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OBSERVATION OF AN AMERICAN BLACK BEAR EATING ODONATES IN YOSEMITE NATIONAL PARK

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ABSTRACT.—American black bears (*Ursus americanus*) are opportunistic omnivores with diets that vary seasonally and geographically depending on food availability. Previous scat analyses across several populations suggest that the majority of animal material in the diet of black bears is from insects (mainly ants and wasps). In 2015, a black bear in Yosemite National Park was observed eating dragonflies, a previously unidentified insect food item. Emerging aquatic insects may be an important but overlooked aspect of black bear diet. Documenting the food sources of organisms is critical to understanding their natural history and ecology. In the case of highly digestible food items, visual observation is an important and underrepresented tactic for documenting diet.

RESUMEN.—Los osos negros americanos (*Ursus americanus*) son omnívoros oportunistas con dietas que varían estacional y geográficamente dependiendo de la disponibilidad de alimento. Análisis previos basados en heces de varias poblaciones, sugieren que la dieta de los osos negros contiene en su mayoría insectos, principalmente hormigas y avispas. En 2015 se observó a un oso negro, en el Parque Nacional de Yosemite, comiendo libélulas, un alimento no identificado previamente; los insectos acuáticos pueden ser un componente importante, pero poco estudiado, de la dieta del oso negro. La documentación de las fuentes de alimento de los organismos es fundamental para comprender su historia natural y su ecología. En el caso de alimentos altamente digeribles, la observación visual es una táctica importante y poco utilizada para documentar la dieta.

American black bears (*Ursus americanus*) have a broad dietary range that is dominated by plant material and, to a lesser extent, insects, carrion, and vertebrate prey. The current geographic range of black bears includes much of Canada, parts of the United States, and northern Mexico. Across this range, the importance of different food sources varies widely. For example, plant matter accounts for 73% of black bear scat volume in the Sierra de Picachos, Nuevo León, México (Juárez-Casillas and Varas 2013), but 95% in the Pelly River valley, Yukon, Canada (MacHutchon 1989), though comparison between populations can be difficult due to seasonal differences in diet. The majority of plant material in scat may consist of plant reproductive parts, grasses, sedges, or herbaceous dicots (Graber and White 1983, Fortin et al. 2013). Animals are also an important part of black bear diet, as bears prey upon vertebrates such as fish and artiodactyls across much of their range, although these prey may not be commonly captured (Fortin et al. 2013, Juárez-Casillas and Varas 2013).

Black bears also eat many invertebrates, including scorpions (*Diplocentrus peloncillensis*) in some populations (Sierra de San Luis, Sonora, México; López-González et al. 2009), and scat analyses show that most sampled populations rely on insects more than any other animal food source, though reliance is highly variable among (and potentially within) populations (Bull et al. 2001, Greenleaf et al. 2009, Juárez-Casillas and Varas 2013). Recorded insect food sources include ants, wasps, bees, termites, beetles, grasshoppers, and maggots (Graber and White 1983, Holcroft and Herrero 1991, Bull et al. 2001, Baldwin and Bender 2009, Greenleaf et al. 2009, Juárez-Casillas and Varas 2013).

Insect remains in total fecal volume range from <3% (Yosemite Valley; Greenleaf et al. 2009) to 24% (northeastern Oregon; Bull et al. 2001). This variability, however, should not diminish the potential importance of an unusual food source within specific habitats, such as grizzly bear reliance on army cutworm moths (*Euxoa auxiliaris*) during some summers in Glacier National Park, Montana, and in other high-elevation montane habitats. Larval or newly emerged insects may have potential for seasonal importance in the black bear diet because they are more digestible and have higher tissue concentrations of

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phosphorous and nitrogen than adult insects (Elser et al. 2003).

Odonates (dragonflies and damselflies) could be a highly seasonal—but temporally important—source of food in summer for bears foraging in montane areas near ponds or lakes. These insects have an aquatic larval stage that lasts from several months to several years, followed by adult emergence. During emergence, larvae climb out of the water, attach to a plant stem or other partially submerged object, and slowly break out of their larval skin; their new skin and wings need to harden before the emergent adults can fly. In some subalpine areas at elevations between 2000 m and 3000 m, most dragonflies emerge in late morning, dry throughout the day, and are ready for flight by 17:00, yet cool or stormy weather may prolong the event, even across multiple days (Willey 1974). Whether emerging in a single day or across several days, adults are vulnerable during the time between emergence from the water and flight. Larval or newly emerged insects have higher tissue concentrations of phosphorous and nitrogen, making them more digestible and nutrient rich (Elser et al. 2003). They may, therefore, represent an important seasonal item in bear diets. However, we found no record of odonates as a food source for black bears.

On 13 June 2015 from 17:39 until approximately 17:55 (Pacific Standard Time), KTM, AKM, and FM observed a black bear ingesting emerging dragonflies at Dog Lake in Yosemite National Park, California. The margin of Dog Lake is densely vegetated with emergent wetland plants such as sedges, on which were numerous torpid, newly metamorphosed dragonflies. There were approximately 11 emerged dragonflies per 50 stems (as measured by KTM and EJL separately, by counting stems and dragonflies in photographs at a later date), as well as a greater number of dragonfly exuviae. We first saw the black bear at 17:37 as it walked near the edge of the lake. It proceeded to enter the water and walk along the lake margin. The bear slowly waded through this vegetated margin while eating dragonflies directly off the sedges. It was not pulling sedges out of the water, nor visibly chewing as it likely would have if it were eating the sedges, a known food item of other bears in Yosemite (Graber and White 1983). From our observation we were unable to gauge the number of dragonflies the bear ate during this time period, nor could we determine whether exuviae were also readily ingested. The bear foraged through roughly 60 m of the lake margin, slowly approaching our location, before its proximity to our group and the trail warranted that we leave the area. The bear was likely aware that we were observing, but it did not acknowledge our presence.

In the following year on the evening of 27 July 2016, KTM returned to Dog Lake and found dragonfly exuviae, but no emergent dragonflies, attached to the sedges. Thus, this location may be a potential source of food for local black bears over multiple years, though the length of the dragonfly emergence season at this location is unknown. Further observation and analysis of bear scat near Dog Lake and in similar habitats is needed to discover whether this behavior is restricted to a single individual at a single location or whether it is a widespread black bear behavior associated with this seasonally available insect food item.

Previous work in Yosemite Valley identifies wasps, bees, termites, and ants as the main animal food items of black bears, although animal matter made up only 3% of fecal volume in these bears (Greenleaf et al. 2009). Dog Lake is at a higher elevation than Yosemite Valley (2815 m and 1220 m, respectively) and has fewer cultivated fruit trees; thus, bears in nonvalley sections of Yosemite National Park may rely more heavily on insects than those in Yosemite Valley that have greater access to fruiting trees.

Much of the insect debris in scat analyses goes unidentified. Due to differences in digestibility, it can be difficult to determine the amount of specific items in an animal's diet from scat (Graber and White 1983). This makes behavioral observations of new food items valuable resources for understanding bear diet and ecology. For example, because most moth parts are well digested (White et al. 1998), the importance of army cutworm moths as food for grizzly bears would likely be underestimated from scat analyses alone.

Observation of new food items is particularly important for understanding animal ecology in light of anthropogenic environmental changes which have caused many species to shift dietary niches. Due to population reductions in cutthroat trout (*Oncorhynchus clarkii*), for example, grizzly bears have increased their

predation of elk neonates (Middleton et al. 2013). Similarly, increased predation of mule deer (*Odocoileus hemionus*) fawns by coyotes (*Canis latrans*) has been linked to reduced populations of microtine rodents (Hamlin et al. 1984). Whether emerging odonates are a seasonal part of the diet of other bears and bear populations is unknown, but documenting use of this food source can improve our understanding of the natural history and landscape use of black bear populations.

SUPPLEMENTARY MATERIAL

Two online-only supplementary files accompany this article (scholarsarchive.byu.edu/wnan/vol77/iss1/9).

SUPPLEMENTARY MATERIAL 1. An American black bear (*Ursus americanus*) foraging among sedges along the margin of Dog Lake in Yosemite National Park, California.

SUPPLEMENTARY MATERIAL 2. In the foreground are dragonfly (Anisoptera) nymphs resting on sedges while their wings dry, and below that, dragonfly exuviae are still sticking to the bases of the sedges. In the background, an American black bear (*Ursus americanus*) can be seen foraging along the margin of Dog Lake in Yosemite National Park, California.

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