SECTION V

RELEASE OF CAPTIVE BRED SPECIES: RAPTORS, RODENTS & LAGOMORPHS

R.E.KENWARD
ITE, Furzebrook

RELEASE OF CAPTIVE BRED SPECIES INTO THE WILD: RAPTORS, RODENTS AND LAGOMORPHS

INTRODUCTION

The release of captive bred species presents a number of possible threats to native wildlife. Severe demographic effects, including extinction of native species through competition, predation of habitat alteration, have frequently occurred following the introduction by man of allopatric species, especially in the Pacific Islands and Australasia (recent reviews by King 1985, Groves & Burdon 1986, Griffin *et al.* 1988). Introductions of any sort are therefore viewed with concern by many conservationists. Even when introductions are to support threatened stocks, there is concern that captive reared animals may introduce disease. Further concern centres on the possibility that:

(i) Released organisms might carry alleles not found in the native stock (perhaps from disjunct parts of the species' range, or from hybridisation with allopatric species).

(ii) Released organisms may lack alleles found in native stocks, and are released in such numbers that native alleles become diluted to the point of being lost through stochastic events.

The following sections examine the evidence for adverse effects on native species from the release of raptors, rodents and lagomorphs.

RELEASE OF RAPTORS

Raptors, as predators which are often sparsely distributed, have been vulnerable to biocide accumulation, habitat destruction and persecution by man more than many other animals. Where this has caused population declines, birds have been

bred for restocking and for falconry. By 1975 at least 200 raptors from at least 12 species were being bred each year throughout the world (Kenward 1976), and larger numbers are now bred annually in Britain alone. Captive breeding has been used for re-stocking peregrine falcons (*Falco peregrinus*) in Canada, Sweden, West Germany and the United States (Fyfe 1988, Lindberg 1988, Saar 1988 and other papers in Cade *et al.* 1988), for Aplomado falcons (*Falco femoralis*) in the United States and Mexico (Jenny *et al.* in press), for griffon vultures (*Gyps fulvus*) and bearded vultures (*Gypaetus barbatus*) in the Alps (Terrasse 1983, Esteve 1986), for bald eagles (*Haliaeetus leucocephalus*) in the United States (Nye 1988), for sea eagles (*Haliaeetus albicilaa*) in Germany (Fentzloff, C., pers. comm.) and for eagle owls (*Bubo bubo*) in Germany (Radler & Bergerhausen 1988) and Sweden (Broo 1977). In Britain there have also been release programs for imported wild Scandinavian sea eagles (Love 1983) and red kites (*Milvus milvus*), with many imported or captive bred raptors being lost annually by falconers (Kenward 1974) or released by breeders. Moreover, the goshawk (*Accipiter gentilis*) was re-established in Britain as a result both of deliberate release and loss by falconers of hawks from Fennoscandia and central Europe in the late 1960s and early 1970s (Kenward *et al.* 1981, Marquiss & Newton 1982).

All the recent release programs have reintroduced raptors to areas where they had previously become extinct as a result of human activities, with the exception of 12 Andean condors (*Vultur gryphus*) which were released in California to monitor habitat suitability and develop release techniques for Californian condors (*Gymnogyps californianus*). The Andean condors were released outside their normal geographic range after the last Californian condor was captured for a captive breeding program. All are female, and they will be removed again before any captive-bred California condors are released (Wallace in press). The establishment of European little owls (*Athene noctua*) in Britain

early this century, from the release of wild birds (Mikkola 1983), may well be the only record of a raptor being re-introduced successfully where a natural event (glaciation) rather than man had caused its extinction.

In none of the raptor release projects has evidence been provided of the released birds transferring disease to local wildlife. Considerable care has been taken to re-introduce species from neighbouring stocks, except in the case of replacing the *anatum* race of the peregrine falcon after its apparent extinction in the eastern United States. In that case the breeding stock was assembled from surviving North American (*tundrius*, *pealii*) subspecies and European peregrines (*peregrinus*, *brookei*) to maximise genetic variability. Nevertheless, 90% of the gene pool of 758 released birds can be traced to just 16 founders, and among 26 birds which have bred in the wild almost 90% of the gene pool comes from 8 captive parents (Temple & Cade 1988). DNA hybridisation techniques will be used to assess the relative importance of these founders in subsequent generations.

There is as yet no record of accidentally released raptors establishing a breeding population outside their normal range. Since these birds are normally so mobile, the risk of such introductions is probably limited to the establishment of North American raptors in Eurasia and *vice versa*. However, fertile hybrid raptors have been produced on many occasions in captivity, sometimes through natural pairing (Morris & Stevens 1971), but more often as a result of artificial insemination (Albrecht & Albrecht 1980, Parks & Hardaswick 1987). These crossingss have been almost exclusively within the genus *Falco*, most commonly the three possible f_1 hybrids between sympatric peregrines (*Falco peregrinus*) and gyr falcons (*F. rusticolus*) or prairie falcons (*F. mexicanus*), but also including *peregrinus* x *sparverius* (American kestrel), *peregrinus* x *rufigularis* (bat falcon), *rusticolus* x *columbarius* (merlin), *peregrinus* x

cherrug (saker falcon), and even a single "shahmerie" *peregrinus* x *columbarius* x *mexicanus* (reviews by Haak 1980, Parrish & White in press). Among other genera, the most significant crossing was a single hybrid produced at Vienna Zoo between the Eurasian buzzard (*Buteo buteo*) and the North American redtailed hawk (*B. jamaicensis*).

Considering the possible accidental release of such birds, the Raptor Research Foundation (whose membership includes about 900 raptor biologists from all parts of the world) recently concluded that "Escape of sympatric and parapatric species or their hybrids is unlikely to pose any substantial threat to wild populations", because natural selection would be expected to act against them, but that "traits from an individual hybrid between allopatric species might establish in native stocks, and species from other super continents might become accidentally introduced if used in large numbers for falconry" (Raptor Research Foundation Position Statement on Falconry, in press). Following restrictions on the import of goshawks for falconry, North American red-tailed hawks (*Buteo jamaicensis*) and Harris' hawks (*Parabuteo unicinctus*) are bred frequently in Britain. Britain lacks suitable habitat for the Harris' hawk, but captive-bred red-tailed hawks could probably establish in the wild if lost in large numbers, possibly to the detriment of native *Buteo buteo*. Few Eurasian raptors are flown by falconers in North America, where licences are relatively easily obtained for wild raptors.

RELEASE OF RODENTS AND LAGOMORPHS

In Britain alone, at least six species of rodent were introduced by man: the brown rat *Rattus norvegicus*, the black rat (*R. rattus*), the dormouse *Glis glis*, the grey squirrel (*Sciurus carolinensis*), the bisam (*Ondatra zibethicus*) and the

coypu (*Myocastor coypus*). The bisam and coypu escaped from fur farms, and have now been eliminated (Gosling & Baker 1989). Their ranges were relatively restricted, as is that of *Glis glis*, and their impact on native species therefore of little importance. *Rattus rattus*, which was apparently introduced around 1100, declined dramatically after the introduction during the 1800s of the larger *Rattus norvegicus*, and is now confined to three ports where its populations may only be maintained by reinfestation from ships (Corbet & Southern 1977, Richards 1989). The introduced North American grey squirrel has had a dramatic impact on the native Eurasian red squirrel *Sciurus vulgaris*, which it has displaced through much of its British range (Lloyd 1983), probably because grey squirrels alone can live on a diet of acorns and thus have a superior ability to exploit this dominating deciduous seed crop (Kenward & Holm 1989).

It is probably a lagomorph, the rabbit (*Oryctolagus cunniculus*), which has had the most dramatic impact on other species in Britain. Rabbits were apparently introduced by the Normans as captive bred stock (Lockley 1985), and their grazing has in some areas been a major factor not only in preventing shrub succession, but also in maintaining populations of wild flowers and grasses (Tansley & Adamson 1922, Hope-Simpson 1940) and even in maintaining ant communities which are important for Lycaenid butterflies (Thomas 1981).

Although rodents and lagomorphs have been introduced beyond their original range throughout the world, as commensals, as game and as escapes from captive stock, their main impacts have been demographic rather than through the introduction of new genes. The single exception seems to be the suggestion that introduced alleles benefitted the eastern cottontail rabbit (*Sylvilagus floridanus*) in Maryland. Chapman & Morgan (1973) found that the local subspecies *S.f. mallurus* had been hybridising with introduced races from west of the Missisippi, and

proposed that increased genetic variability had enabled this species to expand its population in agricultural areas, whereas the woodland-dwelling New England cottontail (*Sylvilagus transitionalis*) had declined to very low numbers. Nevertheless, the population changes could also have been due to the agricultural changes alone, without the involvement of heterosis.

In general, genetic issues have had little influence during re-stocking of game species, and attempts are still being made to introduce new game species in some countries, including work with the eastern cottontail in France (Arthur & Chapuis 1983). Even where rodents have been re-introduced for conservation purposes, for example in reintroducing beavers to Finland, France, Germany, Poland, Sweden and Switzerland (Lahti 1977, Esteve 1987, Heidecke 1983, Zurowski & Kasperczyk 1988, Lavsund 1977, Stocker 1985), source animals have generally been obtained directly from the wild and little attention has been paid to genetic considerations. In Finland, American beavers *Castor canadensis* were released in some areas and Norwegian *C. fiber* in others.

Other evidence from rodents suggests that founder effects and deleterious alleles may be relatively unimportant considerations for re-introduction projects. Thus, no difference in heterozygosity was found between house mice (*Mus musculus*) on the mainland and those on an island to which a handful of founders had been introduced 70 years previously (Berry & Murphy 1970). In pest control experiments, the male-sterile gene t^{w^2} was introduced in heterozygotic females to a house mouse (*Mus musculus*) population in a large enclosure, but the allele was no longer present in the population of about 1000 mice after 2 years (Pennycuik *et al.* 1978). However, there is no doubt that introgression can occur rapidly in *Mus* at least, since alleles introduced experimentally to the Isle of May spread throughout the 2km-long island within one breeding season (Berry *et al.* in press).

CONCLUSIONS

1. There is no evidence that accidental or deliberate release of captive bred raptors has had negative demographic or genetic consequences for native raptors anywhere in the world. However, the present captive breeding of North American red-tailed hawks might result in the accidental introduction to Britain (and hence, presumably to Eurasia as a whole) of this species, or of its genes through hybridisation with *Buteo buteo*.

2. Release of captive bred rodents and lagomorphs has established populations of alien species which have had both positive and negative demographic consequences for native flora and fauna, but there is no evidence that captive bred small mammals have adversely affected the gene pool of wild populations.

R.E. Kenward 26.10.89