

## **Regime shifts in coral reefs under macroalgal toxicity and overfishing**

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### **Abstract:**

Macroalgae and corals compete for the available space in coral reef ecosystem. While herbivorous reef-fish play a beneficial role in decreasing the growth of macroalgae in coral reef ecosystem. Abundance of macroalgae changes the community structure towards macroalgae dominated reef ecosystem. We investigate coral-macroalgal phase shifts by means of a continuous time model in a food chain. It is observed that in presence of macroalgal toxicity and overfishing the system exhibits hysteresis through saddle-node bifurcation and transcritical bifurcation. We also examine the effects of time lags in the liberation of toxin by macroalgae and recovery of algal turf in response to grazing of herbivores on macroalgae.