

ANOTHER ACCOUNT OF INTERSPECIFIC AGGRESSION INVOLVING  
A HOARY BAT (*LASIURUS CINEREUS*)

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ABSTRACT—We observed an incident of interspecific aggression between a male Hoary Bat (*Lasiurus cinereus*) and a male Silver-haired Bat (*Lasionycteris noctivagans*). The Silver-haired Bat suffered few external injuries, the most conspicuous of which were a missing lower right canine and small puncture wounds on the left wing membrane. The Hoary Bat experienced much more extensive external injuries, including sub-dermal bleeding on wing and tail membranes and bite marks and tears in both wings. Few published accounts describe physical altercations among bats, but Hoary Bats are frequently involved. Rabies is often implicated as a driving factor in the aggressive interactions. We decided not to euthanize the bat for rabies testing, but encourage others who encounter these types of interactions to have bats tested.

Key words: bat, Hoary Bat, interspecific aggression, *Lasionycteris noctivagans*, *Lasiurus cinereus*, rabies, Silver-haired Bat

Aggressive interactions between North American bats have rarely been reported (Bell 1980), but are occasionally observed on foraging grounds, usually as chasing or pursuing flight patterns (Ransome 1990). Bats sometimes emit agonistic social calls during these encounters as they defend foraging space or prey items (Barlow and Jones 1997). Encounters that result in physical contact are even more rarely observed and, in North America, usually involve Hoary Bats (*Lasiurus cinereus*; Table 1).

We observed an incident that we believe represents interspecific aggression on 14 May 2015, while mist netting along Bull Creek, Humboldt Redwoods State Park (UTM: Zone 10 N, 416309E, 4467328N, WGS84). Humboldt Redwoods State Park protects remnant stands of old-growth Coast Redwood (*Sequoia sempervirens*) and is a migratory stopover site for several species of bats. At 21:05, during a routine net check, we heard audible “distress” calls of a bat emanating from a small stand of Red Alder (*Alnus rubra*) along the creek channel. Silver-haired Bats (*Lasionycteris noctivagans*; average mass at our study site = 10 g) often produce

similar vocalizations when caught in a mist net, though no bats were in the nets. At 21:15, we observed 2 bats engaged in an apparent physical interaction on the stream bank approximately 5 m ahead of us and 3 m from the nearest net. As we approached, one of the bats flew off. We immediately identified it as a Hoary Bat (average mass at our study site = 23 g) by its distinct size, coloration, and flight style. We retrieved the 2nd bat from the ground, and identified it as a male Silver-haired Bat.

Upon physical examination of the Silver-haired Bat, we noted blood on its mouth and a missing lower right canine tooth (Fig. 1). The only other external evidence of injury was a puncture hole on the left wing between the 3rd and 4th digits. It was an adult male with non-descended testes and 25% filling of the epididymes (forearm 42.5 mm, mass 7.8 g), which is typical of Silver-haired Bats captured in May at this site. During standard measurement procedures, the Silver-haired Bat displayed no unusual behaviors. When released, the bat flew away normally.

Approximately 10 min after retrieving the Silver-haired Bat from the ground, we captured a male Hoary Bat (non-descended testes, no epididymal filling, forearm = 54.3 mm, mass = 21.1 g) in the net nearest to where the bats had been observed on the ground. The Hoary Bat exhibited a much more extensive set of external injuries than had the Silver-haired Bat. When fully extended, the uropatagium displayed sub-dermal bleeding and bruising along almost the entire length of the tail vertebrae (from the anus to approximately 5 mm from the tip of the tail; Fig. 2a). The right wing displayed similar levels of bruising between the elbow and the thumb. There were a few tears in the right wing membrane, including a large bloody one between the 5th digit and the leg. The left wing was not bruised, but showed noticeable bite marks in multiple places, and was bloody at the base of the thumb joint and between digits 2–4 (Fig. 2b). The Hoary Bat behaved normally

TABLE 1. Previously reported observations of physical aggression in North American insectivorous bats. NA = not available.

Presumed aggressor	Presumed victim	Rabies?	Reference
<i>Lasiurus cinereus/borealis</i>	<i>Perimyotis subflavus</i>	NA	Bishop 1947
<i>Lasiurus cinereus</i>	<i>Parastrellus hesperus</i>	NA	Orr 1950
<i>Lasiurus cinereus</i>	<i>Lasionycteris noctivagans</i>	Confirmed	Bell 1980
	<i>Tadarida brasiliensis</i>		
	<i>Eptesicus fuscus</i>		
<i>Lasiurus cinereus</i>	<i>Perimyotis subflavus</i>	NA	Krynak and Riebe 2013
<i>Lasiurus borealis</i>	<i>Nycticeius humeralis</i>	Confirmed	Sasse and others 2014

during handling, but when we attempted to release it, it remained still, chewing on the cotton holding bag. After several attempts to encourage the bat to fly, we placed it on the trunk of a nearby tree. When touched, the bat would lift its head and behave aggressively. It hung on the tree for approximately 20 min before we moved it to an asphalt parking lot surface after it grabbed the cloth bag with its teeth and could not be safely separated. Five minutes after the

bat was moved to the ground, it had left the area. We assume that it flew off because we were able to completely search the ground within a 5-m radius of the tree trunk, as most of the area was covered in asphalt and the remaining area was bare soil.

Given the low levels of bat activity at the site on this particular night (these were the only 2 bats captured) and the spatial and temporal proximity between the net in which the Hoary



FIGURE 1. Silver-haired Bat (*Lasionycteris noctivagans*) with missing lower right canine. Photograph by J Clerc.



FIGURE 2. a) Hoary Bat (*Lasiurus cinereus*) with uropatagium extended, showing extent of subdermal bruising along the tail vertebrae; b) thumb and wing damage on the left wing. Photographs by W Brokaw.

Bat was captured and our initial observation of the interaction, we strongly suspect that the captured bats were the 2 interacting individuals and that the injuries observed on each bat were a result of the observed interaction. Although injuries including broken phalanges, wing punctures, and blood in the mouth are occasionally observed during mist netting, an individual bat rarely has all of these injuries at the same time. We have not previously observed missing teeth or injuries to the tail in bats captured in mist nets.

We found only 5 published accounts of physical altercations among bats in North America, and Hoary Bats have been implicated in most of these interspecific encounters (Table 1). These accounts describe interspecific aggression between Hoary Bats and other smaller bat species (Bishop 1947; Orr 1950; Bell 1980). Bell (1980) observed a Hoary Bat aggressively chase and bite 3 different species in a single foraging bout. This bat was later confirmed to have been rabid. In all cases, Hoary Bats were the presumed aggressor (Table 1). In the interaction we observed, it was unclear which bat initiated the encounter. Although the Hoary Bat appeared to sustain more injuries than the Silver-haired Bat, Hoary Bats are larger, have a history of aggressive physical attacks and in this case, upon our disturbance, flew off leaving the Silver-

haired Bat apparently stunned on the ground. In our study area, intraspecific encounters between Hoary Bats are frequently observed, particularly during autumn. We commonly observe Hoary Bats pursuing one another in flight, as well as instances where one has been captured in a mist net and another Hoary Bat dives at it (Weller and Giordano 2013). In addition, Hoary Bats are known to actively investigate the playback of both Hoary Bat and Silver-haired Bat social calls (Reyes 2015), which may be interpreted as aggressive behavior.

Several hypotheses explaining intra- and interspecific interactions involving Hoary Bats have been suggested. Defense of foraging areas is one possibility, but in the present case, seems unlikely because Silver-haired Bats and Hoary Bats likely have other means of partitioning food resources, such as temporal shifts or habitat shifts during foraging (Barclay 1985) and may not exhibit much dietary overlap (Reimer and others 2010). It has been suggested that Hoary Bats may occasionally prey on smaller bats (Bishop 1947), though no direct evidence of feeding has been observed. Territorial defense to protect mating resources has also been proposed (Cryan 2008), particularly where large trees are present. This explanation could apply to our study area, which contains very tall trees, has a highly male-biased population,

and is a place where frequent intraspecific interactions have been observed (Weller and Giordano 2013).

A final possibility is that the interaction we observed was rabies-mediated. Rabies has been implicated in several of the interactions observed previously (Table 1). Neither of the bats exhibited behaviors suggestive of rabies virus infection (for example, abnormally aggressive or paralytic behavior) during processing, but the Hoary Bat behaved unusually upon release, biting at the bag and not flying off. This may have resulted from the stress of the interaction followed by handling, but could also have been a symptom of the early stages of rabies. The rabies virus variant associated with Hoary Bats has been observed in a broader suite of other bat species than any other variant (Streicker and others 2010), suggesting that cross-species transmission from Hoary Bats to other bat species is more common than cross-species transmission from any other species of bat. Cross-species transmission of the Hoary Bat variant into Silver-haired Bats has been observed, but not the reverse (Streicker and others 2010). Hence if rabies was a factor in the encounter we observed, the Hoary Bat was more likely the aggressor. The question remains whether Hoary Bats: (1) attack other bats as a result of the early-stages of rabies infections; or (2) their natural propensity for interspecific attacks explains the prevalence of cross-species transmission of their rabies variant. Despite high prevalence levels of rabies in Hoary Bats and Silver-haired Bats in public health records (Mondul and others 2003; Patyk and others 2012), rabies prevalence in wild, healthy populations of these species is thought to be very low (0–1%; Klug and others 2011). We decided not to euthanize the Hoary Bat for rabies testing, but we encourage others who encounter interspecific physical interactions between bats to have bats tested for rabies. This will help improve our understanding of interspecific interactions of bats and inform cross-species transmission dynamics of the rabies virus, not only among bats but to other taxonomic groups including humans.

*Acknowledgements.*—We would like to thank K Rennie for her assistance in the field. Thank you to W Brokaw for providing photographs. We are grateful to the California State Parks, North Coast Redwood

District for granting us access and permission to conduct research. Comments from P Cryan, C Willis, W Zielinski, and an anonymous reviewer improved the manuscript.

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