Ocean Layering: Density, Salinity, Temperature, and Circulation

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North Pacific Layers Activity – Sample Answers

You will be given a picture of salinity, temperature, and density from the North Pacific. The pictures of salinity, temperature, and density were taken at the same time.

1) What do you notice about salinity, temperature, or density near the surface?
Salinity changes a lot, and gets fresher to the north. Temperature and density are the same everywhere at the surface. The surface layer is very thin.
Other answers are possible, this is a question to get them looking at the data.

2) On the picture of salinity, draw horizontal lines to divide salinity into 2-5 vertical layers.
See '03t.slides.gliders' (http://earthref.org/cgi-bin/erda.cgi?n=1022) for a sample and comments.

3) Pick one of your vertical layers. Describe salinity and temperature in this layer. How are salinity and temperature related?
In the layer below the surface layer, salinity is saltiest near the top and temperature is warmest near the top. Salinity and temperature are about the same across the section. There are places where a blip / blob of salinity and a blip / blob of temperature appear.
The answer will depend on what layer they are describing. Temperature and salinity are frequently related in the ocean.

4) Based on salinity, draw arrows on the picture of salinity where you think water is moving.
See '03t.slides.gliders' (http://earthref.org/cgi-bin/erda.cgi?n=1022) for a sample and comments.

Each person in your group has a different set of sections from the North Pacific. With your group, compare your different sections to answer the following questions.

1) What do you notice is the same between your pictures of salinity, temperature, and density? List at least 2.
They all have fresh salinity at about the same depth. They all have high salinity / temperature near the surface. They all have salinity near the surface that is freshest towards the north.
Many other answers are possible.

2) What do you notice is different between your pictures of salinity, temperature, and density? List at least 2.
The temperature at the surface is different. The density at the surface is different. The highest value of salinity is different. Where salinity changes near the surface are different. Some pictures have blobs of salinity and some are smoother.
Many answers are possible.

3) Compare the vertical layers of salinity you drew with those of your group members. How are they similar or different?

The surface layers are different, some are thin and some are fat / the surface layers have different depths. Below the surface layer, they are pretty much the same. One layer has salinity that is freshest near the top and the layer below has salinity that is freshest near the bottom.
Many answers are possible.

4) Why does salinity change the most near the surface?
Good answers: Because that is where it rains and evaporates. That is where the atmosphere can change the ocean. Rivers spill out into the top of the ocean too.
Acceptable answer: Because of the atmosphere and the winds. Because that is where the air is.
Not Acceptable answers:
Because the sun heats the surface / because it is warmer at the surface. This is true, but does not explain anything about salinity.
Because salty water is warm and warm water is at the surface. Salty water is not always a certain temperature or a certain density. There is thought involved in this answer, but the answer is not correct.

5) Looking at all of the pictures your group has, guess what season each section is from. Winter, spring, summer, or fall? Write the season at the top of each page of pictures.
Students should know that the coldest temperatures occur in winter and the warmest in summer. Spring and fall are more difficult to distinguish, and a guess is fine. The last slides in '03t.slides.gliders' (http://earthref.org/cgi-bin/erda.cgi?n=1022) have example winter, spring, summer, and fall sections for comparison. The time of each section is listed in '03t.activity.nplayers' (http://earthref.org/cgi-bin/erda.cgi?n=1019).