Encounter Competition between a Cougar, *Puma concolor*, and a Western Spotted Skunk, *Spilogale gracilis*

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Encounter competition occurs frequently over food resources and may include kleptoparasitism, where scavengers usurp prey killed by carnivores. Scavenging may have important adverse effects on carnivores and may result in higher than expected kill rates by predators. Using camera traps placed on a Black-tailed Deer (*Odocoileus hemionus columbianus*) carcass killed by a Cougar (*Puma concolor*) in California, we observed a series of encounters in which a Western Spotted Skunk (*Spilogale gracilis*) temporally usurped the carcass from the Cougar. The Western Spotted Skunk also successfully defended the carcass when the Cougar returned and attempted to feed. The Spotted Skunk was about 1% of the mass of the Cougar. Our observation is the largest reported size differential of a mammalian species engaging in successful encounter competition.

Key Words: Cougar, Mountain Lion, *Puma concolor,* Western Spotted Skunk, *Spilogale gracilis,* encounter competition, kleptoparasitism, competition, California.

Encounter competition describes non-territorial inter- and intra-specific competition for resources, including access to food and mates (Schoener 1983). Encounter competition, which includes kleptoparasitism (when an individual attempts to usurp or feed on prey killed by another) (Cooper 1991; Murphy et al. 1995; Trinkel and Kastberger 2005; Hebblewhite and Smith 2010), is likely common but is not well reported in the literature. In interspecific encounter competition, smaller species generally avoid larger species (Dickman 1991); however, when species directly interact, the group or individual of the species with more biomass typically wins access to the contested resource (Johnson et al. 1985; Cooper 1991; Gorman et al.1998; Berger and Gese 2007).

Kleptoparasitism increases in frequency when food resources are scarce, search time for food is high, or, as in other forms of encounter competition, there is asymmetry between the two competitors—meaning that larger, more powerful kleptoparasites more easily and more often steal from physically inferior species or conspecifics (van der Meer et al. 2011; Broom and Ruxton 2003). Scavengers directly decrease carnivore energetic intake and fitness, are responsible for an increase in kill rates, and indirectly alter predator–prey dynamics of ecosystems (Gorman et al. 1998; Krofel et al. 2012; Elbroch and Wittmer 2013a). For example, kleptoparasitism has been noted in kills made by Gray Wolves (*Canis lupus*) (Hebblewhite and Smith 2010), Coyotes (*Canis latrans*) (Jung et al. 2009), and Cougars (*Puma concolor*) (Ruth and Murphy 2010; Elbroch and Wittmer 2012).

Cougars are large, solitary carnivores that frequently kill ungulates. Cougars also provide a significant food subsidy to scavengers, in comparison with other carnivores (Ruth and Murphy 2010; Elbroch and Wittmer 2012). Gray Wolves, Brown Bears (Grizzly Bears) (*Ursus arctos*), and American Black Bears (*Ursus americanus*) usurp Cougars kills (Ruth and Murphy 2010). Mesocarnivores, such as Coyotes, Bobcats (*Lynx rufus*), and Gray Foxes (*Urocyon cinereoargenteus*), have also been documented scavenging from Cougar kills without displacing them (Koehler and Hornocker 1991; Boyd and O'Gara 1995; Logan and Sweanor 2001). The numerous species scavenging from Cougar kills may lead to significant food losses, especially when Cougars are displaced from their kills. Here, we describe a series of encounters between a Cougar and a Western Spotted Skunk (*Spilogale gracilis*) feeding from a Black-tailed Deer (*Odocoileus hemionus columbianus*) killed by the Cougar.

Methods

Our observations were made as part of a study on the influence of Cougar predation on a declining Black-tailed Deer population in Mendocino National Forest, California (39.7°N, 122.9°W). We captured Cougars using trained hounds and box traps, chemically immobilized the Cougars, and then fitted them with Argos GPS collars (7000SAW, Lotek Engineering Inc., Newmarket, Ontario). Based on Elbroch and Wittmer (2013b), GPS collars were programmed to acquire GPS locations at 2-hour intervals, and location data were downloaded via satellite connection every three days. We conducted field investigations of ≥3 points, including a night-time location, within 150 m of each other to locate potential kill sites. When we discovered active kill sites at which the Cougar was still feeding, we placed motion-triggered video-cameras (Bushnell TrophyCam, Overland Park, Kansas) programmed to

collect 60-second videos with a 1-second delay between triggers over the carcass for 20 days to document the diversity of scavengers that fed on it.

Results

On 22 November 2011, we discovered a Black-tailed Deer killed by Cougar F23 approximately 10 hours previously. F23 was an adult female originally captured in June 2011 and estimated to be 4.4 years of age, based on gumline recession (Laundre et al. 2000). During capture, we noted the Cougar as being in very good health (based on fat deposits, pelage condition, and lack of external parasites). She was a large female, weighing 49.5 kg.

The carcass was in a small drainage within a montane hardwood habitat underneath a cluster of scrub oaks (*Quercus* spp.). The carcass was very fresh; the Cougar had removed only minimal organs and had not yet cached it. The Black-tailed Deer was a female and was 3.5 years of age based on molar wear patterns (Heffelfinger 2010*). The video-camera was placed on a tree 2.5 m away, and the carcass was anchored to a tree with a wire cable.

Before the encounter, the Cougar returned and fed from the carcass for three days. During this time, she visited the carcass seven times, with visits lasting a mean of 34.3 minutes (SD 6.7). On 25 November 2011, a Western Spotted Skunk was detected at the carcass at 21:54. The Western Spotted Skunk investigated the carcass and left 1 minute later. The Cougar returned to the carcass 4.3 hours later and fed on the carcass for 24 minutes, at which point she noticed the Western Spotted Skunk arriving from a distance. As the Western Spotted Skunk approached, the Cougar backed away from the carcass. The Western Spotted Skunk then approached the carcass and began feeding. After feeding for 3 minutes, the Western Spotted Skunk moved aggressively towards the Cougar, causing her to hiss and quickly leave the area. Based on the pattern of markings on the coat of the Western Spotted Skunk, we believed it to be the same individual that originally investigated the carcass.

The Cougar returned 20 minutes later and cautiously approached the carcass. The Cougar spent 1 minute alternating between smelling the carcass and visually searching the area. The Western Spotted Skunk then came out from beneath a nearby rock and rushed toward the Cougar, causing her to growl and jump back out of the way. The Cougar moved about 4 m away from the Western Spotted Skunk, up the bank from the carcass. The Western Spotted Skunk spent 18 seconds inspecting the carcass and then moved uphill directly towards the Cougar. When the Western Spotted Skunk approached within 1 m of the Cougar, she retreated and again moved off. The Western Spotted Skunk returned to the carcass and spent 3 minutes feeding before leaving.

The Cougar returned once again at 5:04 (3 hours later) and slowly approached the carcass. She smelled and investigated around the carcass for 3 minutes before she began to feed. The Western Spotted Skunk approached the carcass 12 minutes later. Upon arrival, the Western Spotted Skunk quickly approached the carcass. Instead of retreating, the Cougar hissed and bared her teeth at the Western Spotted Skunk, causing the Western Spotted Skunk to back up, away from the carcass. The Western Spotted Skunk then circled around the bottom side of the carcass before cautiously approaching the carcass again. The Western Spotted Skunk then began feeding on the downhill side of the carcass while the Cougar continued to feed on the uphill side. The Western Spotted Skunk fed actively on the carcass for 2 minutes before leaving the carcass, and the Cougar fed for another 51 minutes before leaving.

The Cougar returned once more on the evening of 26 November 2011 for a 9-minute visit before abandoning the carcass. There were little edible remains left on the carcass at this point. It was monitored for 15 more days, and visits by a Bobcat and a Fisher (*Martes pennanti*) were recorded, but neither the Cougar nor the Western Spotted Skunk were detected again.

Discussion

During these encounters, the Western Spotted Skunk appeared to initially rely upon tail-lifting in order to threaten to spray the Cougar, while also appearing to communicate its aggressiveness to the Cougar through body language. After the initial encounter, the Western Spotted Skunk appeared to rely less on threats of spraying and instead just used aggressive body language in its direct encounters with the Cougar. Hunter (2009) found evidence that potential Striped Skunk (*Mephitis mephitis*) predators learn from experience not to engage skunks and that, through experience, predators learn the implied threat in aposematic coloration. It may be that this Cougar had had past encounters with either Western Spotted Skunks or Striped Skunks and had learned to avoid, rather than confront, them.

Western Spotted Skunks typically weigh about 0.5 kg (Jameson and Peeters 2004). In this series of encounters, a Western Spotted Skunk temporarily usurped a carcass from a Cougar weighing about 99 times more than the Western Spotted Skunk. Our observation is in contrast to most published information on encounter competition, where the larger species displaces the smaller species. We believe that this is the largest reported size differential for the smaller mammalian species winning such an encounter against a larger species. There have been unsubstantiated anecdotal reports of relatively small-bodied Wolverines (*Gulo gulo*) usurping prey from larger-bodied carnivores, but the body size differential is likely not as great as

we observed between a Western Spotted Skunk and a Cougar. Our observations, along with those described for challenge commonly held beliefs about which species will win encounter competition events and should lead us to consider factors other than the size or biomass of the competing species.

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Supplementary video available at:
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