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Macrophyte and fish chemicals suppress *Daphnia* growth and alter life-history traits

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Daphnids undergoing diel horizontal migration (DHM) to seek daytime refuge in the littoral zones of shallow lakes are likely to confront chemical cues from littoral-associated predators and macrophytes. In field experiments, we investigated how the natural suite of chemicals occurring in a wholly vegetated lake as well as within plant-free mesocosms with artificial macrophytes and epiphytes (either fishless or containing small fish) influenced individual daphnid growth. In laboratory experiments, we further examined how water containing chemicals from either a submerged macrophyte (waterweed, *Elodea canadensis*), a planktivorous fish (roach, *Rutilus rutilus*) or both impacted daphnid growth and life-history traits. In the field, we found the greatest suppression of daphnid growth in vials containing water from the wholly vegetated lake relative to growth of daphnids housed in vials containing spring water. Water from the mesocosm with fish also suppressed daphnid growth. Daphnid growth in water from the fishless mesocosm, which contained plastic plants colonized by epiphytes, did not differ from that of daphnids grown in spring water. In the lab experiment, daphnids exposed to *Elodea* chemicals took longer to mature and possessed fewer eggs than daphnids in media without *Elodea* chemicals. Daphnids exposed to chemicals from both *Elodea* and roach reproduced the earliest and at a smaller size. Daphnids exposed to only roach chemical cues did not significantly differ from daphnids in control media for age or size at first reproduction although they did possess fewer eggs. *Daphnia* responses to chemicals from either roach or *Elodea* alone did not predict how *Daphnia* responded to the combined influence of multiple chemical cues. Our results suggest that prolonged exposure to macrophyte chemicals incurs costs for *Daphnia*.

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