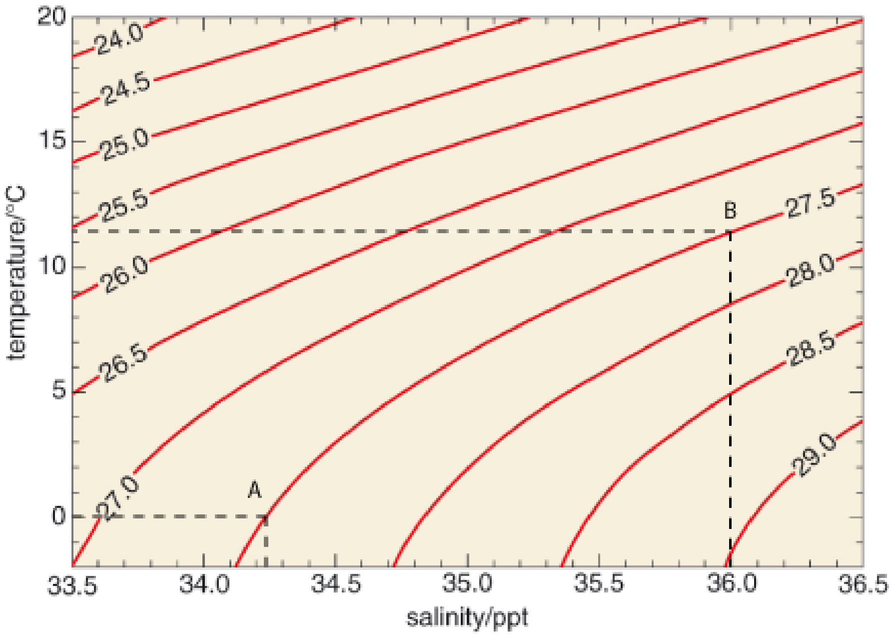
Seawater density is a complex and non-linear function of both temperature and salinity.

This means that it is much more complicated than freshwater and you cannot say "this is colder and so denser".

Have a look at the following picture



This is what we call a temperature –salinity plot. On the *x-axis* is salinity and the *y-axis* is temperature. The density anomaly (which is the density -1000 kgm^{-3}) is shown on the plot as red curved lines. (We only use density anomaly instead of density so we don't have to keep writing so many digits – in seawater only the last two digits will vary).

This picture has two labelled points: A has a temperature of 0°C and salinity of 34.23, point B has a temperature of 11.4°C and salinity of 36.0. But you can see that **both** points lay on top of the 27.5 kg m^{-3} density anomaly contour. So despite very different temperature and salinity they have **the same** density anomaly.

Also note that the picture shows the gradient of the red density anomaly lines is not constant. If you look at point A keeping salinity constant but increasing the temperature to +5°C will decrease the density anomaly to approximately the 27.1 kg m^{-3} density anomaly contour – a change of 0.4 kg m^{-3} (27.5-27.1). At point B keeping the salinity constant but increasing the temperature by +5°C to 16.4°C, would decrease the density anomaly to approximately the 25.9 kg m^{-3} density anomaly contour – a change of 1.6 kg m^{-3} (27.5-25.9).

This non-linear response is also clear if you keep temperature constant and vary salinity, and whilst there is a simple equation to calculate density in fresh water, the equivalent for saline water is very complicated.

So if you plot the temperature and salinity values on a plot like this, by seeing which contour they fall on we can establish which water mass is the densest.