

# OCCURRENCE AND FEEDING ECOLOGY OF THE COMMON FLICKER ON GRAND CAYMAN ISLAND

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The Common Flicker (*Colaptes auratus*) is widely distributed in the western hemisphere from Alaska to Nicaragua and to the West Indies (Cuba and Grand Cayman). Although mainland populations have been well studied (e.g., Noble 1936, Bent 1939, Short 1965a, 1967, Bock 1971), details on the abundance, life history, ecology, and behavior of *Colaptes auratus* on Cuba (*C. a. chrysocaulosus*) and Grand Cayman (*C. a. gundlachi*) have not been reported. Short (1965b) discussed the variation, taxonomy, and evolution of West Indian flickers, Johnston (1970, 1975) summarized some aspects of the ecology of the Grand Cayman Flicker, and Cruz (1974) examined the probable evolution and fossil record of West Indian woodpeckers.

The present study of the Grand Cayman Flicker was initiated in 1965 and continued intermittently until 1973, covering all seasons. Our objectives were to learn the distribution, habitat preferences, foods, and foraging ecology of these birds and to compare our data with those on mainland flickers. Investigations of Florida flickers were undertaken during 1969-1973, covering all seasons.

## STUDY AREAS

### GRAND CAYMAN

The island lies approximately 290 km south of Cuba and 480 km northeast of Honduras, the nearest point in Central America. Much of Grand Cayman (185 km<sup>2</sup>) is less than 5 m in elevation, although an east-west forested ridge on its north side reaches 20 m in places. Temperatures are fairly constant (mean annual high 30°C) and annual mean precipitation is 1,549 mm (Johnston 1975). A dry season extends from November to April.

To obtain as complete a picture as possible of the biology of the Grand Cayman Flicker, we visited many distinct habitats ranging from mangrove woodland to limestone forest (Fig. 1). A brief description of these communities follows (modified from Johnston 1975).

**Strand woodland.** This association is characteristic of coastal areas. Common trees are sea grape (*Coccoloba uvifera*), almond (*Terminalia catappa*), seaside mahoe (*Thespesia populnea*), Australian pine (*Casuarina equisetifolia*), and coconut palms (*Cocos nucifera*). Commonly the trees are wind-pruned, desiccated in appearance, and no more than 5 m tall. Strand woodland occupies a distinct band, usually not more than 30 m wide.

**Mangrove woodland.** Extensive areas are covered

with mangrove and buttonwood swamps. In wetter and more saline places, especially around North Sound (Fig. 1), red mangrove (*Rhizophora mangle*) predominates, but farther inland at seasonally drier sites white mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia nitida*), and buttonwood (*Conocarpus erecta*) combine to form a thick forest. Near North Sound these mangrove-buttonwood swamps are best developed and the trees often reach heights of 18-20 m.

**Open pastures.** In places, the limestone forest has been cleared for pasture. Important introduced grasses of these pastures are Guinea grass (*Panicum maximum*) and Seymour grass (*Andropogon metusus*), with scattered shrubs such as *Comocladia dentata* and trees such as *Bursera simaruba*, *Roystonea* sp., and *Mangifera indica*.

**Scrub woodland.** Abandoned pastures and other cleared areas revert to woods consisting of species such as maiden plum (*Comocladia pinnatifolia*), red birch (*Bursera simaruba*), and logwood (*Haematoxylum campechianum*). Open and, later, dense stands of nearly pure logwood develop on drier upland sites. Older stages frequently include thatch palm (*Thrinax argentea*) and red birch (logwood-thatch palm-red birch association). The woodland averages about 6 m in height, sometimes forms a nearly impenetrable forest, and is most common in the middle of the island.

**Limestone forest.** Originally this type of forest covered most of the drier upland portions of Grand Cayman (Swabey and Lewis 1946), especially on the northern and eastern sections where limestone ridges are common. It is a sparse vegetation cover of low forest and tall scrub growing mainly on bare limestone. Little soil is present except for that deposited in small crevices or washed down to level areas. There is no distinct forest stratification, and heights vary from low scrub to a thin forest with trees rarely exceeding 12 m in height, with occasional emergence of red birch and fig (*Ficus populnea*) up to and over 18 m. Characteristic trees include mahogany (*Swietenia mahagoni*), manchineel (*Hippomane mancinella*), cedar (*Cedrela odorata*), red birch, balsam (*Clusia flava*), fig and other hardwoods.

**Ruderal habitats.** Where the native vegetation has been cleared for houses, an important and distinctive ecological community has developed. House sites, for example, include clearings for small gardens, introduced shrubs, and shade and fruit-bearing trees. Some of the characteristic trees include sea grape, red birch, mango, papaya (*Carica papaya*), guava (*Psidium guajava*), naseberry (*Manilkara zapoda*), thatch palm, and coconut palm.

### FLORIDA

Mainland birds were observed in various natural and modified communities in and near Gainesville, Alachua County, throughout the year from 1969 to 1973. Gainesville, located in northcentral Florida, has a mild climate. The mean annual high temperature is 31°C and the mean annual precipitation is 1,486 mm (N.O.A.A. 1973). Miller (1950) and Monk (1965) have described much of the vegetation of this area.

## METHODS

### POPULATION DENSITY

Traditional techniques for measuring bird populations, such as transect counts or territory-mapping, proved to be impossible in the rough and uneven terrain of Grand Cayman. The absence of trails for accurately measuring distances in most of the woods made it difficult to measure precisely flicker population densities. A semi-quantitative method was devised to provide relative indices of abundance. Ten censuses, each of about two hours duration in the early morning were taken in representatives of each of the major ecological formations during December, June, and August. After all individual birds recorded during each census were counted, relative scores were derived as follows: U (Uncommon), 5–20 individuals/20 h; FC (fairly common), 20–100 individuals/20 h.

### FORAGING ECOLOGY

Habitat use, foraging, and feeding methods of the birds in the study areas were studied by adapting methods used by MacArthur (1958), Cody (1974), and Cruz (1977). The technique involved walking a predetermined route until a bird was encountered. If the bird was foraging, its sex, foraging zones, and behavior were noted. The following zones were identified: ground, stumps, shrubs, trees, and aerial. The trees were divided into three main feeding zones (areas): trunk, inner branches, and outer branches. Each of these main zones was in turn divided into three subzones: lower, middle, and upper. Feeding behavior patterns were categorized as follows: ground gleaning, limb gleaning, fruit and seed gleaning, tree probing, ground probing, epiphyte probing, tree pecking, ground pecking, scaling, and stooping (flying to prey on the ground). An individual observation was terminated if the bird changed behavior or moved more than 1.5 m. We attempted to observe as many flickers as possible and to follow each individual for as long as possible.

### FOODS

We collected 19 adults on Grand Cayman and 9 adults in Florida for stomach analyses. The stomach and intestinal tract were removed soon after death and preserved in 75% alcohol. Later the food samples present were separated into food classes and analyzed by volume and by frequency of occurrence. Food volumes were ascertained with reasonable accuracy by noting the displacement of water in a graduated cylinder accurate to 0.1 ml. Whole invertebrates were identified

at least to family; fragmented insects were identified to order in nearly all cases and often also to family. Similar methods were used to identify fruit and other vegetable material found in the stomachs.

### BODY MEASUREMENTS

We measured the birds to see if any body structure of possible ecological significance was sexually dimorphic. Bill length was measured from the anterior margin of the nostril to the tip; the tarsometatarsus was measured from its posterior proximal end to the distal edge of the most distal unbroken scale crossing the bases of the two forward toes. We weighed all the specimens.

## RESULTS

### MEASUREMENTS

*C. a. gundlachi* is the smallest race of the species, with little or no overlap in measurements with North American forms (Table 1). The data indicate that it is essentially monomorphic, males averaging only slightly larger than females in all measurements (see also Short 1965b).

### HABITAT, DISTRIBUTION, AND ABUNDANCE

Grand Cayman Flickers occurred throughout the island wherever there was forest, from mangrove woodlands to dense limestone forest (Fig. 1). Table 2 shows relative abundances of flickers in various communities. The birds were most numerous in the limestone and mangrove forests, and scarcest in logwood and ruderal sites. Flickers occurred in habitats where the diversity of tree species ranged from low (one species), such as mangrove and logwood forests, to high (10–15 species) such as limestone forest. The birds were absent from pasture and cultivated areas, despite scattered trees.

### FORAGING ECOLOGY

Chi-square tests for homogeneity indicated no significant differences in frequencies of occurrence of any of the foraging categories

TABLE 1. Mean weights and measurements of subspecies of *Colaptes auratus*.<sup>a</sup>

| Subspecies            | Locality             | Sex    | Weight (g)             | Culmen (mm) | Tarsus (mm) | Wing (mm)  | Tail (mm)  |
|-----------------------|----------------------|--------|------------------------|-------------|-------------|------------|------------|
| <i>gundlachi</i>      | Grand Cayman         | Male   | 88.1 (10) <sup>b</sup> | 24.9 (33)   | 23.7 (24)   | 126.4 (15) | 90.7 (13)  |
|                       |                      | Female | 86.2 (6)               | 24.1 (24)   | 23.2 (20)   | 126.8 (11) | 89.2 (9)   |
| <i>chrysocaulosus</i> | Cuba                 | Male   | —                      | 27.5 (32)   | 25.6 (34)   | 141.9 (24) | 107.0 (25) |
|                       |                      | Female | —                      | 27.2 (38)   | 25.7 (38)   | 139.1 (27) | 104.6 (26) |
| <i>auratus</i>        | Florida              | Male   | 113.9 (4)              | 27.3 (36)   | 26.3 (57)   | 144.2 (33) | 100.1 (33) |
|                       |                      | Female | 129.8 (8)              | 26.6 (32)   | 26.0 (47)   | 143.6 (32) | 98.6 (24)  |
| <i>luteus</i>         | Ohio,<br>Indiana     | Male   | 132.9 (3)              | —           | 28.6 (3)    | 158.8 (5)  | 109.3 (5)  |
|                       |                      | Female | 131.0 (2)              | —           | 27.7 (3)    | 152.5 (3)  | 100.3 (3)  |
| <i>cafer</i>          | Greeley,<br>Colorado | Male   | 156.6 (9)              | 29.8 (9)    | 29.8 (9)    | 163.2 (9)  | 115.5 (9)  |
|                       |                      | Female | 139.2 (6)              | 29.5 (6)    | 29.7 (6)    | 161.2 (6)  | 111.8 (6)  |

<sup>a</sup> Data from Ridgway 1914, Baldwin and Kendeigh 1938, Stegman 1955, Short 1965a, 1965b, and this study.

<sup>b</sup> Numbers in parentheses represent sample sizes.

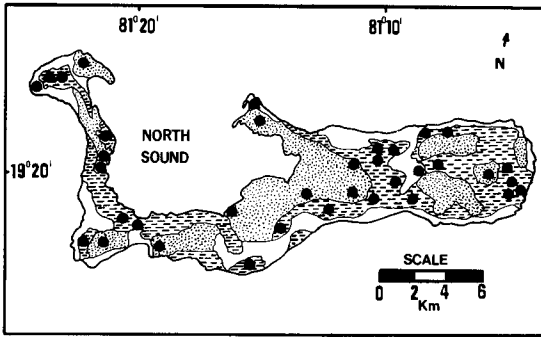


FIGURE 1. Map of Grand Cayman showing general distribution of major forest types. Horizontal = limestone forests; stippled = mangrove forests; open = other habitats. Dots indicate distribution of *Colaptes auratus gundlachi* based on field observations.

(zones and behavior) between the sexes; combined data are summarized in Table 3.

Grand Cayman Flickers foraged primarily in trees, using mainly the inner and outer branches (46 and 30%, respectively, Table 3). They rarely foraged on the ground (6% of observations). Within each major foraging zone (inner branches, outer branches, trunks) different subzones were preferentially used.

The pooled results for both sexes from all the study areas indicate that the birds foraged chiefly by pecking (78%). Probing (18%) and gleaning (4%) accounted for the rest of the foraging. Pecking for food was confined mainly to dead branches of trees (chi-square = 23, d.f. = 2,  $P \leq .01$ ).

Hollow and decaying branches occupied by ants and termites were favored pecking sites. When pecking, the birds punched a series of holes through the twig walls at 1–3 cm intervals, the spacing and size of the holes varying according to the size and type of branch. Once the hole was made, the long and protrusible tongue was used to remove prey. In probing, birds used their bills and tongues to explore natural cavities such as fissures and cracks in the bark, knot holes, weathered holes, and holes previously excavated. Gleaning consisted of searching along the limb and trunk surface for invertebrates, and using the tongue to capture the prey.

Flickers in Florida foraged mostly on the ground (75% of all foraging observations) and did little arboreal pecking and probing (10%; Table 4). In Florida, pecking was used for foraging mainly by Hairy (*Picoides villosus*), Downy (*P. pubescens*), Red-cockaded (*P. borealis*), and Pileated (*Dryocopus pileatus*) woodpeckers.

TABLE 2. Relative abundance<sup>1</sup> of the Grand Cayman Flicker in various habitats.

| Habitat                               | December |                 |    | April |                 |   | August |                 |   |
|---------------------------------------|----------|-----------------|----|-------|-----------------|---|--------|-----------------|---|
|                                       | FC       | U <sup>2</sup>  | U  | FC    | FC <sup>2</sup> | U | FC     | FC <sup>2</sup> | U |
| Strand woodland                       | FC       | U <sup>2</sup>  | U  |       |                 |   |        |                 |   |
| Mangrove swamps                       | FC       | FC <sup>2</sup> | U  |       |                 |   |        |                 |   |
| Pastures and cultivated areas         | NP       | NP              | NP |       |                 |   |        |                 |   |
| Early scrub                           | NP       | NP              | NP |       |                 |   |        |                 |   |
| Logwood forests                       | U        | U <sup>2</sup>  | U  |       |                 |   |        |                 |   |
| Logwood-thatch palm-red birch forests | FC       | U <sup>2</sup>  | U  |       |                 |   |        |                 |   |
| Limestone forests                     | FC       | FC <sup>2</sup> | FC |       |                 |   |        |                 |   |
| Ruderal                               | U        | U <sup>2</sup>  | U  |       |                 |   |        |                 |   |

<sup>1</sup> NP (not present); U (uncommon), 5–20 individuals/20 h; FC (fairly common), 20–100 individuals/20 h. Based upon ten two-hour censuses in each habitat in each season.

<sup>2</sup> Evidence of breeding activity found here in April.

#### STOMACH ANALYSIS

Table 5 lists all food items found in the stomachs of the Grand Cayman Flicker as well as frequency and volume percentages. Animal matter was present in all stomachs and comprised 98% of the total volume. Animal food included two classes, five orders,

TABLE 3. Foraging zones and behavior<sup>1</sup> of the Grand Cayman Flicker; P = pecking, PR = probing, GL = gleaning.

| Foraging zones | Number of observations |     |    |  | Zones (%)   |
|----------------|------------------------|-----|----|--|-------------|
|                | P                      | PR  | GL |  |             |
| TRUNK          |                        |     |    |  | 205 (8%)    |
| Lower          |                        |     |    |  |             |
| Live           | 29                     | 11  | 4  |  | 44 (2%)     |
| Dead           | 56                     | 22  | 7  |  | 85 (3%)     |
| Upper          |                        |     |    |  |             |
| Live           | 15                     | 4   | 5  |  | 24 (1%)     |
| Dead           | 36                     | 12  | 4  |  | 52 (2%)     |
| INNER BRANCHES |                        |     |    |  | 1,233 (46%) |
| Lower          |                        |     |    |  |             |
| Live           | 137                    | 20  | 7  |  | 164 (6%)    |
| Dead           | 536                    | 48  | 16 |  | 600 (22%)   |
| Upper          |                        |     |    |  |             |
| Live           | 65                     | 71  | 2  |  | 138 (5%)    |
| Dead           | 290                    | 33  | 8  |  | 331 (13%)   |
| OUTER BRANCHES |                        |     |    |  | 812 (30%)   |
| Lower          |                        |     |    |  |             |
| Live           | 97                     | 22  | 17 |  | 136 (5%)    |
| Dead           | 362                    | 31  | 14 |  | 407 (15%)   |
| Upper          |                        |     |    |  |             |
| Live           | 58                     | 8   | 6  |  | 72 (3%)     |
| Dead           | 171                    | 22  | 4  |  | 197 (7%)    |
| STUMPS         | 215                    | 43  | —  |  | 258 (10%)   |
| GROUND         | 34                     | 139 | —  |  | 173 (6%)    |
| TOTAL          | 2,097                  | 490 | 94 |  | 2,681       |
| PERCENT        | 78                     | 18  | 4  |  |             |

<sup>1</sup> Pooled foraging behavior for logwood, mangrove, and limestone forests.

TABLE 4. Foraging behavior of Grand Cayman woodpeckers and resident Florida Common Flickers.

| Species                                   | Percent of observations |                    |       |     |     |      |        |       |       |
|-------------------------------------------|-------------------------|--------------------|-------|-----|-----|------|--------|-------|-------|
|                                           | Arboreal                |                    |       |     |     |      | Ground |       |       |
|                                           | N <sup>1</sup>          | Peck. <sup>2</sup> | Prob. | Gl. | Fr. | Epi. | Gl.    | Prob. | Peck. |
| <i>Melanerpes superciliaris</i>           | 523                     | 12                 | 21    | 24  | 38  | 5    | -      | -     | -     |
| <i>Colaptes auratus gundlachi</i>         | 2,681                   | 77                 | 13    | 4   | -   | -    | -      | 5     | 1     |
| <i>Colaptes auratus auratus</i> (Florida) | 1,025                   | 6                  | 4     | 1   | 14  | -    | 23     | 45    | 7     |

<sup>1</sup> Total number of foraging observations.

<sup>2</sup> Peck. = pecking, Prob. = probing, Gl. = gleaning, Fr. = fruit and seed gleaning, Epi. = epiphytes.

and at least eight families. Insects were predominant in the flicker diet and the most important taxa were Hymenoptera (ants) and Isoptera (termites). Included were the ant genera *Camponotus*, *Solenopsis*, *Monomorium*, *Paracryptocerus*, *Paratrechina*, *Formica*, and the termite families Rhinotermitidae and Kaleotermitidae. With the exception of *Solenopsis* and *Formica*, the identifiable ants and termites present belong to groups that infest mainly dead and living trees, logs, branches and stumps (Miller 1949, Van Pelt 1950, Snyder 1956, and J. Carrol, pers. comm.). Also present in the stomachs were woodboring larvae (Buprestidae, Cerambycidae, and Bostrichidae). The abundance of twig- and limb-dwelling insects and woodboring larvae in the stomachs agree with our findings about foraging.

Animal matter also was usual in the diets of Florida flickers, occurring in all stomachs collected and comprising 74% of total volume. Formicid ants comprised 65.3% of total volume. The majority of ants present were terrestrial or semi-terrestrial forms (*Formica*, *Solenopsis*, *Conomyrma*, and *Crematogaster*). This is also in agreement with the observed foraging behavior (Table 4), where ground foraging accounted for 75% of the total.

DISCUSSION AND CONCLUSIONS

The large number of habitats occupied by flickers on both Grand Cayman and the North American mainland probably is related to the widespread presence of ants and the absence of other birds specialized for feeding on them. On the mainland, the

TABLE 5. Animal foods in the stomachs of *Colaptes auratus gundlachi*.

|                  | Percent occurrence |       |       | Percent volume |      |       |
|------------------|--------------------|-------|-------|----------------|------|-------|
|                  | ♂ (11)             | ♂ ♀   | ♀ (8) | ♂ (11)         | ♂ ♀  | ♀ (8) |
| <b>ANIMALIA</b>  |                    |       |       |                |      |       |
| Mollusca         |                    |       |       |                |      |       |
| Gastropoda       | —                  | 5.3   | 12.5  | —              | 0.3  | 0.6   |
| Unidentified     | —                  | 5.3   | 12.5  | —              | 0.3  | 0.6   |
| Arthropoda       | 100.0              | 100.0 | 100.0 | 98.1           | 97.7 | 97.1  |
| Arachnida        | —                  | 5.3   | 12.5  | —              | 0.4  | 0.8   |
| Araneida         | —                  | 5.3   | 12.5  | —              | 0.4  | 0.8   |
| Insecta          | 100.0              | 100.0 | 100.0 | 98.1           | 97.1 | 96.3  |
| Coleoptera       | 18.0               | 26.3  | 37.5  | 12.4           | 12.1 | 11.8  |
| Buprestidae      | 9.0                | 21.0  | 37.5  | 7.2            | 9.2  | 11.8  |
| Cerambycidae     | 9.0                | 5.3   | —     | 3.9            | 2.1  | —     |
| Bostrichidae     | 9.0                | 5.3   | —     | 1.3            | 0.7  | —     |
| Hymenoptera      | 100.0              | 100.0 | 100.0 | 62.3           | 60.8 | 59.0  |
| Formicidae       | 100.0              | 100.0 | 100.0 | 62.3           | 60.8 | 59.0  |
| Isoptera         | 54.5               | 63.2  | 75.0  | 23.4           | 23.3 | 25.5  |
| Rhinotermitidae  | 22.2               | 26.3  | 37.5  | 8.1            | 8.1  | 8.2   |
| Kaleotermitidae  | 44.4               | 41.0  | 37.5  | 15.3           | 16.2 | 17.3  |
| Subtotal: Animal | 100.0              | 100.0 | 100.0 | 98.1           | 97.9 | 97.7  |
| <b>PLANTAE</b>   |                    |       |       |                |      |       |
| Moraceae         | 9.0                | 10.5  | 12.5  | 1.9            | 1.1  | —     |
| <i>Ficus</i>     | 9.0                | 10.5  | 12.5  | 1.9            | 1.0  | —     |
| Myrtaceae        | 9.0                | 10.5  | 12.5  | —              | 1.0  | 2.3   |
| <i>Eugenia</i>   | 9.0                | 10.5  | 12.5  | —              | 1.0  | 2.3   |
| Subtotal: Plant  | 9.0                | 10.5  | 12.5  | 1.9            | 2.1  | 2.3   |

flicker's diet consisted of from 50% (Beal 1911) to 65.3% (this study) ants. Ants were obtained largely by ground probing and gleaning (Table 4). The tendency of mainland flickers to forage on the ground has been reported by many observers (Beal 1911, Burt 1930, Bent 1939, Short 1965a, 1971a, b, and many others). Flickers have, perhaps, the best-developed extensible tongue among woodpeckers (Beecher 1953, Short 1971a). Its hard tip is bordered with backward-pointing barbs, and an enormous sublingual mucous gland makes the tongue sticky. The tongue can extend 5 cm or more into the corridors of ant colonies.

On Grand Cayman, flickers feed primarily on ants, obtained mainly by pecking into dead and dying trees (Table 3). No other bird species on Grand Cayman feeds on ants to such a degree. The West Indian Red-bellied Woodpecker (*Melanerpes superciliosus*) occurs on Grand Cayman, but feeds primarily by gleaning and probing for arthropods and eating fruits (Table 4; Johnston 1970, 1975). Flickers on Grand Cayman forage very differently from those in Florida (Table 4).

Johnston (1975) noted that most land birds on Grand Cayman are arboreal foragers, taking either arthropods or fruits. Ground foraging species are relatively less common than in mainland regions, and are virtually restricted to non-forested areas. This is not surprising because the two most common forest formations on the island are mangrove and limestone forests (Fig. 1). In the former the ground is often covered by salt and brackish water, and in the latter the ground is mainly rock. In these habitats, concentrations of ants and other insects were rarely seen on the ground, but were common in the trees, especially in decaying branches. This contrasts with most mainland (temperate) habitats, where ground ants are relatively common and arboreal ants are uncommon (Wheeler 1910, Van Pelt 1950, Cook 1953, and Cruz, pers. observ.).

The shift of the Grand Cayman Flicker from a terrestrial to an arboreal niche appears to be related to the absence of other woodpeckers specialized for arboreal pecking. Three broad ecological types may be recognized among North American woodpeckers, each centering around a type of food niche (Bock 1970). The first group, the "ground type" is represented by the flickers. Second is a group of "classical" woodpeckers (*Picoides*, *Dryocopus*, and *Campyphilus*), species that obtain their food

largely by pecking and scaling living or dead wood to extract insect prey. Finally, relatively omnivorous species (*Melanerpes*) are opportunistic feeders that obtain most of their food by non-pecking means.

As a result of the availability of tree-dwelling insects and the absence of "classical" species specialized for arboreal pecking, flickers on Grand Cayman can successfully exploit a niche that is not normally used by those on the mainland. Their success is evident in their being a conspicuous and familiar species of many Caymanian habitats.

## SUMMARY

Grand Cayman Flickers (*Colaptes auratus gundlachi*) are resident throughout Grand Cayman in suitable habitat, from mangrove to dense limestone forests. The birds forage primarily for arboreal ants and termites, obtaining their food mainly by pecking (64%) into rotting branches. Mainland (Florida) flickers, by contrast, obtain 75% of their food by foraging on the ground. Ants and other insects in the predominant Grand Cayman forests are uncommon on the ground but abundant in the trees. No woodpeckers specialized for excavating wood are present on Grand Cayman, and it appears that the elsewhere terrestrial flicker has here occupied an arboreal foraging niche.

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## RECENT PUBLICATIONS

**Birds of Northern California/An Annotated Field List. Second edition.**—Guy McCaskie, Paul DeBenedictis, Richard Erickson, and Joseph Morlan. 1979. Golden Gate Audubon Society. 84 p. Paper cover. \$5.80. Available: G.C.A.S., 2718 Telegraph Ave., Suite 206, Berkeley, CA 94705. This is a revised edition of a booklet first published twelve years ago. It includes all native birds recorded in the northern half of the state. Bar graphs and the annotated list give the habitat(s), distribution, and seasonal occurrence of each species. Dates and localities are cited only for unusual records. Appendixes list recent records, introduced species, and name changes. Bibliography.

**The North American Birder's Library Lifest.**—Edited by Susan Roney Drennan. 1979. Doubleday & Co., New York. 630 p. \$24.95. This large volume consists of prepared pages in which bird listers can record their sightings. All North American species are included. For each, spaces are provided for noting the circumstances of the first observation, the states and provinces where seen, trips when seen, and comments. A book to be prized by meticulous record-keepers. Indexes.

**The Birder's Field Notebook.**—Edited by Susan Roney Drennan. 1979. Doubleday & Co., New York. 160

p. Paper cover. \$4.95. This pocket-sized book provides prepared pages for recording standardized field notes on 72 sightings. Spaces are given for noting details of appearance, location, environmental conditions, vocalization, behavior, etc. The notebook is well intended to help birders, mainly novices, keep track of their observations and learn identification. The layout, however, is procrustean and the binding will not withstand field use.

**A Guide to Hawk Watching in North America.**—Donald S. Heintzelman. 1979. Pennsylvania State University Press. 284 p. Cloth \$12.95, paper \$6.95. This book widens the scope of the author's previous works on hawk migration in the northeastern and eastern U.S. (noted in *Condor* 77:232 and 79:138). Some of it is repeated or lightly revised from those works. The species accounts, the directory to migration lookouts, and the list of suggested reading have been expanded. Suggestions for field identification, photographs of western species and of perched birds, and a list of Hawaiian hawks have been added. Hawk watchers in the East who already own the earlier guide will not find it much superseded by this one. However, those who lack it or who live elsewhere in North America will find the new book valuable.