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# A Study of Chaos Control Schemes for Plankton-Fish Dynamics

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**Abstract :** The existence of chaos in the marine ecosystems may cause planktonic blooms, disease outbreaks, extinction of some plankton species, or some complex dynamics in oceans, which can adversely affect the sustainable marine ecosystem. The control of the chaotic plankton-fish dynamics is one of the main motives of marine ecologists. In this paper, we have studied the impact of phytoplankton refuge, zooplankton refuge, and fear effect on the chaotic plankton-fish dynamics incorporating phytoplankton, zooplankton, and fish biomass. The fear of fish predation transfers the unpredictable(chaotic) behavior of the plankton system to a stable orbit. The defense mechanism developed by prey species due to fear of the predator population can also terminate chaos from the given dynamics. Moreover, the impact of external disturbances like seasonality, noise, periodic fluctuations, and time delay on the given chaotic plankton system has also been discussed. We have applied feedback mechanisms to control the complexity of the system through the parameter noise. The non-feedback schemes are implemented to observe the role of seasonal force, periodic fluctuations, and time delay in suppressing the given chaotic system. Analytical results are substantiated by numerical simulation.

**Keywords :** plankton, chaos, noise, seasonality, fluctuations, fear effect, prey refuge
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