



## The role of ultraviolet radiation and fish in regulating the vertical distribution of *Daphnia*

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**ABSTRACT:** Previous studies have demonstrated independent effects of both solar ultraviolet radiation (UV; 280 – 400 nm) and planktivorous fish on the vertical distribution of *Daphnia*. We examined the behavioral response of adult and juvenile *Daphnia* to both UV and planktivorous fish simultaneously in a small temperate lake in eastern Pennsylvania by conducting a large-scale (15 m deep) in situ mesocosm experiment with full factorial treatments ( $\pm$  UV and  $\pm$  fish). UV induced an avoidance of the surface waters in both juvenile and adult *Daphnia*. In contrast, the response of *Daphnia* to fish depended on the presence of UV, with a clear interactive effect. In the presence of both UV and fish, *Daphnia* were deeper in the water column than they were in the absence of either UV or fish. Sampling of the lake also revealed a rapid upward shift in the depth distribution of both juveniles and adults following a rare and intense early-summer storm that reduced the lake's transparency to both UV (for example, 380 nm UV-A) and photosynthetically active radiation (400 – 700 nm) by 44% and 39%, respectively. Evidence of a novel benefit to UV avoidance behavior was also observed: surface avoidance of UV reduces the hazards of *Daphnia* getting caught in the surface air – water interface and perishing. These results highlight the interactive effects of fish and UV on *Daphnia* vertical distribution under near-natural conditions in situ.

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