

BFR 99

NATURAL HISTORY OF THE OCELLATED TURKEY

DAVID W. STEADMAN

JAMES STULL

STEPHEN W. EATON

The Ocellated Turkey (*Meleagris ocellata*) lives in lowland tropical forests from Peten, Guatemala, and adjacent central and northern Belize, north through the Yucatan peninsula of Mexico, and west into the eastern portions of Chiapas and Tabasco. Although the distribution of the Ocellated Turkey within this arc is somewhat patchy today because of habitat destruction and hunting pressure, it is not nearly as limited as indicated in the range map of Lint (1977: 7S). Recent treatments of the distribution and status of the Ocellated Turkey are as follows: Mexico-Brodkorb (1943), Leopold (1948), Paynter (1955), and Storer (1961); Belize-Russell (1964) and Frost (1977); Guatemala--VanTyne (1935), Smithe and Paynter (1963), Smithe (1966), and Land (1970). We follow Ridgway and Friedmann (1946), Paynter (1955), and Steadman (1975) in the use of *Meleagris* rather than *Agriocharis* for the Ocellated Turkey. We are fortunate in that the only other species of turkey, the Common Turkey (*Meleagris gallopavo*), is very well known biologically and thus provides an excellent basis for comparison of the two species.

From 24 February to 13 April 1977, we studied the Ocellated Turkey at the Mayan ruins of Tikal, Peten, Guatemala. The entire 576 km² area of Tikal is a national park of Guatemala, a sanctuary for all plants and wildlife. This protection has allowed the Ocellated Turkey to become very tame and readily studied. Tikal National Park supports a lush tropical forest characterized by very seasonal rainfall, with most of the precipitation falling from June-September. The topography is rather monotonous in this limestone region, with rolling, occasionally steep hills interspersed with flatter, low-lying areas. The elevation of our study area varies from 185-265 m above sea level.

Methods

Observations began soon after first light while the birds were still on their roosts, and ended when they flew up to their roosts and settled down for the night. Observations of flock composition, general movements, and behavior were made singly or by two observers. Two observers were always used when food counts were obtained, one to observe and one to take notes. Work was often suspended from about 11:00 - 14:00, at which time the turkeys usually

sought shelter in the forest and were lost from our view. The tameness of the turkeys permitted most of the observations to be made at a distance of 8–30m. Several hundred 35 mm color slides were made by Stull and Eaton to document certain observations.

We divided males into two age classes (adult vs. yearling) on the basis of the spur being much longer and more sharply pointed in adults. Also, the extent of the coppery sheen on the wing, representing the greater secondary coverts, was considerably greater in adults than in yearlings of both males and females (Figure 1), a feature shared with the Common Turkey (Williams, 1961). Certain individual males and females could be recognized by the distribution of the orange to coral-red warts on the light blue skin of the head and neck (Figure 1), a criterion by which we distinguished Gobblers A, B, and C of the ruins flock, and Gobblers D, E, and F of the airstrip flock. In addition, one could detect an increase in a gobbler's sex drive by his higher rate of gobbling and strutting, an overall change in posture, and a greater swelling of the neck, the knob on the top of the head, and the snood (Figure 6). Throughout this paper, birds in their first year up until 1 January are considered juveniles. Birds in their first year, after 1 January, are called yearlings until after the 2nd basic molt, after which the greater secondary coverts are enlarged and the birds are considered adults.

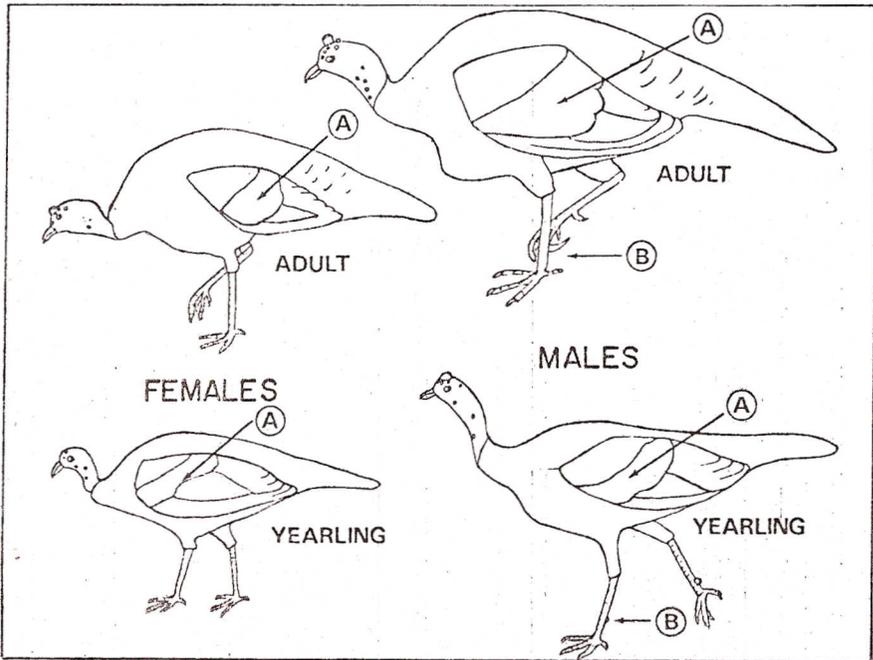


Fig. 1. Field characters to distinguish adults versus yearlings in Ocellated Turkeys.

A-Greater secondary coverts (broad in adults; narrow in yearlings).

B-Tarsal spur (long, pointed in adults; short, rounded in yearlings).

OCELLATED TURKEY

Plumage and Molt

Perhaps the best single collection of wild specimens is that reported by Storey (1961). These birds (7 males, 8 females and 9 downy young) were taken in Campeche, Mexico, and are now housed at the Museum of Zoology, University of Michigan (UMMZ). Unless stated otherwise, the following data on plumage and molt were compiled by Laton during recent visits to UMMZ and to the American Museum of Natural History (AMNH).

The molt in juvenile birds is apparently nearly complete at four to six months of age. A female, collected 28 September, shows one outer rectrix and primaries 1, 9 and 10 to be juvenile. In four juvenile females collected from 8 October to 6 November, juvenile primaries 9 and 10 are present, and the central four to six rectrices are of a newer generation, being both wider and longer. Three yearling females taken on 19 and 21 April show only primary 10 to be juvenile, while their central four to six rectrices represent a new, larger generation of feathers. Two of these last three yearling females were said by their collector, J. Van Tyne, to be in breeding condition. Four other UMMZ females, taken in November and January, are judged to be adults by their lack of juvenile primaries and by having all rectrices of a single feather generation. One juvenile male (UMMZ), taken on 2 December, retains juvenile primaries 9 and 10, as well as having two pairs of central rectrices shorter than the 7 lateral pairs, appearing to be of a newer and larger generation of feathers. Wear on the lateral rectrices suggests that a centrifugal molt had occurred in this earlier generation. No sign of molt was noted in five adult males (UMMZ), taken from 12 March to 6 May, but wear on the tips of primaries 3-9 indicates that the birds had been strutting. An adult male (AMNH), taken in Peten in June, shows no sign of molt, but his strutting marks on primaries 2-10. One yearling and two adult females (UMMZ) from both Campeche and Peten, were referable to the "grey phase", as described by Ridgway and Friedmann (1946), showing a preponderance of grey in the area of the secondaries which is normally white. A female (AMNH) is also of this grey phase.

Nesting Phenology

The general phenology of the annual cycle of the Ocellated Turkey has been partially documented by a variety of authors. Chapman (1896) found it to be not calling (gobbling) from 3-21 March 1896 at Chichen Itza, Yucatan, although he saw from one to six individuals daily. During our study at Tikal, the birds began to gobble on 9 March, with strutting following on 10 March. We first observed copulations on 7 April. Russell (1964) reported a nest and eggs found by D. Lancaster on 27 April 1957, near Gallon Jug, Belize. Van Tyne (1935) documented a nest with 8 fresh eggs (found by H. Malicis) from Chultuqli, Peten, on 6 May 1923, while Smith and Plynter (1963) reported a nest of 8 eggs at Tibal on 30 May 1959. Dr. Taibel, in Ghigi (1936) stated that laying takes place in the early days of April, and that on his arrival in Yaxh, Peten, on

25 May 1932, he saw poults of Ocellated Turkeys about three weeks of age, therefore having hatched on about 4 May. He went on to say (p. 362.) "One can still find nests with eggs until the first days of July: The last brooded one that was in my possession hatched the 6th of July." While at Flores, Peten, from 21 May until early August, several persons banded young poults to Dr. T. J. H. only two of which survived. One additional poult was obtained from Yaxchi before he left Peten. All three birds were females, one of which mated with a "wild turkey" in captivity and laid 9 eggs, all of which hatched. However, none of the poults survived beyond two months of age. A review of reproduction in captivity of the Ocellated Turkey is provided by Lint (1977-78).

A female in juvenal plumage (UMMZ, wing = 206 mm) collected on 8 August, was probably about 5 weeks old, as a similarly sized Common Turkey in the collection of St. Bonaventure University (SBU) was determined by the aging method of Knoder (1959) to be five weeks old. This gives a hatching date of about 4 July for the specimen of 8 August. Storer (J. 9(1)) reported wing lengths of up to 60 mm in five recently hatched downy young (UrvtMZ) from Campeche, taken on 27, 28 May, and 1 June. Again based on comparison with wild poults of Common Turkeys of known age (SBU), these poults were probably two to three days old, and thus would have hatched about 25-28 May. Four other poults (UMML) of Ocellated Turkeys from Campeche have wing lengths of 107-118 mm (Storey, 19(1)), similar to a 10 day old poult of Common Turkey (SBU), yielding a hatching date of about 1 June. A poult (UMMZ, wing = 76 mm), taken at Laguna Tridida, Peten, on 2 June (Storey, 19(1)), was probably three to five days old, placing its hatching date on about 28 May. In summary, these data show hatching dates in Ocellated Turkeys to extend approximately from 4 May - 4 July.

The clutch size in Ocellated Turkeys is considered to range from 8-15 (Leopold, 1948), thus yielding an average clutch size of about 12 eggs. If Ocellated Turkeys require about 1.5 days to lay each egg, as is the case in Common Turkeys (Schorger, 1966), a clutch would be completed in about 18 days. Adding an incubation time of 28 days yields a period of about 46 days from the laying of the first egg until hatching. By subtracting 46 days from the various hatching dates discussed above, one can estimate the date of laying of the first egg in Peten, Guatemala, and Campeche, Mexico, to range from about 19 March until 19 May. As this is approximately the maximum time during which viable sperm can be stored by domestic females of Common Turkeys (Lalic, 1955), it may well be that females of Ocellated Turkeys, once serviced, do not go back to the male to start a new nesting cycle, should an early nest be destroyed.

Reproductive Behavior

Gobbling was delivered from the ground and from roost trees by adult males. It was most often heard in the morning between 06:00 - 11:00, and

OCELLATED TURKEY

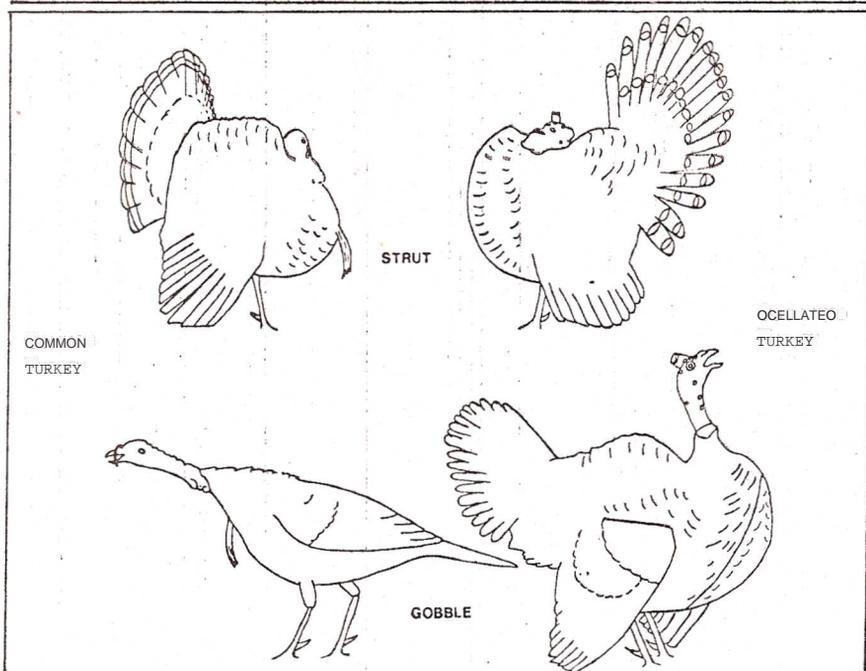


Fig. 2. Comparison of postures during strutting and gobbling in the Common Turkey and the Ocellated Turkey.

again in the evening from just before dark until up to 30 minutes after d.lfk. During some days an adult male would gobble most of the day. The gobble was preceded by 3-7 deep, hollow sounds ("whump-whump-whump"). Then, with the head and neck quickly thrust upward into a vertical position, the strangely sounding gobble was delivered, as shown in Figure 2. An attempt to transliterate the entire gobble is "whump-whump-whump-pum-pull 1-pum-peedle-glunk", which appears to correlate with the "ting-ting-ting-co-on-cot-zit-glung" of Leopold (1948:399), and further attests to the impossibility of expressing the gobble in words. The entire gobble reminded one of an old treadle sewing machine starting up. Where the forest did not greatly dampen the sound, the gobble could be heard up to about 700 m away, as observed at the airstrip.

After beginning on 9 March, gobbling was heard on about one half of the days until we left on 13 April (Table 1). Legters (in Leopold, 1948) found Ocellated Turkeys in Yucatan to begin gobbling in April, reaching a peak about 1 May, and ending in May. Lint (1977) reported that gobbling is heard only during May and June, but perhaps he was referring only to live birds.

Among the three adult males of the nine flock, Gobbler A was apparently dominant, at least in the immediate area of the ruins. He gobbled more than Gobblers B or C, and was the only one known to copulate in the area. Gobbler B was heard to gobble only on four different days, while Gobbler C was

never he:m:: :) gobble. [t is interesting to note the extreme ll:h:onsistcIH'y in daily rates of gobbling for each bird which did indeetk gobble. Al thc airstrip Gobbler D dominated reproductive activities. ilcluding gobbling. through ll April. after whi-h he was replaced by Gobbler E, as discussed below. No gobbling was ever heard from Gobbler F.

Strutting nhs observed (Figure 4) in Cobblers A, D, and I: (Table 1) and in one yearling male. No females were seen to strut.. Preceding a typical strut the male lowe,"ed his head and, with tail feathers horizontal to the ground and partially spread, wagged the tail from side to side about five times before elevating and fully spreading the tail feathers and those of the dorsal tract.. The wings were lowered, with primaries 6-10 reaching the ground. The feathers of the breast were interestingly elevated into a narrow triangle with the apex about 10 CIII directly forward of the head (Figure 2). The head and upper neck were held back and pressed into the elevated feathers of the dorsal tract.. The head and neck were very Oacid and remained the same shade of blue throughout.. While strutting, the wing on the side away from the female(s) involved was vibrated rapidly, while the other wing was held down stiffly. The strutting male wouldk circle the female(s), trying to keep them in a tight group. Yearling males were excluded in this herding, evidence that the adult males can recognize the females as distinct from the yearling males. Often strutting was seemingly reinforced by gobbling. By elevating the head quickly to the vertical position, gobbling could be added to the strutting display without relaxing from the strutJlllg posture. Once a yearling male was seen to wag its tail and then begin a typic;l strut. Although he was with only another yearling male, he continued to strut for 8 minutes, vibrating the far wing and herding the fellow yearling male just as if it were a female..

The adult male crouch was seen on six occasions. As females coming from the roost approached a gobbling and strutting male to within about 15 m, the male would squat on the ground with its head lowered, not unlike a soliciting female. As the females came in closer, the squatting male would rise up and begin to strt!t and gobble while herding the females. No females solicited on the first day that the adult male crouch was seen (8 April), but on the following day this same sequence was followed by female solicit and copulation. Female solicit occurred when a female, in the presence of a strutting and gobbling adult male, squatted on ttle ground with her head and neck at approximately a 70° angle (o the ground. An adult male usually strutted around the female two or three times before stepping on her back to begin copulation.

Copubtioll was observed in Gobblers A, D, and E (Table 1). A typical copulation is described as follows. After stepping on the back of the female, Gobbler D, with his tail at about a 45° angle to the ground, treaded for about 10 seconds. The female then lowered her head and apparently elevated her tail as Gobbler O lowered his tail, forcing the remale's tail up further, and thus

Table 1
Gobbling and strutting in the ruins flock (Gobblers A, B, C) and airstrip flock (Gobblers D, E, F)

Date	Weather	Gobbler A			Gobbler B			Gobbler C			Gobbler D			Gobbler E			Gobbler F		
		S	G	N	S	G	N	S	G	N	S	G	N	S	G	N	S	G	N
9 March	Overcast	-	-	-	0	1	0	0	0	10	-	-	-	-	-	-	-	-	-
10 March	Warm, clear	2	9	10	0	0	11	0	0	11	-	-	-	-	-	-	-	-	-
11 March	Foggy, clearing	0	0	9	-	-	-	0	0	9	-	-	-	-	-	-	-	-	-
12 March	Foggy, clearing	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
13 March	Cloudy, clearing	0	0	5	0	0	5	-	-	-	-	-	-	-	-	-	-	-	-
14 March	Cloudy, clearing	0	60	9	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
15 March	Cloudy, clearing	2	82	8	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
16 March	Cloudy, clearing	2	8	4	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
17 March	Cloudy, clearing	-	-	-	0	0	5	-	-	-	-	-	-	-	-	-	-	-	-
18 March	Cloudy, clearing	1	2	4	0	0	4	0	0	4	-	-	-	-	-	-	-	-	-
19 March	Cloudy, clearing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20 March	Overcast	0	0	0	-	-	-	0	0	9	-	-	-	-	-	-	-	-	-
21 March	Overcast, cool, breezy	0	0	0	0	0	4	0	0	4	-	-	-	-	-	-	-	-	-
22 March	Cloudy, clearing	0	0	0	0	0	2	0	0	3	-	-	-	-	-	-	-	-	-
23 March	Foggy, clearing	0	0	1	0	0	1	-	-	-	-	-	-	-	-	-	-	-	-
24 March	Foggy, clearing	0	0	1	0	0	5	-	-	-	-	-	-	-	-	-	-	-	-
25 March	Foggy, clearing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26 March	Foggy, clearing	4	149	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27 March	Very overcast	0	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28 March	Very overcast	0	16	1	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
29 March	Slightly overcast	0	7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30 March	Overcast, clearing	1	85	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31 March	Overcast, clearing	1	66	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 April	Foggy, clearing	0	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 April	Foggy, clearing	0	1	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
3 April	Overcast, warm	-	-	-	0	26	1	-	-	-	2	79	9	1	17	9	0	0	9
4 April	Overcast	-	-	-	-	-	-	-	-	-	0	114	9	0	69	9	0	0	9
5 April	Overcast	0	71	1	0	0	0	-	-	-	-	-	-	0	0	4	0	0	3
6 April	Rain, clearing	0	0	?	-	-	-	-	-	-	0	0	2	-	-	-	-	-	-
7 April	Light rain, cool	*2	124	2	-	-	-	-	-	-	2	268	4	0	0	4	-	-	-
8 April	Cloudy, clearing	-	-	-	-	-	-	-	-	-	0	100	4	-	-	-	-	-	-
9 April	Cloudy, clearing	0	92	0	0	18	0	-	-	-	*3	72+	8	-	0	8	-	-	-
10 April	Light rain	0	0	0	-	-	-	-	-	-	*0	125	5	-	-	-	-	-	-
11 April	Clear	-	-	-	-	-	-	-	-	-	3	58+	3	0	0	0	-	-	-
12 April	Light rain, warm	0	111	0	-	-	-	-	-	-	0	0?	7	**5	0?	7	-	-	-
13 April	Light rain, warm	0	15	0	0	18	0	-	-	-	0	1+	8	**6	300±	8	-	-	-
Total		15	901		0	63		0	0		10	817+		12	386±		0	0	

No gobbling or strutting observed from 24 February - 8 March. * - one copulation.
 A Dash (-) means that the bird in question was not observed on that day

affecting the meeting of oeloaes. Ther, they wobbled for about 35 seconds. After which the female managed to free herself, running about in the forest stopping to preen. All seven observed copulations were in the early morning, shortly after the females new down from their roosts.

The three gobblers (D, I, J) were the most vigorous group. Gobbler I seemed to be the most vigorous of the trio from 3-11 April, and was seen to copulate on 9 April. Gobbler E appeared to be older and less vigorous than Gobbler D, but did gobble and strut occasionally. On 11 April, Gobbler E attempted to come close to a flock consisting of four females, three yearling males, and Gobbler D, at which time he was confronted by Gobbler D. Both birds began to walk parallel to each other with their breasts lowered, followed by a rapid vertical flight of about 2 m, after which they continued the parallel walk. Finally, Gobbler E moved away and Gobbler D was left with the females and yearling males. On 12 April, however, Gobbler D chose not to defend the flock, whereupon Gobbler E strutted five different times for several minutes each, gobbled a great deal and copulated with two females. The following day (13 April), Gobblers D and E had an exchange similar to that of 11 April, and Gobbler E again won and copulated twice. Gobbler F moved away from the airstrip after 5 April, and perhaps was the bird heard gobbling occasionally to the north of the eastern end of the airstrip.

Table 2

Composition of the two flocks of Ocellated Turkeys at Tikal

Period	Adult Males		Yearling Males		Female Adults and Yearlings)		Total flock	
	M	R	M	R	M	R	M	R
Ruins flock								
24 February								
5 March	1,3	0-2	3,5	3-5	4,2	0-6	9,0	5-12
6 - 15 March	1,5	1-3	4,0	3-5	5,1	4-6	10,6	9-12
16 - 25 March	1,3	0-3	3,1	1-5	3,2	0-6	7,7	1-10
26 March								
4 April	0,9	0-1	2,1	1-6	2,8	0-5	5,8	2-9
5 - 13 April	0,9	0-1	1A	0-4	0,9	0-3	2,9	1-6
Airstrip flock								
24 February								
8 March	1,8	1-3	4,5	4-5	4,0	4	10,5	8-16
3 - 13 April	2,0	1-3	2,4	2-3	3,0	1-5	7,4	5-10

Numbers represent the largest number of individuals in each category seen on each day during the period. Numbers in the "Total" category represent the largest number of birds seen together at one time during each day of the period, including birds of unknown age and sex.

M = Male, R = range.

Sociality

Daily records were kept of the composition of the ruins flock from 24 February - 13 April, and of the airstrip flock from 27 February - 8 March and T-13 April (Table 2). These data show the flock composition from 24 February - 15 March to be similar to that of fall and winter flocks of Ocellated Turkeys in Mexico as reported by Leopold (1948). The breaking up of the ruins flock, shown graphically in Figure 3, began in mid to late March when the adult males began to gobble and strut intensely, each thus attempting to attract its own small group of females and yearling males. Flocks continued to reduce in size in each succeeding interval. The large reduction in number of females in the last interval may have been due to their leaving the flock to begin egg laying. The adult males also became more solitary when gobbling and strutting began, consortng with other turkeys in the early morning only. The limited data from the airstrip flock suggest a similar pattern although having a higher average flock size (7.4 birds) than that of the ruins flock (2.9 birds) in the last interval. This is largely because two active gobblers (D,E) were in the same area at the airstrip, while the gobblers of the ruins had apparently isolated themselves more effectively by this time, and our observations there concentrated only on Gobbler A.

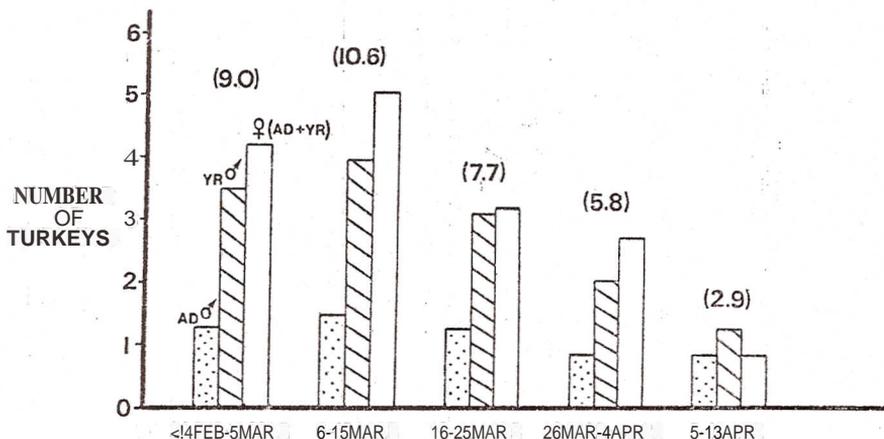


Fig. 3. Average composition of the ruins flock during five 10-day intervals, showing age and sex structure of the flock. Numbers in parentheses represent average maximum size of the flock during the interval. From data in Table 2.

The yearling males of Ocellated Turkeys stay with the females through the winter (Leopold, 1948), and, as we saw at Tibl, through the period of copulation until nesting begins in mid-April. In Common Turkeys the juvenile males break away from the females when they become considerably larger than the females, usually in December (Bailey and Rindl, 1977; Schorger, 1960). Exactly what happens to the yearling males of Ocellated Turkeys after the females leave the flocks to nest is apparently unknown.

Behavioral Note

During the study period the turkeys were mainly feeding directly, without scratching, as they slipped seeds of grasses, plucked small flowers, and picked up exposed fruits. However, when feeding in the forest, Gobbler A was seen to scratch fallen Hems which were covered by fallen leaves. He always scratched 1-2-1, i.e., while standing on one foot, he scratched once with the off foot and then, shifting his weight to the other foot, scratched twice before again shifting to the other foot and scratching once more. Then he stepped back, examined the area, and pecked at the food, mostly fallen fruit. Most *M. g. silvestris* which Eaton has watched have scratched 2-2, i.e., twice on one foot, twice on the other, then stepping back.

Double-wing turn was a display observed four times in yearling males, directed toward adult males. The yearling male took two or three steps toward the adult male, and when within one half meter of the adult male, gave a double wing stretch and then rapidly turned 180°, moving a few meters away from the adult male.

Roosting

The trees selected for roosting in 75% (29 of 39) of our observations were *Cecropia* sp., about 15 cm in diameter at breast height (d.b.h.), in which the turkeys selected nearly horizontal limbs 5-11 m above the ground. Occasionally they used larger trees: a Ramon (*Brosimum alicastanum*), d.b.h. = 35 cm; a possible species of Bignoniaceae, d.b.h. = 80 cm; and two other unknown species, d.b.h. = 25-60 cm. In these trees the turkeys again used nearly horizontal limbs, from 6-22 m above the ground. All roost trees were at the edge of a clearing, up to only a few meters into the forest. They occasionally selected the same roost trees on consecutive nights, but more often they changed sites. After initially flying up into a tree, they would often fly again to higher branches in the same or adjoining tree. They remained alert for a few minutes, and then, closing the knee and ankle joints, they rested their sterna on the branch. This was followed by placing their heads backwards under the feathers of the humeral tract. Lint (1977-78) reported that poults (apparently captive) can fly to roost at two weeks of age, and are brooded there by the female.

Never were more than 11 birds seen at a given roost in Tikal. Gaumer (1883) reported a flock of 62 individuals roosting together in three trees, at an undisclosed locality and season. In February and early March the females, adult males and yearling males usually roosted near each other. On 8 March, for example, one adult male; four yearling males and six females were all roosting within a radius of 8 m, near the Great Plaza of the ruins. After gobbling began on 9 March, the adult males usually roosted alone, while the females and yearling males continued to roost together in groups of 2-6 birds. Three adult males, undoubtedly Gobblers D, E, and F, roosted in the same *Cecropia*, 70 m north of the Tikal Inn, near the airstrip, on 27-28 February. (This was before

OCELLATED TURKEY



Fig. 4. A strutting adult male Ocellated Turkey (Gobbler D of the airstrip flock). In front of Gobbler D., and to the immediate left and right of him, are two females. To the far left are two yearling males. (Stephen W. Eaton)

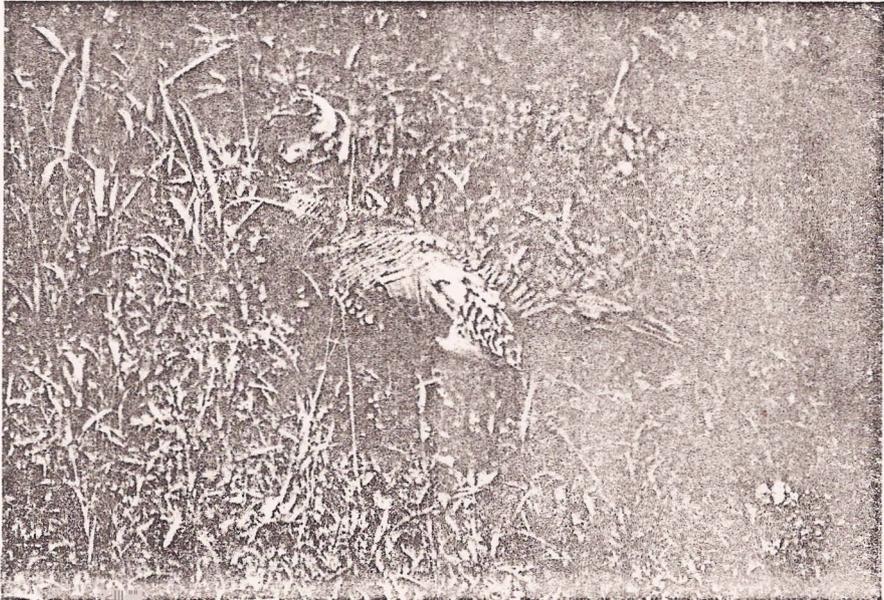


Fig. 5. Adult female from ruins flock, in a weedy patch of tall grass on the E. side of Temple 1. This small plot and the adjacent area of short, mowed grass were among the most important feeding areas for the ruins flock.

we were distinguishing Gobblers D, E, and F as individuals). Gobbler F broke away from Gobblers D and E about 1 March, while Gobblers D and E also roosted separately after 4 March, but usually within hearing distance of each other. They would often gobble from the roost before settling down for the night; and again in the morning before flying down.

Birds of the airstrip flock new to their roosts near the edge of the airstrip at about the same time, regardless of age or sex. This time ranged from 17:30 - 17:55 during 26 February - 5 March, and from 17:50 - 18:38 during 26 March - 12 April. Birds of the ruins flock flew to their roosts slightly later than those of the airstrip, ranging from 18:06 on 8 March to 18:35 on 18 March. The more open nature of the undergrowth around the ruins may have allowed more light into their foraging areas, thus extending their foraging time. The airstrip birds flew from their roosts from 06:30 - 06:55 during 27 February - 5 March, occasionally later if it was raining. These same birds flew down at about 05:44 on 5 and 7 April. Thus light intensity seems to be the immediate trigger to initiate flying to and from the roost.

Table 3

Rate of feeding during different times of day, stated in pecks per minute

Time	Adult Males		Yearling Males		All Females		All Birds	
	X	N	X	N	X	N	X	N
06:00 - 10:00	5.8	7	9.0	5	8.8	10	*7.9	22
10:00 - 14:00	1.0	3	2.7	4	11.8	2	*4.2	9
14:00 - 18:00	6.0	19	15.8	19	11.9	19	*11.2	57
Entire day	4.3+		9.2+		10.8+		*9.7	88
							8.1+	

Based on food counts of 10 minutes each. Both the ruins flock and the airstrip flock are included. See below for methodology of food counts.

X = mean. N = number of food counts upon which X is based.

* weighted mean. + - unweighted mean.

Food

Food habits were studied from 3 - 12 April by following birds for periods of 10 minutes as they foraged on the ground (Tables 3, 4, 5). From a distance of 10-30 m, one person would watch the turkey with 7 x 35 binoculars and attempt to identify the food items pecked at, stripped, or picked up by the birds, and then call it to another person who would record the data in a notebook. Plants seen to be eaten were collected and these specimens have been identified by various members of the Department of Botany of the United States National Museum (Table 6).



Fig. 6. A reproductively active adult male Ocellated Turkey (Gobbler A of the ruins flock). Note inflated snood and neck, and extended feathers of breast and back. Photograph taken during a pause in gobbling. *(Photo: James Stull)*

Fig. 7. Adult female from ruins flock, in tall forest with almost no ground cover, at the Plaza of Seven Temples. Such areas provide easy access to fallen fruits of palms, figs, sapotes, and other trees.



Upon arising their roosts at one half hour before sunrise, the turkeys immediately walked to grassy areas where they would preen and do single and double-wing stretches. If not involved in reproductive activities they then began to feed. Feeding in the morning lasted from about 06:00 -- 10:00, averaging 5.8 pecks per minute (ppm) in adult males, 9.0 ppm in yearling males, 8.8 ppm in females, and 7.9 ppm overall. (Table 3). As temperatures rose in the late morning, the birds moved into the forest and often were lost from our view for 2-5 hours. The turkeys were much more elusive in the forest, probably because they were subject to more predation there. Table 3 documents a reduced rate of feeding from 10:00 -- 14:00 (4.2 ppm overall), at which time the turkeys devoted much time to maintenance activities such as preening, stretching, or simply standing still. From 14:00 -- 18:00 the birds generally returned to more open areas and fed more rapidly than in the morning, averaging 11.2 ppm overall. The lower rate of feeding in adult males as compared to yearling males or females in Table 3 is undoubtedly due to the adult males' preoccupation with reproductive exploits at this time.

Food in the stomach of one specimen from Campeche (Starer, 1961) contained berries of palms. Leopold (1948), in describing their feeding habits in Yucatan and Campeche, said that the wild population stayed in heavy forest throughout the summer and early fall, but began to feed in isolated cornfields about 1 October. In the crops of four birds collected by Leopold's party were corollas

Table 4

Summary of feeding observations

Food Item	Total Pecks	Pecks per Minute	% of Total
Miscellaneous pecks	3907	4.44	45.91
Grass (seeds)	2335	2.65	27.44
Small mint-like herb (leaves and flowers)	865	0.98	10.16
Miscellaneous leaves	748	0.85	8.79
<i>Brosillonia</i> sp. (fruit)	237	0.27	2.78
Ants	107	0.12	1.26
Composite (flowers)	102	0.12	1.20
<i>Ficus</i> sp. (fruit)	69	0.08	0.81
Grit	60	0.07	0.70
Miscellaneous fruit	38	0.04	0.45
<i>Cholla</i> sp. (fruit)	30	0.03	0.35
<i>Adiantum</i> sp. (leaves) Maidenhair fern	6	0.01	0.07
Grass (leaves)	4	<0.01	0.05
Caterpillar		<0.01	0.01
Dipteran		<0.01	0.01
Total		9.67	100.00

Based on 88 food counts of 10 minutes each, taken from 3 -- 12 April, 1977. All birds of both sexes included.

or squash blossoms. One had eaten also the leaves of the fruits of *Solalluln* *hilt/111.* (nightshade), many *S111311* cucumbers and a few unidentified berries. G. Illmer (1883) said that they were omnivorous, feeding alike on grass, grains, fruits and insects as well as the roots of the cultivated poison yucca. In the forest they preferred the fruit of the sapote *tr-e(A:/:~ras* sp.), and (p.G:!), "... equally delighted to find a nest of white ants."

Identification of food items was not possible in 45.9% of the recorded attempts of the turkeys at Tikal to obtain food (Table 4). Considering only those attempts in which the food items were identified (Table 5), seeds of grasses dominated (50.7% of the total). These seeds were usually ingested by "stripping", in which the culms, of fruiting heads were taken in the bill and removed by sliding the bill up toward the terminal end of the culm. Next in order of abundance were the leaves of various plants; followed by fruits, flowers, insects, and grit (Table 5).

Table 5

Consolidated summary of feeding observations, with "miscellaneous pecks" omitted

Food Item	Total Pecks	Pecks per Minute	% of Total
Seeds of grasses	2335	2.65	50.7
Leaves	1403	1.59	30.5
Fruits	374	0.42	8.1
Flowers	322	0.36	7.0
Insects	109	0.12	2.4
Grit	60	0.07	1.3
Total	4603	5.21	100.00

Based on 88 food counts of 10 minutes each, taken from 3 - 12 April, 1977, All birds of both flocks included.

Vocalizations

(a) "Put". A short, low, nasal call, the put was given by males and females of all ages as a location signal or as an alarm. Puts were sometimes hoarse and were given at frequencies varying from about 6-30 per minute. An adult male gave the put call when two people walked to within 10 m of it, quieting as the people moved away. One bird emitted this call once while standing on its roost at daybreak, while the put was also once given after a bird flew up to its roost. One yearling male gave a put after being flushed into a tree by Gobbler A.

(b) "Whistle", a high call, lasts about 0.5 seconds, the whistle was given by females and yearling males. Both the whistle and put calls were frequently given while the turkeys were in the forest. On one occasion, a bird which was separated and could not see the rest of the flock gave the whistle until it again saw the other birds of the flock, none of which answered its whistle.

(c) "Beep". Reminiscent of that of the Alleric Woodcock (*Phallochla minor*), the beep was given once by a female 40 ft within the forest, in a loose flock of seven other birds.

(d) "Hee-haw". A very nasal call of two notes, this was given once by a female in a flock of 11 birds.

(e) "Canada Goose Call". A highly pitched yell, sometimes decreasing in pitch at the end, this call was similar to that of a distant Canada Goose (*Branta*

Table 6

Species of plants eaten by Ocrated Turkeys at Tikal (February - April 1977)

Plant	Part Utilized
Acanthaceae	
<i>Dialium</i> (Swartz) (Swartz) CL. Juss.	leaves
<i>Justicia</i> sp.	leaves
<i>Ruellia</i> sp.	leaves
Asclepiadaceae ?	leaves
Begoniaceae	
<i>Begonia</i> sp.	leaves, stems, flowers
Bursaceae	
<i>Bursaria simaruba</i> CL. Sarg.	fruits
Commelinaceae	
<i>Commelina</i> ?	leaves
Compositae	
<i>Parthenocissus (Hemiphragma) L.</i>	leaves, flowers
Cruciferae	
<i>Lepidium</i> sp.	seeds
Labiatae?	leaves
Moraceae	
<i>Brosimum alicastrum</i> Sw.	fruits
<i>Ficus</i> sp.	fruits
Palmae	
<i>Chamaedorea</i> sp.	fruits
Phytolaccaceae	
<i>Rivilla</i> sp.	leaves, stems, flowers fruits
Piperaceae	
<i>Piper</i> sp.	leaves
Polypodiaceae	
<i>Polypodium</i> (Swartz)	leaves, stems
Rubiaceae	
<i>Psychotria</i> sp.	leaves
Strychnaceae	
Violettaceae ?	leaves
<i>Violetta</i> ?	leaves

Based on specimens collected by the authors in March and April, 1977. Identified by members of the Department of Botany of the United States National Institute of Natural History.

of *Jl/udeilsis*). It was observed on only two occasions, it was given by three females which were entering the forest just after leaving Gobbler A. One yearling male and one female. This was also given by a yearling male as it entered the Plaza of Seven temples, where Gobbler A was gobbling.

Table 7

Habitat of Ocellated Turkeys at Tikal (February - April 1977)

Habitat Type	Ruins flock		Airstrip Flock	
	Hectares	% of Total	Hectares	% of Total
I Forest	(280.2)	(92.5 ~	(150.1)	(88.0)
A. Tall	227.8	75.2	35.2	21.3
13. Medium Height	10p	3.3	23.7	14.4
C. Medium to tall, open crown				
1. Brushy ground cover	5.2	1.7	-	-
2. Little or no ground cover	10.3	3.4	4.2	2.5
D. Short				
1. Pure (Escobal)	15.4	5.1	78.3	47.5
2. Mixed with second growth	-	-	2.0	1.2
E. Second growth	11.5	3.8	6.7	4.1
II Short Brush	-	-	(2.0)	(1.2)
III Grassy Plots	(8.7)	(2.9)	(9.2)	(5.6)
A. Tall, with other herbs	6.0	2.0	4.0	2.4
B. Mowed lawn	2.7	0.9	5.2	3.2
IV Miscellaneous	(14.1)	(4.7)	(3.7)	(2.2)
A. Soil-covered trails	0.8	0.3	0.2	0.1
13. Limestone roads or runways	1.3	0.4	3.0	1.8
C. Buildings not covered by vegetation	12.0	4.0	0.3	0.2
D. Open water	-	-	0.2	0.1
Total	303.	100%	165.	100%

Numbers in parenthesis are totals of major habitat types.

Habitat Utilization

The ruins flock lived in approximately 300 hectares dominated by tall forest and centered about the Great Plaza, while the airstrip flock occupied about 165 hectares centered on the airstrip, dominated by short forest (Figure 7, Table 7). Characteristic trees of tall forest included *Ficus* sp. (Fig), *Bursera* sp. (Gumbp-Limbo), *Swietenia* sp. (Mahogany), *Brosimum* sp. (Ramon), and *Adiantum* sp. (Sapote). This type of forest is relatively unimportant as a feeding area for the turkeys, but it is very important to the birds as a place of rest and preening during mid-day. Near many of the ruins the tall forest is with little brushy undercover, it having been cleared for easy access and viewing of the ancient buildings (Figure 7). For the turkeys this habitat was a feeding site.

fruits. Grassy plots constituted only about 3% (ruins flock) and 6% (airstrip flock) or less; habitats, but was by far the most important feeding area (Figure 1), as well as the site of most reproductive activity. The absolute amount of grassy plots (Table 7) was about the same (9 hectares \pm) for both nocks, while the density and type of forest was very different. This suggests that the density and distribution of Ocellated Turkeys in heavily forested areas such as Tikal may be largely controlled by the distribution and size of grassy areas. However, we stress here the importance of forests for roosting, resting, general maintenance activities and nesting. The scarcity of Ocellated Turkeys noted by us and many other observers in heavily cleared areas also argues for their need for forests. This scarcity in disturbed areas is also partly due to hunting pressure from man, which probably not only reduces the actual density of turkeys but also makes them more wary and therefore more difficult to observe. In this respect, the importance of Tikal National Park as a wildlife refuge cannot be overemphasized. Smithe (1966: 54) reported the turkeys at Tikal to be "... widespread but not numerous, ... Until local pothunting discouraged their presence, they were found in groups of three or more within a quarter mile of the Aguada Tibl, and nested within half a mile." Thus protection within the park has resulted in their becoming quite numerous and tame within only 10 years. The government of Guatemala and the staff of Tikal National Park are to be commended for their ambitious efforts in maintaining the wonderful naturalness of the land within the boundaries of the park.

Estimate of Number of Turkeys in Tikal National Park

On 8 April we each hiked on roads or trails for about 6 km away from Tikal. Starting at the western end of the airstrip, we walked slowly and carefully listened for gobbling turkeys. Eaton took the trail north toward Uaxactun, Steadman the trail ESE toward Yaxha, and Stull the road south toward Rellicat. We started at 06:00, about the time that the first gobbles were normally heard in the study area. Each person walked at a rate of about 2 km per hour until 09:00, and then returned. In addition to the six males heard within 1.0 km of Tikal, one was heard 3.1 km to the north, and three were heard to the south of Tikal (single birds at 3.0 km, 4.5 km, and 5.5 km). As stated above, we estimated that we could hear a gobble from a distance of approximately 700 m. This distance would probably be somewhat less in the forested areas which we sampled in our survey, and thus we estimated that we could hear a gobble in the forest up to about 500 m away. Thus, these 10 gobbling males occupied an area of approximately 30 km². Other gobblers could have occurred within this area, a factor probably more than offset by the undoubtedly higher than normal concentration of turkeys about the ruins as a result of man's limited clearing of the forest. Assuming then that 10 gobblers per 50 km² represents the average density of gobblers in Tikal National Park would result in about 115 gobblers in the 576 km² park. Assuming also that the composition of the ruins and airstrip

locks (Table 2) is typical of this area would yield four other birds (females and yearling males) per gobbling male, or approximately 575 Ocellated Turkey-locks in the park just before the nesting season. This very crude but conservative estimate results in a density of about one individual per km².

Summary, with Comparison of the Ocellated Turkey to the Common Turkey

Based on our own field work and previous literature, a review of the biology of wild Ocellated Turkeys is presented. Juvenal birds appear to hold juvenal primaries 9 and 10, or only 10, until the second pre-basic molt. An alternate molt follows the first basic plumage, involving only the central 4-6 pairs of rectrices. This general pattern is similar to that seen in wild populations of all subspecies of Common Turkeys which have been studied.

From records in the literature analyzed above, the date of laying the first eggs of the clutch in Ocellated Turkeys ranges from 19 March - 19 May, while the hatching date varies from 4 May - 4 July. Nests with eggs in Common Turkeys range from 15 February - 15 July, with the majority occurring in April and May (Schorger, 1966). It appears that the timing of the nesting cycle in Ocellated Turkeys is more similar to that of northern populations of Common Turkeys than to those of southeastern United States.

The great variability in gobbling from day to day by individual gobblers (Table 1) is also seen in most gobbling bouts of Common Turkeys (for example, Donohoe and McKibben, 1970; Scott and Boeker, 1972). The adult male of the Ocellated Turkey, as demonstrated by Gobblers D and E (p. 22), managed to rejuvenate its energy periodically, and is perhaps normally incapable of maintaining dominance throughout the breeding season. A change of dominance throughout the period of mating in alpha males of sibling groups in *M. g. intermedia* occurred in only two of 78 cases seen by Watts (1968). Perhaps the fat sponge (Schorger, 1966), a reservoir of stored energy typical of breeding males of Common Turkeys, is not as well developed in Ocellated Turkeys, thus necessitating the period of rejuvenation.

A gobbling and strutting male defends an area near the females for a few hours after the females leave the roost. The strutting and copulatory sequences of Ocellated Turkeys differed from those of Common Turkeys (Hale and Schein, 1962) in the following particulars (Table 8): 1) Before assuming the strut posture, they wagged the partly open tail three to five times (not present in Common Turkey); 2) While strutting, the wing of the male on the side opposite the female(s) was rapidly vibrated, tending to turn the male as he took short steps and circled the females as though in a glide (not so delivered in the Common Turkey); 3) Strutting male crouches as it is approached by females (no such crouch in the Common Turkey); 4) The head of the female was initially held at about a 45° angle to the ground, and then was lowered even more as the sequence proceeded (in Common Turkeys the head is raised further at this point, not lowered). The rest of the sequence in Ocellated Turkey was much like that in

Table 8

Differences in reproductive behavior between Ocellated Turkeys and Common Turkeys

Ocellated Turkey	Common Turkey
1. TuU will heroro ~trutting.	J. No tail wag b)It'on~ stru lting.
2. Off wing vibrated rapidly as gobbler herds females.	2. Both wings held down rigidly ill strut; no obvious herding.
3. Male crouches as female approaches during stru tting.	3. No male crouch as female approaches during strutting.
4. Female solicits male initially with head at 45° angle with ground, lowering neck to near horizontal as male mounts.	4. Female solicits male initially with neck horizontal to ground, raising neck to vertical as male mounts.

Common Turkeys as described by Hale and Schein (op. cit.). The lowering of the head by female Ocellated Turkeys is perhaps a consequence of the lack of a beard in males, whose tip in Common Turkeys seems to touch the top of the head or the female, and perhaps thus aids in orienting tactily in an otherwise awkward situation. In copulating males of Ocellated Turkeys, the inward orientation of the breast feathers, coupled with the head being held further back, may permit the male to see the female and thus orient visually, rather than tactily as in Common Turkeys.

The social organization of Ocellated Turkeys differs from that of Common Turkeys in that the yearling males remain with the females and adult males through the period of copulation. This may be related to the fact that these younger males are apparently quite close in size to the females, as we could detect no difference in size in the field. In Common Turkeys, however, the juvenile males are generally much heavier than the females when they leave the females in December and January (Lewis, 1967:48).

A behavioral display not recorded in Common Turkeys but given in Ocellated Turkeys was what we termed the "double-wiligturn". The scratch in an adult male Ocellated Turkey was 1-2-1 rather than 2-2, which normally occurs in *Pl. g. silvestris*. Of the several vocalizations described herein, the gobble was found to be easily distinguishable from that of the Common Turkey, especially in its preliminary "whumps".

Trees most often selected as roosts by Ocellated Turkeys at Tikal were *Cecropia* sp. with widely spaced, usually quite horizontal branches 5-11 m above the ground. A review of the literature on the roosting habits of various populations of Common Turkeys throughout its extensive range reveals great variation in roosting sites and species of trees used, as dictated by limitations or the habitat involved. Ocellated Turkeys at Tikal descended from roosts shortly

after daybreak and flew up to their roosts shortly after sunset. The intensity of the light seemed to be the determining factor in both cases.

The food of Ocellated Turkeys was dominated by seeds, particularly of grasses, followed by leaves, fruits, flowers, and insects. Ocellated Turkeys generally fed on these items in the same manner as Common Turkeys, as indicated in studies reported by Korschgen (1967). This is probably to facilitate water intake, as water is generally not available at Tikal except at widely separated aguadas, which are natural or man-made reservoirs. Females appeared to feed more regularly than adult or yearling males (Table 3). Considering only the number of pecks per food item, the adult males fed about one half as much as females or yearling males, probably because of their preoccupation with reproductive activities. Our observations show that Ocellated Turkeys fed more vigorously in the late afternoon than in the morning and least at mid-day. This pattern of feeding is very similar to that of the Common Turkey (Bailey, 1967:94).

Habitat usage in Ocellated Turkeys was much as it is in Common Turkeys, being essentially a forest bird which uses openings for grasses and other foods. A density of about one turkey per km² in Tikal National Park was crudely estimated from a count of gobbling males.

Acknowledgments

A Frank M. Chapman Grant from the Department of Ornithology of the American Museum of Natural History to Steadman helped to defray much of the expenses of travel and equipment. We especially thank Wesley W. Lanyon in this respect. Financial support from Norstead Farms, Inc. permitted an additional week in the field. For allowing us to study skins of Ocellated Turkeys at the American Museum of Natural History and the Museum of Zoology at the University of Michigan, we are indebted to Dean Amadon and Robert W. Storer, respectively. For allowing us to study the Ocellated Turkey in their beautiful refuge, we are most grateful to the entire staff of Tikal National Park, especially Sr. Amilcar Gusman, Sr. Vicente Bagu, and Sr. Edgar Lee. For help in obtaining quarters for Steadman and Stull at Tikal, we thank Dr. Luis Lujan, Dr. Jorge Ibarra, and Sra. Vivian de Morales. Mary L. Wise and Nicholas M. Hellmuth provided services and information concerning the logistics of travel and living in Guatemala. William Clow and Bruce Lyon occasionally aided us in the field. Frank B. Smith provided very helpful information about many aspects of field work at Tikal. Correspondence with George M. Sutton was fruitful. Charles Krantz and Alison Habel aided in preparation of figures and plates. Lynn Smith and Sandra Hallenbeck kindly typed the manuscript. We thank the Smithsonian Institution for a cable informing the U.S. embassies in Mexico and Guatemala of our trip. We also thank the Division of Birds (especially J. Phillip Angle and John C. Barber) of the United States National Museum, and the University of Pennsylvania for their support. We also thank the Division of Birds (especially J. Phillip Angle and John C. Barber) of the United States National Museum, and the University of Pennsylvania for their support.

Arizona, for permitting Steadman to use the facilities during preparation of this manuscript. Steadman has benefited greatly from the many courtesies and services of Swrs L Olson. This is contribution No. 836 of the Department of Geosciences, University of Arizona.

References

- Bailey, R.W., 1967. Behavior, pp. 93-111, in Hewitt, O.H., ed. *The Wild Turkey and Its Management*. The Wildlife Society, Washington, D.C. 539 pp.
- Bailey, R.W. and K.T. Riney, 1967. Events in the turkey year, pp. 73-91, in Hewitt, O.H., ed. *The Wild Turkey and Its Management*. The Wildlife Society, Washington, D.C. 589 pp.
- Brodkorb, P., 1943. Birds from the gulf lowlands of southern Mexico. *Misc. Pub. Mus. Zool. Univ. Michigan*. No. 55, 88 pp.
- Chapman, F.M., 1896. Notes on birds observed in Yucatan. *Jull. A Iller. Natus. Nat. Hist.* 8:271-290.
- Donohoe, J.U.V. and C. McKibben, 1970. The wild turkey in Ohio. *Ohio Game Monog.*, No. 3, 32 pp.
- Host, M.D., 1977. Wildlife management in Belize: program status and problems. *Wildl. Soc. Bull.* 5:48-51.
- Gaumer, G.L., 1883. Notes on *Meleagris ocellata* Cuvier. *Trans. Kansas Acad. Sci.* 8:60-62.
- Ghigi, A., 1936. Il tacchino ocellato, pp. 354-385 in *Galline di Faraone e Tacchini*. Milan, Italy. 494 pp.
- Hale, E.B., 1955. Duration of fertility and hatchability following natural hatching in turkeys. *Poultry Sci.* 34:228-233.
- Hale, E.B. and M. Schein, 1962. The behaviour of turkeys, pp. 531-564 in Hafez, E.S.E., *The Behaviour of Domestic Animals*. Williams and Wilkins Co., Baltimore. 619 pp.
- Knoder, E., 1959. An aging technique for juvenile wild turkeys based on the rate of primary feather moult and growth. *Proc. 1st Nat. Wild Turkey Syll.*, Memphis: 159-176.
- Korschgen, L.J., 1967. Feeding habits and foods, pp. 137-198 in Hewitt, O.H., ed. *The Wild Turkey and Its Management*. The Wildlife Society, Washington, D.C. 589 pp.
- Land, H.C., 1970. *Birds of Guatemala*. Livingston Pub. Co., Wynnewood, Pennsylvania. 381 pp.
- Leopold, A.S., 1948. The wild turkeys of Mexico. *Trails* 135:11, IV. *Am. Wildl. Nat.* 393-400.
- Lewis, J.C., 1967. Physical characteristics and physiology, pp. 45-72 in Hewitt, O.H., ed. *The Wild Turkey and Its Management*. The Wildlife Society, Washington, D.C. 589 pp.
- Lint, K.C., 1977-78. Ocellated Turkeys. *WPJ Journal*, 11:14-21.
- Paynter, L.A., Jr., 1955. The ornithogeography of the Yucatan peninsula. *Wilson Bull.* No. 9, 347 pp.
- Ridgway, R. and H. Friedmann, 1946. The birds of North and Middle America. Part X. *U.S. Nat. Mus. Bull.*, No. 50, 484 pp.

- Russell, S.L., 1964. A distributional study of the birds of British Honduras. *Omilia Monog.* No. 1, 195 pp.
- Schorger, A.W., 1966. *The Wild Turkey: Its History and Domestication*. Univ. Oklahoma Press, Norman. 625 pp.
- Scott, V.E. and E.L. Boeker, 1972. An evaluation of wild turkey call counts in Arizona. *J. Wildl. Mgmt.* 36:62-8-63'0.
- Smith, L., 1966. *The Birds of Tikal*. Natural History Press, Garden City. 350 pp.
- Smith, L.B. and R.A. Paynter, Jr., 1963. Birds of Tikal, Guatemala. *Bull. Mus. Comp. Zool.* 128:245-324.
- Steadman, D.W., 1975. The Plio-Pleistocene Evolution of Turkeys (Aves: Meleagridinae). *U.S. Thesis, Univ. Florida*. 143 pp.
- Storer, R.W., 1961. Two collections of birds from Campeche, Mexico. *Occ. Pap. Mus. Zool. Univ. Michigan*. No. 621; 20 pp.
- Van Tyne, L., 1935. The birds of northern Peten, Guatemala. *Muse. Puh. Mus. Zool. Univ. Michigan*, No. 27,46 pp.
- Watts, C.R., 1968. Rio Grande turkeys in the mating season. *TrailS. Jru N. Wildl. and Nat. Res. Coll.* : 205-210.
- Williams, L.E., 1961. Notes on wing molt in the yearling wild turkey, *J. Wildl. Mgmt.* 25:439-440.

D.J. VID W. STEADMAN, LABORATORY OF PALEOENVIRONMENTAL STUDIES, DEPARTMENT OF GEOSCIENCES, UNIVERSITY OF ARIZONA, TUCSON, ARIZONA 85721

JAMES STULL, R.D. #2, BENSON ROAD, WATERFORD, PENNSYLVANIA 16441

STEPHEN W. EATON, DEPARTMENT OF BIOLOGY, ST. BONA VENTURE UNIVERSITY, ST. BONA VENTURE, NEW YORK 14778