THE ECOLOGY OF THE EARED DOVE (*ZENAIDA AURICULATA*) IN ARGENTINA

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In South America, south of Trinidad and other islands in the southern Caribbean, the familiar Mourning Dove (*Zenaida macroura*) of North America is replaced by the Eared Dove (*Zenaida auriculata*) also known as "Torcaza," "Mediana," or "Paloma dorada;" three distinctive but intergrading races have been described. The Eared Dove is very similar to the Mourning Dove in color and pattern but differs primarily in having a shorter, less graduated tail, heavier bill, more brownish coloration, and more distinctly yellow-bronze display plumage on the neck; these two doves comprise a super-species. There are numerous published references to the Mourning Dove but very little has been recorded about the biology of its southern congener. Comparative studies of closely related species are of interest for they often reveal features not readily seen in isolation. The Eared Dove also poses an economic problem for it has prospered with the development of intensive arable farming and thrives on corn and sorghum crops, the latter eaten from the standing crop from November until March. In addition, some farmers have almost stopped growing millet because the birds take the ripe crop. This is true of wheat also, but to a lesser extent. In its relationship with agriculture, the Eared Dove can be compared with certain Old World pigeons, particularly the Wood Pigeon (*Columba palumbus*), while its capacity to form enormous flocks for breeding and feeding is reminiscent of the extinct Passenger Pigeon (*Ectopistes migratorius*) of the eastern United States and the Red-billed Dioch (*Quelea quelea*) an African weaver finch.

The natural habitat of *Z. auriculata* is mostly arid and semiarid scrubland, usually with some trees or patches of woodland, but it avoids the tropical forest areas. Its niche is similar to that occupied by the collared doves of the Old World [the Vinaceous Dove (*Streptopelia vinacea*), the Mourning Dove (*S. decipiens*), and the Pink-headed Dove (*S. roseogrisea*) of Africa; the Collard Dove (*S. decaocto*) of India and since 1930 of northwest Europe and Britain; and the Turtle Dove (*S. bitorquata*) of Java]. All these doves are ground feeders that eat small weed seeds. In South America *Z. auriculata* was found in the thornscrub Chaco region of Argentina and Paraguay, which originally was a mosaic of woodland and grassland maintained as a stable, climax community by periodic fires (Odum 1969; Morello 1970). Although very common in this favored pulsatile ecosystem, the species never formed the enormous flocks which are still typical of the more xeric caatinga region of Brazil (fig. 1). There the enormous flocks of Eared Doves are nomadic, ranging over very large areas in search of the seeds of wild grass and other plants, in a manner reminiscent of the Flock Pigeon (*Phaps histrionica*) of the Australian desert and the African Weaver Finch. Sandwiched between the coastal and Amazonian rain forests is a corridor of savannas known as the Cerrado, which extends from the Chaco to the Caatinga, throughout which the Eared Dove is common (fig. 1).

In Argentina, the Pampas region was, until the end of the 19th century, covered with native grasslands with practically no trees. The Eared Dove was a common, albeit not characteristic, bird of the region for many migrated in large flocks from the Chaco to feed on thistle seeds which were abundant on the plains. Hudson (1920) wrote "this is the commonest species of pigeon tribe in

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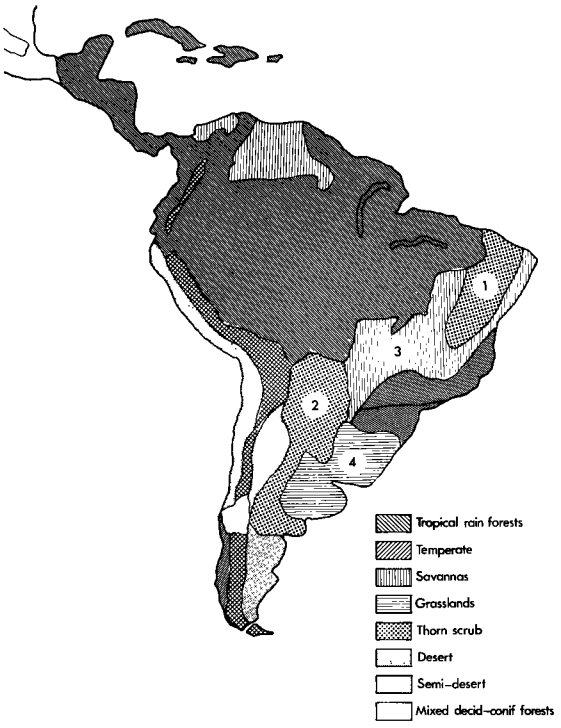

FIGURE 1. Vegetation map of South America. The Eared Dove favors thorn scrub regions represented by the "Caatinga" of Brazil (1) and the "Chaco" of Argentina (2) and extends throughout the savanna region, the "Cerrado" (3), which links these two regions. Eared Doves are also abundant in the savanna region of Venezuela and are common in the Pampas of Argentina (4).

the Argentine country. . . . In autumn they often congregate in very large flocks, and are sometimes observed migrating, . . . autumn and winter movements are very irregular, and apparently depend altogether on the supply of food. When the giant thistle has covered the plains in summer incredible numbers of Torcasas appear later in the season, and usually spend the winter on the plains, congregating every evening in countless myriads wherever there are trees enough to afford a suitable roosting-place." Hudson was referring to localities not far from Buenos Aires. Almost the whole Pampas was ploughed for agriculture between 1870–1900 and today, although the Eared Dove is still common, the abundant autumn concentrations have vanished with the loss of thistles. At present, surrounding the Pampas in a great arc stretching from Uruguay and Rio Grande in Brazil, inland to Córdoba and back to the coast at Bahia Blanca, Argentina, is a belt of scrub country. This forms an ecotone between the Pampas and Chaco to the west and between the Pampas and Patagonian desert to the

FIGURE 2. Agricultural development in the thorn scrub belt of Argentina has created a patchwork mosaic of feeding and breeding habitat ideally suited to *Zenaida auriculata*; here the species has become a pest.

south. It is locally referred to by Argentine botanists as "Espinal." This transition zone agricultural development is expanding and creating a mosaic of croplands and patches of secondary thornscrub, primarily of *Prosopis* and *Acacia* sp. (fig. 2). Here *Z. auriculata* has become a major pest of sorghum, one of the most suitable crops for the area, and one which was introduced in the early 1950s (Bucher 1970). Also in the arid valleys of Venezuela and Colombia, where irrigation schemes are enabling sorghum to be planted, *Z. auriculata* does cause damage and is becoming a serious problem (De Grazio 1970).

RESULTS

FOOD AND FEEDING HABITS

Doves were collected at Piquillin, 60 km ENE of Córdoba (31°S), Argentina, and at Villa Ascasubi, 160 km SE of Córdoba. Monthly samples of the crop contents were mixed, dried, sorted, and weighed to give a gravimetric measure of the diet (table 1). Seeds of wild plants were represented in only small quantities, but those found gave some indication of the natural food preferences of the species. One of the most important was *Echinochloa colonum*, a grass which occurs in savanna regions throughout the world, in areas of damp ground, or following the seasonal rains. It is an important source of food of *Quelea quelea* in Africa (Ward 1965). Another grass species, included with *Echinochloa* because it is difficult to distinguish, was *Setaria pampeana*. Both of these grasses produce seeds about 1–2 mm in length that weigh about 1.0 mg. *Amaranthus* spp. (family Amaranthaceae closely related to Chenopodiaceae) and *Chenopodium album* (fat hen), introduced from Europe, comprised

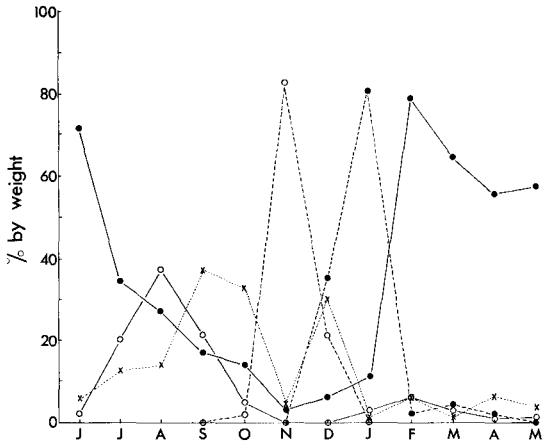

FIGURE 3. Sequence in which various cultivated seeds feature in diet of Eared Doves in Argentina. Based on percentage by weight of crop contents of shot birds. See also table 1. Solid dots and lines = cultivated sorghum; open dots and lines = wild sorghum; solid dots and dashed lines = millet; open dots and dashed lines = wheat; crosses and dotted lines = weed seeds.

the other major seed foods. Seeds of wild plants taken in smaller quantities were *Croton* sp., *Euphorbia* sp. (Euphorbiaceae), and *Argemone subfusiformis* (Papaveraceae). *Croton* sp. is also a favorite food of *Z. auriculata* in Brazil (Von Ihering 1935; Aguirre 1964). The natural diet of the Eared Dove therefore appears to be mostly the small seeds of annual plants which can be collected from the ground. These feeding habits are typical of other *Zenaida* and *Streptopelia* doves, which often eat the same or closely related seeds. For instance, in Europe the Turtle Dove (*Streptopelia turtur*) specializes on grass seeds and such small seeds as *Chenopodium* (Murton et al. 1964).

Today, most of the diet of the Eared Dove in central Argentina is comprised of the seeds of cultivated plants, particularly *Sorghum*, wheat (*Triticum aestivum*), millet (*Panicum miliaceum*) and, to a lesser degree, maize (*Zea mays*), peanuts (*Arachis hypogaea*), and sunflower (*Helianthus annuus*) (table 1). Wheat is the first crop to ripen in November or December and it may constitute over 80% of the diet in November. It is followed by millet, which ripens and is eaten in January, and then sorghum in February or March (fig. 3). During the crop analyses, those sorghums with the big round seeds which are grown for their grain "sorgos graniferos" were grouped to include *Sorghum caffrorum*, *S. saccharatum*, and *S. sudanense* in their many varieties and hybrids. These sorghums are grown for alcohol and starch production or as components for animal feeding stuffs. The birds collect the seeds from the growing plants and, thereafter in April and May, from the stubbles. As this food supply is depleted, the birds exploit a wider variety of foods, each of which contributes a relatively small share to the total diet. Thus from July to September seeds of wild plants feature prominently in the daily diet. A second group of sorghums has small elongated seeds, and is grown as a forage crop. *S. almum* is a perennial used entirely to provide pasturage; *S. halepense* is also a perennial which has become wild. It is a pest, and invades many fields where it may be grazed, particularly at Piquillin where the emphasis is on cattle-grazing. Wild sorghums (usually a mixture of the above two species and their hybrids) ripen at the same season as the cultivated varieties, usually between February and May. They become important constituents of the doves' diet in August and September if they have not been harvested and the seeds still remain on the plants or ground. As the stubbles of cultivated sorghums are ploughed, the birds change to this alternate food source.

Insects were recorded only in September and comprised aphids from a wheat crop that had been sprayed with insecticides. Perhaps the aphids resembled seeds. Snails were eaten during the breeding season, possibly for the calcium content of their shells.

FOOD AND BREEDING

The climatic conditions in the study areas (meteorological data from Pilar, 70 km E of Córdoba) result in a semi-desert vegetation. The rainfall is about 600–700 mm per annum of which 80% is concentrated during the October-March period; August and September are the driest months and most trees shed their leaves at this time. Temperature ranges are 17–32°C (mean min/max) in January and 4–17°C in mid-winter (July). Wheat is planted in May or June and is half-grown by the dry season. The first rains stimulate rapid growth and sorghum is then planted. The rains come as heavy showers interspersed with sun and the cultivated crops and wild seeds ripen rapidly. Grass seeds and other natural vegetation are at peak productivity in March and April. Scattered comments in old literature indicate the likelihood that, prior to agricultural development in the late 1800s, the Eared Doves began breeding sometime between October and the end of February, continuing until April; that is, breeding

TABLE 1. Diet of Eared Dove as determined from crop contents.

Food	% composition of crop contents by weight											
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Cultivated sorghum	71	34	27	17	14	3	6	11	78	64	55	57
Wild sorghum	2	20	37	21	5	0	0	3	6	3	1	1
Maize	11	17	15	13	14	2	1	0	1	12	11	14
Millet	0	0	0	0	0	0	35	80	2	4	2	0
Peanut	9	14	7	10	26	2	0	0	0	7	24	19
Wheat	0	0	0	0	2	82	21	0	0	1	0	0
Other cultivated	1	2	0	1	3	3	5	1	2	4	1	4
Total cultivated (%)	94	87	86	62	64	92	68	95	89	95	94	95
Chenopodium sp. and *Amaranthus* sp.	2	7	8	14	11	0	6	0	1	0	2	1
Echinochloa colonum and *Setaria pampeana*	3	6	6	21	17	0	0	1	3	2	3	2
Other wild seeds	1	0	T	2	5	4	24	1	2	0	1	1
Other unidentified	0	0	0	0	3	4	2	3	5	3	0	1
Snails shells and insects	0	0	0	1	0	0	0	0	T	T	T	T
Total weight food (g)	1125	521	759	419	459	495	604	544	625	707	747	833
No. birds examined	159	79	106	91	125	90	97	111	112	111	150	162
Amount food per bird (g)	7.1	6.6	7.2	4.7	3.7	5.5	6.2	4.9	5.6	6.4	5.0	5.1

coincided with, or else followed, the summer rainy season when seeds became abundant. This regime is still typical in uncultivated parts of Córdoba province where the birds live more or less solitarily and never breed during the winter (Bucher, pers. observ.). In Brazil, the birds breed mostly during the rainy season from April until June (Aguirre 1964). In Argentina, the advent of pulse crop (edible seed crop of leguminous plants) arable farming has extended the breeding season to August or September, depending on the availability of sorghum. Thus during the period April to November, assuming that droughts do not intervene to cause a crop failure and bring an end to breeding activity, the birds can obtain a succession of cultivated foods (fig. 3). There is usually a bimodal pattern to the breeding season for activity virtually ceases in June. This is seen in figure 4 which shows the number of nests with eggs or young and the total occupied per hectare and is based on approximately weekly searches of two nesting localities.

The adults cease breeding when they can still obtain cereal seeds, judged by the crop contents of collected samples (fig. 3), but probably food supplies become restricted at this season (see below). Some birds lose their reproductive capacity during the period of short "winter" days (see below). The breeding season was longer with more nesting activity during the winter at Villa Ascasubi than at Piquillin; cattle raising predominated in the latter locality so that cultivated cereals were less easily found than at Ascasubi.

The diet of nestlings was similar to that of adults although some small differences are apparent in the data in table 2. The nestlings received smaller quantities of the larger seeds, including sorghum, and proportionately more small seeds, particularly seeds of wild plants. The adults recorded in table 2 were collected in the same nesting locality as the chicks, whereas those recorded in table 1 were shot flying to roost or near their breeding stations and so were a different sample.

At hatching, pigeon squabs are fed entirely on crop-milk, but as they grow older, the parents feed them increasing quantities of foods which they collect from the fields (table 3). However, the adults apparently exercise some discrimination in the foods they bring to the nestlings, regurgitating only small seeds and milk initially and feeding larger seeds as the squabs grow (table 3). Such discrimination could depend on some manner of selective regurgitation, the adults "holding back" large foods or those not entering the squab's gape, but this seems unlikely. Instead, it is probable that the adults collect only appropriate foods. This implies that there is some temporal mechanism which ensures that the food eaten by the adults for themselves passes to the gizzard, whereas seeds for the nestlings are retained in the crop. For some species the "milk cells" are sloughed from the crop wall at specific times of day (Murton 1965) and it has been demonstrated that in some

TABLE 2. Diet of nestling and adult Eared Doves as determined from crop contents.

Food	% composition of crop contents by weight							
	January 1970		April 1970		June 1970		September 1970	
	Nestlings	Adults	Nestlings	Adults	Nestlings	Adults	Nestlings	Adults
Cultivated sorghum	0	5	50	57	61	73	45	69
Wild sorghum	9	0	2	1	0	0	4	3
Maize	0	3	2	3	13	8	6	11
Millet	44	33	2	4	5	0	1	0
Peanut	0	0	21	27	5	13	7	7
Wheat	0	3	0	0	0	0	0	0
Other cultivated	0	6	6	1	1	1	4	1
Total cultivated	53	50	83	93	85	95	67	91
Chenopodium sp. and *Amaranthus* sp. seeds	2	9	7	4	1	0	10	0
Echinochloa colonum and *Setaria pampeana*	0	0	7	1	9	5	20	8
Other wild seeds	45	40	1	1	0	0	1	0
Other	0	1	2	1	5	0	2	1
Total weight food (g)	101	305	44	373	81	508	182	390
No. birds examined	50	47	62	71	46	86	85	85

pigeons milk production depends on a circadian timing mechanism (Hoffman 1969). Conceivably, when the crop becomes filled with milk, the field food collected by the adult is retained and is then carried to the chicks.

BREEDING BIOLOGY

Nests are built in thornscrub at a height corresponding to the maximum cover although sometimes nests are built on the ground. In Brazil, birds seem to nest mostly on the ground in the shelter of the thorny scrub formed by various bromeliads (pineapple group) (Aguirre 1964). Solitary nesting is usual throughout large areas of the birds' range, where the species occurs singly or in small parties, but in the cultivated regions of Argentina enormous colonies of up to 1–5 million individuals can occur.

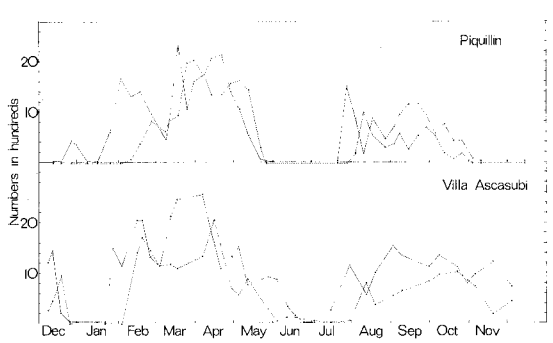

FIGURE 4. Breeding season of Eared Dove in 1970 at two localities in Argentina based on number nests containing eggs (solid line) or young (dotted line). Upper graph data from Piquillin, lower graph from Villa Ascasubi.

The Eared Dove normally lays two eggs and like some other pigeons studied is probably a determinate layer (Poulsen 1953). Clutches of a single egg could result from partial predation and clutches of three eggs result from a second female depositing eggs in the wrong nests in the exceptionally densely crowded nesting colonies. In a sample of 417 clutches at Piquillin, 77 were of single eggs of which 18% hatched; of 622 eggs in clutches of two, 55% of the eggs hatched; and of 87 eggs in clutches of three, 47% hatched. *In toto*, 51% of all eggs laid hatched and 45% of the chicks were fledged. If the partial success of whole clutches is considered, then 47% of those laid produced at least one chick to fledging. Some slight seasonal variations in breeding success were detected; in particular, success was low in November and December when few birds were nesting (table 4). Presumably, the doves experienced diffi-

TABLE 3. Percentage by weight of seeds and adult crop milk in the diet of nestling Eared Doves.

Age of nestling (days)	% by weight				Total weight crop contents	No. birds examined
	Milk	Seeds < 3 mm	Seeds 3–8 mm	Seeds > 8 mm		
0–1	100	0	0	0	?	8
1–2	47	28	25	0	13.3	16
2–3	35	32	33	0	33.8	18
3–4	18	34	48	0	23.9	9
4–5	17	37	38	8	35.8	12
5–6	5	24	41	30	40.2	14
6–7	6	36	33	25	24.2	7
7–8	6	24	52	18	27.4	6
8–9	3	13	75	9	22.3	4

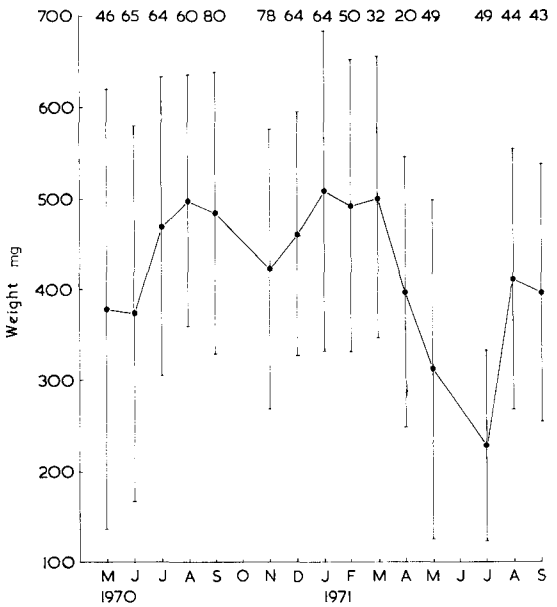

FIGURE 5. Seasonal variation in mean paired testes weights (mg ± S.D.) of Eared Doves in Argentina (lat. 32°S). The number of birds in each monthly sample is given.

culty in finding sufficient food during the latter part of the dry season. Those birds which did manage to breed were doubtless dependent on such cultivated crops as wheat and millet (fig. 3 and table 2). Breeding success was also reduced in May at the end of the main nesting season and at a time when the gonads of many birds became partly regressed.

Eggs and young may be eaten by various predators. The opossum (*Didelphis azarae*), known collectively with related species as "Comadreja," is a medium-sized arboreal marsupial which lives in tree holes in scrub areas and forages on eggs and young in the colonies. According to local residents, much egg predation is caused by a Guira Cuckoo (*Guira guira*) but this has not been confirmed. Many scavengers congregate at the breeding colonies, particularly the Red-backed Hawk (*Buteo polyosoma*) called Aguilucho comun and the Chimango caracara (*Milvago chimango*) called Chimango, the latter frequently was seen attacking nestlings.

Seasonal changes in gonad size were relatively slight compared with those noted in temperate species. There was only a twofold difference between the maximum and minimum monthly mean testes weights (fig. 5), whereas reproductively active testes of Wood Pigeons in England exhibit a 42-fold weight increase over the regressed condition. The testes of most Eared Doves remained partially to fully recrudesced throughout the year, so that individuals with spermatozoa could be found in all months. Of a sample of 37 birds collected throughout the year, the testes of one contained secondary spermatocytes, one had spermatids, and the rest contained spermatozoa. Testes weighing as little as 200 mg contained spermatozoa. Considerable variability was noted between individuals and probably some of the sample detailed in figure 5 included young birds coming into breeding condition for the first time. These could not be distinguished by plumage characteristics, but it is known from cage studies that an individual can breed 4–5 months after being fledged (Bucher, pers. observ.). Many individuals begin to breed in the same year as they are born, and similarly, breeding behavior has been recorded in juveniles of Z. *macroura* (Irby and Blankenship 1966).

In any year the minimum mean testis weight was noted in the winter months of May-July when daylength is only about 10.25 hr, excluding twilight. A degree of photoresponsiveness was probably involved although probably most of the reduction in mean testis size depended on the appearance of first-year birds in the breeding population, as noted above. Thus most birds continued to exhibit some spermatogenetic development and presumably could rapidly become fully active. Indeed, the beginning of breeding can be very sudden in the Eared Dove, indicating that the birds are in reproductive readiness and respond as soon as suitable environmental conditions occur. This is a characteristic adaptation of many tropical species, including nomadic ones that must be ready to take advantage of the appearance of suitable food supplies following rains. A similar pattern of testicular development has been found in several Australian pigeons (Braithwaite, pers. com.). The heaviest testes were noted in a subject killed in March (989 mg paired weight). Individuals with testes weighing 856, 905, and 802 mg were recorded in May and June 1970 and May 1971, respectively, that is, even in those months when the mean testicular weight was reduced, there were individuals with fully recrudesced organs. However, in July 1971 no bird had testes exceeding 460 mg.

The ovaries varied more in weight than the testes. The gonad weight of the female can exhibit considerable variation depending on whether she has just become paired, is ready to lay, or is caring for eggs or young. For this reason seasonal changes in ovarian

TABLE 4. Breeding success of Eared Dove in Argentina (data for breeding season November 1969–May 1970).

Month	No. of eggs laid	% of eggs laid which hatched	% of eggs from which nestlings fledged	% of clutches from which at least one nestling fledged (No. clutches)
November	37	14	0	0 (18)
December	173	15	12	13(101)
January	104	67	64	69 (55)
February	162	67	61	65 (83)
March	167	65	63	67 (84)
April	74	61	55	54 (41)
May	69	52	35	37 (35)
Totals	786	51	45	47(417)

For variations in per cent of eggs from which nestlings fledged $\chi^2_6 = 165.6$; $P < 0.001$.

weight cannot be distinguished; monthly means are given in table 5.

MOLT

The progress of the primary molt is shown in figure 6. Feathers were noted as being old, in process of replacement, or new, but intermediate categories were not recorded. Accordingly, a score of zero was allocated to an old feather, 3 to one being molted, and 5 for a new feather, thereby giving a potential score of 50 for a bird which had replaced all 10 primaries. The score can be doubled since the primaries on each wing are molted symmetrically (two at a time) beginning with the innermost and proceeding sequentially to the tenth. The population contained individuals which were at different molt stages

TABLE 5. Seasonal variations in mean weight ± SD of ovaries of Eared Dove.

Year/Month	Weight (mg) ± SD	Range	No. birds examined
1970			
May	121 ± 90	20–295	17
June	234 ± 293	43–1400	33
July	615 ± 712	20–2800	53
August	423 ± 521	30–2400	62
September	258 ± 428	30–2305	48
October	—		
November	334 ± 415	43–1840	47
December	100 ± 54	20–270	69
1971			
January	492 ± 625	31–2438	51
February	283 ± 418	50–1980	55
March	361 ± 460	50–1861	59
April	378 ± 553	20–1904	38
May	144 ± 191	30–867	25
June	—		
July	178 ± 247	20–1052	31
August	305 ± 497	30–2400	47
September	251 ± 288	35–980	39

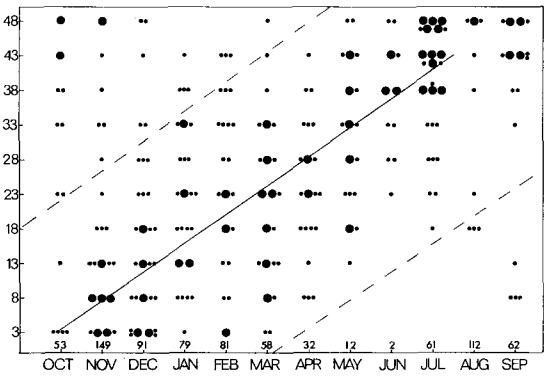

FIGURE 6. Primary molt score of Eared Dove near Córdoba, Argentina. Large dots = 5 individuals, small dots = single individuals, sample size given by numbers. Some lack of synchrony in the stage of molt was noted throughout the population and so the regression is based on the data plotted between the dotted lines. The regression line is $y = -1.0 + 4.2x$ (month), (the months being numbered from 1 = October to 10 = July); $r_{371} = 0.813$; $P < 0.001$. Many doves were captured which were not molting and these have been omitted. The percentage of birds not in process of molt each month was Oct.—28% (i.e., 53 birds were molting and are included in the figure and 21 were not and are omitted to give $21/74 \times 100 = 28\%$); Nov.—25%; Dec.—36%; Jan.—34%; Feb.—30%; Mar.—46%; Apr.—48%; May—76%; Jun.—92%; Jul.—55%; Aug.—10%; Sept.—34%.

at any one time but there was a clear trend toward synchrony. In May and June most birds were molting but many had finished in July and nearly all by August. Molt appeared to begin again in October or November, at the end of the dry season, for most birds although a few individuals were molting the innermost primaries in September while others did not start until April. Judging from the pattern of the molt score, it seems likely that an individual bird requires about 10 months to replace all primaries, that is, the regression of molt score on month increases by 4–5 points per month (see fig. 6).

Body molt occurred coincidently with, and occupied about the same period as, the primary molt, but is was not studied in detail.

MOVEMENTS

The nesting location can be used as a postnuptial roost. Subsequently the birds move to other traditional sites as they roam the countryside in enormous flocks seeking food. During the autumn (April–June), a black cloud of 100,000 birds may descend to feed on a group of grain fields. In 2.5 million hectares there were between 15 and 20 roosting places each containing a million or so birds. The adaptive value of congregating in enor-

mous flocks presumably depends on the facilitation of feeding by local enhancement, the birds being able to exchange information in the manner proposed for various other species (Zahavi 1971). During the dry season, food for the doves may be abundant once located, as on an unploughed stubble, but such a good source could be isolated within many square miles of countryside containing little food. Several instances have been noted of the birds returning to traditional roosting sites even though the trees have been felled. In such cases the birds may roost on the ground or in low shrubs even though tall woodland remains elsewhere in the neighborhood. Similar behavior has been noted in Z. *macroura* (Harris 1961).

During the winter the number of doves in the more humid Pampas increases and it is likely that a proportion of the population near Córdoba moves to this area to find a new food source. Few doves breed in the Pampas possibly because there is little woodland or scrub to provide breeding and roosting places.

DISCUSSION

In its feeding ecology the Eared Dove clearly bears a close resemblance to the Mourning Dove in North America. Thus grain sorghum (*Sorghum vulgare*), Johnson grass (*S. halepense*), one seed croton (*Croton monanthogynus*), and annual sunflower (*Helianthus* spp.) were the major food items of the Mourning Dove in Texas, while such wild seeds as those of *Euphorbia* spp., *Amaranthus* spp., *Panicum fasciculatum*, and other grass seeds were taken in smaller amounts (Dillon 1961). The same food items were taken by Mourning Doves in Oklahoma; the seeds of Gramineae comprised two-thirds of the diet by volume and sunflower seed also was important (Carpenter 1971). So, too, in their breeding ecology the two species are very close, preferring a similar range of nesting habitats and having virtually identical nests and eggs. In its southern range, where it is resident, the Mourning Dove has an extended breeding season. Active nests were found in all months of the year except November and December in Texas (ca. 33°N), but the main breeding season was from early March until early September (Swank 1955). Also in California (ca. 37°N) nesting lasted from mid-March until late September (Cowan 1952). McClure (1950) examined the breeding success of the Mourning Dove in Iowa, Nebraska, and California and the average percentage of clutches from which at least one chick was fledged was 51% (cf. 52% in the present study). Hatching success (per cent of total eggs which hatched) was 59% (51% for Eared Dove) and breeding success (per cent of total eggs giving fledged young) was 49% (cf. 45%). For the Eared Dove we can infer that 88% of the chicks which hatched were fledged (i.e., nestling success $= 352 \times 100/399 = 88$), while nesting success, which was measured directly in the Mourning Dove, averaged 82%.

Whereas the Mourning Dove is a valued sporting bird in North America, the Eared Dove is generally rated a pest species in many parts of South America. In Colombia the Eared Dove is reported to cause much economic damage by eating the seeds and emerging cotyledons of soybeans (Londōno et al. 1972). In the province of Córdoba, Argentina, the equivalent of US $15,000 is spent officially per annum in attempts to kill the doves and other provinces have similar schemes; about one-third of the expenditure is devoted to strychnine baits which are distributed round the roosts. Although large numbers of doves are killed, it seems that the problem is not solved. Moreover, it is not likely that the slaughtering of doves in this way will bring remedial benefit if the lessons learned from other species, including *Quelea*, are at all applicable to the South American scene (Crook and Ward 1968).

SUMMARY

The ecology of the Eared Dove was studied near Córdoba, Argentina, in an area of arable cultivation interspersed with secondary thornscrub. Analysis of crop contents revealed that the bird's main diet by weight was composed of cultivated seeds (85%), particularly sorghum, wheat, and millet. Their feeding habits made the birds pests of the farmer. "Natural" foods were grass and wild seeds, with *Chenopodium*, *Amaranthus*, *Echinochloa*, and *Setaria* spp. being important constituents of the diet. The food of nestlings was similar.

In uncultivated areas the breeding season began variably between October and February and extended until April, thereby coinciding with and following the summer rains. Arable farming has enabled the breeding season to begin in August or September so that reproduction occurs during about 10 months. Seasonal changes in gonad size and histology are described. The molt takes 10 months, generally starting in October and ending in July, so that one pair of primaries is changed

per month. But there is variability in the population and some individuals do not begin molting until April.

Of the eggs laid, 45% give rise to fledged young, while from 52% of the clutches laid at least one chick is reared. Some causes of failure are mentioned.

The discussion briefly compares the feeding and breeding ecology of the Mourning Dove in the southern United States and mentions the differing economic status of these two allopatric species that are obviously geographical representatives of a common ancestral stock.

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