Light-Driven Changes in Aquatic Macroinvertebrate Community are not Reflected in the Diets of Coastal Cutthroat Trout

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Stream light availability is an important factor influencing aquatic food webs. In forested headwaters, stream algal production is highly light-limited, and an increase in light often enhances benthic algal growth, which in turn increases food availability for primary consumers in the stream. In headwater streams, light availability is mediated almost entirely by the canopy structure of stream-side vegetation. In the Pacific Northwest, many streamside forests are continuing to undergo stand regeneration after more than a century of heavy harvesting in which the riparian zones of forested headwater streams were cleared and now support dense second growth riparian vegetation. So, in young second growth riparian forests with dense closed canopies, we would expect low primary production and a low abundance of invertebrates that feed on stream algae (those in the “scraper” feeding guild). Earlier research has shown that a release from light limitation associated with the removal of all or nearly all of the riparian forest can result in an increase in algae and stream invertebrate scrapers. But how do stream algae, stream invertebrates and ultimately stream fish respond to smaller changes in light that are more characteristic of the natural and anthropogenic disturbances that occur along headwater riparian streams today? In this study, we manipulated stream-side canopy cover of several streams in the western Cascades of Oregon by creating small (≈ 40-meter diameter) gaps in order to increase local light availability. We investigated the response of benthic periphyton, stream macroinvertebrates, and prey consumption by trout in gap and reference reaches. We hypothesized that increases in light availability would have a positive response on grazing macroinvertebrates due to elevated algal production, and predicted that this change in community structure would be reflected in the diets of trout. The study was designed with paired control and treatment reaches at five different sites. Pre-treatment benthic invertebrate samples were collected during summer of 2017, gaps were cut over the winter of 2017-2018, and sites were resampled for macroinvertebrates during summer of 2018. To determine if changes in macroinvertebrate communities affected prey consumption by trout, trout diets were collected in the summer of 2018 within 5 days of the benthic sampling. The response of macroinvertebrate communities (evaluated by taxa and by functional feeding group) were evaluated in each year by comparing differences in paired reference and treatment reaches. We also compared the relative abundance of invertebrate taxa in trout diets to the relative abundances in the benthic community in treatment and control reaches. The presence of a canopy gap increased the abundance of scraping invertebrates, but this change was not reflected in summer trout diets.