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Summary of Part I

Biological invasions have become one of the most significant threats to global biodiversity as they have severe consequences for ecosystems. The movement of aquatic and terrestrial non-indigenous species worldwide, either intentional or accidental, has triggered a homogenization of biota by breaking down natural barriers. Numerous vectors responsible for the introduction of these non-indigenous species have been identified and described over the years. Several studies have been conducted exclusively to understand and quantify the role of vectors and the impacts of invasions.

The first section of this book includes six chapters characterizing several vectors of introduction as well as spatial and temporal scale patterns of invasions across different ecosystems and taxonomic groups. The section opens with an account on vectors of marine invasions, where James Carlton and Greg Ruiz (**Chapter 1**) present a general framework for vector science, expanded from a previous 10-year-old model. In the marine system, several studies conducted over the years have contributed to the current understanding of species movements on our planet. However, over time, the causes, routes, corridors, vectors, propagule pressure, and vector strength of these movements have changed, leading to a fair number of unanswered questions. In this opening chapter, Carlton and Ruiz leave the term ‘pathway’ behind and give life to ‘vector science’, a framework that could encompass the 4 stages of the standard models of invasion (transport, introduction, establishment and spread). The authors further review the role of several vectors that contribute to the spread of marine invasive species.

Chapter 2 by Phillip Cassey and co-authors reviews the biogeography of bird invasions, with particular emphasis on the history and market trade of birds. Despite their great capacity for flying long distances, bird species have also been influenced by humans in their movement across continents. Interest in birds has been increasing over time as a source of food, hunting sports, and also for pets and ornamentation, contributing to a breaking down of the remaining barriers. This chapter identifies two eras that had a major impact on the spread of non-native birds: i) the era of the Acclimatisation Societies between the eighteenth and twentieth centuries; and (ii) the era of the international trade in wild birds for bird-keeping from the late-twentieth century to the present. The authors refer to several examples from different geographic locations and elaborate on future trends in avian invasions.

Mark Sytsma and Toni Pennington provide an overview of the pathways and vectors involved in the anthropogenic and natural dispersal of freshwater vascular plants in **Chapter 3**. Non-native vascular plants are known to cause ecological damage when transplanted to other ecosystems. In this chapter, the authors categorize vectors as primary (vectors for initial introduction to a new habitat) and secondary (natural processes for spread following establishment) and illustrate these two

categories with several examples. In this account, authors attribute key importance to vector management, but suggest that new effective predictive models of non-native species dispersal will require a combination of better knowledge of organism biology, probability of introduction, and site suitability.

Insects and other arthropods, too, are considered relevant invasive species both in magnitude and in their economic impact. **Chapter 4** by George K. Roderick and Maria Navajas outlines the major pathways and vectors for insect invasions and also provides novel insights on new emerging tools, such as molecular population genetics, computational methods, climate modeling, and collection science. The authors further highlight the significance of policy and risk assessment in the management of invasive arthropods.

As a result of human actions, freshwater fishes and invertebrates are capable of traveling between and across ecosystems, contributing to a more homogeneous biodiversity. In freshwater ecosystems, aquaculture and aquarium release appear to be the main sources of introduction, but stocking and ornamental pet industry have high importance. Through time, many factors that influence invasion by invertebrates and fishes have changed due to reasons ranging from improvements of transport to the change of peoples' interest in different animal groups. In **Chapter 5** of this work, Pam Fuller reviews the causes and vectors of invasions in freshwater fishes and invertebrates with several North American examples and also provides basic solutions for these problems.

Finally, in **Chapter 6** Christina Romagosa describes the live animal trade, the vectors through which animals are transported, and how each vector has contributed to invasions on a global scale. The transport of live animals involves the exchange of several millions of individuals worldwide and is a growing issue. The intentions of the transport of live animals are numerous and human-driven, such as zoos, tourist attractions, and religious purposes. In addition, certain species are exploited for other purposes such as food, traditional medicine, or fishing bait.