

11:628:320 Dynamics of Marine Ecosystems 2011

Homework 3

Due Monday Oct 26, 2011



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- 1) Describe the normal pattern of sea temperatures and currents in the equatorial Pacific Ocean and how these are coupled with the circulation of the atmosphere.
 - 2) Describe the sequence of coupled ocean and atmosphere events that can upset this normal pattern and give rise to El Niño conditions.
 - 3) Describe the how the weather/climate and biology differ from normal during an ENSO warm event.
 - 4) Suggest some geochemical tracers that might be useful for documenting these phenomena.
 - 5) Atmospheric CO₂ levels reflect changes in primary production driven by annual variation and by interannual cycles such as ENSO. If the ENSO system got “stuck” in an el Niño configuration for an extended period (say a few decades) how might this affect the atmosphere –ocean CO₂ balance? What if it got stuck in a la Niña configuration?
 - 6) In upwelling zones the plankton production and community composition vary with distance from the coast. Assume that in a normal year, strong upwelling is persistent. Using the west (Pacific) coast as your reference, draw two figures showing biomass vs. distance from shore in A) a normal year and B) an El Niño year. Draw and label the biomass of both phytoplankton and zooplankton, and indicate the wind direction.

As always, diagrams are welcome and answers should try to draw together points across the lectures with different disciplinary emphases.

In questions 1 and 2, your discussion should consider all aspects of the physical environment (winds, currents, temperatures, stratification). **In question 3** consider all aspects of the ecosystem: nutrient sources, nutrient cycling, primary and secondary productivity, trophic structures and species composition, and fishing activities.

Chapters 9 and 10 of Mann and Lazier, “Dynamics of Marine Ecosystems”, are a useful starting point for this assignment but do not consider the geochemistry in any detail and geochemical aspects should be included in your answers.