

Dissolved Oxygen in the Marine Environment

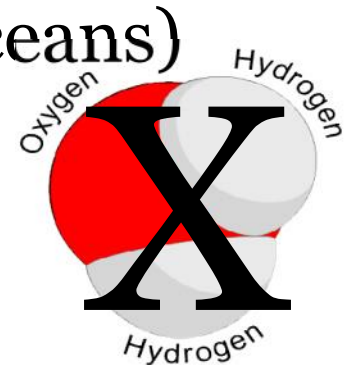
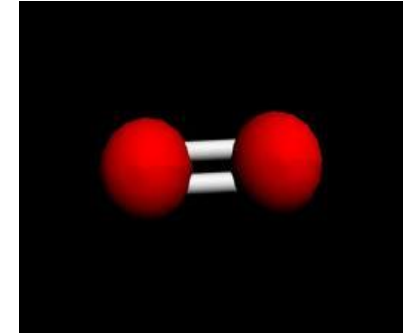
Randie Bundy and Mrs. Ogo

APES 10-4-12

What is dissolved oxygen?

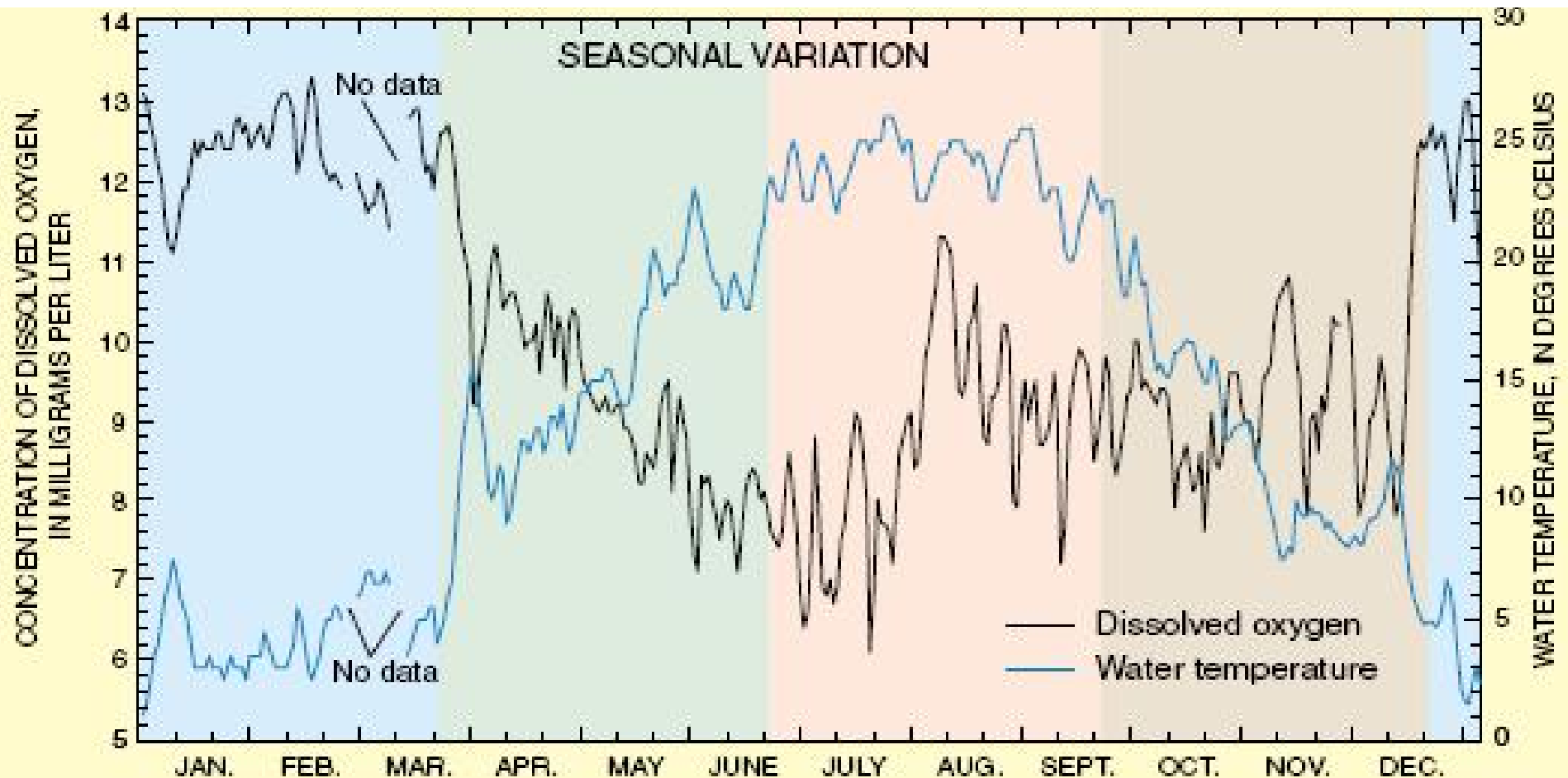
- **Dissolved Oxygen-**

- O₂ (gas) molecules dissolved in water
- How did we begin to have oxygen in our atmosphere?
 - It all started in the oceans- cyanobacteria
 - Oceans became oxygenated, and then went in the atmosphere
- Sources of oxygen to water (lakes, rivers, oceans)
 - Oxygen dissolves in water from the air
 - Primary production from the phytoplankton



What can affect dissolved oxygen concentrations in water?

- O_2 dissolving in water from the air-
 - Mixing (waves, wind)
 - Temperature (colder air holds more oxygen)
- O_2 produced in the water by primary production-
 - Nutrients
 - Light
- Destruction of O_2 -
 - Organic matter degradation (breakdown of dead organisms/waste by bacteria)



MEAN DAILY DISSOLVED-OXYGEN CONCENTRATION AND WATER TEMPERATURE, PASSAIC RIVER BELOW POMPTON RIVER AT TWO BRIDGES, N. J., JANUARY-DECEMBER 1998

How do we measure dissolved oxygen in water?

- Winkler titration (color change titration)
 - Reagents are added to a water sample until the sample changes color
 - Amount of “titrant” (color change reagent) added is proportional to oxygen concentration
 - **Most accurate** way of determining O_2 concentrations



(a)



(b)



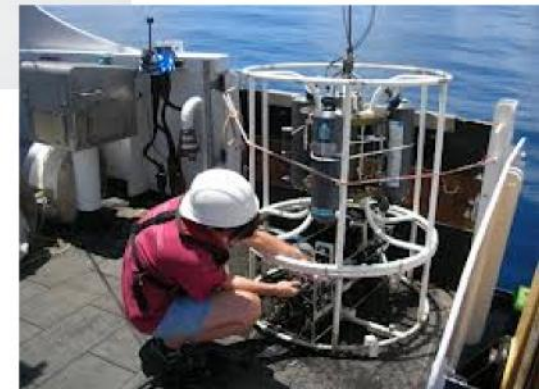
(c)



(d)

How do we measure dissolved oxygen in water?

- Dissolved Oxygen meter (probe or sensor)
 - Needs to be calibrated- use Winkler method



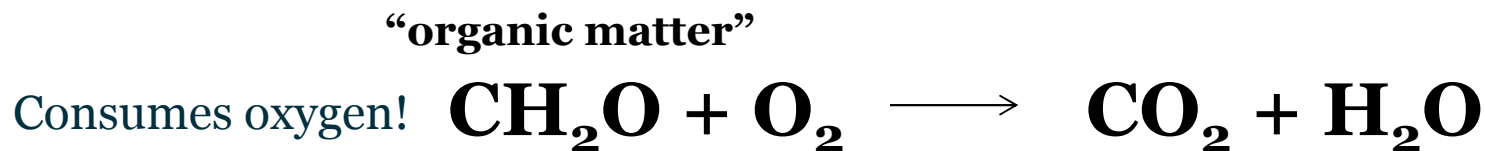
How is O₂ related to CO₂ and pH?

- It's all about photosynthesis and degradation!

Photosynthesis:

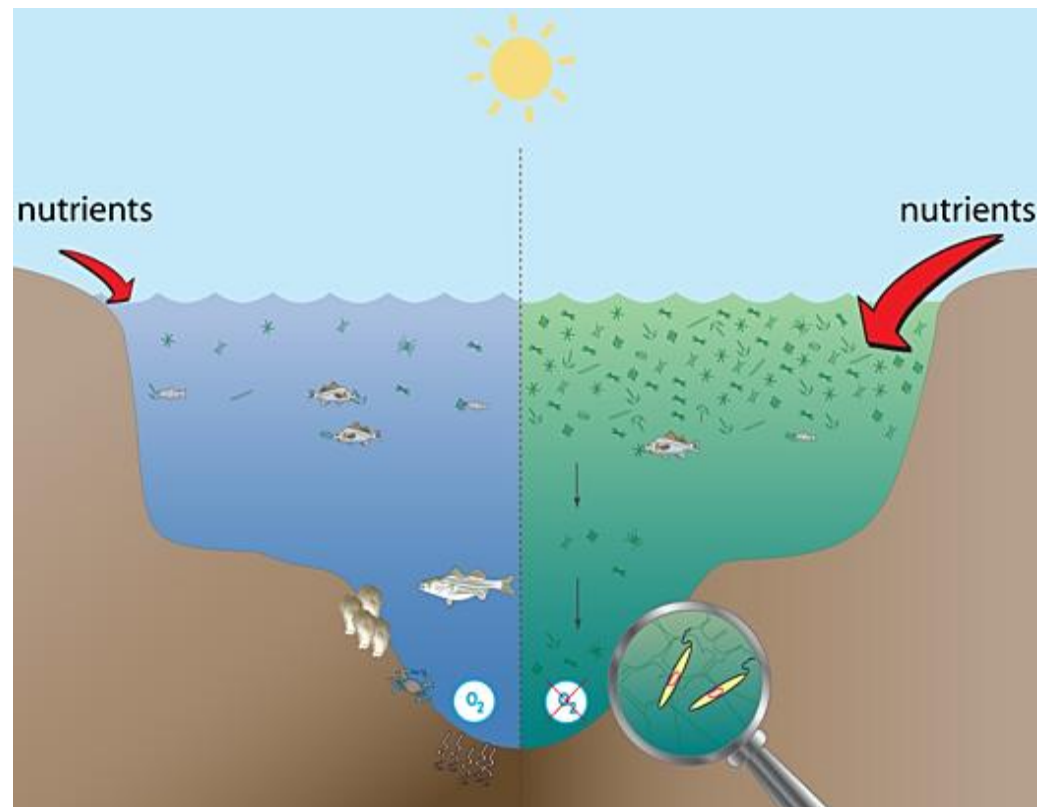


Reverse of photosynthesis:



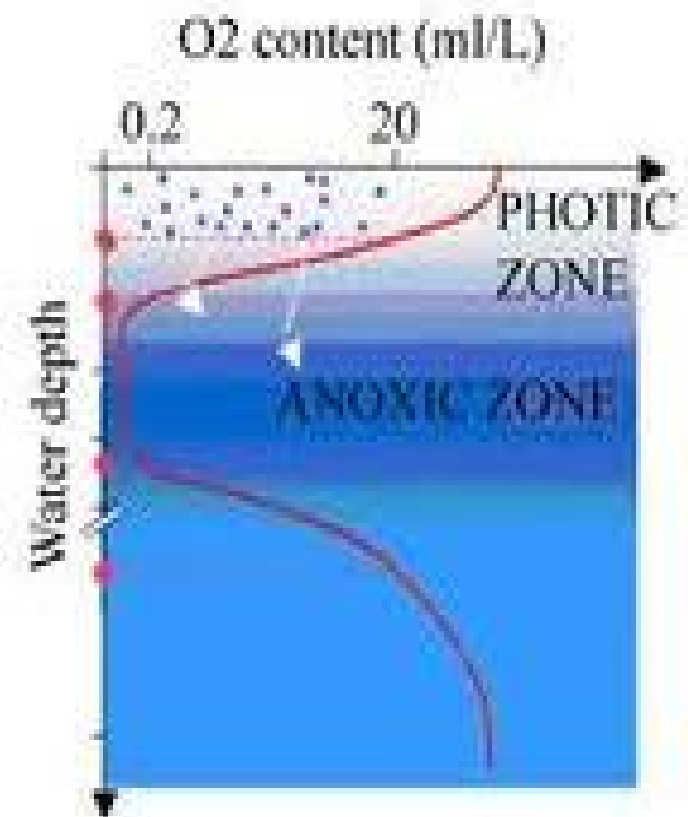
Why do we care about dissolved oxygen levels?

- More oxygen in the water leads to a healthier ecosystem
 - Higher primary production
 - Supports the base of the food web
 - Healthy fisheries



Problems with low oxygen: Oxygen Minimum Zones (OMZs)

- What causes OMZs?
 - Occur below areas of high rates of primary productivity (due to high nutrients)
 - Areas with high levels of CO_2
 - Little exchange of water with the atmosphere (stratification)





Problems with low oxygen: Eutrophication

- What is **eutrophication**?
 - When too many nutrients are added to the water (by humans) and primary production is much higher than normal
- But wait, doesn't primary production increase O_2 ?
 - Yes, at first but then the phytoplankton die and are degraded by bacteria
 - That destroys oxygen!