

## INFLUENCE OF HARVEST ON THE DYNAMICS OF POPULATIONS WITH AGE AND SEX STRUCTURES

Oksana Revutskaya, Galina Neverova, Efim Frisman  
Institute for Complex Analysis of Regional Problems Far Eastern Branch Russian  
Academy of Sciences, Birobidzhan, Russia

The population harvesting control is one of the important problems in mathematical biology. Due to harvesting the population density decreases, which leads to intensive reproduction of the population of game animals. At the same time, the individuals of unexploited populations with high density are often under stress, their birth rate decreases and mortality increases due to epizootics and other intra-population factors. As a result harvesting strategies should be developed with taking into account of population structure, in particular, age and sex structures.

The paper investigates influence of sex- and age-specific harvest on the dynamics of structured populations based on the mathematical model with discrete time. We assume birth rate depends on the population sex ratio and is described by the modified harmonic mating function with switching. The population size is regulated by decreasing juvenile survival rate with growth of sex-age class sizes. The aim is to study the mechanisms of formation and evolution of dynamic modes for the exploited structured population models due to harvesting intensity. Conditions for sustainable development of the exploited population are obtained. Dynamic modes of the population models are studied. Influence of birth, survival, and self-regulation rates, the formation process of the mating pairs, and sex- and age-specific harvest on transitions between different dynamic modes are investigated. Sex-specific harvest of mature females or males will change the pair formation if the sex class, whose number of individuals is more, is exploited. Depending on values of the population parameters, the sex- and age-specific harvest (juveniles, mature females or males) can result in both damping of the oscillations, which stabilizes population dynamics, and the oscillation appearance, including two-year or quasiperiodic population fluctuations. The model of exploited population reveals the phenomenon of multistability, which is typical for a population without harvesting. The multistability is the result of complex bifurcations occurring due to both the system nonlinearity and the changing pair formation principle.

This work was performed in the framework of the State targets of the Institute of Complex Analysis of Regional Problem FEB RAS and partially supported by the Russian Foundation for Basic Research (No. 18-04-00073 a).