



Female–female mounting in pumas

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Abstract

Female–female sexual behaviors have been recorded in many species across several taxa, but their infrequency except in a few species has resulted in continued speculation about their function and potential evolutionary consequences. Here, we report two observations of female–female mounting in wild puma populations representing two sub-species from opposite ends of puma range. We believe our observations provided support for the social glue hypothesis and dominance in same-sex hierarchies, but not for surrogacy in the absence of a male or as a means to stimulate and encourage male partners to copulate.

Keywords Dominance · *Puma concolor* · Same-sex competition · Social behaviors

Introduction

Female–female sexual behaviors have been recorded in many species across several taxa, but their infrequency except in a few species (e.g. Bonobos, *Pan paniscus*; Fruth and Hohmann 2006, Laysan albatross; Young et al. 2008) has resulted in speculation about their function and potential evolutionary consequences (Dagg 1984; Bailey and Zuk 2009). Among mammals, common functional hypotheses for female–female sexual behaviors include (1) surrogacy in the absence of a male, (2) bonding and building alliances, (3) reducing social tensions to mitigate physical contests or to alleviate tensions following fights, (4) establishing dominance hierarchies as a form of same-sex competition, (5) a means to stimulate and encourage male partners to copulate

or alternatively (6) that they betray a maladaptive morphological or neurological trait (Parker and Pearson 1976; Srivastava et al. 1991; Bailey and Zuk 2009). Hypotheses 2 and 3 are sometimes lumped together in what is referred to as the “social-glue hypothesis” (Van Vugt and Hart 2004). In mammals, female–female mounting generally occurs when at least one female is in oestrus, suggesting an influence of hormonal state as well (Parker and Pearson 1976; Baker and Seidel 1985; Srivastava et al. 1991; Fang and Clemens 1999).

The puma is the second largest felid in the Americas, ranging from Alaska in North America to the Magellanic Strait in the southern hemisphere (Nielsen et al. 2015). Pumas are territorial, solitary carnivores that forage alone (Logan and Sweanor 2001; Allen et al. 2015; Elbroch and Quigley 2016). Nevertheless, recent research has revealed that pumas interact with conspecifics with regularity and, perhaps, predictability (Elbroch et al. 2017; Lagos et al. 2017).

Pumas reach sexual maturity between 2 and 3 years old and are induced ovulators, requiring physical contact to stimulate opportunities for breeding (Bonney et al. 1981). Pumas can produce litters at any time of the year; however, in temperate climates, they exhibit a birth pulse during the warmer months (Jansen and Jenks 2012; Elbroch et al. 2015). Courting pairs locate each other through chemical and vocal communication (Allen et al. 2014, 2015) and then generally exhibit multiple copulations over a period between ranging between 1 and 16 days, during which the male and female typically travel together (Logan and Sweanor 2001).

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As with diverse carnivores, many aspects of puma behavior have been difficult to document given their cryptic nature. Female–female mounting has been observed in captive domestic cats (Fox 1975), cheetahs (Eaton 1974) and lions (Beach 1968), but their function is unknown.

Intrepid filmmakers and growing puma tourism in Patagonia, during which pumas are observed for long periods in open country, are providing opportunities to fill gaps in our current knowledge about pumas; this information may also be applicable to diverse carnivores difficult to observe in the wild. Here we report two observations of female–female mounting in wild populations representing two sub-species from opposite ends of puma range. To what extent we could, we discuss whether our observations provide support for any of the functional hypotheses presented above.

Methods and results

Our first observation occurred in northwest Wyoming, USA in a population of *Puma concolor cougar*, as part of a long-term ecological study of the local population (Elbroch et al. 2015, 2017). Pumas in this study system were observed in two ways: motion-triggered video cameras recorded 88,116 min of wild puma behavior (Elbroch et al. 2017) and people using long-lens cameras for documentary films recorded an additional 14,400 min of behavior. On 8 August 2014, during a routine check on F61, a pregnant 7-year-old female puma unaccompanied by kittens, we heard the mating vocalization called caterwauling (Stanton et al. 2015). At the time, a film crew accompanied researchers to document their work. Using the vocalizations as guide, we approached two pumas in the field and discovered that the female caterwauling was a small, young unmarked female of approximately 18–24 months of age, and not F61. We began filming the pair at 16:06 and captured 8 min of film before they moved over a ridge and out of view. We captured 6 min of film of the pair the next day, 3 min on day three, and finally 14 min on the fourth and final day in succession that we found the pair together.

On 8 August, we witnessed the most antagonistic exchanges, which we interpreted to mean that the pair had not been together long. Initially, F61 followed approximately 3 m behind the caterwauling female as they traversed a steep slope. Then F61 moved up and bit the back end of the female. F61 clawed one side and bit the other again, before quickly moving forward to bite the young female's neck (Video S1). When F61 made contact, the young female did not run, but squatted into a position of a female during courtship, but when F61 moved forward to bite her neck, she flipped, swatted with a front paw and fled. F61 pursued for 50–60 m, at which point the young female sat and confronted F61. Then the pair moved out of view.

On 9 Aug, we found the pair lying together, and began filming at 17:44. After several minutes, F61 walked uphill and the young female followed. They moved together, alternating lead as they traveled. Then, the young female began caterwauling, and at F61's approach, she squatted in lordosis as if ready for mating. F61 moved into bite her hind end and back. The young female pulled away. F61 hissed at her and followed (Video S2). They repeated these behaviors three times before moving out of sight.

On 10 Aug at 14:00, we located the pair lying together in the shade of a tree. They detected us as we approached and moved away. On 11 August at 17:43, we located the pair lying on a hillside. The pair rose after several minutes and traversed a steep slope together. F61 led the pair more often than not. The young female periodically caterwauled, but for shorter duration and less intensity than during our previous observations. F61 did not engage the young female during these vocalizations, and they moved beyond view. The young female was never seen by researchers again; whereas, F61 was monitored until she was 11 years old.

Our second observation occurred in Torres del Paine National Park in southern Chilean Patagonia in a population of *Puma concolor puma*, during work conducted for a documentary film. Pumas there are likely the most observed population in their range, due to ongoing puma tourism (Tortato et al. 2020). For example, this observation occurred during 30 consecutive field days filming pumas, and to date, co-author NL has logged 440 days with pumas in the study area, suggesting the rarity of this behavior.

On 14 April 2019 at 14:42, we spotted a seven- to 8-year-old female puma ("Female 1", age estimated from tooth color and wear) in heat, caterwauling. A second, 6-year-old female lay nearby (age known since she was followed since she was a kitten), about 5 m away. At 14:45, the female in heat stood up and positioned herself in front of the second female. Female 2 stood up and displayed typical male mounting behavior (Fig. 1), positioning herself behind and atop female 1. Female 2 bit female 1's neck, after which female 1 stood, displacing female 2. Female 1 continued vocalizing. The pair repeated these behaviors three times over 34 min, laying on the ground close to each other in between each mounting event. At 17:35, the pair stood together but walked away in different directions. Two days later, we saw female 2 by herself, with no signs of female 1 nearby. Female 1 was not seen again after this event.

Discussion

Our observations were few and, thus, we encourage others to share observations that may begin to elucidate patterns of female–female mounting in cryptic carnivores. Our observations were also very different from one another,



Fig. 1 Female–female mounting in pumas observed in Torres del Paine National Park, Chile. Photograph by Nicolás Lagos

each providing insights into the potential functional roles of female–female mounting in this cryptic carnivore. Our first observation was highly antagonistic, included chasing and physical fights, and involved mounting that looked more like a puma subduing prey than typical male–female copulation. Thus, we speculated that at least in this case, female–female mounting served to enforce dominance hierarchies and same-sex competition (hypothesis 4). Given that F61 accompanied the female for multiple days as she caterwauled in her territory, we speculated that she may have interfered if a mating opportunity had materialized. Such an exhibition would have been the strongest support for hypothesis 4.

Established dominance hierarchies, however, minimize physical contests as well. For this reason, we believe that the aggressive exchange between F61 and the young female may also support the social glue hypothesis (hypotheses 2 and 3 above). Pumas exhibit regular social interactions and reciprocal tolerance at food resources (Elbroch et al. 2017; Lagos et al. 2017), and thus, hierarchies may mitigate further contests during future social interactions.

Our observation in Patagonia was less antagonistic, initiated by the female in oestrus, and mimicked typical male–female copulation (Mellen 1993; Stanton et al. 2015). We do not suspect that it served as surrogacy (hypothesis 1) as there were known male pumas in the vicinity, but we cannot rule this out completely. We do not believe mounting served to attract male attention (hypothesis 5) as there wasn't a male nearby, and because this strategy is more common in social mammals (Parker and Pearson 1976). We suspect that the interaction served a social glue function (hypothesis 2 and 3) as these females shared overlapping territories in a prey-rich area. We cannot rule out that the behaviors did not contribute to dominance hierarchies as well (hypothesis 4), for reasons we described above.

Our observation in Patagonia was further complicated by the fact that female 2 exhibited an unusually large

morphology similar to a male puma, suggesting the potential for a phenotypic explanation to the behavior, or at least a potential phenotypic contribution. Female 2 is distinctive in the population. She has been observed courting and mating on multiple occasions, but never with kittens. In female mammals, distinct morphotypes can occur due to environmental effects in the uterus that increase testosterone in female embryos, and result in different levels of masculinization and aggressiveness among females in a population (Correa et al. 2016). These effects may be maladaptive but because they are environmentally derived, cannot be removed via natural selection.

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