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Vertebrate Species Introductions in the United States and its Territories

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ABSTRACT Thousands of species of plants and animals have been introduced to various parts of the world (Pimental 2011). Greatly increased levels of travel and international trade have been, in large part, responsible, but many pathways of introduction are involved and these vary by taxonomic group. Much concern, action, and funding has been directed towards invasive pathogens, insects, and plants because of the threat to agriculture and livestock production. However, a very large number of vertebrates have also been introduced with some causing substantial damage and losses to human and natural resources.

KEY WORDS eradication, introductions, invasive species, management, United States, vertebrates.

We compiled a list of 1,065 vertebrate species that have been introduced in parts of the United States and its territories (Witmer and Fuller 2011). The list includes:

- 86 mammalian species (especially ungulates)
- 127 avian species (especially perching birds and parrots)
- 179 reptilian and amphibian species (especially lizards and frogs)
- 673 piscine species (especially perch-like fishes and minnows).

Our list is long because we included species native to North America, but which have been moved to different regions or watersheds (in the case of fish species). We are sure that our list is not comprehensive, especially with regard to species introduced to some of the U.S. territories. Additionally, some of the species may not become established or may have been eliminated. On the other hand, we suspect that more vertebrate species will be introduced whether purposefully or inadvertently.

Examples in each major taxonomic group include domestic cat (*Felis catus*), small Indian mongoose (*Herpestes auropunctatus*), red fox (*Vulpes vulpes*), goat (*Capra hircus*), pig (*Sus scrofa*), European rabbit (*Oryctolagus cuniculus*), rats (*Rattus* spp.), house mouse (*Mus musculus*), gray squirrel (*Sciurus carolinensis*), nutria (*Myocastor coypus*), starling (*Sturnus vulgaris*), Indian common myna (*Acridothereres tristis*), brown treesnake (*Boiga irregularis*), red-eared slider (*Trachemys scripta*), bullfrog (*Rana catesbeiana*), brown trout (*Salmo trutta*), tilapia (*Tilapia* spp.), and grass carp (*Ctenopharyngodon idella*). Many of these species cause damage to human resources (e.g., feral pigs) or to natural ecosystems (e.g., rats introduced to islands). Fall et al. (2011) discussed some of the introduced vertebrates species, the damage caused, and management approaches. The basic methods used to manage native wildlife species and the damage they cause are the same as those used with introduced vertebrate species: traps and snares, shooting, toxicants, trained dogs, frightening devices, barriers, habitat management, etc. Our management techniques are perhaps weakest for introduced reptiles and amphibians and fish. Nonetheless, we have been able to eliminate some populations of introduced vertebrates and more successes are expected (Nogales et al. 2003, Campbell and Donlan 2005, Howald et al. 2007).

We face many challenges in managing these species, including issues with the use of toxicants, traps and snares, land access (especially to private lands), public attitudes about animals and management methods, mixed jurisdictions with conflicting laws and regulations, difficulties of detection and monitoring, inadequate funding, and a large and not well-regulated pet industry. More research and regulation is needed to overcome these difficulties and to provide more efficient methods of control and eradication (Wittenberg and Cox 2001). Research is underway on improved detection and monitoring methods, improved attractants, improved barriers, improved capture methods, fertility control, benefit-cost analyses, and risk assessment methods.

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