Headwater streams are the beginnings of stream networks and because of their high edge to area ratio, a lot of allochthonous material enters them where it is rapidly biogeochemically processed. This organic material is metabolized at the base of a heterotrophic food chain by fungi and bacteria which are then eaten by aquatic invertebrates and then by fish, which are regularly the top predators. The activity of virtually all of these organisms may be summed up with a measure of ecosystem metabolism. On the eastern slopes of the Cascade mountains in Kittitas County Washington I chose 10 sites on 10 different headwater streams and sampled them 3 times to see if ecosystem metabolism would relate to fish biomass. To estimate fish biomass I conducted a multiple pass removal population estimate multiplied by the average fish mass. To estimate ecosystem metabolism I used the single station method with a diel oxygen curve and inverse modeling. A critical component in this modeling the air-water gas exchange value which I estimated based on stream slope because previous studies have found these to be closely linked. I estimated gross primary production (GPP) across sites and sampling periods to range from 0.01 to 0.71 g O2 m-2 d-1 and the magnitude of ecosystem respiration (ER) ranged from 4.55 to 24.29 g O2 m-2 d-1. Fish biomass was mostly cutthroat trout (*Oncorhynchus clarkii lewisi*) and ranged from 0 to 8.38 g m-2. I found that GPP varied by sampling period and increased with stream depth while ER increased with stream depth and slope. Trout biomass increased with colder water especially under more open canopies but I was not able to establish a relationship with ecosystem metabolism. Overall stream metabolism was probably limited by photosynthetically active radiation and dissolved inorganic nitrogen. Metabolism predictors were limited to model inputs and so no insights were gained possibly because values were unreliable stemming from inaccurate air-water gas exchange estimations. No relationships were found with photosynthetically active radiation, dissolved inorganic nitrogen, soluble reactive phosphorus, dissolved organic carbon, or other physical attributes of the streams.

Word count so far 343 of 350 possible.