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NESTING ECOLOGY OF THE PLAIN CHACHALACA IN SOUTH TEXAS

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Plain Chachalacas (*Ortalis vetula mccalli*) of the family Cracidae range throughout eastern Mexico from central Vera Cruz northward to southern Texas (Delacour and Amadon 1973:91). The range in southern Texas is very restricted and includes only portions of 4 counties within the Rio Grande Valley (Marion 1974). Delacour and Amadon (1973) provided a comprehensive review of the literature on the family Cracidae, but their discussion of chachalaca reproduction was based almost entirely on observations of a few nests of 2 species of *Ortalis*. These species, the Chestnut-winged Chachalaca (*O. garrula*) and the Rufous-vented Chachalaca (*O. ruficauda*), were briefly studied by Skutch (1963) and Lapham (1970), respectively. Earlier reports by Bendire (1892:119–121) and Bent (1932:345–352) provided a brief discussion of the nesting activities of Plain Chachalacas. We present here a more comprehensive nesting study for this species.

METHODS

Our research was conducted between 1959 and 1966 (Fleetwood) and during 1971 and 1972 (Marion) at Santa Ana National Wildlife Refuge, adjacent to the Rio Grande, 19 km southeast of McAllen, Hidalgo County, Texas. Nesting information for 1964, 1965, 1966, and 1971 are emphasized in this paper. We obtained reproductive data from wild birds, live-trapped birds, captive birds, and dead birds.

All birds captured during 1971 and 1972 were sexed by methods reported earlier (Marion 1977) and sex ratios are summarized in this report. Chachalaca traps were assumed to be unbiased in attracting either sex. Gonadal development is also reported for birds sacrificed during 1971 and 1972. Reproductive organs were fixed and preserved in AFA solution (Mosby et al. 1969:265) for further examination. Testes and ovaries were trimmed of extraneous tissue and dried on paper towel until all evidence of external moisture was removed. They were then weighed to the nearest 0.1 mg. Ovaries were examined using methods described by Meyer et al. (1947).

Data recorded for each nest observed during field studies included a nest site description involving measurements of the diameter of the nest, species and diameter (DBH) of the supporting tree, distance to water, and height of nest. Nest height was measured with a 6.1 m pole marked off at 0.3 m intervals. This pole, divided into 1.5 m sections for portability, had a mirror at one end which was used to observe nest contents. Nests in taller trees were inspected by climbing.

Clutch sizes were calculated from incubated clutches of eggs and incubation periods were determined where nest history was carefully observed from beginning to end. Egg hatchability was derived from successful nests with complete clutch counts. Eggshells from hatched eggs were easily recognized because they had one end removed by circular

pipping and membranous tissue firmly attached inside. Eggs destroyed before hatching lacked firmly attached membranes and shells were often unevenly fragmented.

Nesting success was determined using nests for which the complete history was known. Nests from which at least 1 egg hatched were considered successful. Nest failure was generally classified as either due to abandonment or to destruction depending on the appearance of the nest and its contents.

Abandoned eggs typically were cool and remained in the nest for some time. Nest destruction was characterized by physical fragmentation of eggs and/or nest (mammals), complete removal of all evidence of eggs and shells (snakes), and unbroken eggs knocked to the ground (wind damage) from the flimsy, shallow nests. The thick-shelled eggs rarely broke when they hit the ground and whole eggs, found beneath a nest, were assumed to have fallen because of wind.

RESULTS AND DISCUSSION

Pairing and sex ratios.—Pair formation begins while Plain Chachalacas are still in winter feeding flocks. Activity levels and loud calling increase considerably in February and March prior to the breeding season. Loud raucous calling is apparently associated with establishment and maintenance of pair bonds, which appear to be monogamous. In 1971, 66 males and 78 females were live-trapped; this was equivalent to a sex ratio of 100 males:118 females. The next year, 35 males and 43 females were captured, or a ratio of 100 males: 122 females. Chi-square values of 1.0 and 0.8 (1971 and 1972, respectively) indicated that these sex ratios were not significantly ($P > 0.05$) different from a 1 male:1 female ratio. No evidence was found to support a strict 1 male:2 females ratio during courtship, as reported by Bent (1932:347).

Gonadal development.—Average testes weights for 48 male Plain Chachalacas collected during all months of the year indicated that the left testis is slightly larger than the right one (125.1 ± 122.4 mg and 102.8 ± 107.3 mg, respectively). The annual cycle in testicular development revealed that the testes weight/body weight ratio was smallest in December and January and largest in March and April (Table 1). Recrudescence and regression of testes was apparently maximum in late February and early May, respectively, but the small sample size restricts further discussion.

In all 102 female specimens examined, only the left ovary was present. Seasonal variation in development of ovaries also was characterized by enlargement during the spring and regression during the summer and fall (Table 2). Peak in ovarian development occurred during April and May when the ovaries had average weights of 3227 ± 4902 and 1099 ± 417 mg, respectively. High variability associated with these mean values was possibly due to the presence of subadult females (which may or may not breed during their first year) in the sample or a lack of breeding synchrony in adults.

Postnuptial regression of ovaries was rapid. Ovaries from 2 (1-year-old) captive females, sacrificed 26 days after laying the last of 19 eggs, weighed

TABLE 1

SEASONAL VARIATION IN TESTES WEIGHT OF PLAIN CHACHALACAS, 1971–72

Month	N	Mean Weight* (mg ± SD)	Range	Testes Weight/ Body Weight (× 1000)
January	3	24 ± 16	14–42	0.04
February	2	245 ± 263	59–431	0.44
March	4	360 ± 102	211–424	648.40
April	9	435 ± 329	62–545	802.60
May	2	546 ± 12	537–554	0.89
June	2	404 ± 13	395–413	0.75
July	2	314 ± 154	205–423	0.06
August	7	207 ± 124	69–451	0.37
September	2	86 ± 38	59–113	0.14
October	6	69 ± 30	37–109	0.10
November	6	60 ± 39	24–112	0.09
December	3	35 ± 18	23–55	0.06

* Represents the mean weight of the pair of testes for each bird.

only 183 and 178 mg. Ruptured follicles were easily observed on ovaries of chachalacas collected within 2 weeks after ovulation. After 5–6 weeks, regression of post-ovulatory follicles was so complete that many could not be distinguished. Ovaries of these 2 captive females had only 9 tiny ruptured follicles (6 on the overy from 1 bird and 3 on the ovary from the other). Unless ovaries are examined within 2–3 weeks after ovulation, post-ovulatory follicles are apparently poor indicators of egg laying histories of Plain Chachalacas.

Age at sexual maturity.—Although many gallinaceous birds breed during their first year (Van Tyne and Berger 1959:273), it has been reported (Grzimek 1972:449) that many cracids do not breed until their second breeding season. Several chachalacas that appeared to be subadults (Marion 1977) were collected during the breeding season. Some females had enlarged ovaries and ruptured follicles while others had considerably smaller reproductive organs. These observations suggested that some subadult females bred during their first year; others apparently did not. Inaccuracies associated with aging older subadult females (Marion 1977) made it difficult to determine the ratio of breeders to non-breeders. Similarly, accurate determination of the proportion of breeding subadult males was restricted by difficulties encountered in aging males during the breeding season. During this time, the majority of sacrificed males had enlarged testes, but considerable variation existed in testes size (Table 1).

Captive young chachalacas had the potential for reproduction during their

TABLE 2

SEASONAL VARIATION IN OVARY WEIGHT OF PLAIN CHACHALACAS, 1971–72

Month	N	Mean Weight* (mg ± SD)	Range	Ovary Weight/ Body Weight (× 1000)
January	1	91.0	—	0.20
February	3	128 ± 34	89–151	0.25
March	2	117 ± 6	113–121	0.28
April	7	3227 ± 4902	37–11,473	5.74
May	3	1099 ± 417	742–1557	2.10
June	0	—	—	—
July	0	—	—	—
August	4	151 ± 34	121–183	0.31
September	3	201 ± 15	186–216	0.41
October	2[a]	40 ± 50	5–75	0.08
November	9	116 ± 54	49–194	0.23
December	3[b]	123 ± 87	56–221	0.24

* Only a left ovary was ever found.
[a] Both of these females were apparently juveniles.
[b] Two of these females were apparently juveniles.

first breeding season. Two captive females mentioned earlier began laying eggs on 26 April 1972, when they were approximately 10 months old. Since 2 eggs were often laid on the same day, both females obviously participated in egg laying. Captive females failed to incubate their eggs. Plain Chachalacas are generally single-brooded but laid additional clutches when eggs were removed or destroyed. Four different clutches totaling 19 eggs were laid by each of the 2 captive females in 1972. Recycling time between clutches was 20–25 days; the last egg was laid on 23 July 1972.

At least 3 incubated eggs from the first 2 clutches contained embryos, indicating that 10-month-old males successfully bred females of the same age. Social mechanisms among wild chachalacas may inhibit young males from breeding during their first year, but data are lacking.

Breeding season.—The first chachalaca nests of the season were typically found in April. Sennett (1878:52) and Davie (1889:154) also reported finding the first nests of this species in the Rio Grande Delta during April. Earlier nests do occur, but they are rare. Observation of a chick (about 2 days old) on 24 April 1972 suggested that at least one egg must have been laid and incubated during the last week of March. The incubation period is approximately 25 days. In captivity, Plain Chachalacas have laid eggs as early as the middle of January (P. James, pers. comm.).

The first chachalaca chicks are usually observed in May. Hatching dates were accurately determined during 1971 for 19 nests; the earliest, median,

and latest hatching dates recorded were 10 May, 28 June, and 14 August, respectively. If the initial nest or young are destroyed early in the breeding season, wild chachalacas occasionally renest; this has occurred as late as September or October. On 5 November 1972, juvenile birds less than 1 month old (estimated according to their size) were observed at Santa Ana Refuge and Bentsen-Rio Grande State Park. These observations provided indirect evidence that nesting during the 1972 breeding season occurred in October. Most nesting activity, however, was completed during May, June, and July.

Nest site description.—Plain Chachalacas are somewhat unique among gallinaceous game birds since they nest exclusively in trees, or vines supported by trees. Of 209 nests examined, 204 (98%) were in trees and 5 (2%) were in vines supported by trees. Mean height above the ground for 192 nests was 3.55 ± 1.45 m (0.9–10.0 m). Heinroth (1931) suggested that the typical tree-nesting habit of cracids was due to frequent flooding of areas inhabited by these birds.

Nineteen tree species were used for nesting, with cedar elm (*Ulmus crassifolia*), huisache (*Acacia farnesiana*), sugarberry (*Celtis laevigata*), anaqua (*Ehretia anacua*), and Texas ebony (*Pithecellobium flexicaule*) accounting for over two-thirds (22, 16, 13, 9, and 8%, respectively) of 209 nesting sites. Other trees and vines used, in decreasing frequency, were coma (*Bumelia lanuginosa*), granjeno (*Celtis pallida*), Wright's acacia (*Acacia wrightii*), Mexican ash (*Fraxinus berlandieriana*), Texas persimmon (*Diospyros texana*), Brasil (*Condalia hookeri*), tepeguaje (*Leucaena pulverulenta*), colima (*Xantholylum fagara*), retama (*Parkinsonia aculeata*), Texas sandbar willow (*Salix interior* var. *angustissima*), honey mesquite (*Prosopis glandulosa*), guayacan (*Porlieria angustifolia*), guajillo (*Acacia berlandieri*), and Texas virgins bower (*Clematis drummondii*).

These trees were highly variable in size, with an average diameter (DBH) of 18.0 ± 17.2 cm (range 1.3–78.7 cm). The majority (85%) of trees containing nests were living and were draped with Spanish moss (*Tillandsia usneoides*) and tangled vines (*Serjania brachycarpa* and *Cocculus diversifolius*) that commonly supported and concealed nests. Nests also were located in crotches of trees or forks of horizontal branches. Occasionally, no nest structure at all was used; eggs were laid (and incubated) on tree stubs, on bare crotches of trees, and on horizontal portions of broken limbs.

We found no evidence of Plain Chachalacas nesting in colonies as suggested by Sutton and Pettingill (1942:12). Adjacent nests in close proximity (within 10–30 m) to each other were apparently not used simultaneously during the breeding season and this undoubtedly alleviated conflicts between adjacent breeding males defending nest sites.

Description of nests.—Nests were typically small and flimsy because Plain Chachalacas nest extensively in rejuvenated nests or nests of smaller birds, including the Yellow-billed Cuckoo (*Coccyzus americanus*), the Curve-billed Thrasher (*Toxostoma curvirostre*), and the Groove-billed Ani (*Crotophaga sulcirostris*). Most nests appeared to be too small to support a clutch of large eggs; the average maximum diameter (nests were usually oblong) of 42 nests was 21.7 ± 6.4 cm (range 11–34). Frequent wind damage (17% of nest and egg destruction) was undoubtedly due to the instability and small size of nesting structures. Plain Chachalacas were never observed actively building a nest or carrying nesting materials. Nests were composed of a variety of readily available plant materials, including twigs, Spanish moss, vines, and leaves. Nests were occasionally used more than once during the breeding season and from year to year. Three of the 59 active nests (5%) examined in 1971 were reoccupied. Whether these observations represented renesting attempts by the same pair or initial nesting attempts by another pair was unknown.

Description of eggs.—Plain Chachalaca eggs are relatively large and have thick, buffy-white and roughly granulated eggshells. These white eggshells, initially unmarked, often become stained by nesting materials in wet weather. Egg shape varies from short ovate to elongate ovate. Size is large in relation to bird size. Mean egg measurements were: length 58.0 ± 2.2 mm (range 51.0–63.7 mm), width 41.0 ± 1.5 mm (range 37.5–49.0 mm), and weight 56.0 ± 6.3 g (range 42.5–70.9 g) obtained from 129, 130, and 89 eggs, respectively.

Clutch size.—Average clutch size for 158 complete clutches was 2.88 ± 0.43 eggs (Table 3). Only 3% (5 of 158) of the completed clutches contained 4 eggs; none contained only 1 egg.

Egg laying occurred on alternate days until the clutch was complete. A normal clutch was laid in about 5 days. Nests occasionally contained more than the normal number of eggs, suggesting that more than 1 female used the nest. One nest of 5 eggs was discovered in 1971; 2 of these eggs were laid in an interval of less than 18 h, indicating that more than 1 female contributed to the clutch. This nest was incubated until it was upset by strong winds.

Fleetwood and Bolen (1965) reported a Plain Chachalaca nest that contained 9 eggs. The 9 unincubated eggs in this nest were apparently laid by 4 females. "Dump nests" like these are rare and not severely detrimental to the reproduction of this species.

Nesting observations during 1972 provided positive evidence that 1 nest was used twice by the same pair. This marked pair laid an initial clutch of 3 eggs in late April. These chicks hatched and left the nest on 10 May. Later, the

pair was observed on 3 occasions (12 May, 13 May, and 29 May) without young. A severe thunderstorm the night of 10 May 1972 probably killed the chicks soon after they left the nest. In early June, this pair again nested in the same nesting structure. The second clutch of 2 eggs hatched and both young left the nest before 3 July 1972. No further observations of this marked pair and young were obtained.

Egg production in captive chachalacas commonly exceeds normal production in wild birds. In addition to 2 captive females (approaching a year old) laying 19 eggs, another captive flock (including 4 adult females) laid nearly 100 eggs in 1972 (P. James, pers. comm.). A third captive flock of approximately 60 pairs also laid many more eggs than the normal clutch, depending upon existing moisture conditions. When damp conditions prevailed during the breeding season, many eggs were laid. During drier times, however, egg production was severely curtailed (F. Wied, pers. comm.).

Incubation.—Observations at the nest site indicate that incubation begins within hours after completion of the clutch and only the female incubates. She sits motionless and leaves the nest reluctantly when disturbed. Departure from and return to the nest are typically accomplished quickly and quietly. During the day, incubating females left the nest for brief periods (15–30 min) to feed, but apparently incubated continuously at night. The breeding male was never observed bringing food to his mate; he was observed to remain nearby and to defend the nest site from conspecifics. The incubation period, measured for 6 clutches of eggs in 1971, was 25.3 ± 1.0 days (range 24–27 days). The 25-day average incubation period was slightly longer than those previously reported for this species: 21 days (Grzimek 1972:448), 22 days (Bent 1932:348), 22–24 days (Kendeigh 1952:194), and 24 days (Delacour and Amadon 1973:15).

Hatching.—Hatching of chicks was synchronous. Pipping began approximately 24 h prior to hatching and chicks retained the white egg tooth for 6–10 days after hatching. Egg hatchability was 92% of 249 eggs in successful nests with complete clutch counts (Table 3).

Chicks left the nest within 2 h of hatching. Overall success from 455 incubated eggs was 50% with the average number of chicks per successful nest ($N = 89$) being 2.5 (Table 3). As the down dried and the last egg was hatching, the precocial chicks actively crawled around in the nest and on top of the mother. The adult male rarely visited the nest during hatching, but watched intently from a nearby perch. After all young hatched, the mother descended to the ground and, with a clucking vocalization, urged the chicks to follow. In descending to the ground, the chicks leaped from the nest and clung to branches and vines as they tumbled downward. After joining the

TABLE 3

PLAIN CHACHALACA NESTING SUMMARY FROM SANTA ANA NATIONAL WILDLIFE REFUGE FOR 1964–66, AND 1971

	Year				
	1964	1965	1966	1971	Total
Clutch size					
No. incubated eggs	133	123	88	111	455
No. incubated clutches	46	43	31	38	158
Mean*	2.89 ± 0.43	2.86 ± 0.47	2.84 ± 0.45	2.92 ± 0.36	2.88 ± 0.43
Range	2–4	2–4	2–4	2–4	2–4
Egg Hatchability					
No. successful nests	16	26	24	23	89
No. eggs	44	72	67	66	249
Percent hatched	93	97	94	82	92
Nesting Success					
No. nests with complete history	25	37	35	38	135
Percent successful	60	70	69	61	65
No. of chicks leaving nests	40	70	61	53	224
Mean no. to leave successful nests	2.5	2.7	2.5	2.3	2.5

* ± one standard deviation.

mother on the ground, chicks entered the underbrush where they were difficult to observe.

Nesting losses.—Nesting success of Plain Chachalacas was 65% of 135 nests with complete histories over the 4 years, 1964–66 and 1971 (Table 3). Although the nests were usually inconspicuous, over a third of those observed were destroyed or abandoned (30 and 4%, respectively). Agents of destruction were not obvious and determination of causes of nesting losses was somewhat arbitrary. Mammalian predators, such as raccoons (*Procyon lotor*) and oppossums (*Didelphis marsupialis*), were apparently responsible for approximately 44% of the nesting losses.

Snakes swallowed entire clutches of eggs, leaving no trace in the nest or on the ground. For this reason, the detrimental impact of snakes on nesting was probably underestimated. Texas indigo snakes (*Drymarchon corais erebennus*) have been found that swallowed whole chachalaca eggs (D.

Blankinship, pers. comm.). Snakes were the apparent agents of destruction for approximately 25% of the unsuccessful nests. Eggs were apparently shaken out of approximately 19% of unsuccessful nests by strong winds. In addition, discovery of 5–10 randomly dropped eggs in March and early April each year was not uncommon and an effort was made not to include such eggs in this calculation. Causes of loss were unknown for the remaining 12% of unsuccessful nests.

Care of young.—Observations of family groups indicated that chicks were brooded by both parents. The precocial chicks were observed feeding and roosting with the adult pair at various stages of early development. Within a week of hatching, chicks exhibited great agility in climbing through shrubs and trees. Observations of captive chicks indicated that they were able to jump and fly at least 1.3 m at 6 days of age. Rapid rates of growth and development were previously reported by Marion (1977).

SUMMARY

Nesting ecology of the Plain Chachalaca in the Lower Rio Grande Valley of Texas was investigated during the mid-1960's and early 1970's. Pairing and strengthening of pair bonds apparently occur in the late winter; the sex ratio approximates 1 male:1 female, and Plain Chachalacas are apparently monogamous. Gonads enlarge rapidly during early spring; testes size peaks in March and April and ovaries are largest in April and May. Nesting begins in April and is usually completed in July or August. Chachalacas are apparently capable of breeding during their first year, but the incidence of this occurring in wild birds remains unknown.

Plain Chachalacas use flimsy nests supported by a variety of native trees, shrubs, and vines. The mean clutch size for 158 complete clutches was 2.88 ± 0.43 eggs. Incubation by the female takes approximately 25 days, and overall egg hatchability for 249 eggs was 92%. Nesting success for 135 nests over the 4-year interval was 65%; major causes of nest failure included mammalian predators, snakes, and wind damage. Chicks left 47% of the nests in which eggs were incubated and these successful nests ($N = 89$) produced an average of 2.5 chicks per nest. Chicks are extremely precocial and leave the nest within hours after hatching.

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