
Preface

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At an unprecedented speed, the biosphere is undergoing alteration at all levels of its organization. Pollutants, habitat fragmentation, global warming, species' invasion, and land management changes are creating considerable changes in the functioning of meta-ecosystems. This is occurring through changing aspects of the physical/chemical environment (e.g. temperature, humidity, erosion, etc.), changing habitat availability (e.g. habitat loss, fragmentation, and degradation), and by changing biodiversity dynamics (invasive species, changing species composition, etc.). For millennia, organisms have evolved ways of tackling spatial and temporal fluctuations in their abiotic and biotic environments. Local adaptation, selection, and phenotypic plasticity are all well-known processes to adapt to environmental change or fluctuation. However, such processes have limits especially when the environmental changes are too rapid or too big as is currently the case. In many cases, the only mechanism left to cope with large scale modifications of the local environment will be to leave it and settle in a better one; i.e. to disperse.

Dispersal has long been recognized to be an important life-history trait. Dispersal evolves in response to any kind of alteration in the biotic and abiotic environment, and dispersal profoundly changes the potential for local adaptation and population genetic differentiation. It plays a prominent role in meta-population (and in meta-community and meta-ecosystem) dynamics, species invasion, range shifting, and hence in conservation biology and population management. With the rapid changes that most ecosystems are undergoing, there has been a renewed interest about the causes, con-

sequences, and mechanisms of dispersal. Over the last twenty years there has been a steady increase in studies dealing with dispersal and/or migration. In particular, two important books on dispersal, edited by two of the current editors, were published about ten years ago (Clobert *et al.* 2001, Bullock *et al.* 2002). The great theoretical and empirical advances over even that short period are testament to the research interest in this subject. Despite this interest and although the importance of this particular life-history trait is widely recognized, it is perhaps understudied with respect to its overall importance in spatial ecology. There are several reasons for this. Dispersal may occur at spatial scales that are often difficult to cover. Dispersal is also a complex behaviour (see Part I) which is the result of an integration of genetic, morphological, physiological, and, sometimes, behavioural factors with an individual's specific environment (see Parts II and III, Benton and Bowler 2005, Clobert *et al.* 2009). Dispersal is often confused with migration (which are periodic movements), and this confusion is furthered as some geneticists also call dispersal migration). Dispersal is basically a three-step process which includes departure from the local environment, the movement across a more or less hostile matrix, and settlement in a new habitat. Processes at work within each of these stages might be different (Part IV) and each stage entails different costs (Bonte *et al.* 2011). Furthermore, the proximal causes of departure, the path across the matrix, and the criteria for settling in a new habitat might strongly interact, creating many potential strategies as the dimension of the interactions. It follows that, depending on the type of environmental change considered (Parts V and

VI), the consequences of dispersal for dynamics (population and evolutionary) can be complex and variable, and therefore be contrary to the predictions which are derived from simplest models.

The book has been organized in seven parts in which we have tried to cover most of the hottest topics in the study of dispersal. The first part deals with the many interacting causes of the dispersal process. The second deals with the genetic structure of the trait, and the third with its association with other life-history traits. Part III considers the covariation between dispersal and other life-history traits, and stresses reality of dispersal syndromes. Part IV recognizes that recent years have seen the development of conceptual frameworks to integrate movement into dispersal. The importance of dispersal for spatial dynamics is the theme developed in the fifth part. Because the biosphere is experiencing unprecedentedly rapid alterations, the two last parts focus on two important aspects of these alterations: habitat fragmentation and global (in particular climatic) changes.

Each section is composed of five chapters: the first reviews the recent research, the second either reviews relevant theory or presents theoretical work pertaining

to the section, and finally chapters 3, 4, and 5 describe case studies on vertebrates, invertebrates, and plants respectively. In some cases, the example chapters are mini-reviews of systematic, and particularly well-studied taxonomic groups. The only exception to this structure is the 'genetic' section for which no real theory is yet available on the way the genetic structure underpinning the dispersal process has evolved.

The book concludes with a chapter which is an attempt to bridge human and non-human dispersal. We deliberately give some details about human expansion and the likely reasons for it such that everyone might build their own opinion about the possible parallels.

To help readers, we provide a Glossary with definitions of the most important terms used throughout the book. In most cases, a given term has the same meaning through all chapters. In order to avoid repetition, we also provide four initial introductory boxes for the most well-studied, or iconic, model systems.

We are grateful to leading authors in the field of dispersal for their time and dedication to the production of this book. We dedicate our efforts with this volume to our respective partners and children.