Anderson, S. L., J. Machula, G. Cherr, R G. Zepp, D L. Santavy, L J. Hansen, AND E. Mueller. INDICATORS OF UV EXPOSURE IN CORALS AND THEIR RELEVANCE TO GLOBAL CLIMATE CHANGE AND CORAL BLEACHING. HUMAN AND ECOLOGICAL RISK ASSESSMENT 7(5):1271-1282, (2001).

A compelling aspect of the deterioration of coral reefs is the phenomenon of coral bleaching. Through interactions with other factors such as sedimentation, pollution, and bacterial infection, bleaching can impact large areas of a reef with limited recovery, and it might be induced by a variety of stressors including temperature and salinity extremes, and ultraviolet light. Under conditions of ocean warming, often associated with calm and stratified waters, photobleaching of UV-absorbing chromophoric dissolved organic matter (CDOM) is increased, and penetration of both UV-B. and UV-A is greatly enhanced. Indices of UV-specific effects in coral tissue are needed to test whether UV increases, associated with global climate change, are harmful to corals. To address this challenge, we have evaluated UV-specific effects in corals and have characterized factors that alter penetration of UV radiation over coral reefs. An immunoblotting assay was developed to examine UV-specific lesions (thymine dimers) in coral and zooxanthellae DNA. We observed dose-dependent increases of thymine dimers in coral (Porites porites var porites) exposed to artificial solar irradiance in a solar simulator, although effects were not strictly proportional. UV measurements were made in July 1999 at Eastern Sambo reef and nearby sites, including profiling along transects from reef to shore. Results of these analyses indicate that the coral at Eastern Sambo reef (at 34 meters) were receiving UV-B radiation that was equivalent to 25 to 30% of surface UV irradiance. However, the water just inside the reef in Hawk Channel (located closer to land) was considerably more opaque to UV. This water photobleached with loss of UV absorbance and fluorescence when it was exposed to simulated solar radiation. These results indicate that photobleaching of the DOM and transport of near-shore water out over the reefs might play a key role in controlling UV penetration to the reef surface.