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A MUTUALISTIC FEEDING ASSOCIATION BETWEEN BOAT-TAILED GRACKLES AND PIED-BILLED GREBES

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At noon on 25 December 1978, I observed a feeding association between Pied-billed Grebes (*Podilymbus podiceps*) and female Boat-tailed Grackles (*Quiscalus major*) on Horn Island, approximately 10 km south of Ocean Springs, Jackson County, Mississippi. My attention was drawn to the birds because of their numbers, proximity to one another, and their frenzied behavior. Observations were made with a 20× spotting scope from 30 m away at a ca. 1-ha freshwater pond fringed with yaupon (*Ilex vomitoria*) and low (<0.3 m) grasses and herbaceous vegetation. When first seen, two grebes were feeding within 1 m of one another and within 0.3 m of a grassy shoreline. Water depth did not exceed 0.2 m and the grebes were capturing prey from the surface. A tight group of eight female Boat-tailed Grackles was clustered at the water's edge near (often within 0.1 m) the grebes. The mixed group moved steadily along the shore at about 1 m/10 s.

As the grackles worked their way through the grass, climbing, hopping, and flying, I saw numerous grasshopper nymphs jumping in front of them. Some were captured by the grackles, others escaped to the water where many were caught by the grebes, and still others escaped back to land either to be eaten by waiting grackles or to be chased back to the water. Because of the rapid movement, the number of birds, and the partially obscuring vegetation, it was difficult to determine capture rates. For brief periods when I was able to keep one bird in view, grackles caught grasshoppers at an average rate of one every 9 s (range 5-17 s, $n = 11$) and grebes caught grasshoppers at a rate of one every 11 s (range = 5-23 s, $n = 14$). These peak rates were for individuals closest to the water's edge, capture rates seemed slower for birds more distant. This feeding frenzy continued for nearly 20 min, at which time the group arrived at a dense cattail (*Typha latifolia*) stand. The grackles then flew off as a group and the grebes disappeared into the cattails.

Although the grebes were the primary beneficiary of the feeding association, the observed behavior was mutualistic rather than merely commensal. Most captures by both species resulted from flushing of the insects back and forth between the land and the water. Leck (*Am. Midl. Nat.* 86:

241-242, 1971) described a similar instance of feeding by Pied-billed Grebes and Snowy Egrets (*Egretta thula*) in which the grebes were chasing small fish into shallow water where they were captured by both species, the grebes benefitting by the herons "chasing" fish from their refuge in vegetation. Mueller et al. (*Auk* 89:190, 1972) reported similar interactions between Pied-billed Grebes, a Tricolored Heron (*E. tricolor*), and a Snowy Egret. Paulson (*Auk* 86:759, 1969) reviewed examples of feeding associations between other grebe species and other aquatic birds. The observation reported here is novel in that it involved interaction with a terrestrial bird species, and unusual prey for the grebes.

Similar involvement of multiple individuals of two bird species was described by Clark (*Fla. Field Nat.* 6:45-46, 1978) for a feeding association of American White Pelicans (*Pelecanus erythrorhynchos*) and Wood Storks (*Mycteria americana*), and by Rodgers (*Fla. Field Nat.* 6:44-45, 1978) for Brown Pelicans (*Pelecanus occidentalis*) and Wood Storks. Both of these cases also recognized one species (the Wood Stork) as the primary beneficiary of the association. Those associations might also have been mutualistic, however, because fish that escaped the Wood Storks were probably often herded back into the path of the pelican assemblages.

Such interactions involving multiple individuals of each predator species herding multiple prey individuals are likely to be mutualistic. Various authors have referred to such associations as "cooperative" (e.g., Leck 1971) or "commensal" (e.g., Paulson 1969, Clark 1978, Rodgers 1978). None of the interspecific associations there described suggested that the relationship resulted from active association by both species. Rather it appears that one, the grebe or the Wood Stork in the cases described above, was attracted to the feeding activities of the other. Thus "cooperative" seems an inappropriate descriptor. In all of the cases described here, however, both species probably benefited from the activity, albeit the grebes and storks perhaps more so. Thus, the associations are more than "commensal." It seems significant that in none of the cases was interspecific evasive or aggressive actions observed. This supports the notion that the associations were mutualistic. It is easy to imagine, however, that under circumstances of more distant or closer association and/or decreased or increased numbers of grebes, the relationship might become one of commensalism or kleptoparasitism, respectively. Interspecific feeding associations thus seem to form a graded series from commensalism to mutualism to kleptoparasitism, depending on the closeness of the birds and the numbers of the "benefitted" species.

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RE-EVALUATION OF THE "HYBRID" HUMMINGBIRD *CYNANTHUS SORDIDUS* × *C. LATIROSTRIS* FROM MEXICO

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Friedmann et al. (1950) reported a "hybrid" between the Dusky Hummingbird (*Cynanthus sordidus*) and the nominate race of Broad-billed Hummingbird (*C. latirostris*). Gray (1958) did not list this hybrid combination in her extensive survey, but Short and Phillips (1966) and Mayr and Short (1970) mentioned its existence. Here I present evidence that the purported hybrid, as well as 14 similar specimens, are simply plumage variants of *C. sordidus*.

While studying the avifauna of the Mexican state of Oaxaca, I examined the hybrid specimen in question, No. 37930 in the Moore Laboratory of Zoology (MLZ) Occidental College, Los Angeles). It was an adult male collected by C. C. Lamb on 9 July 1943 at 1,829 m elevation at "Tamazulapam" (=Tamazulapan del Progreso), a town located in the interior highlands of extreme northwestern Oaxaca, not far from the Puebla border. My field companions took two similar specimens in Oaxaca, and my search of museums disclosed an additional 12 from various Mexican states, as follows: MICHOACÁN: Tafetán, 1,410 m elevation, 31 July 1939 (MLZ 24159); DISTRITO FEDERAL: no locality, 14 March 1943 (MLZ 36007); MORELOS: 3 mi S Cuernavaca, 1,433 m elevation, 3 November 1946 (MLZ 44491); 12 mi E Cuernavaca, 1 March 1970 (F. G. Stiles 249); PUEBLA: no locality, July 1928 (MLZ 641); 4 mi N Izúcar de Matamoros, 1,326 m elevation, 28 July 1957 (Western Foundation of Vertebrate Zoology [WFVZ] No. 4407) and 29 July 1957 (WFVZ 4408); OAXACA: Rancho Las Animas, 2 mi W Nejapa, 915 m elevation, 8 July 1957 (WFVZ 4402), 11 July 1957 (WFVZ 4403), and 25 September 1952 (MLZ 54436); 9 mi E El Tule (=Santa María del Tule), 9 May 1961 (Louisiana State University Museum of Zoology [LSUMZ] No. 24339); 18 mi SE Matatlán [=Santiago Matatlán], 976 m elevation, 30 May 1964 (LSUMZ 33086); 10 mi SE Oaxaca, 1,585 m elevation, 28 November 1964 (WFVZ 21269); 15 mi SE Oaxaca, 1,585 m elevation, 30 November 1964 (WFVZ 21268).

The purported hybrid has never been described. I compared it and the other "hybrids" for size and plumage color to typical examples of *C. sordidus* and all races of *C. latirostris* (*magicus*, *propinquus*, *latirostris*, *toroi* and *doubledayi*). A. R. Phillips (in litt.) and I both agree with Salvin and Godman (1888-1904), Ridgway (1911) and others that *C. l. nitida* (Salvin and Godman), accepted as a distinct race by Friedmann et al. (1950), is a synonym of *C. l. doubledayi* (Bourcier), the described differences being attributable to age, wear, or individual variation. All of the "hybrids" were adult males as determined from the labeled sex, plumage characters, and absence of the strong bill corrugations of immatures (Ortiz-Crespo 1972). Of the many females and 14 immature males that I examined, none possessed intermediate characters. Hence, here I deal with only adult males.

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The major color differences between *C. sordidus* and *C. latirostris* are as follows (*C. latirostris* in parentheses): (1) throat dull sooty-gray, each feather with a concealed darker gray subterminal area (strongly glittering bluish-green to purplish-blue); (2) midbreast sooty-gray (metallic, i.e., shiny but not strongly glittering, yellow-green, green, blue-green or blue); (3) abdomen dull pale gray (metallic yellowish-green to blue-green); (4) long undertail coverts pale buffy-gray (white, mostly white or, in *doubledayi*, glossy bluish-black); (5) dorsal surface of central rectrices olive-green, basal one-third orange-green (glossy bluish-black, tipped gray); and (6) forehead and crown metallic yellowish-green (similar, except strongly glittering green to bluish-green in *doubledayi*).

The "hybrids" were identical to *C. sordidus* in all respects except throat color, which, presumably, was the character noted by Friedmann et al. (1950). The throat of "hybrids" had a variable number (from 1 to many) of feathers with a single, metallic, green-to-blue subterminal disc that was only partially concealed. I judged the color of these spots by eye, employing an evenly graded spectral scale from green to blue, as follows: 1, green; 2, bluish-green; 3, blue-green; 4, greenish-blue; and 5, blue. Of the 15 "hybrids" that I examined, 1 had green spots, 5 bluish-green, 6 blue-green, 1 greenish-blue and 2 blue. The average value was 2.9, or approximately blue-green. If the spotted-throat birds were true hybrids, I would have expected more similarities in plumage color between them and *C. latirostris*, especially in view of the great differences between the species.

Simon (1921) long ago noted that certain "very old" adult males of *sordidus* have colored spots on the "chest." This character might be the result of older age but I cannot think of any way to test this possibility short of raising birds in captivity. The "hybrid" spots are similar in shape and position to the concealed dark gray subterminal areas of typical *sordidus*, differing only in extent, color, and iridescence, which suggests that the two are merely variations on a single theme.

The races *C. l. latirostris*, *magicus*, and *doubledayi* were smaller than *C. sordidus* in wing, tail and culmen lengths, outer rectrix width, and weight (Table 1). The depth of the tail fork was greater in *magicus* and *doubledayi* than in *sordidus* but about the same in nominate *latirostris*. In size, *propinquus* is similar to nominate *latirostris* (Moore 1939), while *toroi* is intermediate between *latirostris* and *doubledayi* (Berlioz 1937).

All available measurements for the reported "hybrid" (MLZ 37930) were similar to the means for *sordidus*; compared to *C. latirostris*, they were outside the range of variation in outer rectrix width and near the upper extremes in tail and culmen lengths. The means for the other "hybrids" were virtually identical to those for typical *sordidus*, except in tail fork depth, and were appreciably larger than those for *C. latirostris*. Compared to *doubledayi*, the "hybrids" exceeded the range of variation in weight, wing length, and culmen length, and matched the largest extremes for tail length and outer rectrix width. Only in the depth of the tail fork were the "hybrids" clearly intermediate between the two species. If the spotted-throat birds were hybrids, I would have expected more of their measurements to be intermediate (or perhaps larger than *sordidus* if hybrid vigor were involved).

The known ranges of the two presumed parents also argue against, if not preclude, hybridization. *C. sordidus* occurs in Jalisco, Michoacán, Guerrero, Oaxaca, Hidalgo, Distrito Federal, Morelos, and Puebla, while *C. latirostris*