

## 10. BIOLOGICAL INVASIONS

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### Introduction

At first sight, and certainly in comparison with most other land areas worldwide, Antarctica appears exceptionally well protected against the dangers of invasion by

non-indigenous (alien) species. It is geographically isolated from other Southern Hemisphere continents and smaller landmasses, historically lacks indigenous human populations or contact, and presents extreme environmental challenges that must be survived both during any transfer process and after establishment at an Antarctic location. Despite this, it is clear that biological invasions have taken place, and have led to serious impacts on indigenous biota, ecosystems, and ecosystem functions, posing a serious risk to the Antarctic region (Dingwall 1995, Smith 1996, Chown et al. 2001, Greenslade 2002, Frenot et al. 2005).

In common with elsewhere, parts of the Antarctic have been experiencing a period of very rapid environmental change, relating to a number of significant variables, over the last 50 or more years (Huiskes et al. this volume, Convey this volume, Lyons et al. this volume). In addition to confirming the significant influence of some existing biological invasions, Frenot et al. (2005) have identified that rapid climate change, in combination with increased human activity, is likely to increase the frequency and significance of future invasions, and increase the impacts of alien biota that are already established.

Worldwide, biological invasions are one of the most important threats to biodiversity (McKinney and Lockwood 1999, Sala et al. 2000, Courchamp et al. 2003) and ecosystem processes (Heywood 1989, d'Antonio and Dudley 1995, Mack et al. 2000). In an Antarctic context, these threats are serious. The subantarctic islands, continental margin, packice and surrounding seas are home to spectacular concentrations of marine megafauna, including a large proportion of the world's seabird species and marine mammals. Life on land, while species poor and less visually spectacular (Gressitt 1970, Chown et al. 1998, Vernon et al. 1998, Convey 2001) is no less significant, and terrestrial biotas often include a particularly high proportion of endemic taxa (as illustrated by lichens, liverworts, flowering plants, arthropods and nematodes).

Antarctic terrestrial habitats are typified by low species richness and the absence of many functional groups that are present elsewhere. This itself may be sufficient to render the sub- and maritime Antarctic islands, and the ice-free islands of exposed land on the continent, susceptible to alien invasion (Bergstrom and Chown 1999, Chown et al. 2000). Furthermore, island biotas may be more susceptible to invasion as indigenous species are less able to cope with the associated change (d'Antonio and Dudley 1995, Vermeij 1996, Williamson 1996, Bowen and van Vuren 1997).

Although human contact with the Antarctic has occurred only over the last two centuries, our influence has increased rapidly. Initially, effort was almost exclusively focused on economic activity. On land, this related to the support requirements that were necessary to allow the excessive commercial exploitation of marine resources (whales, seals, penguins) from the Southern Ocean. In parallel, some farming, social and recreational development also occurred, resulting in many of the introductions of grazing and predatory vertebrates that remain on most of the subantarctic islands today. Throughout this period, concerns over human impact on indigenous Antarctic biota received scant attention, even in the context of the virtual extermination of successive target industrial species.