



Current and depth in relation to levels of
phytoplankton and dissolved oxygen.
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Salish Sea Expeditions is a catalyst for students in their exploration of
Puget Sound through boat based-scientific exploration.

The collected works of the student scientific explorations
aboard the *SV Carlyn* on the waters of Puget Sound by the
7th-9th grades of Whatcom Day Academy.

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Salish Sea Expeditions
647 Horizon View Pl. N.W.
Bainbridge Island, WA 98110

phone: 206.780-7848
www.salish.org



School: Whatcom Day Academy

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Grades: 7th-9th

Teacher: Misty Nikula-Ohlsen

I. Title

Current and depth in relation to levels of phytoplankton and dissolved oxygen.

II. Abstract

The hypothesis for this experiment was: the faster the current and deeper the depth, the less phytoplankton and dissolved oxygen there will be in the water. This hypothesis was chosen by a popular vote. Data was collected by deploying the phytoplankton net with the DO probe attached and the zooplankton net (we only measured Phytoplankton). We also deployed the Niskin bottle to get a DO sample at ten meters and the chip/ricotta log to measure current. The data found in the experiment partially supported the hypothesis because the Phytoplankton and dissolved oxygen both decreased according to the hypothesis, however there were a couple outlying points from the data trend. Future study might include doing more trials or testing other variables such as weather on plankton and dissolved oxygen.

III. Introduction

Our class, Whatcom Day Academy, in 2006 did a science and sailing trip with the Salish Staff aboard the Carlyn (boat). In this experiment, we had not only two independent variables, but also two dependent variables. Our question was, "How does the water depth and current strength affect the amount of plankton and dissolved oxygen?" This makes the variables of this experiment the water depth, current strength, number of plankton, and amount of dissolved oxygen. The class chose these variables for a couple of reasons. The class chose the water depth because the depth can change a lot over distances and it is a common factor of the ocean, so it is relatively easy to measure. Current strength was chosen because it can affect how the plankton is distributed throughout the ocean. Plankton was the only marine creature that is easy to catch and also the only marine organism that we were allowed to study and observe. Lastly, the dissolved oxygen was chosen to be a factor because the class wanted to use the equipment to measure the dissolved oxygen (the probes were cool!).

This experiment connects not only to Puget Sound (our experimental site), but also the entire ocean in a couple of ways. The water depth changes, mostly due to islands, and without the water depth changing, some animals might not be able to live (e.g. a whale could not live if all the water was two feet deep). The current matters in the world because the current stirs the water and would get some of the weaker water creatures

moving through the water. The plankton is very important in the world because there are so many of them in the world; most of the marine creatures eat them. Also, this plankton is young animals, in years to come, if they make it without being eaten, then they will turn into real animals, some of which provide food for humans or other animals. The plankton makes the dissolved oxygen and without it the marine animals wouldn't get any oxygen and they would die off.

The hypothesis for this experiment was where the water is deeper and the current is stronger, we will find less plankton and less dissolved oxygen. This hypothesis was chosen because in deeper water there would be less plankton because the plankton would need sunlight to photosynthesize and sunlight doesn't reach down to deeper depths easily. And if there were less plankton in the deeper waters, then because phytoplankton makes oxygen, there would also be less oxygen. Plankton are called plankton because they can't swim against the tide or current. Knowing this, there would probably be less plankton where the current is stronger. This is because the current would simply push the plankton along, until they drift into a spot with no current that pushes them and where there is less plankton, like before, there would be less oxygen.

IV. Experimental Design

Equipment Used

- a. Zooplankton Net
- b. Phytoplankton Net
- c. Neuston Net
- d. Chip Log
- e. D.O. Probe
- f. Niskin Bottle

Chip Log

Procedure

Materials

1. Chip log
2. Rope
3. Stop Watch/ watch

Let the chip log run out until it reaches 1 knot on the rope then start timing for 16 seconds. Once you reach 16 seconds, stop the watch and count the amount of knots the rope release in the time provided, this will show the current. The distance between each knot was 27 feet.

Niskin Bottle

Procedure

Attach Niskin bottle properly to boat. Assemble Niskin to be dropped, rope must be marked every meter up to ten meters. Niskin bottle is dropped at desired depth. Bottle is pulled up and water is stored for later use. Repeat however many times needed.

Dissolved Oxygen Probe

Procedure

First attach to the Phytoplankton Net. We attached the probe to the bottle with masking tape. Then we measured the ppm of dissolved oxygen from the probe. Then record the measurements at all the necessary depths.

How we analyzed our samples

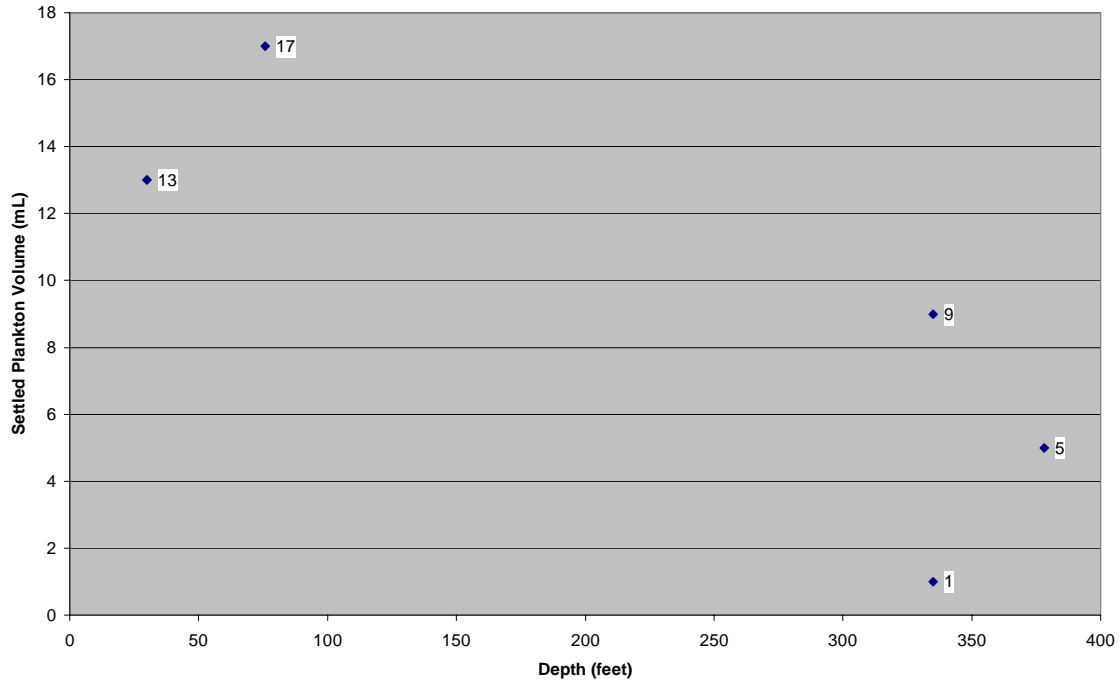
For the phytoplankton that we collected, we let them settle and we looked at the zooplankton under the microscope. This was decided because zooplankton, move around so it would be hard for them to settle. We deployed the phytoplankton net for 2.5 minutes to collect the plankton.

Special pieces of gear we designed or used

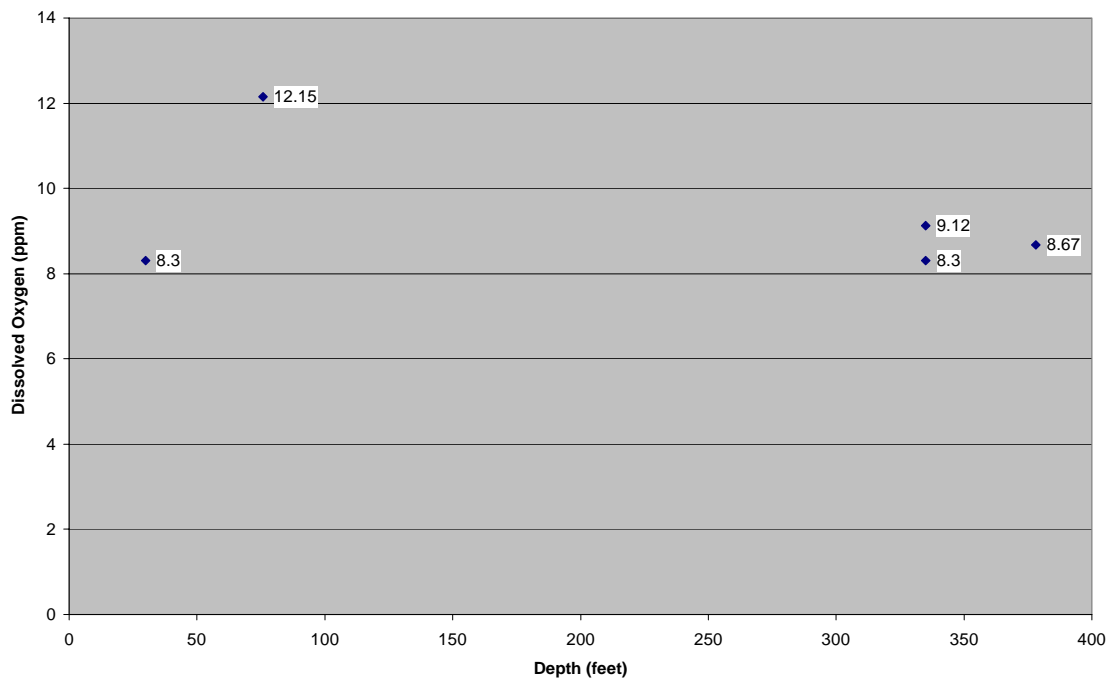
One special piece of equipment that we used during the trip was the Neuston Net (deployed for 5 minutes), and the Chip (Ricotta) Log, which our class designed. The Neuston net was a very large net that we deployed from "the boom" to collect more plankton in a larger area on the surface and for more varieties of plankton.

V. Results

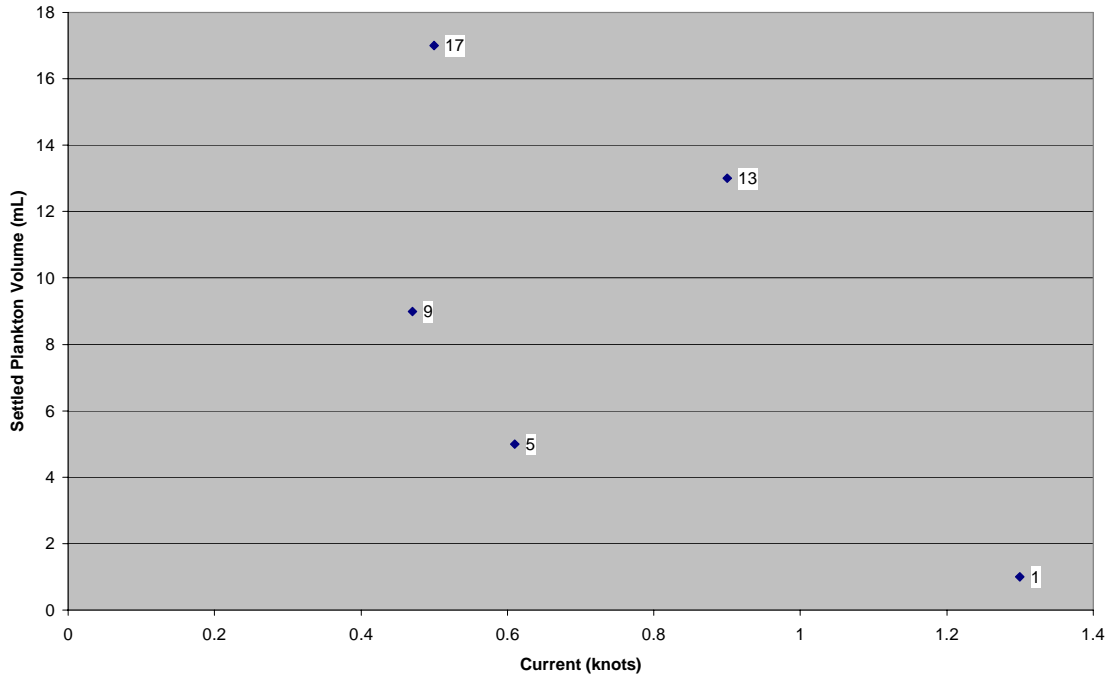
Effect of Depth on Phytoplankton



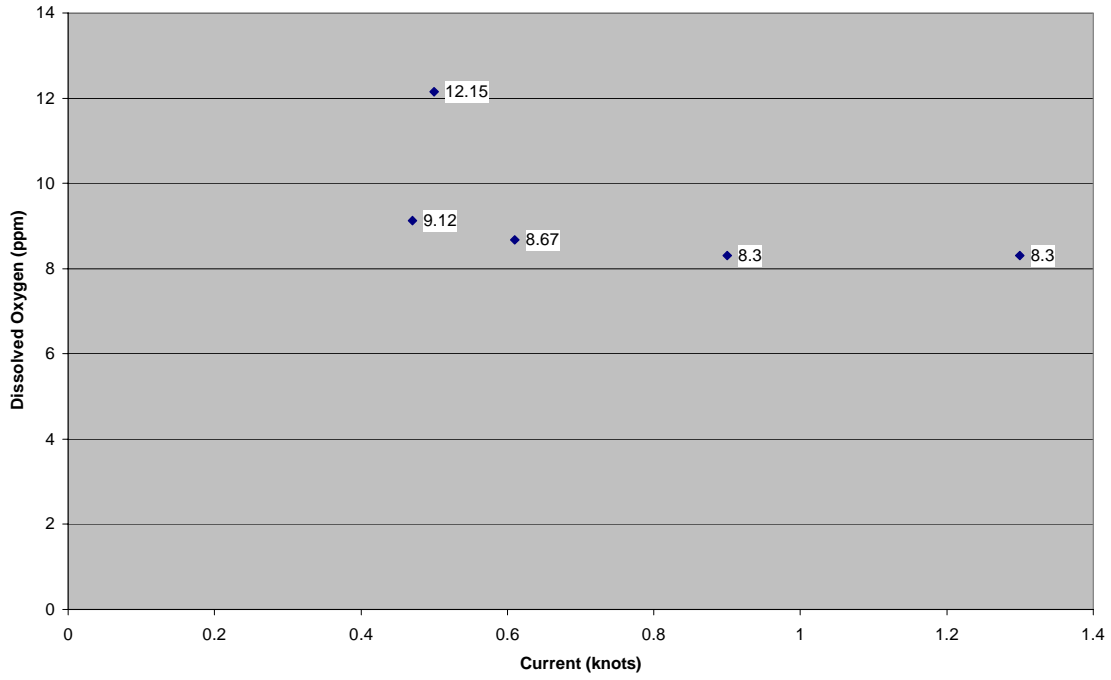
Effect of Depth on Dissolved Oxygen



Effect of Current on Plankton



Effect of Current on Dissolved Oxygen



The data for the effect of the depth and current speed (knots) on the level of dissolved oxygen and amount of plankton (mL) is shown in the graphs. There were several comparisons made.

For the graph that shows depth on the amount of plankton, we figured that when the depth increases, the amount of plankton would decrease. There are a few points plotted near the higher part of the graph where the depth increases and the plankton decreases. Then there are points plotted on the lower part of the graph where the depth decreases and the plankton increases. If we had more data in the middle of the trials, we could perhaps draw a conclusion that when the depth increases the plankton decreases.

For the graph that shows the effect of current on dissolved oxygen, when the current increases the dissolved oxygen decreases. This is shown by a line that gradually declines so that we can tell easily that the trend is when the current increases the dissolved oxygen decreases.

The graph for depth on dissolved oxygen indicates that the data partially supported the hypothesis. The graph's trend shows that for three of the pieces of data, when the depth increases, the level of dissolved oxygen decreases. This however is not a trend that continues throughout the whole graph, which is why this comparison only partially supports the hypothesis.

The data for current on plankton shows that when the current speed increases the number of plankton decreases. There is a trend where the dots are in a random pattern but then at the bottom of the graph we have a point. So this shows that the trend for this graph is when the current speed increases, the number of plankton decreases.

VI. Plankton Discussion

It was concluded that the hypothesis stating that more plankton live in deeper water is supported. Where the water was deeper, more plankton was found on the surface.

The hypothesis that deeper water had less dissolved oxygen was partly supported. The points were a little more scattered; there is a group of three points all in about the same place, and two more that are spread out. It is possible that one of these two may be an outlier.

The hypothesis stating that fewer plankton live in places with more current was partially supported. The points on the graph were spread out, however, it was possible to draw a line through them indicating the general trend. The direction of the current may affect the data also. If the current comes from the front of the net, it will push more plankton in. If the current is coming in from behind the net, less plankton will be caught.

The hypothesis stating that where there is more current, there is less dissolved oxygen is supported. Although there is one outlier, almost all the other points are sloped downward at almost equal intervals. The general trend is that when there is more current, there is less dissolved oxygen.

VII. Cruise Summary

We camped at Sucia Island in Echo Bay, which is in Puget Sound near the U.S.-Canadian border. Echo Bay does echo; our most advanced and excellent scientists determined this. On this voyage, we prepared and cooked our own vittles. Our most delectable cuisine included, but was not limited to, 1/3-pound beef burgers with an excessive amount of condiments, hand-grilled French toast, a wide and tasteful variety of cold cereals, such as Frosted Flakes and Fruit Loops, and brownies. Our vessel, the Carlyn, we navigated and sailed ourselves, after instruction from the veteran crew. The Carlyn was a beautiful ship, with no holes, ruptures, rodents, rot, damage, or other ailments. Unfortunately, we encountered less than favorable conditions while aboard her. We countered these storms and foul weather by donning our waterproof, oil resistant "Banana Suits." Any tsunamis or typhoons that would knock us overboard were countered by our nonstop wearing of personal flotation devices, specifically life jackets. Once ashore, we took long, leisurely strolls through the woods, eventually reaching the China Caves, where we explored and climbed into a cornucopia of caves. Many wildlife sightings were reported, such as blue jays, various forms of rodents, such as squirrels and mice, as well as seals and porpoises. Regrettably, no narwhal sightings were reported, though it is possible a selfish crewman saw a pack and refrained from reporting it. As we thoroughly examined our plankton, many studious and laborious drawings were made of them. As our valiant artists labored, a plethora of refreshments and snacks were provided, and rapidly consumed.