Preface

It was walking along the banks of the beautiful glacier-fed lake Chiar Khota (4660 metres) in the Bolivian Cordillera Real that it suddenly occurred to us that we should write a book on our beloved high altitude waters. That was in October 2013, during a research project on high Andean wetlands, or 'bofedales'. Before that we had been working together for many years on the high, glacier-covered volcanoes of Ecuador, studying the ecology of páramo streams. We became fascinated by the biodiversity, the biological interactions, and the ecological regulation of high altitude streams, lakes, and wetlands, but also deeply concerned about their value in terms of ecosystem services, and their future in a world of increasing human land use and climate changes. Our own experiences, combined with a lack of a thorough overview of the biology and ecology of these important ecosystems, motivated us to write this book.

Who has not heard of the tarns of Mount Kenya, located between the small glaciers above and the clouds of the tropical savanna far below? Or the hundreds of lakes in the Colorado Rockies? Or the headwaters of the large Asian rivers on the Tibetan Plateau? If not, they surely know Lake Titicaca, with its floating islands of totora reeds and giant endemic *Telmatobius* water frogs especially adapted to low oxygen pressure. However, high altitude freshwaters are much more than these iconic systems; they are both numerous and include a wealth of habitat types, organisms, and specializations.

High altitude waters are ideal systems to address a broad range of key and topical themes in ecology, at both the regional and global scales. From specific functional adaptations of aquatic species to harsh environmental conditions through to global diversity patterns along altitudinal gradients and extinction risks of mountain populations due to vanishing glaciers, ecological patterns and processes found in high altitude waters are both diverse and singular. Although poorly considered in classical textbooks on ecology and limnology, high altitude waters have much to offer to existing (aquatic) ecological theories and applications.

The usual perception of pristine mountain waters is far from the truth, particularly in the case of high altitude waters at low latitudes where human population density is often high, and local communities live in intimate contact with, utilize, influence, and exploit these aquatic systems. These habitats are thus ideal for studying the intimate interactions between social and ecological systems that characterize the majority of ecosystems in the Anthropocene.

Here, we bring together and synthesize current knowledge on patterns and processes in the ecology of streams, lakes, and wetlands situated at more than 3000 metres above sea level. We do not intend to provide a traditional and comprehensive limnology textbook as such, but instead focus on key characteristics of aquatic systems at extreme altitudes such as low partial pressure of dissolved oxygen, high solar radiation, large diel variability in temperature, low species richness, and simple food webs. We also aim to highlight how key concepts in ecology (e.g. the stress gradient hypothesis and the biodiversity–ecosystem functioning relationship) could find relevant study models in high altitude waters to be further explored. Last, following Alexander von Humboldt's view, a pioneer of the study of high altitude ecosystems in the tropics, we believe that 'a certain degree of scientific completeness in the treatment of individual facts is not wholly incompatible with a picturesque animation

of style'. For this reason we took special care to illustrate the book with numerous pictures of these poorly known systems and species, with the hope of motivating a new generation of ecologists to get up to these remote places. They will do it not only to satisfy their scientific curiosity but also to embrace truly beautiful and inspiring places, a necessary step towards conservation.

We hope that the book will be a useful source of information to researchers and postgraduate students at colleges and universities worldwide studying ecology, limnology, natural resource management, and/or physical geography. As a secondary readership group, environmentalists and decision-makers alike, needing an up-to-date summary on these topics with respect to high-altitude environments, should also find the book useful.

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