by two others from the west. Then the four went east for a mile before stopping." Summarizing these observations, it may

be said that the flock is a loosely knit organization, whose members tend to associate in pairs.

Territorialism.—It is debatable whether the area occupied by a flock of *Guira* may be called a territory, in the strict meaning of the term. Nevertheless, for the present the term 'territory' will be used, not only because of supporting evidence from the species concerned but also because of the fact that the other members of the subfamily clearly are territorial. The territory of a group may extend over a large area, in some cases more than one mile in diameter. The exact configuration of the territory depends on the ecological conditions; the typical territory possesses a sleeping place, consisting of some tall dense trees, usually around an *estancia,* and a feeding area in the typical *campo.* The birds spread out over this area, one day in one part and another day in another part.

The evidence in favor of calling this area a territory consists of observations on the defense of the area. Typical but brief chasing of the type described for *Crotophaga ani* (Davis, 1940) was seen on two occasions. Thus, on November 19, "several birds chased two or three birds about one-half mile out into the campo"; and again on December 8, I "saw a bird chase another away and then go to the *quinta* (sleeping place)." As further evidence, on November 28, "I tried to drive five of Stirling's birds to the Windmill group and later tried to drive two birds in that direction. Each time the birds circled over my head and returned." This observance of the boundaries indicates that a true territory is maintained. Characteristic defense of territory was observed on several occasions. On December 3, "many birds were sitting and calling all over the area. Several birds flew back and forth and from place to place. Three birds drove two birds out to the east and then returned. The fighting was not severe and the chasing short." Also on December 22, I "saw a bird drive another across the road and away; then return. The pursuit was serious but not fierce."

Although these observations indicate a definite territory for each group, on the other hand several observations show that these territories are not as strictly delimited as is the case in *Crotophaga ani.* Thus on December 3, I saw one group enter the territory of another group and spend some time feeding before leaving of their own volition. On December 17, while watching the nest of a group at dawn, I saw a bird from another group come down to the nest and sit in the same tree as a bird which owned the nest, without any molestation from the owner of the territory. Furthermore on several

occasions birds came from a long distance and mingled with the flock and even slept in the same tree.

A reconciliation of these conflicting observations perhaps can be based on the fact that the members of one flock may simultaneously build more than one nest in the territory. For example, on November 30, two nests were found within 200 meters of each other and certainly within the territory of one group. One of these nests, containing eggs about one-half incubated, was owned by a pair of birds. The other nest, containing young which left the nest when I climbed the tree, was attended by about five birds. Of these five birds only three were solicitous; one of these three drove away another bird although pursuing it for only a short distance. Another case of simultaneous nesting within one territory was observed at the Dixon *estancia*. One nest, in a palm tree, contained four young about three days old in addition to one partly incubated egg. The other nest contained four cold eggs. From information provided by the owners of the *estancia,* it is absolutely certain that this latter nest, which was high up in an araucaria tree about 25 meters from the first nest, was built after the palm-tree nest. It is certain that human interference did not cause the desertion of the araucaria nest for both nests were in a garden where the birds were accustomed to human beings and even to dogs. Although I saw only two birds in the area, a few days previously there had been three. There is thus no doubt that birds of the same group built two nests which were coëxistent. A third case of coëxistent nests was encountered at the Dean *estancia*. Some members of a colony of eighteen birds built one nest, subsequently deserted, in which eighteen eggs were laid, while members of the group were incubating at a nest containing fourteen eggs. In addition to these cases, both Hudson (Sclater and Hudson, 1889) and Daguerre (1924) report that pairs may separate off from the flock to build simultaneously. Hudson describes the history of a colony which broke up into groups of three or four birds and built an abortive nest in October, dropping many eggs on the ground until January, when the birds built another abortive nest and continued to drop eggs on the ground. At the end of January, two pairs each built a nest and raised a total of fourteen or fifteen young. Daguerre reports that one pair of birds took over an old *Mimus* nest, repaired it and, with another female acting parasitically, laid ten eggs. Later when the nest fell down, the pair built another nest and raised eight young.

In those cases in which a pair separates from the rest of the flock

to build a nest, it is probable that the ecological conditions largely determine whether it is possible to leave the group. If the group sleeps in the only trees available for nesting, then the pair cannot separate from the rest of the group but must build in these trees. On the other hand, if there are many suitable nest sites, each pair can have its own nest. Thus it is likely that in many cases the habitat encourages the birds to build a communal nest.

These cases of simultaneous nesting by pairs or groups of the same flock reconcile the conflicting observations concerning the defense of territory. A pair of birds may loosely defend the nest location from other members of the group, but, since in many cases the defense is not adequate to drive the other birds away, simultaneous or communal nesting may result in the territory of a group.

Call notes.—The call notes of the species are discussed at this time because of their social significance.

1. The flight flock-call resembles the same call of *C. ani,* but is much weaker in volume. The birds use the call whenever going from one place to another, thus keeping the group together.

2. The alarm call is a very hoarse and loud rattle, used for a general alarm. The head is thrown back, crest raised and the whole body shakes when the call is given.

3. The danger call, given for hawks, is a rapid *ti-ti-ti-ti-ti,* descending in pitch.

4. The social call is a loud descending series of four or five harsh notes. At the beginning the bird throws the head far back so that the bill is vertical and at each note lowers the bill slightly until the bill is again horizontal. This call is used frequently by the birds in the early morning and at any time during the day to keep the flock together. When the flock is spread out over a large area, a lone bird can give the call and thus locate the others by the response. This call, referred to as a 'song' by some writers, has no analogy among the calls of *C. ani,* although it resembles the *whew* call in sound.

5. When sitting in trees during the mating behavior, a whine, the exact function of which could not be determined, is used.

6. The true pairing note, used in pairing and when looking for a nest site, is a weak *whew* repeated slowly.

7. A note frequently used before the alarm rattle is a series of *klee, klee, klee.* This very loud note, uttered infrequently, seems to be used as an intensification of the alarm.

8. Objection to intrusion at the nest is registered by a croak, also used in the manner of an alarm.

On one occasion I heard a sound which resembled the bubbling of *C. major* greatly. This was given shortly after the birds had gone to the sleeping tree.

In summarizing these calls it should be noted that no call is clearly a territory-defense call, comparable to song in passerine birds, although there is some possibility that no. 4 serves the purpose. The first four calls listed are useful to the flock and therefore may be considered as flock calls.

Pairing behavior.—As in other members of the subfamily, the pairing behavior of *Guira* is simple and unostentatious. No courtship performance in the usual sense of the term was observed. The birds, usually in pairs, hop about in trees suitable for nesting, uttering the pairing note, a low sibilant *whew*. On several occasions one bird fluttered its wings, but immediately flew out to feed. What is probably the normal courtship was observed on December 9: "Throughout the day one or two birds were in the trees, whining, hopping about, using the pairing call and fluttering the wings." Copulation, apparently a very infrequent act, was never observed. This situation is understandable when it is remembered that, judging from the frequency with which eggs are found on the ground even where there is no nest, this species ovulates spontaneously; and furthermore it is probable that many birds require only one fertilization for the insemination of all the eggs (cf. Snow Bunting, Tinbergen, 1939). Adding to these physiological conditions the fact that copulation certainly occurs only in bushy trees, it is not surprising that the act is not observed.

After pairing, the birds hop about the trees looking for a nest site. During this search they frequently carry a leaf about in the bill. As soon as the site has been decided upon the birds begin to carry in leaves and sticks to construct the bulky nest. The process of building is haphazard and desultory. Sometimes the birds will not work for a day or two; sometimes only one bird works; sometimes many work, building the nest in a short time.

In the building and laying sequence outlined above, irregularities are frequent. For example, eggs are frequently dropped on the ground, sometimes even where there is no nest; eggs are laid in the nest before it is finished; the nest may be deserted before it is completed. These irregularities are not due to the interference from other birds in the flock for they occur even when one pair nests apart from the colony. Even when the nest is built within a large colony, there is a tendency for only one pair to be active. The group at

Holland's *estancia,* consisting of fifteen birds, showed this proclivity very clearly. In the nest there were seven young, almost certainly the product of one female. No more than three birds (identified individually by their tail-feathers) came to the nest and one of these came very seldom. Other birds came within a couple of meters of the nest and uttered the alarm call when disturbed, but never actually took part in the incubation or feeding. At another nest (Golf Course) owned by a flock of about thirteen birds, in general only two birds went to the nest, although others came near.

LIFE HISTORY

General characteristics.—Guira guira, known in Argentina as the *pirincho* or *urraca,* is one of the most conspicuous and abundant birds, although the habit of going in groups causes overestimates of their numbers; for when a group is alarmed and flies up in unison, a false impression of the number is obtained. Their loud call notes and habit of feeding in open areas make the birds conspicuous.

In general appearance the birds are typically cuculine. The long tail and lethargic movements are at once diagnostic. The flight is labored and consists of volplaning for long intervals. When the bird comes out of a tree toward the ground, it sets its wings and sails downward, touching the ground with a slight up-swing and then clumsily running for a few steps, hampered by the tail which continues apparently independently and often causes the bird to lose its balance. Long flights are accomplished with much effort. Several other behavior characteristics may be noted at this point. The birds do not follow cattle and do not click the bill as a defense measure. *Guira* resembles other Crotophaginae in that the body possesses a disagreeable odor.

The birds live in any place where there are some bushy trees for sleeping and nesting. Since nearly every *estancia* has some tall trees (eucalypts and others) the birds tend to congregate in the yards. However, groups are commonly found out in the campo and do nest there. It seems likely that the range of the bird has been extended southward since the settlement of the pampas for now there are many trees growing around each house, providing a place for the birds to live. On several occasions the birds were seen in the center of small villages (Goya, Santa Elena) perching on the houses and flying over the cement streets. A colony lived in Plaza San Martin in the center of Buenos Aires. This species is not particularly attracted to rivers or streams.

The birds suffer from the cold greatly and in consequence are frequently seen sitting huddled together on cool mornings. The natives report that after a cold night or frost, birds may be found dead on the ground under the sleeping tree. The wind also is most annoying to the birds, driving them on blustery days to remain in the shelter of thickets and banks.

Mutual preening occurs sometimes during the day but especially when the birds are sitting together in the morning or evening.

The food consists of animal matter almost entirely. Of the stomachs examined, none contained seeds or fruit. Grubs, caterpillars and large insects are the main supply of food; snakes, lizards and young birds are commonly eaten. During the nesting season the adults are reported to destroy many young birds of other species. The birds systematically search through the trees for nests (Pereyra, 1927).

Nest and young.—The nest is usually located in the fork of a tree, although in one case a nest was found in a dense bush about three meters from the ground but close to an overhanging bank; while another nest was suspended in a thick vine. The nest, generally about five meters from the ground, is a bulky affair, composed of sticks and lined with leaves, all broken off from trees. Because the birds carry in green leaves during incubation, the nest always has a clean green lining. However, after the young are hatched the nest becomes very filthy with the excrement which, not contained in a sac, is ejected toward, but seldom over the edge.

The egg is large, greenish blue, spotted and splotched with a white calcareous covering, which is gradually rubbed off during incubation. One egg found was completely covered with chalk, thus resembling the egg of *C. ani.* The number of eggs laid by each female is probably five to seven in conformity with the other members of the subfamily. Table 1 gives the data on eggs and young found in 1939–40. In addition to these data, Sclater and Hudson (1889) record that a colony of birds built two nests and raised fourteen or fifteen young altogether. Gibson (1880) found a nest with four eggs, and Hartert and Venturi (1909) record nests with 5, 7, 11, 19, and 21 eggs, and further state that the clutch is five to seven, agreeing with the statement made by Hudson. Friedmann (1927) found an empty nest and a nest with six eggs. Since so many eggs are dropped on the ground it is not surprising that many nests do not have the full complement.

In the care of the nest the adults are very indolent, sometimes

leaving the nest uncovered for the night even though it contains eggs or young. Further, it seems a miracle that the young can grow without more frequent feeding. During a five-hour period a nest containing four young birds three days old was visited by the adults only four times with food. At another nest containing six young birds two days old, the adults brought food only six times in one hour.

TABLE 1

NESTS FOUND 1939–40

Colony	*Date found*	*Eggs*	*Young*	*Adults*
Holland.....	Nov. 19	1	6 (2 days old)	15
Williams.....	Nov. 24	abortive		4–8
Golf Course....	Nov. 27	1 (addled)	1	13
Campo No. 1...	Nov. 28	1 (on ground)	4	3+?
Stirling.....	Nov. 29	7 (destroyed later)		7
Campo No. 2...	Nov. 30	6 (destroyed later)		2
Dixon No. 1....	Dec. 12	1	4 (3 days old)	2
Dixon No. 2....	Dec. 13	4 (deserted)		?
Rio.....	Dec. 14	5	4	4
Dean No. 1....	Jan. 4	14	0	18
Dean No. 2....	Jan. 5	11 (deserted)		18?
Kelley.....	Jan. 14	7	8	?

This lackadaisical care of the nest may be an important factor in the development of social nesting.

The juvenile birds remain with the flock for several months and soon adopt the adult behavior. The juvenile can be distinguished from the adult by the gray instead of yellow-and-orange bill which possesses a black rim on the upper side. The iris is black instead of orange as in the adult and the tail-feathers are not frayed. The low crest on the beak soon reaches the adult dimensions.

DISCUSSION

This discussion is intended to bring out some of the more important points in the social habits of *Guira*. A correlation with the behavior of the other members of the subfamily is reserved for a future time.

The territorialism of *Guira* is clearly in a state of transition. Each pair may build a nest and even defend the area around the nest in a desultory manner. Yet at the same time the whole group of birds seems to own a piece of land and to defend this land against intrusion. But in all cases the defense is faltering and irresolute. Clearly the development of territorialism is passing through a critical stage. It should further be noticed that there is no fighting in relation to the

sex partner. At no time was any fighting in relation to the female or male seen, a fact which indicates that the territorial fighting is purely in relation to a piece of land.

Flock organization.—Guira can be considered a species in which the flock sleeps and forages together but the pairs nest separately, a behavior not uncommon in other birds.

To indicate the extent of these habits in other species the following notes on the flycatcher *Muscivora tyrannus* are appended. In Argentina this species is migratory; by November at Santa Elena (Entre Rios) the birds have begun to settle down in pairs although flocks of 20 to 30 birds are still passing through to the regions farther south. The first nests are built in the latter part of November. During the day the birds are spread out over the *campo* in pairs and zealously defend their nests and territories from any intruder, demonstrating typical territorialism. But at dusk the birds begin to congregate in the tall bushy trees around the *estancias,* the favorite sleeping places. The birds begin to enter about sundown, continuing as long as there is light. In the morning they leave before sunrise and go directly to their nests. In one yard, less than two acres in extent, about 375 birds, probably including some non-breeding birds, came to roost at the height of the breeding season. One bird of each pair remains on the nest and the other (male?) sleeps in the trees with others of the species. From considerations of the density of the population of these flycatchers in the *campo,* it was estimated that the birds may come from a distance of a mile in radius, an area of course depending on the number of roosting sites available. In summary we can say that *Muscivora tyrannus* is a strictly territorial species which roosts in large groups, even in the breeding season.

As another example, the habits of the Cowbirds may be mentioned. The two parasitic species, *Molothrus bonariensis* and *M. rufoaxillaris,* spend the day in small groups and at night sleep in vast numbers in the roosting trees. The non-parasitic species, *Agelaioides badius,* does not roost with the others till after the breeding season. It is of course not surprising that a parasitic species, which has no nest or territory, should sleep in groups during the breeding season.

These examples of birds which leave their territories or feeding areas to roost together suggest one contributing factor in the origin of the flock habit. The development of the flock habit is in some measure dependent upon the plant communities. Before Argentina was settled, the land was either pampa (tall-grass prairie) or a type of savanna with trees evenly spaced and characterized by thin lacy

foliage. In these areas there is evidence that *Guira* was either absent or at least not common before settlement, and that the species has spread southward from the Chaco (Sclater and Hudson, 1889). The Chaco is an area of grassland interspersed with numerous 'islands' of trees (parkland), an ideal place for the development of this flocking habit. The range of *Guira* extends up into the partly forested regions of Brazil where Snethlage (1928) found this species only in secondary forest, savannas, forest islands and similar areas. To summarize these speculations, it seems likely that the plant communities were conducive to the formation of flocks.

In addition to the flock habit should be considered the relation of the irregular laying habits of *Guira* to the development of social nesting and parasitism. As do other members of the subfamily, *Guira* drops eggs at any place or at any phase of the breeding cycle. Eggs may be found under the nest, in a half-completed nest, or even on the ground far away from the nest. Furthermore, *Guira* lays its eggs in the nest of other birds (*Milvago, Phytotoma*) according to Serie (1923a). Mr. Smyth described to me the nest of the *Milvago* in which he found two *Guira* eggs. It was placed in a low dense gorse hedge, a most likely place for a *Guira* to be. *Phytotoma* builds a nest similar to that of *Guira*. In addition to these observations is the statement of Azara (1805), doubted by Hudson, that *C. ani* and *Guira* lay their eggs in the same nest at times. But much of Azara's information came second-hand from the Indians and furthermore, *Guira* at times lays eggs completely covered with white chalk, thus indistinguishable from the eggs of *C. ani*. The above evidence of promiscuous egg-laying shows that *Guira* ovulates spontaneously, or perhaps in response to a visual stimulus, further increasing the chance of laying in another bird's nest. In support of this assumption, Farley (1924) reports that a pet bird laid eggs in his house anywhere and anytime. In summary, it is suggested that the neuro-endocrine conditions which result in spontaneous ovulation permit the development of parasitism in the Cuculidae and, in the social Crotophaginae, permit the development of communal nesting instead of colonial nesting as was developed in the Weaver Finches and in the parrot *Myiopsitta*.

SUMMARY

1. As a part of a series of researches on the Crotophaginae, the social nesting habits of *Guira guira*, a communally nesting cuckoo, were studied.

2. This species lives in loosely organized flocks, consisting of a varying number of birds which spend the day together and sleep in the same tree at night. Within the flock there is a tendency for the birds to remain in pairs.

3. Evidence indicates that the flock maintains a territory although pairs, which nest simultaneously even when they belong to the same flock, may maintain a territory. In three cases pairs from the same flock built nests simultaneously, while in four cases the flock built a communal nest.

4. The species uses eight distinct call notes, all possessing social significance.

5. For pairing, the birds merely come together and soon hop about the trees 'whining' and looking for a nesting site.

6. The birds are abundant and conspicuous and typically cuculine in behavior. They live about habitations and suffer much from the cold. Their food consists of animal matter entirely.

7. The nest is a bulky affair of sticks, placed in a tree and contains up to twenty eggs, depending upon the number of birds laying. The normal clutch is five to seven eggs. The adults are indolent in their attentions to the nest.

8. In the discussion of the species it is suggested that the territorialism is in a state of transition and that, as in the cases of other species (*Muscivora* and *Molothrus*) the flock habit was encouraged by the ecological conditions. Further, the neuro-endocrine conditions which result in spontaneous ovulation, permit the development of communal nesting within the flock.

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