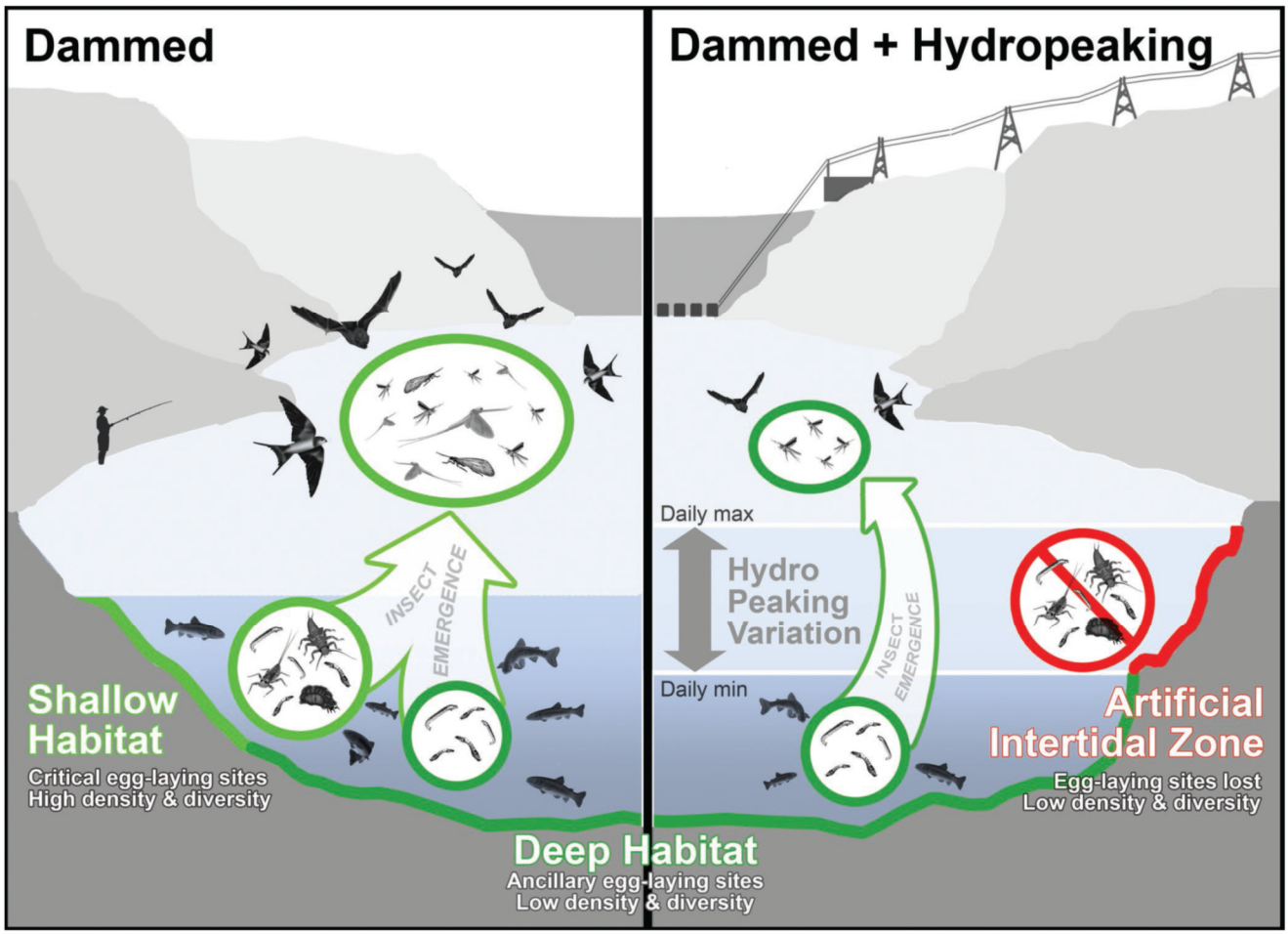
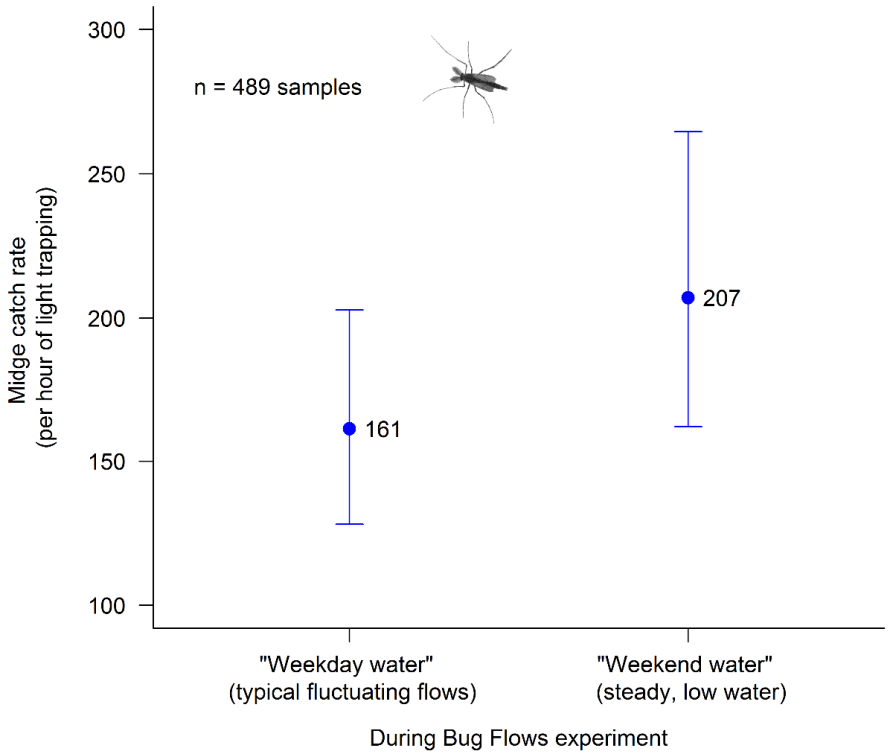
Presenter: Anya Metcalfe, US Geological Survey, Grand Canyon Monitoring and Research Center
Title: Colorado River ecosystem response to the 2018 Bug Flow Experiment released from Glen Canyon Dam.

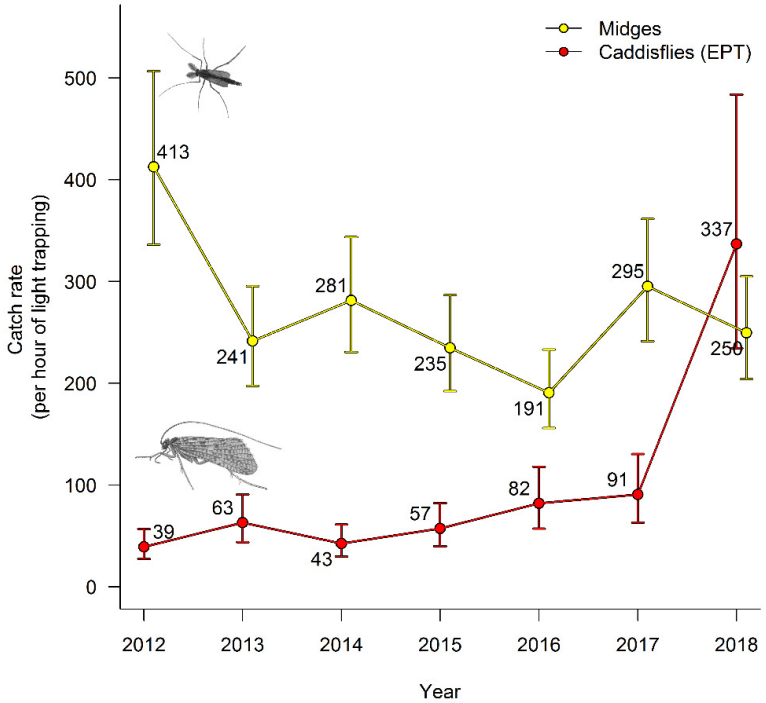
Summary: Research by our group has demonstrated that the absence of Mayflies, Stoneflies, Caddisflies and other sensitive aquatic insects from the Colorado River in Grand Canyon was partly due to acute mortality of insect eggs arising from hydropower generation. In the summer of 2018, flow management of Glen Canyon Dam was experimentally modified in an attempt to benefit aquatic insect populations in the Colorado River in Grand Canyon (Arizona, USA). These "Bug Flows" involved standard daily flow fluctuations for hydropower generation during weekdays, coupled with steady, low flows on weekends to reduce the desiccation and mortality of aquatic insect eggs that are laid in nearshore habitats. This flow strategy, unprecedented in its scope as an aquatic invertebrate environmental flow experiment, was the outcome of direct collaboration between energy distributors, dam operators, and USGS scientists, and its final design was revenue neutral for hydropower. In this presentation, I will report on the large scale ecosystem responses of Bug Flows, including their spatial and temporal effects on aquatic insect drift and emergence throughout 400 km of the Colorado River. I will also highlight some unexpected changes to insect emergence timing and sport fish behavior resulting from Bug Flows that yielded unanticipated benefits to the recreational fishing industry.



Aquatic insects play an essential role in river and riparian food webs. Aquatic insects are ubiquitous in freshwaters and are the primary prey for myriad species of wildlife living in and along rivers. These insects have complex life cycles that include a terrestrial winged adult life stage, whereas egg, larval, and pupal stages are aquatic. Ecologically important insect groups such as mayflies, stoneflies, and caddisflies cement their eggs along river margins, making them especially sensitive to dam water management practices such as hydropeaking that affect these edge habitats (adapted from Kennedy and others, 2016, Bioscience).



Steady, low water during Bug Flow weekends led to increased emergence of aquatic insects. Graph showing average number of non-biting midges captured in light traps from May-August 2018 during weekday water when flows fluctuated versus weekend water when flow was steady. (Provisional data, subject to change, do not cite).



The abundance of sensitive caddisflies (Order: Trichoptera) captured in light traps increased dramatically in 2018, potentially in response to the 2018 Bug Flow experiment. In fact, for the first time ever the numbers of caddisflies captured by river guides in light traps exceeded the number of non-biting midges. (Provisional data, subject to change, do not cite).