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LETTERS

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YELLOW-HEADED CARACARA AND BLACK VULTURE CLEANING BAIRD'S TAPIR

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KEY WORDS: *Yellow-headed Caracara*; *Milvago chimachima*; *Black Vulture*; *Coragyps atratus*; *Baird's tapir*; *Tapirus bairdii*; *cleaning symbiosis*.

In a cleaning symbiosis, one animal species, the cleaner, removes and consumes ectoparasites, necrotic tissue, or mucus from another animal species, the client or host. The only raptors reported as cleaners are of the orders Cathartiformes (Black Vulture [*Coragyps atratus*]) and Falconiformes (Southern Caracara [*Caracara plancus*]; Striated Caracara [*Phalcoboenus australis*]; Black Caracara [*Daptrius ater*]; Yellow-headed Caracara [*Milvago chimachima*]; Chimango Caracara [*M. chimango*]; Sazima 2011). These raptors have been reported cleaning large mammals including wild and domestic ungulates, capybaras (*Hydrochoerus hydrochaeris*), elephant seals (*Mirounga lionina*), and domestic dogs (*Canis lupus familiaris*; Sazima and Sazima 2010). Occasional “cheating” during cleaning sessions occurs when the cleaner picks at wounds, consumes flesh, and drinks blood; cheating has been reported for Black Vulture, Southern Caracara, Yellow-headed Caracara, and Chimango Caracara (Sazima et al. 2012).

The Yellow-headed Caracara is a habitual cleaner of ticks (Ixodidae) on various mammal species, whereas the Black Vulture has only occasionally been observed cleaning mammals (Sazima 2007, 2010). The Yellow-headed Caracara's known clients are domestic ungulates, the lowland tapir (*Tapir terrestris*; Sazima and Sazima 2010), the capybara (Macdonald 1981) and possibly the brown-throated three-toed sloth (*Bradypus variegatus*; Krakauer and Krakauer 1999). Clients documented for the Black Vulture are limited to the capybara and the domestic dog (Sazima 2007, 2010).

We describe the cleaning of a previously unreported client, Baird's tapir (*Tapirus bairdii*, Perissodactyla: Tapiridae), by Yellow-headed Caracara and Black Vulture. Prior to this report, the only cleaner documented for Baird's tapir was a mammal, the white-nosed coati (*Nasua narica*; Overall 1980, McClearn 1992). The endangered Baird's tapir is a keystone browser and an important seed disperser (Foerster and Vaughan 2015, García et al. 2016). Tapirs travel alone with the exception of mothers and dependent young (Eisenberg and Redford 1999).

Raptors were observed cleaning Baird's tapirs near the Sirena Ranger Station in Corcovado National Park (CNP), Puntarenas Province, Costa Rica (8°27.8'N, 83°35.5'W). This portion of CNP consists of lowland rainforest, secondary forest, yolillo palm (*Raphia taedigera*) forest, freshwater, and beach habitats, and a mowed, grassy field. This coastal area receives 5500–6000 mm of precipitation annually, primarily during the rainy season in April through December (Kappelle 2016). The tapirs of CNP have tick infestations (≥ 300 ticks/tapir) year-round, with the highest infestations recorded from December–May, mostly during the dry season (Hernandez-Divers et al. 2005).

From 2012–2017, we documented 11 instances of raptors cleaning Baird's tapir. For our own observations ($n = 3$), we used a Canon EOS 7D digital camera equipped with a 700-mm lens or a 20–60× spotting scope. We also searched the internet and social media sources for other evidence of these raptors cleaning Baird's tapir at CNP, reviewed the photographs and videos found, and then interviewed the observers who reported these additional eight observations of cleaning. We first asked each observer to describe the event, then inquired about specific behaviors observed (e.g., cleaning, tick removal), and requested the date, time, location, duration of observation,

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distance of the observer from focal animals, type of camera system used, and digital metadata, for each observation.

All 11 observed cleaning sessions occurred in open areas at CNP, either on the lawn surrounding the ranger station complex or on the beach. Raptors were observed cleaning tapirs, including removing ticks, in both the dry season [January ($n=2$)] and the rainy season [April ($n=1$), May ($n=1$), June ($n=2$), July ($n=3$), August ($n=1$), October ($n=1$)]. Observations occurred between 0830–1731 H CST, and ranged from 3–48 min in length, with cleaning bouts ranging from 1–45 min. Observations were made from distances ranging between 8 and 20 m from the focal animals.

The single observation of a Black Vulture cleaning a tapir also involved a caracara: both raptors simultaneously cleaned the same tapir. When the observation began, a tapir lying on its side on the beach was being cleaned by an adult caracara. While the caracara removed ticks from the tapir's hindquarters, an adult Black Vulture walked up to the tapir's head to stand on the beach near the snout. The vulture then pecked at the ventral surface of the tapir's proboscis repeatedly, removing and eating substances, most too small to identify. The vulture also removed a large tick, tugging at it with its bill and using enough force to move the tapir's head slightly. After this tick removal, the tapir twitched one ear but did not lift its head. This particular observation occurred during the wet season and over a period of 1 min. D'Angelo et al. (2016) observed these two raptors simultaneously cleaning a group of capybaras in Brazil.

Eight observations involved only one adult caracara, and one observation was of two caracaras, both adults, cleaning the same tapir. Two observations during the wet season involved only one juvenile caracara.

During all of the cleaning sessions, caracaras perched on the back, neck, head, inner thigh, side, or rump of a tapir. The caracaras also walked around on the tapir, appeared to look closely at the tapir's surfaces, and used their bills to remove and eat substances from the fur during all of the cleaning sessions. Tick removal was confirmed for 91% of the sessions, including the two sessions involving juvenile caracaras.

During seven of the cleaning sessions, the tapirs lay down, usually on only one side for cleaning (Fig. 1a). When lying on their sides, the tapirs appeared to be relaxed, usually with eyes closed and mouth open. In five of these sessions, the caracara(s) perched on the tapir's back and then the tapir lay down. In the longest of these sessions (45 min), the tapir first lay down with its abdomen against the ground, head up and front legs tucked under it. The tapir then rolled from this position onto each side numerous times to allow the caracara access to tick-infested areas. Two observations began when the tapir was already lying on its side. The tapir remained standing during one session and was walking during the remaining three sessions. Two cleaning sessions lasting 2.5 and 7.5 min began after the tapir emerged from swimming. In both instances the tapir

walked onto the beach, and then the caracara flew to perch on the tapir's back and begin cleaning.

Five sessions included additional behaviors. During two tick-cleaning sessions, a caracara cheated by pecking at a tapir's open wound (Fig. 1b). On one occasion, a tapir lying on its side lifted a hind limb to present its tick-infested inguinal region and lower abdomen to a caracara. On two other occasions, while a caracara cleaned a tapir lying on its side, a Cattle Egret (*Bubulcus ibis*) flew in to perch beside the caracara. In one instance, the egret then began to peck at the tapir's fur. This may have irritated the tapir, for it stood up abruptly, and both birds flew away. In the second instance, the caracara then defended its resource by making a pecking motion toward the egret, and the egret flew away.

The association between caracaras and tapirs is probably close, as our internet search revealed four additional observations that did not involve cleaning; in these instances, caracaras were observed perching and riding on tapirs. We documented these additional observations by examining photographs and interviewing the observers. These observations occurred at CNP near Sirena Ranger Station from 2011–2015 in March, April, July, and August, between 1304–1720 H, and were made from distances of 9–25 m; the observations lasted 2–25 min, with bird-mammal contact lasting 2–10 min. Three instances involved single adult caracaras; one occurred on the beach after the tapir swam. In the fourth instance, a juvenile caracara rode and walked around on a tapir as the mammal waded and swam in the Pacific Ocean at high tide. Macdonald (1981) suggested that Yellow-headed Caracaras perched and riding on mammals were waiting for opportunities to clean. Sazima (2007) observed a caracara riding on an ox. When the ox stopped, the bird flew to the ground and repeatedly jumped upward to glean ticks from the ox's venter.

The fact that mammalian clients often adopt facilitating or even solicitous postures for their raptorial cleaners may indicate co-evolutionary processes (Sazima and Sazima 2010). During our observations, Baird's tapirs often facilitated cleaning by lying on one side. Similarly, lowland tapirs and capybaras commonly lie on their sides, adopt other postures, or engage in dust-rolling, thus exposing tick-infested surfaces for caracaras to clean (Macdonald 1981, Peres 1996, Tomazzoni et al. 2005, Sazima 2007, D'Angelo et al. 2016). One sloth's reclined posture probably also facilitated cleaning (Krakauer and Krakauer 1999).

Cleaning, and particularly tick removal, may enhance the fitness of both tapir and caracara. The heavy tick infestations found on Baird's tapirs in CNP may be the cause of their low eosinophil levels (Hernandez-Divers et al. 2005). Peres (1996) proposed reduced tick-borne disease transmission rates as a possible benefit lowland tapirs received from cleaning by caracaras. Tick-laden tapirs are likely an important food source for caracaras (Naumburg et al. 1930, Haverschmidt 1962). In a study of

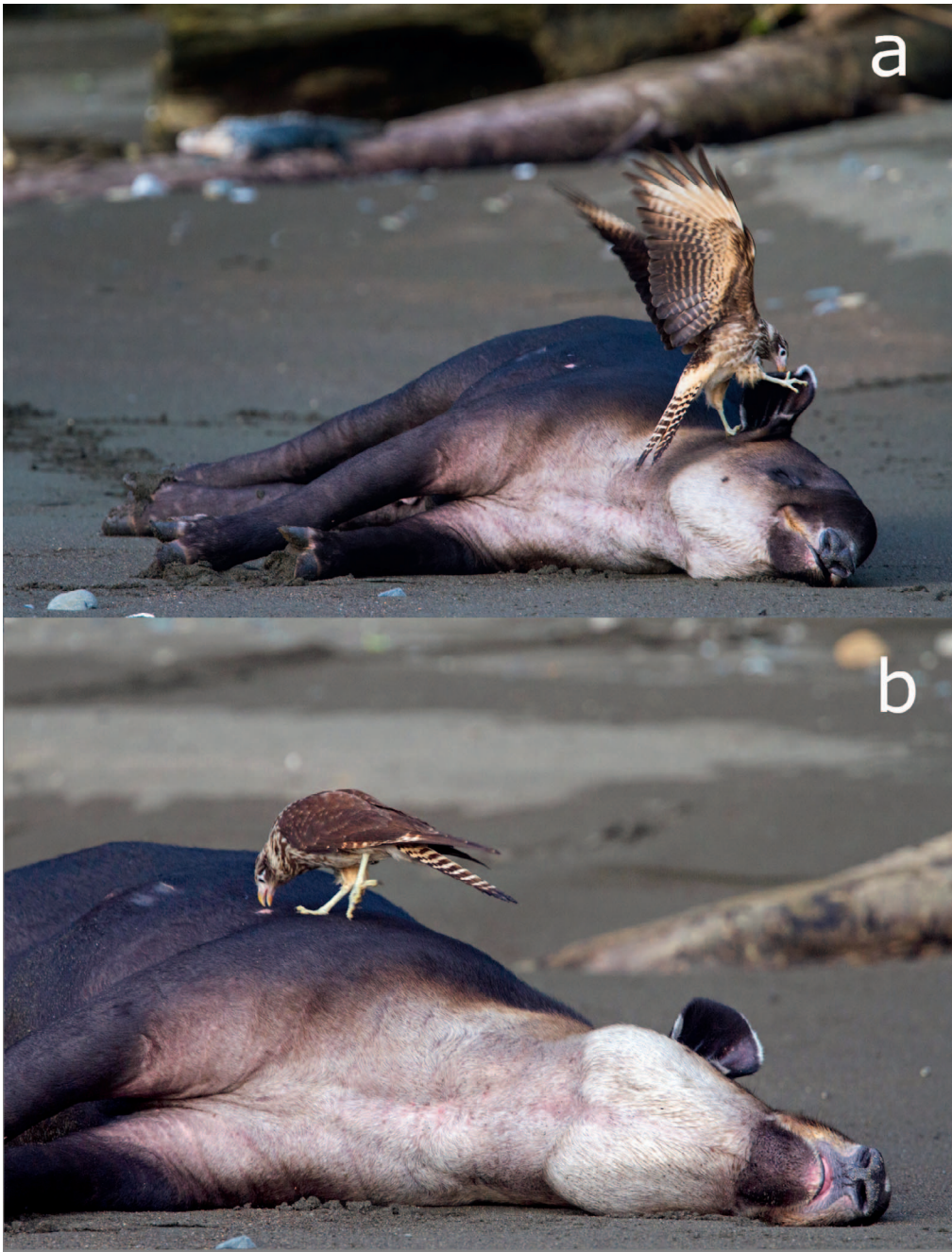


Figure 1. Juvenile Yellow-headed Caracara (a) removing a tick from and (b) pecking an open wound of a Baird's tapir, 14 July 2012. Photos by E. Rondeau.

bird–capybara interactions in Brazil, Yellow-headed Caracaras cleaned ticks from capybaras and were the rodents' most frequent visitors (D'Angelo et al. 2016). After the capybaras were culled in this study area, however, the caracaras left the area, perhaps in response to absence of this food source.

Cleaning behavior may be the ancestral condition within the caracaras, for the behavior is expressed in basal and derived groups. The genus *Caracara* is basal (Griffiths et al. 2004), appearing in the Miocene, while the *Phalcoboenus*—*Daptrius*—*Mikvago* group evolved in the Pleistocene (Fuchs et al. 2012). Cleaning behaviors have been reported for Southern Caracara as well as for Striated Caracara, Black Caracara, Yellow-headed Caracara, and Chimango Caracara (Sazima 2011). More research is needed on foraging strategies of the most northern species, the Crested Caracara (*C. cheriway*), and other members of the genus *Phalcoboenus* to further understand the possible evolutionary origins of cleaning.

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