

# Holling Type-II Functional Response in Aquatic Ecosystem Models Shaping Spatial Heterogeneous Distribution of Phytoplankton Data at Tokyo Bay

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## ABSTRACT

The grazing functional responses shaped the underlying dynamics of theoretical and experimental bio-geochemical models and assumed to be potential to control the top-down dynamics of aquatic ecosystem. In general, the basis of using the particular grazing functional response is not very conclusive except for some experimental models and hence which functional response is suitable for a particular model and in which way it is beneficial for undergoing study, are highly debatable. Conventionally, mathematical models are developed based on mean-field approach in which only first central moment-approximation is applied. Such models may be applicable for meso- or bigger scale measurements but inappropriate when measurements are performed at micro-(mm) scale. To encounter fluctuation in spatially distributed phytoplankton at micro-scale, the Reynold's decomposition from turbulence theory, in which, each variable decomposed into mean and fluctuating parts, are applied. In this way, a new modelling called, the closure model is developed by retaining upto the second central moment-approximations in Taylor series. Based on the comparison of observed intermittent phytoplankton data and model simulation results, we hypothesize that "Holling type-II grazing functional response for higher predators in aquatic ecosystem is more suitable functional response to explain full range of coefficient of variation (CV) data at Tokyo Bay".

**Keywords:** Environmental Heterogeneity; Closure modelling; Functional response; Intermittency.



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