CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
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Project Number
36572

Project Title
Brine Exclusion and Thermoclines

Abstract

Objectives/Goals
My hypothesis was that as sea ice begins to melt, the salt water density will increase. As the sea ice melts, the exothermic energy will create a thermocline. The thermocline and densities will suspend particulate matter in a layer and change the density and thermal structure of the water.

Methods/Materials
First, I filled an 110 L aquarium nearly full with salt water (Instant Ocean) @ 1.0 refraction. I positioned thermometers at 0 cm at the top, 5 cm, 10 cm, 15 cm, and 20 cm near the bottom. Then I recorded temperatures and sample salinity with a pipette at each of the respective depths. After this, I placed 5 kg of the brine infused ice in the water. After I recorded temperatures as before, I inoculated the salt water with 20 ml charcoal/clay dust laced salt water. Then I observed any changes.

Results
After doing all the procedures, a thermocline was created. Layers in 5 cm increments exhibited 1 degree Celsius, 5 degrees Celsius, 15 degrees Celsius, 21 degrees Celsius, and 21 degrees Celsius with a refractive index respectively of 0.4, 0.8, 1.3, 1.9, and 6.0 after 48 minutes.There was a visible layer of the particulate matter at 10 cm. This layer was one of the middle areas. The refractive index of salinity was 1.3 and the temperature was 15 degrees Celsius within this layer.

Conclusions/Discussion
In conclusion, my hypothesis was correct. As the sea ice began to melt, the salt water density increased, and the exothermic energy created a thermocline. The thermocline and densities suspended particulate matter in a middle layer and changed the density and thermal structure of the water. The layer with the most salt appeared to be one of the lower areas of the water. The implications are that if this plume were able to sustain for a longer period of time, the suspended particulate matter may be able to absorb light energy and further heat the plume of sea water disrupting normal patterns of currents, weather, fish migration patterns and feeding, etc.

Summary Statement
This project examines brine exclusion and the formation of thermal layers that are able to suspend particulate matter.

Help Received
My teacher assisted with supplies and equipment and help me with an extra set of hands in doing multiple measurements.