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N° 71 | Spring 2020





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CATnews is produced with financial assistance from the Friends of the Cat Group.

Design: barbara surber, werk'sdesign gmbh
Layout: Tabea Lanz und Christine Breitenmoser
Print: Stämpfli Publikationen AG, Bern, Switzerland

ISSN 1027-2992 © IUCN/SSC Cat Specialist Group

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Plasticity on interference competition – puma and ocelot: An isolated event?

Interference competition is a fundamental ecological process that shapes community structure. We report the details of an interspecific encounter of a top predator, puma *Puma concolor*, and a mesopredator, ocelot *Leopardus pardalis*, resulting in non-antagonistic behaviour. We posit plasticity on interference competition to explain the non-aggressive interaction between the pair of Neotropical felid species. While isolated, this observation may provide insight into, perhaps, diverged behaviours of two syntopic species inhabiting a human-altered landscape.

Behavioral adaptations that facilitate coexistence within carnivore guilds have afforded increasing relevance in the field of ecology. Both intraguild predation and interspecific killing are ecological forces influencing community structure (Polis et al. 1989, de Oliveira & Pereira 2014). Interspecific competition asserts that in the presence of large predators [carnivores], smaller ones are affected by exploitation and interference over limited resources (Palomares & Caro 1999, Donadio & Buskirk 2006). Hence, competing species may use spatial and temporal segregation mechanisms, and partitioning of food resources to facilitate coexistence (Emmons 1987).

We report an anecdotal observation of plasticity on interference competition – with the absence of antagonistic behaviour – bet-

ween a puma and ocelot, sympatric species inhabiting a human-altered landscape (<https://youtu.be/0l-BiC60WIs>). Our observation took place during the dry season (December to April 2017) while performing a long-term monitoring study of the felid guild in the tropical montane forest of Mamóní Valley, Panamá. The sampled area consisted of a mosaic of primary forest, mature secondary forest, and grasslands, with altitudes varying from 100 to 800 m.

Given that the behavioral state of the puma (e.g., hunting), ocelot response (e.g., antipredator behaviour), and the progression of the intraguild encounter are uncertain, we depict a series of events captured by our camera trap on February 10, 2017, as follows: 1) a puma initially appeared at 18:39'40"; 2) an ocelot appeared at 18:51'51"; 3) while the ocelot

sniffed the ground at 18:51'52", a puma reappeared in the background and stood still at 18:52'22"; 4) the ocelot looked towards the puma with ears perked at 18:52'29", then slowly walked away; and 5) the puma walked towards the camera at 18:53'15", then sat down (Figs. 1–4).

Although interactions between co-occurring species in multipredator guilds are often documented (Bustamante et al. 2014), there is a substantial gap in our general understanding of interference interactions in the carnivore guild (Ramesh et al. 2017). Further, there is a paucity of research on the outcomes of competition between pumas and ocelots (Elbroch & Kusler 2018). We posit plasticity on interference competition may facilitate felid coexistence in a human-altered landscape.

Behavioural plasticity can affect all levels of ecological organization through effects on demographic parameters and species interactions, including predation (Miner et al. 2005, Turcotte & Levine 2016). Within the order Carnivora, intraguild predation is a wide-spread interaction (Arim & Marquet 2004, Ritchie & Johnson 2009), including ocelot fatality from interspecific attacks by pumas (de Oliveira & Pereira 2014, Bustamante et al. 2014). While species-specific traits such as body size (Donadio & Buskirk 2006, Di Bitetti et al. 2010) and individual state – nutritional condition and life history – effect intraguild interactions, species can also plastically adjust their responses to en-



Fig. 1. The puma and ocelot in close proximity, puma in the background (Photo Kaminando Habitat Connectivity Initiative).



Fig. 2. Ocelot looked towards the puma in the background (Photo Kaminando Habitat Connectivity Initiative).



Fig. 3. The ocelot walked away from the puma (Photo Kaminando Habitat Connectivity Initiative).



Fig. 4. After the ocelot walked away, the puma approached the camera (Photo Kaminando Habitat Connectivity Initiative).

vironmental changes (Bonnot et al. 2018). Hence, the potential role of plasticity on the outcome of interference competition may enhance puma and ocelot coexistence in human-altered habitats.

Habitat loss forces carnivores to inhabit smaller areas, disrupting species co-occurrence patterns, interspecific relations, and increases the frequency of antagonistic interactions (Caro & Stoner 2003, Karanth et al. 2017). Subsequent changes to carnivore community structure (i.e., loss of apex predators) can result in cascading effects on other carnivores, impacting community stability, and prey density (Ritchie & Johnson 2009, Moreno et al. 2006). As prey availability can moderate the strength of top-down intraguild interactions among carnivores (Elmhagen & Rushton 2007), subordinate competitors may not avoid the dominant species if prey is abundant (Carter et al. 2015).

Studies of non-intact felid guilds have shown that competition between puma and ocelot may be lower when jaguars are absent (Santos et al. 2019). Thus, spatiotemporal and behavioral tactics that change with resource levels may lessen aggressive interactions between the puma and ocelot. Consequently, strategies other than direct killing (e.g., intimidation, displacement) may play an

essential role in strengthening the complex dynamic of intraguild interactions in human-altered tropical forest ecosystems. The diverged behavior reported here warrants further investigation to elucidate when and how plasticity on interference competition promotes or hinders coexistence.

Acknowledgements

The authors thank I. Zea, and the Monteza family for facilitating data collection. We also thank the Shanbrom Foundation and the Laney Thornton Foundation for supporting Kaminando's research.

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