MATHEMATICAL MODELLING OF
POPULATION DYNAMICS
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INTRODUCTION

Population dynamics is the study of changes in the number and composition of individuals in a population, and the factors that influence those changes. Although the first population models appeared in ecology and demography, they have become increasingly important in almost all branches of biology. The rapidly developing techniques of molecular biology and genetics produce large quantities of data that demand mathematical analysis and modelling. Nowadays mathematical modelling of population dynamics is a central topic in mathematical biology and some biologists find that mathematical models are absolutely essential for research in modern biology. Mathematics provides a broad spectrum of methods to study population dynamics. The models use all types of differential equations, probability theory, dynamical systems, discrete mathematics and also very complicated systems which include age, stage or size structures.

The Conference on Mathematical Modelling of Population Dynamics was held at the Mathematical Conference Centre, Będlewo, Poland, from June 24 to June 28, 2002 with 98 participants from 20 countries. The conference was organized by the Institute of Mathematics of the Polish Academy of Sciences, within the EU Programme Centre of Excellence coordinated by the Stefan Banach International Mathematical Centre through the package *Mathematical Modelling and Analysis of Cellular Populations*. The conference was preceded by *The School on Population Dynamics*, also held at Będlewo from June 17 to June 21, 2002. The school was addressed to advanced graduate students and PhD students.

Both meetings focused on mathematical modelling and model analysis of populations at various levels, including cells, genes, and biomolecules, and of population dynamics in ecology, epidemiology and infectious diseases, genetics, physiology, immunology and cancer growth. A variety of important and current topics of population dynamics were presented in more than 60 lectures at the Conference, and nine courses at the School.

This volume contains a collection of three survey papers and ten research articles devoted to mathematical methods in biology and medicine. It reflects some of the recent advances in the field of mathematical modelling of population dynamics, whereas papers presenting the most topical subjects in modern biological research are published in a special issue of the Life Sciences series of Comptes Rendus de l'Académie des Sciences.

The survey papers present the courses given at the school:

1. Ovide Arino and Eva Sánchez, *Delays Induced in Population Dynamics*,

2. Odo Diekmann, *Adaptive Dynamics*,
3. Glenn F. Webb, *Structured Population Dynamics*,

and provide an excellent introduction to the modern mathematical modelling in biology. The papers indicate several current trends in population dynamics. They also illustrate the balance between adequate description of biological phenomena and mathematical methods and techniques. We hope that this volume will be of interest both to biologists and mathematicians.

Each manuscript has been reviewed according to the standards of Banach Center Publications. Thus, this volume consists of a set of high quality articles on mathematical aspects of population dynamics.

I wish to express my gratitude to all authors for their contribution to this publication.

Ryszard Rudnicki