

Evidence of Autumn Breeding in Red Squirrels, *Tamiasciurus hudsonicus*, in Western Montana

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Red Squirrels (*Tamiasciurus hudsonicus*) routinely breed biannually in eastern North America, but normally breed once annually in western North America. However, a postpartum estrus resulting in two breeding seasons per year has been documented within the maritime region of British Columbia. I present two accounts of Red Squirrel behavior suggestive of autumn breeding in Red Squirrels in western Montana, and supporting evidence from the literature suggesting that late-season breeding resulting from a postpartum estrus may occur periodically in Red Squirrels within the Rocky Mountains.

Key Words: Breeding behavior, Montana, Red Squirrel, *Tamiasciurus hudsonicus*.

In the northeastern United States, Red Squirrels (*Tamiasciurus hudsonicus*) commonly produce two litters annually; the first breeding period runs from February through March and the second occurs during June and July (Layne 1954; Hamilton 1939). In western North America, Douglas' Squirrel (*Tamiasciurus douglasii*) breeds twice annually (Smith 1968), but the Red Squirrel breeds in the early spring from the end of February to May (Larsen and Boutin 1994; Kemp and Keith 1970; Swanson 1971; Millar 1970; Smith 1968; Hatt 1943). However, Millar (1970) observed two breeding periods on Vancouver Island, British Columbia in 1966; the result of postpartum estrus exhibited by numerous females in the population. In 1967 he expanded his sampling to include an inland population, but observed only a single breeding period at both locations and suggested that second litters resulted from increased food availability in 1966.

Although Millar's (1970) data indicate that biannual breeding can occur in western populations of Red Squirrels in a maritime climate, it is unclear whether inland populations are also capable of biannual breeding. The limited histological studies conducted within the northern Rocky Mountain States offer no evidence of postpartum estrus or a second, late-season breeding period (Dolbeer 1973; Swanson 1971). I present two observations suggestive of autumn breeding in Red Squirrels in western Montana.

In mid-September 1993, while conducting research in the McDonald Valley, Glacier National Park, I observed Red Squirrels copulating in a low-elevation (ca 1020 m) mature Western Hemlock (*Tsuga heterophylla*) stand. One squirrel chased another around an area approximately 1000 m². After about a minute, the first squirrel paused for a few seconds while standing with its tail against its back as the second squirrel slowly approached mounted and copulated with the first. The two separated and the scene was repeated twice. Each time

the first squirrel awaited the second in the same position. All copulations occurred on the ground and were clearly visible within an open understory. The event lasted 5 to 10 minutes. No other squirrels appeared.

On 4 November 1995, I observed apparent Red Squirrel sexual play on Babcock Mountain in the Rock Creek drainage east of Missoula, Montana. As I stopped to note a Red Squirrel chase, two squirrels appeared on top of a log, paused for a moment, and the second squirrel approached and mounted the first. The chase immediately continued and I watched until the two squirrels disappeared in a large Douglas-fir (*Pseudotsuga menziesii*) tree. The habitat was a dry, mid-elevation (1580 m) Douglas-fir stand on a south-facing slope. Other squirrels vocalized nearby, but I saw none in the immediate vicinity.

The September copulation account is consistent with observations of breeding behavior in Red and Douglas' Squirrels described by Smith (1968) in Washington and with the timing of postpartum breeding of Red Squirrels reported by Millar (1970) on Vancouver Island. Hatt (1943) described a similar copulation event between a pair of Red Squirrels in September in Colorado that is suggestive of late-season breeding along the front range of the Rocky Mountains.

The November observation was likely sexual play as defined by Smith (1968) as I did not observe a definite copulation and the timing would seem too late even for a late-season breeding event. Given that sexual play occurs between recently weaned young males and their mother, or among young squirrels of a litter for about two weeks after weaning (Smith 1968), and that weaning occurs approximately 60 days post parturition (Smith 1968; Nice et al. 1954; after correcting with Lair's [1985] estimate of 33 days for gestation), the estimated time for conception for squirrels exhibiting sexual play in early November would be from mid August to early

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September. This timing is consistent with the period associated with postpartum breeding on Vancouver Island (Millar 1970).

Red Squirrel breeding in Idaho (Swanson 1971), Washington (Smith 1968), Colorado (Dolbeer 1973), southern British Columbia (Millar 1970), and Alberta (Rusch and Reeder 1978) occurs from late February to early June and is generally centered around March and April. Therefore, any breeding activity occurring in September likely results from a second breeding period or late postpartum breeding (Millar 1970). The two observations described here combined with the one reported by Hatt (1943) in Colorado, and the histological data presented by Millar (1970) from Vancouver Island suggest that a second breeding season may occur periodically in western North American Red Squirrels as far east as the Rocky Mountain front range. The irregularity of such breeding (see Millar 1970) would make it difficult to obtain conclusive histological data. However, biologists should be aware of the potential for autumn breeding within Red Squirrel populations in order to better document and potentially quantify this phenomenon.

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