

Seaweed Dissolved Oxygen Exploratory

Introduction

Seaweed looks tough but is really quite sensitive. Oregon's flora is comparatively depauperate with only a little more than half as many taxa (compared to Alaska, Washington, and California). Comparatively narrow temperature range of the near-shore water (temperature differences being the driving engine of upwellings) and heavy sand, not much rock, are also some of the reasons for low diversity (2).

Seaweed is not only eatable, but good for you. Soluble fiber in seaweed (which glue the plants cells together) help to lower blood sugar, pressure, and cholesterol. Dried powdered kelp is a good way to use it such as a salt substitute in cooking and seasoning (5).

In this study I am concentrating on green and brown seaweed because its available readily at both lower and higher intertidal zones. I would have liked to put red algae in this study, especially because it absorbs light more in the far red light spectrum but it doesn't grow in high intertidal zones (4). There are more red algae, Rhodophyta, (4000) than the green algae, Chlorophyta, (1000) and brown algae, Phaeophyta, (1500) combined (3).

The oxygen produced by these plants are important for life. To measure this oxygen, I ran an assay on a variety of seaweeds that I could easily retrieve from the dock. I separated them into roughly green and brown seaweed. I then put them into sandwich bags, and placed them under double four foot fluorescent shop lights at 80 watts. Sea water was 7.8 mg/l and I was generating 13.9 mg/l. I built this study based on my assay of generating measurable amounts of dissolved oxygen in plastic sandwich bags under artificial lights.

B.H. Brinkhuis showed green algae *Ulva* produced more oxygen than brown algae *Fucus* (1). What I would like to show is this comparison of dissolved oxygen generated by a measured amount of seaweed and see if it is zone related. Also run a Ultra Violet sun screen test to see if there is a difference between the zones.

Method

Part 1: I weighed out 45 grams of *Ulva* and put them in plastic bags labeled according to the zone they were collected from. Two bags of *Ulva*, one from the lower intertidal zone labeled green low, the other bag from high intertidal zone labeled green high—I repeated this procedure for the *Fucus*-- One bag of brown low intertidal seaweed and one bag of brown high

intertidal. So I end up with four bags; two green high and low and two brown high and low. I then put all four labeled bags under the shop lights and measured the dissolved oxygen after various times of illumination -- thirty minute intervals up to two hours. After two hours of illumination, I lengthened the time I measured the dissolved oxygen from thirty minute intervals to hour intervals up to ten hours (note a break in the Graph A time axis depicting this change).

Part 2: I weighed out .1 grams of each seaweed and measured the ultra violet absorption. As above, I ended up with four cubetts; two green high and low and two brown high and low.

Results

Part 1: Graph A
In the production of dissolved oxygen the Ulva outperformed the Fucus with not much difference between the high intertidal seaweed and the low intertidal seaweed in terms of oxygen production. Both seaweeds, green and brown, the oxygen production faded after ten hours. Probably due to the product; oxygen built up and the reagent carbon dioxide drawn down shifting the photo synthetic equation to the left of the reaction equation.

Part 2: Graph B
Ultra violet absorption; the data definitely played out according to zone. The low intertidal green and brown seaweed had less sun screen than the high green and brown seaweed. Obviously the seaweeds found higher in the intertidal zone are exposed to more ultra violet light and sunshine and would need more sun screen to protect their proteins from denaturing.

At a wave length of 436 nm, green Ulva high seaweed had more chlorophyll than green Ulva seaweed from low intertidal zones--more than twice the amount of chlorophyll.

Conclusion

Ulva proved to be a superior oxygen producer over Fucus. Both Fucus and Ulva showed no difference by the zones they were collected from (see Graph A). Ulva high intertidal and Ulva low intertidal graph intertwine; their oxygen production was about the same. Fucus produced about the same type of graph, but a little over all reduction in oxygen production. The seaweeds up high need the sun screen more than the lower seaweeds, as expected (see Graph B).

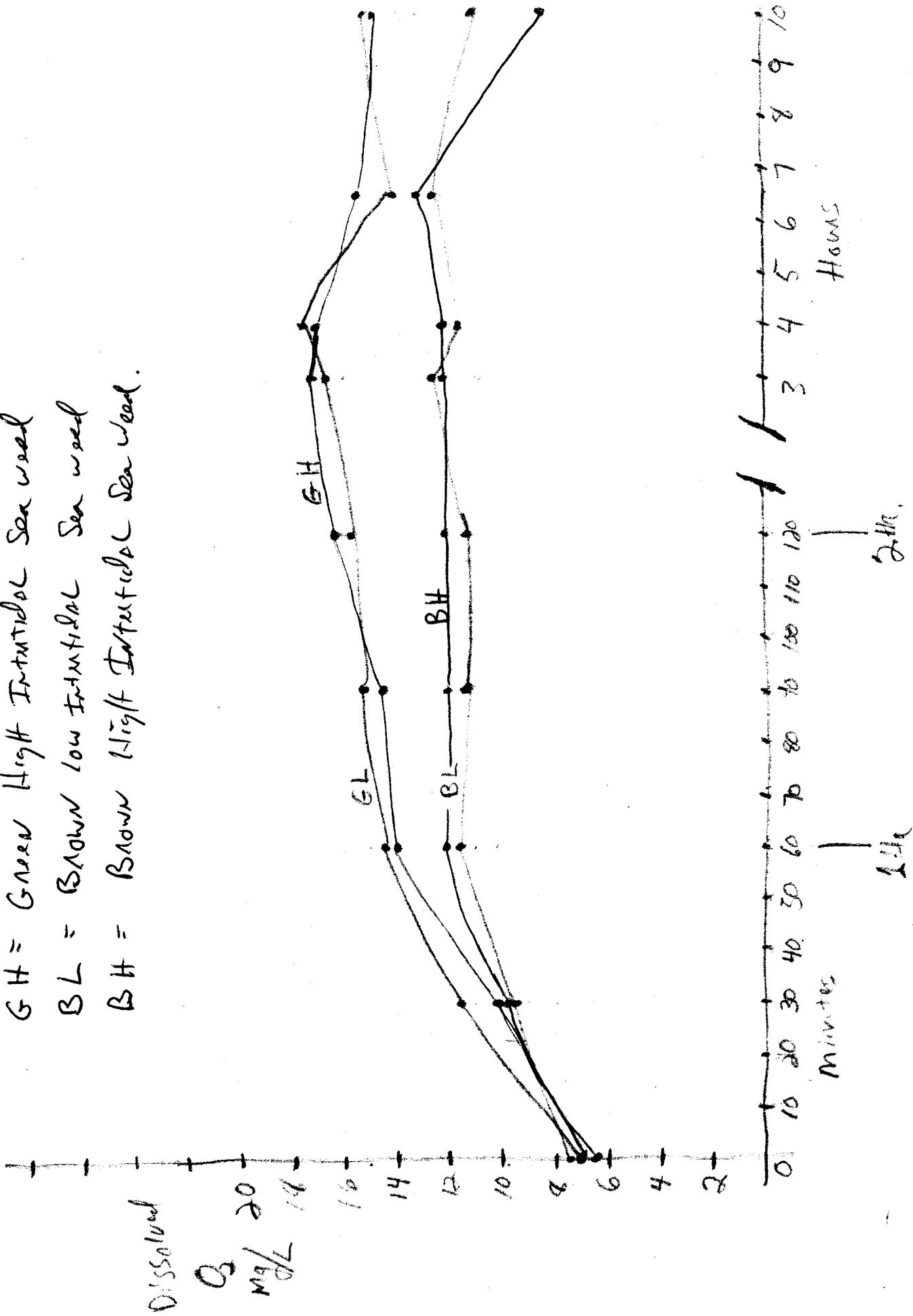
The brown rockweed Fucus, although a smaller producer of dissolved oxygen than green sea lettuce Alva, has more pigment (1). With more pigment, Fucus does not have to make as much sun screen. The Shikimata pathway to sun screen synthesis by plants is expensive. It would take less energy to pump pigment than to synthesis MAAs; considering the small bank of metabolites Fucus has to draw from compared to Ulva.

References

- (1) Brinkhuis, B.H., Seasonal Variations in Salt-March, Macroalgae Photosynthesis 2. Fucau Vesiculosus and Ulva Lactuca, State University of New York, Stony Brook Marine Science Research Center, N.Y., U.S.A. Mar. Bio. 44 (20, 177-186 (1977).
- (2) Hansen, Gayle I., A Revised Checklist and Preliminary Assessment of the Macrobenthic Marine Algae and Sea Grasses of Oregon, Department of Botany and Plant Pathology and the Hatfield Marine Science Center, Oregon State University, from Kaye, T.A., etal.
- (3) Hawkes, M.W., Sea Weed Biodiversity Conservation, Pacific N.W. Environmental Journal 8, 146-148 (documents), (1992).
- (4) Ingram, Jocie, Knowing Nature: Combing for Sea Weed, Comox Valley Naturalists Society, (January 6, 2006).
- (5) Rudy, K. Paul, Innovative Illusions, Pacific Edge Publishing, Ltd., Wave Length Magazine, (2007).

A GRAPH

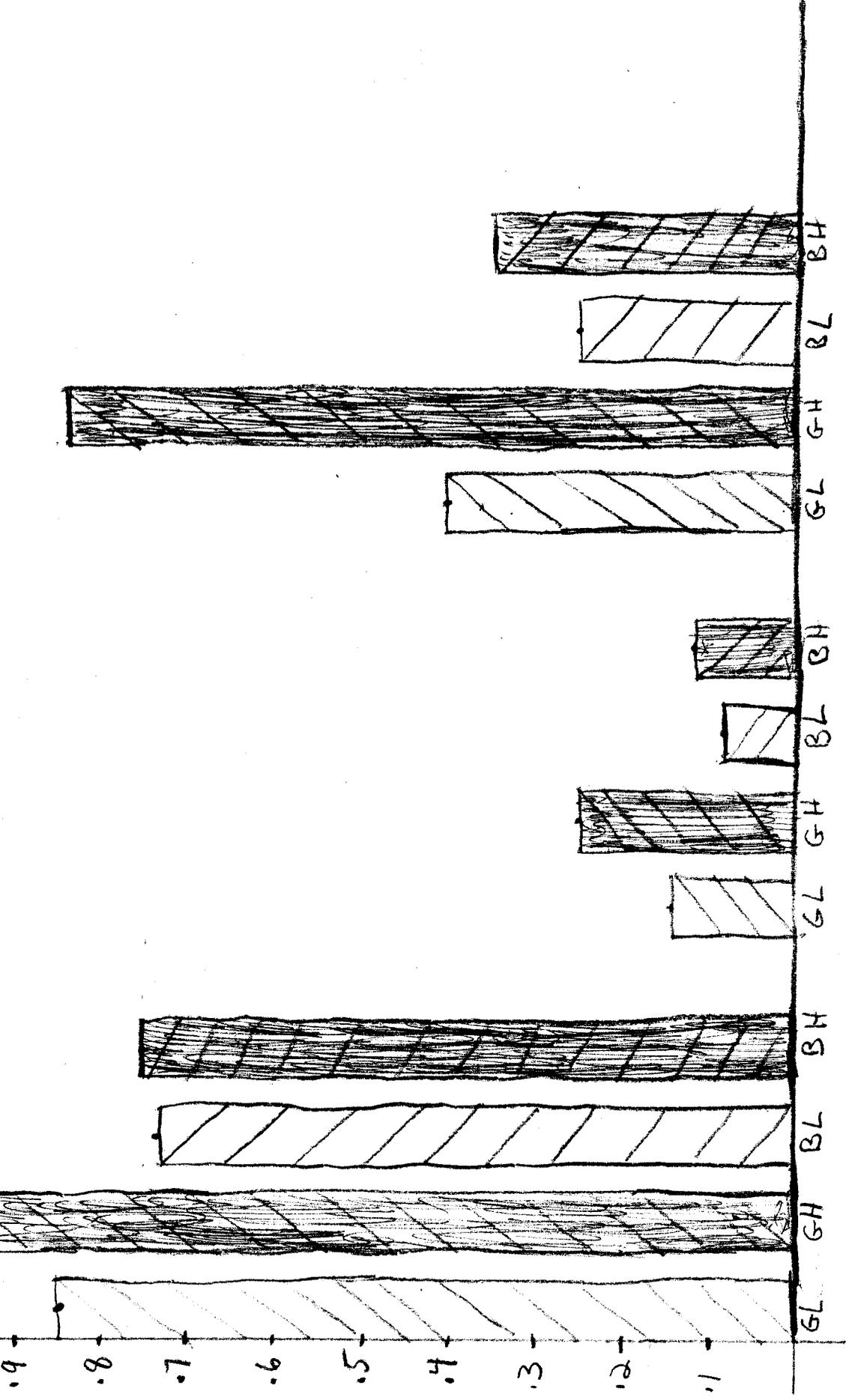
- GL = GREEN Low Intertidal Sea weed
- GH = GREEN High Intertidal Sea weed
- BL = BROWN low Intertidal Sea weed
- BH = BROWN High Intertidal Sea weed



Dissolved O₂ mg/L Generated after being under light over time

GL = Green Sea Weed Low Intertidal Zone
 GH = Green Sea Weed High Intertidal Zone
 BL = Brown Sea Weed Low Intertidal Zone
 BH = Brown Sea Weed High Intertidal Zone

D LIGHT
 ABSORBANCE
A



313 NM
 340 nm
 436 nm
 WAVE LENGTH

Sea Weeds U.V. ABSORPTION ACCORDING TO ZONE OF LOW INTERTIDAL + HIGH INTERTIDAL