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PEMODELAN DINAMIK FITOPLANKTON MENGGUNAKAN MODEL NUTRIEN-FITOPLANKTON-ZOOPLANKTON

(Dynamic Modelling of Phytoplankton using Nutrient-Phytoplankton-Zooplankton Model)

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ABSTRAK

Kadar pertumbuhan fitoplankton yang berlebihan boleh membawa impak yang negatif kepada ekosistem di Tasik Chini. Walau bagaimanapun, fitoplankton merupakan komponen penting dalam jaringan makanan akuatik. Oleh itu, kajian terhadap kepekatan fitoplankton dalam Tasik Chini adalah penting agar dapat memantau keadaan ekosistem tasik. Kajian ini bertujuan untuk membangunkan model matematik dinamik yang sesuai bagi fitoplankton di Tasik Chini dengan menggunakan model nutrien-fitoplankton-zooplankton, serta untuk mengenal pasti bahawa input nutrien adalah faktor kawalan bagi model ini. Persamaan pembezaan biasa (PPB) digunakan untuk simulasi model fitoplankton di Tasik Chini. Model fitoplankton ini terdiri daripada kepekatan nutrien (*Nu)*, fitoplankton (*F*) dan zooplankton (*Z*). Sistem PPB ini diselesaikan dengan kaedah Runge-Kutta-Fehlberg, menggunakan perisian Maple 13. Model *NuFZ* yang dibangunkan ini memilih input nutrien sebagai parameter bifurkasi, iaitu model ini dikawal oleh input nutrien. Hasil kajian menunjukkan bahawa kesan daripada peningkatan input nutrien ke dalam sistem tasik telah menyebabkan sistem menjadi tidak stabil dan kepadatan fitoplankton berubah-ubah. Model ini berguna untuk membantu dalam pemahaman populasi fitoplankton di Tasik Chini.

Kata kunci: Persamaan pembezaan biasa; model fitoplankton; Tasik Chini

ABSTRACT

The widespread growth rate of phytoplankton can cause negative impact to the ecosystem in Tasik Chini. However, phytoplankton are important component in the aquatic food web. Thus, the study on the concentration of phytoplankton in Tasik Chini is essential in order to monitor the ecosystem of the lake. The aim of this study is to develop appropriate dynamic mathematical model of phytoplankton in Tasik Chini by using nutrient-phytoplankton-zooplankton model and to determine the nutrient input as the controlling factor in this system. Ordinary differential equations (ODE) are used to simulate the model of phytoplankton in Tasik Chini. The phytoplankton model is governed by the concentration of nutrient (*Nu)*, phytoplankton (*F*) and zooplankton (*Z*). The ODE system settled down by using Runge-Kutta-Fehlberg method with Maple 13. *NuFZ* model is developed by choosing nutrient input as bifurcation parameter, that is the model is nutrient controlled. The results show that the lake system becomes unstable and the phytoplankton density start to oscillate when nutrient input in the system is increasing. This model is useful in assisting the understanding of phytoplankton populations in Tasik Chini.

Keywords: Ordinary differential equations; phytoplankton model; Tasik Chini

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