

## Variability of Physico-Chemical and Carbonate Chemistry of Seawater in Selected Portions of the Central Atlantic Coastline of Ghana

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**Abstract :** Increase in the oceanic carbon dioxide absorbance from the atmosphere due to climate change has led to appreciable change in the chemistry of the oceans. The change in oceanic pH referred to as ocean acidification poses multiple threats and stresses on marine species, biodiversity, goods and services, and livelihoods. Marine ecosystems are continuously threatened by plethora of natural and anthropogenic stressors including carbon dioxide (CO<sub>2</sub>) emissions causing a lot of changes which has not been experienced for approximately 60 years. Little has been done in Africa as a whole and Ghana in particular to improve the understanding of the variations of the carbonate chemistry of seawater and the biophysical impacts of ocean acidification on security of seafood, nutrition, climate and environmental change. There is, therefore, the need for regular monitoring of carbonate chemistry of seawater along Ghana's coastline to generate reliable data to aid marine policy formulation. Samples of seawater were collected thrice every month for a one-year period from five study sites for the various parameters to be analyzed. Analysis of the measured physico-chemical and the carbonate chemistry parameters was done using simple statistics. Correlation test and ANOVA were run on both of the physico-chemical and carbonate chemistry parameters. The carbonate chemistry parameters were measured using computer software programme (CO<sub>2</sub>cal v4.0.9) except total alkalinity and pH. The study assessed the variability of seawater carbonate chemistry in selected portions of the Central Atlantic Coastline of Ghana (Tsokomey/Bortianor, Kokrobitey, Gomoa Nyanyanor, Gomoa Fetteh, and Senya Breku landing beaches) over a 1-year period (June 2016-May 2017). For physico-chemical parameters, there was insignificant variation in nitrate (NO<sub>3</sub><sup>-</sup>) (1.62 - 2.3 mg/L), ammonia (NH<sub>3</sub>) (1.52 - 2.05 mg/L), and salinity (sal) (34.50 - 34.74 ppt). Carbonate chemistry parameters for all the five study sites showed significant variation: partial pressure of carbon dioxide (pCO<sub>2</sub>) (414.08-715.5 μmol/kg), carbonate ion (CO<sub>3</sub><sup>2-</sup>) (115-157.92 μmol/kg), pH (7.9-8.12), total alkalinity (TA) (1711.8-1986 μmol/kg), total carbon dioxide (TCO<sub>2</sub>) (1512.1 - 1792 μmol/kg), dissolved carbon dioxide (CO<sub>2</sub>aq) (10.97-18.92 μmol/kg), Revelle Factor (RF) (9.62-11.84), aragonite (ΩAr) (0.75-1.48) and calcite (ΩCa) (1.08-2.14). The study revealed that the partial pressure of carbon dioxide and temperature did not have a significant effect on each other ( $r^2 = 0.31$ ) (p-value = 0.0717). There was an appreciable effect of pH on dissolved carbon dioxide ( $r^2 = 0.921$ ) (p-value = 0.0000). The variation between total alkalinity and dissolved carbon dioxide was appreciable ( $r^2 = 0.731$ ) (p-value = 0.0008). There was a significant correlation between total carbon dioxide and dissolved carbon dioxide ( $r^2 = 0.852$ ) (p-value = 0.0000). Revelle factor correlated strongly with dissolved carbon dioxide ( $r^2 = 0.982$ ) (p-value = 0.0000). Partial pressure of carbon dioxide corresponds strongly with atmospheric carbon dioxide ( $r^2 = 0.9999$ ) (p-value = 0.00000).

**Keywords :** carbonate chemistry, seawater, central atlantic coastline, Ghana, ocean acidification

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