# Oscillations and Waves in a Plankton System with Viral Infection

Horst Malchow[1] , Frank Hilker[2]  and Sergei V. Petrovskii[3].

A model of phytoplankton-zooplankton dynamics [1, 2, 3] is considered for the case of viral infection of the phytoplankton population. There is not so much known about the mechanisms of viral infection and spread of disease in and between plankton populations as well as along plankton-fish food chains. A few papers on the modelling of the impact of virus-infected plankton during the termination of phytoplankton blooms have been published [4, 5]. Here, the phytoplankton population is split into a susceptible ($S$) and an infected ($I$) part. Both parts grow logistically, limited by a common carrying capacity. Zooplankton ($Z$) is grazing on susceptibles and infected, however, the uptake of infected leads to a higher mortality. The local analysis of the $S$-$I$-$Z$ differential equations yields a number of stationary and/or oscillatory regimes and their combinations. Correspondingly interesting is the spatiotemporal behaviour, modelled by reaction-diffusion equations. Spati al spread or suppression of infection will be presented just as well as competition of concentric and/or spiral population waves with non-oscillatory sub-populations for space, and long transients to spatially homogeneous population distributions.

[1]Institute for Environmental Systems Research, Department of Mathematics and Computer Science, University of Osnabrück, D-49069 Osnabrück, Germany (e-mail: malchow@uos.de).

[2]Institute for Environmental Systems Research, Department of Mathematics and Computer Science, University of Osnabrück, D-49069 Osnabrück, Germany (e-mail: fhilker@uos.de).

[3]Shirshov Institute of Oceanology, Russian Academy of Science, Nakhimovsky Prospekt 36, Moscow 117218, Russia (e-mail: spetrovs@sio.rssi.ru).

## References

[1] Scheffer, M., 1991, Fish and nutrients interplay determines algal biomass: a minimal model, *OIKOS*, 62, 271-282.

[2] Pascual, M., 1993, Diffusion-induced chaos in a spatial predator-prey system, *Proc. R. Soc. Lond. B*, 251, 1-7.

[3] Malchow, H., 1993, Spatio-temporal pattern formation in nonlinear nonequilibrium plankton dynamics, *Proc. R. Soc. Lond. B*, 251, 103-109.

[4] Beltrami, E. & T.O. Carroll, 1994, Modelling the role of viral disease in recurrent phytoplankton blooms, *J. Math. Biol.*, 32, 857-863.

[5] Chattopadhyay, J. & S. Pal, 2002, Viral infection on phytoplankton-zooplankton system - a mathematical model, *Ecol. Model.*, 151, 15-28.