

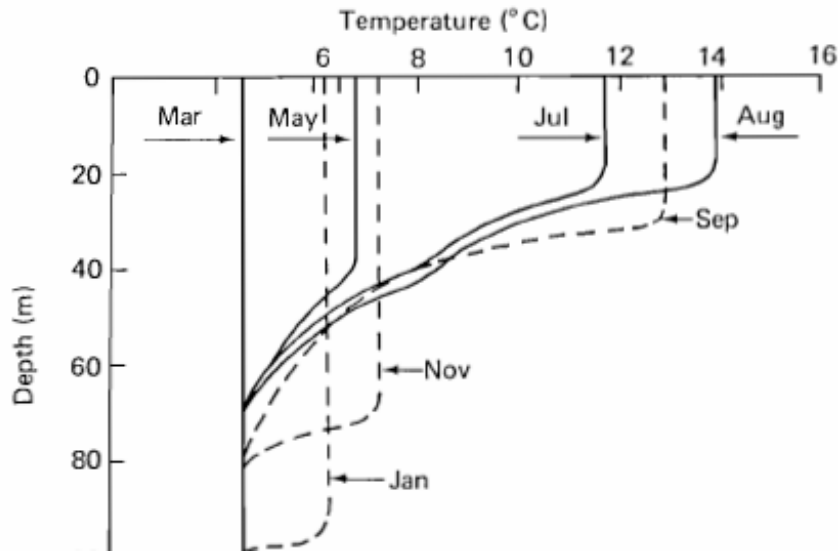
11:628:320 Dynamics of Marine Ecosystems 2011

Homework 1

Due: Friday September 16, 2011

1. We discussed in class how light and productivity are balanced in the surface mixed layer.
 - a) Draw a productivity-irradiance curve with a half-saturation constant I_k at $100 \mu\text{mol photons m}^{-2} \text{s}^{-1}$. Use units of $\text{g C m}^{-2} \text{y}^{-1}$ for primary production. Irradiance has units of energy per area per time; in this case, the energy unit is $\mu\text{mol photons}$.
 - b) Draw a light profile versus depth in the open ocean.
 - c) Draw the productivity profile versus depth using the two curves you have drawn assuming that phytoplankton are at a constant concentration with depth.
 - d) Draw the productivity profile versus depth using the two curves you have drawn assuming that phytoplankton are constant with depth except for a subsurface peak at a depth below I_k

2. The figure below shows a typical sequence of change in the vertical temperature profile of the ocean during the course of a year. Beginning with March, when conditions are cold and unstratified, *describe* and *explain the processes* that cause the changes from month to month.



3. Nitrate profiles will also change month by month, just as do the temperature profiles shown above.
 - a) For March, May, and August, sketch the temperature profiles (from the figure above) *and* the likely nitrate profile that would go with it.
 - b) Explain the physical reason and the biological importance of the nitrate profiles as you have drawn them.
 - c) Describe a potentially important source of fixed nitrogen during July and August for the temperature and nitrate profiles you've drawn. What is it, and why is it important?

4. You are in the North Atlantic Ocean and you observe the progression of a phytoplankton bloom. In the beginning there is a big bloom of diatoms. As nutrients are consumed, the diatom numbers drop and they are replaced by coccolithophores. Draw and label the nutrient uptake curves for the diatom and the coccolithophore. Label the curves and provide the equation to describe the curves.