

Algae as Bioindicators of Stream Function in Acid Mine Drainage; Qualitative Analyses of Algal Communities in Santa Cruz Watershed

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INTRODUCTION

Acid Mine Drainages (AMD) alter stream characteristics via input of acidic and metal-laden waters from abandoned mines and tailings. In the Santa Cruz watershed, many geologic workings, tailings, and drainages periodically discharge metal-rich, acidic water and leachates into surrounding aquatic systems (Fig. 1). Algae communities can be used as bioindicators of stream function as indicated through decreased biodiversity and primary production.

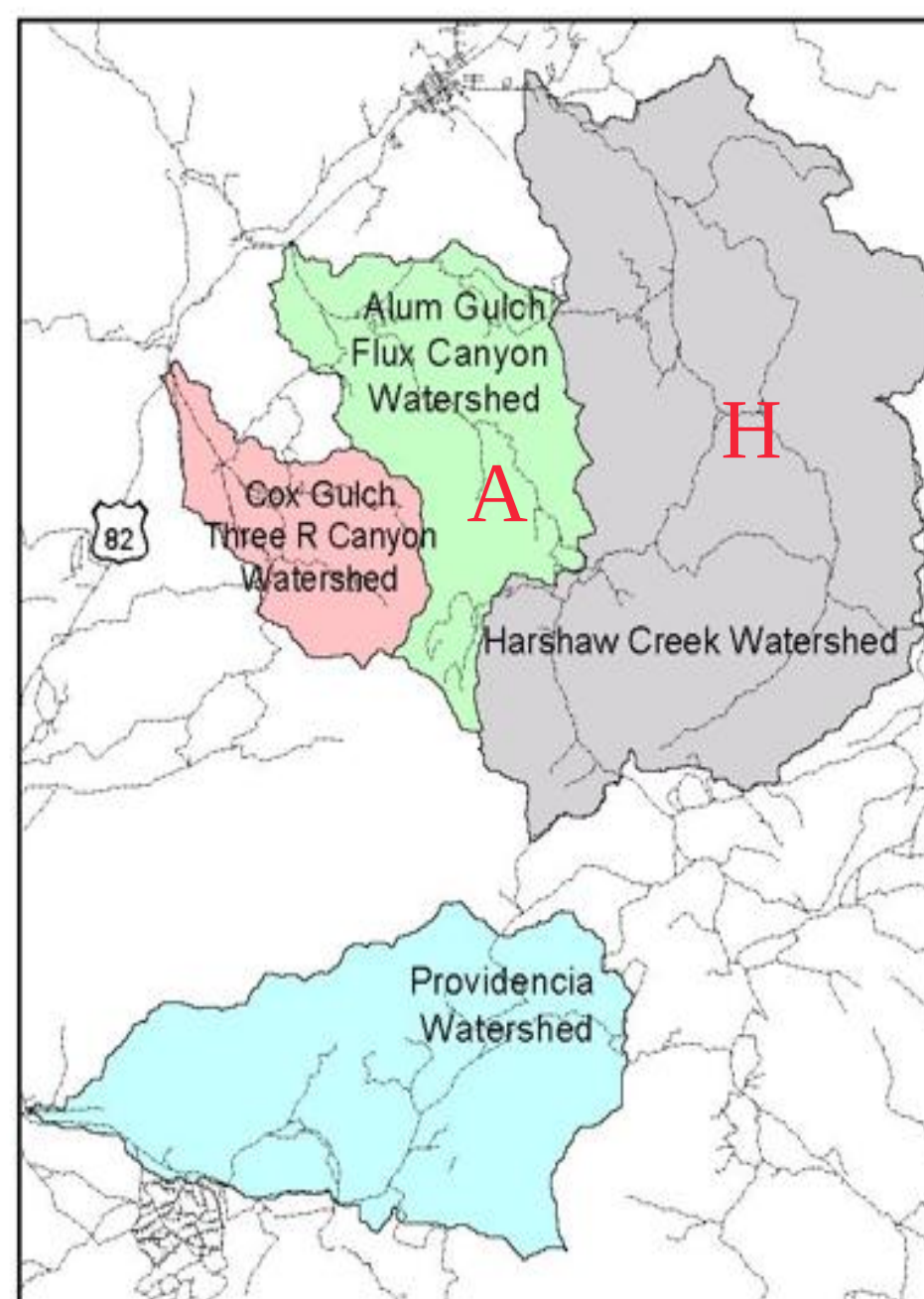


Fig. 1 – Watersheds in Patagonia Mountains. Alum Gulch (A) and Harshaw Creek (H) watersheds are study sites presented here.

PRELIMINARY RESULTS

Methods: Algal communities were examined in two sites in the Patagonia Mountains: Harshaw Creek (neutral pH[7.3-8.6], trace metals) and Alum Creek (low pH and high metals - Pb) (Fig. 1). Algae community structure was qualitatively analyzed during pre- and post- monsoon seasons. Five slides of algae were wet mounted for each site and examined under 100X and 430X magnification. Algal cells were identified to genus.

Results (Fig. 2): Harshaw Creek had higher algae genera richness in both season.

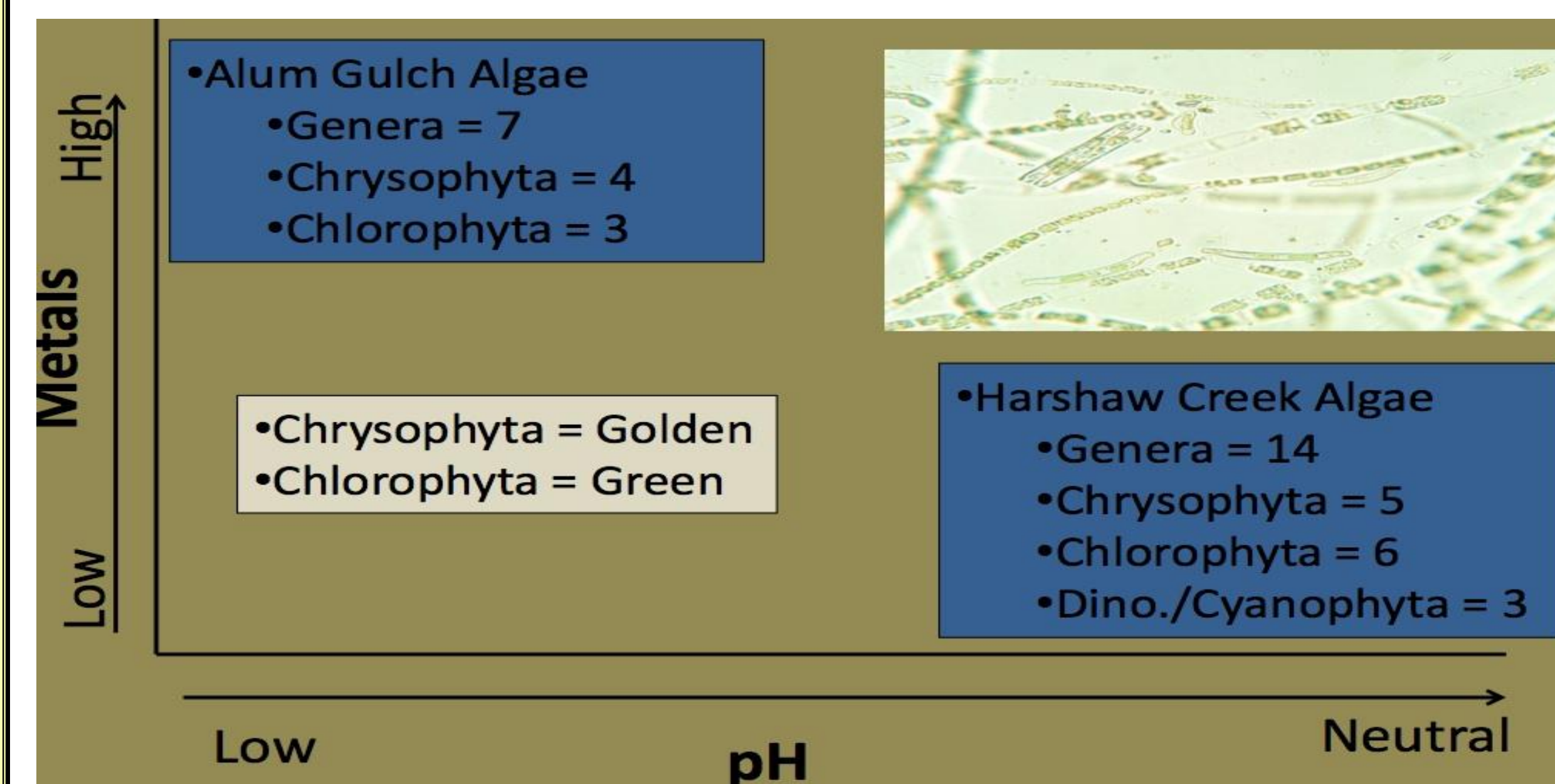


Figure 2: Comparisons of Alum and Harshaw algae communities.

CURRENT/ FUTURE INVESTIGATIONS

We will investigate algae diversity and abundance in three streams in the Patagonia Mountains; Alum Gulch (low pH-high metals), Humboldt Canyon Tributary (low pH-low metals), & Harshaw Creek (neutral pH[7.3-8.6]-trace metals). Four sites will be sampled in Alum gulch, two sites above and two sites below World's Fair Mine.

•Quantitative techniques:

•Sedwick rafter slide (Fig. 4): relative abundance of algae (indicated by average cell counts)

•Chlorophyll A: fluorometric techniques will be used to determine the amount of chlorophyll in each stream.

•Benthic Algae: In-stream, top soil samples will also be taken from each location



Figure 3: Map of four sites in Alum Gulch and World's Fair Mine.



Figure 4: Test Locations: Harshaw on left, Toe Zone on right.



Figure 5: Microscope evaluation of algal samples using Sedgwick-Rafter slide to determine algae genus and biomass



Figure 6: Coring samples taken at each location

CURRENT RESULTS

Chlorophyll A Abundance: Hidden Spring and Waterfall had the lowest Chlorophyll A. End Pool and Toe Zone had high amounts of Chlorophyll A. Harshaw Creek had the highest amount of Chlorophyll A. Humboldt Canyon's Chlorophyll A was in the middle range (Fig. 7)

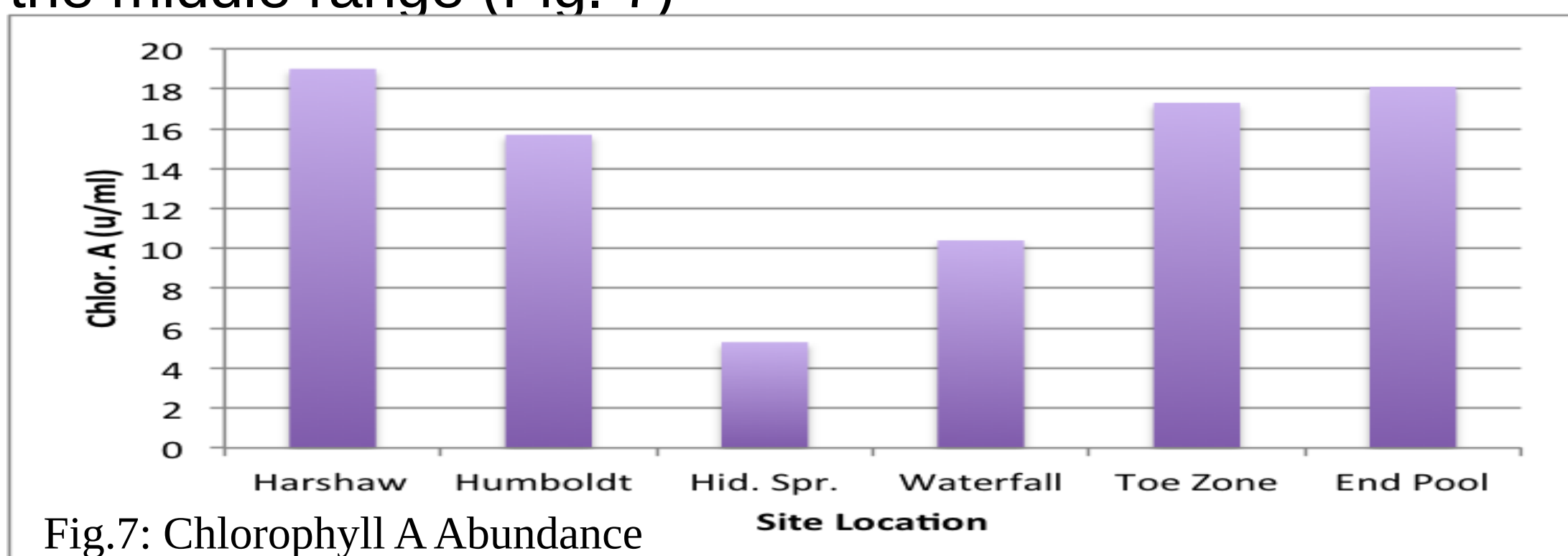


Fig.7: Chlorophyll A Abundance

Predicted Results

Biomass: We predict that Harshaw Creek will have greater abundance and diversity, while the Alum Gulch sites will be lower (Fig. 8)

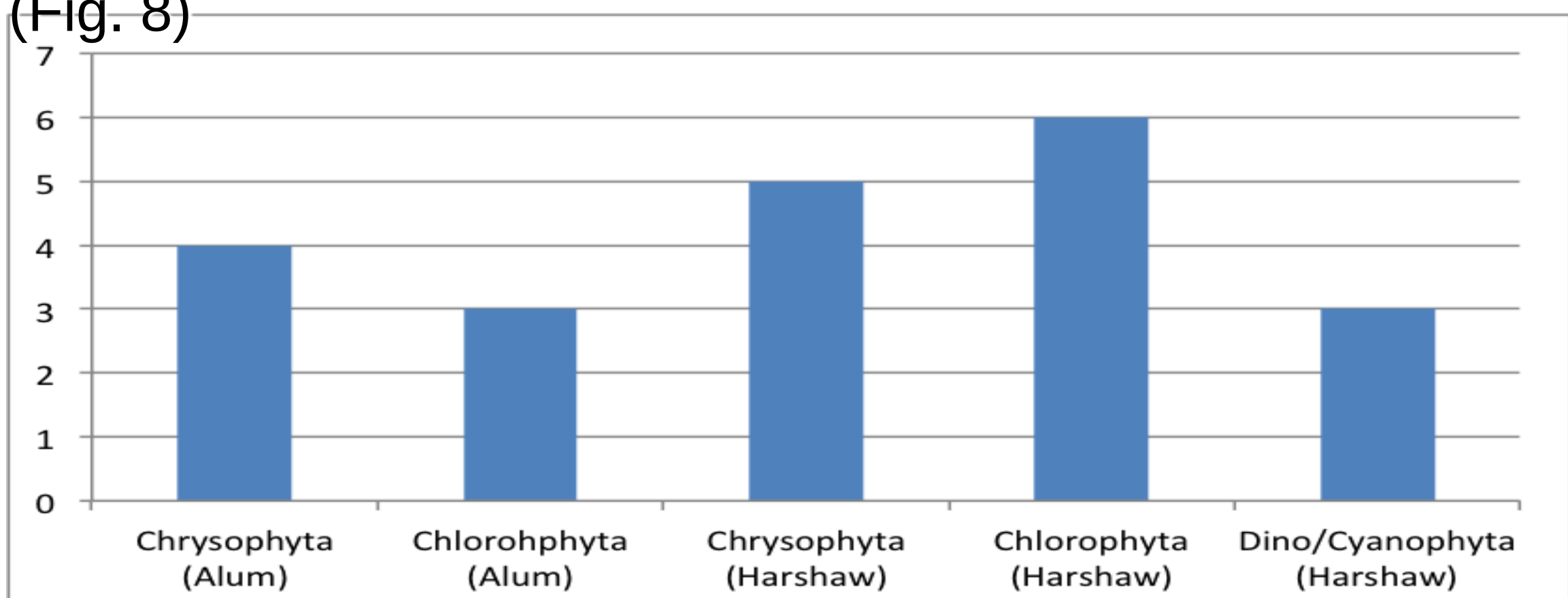


Figure8: Algae genera abundance in both Harshaw Creek and Alum Gulch

DISCUSSION

Harshaw Creek will display the greatest species diversity and algal biomass due to its moderate pH and trace metal level. Humboldt Canyon will have the lowest species genera due to low pH and copper load. Alum Gulch will offer moderate genera diversity primarily featuring algae capable of withstanding low pH, but will have low algae biomass.

ACKNOWLEDGMENTS

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