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BLACK BEAR (*URSUS AMERICANUS*) PREDATION ON NEST CONTENTS OF CAVITY-NESTING BIRDS ALONG THE EAST SLOPE CASCADES

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Cavity-nesting birds often have higher nesting success than birds that construct open cup nests (Martin and Li 1992, Johnson and Kermott 1994). Primary predators usually associated with predation of cavity nests in the western United States and Canada include squirrels (*Tamiasciuris* spp.), chipmunks (*Tamias* spp.), long-tailed weasels (*Mustela frenata*), and forest mice (*Peromyscus* species) (Li and Martin 1991, Walters and Miller 2001, Fontaine and Martin 2006). Black bears (*Ursus americanus*) account for few predation events involving nest contents of cavity-nesting birds (DeWeese and Pillmore 1972, Franzreb and Higgins 1975, Walters and Miller 2001). In this paper, I present data on black bear predation at nests of cavity-nesting birds within ponderosa pine (*Pinus ponderosa*) forests managed for timber production along the eastern slope of the Cascade Range in central Washington.

METHODS

This study was conducted within Yakima, southern Kittitas, and northern Klickitat counties. Study sites were located in the Okanogan-Wenatchee National Forest and on Washington Department of Natural Resources and Western Pacific Timber Company lands. This area is comprised of a broken topography with intermixed aspects and slopes (Everett et al. 2000). All study areas have a past history of timber harvest or post-fire salvage logging. Overstory of the study areas was dominated by ponderosa pine with smaller components of Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), grand fir (*Abies grandis*), and quaking aspen (*Populus tremuloides*). The understory was dominated by snowbrush ceanothus (*Ceanothus velutinus*), antelope bitterbrush (*Purshia tridentata*), snowberry (*Symphoricarpos alba*), and Douglas spirea (*Spirea douglasii*). Elevation of sites ranged from 560 to 1280 meters.

In 2003-2007, I searched for nests of cavity-nesting birds each year beginning the first week of April and continuing until mid-June. Woodpecker nests were found by following lone adults back to the cavity, as both sexes take part in cavity excavation, incubation, and brooding. Nests of secondary cavity-nesting species were located by following adults carrying nesting material or food to cavities, and by checking cavities occupied in previous years. In 2005-2007, I viewed cavity contents with a Tree Top

Peeper IV elevated nest inspection system (Sandpiper Technologies, Inc.). This system consists of a probe that is inserted into cavities and that is attached to a telescoping pole. The probe contains two downward pointing light-emitting diode lights and a camera. The camera sends a video image to a color monitor that is attached at the base of the pole in order to view the nest contents. I checked nests at least once a week until nest fate could be determined. I determined nests to have been successful if fledglings were observed near the cavity or if young were within two days of fledging (i.e., young were at the cavity entrance and looking out when adult birds were not present at the cavity). I recorded nests as depredated if all eggs or young were gone before the anticipated time of incubation or nestling stage was complete (Kozma and Matthews 1997). Black bear predation was evident by the cavity being ripped open to expose the inside of the nest cavity and/or presence of claw marks on the bark surrounding the cavity entrance (Figures 1 and 2; Deweese and Pillmore 1972, Walters and Miller 2001). Results are presented as means ± standard error.

I sampled microhabitat vegetation characteristics after cavities were vacated. At each tree/snag that contained an active cavity, I recorded cavity height, tree/snag height, decay class of snag, diameter at breast height (dbh), and tree/snag species. I measured nest height and tree height with a meter tape or with a clinometer. I used a diameter tape to measure dbh. Nest tree/snags were divided into 4 classes; Type 1 were live trees, Type 2 were recently dead trees with most needles still present, Type 3 were snags with moderate decay, unstable branches and no visible needles, and Type 4 were snags in advanced stages of decay with unstable upper portions and roots, and often containing a broken top and loose bark. This classification corresponds to Washington State Forest Practice Rules (WAC 222-16-010).

Figure 1. Northern Flicker (left) and Western Bluebird (right) nest cavities showing evidence of successful predation attempts by black bears along the east slope Cascades, Washington, 2003-2007. The flicker cavity was 0.61 meters from the ground in a cut ponderosa pine stump and had a diameter at cavity height of 78 cm. The bluebird cavity, showing bear claw marks to the left of the cavity opening, was 0.9 m from the ground in a recently dead ponderosa pine with a dbh of 48 cm.

RESULTS

I monitored 406 nests of 19 cavity-nesting bird species. Of all nests with a known outcome, 190 were successful (at least one young fledged) and 80 were unsuccessful. Black bear predation accounted for 12.5% (n = 10) of unsuccessful nests. In addition, bears attempted predation at two additional cavities, but were unable to access the cavity. Bear predation occurred at one additional nest of a Northern Flicker (*Colaptes auratus*), where at least one chick was killed and consumed while the others successfully fledged (the chicks were at fledging age the day before the predation event as indicated by feather development and I only found feather evidence to indicate one chick was consumed by the bear). Six of the bear predation events occurred at nests with nestlings, three involved nests with eggs, and the other I was unable to determine the nest stage when predation occurred. The two unsuccessful bear predation attempts occurred at cavities containing nestlings. Mean height of cavities where bear predation occurred was 2.9 ± 1.4 meters (range 0 – 14.1 meters). Northern Flickers suffered the highest rate of black bear predation, with 9.1% (n = 7) of their nests failing due to bears. The three other cavities depredated by bears were occupied by nesting White-headed Woodpeckers (*Picoides albolarvatus*) (3.8% of nests), Mountain Chickadees (*Poecile gambeli*) (5.9%), and Western Bluebirds (*Sialia mexicana*) (1.1%). The two cavities where bears attempted predation but were unsuccessful were excavated and occupied by Hairy Woodpeckers (*Picoides villosus*).

Figure 2. White-headed Woodpecker nest cavity (lowest hole) excavated in 2004 (left) and then renovated by a Northern Flicker and subsequently depredated by a bear in 2006 (right) along the east slope Cascades, Washington. The cavity entrance was 1.02 m from the ground and in a 24.6 cm dbh ponderosa pine snag.

DISCUSSION

Black bears are rarely documented as significant predators of cavity-nesting birds. In previous studies examining the diet of black bears, birds were either absent from their diet (Beeman and Pelton 1980, Maehr and Brady 1984, Stubblefield 1993) or found in very small amounts (Landers et al. 1979, Graber and White 1983). Two studies indicated bears as major predators of cavity-nesting waterfowl, but predation events occurred only at nest boxes, not natural cavities (Zicus 1990, Evans et al. 2002). Nest boxes may be more visible and easier to open by bears than nests located in natural cavities. Predation by bears on the contents of bird nests located in cavities appears to be opportunistic. Seven of the 10 cavities where predation by bears occurred were below 1.5 meters in height and therefore were easily accessible to them. Nests located closer to the ground have been shown to be more susceptible to predation by mammalian predators (Wilson and Cooper 1998, Hooge et al. 1999, Saab et al. 2004).

Northern Flicker nest cavities had the highest rate of predation by bears. Being a large bodied weak excavator, flickers require large diameter, well-decayed snags in which they excavate a cavity (Lundquist and Mariani 1991, Ingold 1998). Eighty-one percent of flicker nests I monitored were in snags with advanced stages of decay (Type 4). In my study area, tall and large diameter snags were rare on the landscape. Often, the only substrates with sufficient decay characteristics and large enough diameters to accommodate a flicker cavity were remnant tree stumps from past timber harvest or broken snags that were short in height. Along the east side of the Cascades, Bevis and Martin (2002) also found that flickers used the shortest snags among all cavity nesters studied and were consistently found nesting in broken off, well-rotted snags in managed forests. Walters and Miller (2001) found that flicker nests were particularly susceptible to bears because they were close to the ground in rotten snags. Cavity nests located nearer to the ground are most likely easier to detect due to bears' keen sense of smell (Bacon and Burghardt 1976). In addition, I have observed evidence of bears foraging on rotted stumps and snags that did not contain nest cavities, presumably because they often contain insect prey (ants, termites, etc.) that bears feed upon and that are an important component of their diet (Landers et al. 1979, Beeman and Pelton 1980, Graber and White 1983, Stubblefield 1993). Therefore, bears may find some nest cavities located in stumps incidentally in their search for insect prey.

Nestlings of many woodpeckers and sapsuckers are known for having loud begging calls that carry for long distances (Kilham 1966, 1968, 1977). Loud nestling vocalizations are thought to function as a feeding stimulus to the parent birds, but can inadvertently attract the attention of predators (Haskell 1994, Briskie et al. 1999). Many times I have witnessed loud vocalizations by flicker nestlings in response to sound at the cavity entrance when I was inspecting the nest contents. Therefore, a bear attracted to low cavities by scent of the nestlings may trigger begging calls

from the nestlings as the bear investigates the cavity opening. This in turn could provide further stimulus for the bear to access the cavity. The propensity for flickers to excavate cavities close to the ground, in well-decayed snags, and that contain nestlings with loud begging calls make these nests vulnerable to bear predation in my study area.

Bears attempted predation at two cavities excavated and occupied by Hairy Woodpeckers, but were unsuccessful at gaining entry. Hairy Woodpeckers are considered strong excavators and are capable of excavating cavities in firmer substrates than flickers and White-headed Woodpeckers (Schepps et al. 1999, Saab et al. 2004, Kozma 2009). The Hairy Woodpecker cavities that bears failed to depredate were excavated in firmer wood, which prevented bears from gaining access to the nest contents (Dixon 1927).

These results suggest that cavities located in well-decayed snags that are closer to the ground are more susceptible to predation by black bears. It is important for land managers to strive to retain the largest diameter and tallest snags, and defective or "risk" trees on the landscape during forest management activities. Providing this habitat feature could increase the reproductive success of Northern Flickers and other cavity nesters by reducing susceptibility of their nests to black bear predation. Because cavities that are torn apart by bears are no longer available for use, providing nest substrates that limit their susceptibility to predation by bears will likely benefit the secondary cavity-nesting animal community as well.

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