

LATE BREEDING ON THE TRES MARÍAS ISLANDS

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There is evidence that some passerine bird species breed later on the Tres Mariás Islands than on the mainland of México at the same latitude (Grant, 1964). Observations on breeding activities were made on both mainland and islands in the years 1961–1963, and it was concluded that equivalent phases of the breeding season of eight species are reached from three to eight weeks later on the islands (modal value, 4 weeks) than on the mainland.

These findings have been substantiated and enlarged by using other sources of data, namely references in the literature and the condition of the gonads of collected specimens (table 1). The results are as follows. Whereas at least 16 of the 19 passerine species breed later on the islands than on the mainland, according to available data, there is no clear indication that nonpasserines do so. Secondly, the breeding of most nonpasserines starts earlier in the year than does the breeding of passerines. Furthermore, at least four of the nonpasserine species have a longer breeding season than do the passerine species on both islands and mainland. The season of *Amazilia rutila* (Cinnamon Hummingbird) spans 10 of the 12 months of the year; and writing of *Cyanthus latirostris* (Broad-billed hummingbird), Schaldach (1963) refers to specimens being in breeding condition at all seasons of the year.

The reasons for these differences are not obvious. The passerine species feed more extensively on insects than do the nonpasserines, a difference that might be correlated with the difference in time and duration of the breeding season if the pattern of available insect food is different than that of vegetable food. If this is so, the long breeding season of the predominantly nectar-feeding hummingbirds is perhaps related to a nearly year-round availability of flowers for food. Lack (1954) and several others stress the biological importance of the fact that the time at which most parent birds are feeding nestlings (maximum feeding activity) coincides approximately with the greatest available food supply during the breeding season. On the Tres Mariás Islands the maximum feeding activity of the passerines follows the emergence of leaves on the deciduous trees. Leaf emergence is dependent upon rainfall. Perhaps, therefore, the difference in breeding season between mainland and island passerine birds is due to a different pattern of rainfall in the two regions. The rainy season starts in early to mid-June in both regions; by the end of June more than 150 millimeters of rain have fallen on the mainland at Puerto Vallarta in Jalisco and at San Blas and Tepic in Nayarit, whereas on the islands that quantity has not fallen until the beginning of August (see Contreras, 1942). Thus the breeding seasons may be related to the time of maximum food supply, which is governed by leaf emergence and in turn by rainfall. Ennion and Ennion (1962) have adopted a similar explanation to account for the unusual fact that on Tenerife (Canary Islands) some terrestrial bird species regularly breed two months in advance of the normal breeding season on that island.

Any future assessment of the significance of late breeding on the Tres Mariás Islands should take into account the unusual fat deposition in several island forms, which is not exhibited by their mainland counterparts (Grant, 1965). Fat is accumulated in March and April, two to three months before the advent of the rains and the onset of passerine breeding. It is used just prior to and in the early stages of breeding. There is scant evidence with which to interpret the significance of the fat deposition. It might be related to the lateness of breeding, and the following sugges-

TABLE 1
 DATA ON THE BREEDING SEASONS OF THE TERRESTRIAL BIRD SPECIES WHICH BREED ON THE
 TRES MARIAS ISLANDS (I) AND THE ADJACENT MAINLAND OF MÉXICO (M)^a

| Species | | Months of the year | | | | | | | | | | | |
|---------------------------------|---|--------------------|---|---|---|---|---|---|---|---|---|---|---|
| | | J | F | M | A | M | J | J | A | S | O | N | D |
| <i>Cathartes aura</i> | M | | | | | | | | | | | | |
| | I | | | x | | | | | | | | | |
| <i>Caracara cheriway</i> | M | | | | | x | x | | | | | | |
| | I | | | | | | | | | | | | |
| <i>Columba flavirostris</i> | M | | | x | x | x | x | | | | | | |
| | I | | | | | | | | | | | | |
| <i>Zenaida asiatica</i> | M | | | x | x | | | | | | | | |
| | I | | | | | | | | | | | | |
| <i>Columbigallina passerina</i> | M | | | x | | | x | x | x | | | x | |
| | I | | | | | | | | x | | | | |
| <i>Leptotila verreauxi</i> | M | | x | x | x | x | x | | x | | | | |
| | I | | x | | | x | | | x | | | | |
| <i>Forpus cyanopygius</i> | M | | | | | | x | x | | | | | |
| | I | | | | | | | | x | | | | |
| <i>Amazona ochrocephala</i> | M | | x | | | | | | | | | | |
| | I | | | | | x | | | | | | | |
| <i>Coccyzus minor</i> | M | | | | | | | x | x | | | | |
| | I | | | | | | | x | | | | | |
| <i>Nyctidromus albicollis</i> | M | | | | x | x | x | x | | | | | |
| | I | | | | | x | | x | | | | | |
| <i>Cynanthus latirostris</i> | M | | x | x | | x | | x | | | | | |
| | I | | | | x | | | x | | | | | |
| <i>Amazilia rutila</i> | M | | x | x | x | x | x | x | | | x | x | |
| | I | | x | x | x | | | | x | | | | |
| <i>Trogon elegans</i> | M | | | | | x | x | x | | | | | |
| | I | | | | | | | | | | | | |
| <i>Dendrocopos scalaris</i> | M | | | x | x | | x | | | | | | |
| | I | | | x | | x | | | | | | | |
| <i>Platyptaris aglaiae</i> | M | | | | | x | x | x | | | | | |
| | I | | | | | | x | x | x | | | | |
| <i>Tyrannus melancholicus</i> | M | | | | x | x | x | x | | | | | |
| | I | | | | | | x | x | x | | | | |
| <i>Myiarchus tyrannulus</i> | M | | | | | x | x | x | | | | | |
| | I | | | | | | x | x | x | | | | |
| <i>Myiarchus tuberculifer</i> | M | | | | | x | x | x | | | | | |
| | I | | | | | | x | | | | | | |
| <i>Myiopagis viridicata</i> | M | | | | | x | x | x | | | | | |
| | I | | | | | | x | | | | | | |
| <i>Camptostoma imberbe</i> | M | | | | | x | | | | | | | |
| | I | | | | | | x | | | | | | |
| <i>Thryothorus felix</i> | M | | | | x | x | x | x | x | | | | |
| | I | | | | | | x | x | | | | | |
| <i>Melanotis caerulescens</i> | M | | | | x | x | x | x | | | | | |
| | I | | | | | | x | x | x | | | | |
| | I | | | | | | x | | | | | | |
| <i>Mimus polyglottos</i> | M | | | | | | x | | x | | | | |
| | I | | | | | | x | | | | | | |

TABLE 1 (Continued)

| Species | | Months of the year | | | | | | | | | | | |
|--------------------------------------|---|--------------------|---|---|---|---|---|---|---|---|---|---|---|
| | | J | F | M | A | M | J | J | A | S | O | N | D |
| <i>Turdus rufo-palliatu</i> s | M | | | | | x | x | x | | | | | |
| | I | | | | | | x | x | x | | | | |
| <i>Myadestes obscuru</i> s | M | | | | | x | x | x | | | | | |
| | I | | | | | | | | | | | | |
| <i>Vireo hypochryseu</i> s | M | | | | | x | x | x | x | | | | |
| | I | | | | | | x | x | x | | | | |
| <i>Vireo flavoviridi</i> s | M | | | | | x | x | x | | | | | |
| | I | | | | | | x | x | x | | | | |
| <i>Parula pitiaiyuma</i> | M | | | | | x | | x | | | | | |
| | I | | | | | | x | x | x | | | | |
| <i>Granatellu</i> s <i>venustu</i> s | M | | | | | | | x | | | | | |
| | I | | | | | | x | x | x | | | | |
| <i>Icterus pustulatu</i> s | M | | | | x | x | x | x | | | | | |
| | I | | | | | | x | x | x | x | | | |
| <i>Piranga bidentata</i> | M | | | x | x | x | x | x | | | | | |
| | I | | | | | | x | x | | | | | |
| <i>Spinu</i> s <i>psaltria</i> | M | | | | | x | x | x | | | | | |
| | I | | | | | | x | x | | | | | |
| <i>Richmondena cardinali</i> s | M | | | | | x | | | | | | | |
| | I | | | | | | x | x | | | | | |

* Data taken from the specimens of several museums (see Acknowledgments), author's specimens and observations, and the following references: Bailey (1906), Friedmann *et al.* (1950), Miller *et al.* (1957), Miller (1905), Nelson (1899), Selander and Giller (1959), and Zimmerman and Harry (1951). No data available for *Buteo jamaicensis*.

tion is made as a basis for further study. Late breeding enables birds to feed their nestlings at a time when food is plentiful. But this late breeding necessitates starting at a time when it is metabolically disadvantageous to do so and is offset by the utilization of fat reserves.

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