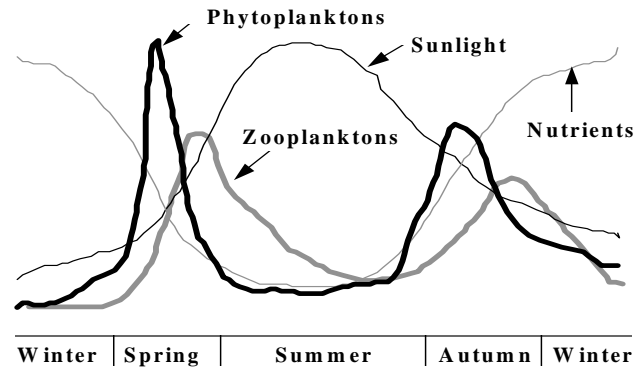
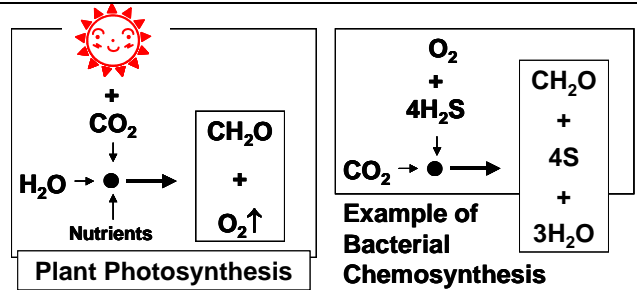
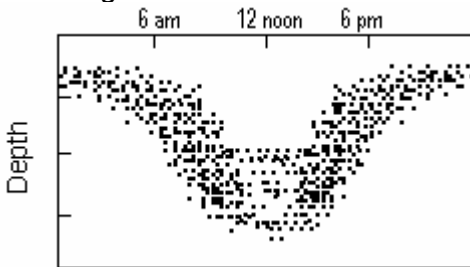


The Primary Producers

- The primary food producers or *autotrophs* are the organisms that synthesize their own food, i.e., they synthesize carbohydrates from inorganic matter.
- Both the primary food production activities — *Photosynthesis* and *chemosynthesis* — occur in the oceans.
- A primary food production activity like *Photosynthesis*
 - requires sunlight, nutrients, water and carbon dioxide (CO₂) and
 - is measured in gC/m²/yr.
- Planktons carry most of the oceanic biological activity. Of them, phytoplanktons are microscopic to submicroscopic primary food producers in the oceans. These marine autotrophs account for 90-98%, marine plants for 2-10%, and chemosynthesis perhaps <1%, of ocean's primary food production activity.
- Not surprisingly, therefore, phytoplanktonic as well as zooplanktonic activities in the temperate waters follow the seasonality of the thermocline. Indeed, a similar dependence on thermocline is also what produces the daily vertical migration of microorganisms that was first observed during World War II: it was named "deep scattering layer" because it disrupted sub-marine communications by scattering sonar signals.



- Marine biological productivity and production are generally limited to where nutrients are available in the photic waters, i.e., the coastal regions and upwellings (equatorial and circum-Antarctic).



	Primary production rate (gC/m ² /yr)	Ocean area (million km ²)	Total primary production (tons C/yr)
Open ocean	50	325 90%	16 billion 82%
Coastal Sea	100	36 10%	4 billion 18%
Upwelling	300	0.36 0.1%	0.1 billion 0.5%

Marine Autotrophs:

- Plant evolution occurred in four stages: from *thallophytae* (algae and fungi) → *bryophytae* (mosses) → *pteridophytae* (ferns) → *spermatophytae* (seed bearing plants). These are therefore the four subkingdoms of the plant kingdom. Only the first and the last of these are found in the oceans, however.
- Clearly, the evolution of marine spermatophytae could not have been intrinsic to the marine environment.
- *Thallophytae* like algae and fungi are the phytoplanktons that dominate marine life. These include blue-green, brown and red algae, diatoms and dinoflagellates. Seaweed is a large marine multicellular algae.
- Carbon compensation depth defines the depth extent for phytoplanktonic life.
- Marine vascular plants include sea grass and mangroves.
- There is increasing evidence of chemisynthesis in the oceanic environment (e.g., visit the URL: <http://www.ocean.udel.edu/deepsea/level-2/chemistry/chemo.html>).

