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## Records of black jaguars at Parque Nacional Barbilla, Costa Rica

**Melanism in jaguars *Panthera onca* is rarely reported quantitatively, despite the suggestion that it appears to be more common than for any other large cats. Using camera traps in Parque Nacional Barbilla, Costa Rica, we obtained videos of more than 2 black and more than 3 yellow jaguars during April 2013 - January 2014. One previous record of a black jaguar has been reported from Costa Rica, but extensive camera trapping throughout the species' range has revealed few other records. We suspect that melanism in jaguars is rare, and thus, identifying the ecological circumstances under which black jaguars are more common will likely be elusive.**

The jaguar currently ranges from northern Mexico and the southwestern United States to northern Argentina (Rabinowitz & Zeller 2010) and is known to occur in two color phases – yellow with black spots or rosettes, and black (Sunquist & Sunquist 2002). The black coloration pattern is defined as a melanic polymorphism (Majerus & Mundy 2003), a characteristic reported in 11 of the 37 felid species (Eizirik et al. 2003). Black jaguars, commonly known as panthers, are rare and reported infrequently (Meyer 1994), though it has been suggested that such melanism is more common in jaguars than in other large cats (Sunquist & Sunquist 2002), and that it could confer an adaptive advantage under certain ecological circumstances (e.g., Eizirik et al. 2003, Allen et al. 2011). Here we report the occurrence of at least two black jaguars in the Caribbean region of Costa Rica. Parque Nacional Barbilla, in Limón and Car-

tago provinces (9°58'19" N / 83°28'51" W), protects 120 km<sup>2</sup> of humid lowland rainforest along the Caribbean slopes of the Talamanca mountain range in the northeast part of the country. The area is also home of the Cabécar, the second largest indigenous group in Costa Rica, who mainly hunt and fish, and farm bananas, cassavas, and grain. Annual rainfall averages 350-450 cm. Elevation ranges from 110-1,617 m and the trails that run through the park are quite rugged. From 26 April 2013 to 24 January 2014, we placed four digital cameras (Bushnell Trophy Cam® HD black LED) 0.7-4.0 km apart along two natural trails, one commonly frequented by visitors and the other used infrequently by researchers. One camera was placed at each site, 0.5 m above the ground and 2-4 m from the center of the trail. Cameras were active 24 hours per day and when activated recorded a 30-sec video with a minimum of 1 min

between consecutive videos. Individual jaguars were identified by unique spot patterns (Silver et al. 2004) and secondary sex traits (Sollmann et al. 2011).

During 894 trap-nights, we recorded seven videos of black jaguars and five videos of yellow jaguars, all at just two different camera sites 700 m apart, one on the visitor trail and one on the research trail (Table 1). At both cameras, both yellow and black jaguars were photographed. At least two different black jaguars were identified, one a male and the other a female, as were as at least three yellow jaguars, one male and two of unknown gender (Fig. 1). Neither the sex nor individual identification of black jaguars in two other photos could be determined. In addition, at two different times, the same male black jaguar used both trails as part of its travel route, with an average of 30 min between both video captures (Table 1).

Melanism in jaguars, inherited as a monogenic dominant to the normal colored form (Dittrich 1979), has been reported to be more common than any other large cat species (Seymour 1989, Sunquist & Sunquist 2002), but no quantitative field data have been collected to verify this (Meyer 1994). The only published report of a black jaguar in Costa Rica was that of a single juvenile photographed twice at Reserva Biológica Alberto Manuel Brenes, 140 km west of our study site (Cartín Núñez & Carrillo Jiménez 2009), the relative number of black (>2) vs. yellow (>3) jaguars that we obtained may be unusual, even if the black jaguars were related. In another camera trapping study of jaguars 155 km south of the study site only four yellow jaguars and no black jaguars were recorded (Salom-Pérez et al. 2007; 11 traps, 363 trap nights, 7 photos). Similarly, no black jaguars have been photographed in Belize despite 12 years of camera trapping (R. Foster pers. comm.). In Ecuador, 1 of 21 individual jaguars identified via camera trapping was melanistic (Blake et al. 2014), and in eastern Brazil, 4 of 12 individual jaguars identified via camera trapping were melanistic (Silveira et al. 2010).

Seymour (1989) identified historical records reporting melanistic jaguars in various locations, and recently it has been acknowledged that melanism might confer an adaptive advantage under certain ecological circumstances (e.g., Eizirik et al. 2003). Previous studies of the adaptive function of felid coat patterns have indicated that they are likely to be for camouflage rather than communication or physiological reasons (Ortolani 1999).

**Table 1.** Chronological order of videos obtained of jaguars at two camera stations in Parque Nacional Barbilla, Costa Rica.

Date	Time	Color	Individual <sup>a</sup>	Trail
17 May 2013	12:13 h	yellow	Unk1	Researcher
6 Jun 2013	21:04 h	yellow	M1	Researcher
8 Jul 2013	04:46 h	yellow	Unk1	Researcher
7 Sep 2013	01:30 h	black	Unk	Visitor
4 Nov 2013	19:19 h	black	M2	Visitor
4 Nov 2013	19:52 h	black	M2	Researcher
25 Nov 2013	17:38 h	black	M2	Visitor
25 Nov 2013	18:06 h	black	M2	Researcher
29 Nov 2013	02:09 h	black	Unk	Visitor
12 Dec 2013	19:29 h	black	F1	Researcher
28 Dec 2013	14:02 h	yellow	M1	Researcher
2 Jan 2014	20:16 h	yellow	Unk2	Visitor

<sup>a</sup> Same number after M(male), F(female), or Unk (sex unknown) indicate the same jaguar; if no number is given, the individual identification of the jaguar was not possible to obtain.



**Fig. 1.** Photos of a melanistic (M2, 4 Nov 13 from Table 1) and yellow (M1, 6 Jun 13) jaguars at the same camera station in Parque Nacional Barbilla, Costa Rica.

Allen et al. (2011) suggested that disruptive selection is the mechanism accounting for the prevalence of melanistic forms in some cats but not others, but that it was unclear how melanistic forms might use their environments differently from standard morphs although they would be expected to be found at the extremes (for example having especially nocturnal activity patterns or living in particularly dense forest).

Though molecular techniques now allow for melanism to be identified genetically from field collected samples (Haag et al. 2010), camera-trapping results suggest that melanism in jaguars is rare. Thus, identifying the ecological circumstances under which black jaguars are more common will likely be elusive, as well.

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