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ALGAL BLOOMS DUE TO TROPHIC INTERACTION: STUDY OF TIME DELAY MODEL

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Abstract. In this paper, we consider a discrete delay differential equation model of an outbreaks that links the trophic structure of primary and secondary producer in the estuary. Although the environmental and other physical factors that unleashed the bloom, but ensuing duration and severity of an outbreak are largely due to the subsequent biological activity between organisms. We give results that are qualitatively resemble with those observed in the Hoogly estuary, India and thereby offers an insight for the factors that sustain a bloom in this region. We have derived the conditions for asymptotic stability of the steady state. The criterion for existence of Hopf-bifurcating small amplitude periodic oscillations are derived. Finally, all the analytical results are interpreted ecologically.
Keywords. Algal bloom, discrete delay, biological activity, asymptotic stability, Hopf-bifurcation, periodic fluctuations.

1. INTRODUCTION

Any aquatic system starts its lifecycle as aligotrophic, i.e., a clear body of water and in this system normal growth of algae occurs. This growth of algae have been studied particularly in estuaries and coastal areas for a long period of time (Canale et.al.,1976; Vidal,1980; Powel and Richerson,1985; Legovic,1997).

During recent years due to man made pollution by discharging sewage and agricullural run-off containing phosphates, nitrates or other nutrients to the aquatic system, cause overnutrition, leading to the formation of thick algal mat on the surface layer which reduces the photic zone and this condition is called eutrophication or algal bloom. The bloom events are marked by a sudden proliforation of cell counts that exhibit hapazard fluctuations, followed by a rapid disintegration. The rate of eutrophication strikes a balance between the production of aquatic life particularly fisheries, aquaculture and its destruction by bacterial decomposition. Beltrami (1996) studied the harmful *Aureococeus anophagefferens* bloom along a part of the coastline of the northeastern United States. A nutritional threshold exists in the aquatic system below which the algal species remains essentially undetected at endemic