

## **Temporal and Spatial Variation of Biological Pump for Air-water Exchange of CO<sub>2</sub> Controlled by Phytoplankton Productivity**

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Mathematical simulations predict that the pre-industrial atmospheric CO<sub>2</sub> concentration might have been as high as 460 ppm in the absence of a biological pump (Sarmiento and Toggweiler, 1984). An estuary can be shifted from source to sink for CO<sub>2</sub> when phytoplankton production predominates over heterotrophic production, resulting significant change of regional atmosphere composition with respect to carbon dioxide. Out of the five major rivers on the east coast of India, The Ganges with mangroves at the lower stretch of its distributaries, Saptamukhi, Thakuran etc and the Mahanadi with fringing mangrove at the lower stretch have different nutrient composition and biological communities especially with reference to primary producers. Bascillariophyceae, Dinophyceae Cyanophyceae and Chlorophyceae were the major group of phytoplankton in the Mahanadi estuary, while Saptamukhi estuary was enriched with Bascillariophyceae and Dinophyceae. Flux of carbon dioxide from the Mahanadi estuary to the atmosphere was found to be greater ( $52.87\text{--}2472.16\text{ }\mu\text{M.m}^{-2}.\text{h}^{-1}$ ) than that of Saptamukhi estuary ( $4.7\text{--}810.62\text{ }\mu\text{M.m}^{-2}.\text{h}^{-1}$ ) (Table 1). Reverse trend was observed for primary productivity and the Saptamukhi estuary showed greater primary productivity ( $54.23 \pm 18.39\text{ mg C m}^{-3}.\text{h}^{-1}$ ) than that of the Mahanadi estuary ( $45.43 \pm 21.91\text{ mg C m}^{-3}.\text{h}^{-1}$ ). Earlier Biswas et al (2004) reported that the biological processes could remove 59.3% of the emitted CO<sub>2</sub> from the atmosphere in the heterotrophic Sundarban mangrove waters. Activity of biological pump could be more significant to control atmospheric CO<sub>2</sub> at 344-394.8 ppmv over the Saptamukhi relative to that of the Mahanadi with more CO<sub>2</sub> (344–412.25 ppmv) in the atmosphere.

Table 1. Seasonal variation of air-water CO<sub>2</sub> flux, GPP, NPP, R and number of phytoplankton at two different estuaries.

<b>Saptamukhi</b>	CO <sub>2</sub> flux (μM.m <sup>-2</sup> .h <sup>-1</sup> )	GPP (mg C m <sup>-3</sup> .h <sup>-1</sup> )	NPP (mg C m <sup>-3</sup> .h <sup>-1</sup> )	Community Respiration (R, mg C m <sup>-3</sup> .h <sup>-1</sup> )	No Of Phytoplankton cells.L <sup>-1</sup>
Premonsoon	307.28±394.99	69.96±12.03	81.66±80.92	57.31±21.09	1.54E+04±3.35E+02
Monsoon	45.05±43.72	41.00±12.67	56.07±16.85	14.48± 8.09	8.88E+03±5.64E+02
Postmonsoon	43.06±30.96	34.02±17.30	34.29± 0.95	67.53±18.77	8.04E+03±5.60E+02
<b>Mahanadi</b>					
Premonsoon	148.24±134.02	47.06±31.35	34.01±26.48	65.00±39.42	5.18E+04±2.26E+03
Monsoon	1420.56±1487.19	31.46±39.71	36.45±50.24	11.57± 8.09	6.80E+04±4.39E+03
Postmonsoon	1295.88± 402.43	57.76±10.32	64.43±18.07	25.07± 10.22	4.21E+05±1.80E+04

## References

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