Genetics and Conservation

A REFERENCE FOR MANAGING WILD ANIMAL AND PLANT POPULATIONS

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1983

THE BENJAMIN/CUMMINGS PUBLISHING COMPANY, INC.,
Advanced Book Program
Menlo Park, California

LONDON · AMSTERDAM · DON MILLS, ONTARIO · SYDNEY · TOKYO

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FOREWORD

Management of populations of wild animals and plants is as old as settled civilization itself—after all, domesticated species started their careers as their wild ancestors, and the genetic distance between them may not be very great. Basic lessons and useful practices were learned from domestication, the most basic being the avoidance of consanguineous matings, which was enshrined in social and religious precepts of ancient communities and has remained the focal point in the management of wild animal populations to this day. But settled civilization brought a parting of the ways: domesticates began to be managed—and gradually to be selected—for productivity, and wild species were there to be exploited, for their products such as meat, skins, or pelts, or for the enjoyment they gave, mostly to the privileged, in killing them. Ancient civilizations saw nature as created to serve man's uses as he chose, and man's stewardship for nature, at best, was "a minority tradition" in western civilization (Passmore, 1974). Neither the authorities of the church nor the poets and philosophers of the enlightenment deviated from the basic assumption of man's dominance over nature. Indeed, the drastic change of attitudes is a contemporary development, the result of the dramatic changes in the ecology of the world brought about by the destructive exploitation of the world's resources.

Once the conservation of threatened environments and resources became a recognized objective, it was natural that the emerging science of ecology stepped in to provide the theoretical infrastructure and the principles of management for the reserved or protected areas that began to be set aside a hundred years ago. Recently, population biology became an integral part of what is now termed conservation biology (Soulé and Wilcox, 1980). When it was postulated that genetic diversity may be a condition of long-term survival (Frankel, 1970; Frankel and Soulé, 1981), population and evolutionary genetics were seen as having a significant role in conservation biology.

The symposium from which this book emerged was planned to make managers of nature reserves, botanical and zoological gardens, and other forms of preservation aware of genetic principles and technologies of relevance in the management of biological resources. The aim of the symposium was to bring this new knowledge with the least possible delay to those best placed to apply it. This book will make it available to a wider circle.

The book addresses itself to population dynamics, which are liable to affect rates of survival or extinction in protected areas, and to the genetic principles and practices by which survival can be enhanced. The alternatives are clearly evident in the choice of topics: decline and extinction of species, in juxtaposition with the founding of new populations; isolation of populations in protected areas versus the merging of separated populations and taxa. A focal theme is the maintenance of genetic diversity as the genetic base for continuing evolution.

Readers concerned with reserve management may discern a bias toward animal problems. This is clearly not deliberate. There are a number of botanical chapters, but they deal largely with the basic issues of population genetics. Indeed, it is hard to see how it could be otherwise. There is little scope for the management of plant species with the exception of those with scientific or economic connotations, such as forestry species or wild relatives of domesticates. For this there are two reasons. The first is the great diversity of breeding systems—for many species totally unknown—as against the bisexual simplicity in the majority of likely animal target species. The second is the ecological difficulty of "managing" plant species without acute interference with the ecosystem.

Indeed, the genetic management of particular species—usually rare or endangered ones—as a means of securing their survival may affect the stability of the ecosystem of which they form a part, if the effect of management is to increase the population size and hence the demand on resources within the ecosystem. There are, of course, situations in which the species of concern is so far removed from natural conditions or of such focal concern that an impact on other biota is either absent or irrelevant. Captive preservation is the paradigm of such situations. But, to paraphrase John Donne, under natural conditions "no species is an island." Managerial support for one species is likely to be at the expense of others, and managers will have to attempt a balance sheet of the short- and long-term effects that can be expected.

The opportunities for genetic management are determined by a number of variables—primarily the population size, which in turn depends on area size and on body size. This is brought out clearly in an ingenious model presented in the final chapter, with demographic data for three size classes of mammals related to area size. Clearly in the smaller reserves there is scope, and need, for genetic management to avoid or reduce inbreeding. Only large reserves have the potential to generate and maintain

genetic diversity for adaptation to environmental change. This does not mean that smaller reserves have no evolutionary role to play. Indeed, they have, though perhaps not for the long-term preservation of the larger vertebrates, which now occupy the prime attention of conservationists. Moreover, the future is unknown, and long-term models, plausible as they seem, should not discourage concerted conservation efforts on a less than ideal scale.

Whatever the opportunities for genetic management, genetic information should prove valuable to reserve managers in shedding light on processes in populations that neither facilitate nor require management, but are full of interest for the observant biologist. Besides, awareness of genetic principles and, even better, of genetic variation in populations facilitates intelligent intervention, or helps to avoid disturbances and harmful interference. Estimates of levels of genetic diversity have become possible and are widely obtained; and, as this book shows, they provide information of managerial relevance and scientific interest. Indeed, it is perhaps the heightening of scientific insight, as much as the application in management, that is the most significant contribution made by this book.

O.H. Frankel