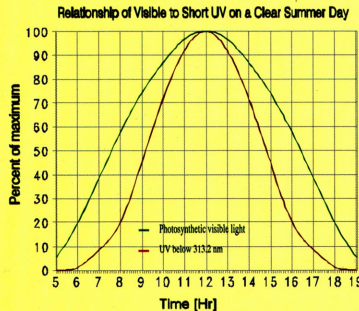


The Effect of UV-B in the Marine Environment

Short UV has the highest photon energy in the environment. Each photon at 300 nm has an energy of 4.13 electron volts., which for an einstein supplies 95 kcal per mole. This is sufficient to produce chemical reactions in many protein or pollutant molecules.

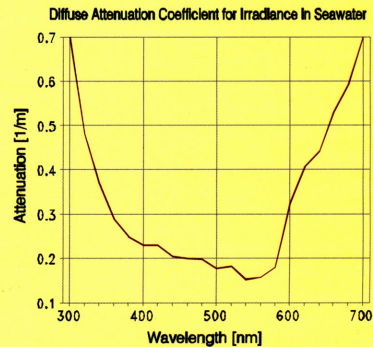
The typical sharply increasing UVB action spectrum results from photons with energy just above or below that required to break particular molecular bonds. Since breakage is defined by probability, the spectral slope increases exponentially with decreasing wavelength. Thus, even chemical processes requiring more than 95 kcal can be expected to proceed with UVB.



M.Lackiech in "GERMICIDAL & INFRARED ENERGY" D.Van Nostrand Co. (1946)
L.Koller in "ULTRAVIOLET RADIATION" John Wiley & Sons (1952)

Solar irradiance required for photosynthesis is also the source of harmful ultraviolet. Phytoplankton, a major source of marine photosynthesis and therefore a foundation for nourishing marine life, can be killed by UV. Ultraviolet absorbers and descent during high sun periods reduces UV insult.

Since damaging UV falls off more rapidly than photosynthesizing radiation with solar angle as well with sea depth, their descent reduces UV relative to PAR (see figures). Decreased stratospheric ozone will increase UV damage to phytoplankton (ref 1) and marine fauna: fingerlings, fish and crustacean larvae, and adult copepods (ref 2).



K.Baker and R.Smith in "The Role of Solar Ultraviolet Radiation in Marine Ecosystems" Plenum Press (1982).

The damaging effect of UV-B on protein molecules has a beneficial effect in respect to human needs by destroying pathogenic coli organisms in sewage treatment plants (ref 3).

- ref 1. B. Mitchell, *Scripps Institution of Oceanography*, 1991
- ref 2. R.C. Worrest, Impact of UV radiation upon *marine organisms* in the "Role of Solar UV Radiation in Marine Ecosystems", edited by J. Calkins, Plenum Press, 1982.
- ref 3. J. Calkins, *The role of solar ultraviolet radiation in "natural" water purification*, Photochemistry and Photobiology, No. 24, pg. 746-749, 1976.