Crash-testing spider webs to understand the rare, large prey hypothesis

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Spider orb-webs are the ultimate anti-ballistic devices, capable of dissipating the relatively massive kinetic energy of flying prey. Increased web size and prey stopping capacity have co-evolved in a number orb-web taxa, but the selective forces driving web size and performance increases are under debate. The rare, large prey hypothesis maintains that the energetic benefits of rare, very large prey are so much greater than the gains from smaller, more common prey that smaller prey are irrelevant for reproductive fitness. Here, we integrate biophysical and ecological data and models to test a major prediction of the rare, large prey hypothesis, that selection should favour webs with increased stopping capacity and that large prey should comprise a significant proportion of prey stopped by a web. We find that larger webs indeed have a greater capacity to stop large prey. However, based on prey ecology, we also find that these large prey make up a tiny fraction of the total biomass (= energy) potentially captured. We conclude that large webs are adapted to stop more total biomass, and that the capacity to stop rare, but very large, prey is an incidental consequence of the longer radial silks that scale with web size.