GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Mus musculus***

Mus musculus 简体中文 正體中文 **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Rodentia	Muridae

Common name raton casero (English, Dominican Republic), Hausmaus (German), biganuelo (English, Dominican Republic), house mouse (English), souris commune (French), wood mouse (English), field mouse (English), kiore-iti (Maori)

Synonym

Similar species

Summary

The house mouse (Mus musculus) probably has a world distribution more extensive than any mammal, apart from humans. Its geographic spread has been facilitated by its commensal relationship with humans which extends back at least 8,000 years. They cause considerable damage to human activities by destroying crops and consuming and/or contaminating food supplies intended for human consumption. They are prolific breeders, sometimes erupting and reaching plague proportions. They have also been implicated in the extinction of indigenous species in ecosystems they have invaded and colonised. An important factor in the success of M. musculus is its behavioural plasticity brought about by the decoupling of genetics and behaviour. This enables M. musculus to adapt quickly and to survive and prosper in new environments.

view this species on IUCN Red List

Species Description

A long tail (60-105mm - approximately equal to its head and body length of 65-95mm), large prominent black eyes, round ears and a pointed muzzle with long whiskers. Adults 12-30 g. Wild mice are commonly light brown to black; belly fur white, brown, or grey. Colour of tail also lighter below than above.

Notes

The taxonomy of the genus *Mus* is still not entirely clear and the last 30 years have seen a continuing reduction in the number of species recognised and a rearrangement of the phylogenetic tree. The confusion arises because of the gross morphological similarity of many *Mus* species, many of which are only (relatively) distantly related and the phenotypic plasticity within the various species themselves. It is now accepted that the genus *Mus* is actually comprised of 4 subgenera - *Pyromys*, *Coelomys*, *Mus*, and *Nannomys* - containing, in total, approximately 40 species plus an unknown number of subspecies (Nowak, 1991).
Silver (1995), drawing on detailed genetic analysis, lists 8 true species in the *Mus* subgenus plus 4 morphologically and biochemically distinct *Mus musculus* subspecies that together form an *M. musculus* species group. These are *Mus mus musculus*, *M. m. domesticus*, *M. m. castaneus*, and *M. m. bactrianus*. He relegates *M. m. molossinus*, found throughout Japan, to *faux*-species status as it has been found to be a hybrid between *M. m. musculus* and *M. m. castaneus*. Furthermore, the genetic evidence supports the Indian subcontinent as the centre of radiation for the *M. musculus* species group, *M. m. bactrianus* being the founder population. The members of the *M. musculus* group would have occupied non-overlapping ranges within the Indian subcontinent until Neolithic human population expansion and migration approximately 10,000 yrs BP facilitated their dispersal.
The two species found in Europe - *M. m. musculus* and *M. m. domesticus* - accompanied humans migrating into the area approximately 4,000 yrs BP. It is predominantly these two species that have become invasive throughout the world, primarily aided by past European colonial expansion. Recently genetic methods have been used to trace the colonisation history on mice in New Zealand and the United Kindom (Searle *et al*. 2008a, 2008b).
It has been estimated that in the USA seven mice are transported per 100 tonnes of grain and 70 per 100 tonnes of hay or straw. In one year 550,000 tonnes of hay and straw were exported from the USA potentially containing many thousands of house mice (Baker 1994 cited in Pocock *et al*. 2005).

Lifecycle Stages

Depending on prevailing environmental conditions, house mice occur alone, in pairs, in small family parties, or several families co-exist at very high densities\r\n(Pillay, N., pers. comm., 2004). Breeding takes place throughout the year in laboratory, most commensal, and some wild populations. The oestrus cycle is 4-6 days, with oestrus lasting less than one day. The oestrus cycle stops during lactation except for one oestrus 12-20 hours postpartum. Gestation period is 19-21 days, although this may be extended by several days if the female is lactating. There are usually 5-10 litters per year, depending on conditions, but up to 14 may be produced. Litters range from 3-12, but usually consist of 5-6, young. Newborn mice weigh around 1 g, are naked except for short vibrissae, and their eyes and ears are closed. They are fully furred after 10 days and by 14 days old their eyes and ears are open, and their incisor teeth have erupted. The young are weaned and start to leave the nest at 20-23 days old, weighing around 6 g, and can reach sexual maturity at 5-7 weeks. In the wild mice rarely live longer than 18 months. Captive mice live 2 years on average although there are records of some individuals living up to 6 years.

Habitat Description

As commensal animals, house mice live in close association with man — in houses, outbuildings, stores and other structures. Mice are not limited to commensal situations and feral house mice are found in many different habitats in a number of regions of the world. Mice are found throughout New Zealand in habitats ranging from rank coastal grasslands and dunes to sub-alpine tussock. They can reach very high densities in some habitats, particularly those with dense ground cover. In Australia mice are commonly found in arable crop fields and can reach enormous densities in these areas. Mice are also found on a number of sub-Antarctic islands where they have become a major conservation concern.

Reproduction
Placental. Sexual. Endogenous reproductive cycle most likely modulated by nutrition and, possibly, population density.
15-150+ young per female adult per year, depending on conditions. Females as young as 5 weeks can breed. The pre-independence mortality rate is typically 60-70%. Population densities range from 10 per sq metre for commensal populations to 1 per 100 sq metres in feral populations. Given ideal conditions populations can errupt spectacularly and numbers can exceed 200,000 per hectare.
While favourable conditions (e.g. nutrition) determine reproduction in commensal populations, free-living (feral) populations are seasonal breeders, and reproduction is probably influenced by a combination of day length and nutrition \r\n(Pillay, N., pers. comm., 2004).

Nutrition
Wild mice eat many kinds of vegetable matter, such as, fleshy roots, leaves, and stems. Insects and some meat may be eaten when available. Commensal mice feed on any human food that is accessible, as well as paste, glue, soap, and other household materials. Cereals are preferred to foods containing higher proportions of fat or protein. A large part of the water requirement of mice is met by the moisture content of their food as they have the ability to concentrate their urine and this has enabled them to colonise semi-desert areas. Mice on a seed diet of 12% protein can survive without free water, but above this level of protein require 3-13 g water per day.

General Impacts
House mice are major economic pests, consuming and despoiling crops and human foodstuffs, and they are host to a range of diseases and parasites infectious to humans, the most serious being bubonic plague (*Yersinia pestis*) and salmonella (*Salmonella* spp.). However, mice are considered relatively unimportant as vectors for their transmission to humans.
Mice have also been implicated in extirpations and/or extinctions of indigenous species in ecosystems they have invaded and colonised which are outside their natural range. Angel *et al* (2009) reviewed mouse impacts on islands in the Southern Ocean and found that mice had negative impacts on plants, invertebrates, land birds and sea birds. An important finding of this review is that when mice are the only introduced species on an island their behaviour is more similar to that of rats and has a much larger impact on the native ecosystem. When mice are part of a complex of invasive species their densities are suppressed and their impacts are not as great.
On Juan de Nova Island in the Mozambique Channel cats have a major impact on the sooty tern (*Sterna fuscata*) colonies through predation. Peck *et al* (2008) found that introduced mice and rats supported the cat population through the tern non-breeding season meaning the cat population was large throughout the year. This effect is known as hyperpredation and the authors suggest removing mice andsand rats may help preserve the tern colony.
\r\nRecent research and video evidence from Gough Island in the South Atlantic Ocean, has shown conclusively that mice are responsible for widespread breeding failures and that predation of seabird chicks by mice occurs at levels that are probably driving population decreases. Please follow this link to view the video Wanless mouse attack on albatross chick recorded by Ross Wanless and Andrea Angel on Gough Island (Viewer discretion is advised).
Please follow this link for terms and conditions of use of the video.
Species affected on Gough Island include the 'Crtically endangered (CR)' Tristan albatross (see *Diomedea dabbenena*) and the 'Endangered (EN)' Atlantic petrel (see *Pterodroma incerta*). Other species believed to be subject to mouse predation include the two winter breeders - the 'Near Threatened (NT)' grey petrel (see *Procellaria cinerea*) and the great-winged petrels (see *Pterodroma macroptera*) (Wanless *et al*. 2007). *M. musculus* may pose the greatest present threat to the 'Critically endangered (CR)' Gough bunting (see *Rowettia goughensis*) through competition and predation (Birdlife International, 2004).
A study of seed predation by mice in a New Zealand forest found that mice were able to consume almost the entire seed crop of some species therefore having important implications for tree population dynamics (Wilson *et al* 2007). Another study in New Zealand found that mice were predating upon lizards and that adults were more susceptible than juveniles (Newman 1994).

Management Info
House mice are controlled by poisoning, fumigation, trapping and repellents. Thirty eight percent of mouse eradication attempts on islands worldwide have failed (17 out of 45 attempts), but there doesn't seem to be a consistent simple operational explanation for these failures. Eradications should be attempted provided sufficient planning and preparation has taken place to rule out failure due to operational errors or factors that can be controlled for. Factors to consider in order to maximise the likelihood of success include:
o Will the chosen poisoning method allow every mouse on the island access to poison?
o Take genetic samples prior to the eradication attempt. This allows the distinction to be made between eradication failure and a re invasion and also can be used to determine sub-species.
o Consider the effects of other mammals. Will they prevent mice accessing poison?
o Will the mice eat the bait? Consider bait trials to check for poison palatability and cereal aversion.
o Are there areas which may require extra poison? Dense grassland can support very high numbers of mice and may require more poison than forest areas (MacKay *et al*., 2007).
Preventative measures: House mice are able to stow away in very small spaces so there is a constant threat of invasion or reinvasion. Visitors to areas that are at risk of mouse invasion should be encouraged to check all baggage and pockets for mice before heading to such places. Mouse free areas that are considered at risk of invasion should implement a programme of regular monitoring to identify mouse invasions early.
Chemical: House mice have been successfully eradicated from 28 islands worldwide. In all these cases some form of anticoagulant poison was used (MacKay *et al*. 2007). Brodifacoum was the most commonly used poison, other successful attempts used pindone, warfarin, bromodiolone and floccoumafen. Brodifacoum is a very widely used toxin but there are some concerns about it building up in ecosystems (Hoare and Hare, 2006). Fisher (2005) discusses the susceptibility of mice to a variety of anticoagulant poisons; Morriss *et al*. (2008) updates this study by investigating factors that affect the palatability of different baits to house mice and rat species.
Biological: Virally vectored immunocontraception using a modified murine cytomegalovirus (MCMV) has been investigated in Australia to control mouse plagues in the grain growing regions but results are not promising. Viral transmission rates are too slow to effectively control fertility on the population (Arthur *et al*. 2009). A review of fertility control in rodents is available (Jacob *et al*. 2010).
Integrated management: The abundance of *M. musculus* will increase dramatically where a significant number of rats are removed from an area, perhaps due to an improved food supply or a release from predation pressure (Caut *et al*. 2007, Witmer *et al*. 2007). It is important to attempt to remove mice at the same time as rats to prevent large populations of mice appearing following rat removal.

Pathway

Principal source:

Compiler: Jamie MacKay, School of Biological Sciences, University of Auckland, New Zealand & IUCN/SSC Invasive Species Specialist Group (ISSG)
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ALIEN RANGE

[1] AFRICA
[1] ANGUILLA
[2] AUSTRALIA
[2] BAHAMAS
[1] BERMUDA
[1] BRAZIL

[1] CANADA
[3] CAYMAN ISLANDS
[2] COOK ISLANDS
[1] CURACAO
[1] DOMINICA
[1] DOMINICAN REPUBLIC
[1] FALKLAND ISLANDS (MALVINAS)
[3] FIJI
[1] FRANCE
[3] FRENCH POLYNESIA
[6] FRENCH SOUTHERN TERRITORIES
[1] GUADELOUPE
[1] GUAM
[1] HAITI
[1] ISLE OF MAN
[2] KIRIBATI
[3] MARSHALL ISLANDS
[1] MARTINIQUE
[3] MAURITIUS
[1] MAYOTTE
[1] MEXICO
[2] MICRONESIA, FEDERATED STATES OF
[1] NAURU
[5] NEW CALEDONIA
[11] NEW ZEALAND
[2] NORTHERN MARIANA ISLANDS
[3] PALAU
[1] PERU
[1] PITCAIRN
[1] REUNION
[3] SAINT HELENA
[1] SAINT LUCIA
[1] SAO TOME AND PRINCIPE
[1] SOLOMON ISLANDS
[1] SOUTH AFRICA
[1] SOUTHERN AFRICA
[1] SOUTH GEORGIA AND THE SOUTH SANDWICH ISLANDS
[1] TONGA
[1] TRINIDAD AND TOBAGO
[1] TUVALU
[13] UNITED STATES
[4] UNITED STATES MINOR OUTLYING ISLANDS
[3] VANUATU
[1] VIRGIN ISLANDS, BRITISH

Red List assessed species 26: CR = 6; EN = 7; VU = 9; NT = 3; LC = 1;

Aegialomys galapagoensis **VU**
Afroablepharus africana **VU**
Alectryon macrococcus **CR**
Aphrastura masafuerae **CR**
Bettongia lesueur **NT**
Charadrius sanctaehelenae **CR**
Crocidura canariensis **EN**
Cyanoramphus unicolor **VU**
Diomedea dabbenena **CR**
Eudyptes moseleyi **EN**
Labidura herculeana **CR**
Lagostrophus fasciatus **EN**
Lewinia muelleri **VU**
Nesofregetta fuliginosa **EN**
Nesoryzomys fernandinae **VU**
Nesoryzomys narboroughi **VU**
Nesoryzomys swarthi **VU**
Oligosoma acrinasum **NT**
Oligosoma otagense **EN**
Parantechinus apicalis **EN**
Procellaria cinerea **NT**
Pterodroma incerta **EN**
Pterodroma longirostris **VU**
Pterodroma macroptera **LC**
Rowettia goughensis **CR**
Xenicus gilviventris **VU**

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Summary: Abstract: Avoidance of 1080 (sodium fluoroacetate) could be one of the main reasons why multi-species control operations sometimes do not produce high reductions in wild house mouse (Mus musculus) populations in New Zealand. This study investigated how the concentration of 1080 in pellet bait affects acceptance by mice; whether pre-feeding with non-toxic bait mitigates mouse avoidance of bait containing 1080; and whether a non-toxic bait containing a masking agent is acceptable to mice. Wild-caught mice demonstrated very low acceptance of, and subsequent low mortality (25%) from, baits containing 0.08% 1080 in a two-choice laboratory test. In a second test, mice ate comparatively more pellets containing 0.001% 1080, but there was no resulting mortality and the non-toxic alternative pellets were still significantly favoured. Pre-feeding for 3 days with non-toxic pellets did not improve the low acceptance of 0.15% 1080 pellet baits by mice. In two of the three two-choice tests, the intake of all food by mice was significantly reduced for 2 days following the introduction of 1080-treated food. This �drop feed� effect was followed by an increase, mostly of non-toxic food, in daily intake over the next 3 days, to return to eating similar amounts to those measured before the introduction of 1080 (and to daily food intakes of control mice). Non-toxic bait was strongly preferred over two different types of non-toxic bait containing a masking agent. We suggest that avoidance of 1080 by mice is mediated by conditioned taste aversion. However, masking the taste of 1080 may not be effective if mice are micro-sampling and learning to associate sublethal poisoning effects with any distinctive taste. Improvement of bait efficacy may involve developing baits that delay the onset of symptoms of 1080 poisoning; or pre-feeding with baits containing a non-toxic substance with similar taste and/or odour to 1080.
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The species list sheet for the Mexican information system on invasive species currently provides information related to Scientific names, family, group and common names, as well as habitat, status of invasion in Mexico, pathways of introduction and links to other specialised websites. Some of the higher risk species already have a direct link to the alert page. It is important to notice that these lists are constantly being updated, please refer to the main page (http://www.conabio.gob.mx/invasoras/index.php/Portada), under the section Novedades for information on updates.
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Spanish:
La lista de especies del Sistema de informaci�n sobre especies invasoras de m�xico cuenta actualmente con informaci�n aceca de nombre cient�fico, familia, grupo y nombre com�n, as� como h�bitat, estado de la invasi�n en M�xico, rutas de introducci�n y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la p�gina de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualizaci�n, por favor consulte la portada (http://www.conabio.gob.mx/invasoras/index.php/Portada), en la secci�n novedades, para conocer los cambios.
Especies invasoras - Mam�feros is available from:
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