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978-0-521-10698-6 - Reindeer on South Georgia: The Ecology of an Introduced Population

N. Leader-Williams

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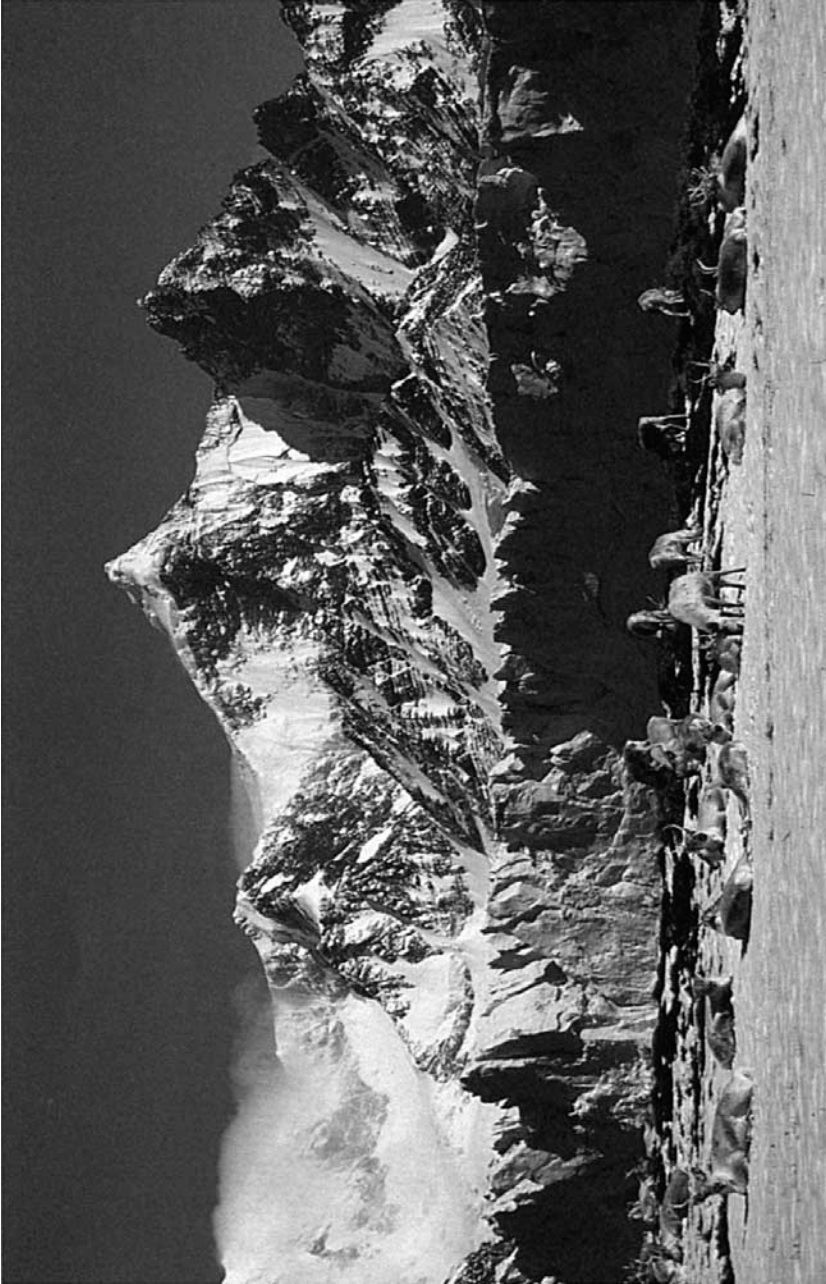
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Reindeer in front of Neumayer Glacier and the Allardyce Range on South Georgia

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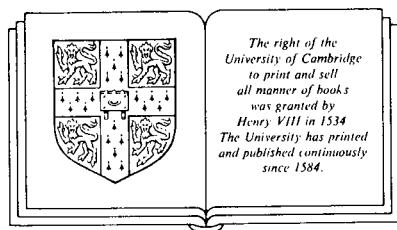
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REINDEER ON SOUTH GEORGIA

*The ecology of an introduced
population*

N. LEADER-WILLIAMS

British Antarctic Survey, Cambridge



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For my father and in memory of my mother

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Preface

The faunas and floras of Arctic and Antarctic regions are both adapted to the climatic extreme of cold, but differ in their evolution and ecology (Dunbar, 1977). The Arctic is an ice-covered ocean basin mostly encircled by continental or large island land masses, where temperatures can rise to well above freezing in summer. Although extensively glaciated on several occasions during the last one million years, Arctic tundra now supports simple but well-developed floras and faunas which were able to survive and evolve further in glacial refugia, and recolonise during inter-glacial periods. In contrast, the Antarctic continent is colder, has remained frozen for over 20 million years and supports the most limited terrestrial flora and fauna of any continent, and terrestrial life only survives close to continental margins. Antarctic tundra habitats have developed only on oceanic islands, but are poor in species due to the extreme isolation of each island group from other continental land masses. Antarctic animal life is essentially marine and is based largely upon krill which is at the centre of the food-web of whales, seals and seabirds in the Southern Ocean.

Reindeer and caribou (*Rangifer tarandus*) are a numerically prominent and sociologically important species amongst the Arctic fauna. Their common western European name is derived from the Lapp name of 'reino' for young of the species, whereas the common North American name of caribou derives from the Micmac Indian word 'xalibu', meaning 'pawer' or 'shoveller' in reference to their method of obtaining food through snow in winter (Banfield, 1961). They occur at higher latitudes than other species of deer and have adapted to the rigours of life in the Arctic tundra. As a species, reindeer and caribou are generally noted for their exceptionally long migrations, for their large group sizes, for their dependence on lichens as forage in winter and for providing food for wolves and man. The introduction of Norwegian reindeer to the suban-

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tarctic island of South Georgia earlier this century resulted in an unusual interaction between this Arctic mammal and a southern ecosystem. Early studies (Olstad, 1930; Bonner, 1958) showed that reindeer had adapted to an unusual diet and had increased greatly in numbers from the few animals originally introduced. In this monograph I will develop these observations into two main themes.

First, this is a comparative study of the biology and ecology of a cervid which occurs in a wide variety of habitats throughout the Arctic. Comparative studies amongst other groups of mammals (primates: Crook & Gartlan, 1966; Clutton-Brock, 1974; sheep: Geist, 1971; antelopes: Jarman, 1974; seals, ungulates and primates: Alexander *et al.*, 1979) have explained many differences in behaviour and ecology between and within species, and their particular adaptations to their environments. The study on South Georgia provides a basis for an intraspecific comparison between this unusual population and those occurring on natural range elsewhere. Additionally, studies of other cervids (e.g. Clutton-Brock, Albon & Harvey, 1980; Clutton-Brock, Guinness & Albon, 1982) have shown that characteristics favouring polygyny, such as large body size in males relative to females and large weapon size in males, are more enhanced in species living in large groups such as reindeer. Such dimorphism may lead to interesting sexual differences in feeding habits, growth and reproduction. Therefore, the adaptations shown by the most northerly species of cervid are investigated in interspecific comparisons with other temperate species.

The second theme of this study concerns the ways in which an introduced population adapts to a new environment, and its relevance to the population ecology of mammals and to the conservation of southern island ecosystems. The size of natural populations may fluctuate irregularly between restricted limits (Lack, 1954), but little has been learned of population processes in such situations (Caughley, 1976a). Much has been learned of population processes and of the ungulate-vegetation interaction in situations of greater instability. More dramatic fluctuations in population numbers amongst deer and other ungulates occur as a result of human interference. Increases result from predator removal (including the cessation of heavy hunting by man) or the introduction and subsequent eradication of a disease, whilst declines arise from the overutilisation of resources (Rasmussen, 1941; Murie, 1944; Jordan, Botkin & Wolfe, 1971; Bergerud, 1974c; Sinclair, 1979; Owen-Smith, 1981; Clutton-Brock *et al.*, 1982; Pellew, 1983). However, the most dramatic fluctuations of all arise when an ungulate encounters a new

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habitat, such as occurred with the introduction of Himalayan thar to New Zealand or of reindeer to Arctic islands (Caughley, 1976a,b). The reindeer on South Georgia provide an opportunity to study introductions made under comparable circumstances to those on Arctic islands. They also provide the opportunity to assess the impact of an introduced species upon a southern island ecosystem that is not adapted to grazing (Holdgate & Wace, 1961; Clark & Dingwall, 1985).

The monograph is arranged into four parts. Part I is a preamble to the study, Part II discusses the comparative biology of reindeer, whilst Part III discusses the consequences of the introduction of reindeer to South Georgia. Part IV provides a short overview of the study. Readers intent on methods and statistical justification of the results will need to include the information printed in small type in their reading of the monograph, whilst those interested in the results themselves may pass over these paragraphs. Much of the work described in this monograph has been published already in separate articles in a variety of specialist journals, each catering for its own readership. The invitation from Cambridge University Press to prepare this monograph gave me the opportunity to bring the various threads of the study together in one volume aimed at a wider readership. This study was undertaken some time ago and the delay in the appearance of this monograph resulted from my involvement with another field project in Africa. Nonetheless, I hope this contribution will add to our knowledge and appreciation of polar animals and cold regions.

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It is a great pleasure to thank the many people who have helped with this study over the years. My greatest single debt is to the British Antarctic Survey and its staff, both on South Georgia and in Cambridge. I am particularly grateful to the then Director, Richard Laws, for his continuous encouragement.

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In Cambridge, Bob Pratt, Liz Kirkwood, Tessa Scott, Nigel Bonner, Howard Platt, Mike Payne, David Walton, Roger Worland and Alison Rosser assisted with laboratory material. Hormone analyses were undertaken at the MRC Unit of Reproductive Biology, Edinburgh with the help of Roger Short and Gerald Lincoln; histological analysis of reproductive material was completed at the AFRC Institute of Animal Physiology, Cambridge with the help of Hector Dott; rumen samples were milled at the University of Aston and ruminal nitrogen levels were measured at Merlewood Research Station, Institute of Terrestrial Ecology; parasites were identified by Roger Connan of the University of Cambridge and by Lynda Gibbons and Arlene Jones of the Commonwealth Institute of Helminthology; pathological material was examined by Arthur Jennings of the University of Cambridge and by Gwynneth Lewis and Carol Richardson of the Central Veterinary Laboratory. Steve Albon, Alastair Murray, Peter Rothery and Chris Ricketts have all helped greatly with, or collaborated in, data analysis.

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