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Measuring Protons with Photons: An Optical pH Instrument for Large-Scale Monitoring of Ocean Acidification

pH, a measure of proton concentration, is a critical parameter impacting our global ocean ecology due to its governing nature in chemical equilibrium. Since the onset of the Industrial Revolution, A 0.1 drop in ocean pH has been measured off the coast of Hawaii. Many data sets suggest this is a result of a chemical exchange between Earth's atmosphere and its oceans. 30 to 40% of atmospheric carbon dioxide is absorbed by our oceans. Carbon dioxide reacts with water to produce carbonic acid, which decreases oceanic pH. The implications of this is not fully understood due to its large spatial dimensions. Usable technology exists to measure pH with sufficient accuracy and precision, but is very expensive and therefore inaccessible to the general public. We developed an indicator-based pH photometer for in-the-field measurements that is easily assembled, inexpensive, handheld, and runs off of a cell phone allowing for web linked geo-referenced data. Five of these instruments were taken and tested in the South Pacific during a student study abroad trip. The instrument proved to be useful for in-field scientific inquiry and competitive relative to other instruments of its class at a fraction of the cost. The photometer, nicknamed the "pHyter", is currently undergoing field testing by the National Oceanic and Atmospheric Administration and lab tests by Sunburst Sensors, a national leader in this technology based in Missoula, MT. A citizen's science effort distributing pHyters on coastlines around the world would surpass the size of this issue and begin a better understanding of this important change in our global system.