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HERONS AND BROWN PELICANS USE CORMORANTS AND A GREBE AS "BEATERS"—WHY DOES THIS FORAGING BEHAVIOR OCCUR?

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Many animals follow other animals and use them as "beaters," capturing prey disturbed by the beater. Heron species using beaters include Eastern Reef Herons (*Egretta sacra*) using predatory fish as beaters (Recher and Recher 1969), Snowy Egrets (*E. thula*) using grebes (Leck 1971), Snowy Egrets and a Tricolored Heron (*E. tricolor*) using mergansers (Parks and Bressler 1963), White-faced Herons (*E. novaehollandiae*) using Australian White Ibises (*Threskiornis mollucca*) (Davis 1985), Snowy Egrets and Great Egrets (*Casmerodius albus*) using mergansers and cormorants (Christman 1957), and Cattle Egrets (*Bubulcus ibis*) using cattle, elephants, rhinoceroses, etc. (Telfair 1994). I reported on possibly the same Tricolored Heron using a Double-crested Cormorant (*Phalacrocorax auritus*) as a beater, following the cormorant and attacking prey stirred up by the foraging cormorant, at "Ding" Darling National Wildlife Refuge (DDNWR) on Sanibel Island, Florida, in March 1999 and 2000 (Davis 2000). In this note I report on further observations of herons and Brown Pelicans (*Pelecanus occidentalis*) using cormorants and a Pied-billed Grebe (*Podilymbus podiceps*) at DDNWR, and speculate on the evolution of beater-following foraging behavior.

On 7 March 2001, at 0800 I was at Cross Dike Trail at the identical location where I had made the previously reported observations. I found a Tricolored Heron and Double-crested Cormorant roosting about 2 m apart on the sandy shore of the dike, about 0.3 m from the far side of the approximately 7-m-wide water course that ran the length of the dike. Both birds were awake but quiescent, and were the only fish-eating birds on the approximately 200 m of shoreline and mangroves that ran the length of the water course. At 0850 The heron entered the water, then flew across the water and out of sight behind a clump of mangroves. At 0853, the cormorant entered the water and the heron immediately flew back and joined the cormorant, uttering a loud *Cronk*. The cormorant began swimming to my right, near the shore, and the heron followed along the edge of the water, running to keep up with the foraging cormorant and stopping occasionally to strike at a fish. An immature Brown Pelican flew in and landed behind the cormorant and was soon joined by a second immature pelican. The cormorant moved to mid-stream closely followed by the pelicans. When the cormorant reached my side of the water, the heron flew across and joined it, walking beside it, as the cormorant continued to forage in the same direction, away from me. The cormorant made a 180-degree turn and began swimming in my direction. Both pelicans and the herons also changed directions, follow-

ing the cormorant. The heron made frequent strikes at small minnows near the water's edge as it ran along following the swimming cormorant. One pelican had made a single prey attack, scooping its bill under the water. When the entourage reached me, the pelicans flew off, presumably disturbed by my presence. A few seconds later the cormorant again swam over to the far side of the water and the heron flew over to rejoin it, and continued to follow it. The cormorant again reversed directions, and the heron did the same, keeping pace with the cormorant. They continued to forage for about 50 m when the cormorant again swam over to the shore on my side and reversed direction, swimming towards me; the heron followed with a loud *Cronk*. They again foraged past me, stopping occasionally while the cormorant swirled about and the heron stabbed at fish. They were directly across the water from their original roosting place when an immature Great Blue Heron (*Ardea herodias*) flew in and joined the group. About a dozen people had crowded around watching the foraging birds, and at 0901 the birds dispersed, apparently disturbed by the human presence. During my observations the Tricolored Heron caught at least 19 fish, all between 3-6 cm in length.

At 1154 another beater-following event occurred when a Tricolored Heron (presumably the same bird) flew in the direction of a foraging cormorant and landed on my side of the 10-m-wide channel. The cormorant moved close to the shore and began foraging. The heron immediately flew over and joined the cormorant, and began actively foraging beside it in shallow water. The heron had followed the cormorant for about 20 m when mangrove roots protruded from shore into deep water, blocking further progress by the heron. At 1159 the heron began foraging on its own.

On 4 February 2003 at 1100 I arrived at Cross Dike Trail and found a Tricolored Heron closely following a Pied-billed Grebe. The heron followed the foraging grebe along the ditch, staying about 0.5 m from shore in shallow water, the grebe diving and surfacing in deeper water. When the grebe changed direction along the dike the heron did also, sometimes walking very quickly in order to keep up with the grebe. At one point the heron walked out into deeper water to where the grebe was sitting on the surface. After about 3 minutes of observation the heron flew across the ditch and landed next to a newly arrived Double-crested Cormorant. I walked down to the end of the ditch so that I could have an unobstructed view of the heron and cormorant. During the following 12 minutes the heron followed the cormorant the length of the dike (about 200 m), occasionally stabbing for fish. The heron stayed close to the shore and the cormorant usually stayed within 2 m of the shore. On four occasions the cormorant swam over to the opposite shore and the heron flew across the ditch to join it. Once the cormorant reversed directions and the heron followed. When the cormorant again reversed direction the heron did also. When the cormorant swam fast, the heron walked fast to keep beside it. When the cormorant stopped or slowed down, so did the heron. The pace was rapid but the heron never got more than about 2 m from the cormorant. When they reached the end of the dike I ceased observation.

Using beaters is a rare behavior in Tricolored Herons (Frederick 1997) and since I observed this behavior in exactly the same location on one-day visits during four of five consecutive years, I think it possible that I was observing the same heron. If this is the case, I find it remarkable that an individual bird could make a rare foraging behavior such a dominant part of its winter foraging repertoire, that included accompanying the cormorant at roost, and initiating its foraging when the cormorant became active. Alternatively, if I observed several Tricolored Herons, the general rarity of this behavior suggests the possibility that the behavior may be learned by imitation. This would be analogous to the situation in Striated Herons (*Butorides striatus*) where the rare behavior of "bait fishing," or "baiting" was locally common among Striated Herons in Japan (Higuchi 1986).

The practice of following a "beater" may be an extension of more general mutualistic foraging behavior where several birds take advantage of prey scared into motion by

each other's foraging. Earlier on the same day (about 1030) as the most recent Tricolored Heron observations, I watched three Double-crested Cormorants, a Tricolored Heron, and a Brown Pelican foraging together in open water at DDNWR. The birds foraged in a tight group, with never more than 5 m from closest to farthest members of the group, and they were separated by more than 100 m from any other foraging birds; they moved as a group perhaps 30 m during the approximately 5 minutes of observation. The three cormorants moved together and sometimes closely followed the pelican. The heron sometimes closely followed the cormorants. The pelican and heron made numerous strikes at fish (the pelican taking in pouches of water while swimming). The foraging was very dynamic with all birds milling about amongst the group. It seemed clear to me that they were all taking advantage of the "group beater" effect, where all foraging birds were stirring up fish prey. I speculate that the linearity of the dike ditch may serve to organize this group commensal foraging into a more directed situation where one bird uses a second bird as a "beater." The linearity of the ditch allows the fish schools to be trapped against the shore where the heron forages with the swimming cormorant. Further, the heron can forage at a relatively constant depth and is presented by a continually moving feast as the cormorant swims along into new territory. The pattern was relatively consistent with the cormorant keeping close to shore, rarely changing direction or moving to the other side of the ditch.

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