Kodiak bears found to switch to eating elderberries instead of salmon as climate changes

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Brown bear mother and cub. Credit: Lisa Hupp (photographer)

(Phys.org)—A team of researchers affiliated with several institutions in the U.S. has found that warming in Alaska has sometimes caused the Kodiak bear to switch to eating elderberries during salmon spawning periods instead of eating salmon. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes their multi-pronged study of the impact that seasonal changes occurring on the Kodiak Archipelago are having on the bears that live there.

The Kodiak Archipelago is a group of islands off the southern coast of Alaska. It is home to what are known as Kodiak bears—very large brown bears distantly related to polar bears. The bears have become famous due to pictures of them catching salmon in shallow rivers. The archipelago is also home to elderberries, which are also eaten by Kodiak bears. But the researchers with this new effort have found that the feeding habits of the bears are changing due to a warming climate.

To learn more about how the bears are adapting to changing temperatures, the researchers used time-lapse cameras to capture the bears feeding on salmon, placed GPS collars on 36 of the females and then tracked them, conducted aerial surveys and studied bear droppings. The researchers discovered that the bears are increasingly faced with whether to eat salmon or elderberries because the berries are ripening earlier, causing an overlap with salmon spawning.

In the past, the researchers note, salmon spawning typically occurred around the end of July each year, while elderberries typically ripened in late August. The bears would wade into shallow rivers and grab the spawning salmon and eat them (or just their eggs) on the shore. Then, a

month later, the berries would ripen, and they would start eating those. But over the past few decades, there has been a change—elderberries have begun to ripen earlier, sometimes as early as late July. This means the bears are faced with a choice: continue to feast on the salmon or switch to eating the berries. The decision by the bears is obvious, the team reports—when the berries ripen early, the bears completely abandon the rivers and feast almost exclusively on the elderberries.

It is not clear at this time how the switch will impact the bears, the salmon or other creatures that normally feed on fish carcasses abandoned by the bears.

More information: William W. Deacy et al. Phenological synchronization disrupts trophic interactions between Kodiak brown bears and salmon, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1705248114

Abstract
Climate change is altering the seasonal timing of life cycle events in organisms across the planet, but the magnitude of change often varies among taxa [Thackeray SJ, et al. (2016) *Nature* 535:241–245]. This can cause the temporal relationships among species to change, altering the strength of interaction. A large body of work has explored what happens when coevolved species shift out of sync, but virtually no studies have documented the effects of climate-induced synchronization, which could remove temporal barriers between species and create novel interactions. We explored how a predator, the Kodiak brown bear (Ursus arctos middendorffi), responded to asymmetric phenological shifts between its primary trophic resources, sockeye salmon (Oncorhynchus nerka) and red elderberry (Sambucus racemosa). In years with anomalously high spring air temperatures, elderberry fruited several weeks earlier and became available during the period when salmon spawned in tributary streams. Bears departed salmon spawning streams, where they typically

kill 25–75% of the salmon [Quinn TP, Cunningham CJ, Wirsing AJ (2016) *Oecologia* 183:415–429], to forage on berries on adjacent hillsides. This prey switching behavior attenuated an iconic predator–prey interaction and likely altered the many ecological functions that result from bears foraging on salmon [Helfield JM, Naiman RJ (2006) *Ecosystems* 9:167–180]. We document how climate-induced shifts in resource phenology can alter food webs through a mechanism other than trophic mismatch. The current emphasis on singular consumer-resource interactions fails to capture how climate-altered phenologies reschedule resource availability and alter how energy flows through ecosystems.

Press release