



Case Study: The Tuatara

The Tuatara is endemic to New Zealand, surviving on 32 off-shore islands. From the order 'Sphenodontia', Tuatara have continued to survive here since New Zealand separated from Gondwanaland, some 80 million years ago.

The Southland Museum and Art Gallery is the world's leading captive centre for Tuatara starting with its first breeding success in 1984. The Museum faced many challenges with captive husbandry in raising Tuatara, particularly in regard to environmental lighting quality as the enclosure was indoors. A fibreglass roof was first used in 1990 to provide a source of supposedly natural lighting. All the commercial clear roofing materials available in 1990 were designed to filter out UV.



After four years under this roof I was experiencing a high egg mortality rate and signs of calcium deficiencies with baby Tuatara. An opening ventilation louver in the roof also provided a shaft of direct unfiltered sunlight and a female whose burrow was in this daily pathway produced viable eggs. These results indicated to me there was not enough UV reaching the other sun-bathing Tuatara for vitamin D synthesis. Oral vitamin supplementation did not work for the Tuatara.

A grant from New Zealand Lotteries Commission in 1995 allowed the purchase of a Skye DataHog which ran a UVA and UVB sensor. We also purchased the hand held SpectroSense for instant testing. The DataHog was used to monitor climate suitability on a southern New Zealand off-shore island for Tuatara re-colonising. This equipment provided the confirmation of insufficient UV.

No UVA or UVB was passing through the fibreglass roof. As replacing the roof at this stage was not possible the only option was to use UV bulbs where we could and replace some of the roof with ordinary glass; 5mm glass allows 60% of UVA through but no UVB. The sensors enabled me to test the UV output of the different bulbs available. I was surprised to find how UV tube type lighting was not emitting any measurable UV further than 150mm from the bulbs surface. In 2006 we replaced the roof with UVT Plexiglas which allows 75% UVB and is durable enough to withstand the elements of climate extremes.

Five years ago I made an interesting observation after a major solar flare (sun-spot activity) out-burst that interfered with global satellite communications at that time. After this event, UVB levels plummeted here. Previous midsummer readings were around 11Wm^{-2} but went down to 1.5Wm^{-2} . During the following two years UVB levels remained very low. Even in 2007, UVB levels here had only come back to half of what they were before the solar blow-out.

I suspect the Solar wind bombardment of the upper atmosphere (stratosphere) produced a lot of ozone (solar radiation hits the oxygen molecule splitting it creating ozone) and with a greater ozone density, higher frequency light, can't penetrate through at our latitude 46.5 degrees south. The angle is too acute and bounces this light off the upper atmosphere back out into space. Based on this logic, ozone will be mostly produced in the equatorial latitudes with a sun angle of light incidence less than 45° north and 45° south.



I suspect solar sun-spot cycles and their relation to ozone production may have a long term effect to all life in regard to UV. Vitamin D electrolytic metabolism relies on UVB exposure and contributes to the up-take of calcium. New Zealand's Otago University research shows there are low vitamin D levels within the population of Southland and that low levels of vitamin D may be a risk factor to the onset of Multiple Sclerosis.

A scary thought; Our teenager bone growth years are when we build our bodies calcium reserves for life. The 'today' life-style of predominantly indoors, low calcium intake, sugar-water instead of milk, UV sun block creams and little to no exercise, are all bad combinations for long term health. Bone quality will be poor and present medical problems in the future such as osteoporosis.

Mother Nature also can provide life challenges; too rapid an environmental change can result in a species struggling for genetic adaptation or even becoming extinct, as evidenced by the dinosaurs!

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