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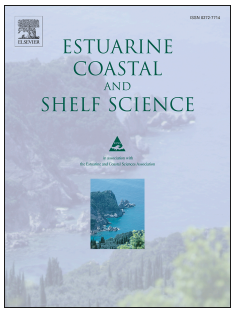

Nitrogen fixation rates in the eastern Arabian Sea

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Ayaz Ahmed*, Mangesh Gauns, Siby Kurian, Pratirupa Bardhan, Anil Pratihary,

Hema Naik, Damodar Shenoy and S.W.A Naqvi

CSIR-National Institute of Oceanography, Dona Paula Goa-403004

*Corresponding author: Ayaz Ahmed, e-mail: naikayaz80@gmail.com

Abstract

The Arabian Sea experiences bloom of the diazotroph *Trichodesmium* during certain times of the year when optimal sea surface temperature and oligotrophic condition favour their growth. We measured nitrogen fixation rates in the euphotic zone during one such event in the Eastern Arabian Sea using $^{15}N_2$ tracer gas dissolution method. The measured rates varied between 0.8 and 225 µmol N m^{-3} d^{-1} and were higher than those reported from most other oceanic regions. The highest rates (1739 µmol N m^{-2} d^{-1}; 0-10 m) coincided with the growth phase of *Trichodesmium* and led to low $\delta^{15}N$ (< 2‰) of particulate organic matter. At stations not experiencing *Trichodesmium* bloom nitrogen fixation rates were low (0.9 - 1.5 µmol N m^{-3} d^{-1}). Due to episodic events of diazotroph bloom, contribution of N_2 fixation to the total nitrogen pool may vary in space and time.

Keywords: Nitrogen cycle, N_2 fixation, *Trichodesmium*, Arabian Sea, Indian coast

1. Introduction

The availability of nitrogen (N) is essential for biological production in the ocean. However, most parts of the world oceans are depleted in bioavailable nitrogen at the surface (Montoya et al., 2004). Supply of nitrate from deep water is the major source of new nitrogen sustaining primary productivity. This flux of new nitrogen into the euphotic zone is balanced by loss through sinking particles (Dugdale and Goering 1967) and export of organic nitrogen out of the upper ocean (Eppley and Peterson, 1979; Lewis et al., 1986; Platt et al., 1992; Capone et al., 2005). Estimates of the nitrogen demand for new production, however, often exceed nitrate flux into the euphotic zone (Lewis et al., 1986) prompting speculation about other nitrogen inputs (Legendre and Gosselin 1989, Karl et al., 2002). Several studies have shown that biological nitrogen fixation plays a critical role in supporting new production (Carpenter and Romans, 1991; Gruber and Sarmiento, 1997; Karl et al., 1997; Capone et al., 1997; Montoya et al., 2002; Gruber, 2008; Großkopf et al., 2012) by providing the largest external input of nitrogen to the ocean, thereby also exerting important control on the ocean's nitrogen inventory (Falkowski et al., 1998;