

Marine Chemistry 372

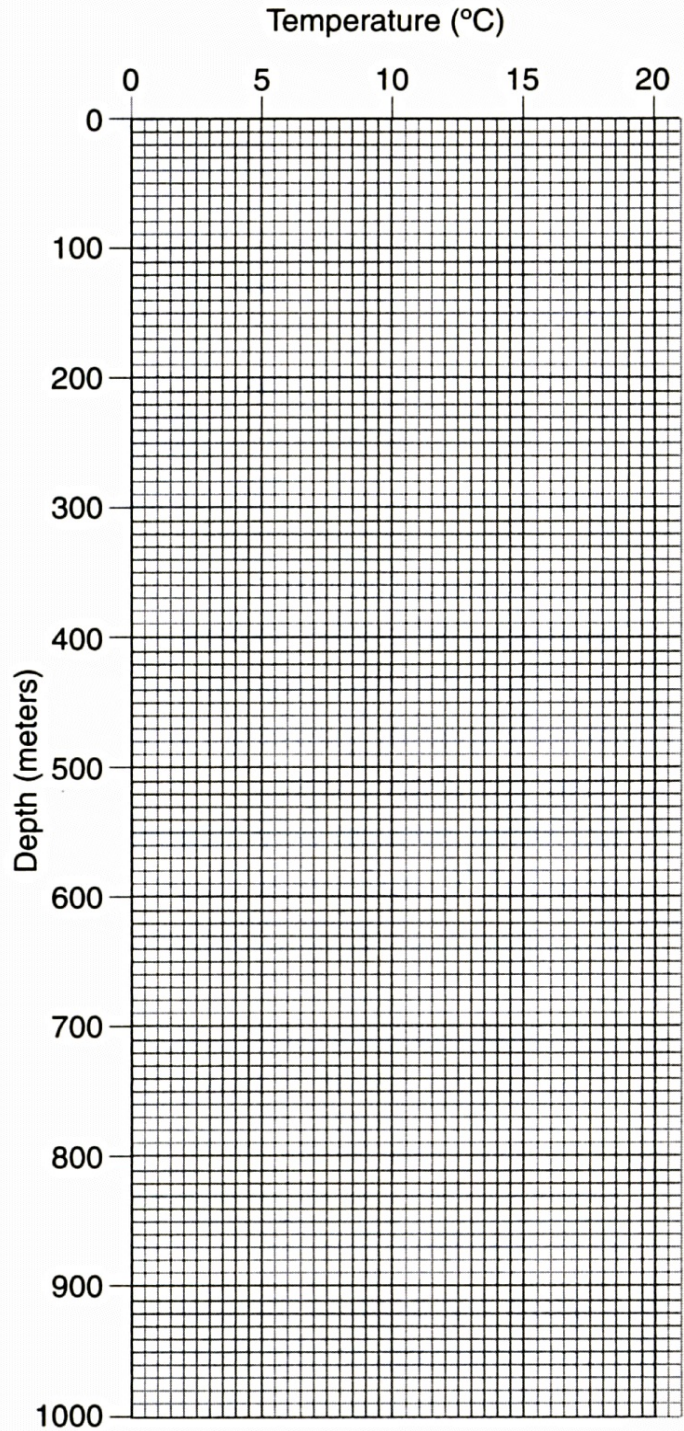
Lab Sheets

Part I: Profiling and Seawater Analysis

Temperature Profiling I

- The chart below includes temperature and salinity data for a location off the California coast. Your goal is to chart the temperature profile and to *identify* the surface (mixing) layer, thermocline and deep zone. Be on the lookout for seasonal thermoclines as well.

Depth (meters)	Temperature (°C)	Salinity (ppt)
10	14.56	31.22
20	14.50	31.40
30	14.48	31.56
40	12.72	31.88
50	10.86	32.40
75	9.20	33.24
100	8.82	33.60
150	7.77	33.88
200	7.10	33.94
250	6.57	33.98
300	6.15	34.01
400	5.49	34.07
500	4.01	34.14
600	4.65	34.20
700	4.36	34.26
800	4.10	34.31
1000	3.51	34.41



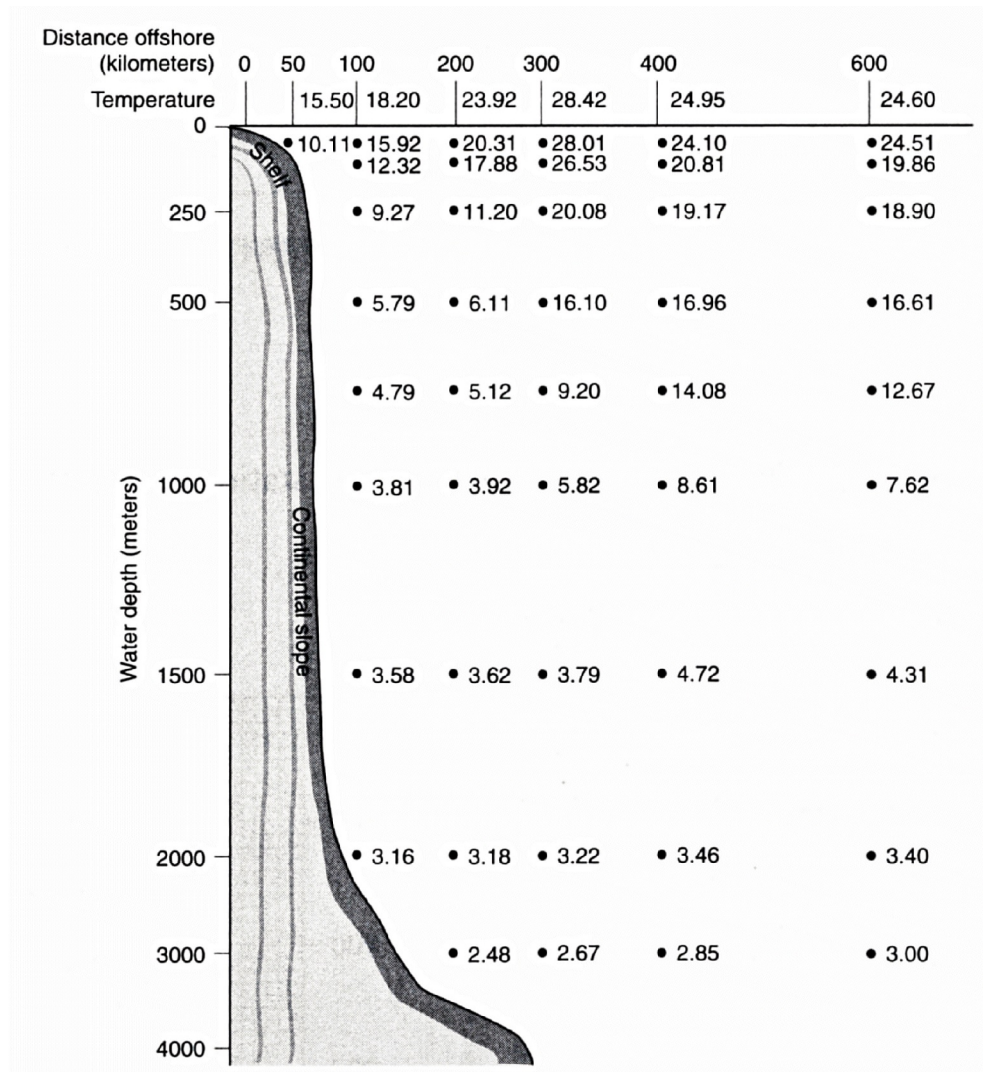
2. Based on the temperature profile, what season was this data taken in? Support your answer.

Temperature Profiling II

3. This example is a bit more involved than Profile I. Back in meteorology, you were introduced to the concept of isopleth mapping on pressure maps. Now the identical process will be used to examine a three dimensional temperature profile. This profile was created by temperature probes that were dropped vertically through the water column in six locations off the coast of North Carolina. For the chart, identify the isotherms in 2°C intervals. Then, take a critical look at what those isotherms are saying about the ocean.

To get a better feel for the data, consider using colored pencils to enhance certain temperature profiles. If you like, devise a color scheme for the various temperatures. If you do this, I recommend using red to represent the warmest water and blue/violet to represent the coldest.

When completed, also identify any thermoclines (seasonal and/or permanent). They can be identified by closely spaced isotherms.



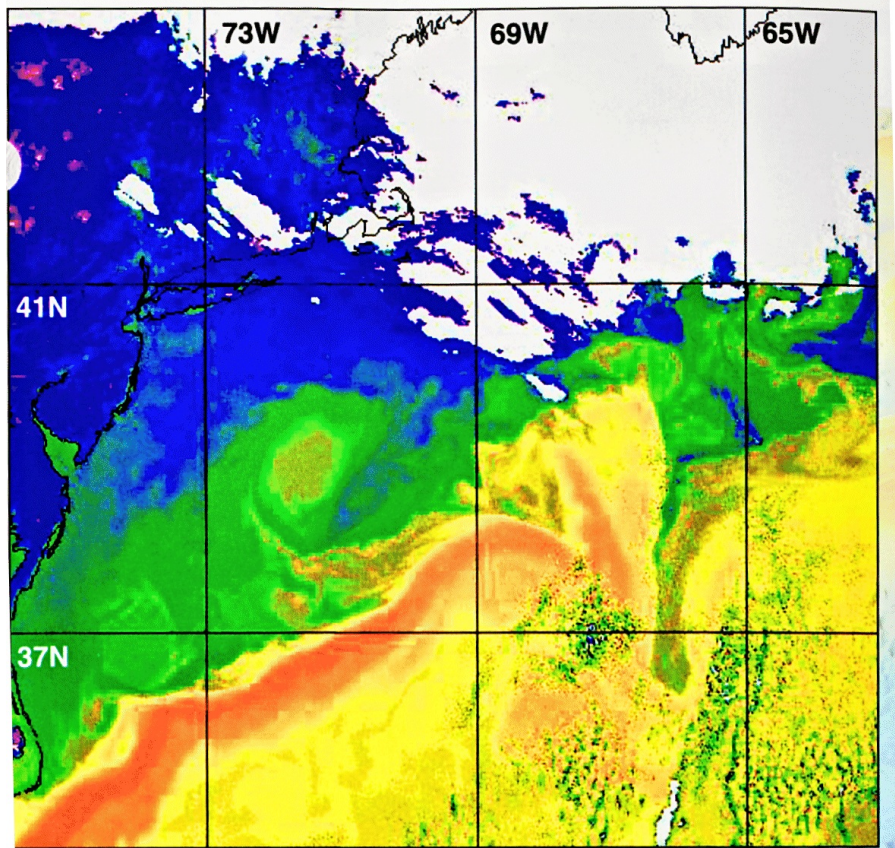
4. Look closely at the temperature profile. How do you explain the pattern of the isotherms along the part of the diagram identified as the continental slope?

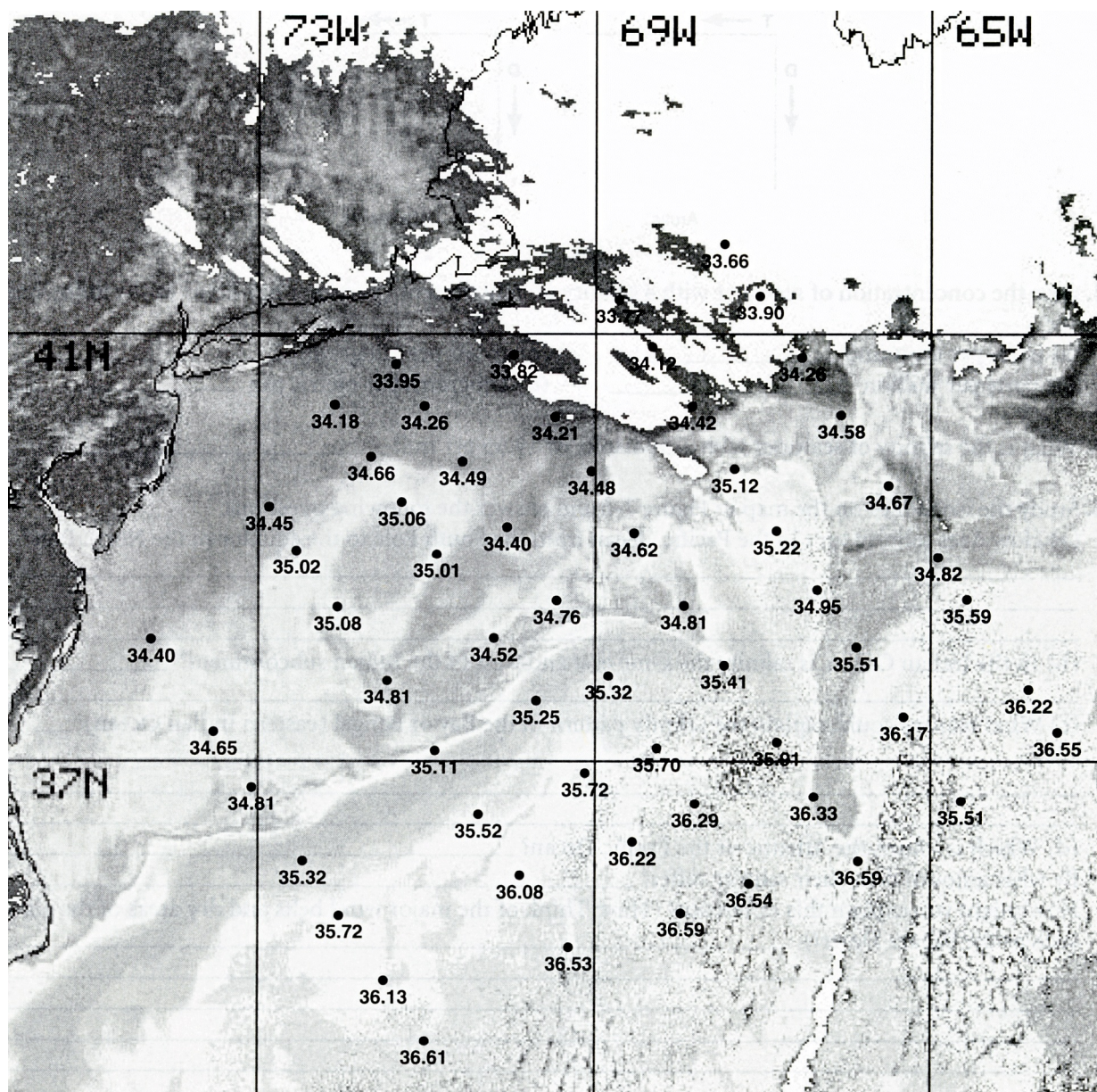
5. There should be an unusually warm surface feature visible on the profile as well. Considering this profile was taken off the east coast of the United States, how can this feature be explained? Approximately how large is it and how deep does it penetrate into the water column?

6. Refer to the world temperature map on the Temperature (text) page. Based on these temperature patterns, where should the ocean water with the greatest density be located? What could logically be expected about the height of the ocean at these locations with regard to “sea level”?

Salinity Profiling

7. Like temperature salinity can show unusual patterns as well. In the image below, a US NOAA satellite scanned the ocean off the coast of New England. The image was captured by the satellite's Advanced Very High Resolution Radiometer (AVHRR) scanner and has been color coded according to sea surface temperature (SST). Reds are the warmest and blues are the coolest. White pixels represent cloud cover. If you look closely, you should be able to make out the coast of the Delmarva Peninsula, Long Island and Cape Cod. On the following page, the same image is shown in grey scale. Each data point on that chart was collected by salinity probes placed in the water by a research vessel. On the chart, draw in isohalines for salinity values in .5 ppt increments and then use that data to answer the questions that follow.





8. SST profiles often assume similar shapes to the coastline they border. You should notice the same pattern does not exist with regard to salinity. How can the salinity pattern shown be explained?

Source: Laboratory Exercises in Oceanography, 3rd Ed., W.H. Freeman and Company, New York, NY, exercises 7-1, 7-2, figures 7-5, 7-7

Part II: Field Observations

For Part II of this lab, you will set up a variety of controlled experiments to illustrate the patterns charted in Part I. Each set of 2-3 students will require the following equipment:

- 1 water tank w/divider
- 1 clamp and rod assembly
- 1 digital thermometer
- 4 400-500 ml beakers
- 1 hot plate
- Small quantity of colored food dye
- Ruler
- Salt
- Scale or balance

Model 1: Temperature Simulation 1

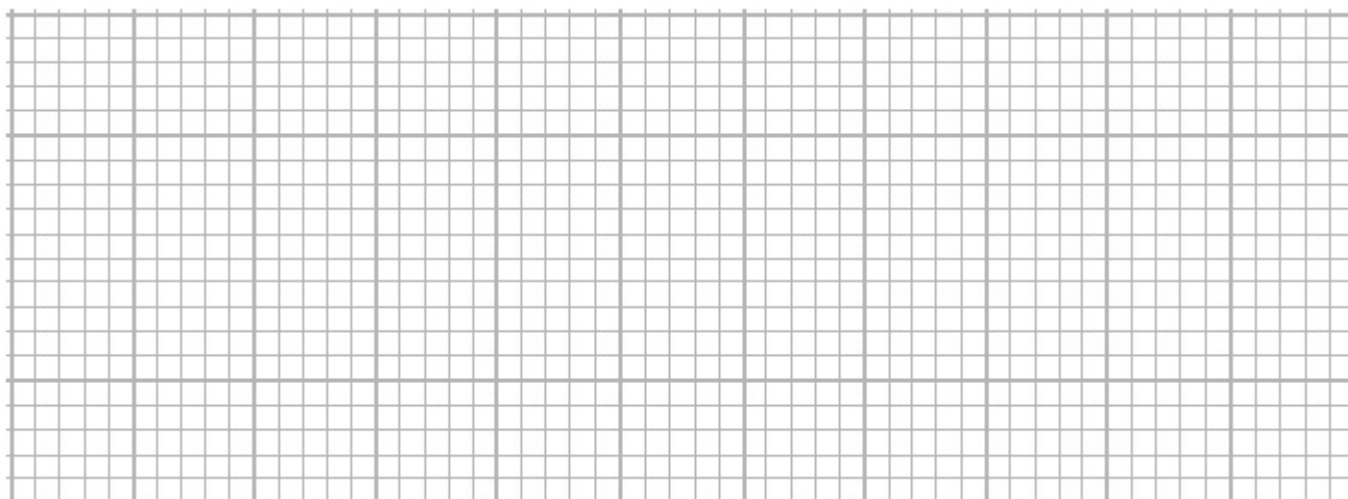
Prepare 250 ml of water in two beakers with one chilled to a cold temperature and the other heated on the hot plate so that it is hot to the touch. The actual temperature difference between the two samples is not as important as the total difference in temperature. Put a few drops of red food coloring in the warm water and several blue drops in the cold water.

Pour the cold sample into one side of the tank and the warm sample into the other. Then, lift the barrier between them slowly and carefully allowing the two sides to mix. Observe what occurs.

Temperature Readings: Warm body _____ (°F) Cold body _____ (°F)

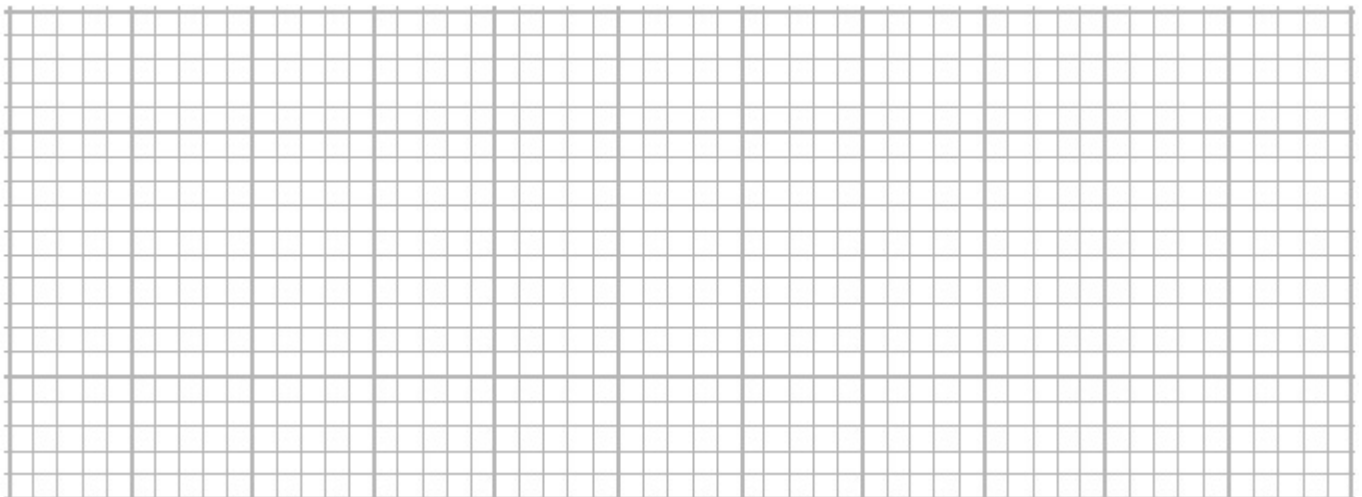
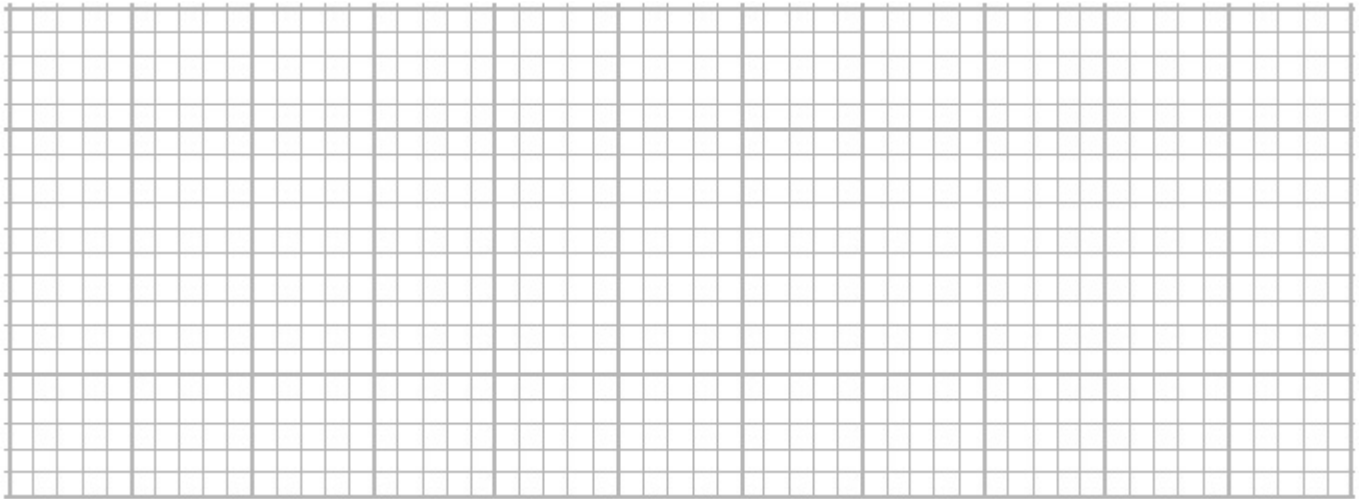
12. Describe the appearance of the two water bodies when they were permitted to mix together.

13. Using the ruler and the empty chart below, identify the various temperature zones found in the tank and label them accordingly. Take temperature readings every .25".



Model 2: The Atmosphere/hydrosphere Interface

18. What impact will surface winds have on the distribution of currents in the oceans? For this experiment, reset the water tank with warm and cold water bodies as earlier but this time, produce a steady stream of air across the surface of the tank from one end to another using a fan, hair dryer, etc. Observe and describe any results you discover here and relate them to actual patterns found in the Earth's oceans. Be sure to indicate the direction of the wind in your diagram.



Model 3: Salinity

Now that you have observed the effects of temperature, let's consider the impact of salinity on ocean water. There are many places on Earth where salt water meets large amounts of freshwater (the Amazon delta for instance) but what happens when this interaction occurs?

For this model, keep the two water bodies the same temperature but turn one body into seawater by adding the appropriate amount of salt to bring the sample up to 35 ppt. Then slowly mix the samples together and observe the interaction between them.. Describe your observations below.