

Lecture 4 – Primary Productivity in Aquatic Ecosystems

READINGS FOR NEXT LECTURE:

- Chisholm, SW. 1992. What limits phytoplankton growth? *Oceanus*. **35**:36-46. (H,W)
- Falkowski, PG. 2002. The ocean's invisible forest. *Scientific American*. **287**:38-45. (H,W)
- Raloff, J. 2003. Zebra mussels to the rescue. *Science News*. **163**:365. (H)
- Perkins, S. 2003. Slow turnover: Warming trend affects African ecosystem. *Science News*. **163**:404. (H)

Outline for Today:

- I. Review Global Distribution
- II. Measurement techniques
- III. Limiting factors for freshwater and marine systems
 - A. Light
 - B. Nutrients
 1. Distribution and availability
 2. Biological requirements (next class)

Study Questions

1. Explain why light tends to be more limiting in freshwater or coastal systems than in the open ocean.
2. Explain the concept of a limiting nutrient. How would you design an experiment to determine which nutrient is limiting in a particular system?
3. What are the challenges associated with using uptake of $^{14}\text{CO}_2$ to measure primary productivity?
4. Why are phytoplankton so much more productive (on the basis of biomass) than land-based plants? Approximately how much do phytoplankton and land-based plants contribute to global primary productivity?
5. Why did scientists used to think that phosphorus, rather than nitrogen, should be the limiting nutrient in oceans? Why is nitrogen often the limiting nutrient instead? And what role does Fe play in nitrogen limitation in oceans?
6. Both Chisholm and Falkowski explain how adding iron to the world's oceans may enhance their primary productivity, but caution against taking drastic actions on a large scale. Why would the addition of iron enhance productivity? Why might this not be a panacea for elevated atmospheric CO_2 levels?