

Equilibrium Solutions for Marine Food-chain to Bottom-up and Top-down Controls

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Using a simple four-level food-chain model (N: nutrient, P: phytoplankton, Z: zooplankton and F: fish), the equilibrium solutions are investigated under the nutrient supply (bottom-up control) and the loss-parameter of fish (top-down control). The solutions of bottom-up control suggest that Z stock is always stabilized, while those of top-down control reveal the phase relation between [N, Z] and [P, F] is out of phase.

Keywords: Bottom-up control, Top-down control, Marine food-chain, Volterra equation

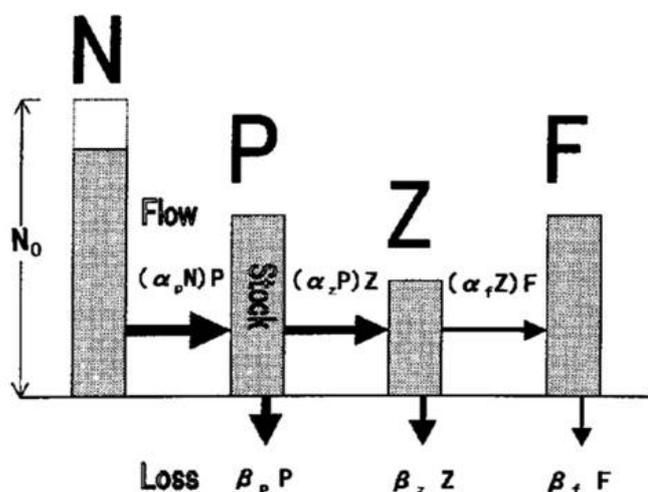


Fig. 1. Diagram of the dynamics of our food-chain model with four stock levels: N (nutrient), P (phytoplankton), Z (zooplankton), and F (fish).