

Rodents – their biology and damage capabilities.

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Outcomes



- By the end of this session you should
 - understand the biology of commensal rodent species.
 - appreciate some of the key behavioural traits relevant to public health & control.

Biology



- **Brown Rat**

- The brown rat (also known as the Norway or sewer rat) is typically a large bodied rat with a long, sparsely haired, scaly tail. Its dorsal hair is coarse and varies from brown to brownish-black, while the abdominal hair is usually a paler grey or tan.
- The tail is shorter than the length of its body. The measurements of the brown rat range from 315 mm to 460 mm for the total length; 195 mm to 245 mm for the head and body; 120 mm to 215mm for the tail; and 140 g to 500 g for the weight. Males are typically larger than females.
It has a worldwide distribution.

Brown Rat



Biology cont'd



- **Roof Rat (Black Rat)**

The roof rat (also known as the house rat, black rat and ship rat) is a medium-sized rat with a long naked, scaly tail. Its coarse hair ranges from black to dark brown or brownish-grey on the dorsum and is a paler grey on the venter.

- The tail is longer than the head and body. This tail helps in climbing up ropes. The measurements of the roof rat range from 315 mm to 460 mm for the total length; 155 mm to 205 mm for the head and body; 160mm to 255 mm for the tail; and 115 g to 350 g for the weight. Males are larger than females, and this species is typically smaller than the brown rat.

Because this species is most commonly spread through human seafaring, the roof rat is more common in coastal areas.

Black Rat



Biology cont'd



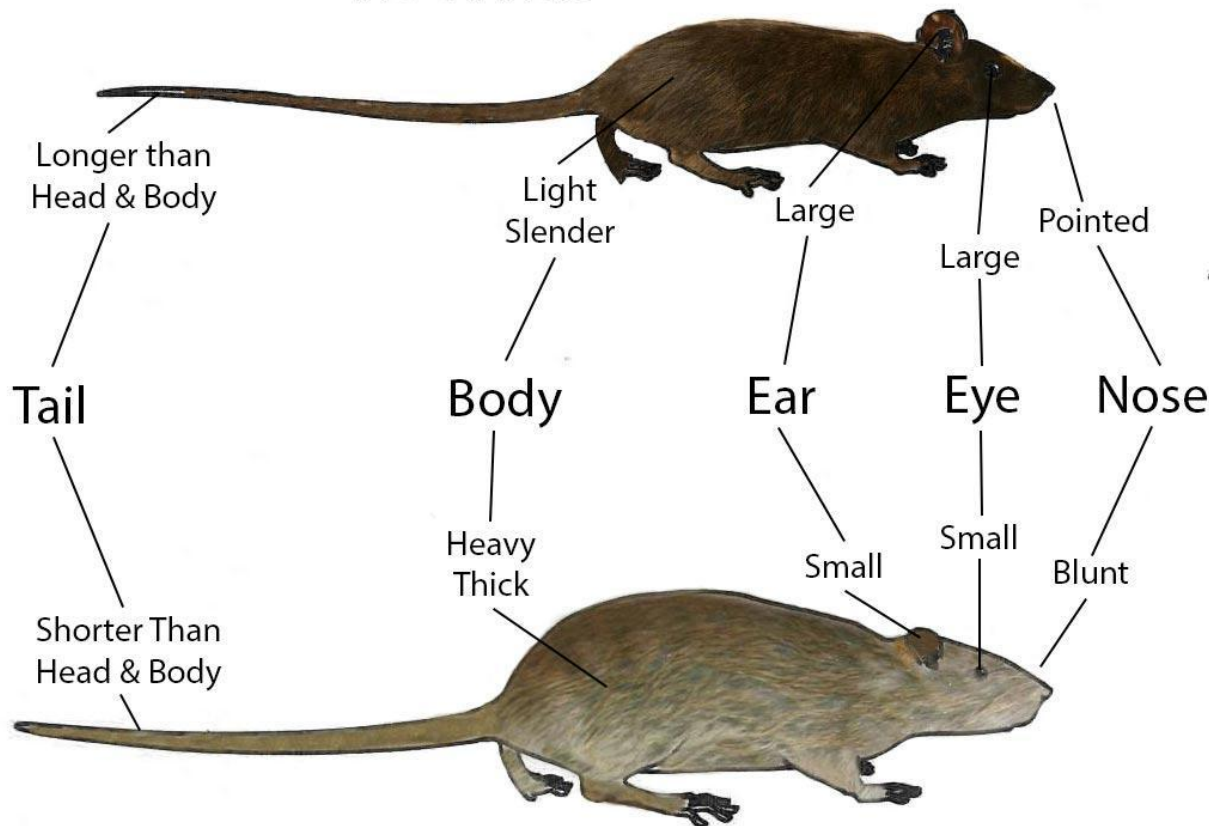
- **House Mouse**

The commensal house mouse is comprised of four subspecies, according to its geographic location: the western European house mouse (*M. musculus domesticus*). The house mouse is considerably smaller than the brown rat and roof rat.

- Its tail is long, with circular rows of scales, and it has very little fur. Its fur varies from a nearly uniform greyish-brown to a pale grey or buff belly.
- The measurements of the house mouse range from 125 mm to 200 mm for the total length; 65 mm to 95 mm for the head and body; 60 mm to 105 mm for the tail; and 12 g to 30 g for the weight. Their feet are always small compared to young rats.
The house mouse is distributed worldwide and tends to have a close association with people. They urinate frequently on the move.
- A mouse can squeeze its head and body flat to enter gaps of 6mm high and 9mm wide. Generally nocturnal but may also be active during the day in human dwellings.

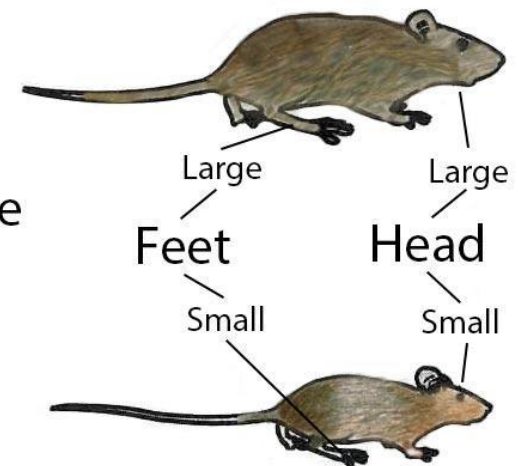
Spot the differences

Roof Rat



Norway Rat

Young Rat



House Mouse

Reproduction & Lifecycle

- **Brown Rat**

The brown rat is capable of reproducing all year in some wild populations, but there are usually spring and autumn peaks. Capable of mating within 18 hours of giving birth, the polyestrous females may bear anywhere from 1 to 12 litters a year of up to 22 pups per litter, with an average of 8–9 pups.

- They reach sexual maturity at 2–3 months of age. While huge numbers of offspring are mathematically possible, predation, limited resources and unfavourable climate, as well as behavioural characteristics, limit the realization of this rat's reproductive potential. In the wild the average lifespan of a rat is probably less than 18 months.

Reproduction & Lifecycle

- **Black Rat**

Reproduction in the roof rat can occur throughout the year, with varying seasonal peaks. Gestation ranges from 21 to 29 days and litter size ranges from 1 to 11 pups, with an average of 8 pups. Females can produce up to five litters in a year. The pups are born naked and blind and are weaned and independent at 21–28 days.

- Females are capable of giving birth at 3–5 months of age. Annual mortality for roof rats that live in the wild is 91–97%, with most living only a year. Captive roof rats have been known to live for 4 years.

Reproduction & Lifecycle

- **House Mouse**

House mice are prolific breeders. They are capable of reproducing throughout the year although seasonal breeding may occur in wild populations. Females may breed 12–18 hours after giving birth. The gestation period is 19–21 days, but may be longer if the female is lactating. Litter size ranges from 3 to 12 pups, with an average of 5–6 pups. Pups are born naked and blind and are fully furred at 10 days; eyes are open at 14 days, and they are weaned and independent at 21 days. There is usually 60–70% mortality before independence is reached.

- Sexual maturity is reached at 5–7 weeks. On average, captive mice live 2 years, while the normal lifespan of wild mice is 12–18 months.

House mouse



Rats at different stages of maturity can be confused with other non-target species especially around water courses.

Water voles are the main problem as they are not pests. They can be identified by small furry ears and shorter tail –10 cm compared to over 20 cm in brown rat.

Rat droppings can also be confused with squirrel droppings in shape and size. This can occur in roof infestations where squirrels have become established.

SQUIRREL DROPPINGS –rounded at both ends



Pipistrelle bat droppings in roof space – shiny surface and full of insect bits



One of two small rodent bodies found inside bags of imported haricot beans.





Tracking powder indoors
is a useful tool to prove
presence and rodent type.
UV light shows up fluorescent
dye.



Engine compartment becomes home to a rat family



It's one thing to share a milk bath or breakfast bowl with the local rats, but in 2003 the rice taken by rodents in Asia equated to food for **200 million people** for the year.



That last slide shows what happens when people don't care and try to live in existence with rodent problems.

Site assessment prior to control implementation.

Site assessment



This forms the basis for control at many levels.

1) Location and type of site – farm, food production premises, food outlets, domestic premises, schools, hospitals, shops, land fill and factories.

Neighbouring premises must be considered as possible sources.

Proximity to water courses must be considered to avoid damage to natural wildlife and non-target species.

2) Fitness of premises.

3) Rodent species involved.

4) Extent of infestation.

1) Premises type present a range of rodent problems.

Where food is readily available rodents will be attracted and try to enter from any direction –

Underground through sewers , pipes, toilets, electrical conduits, and foundation faults.

Above via adjoining roofs and cavity walls.

Simply climbing in through open windows.

Walking through open doors.

Their gnawing and climbing capabilities also help to overcome barriers to entry.

Availability of water is a major factor in rat infestations.

Water is not as important to mice as they utilise moisture in food.

Contamination of water courses must be taken into consideration.

2) Fitness of premises.

Harbourage sites offer ideal shelter and breeding grounds. These can include pallet stores, waste cardboard, neglected vegetation, disused buildings and waste food dumps. Animal food spillages attract rodents quickly and they will return for a free lunch whenever available.

State of repair and maintenance of premises are essential parts of control measures. This includes above and below ground.

Tidy, well maintained premises are less likely to sustain a rodent infestation.

Bait box drowning in alternative
food



3) Identifying the pest species is essential to treatment measures.

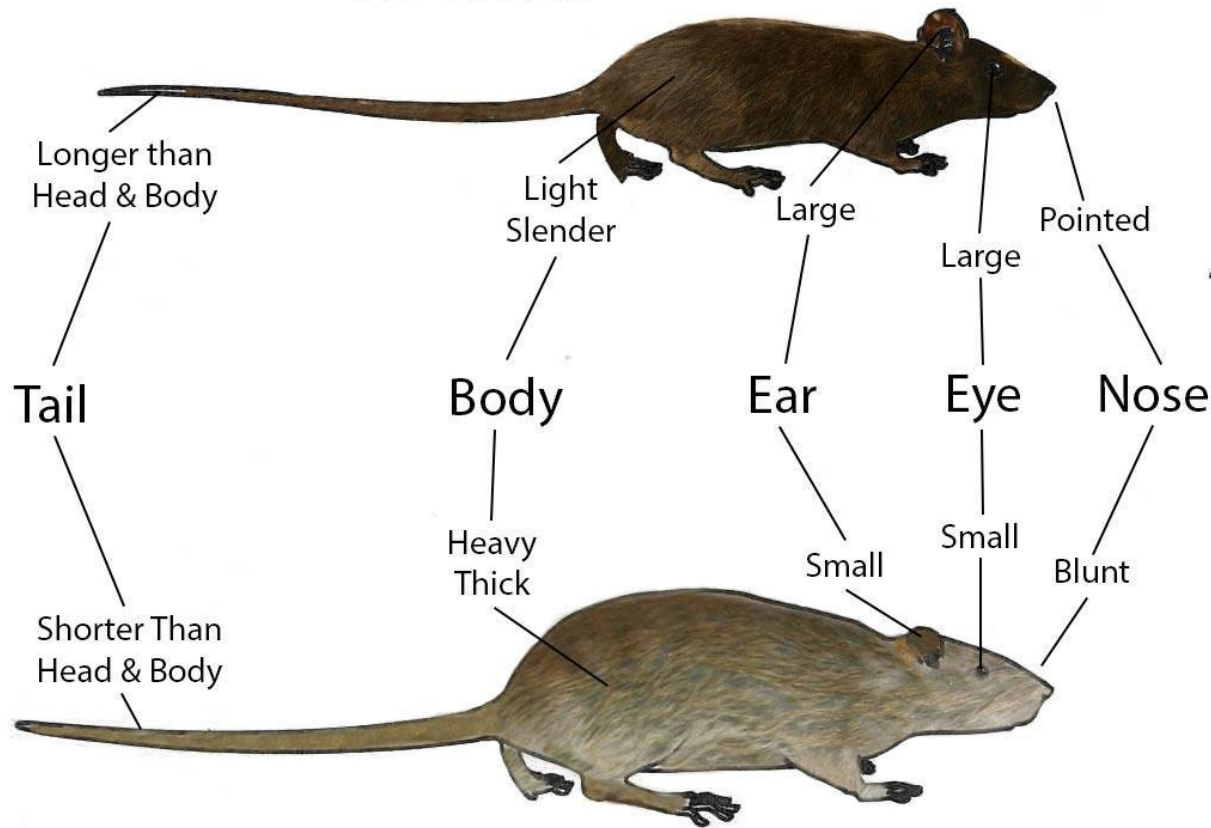
A good torch and camera are useful tools to identify species involved. Small plastic containers to collect droppings may also be of help.

Mouse and rat treatments require different formulations and application regimes.

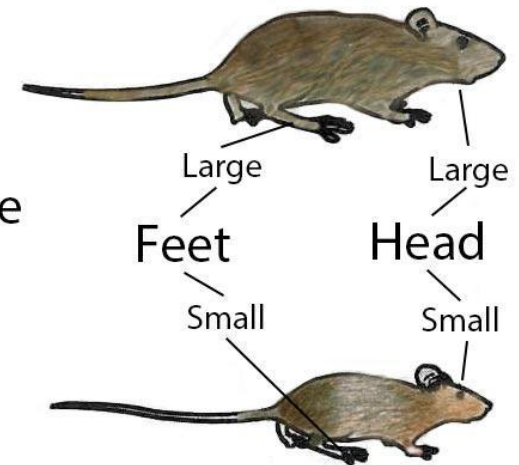
Location, type and numbers of bait stations depend on species involved.

Spot the
differences

Roof Rat



Young Rat



House Mouse

Extent of infestation.

Rodents feed and move at night to reduce risk of predation. If individuals are noticed during daylight hours there is a possibility of a large population where immatures search for food at risk. Rats encountered at night always seem more confident around humans.

Check for signs of active infestation.

Fresh droppings, tail smear marks, smell, foot prints, gnawing, nesting and damage to food packaging or building fabric.

Local personnel should be questioned about sightings but remember to keep an open mind using your own current evidence.

Gauging the size of infestation.

Once an infestation has been confirmed hygiene measures should be enforced to give best effect of treatment.

Baiting stations (toxic or non-toxic) must be secured, mapped, recorded and dated by operative.

Takes on bait should be recorded to show continued effect on infestation. Renew baits to enable further detection.

No takes over a long period suggests end of infestation.

Observations should be logged for future reference to owner.

Single rat or mouse reports in shops or food premises may be controlled by trapping as a quicker route.
Frequent monitoring of traps by operative is required and can supplemented by local staff involvement.

Behaviour Relevant to Control

- By understanding the various **behaviour traits** of rodents we can exploit them to aid control or building protection.

Rodent proofing buildings – young rats can squeeze through openings of less than 25mm, house mice can get through gaps of 6mm.

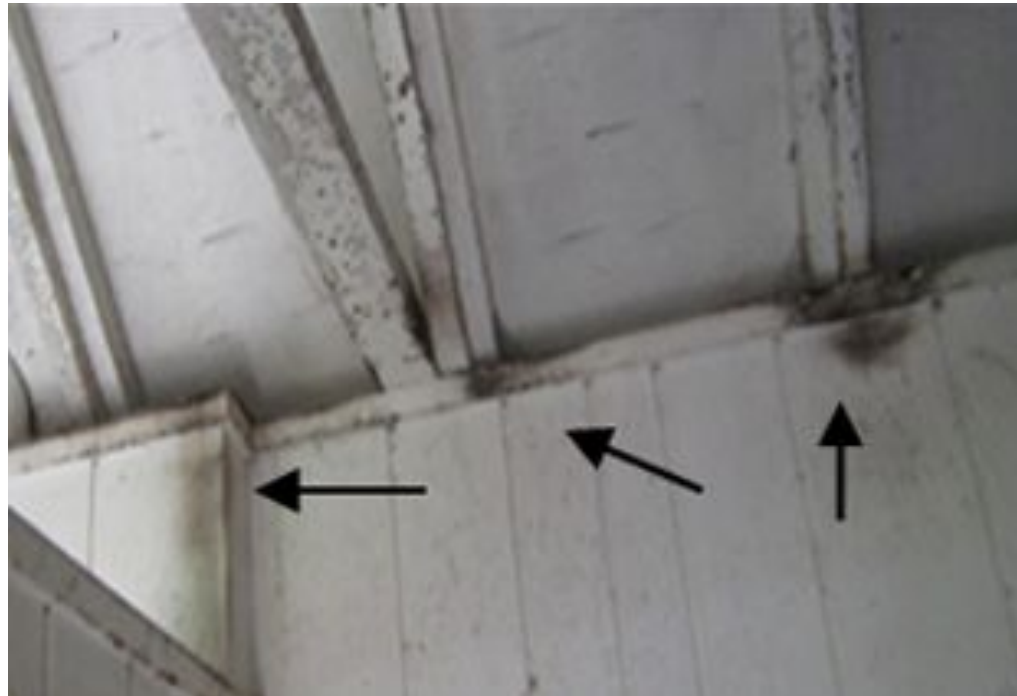
Gnawing – cables, wood, even plastic concrete and metal pipes are all vulnerable.

Burrowing – can be extensive interconnecting burrows and tunnels in well established colonies. Rats like to move along vertical surfaces or under horizontal surfaces and leave smudges which can indicate infestations and runs



Plastic drain pipes chewed through
by
rats

Smear trails/loops at ceiling
level



Behaviour Relevant to Control

- Rats like overhead cover such as low shrubs and vegetation to protect the entrance to burrows. Preferably on sloping terrain – they like to move downwards.
- They build their burrows close to source of water and food. But they will not always take the shortest route to the source preferring, as described above, to follow vertical surfaces.

Easy to spot trails and rat holes under concrete grain silo among sprouting wheat



Behaviour Relevant to Control

- **Neophobia** – avoidance of novel or new things. This is a trait of rats but not the house mouse.
Need to pre-bait. Bait boxes and traps will be avoided when introduced and even after they have become used to them the older rats may still avoid them with only young inexperienced rats being trapped. Dominant mature rats will survive and restore the population.
- Handling traps and bait boxes with gloves prevents transfer of human smell. Old boxes become more acceptable over time.
- Rats may however exhibit **neophilic** behaviour (curiosity) when scavenging, particularly in sites where there is constant change such as landfills.

Behaviour Relevant to Control

- **Populations**

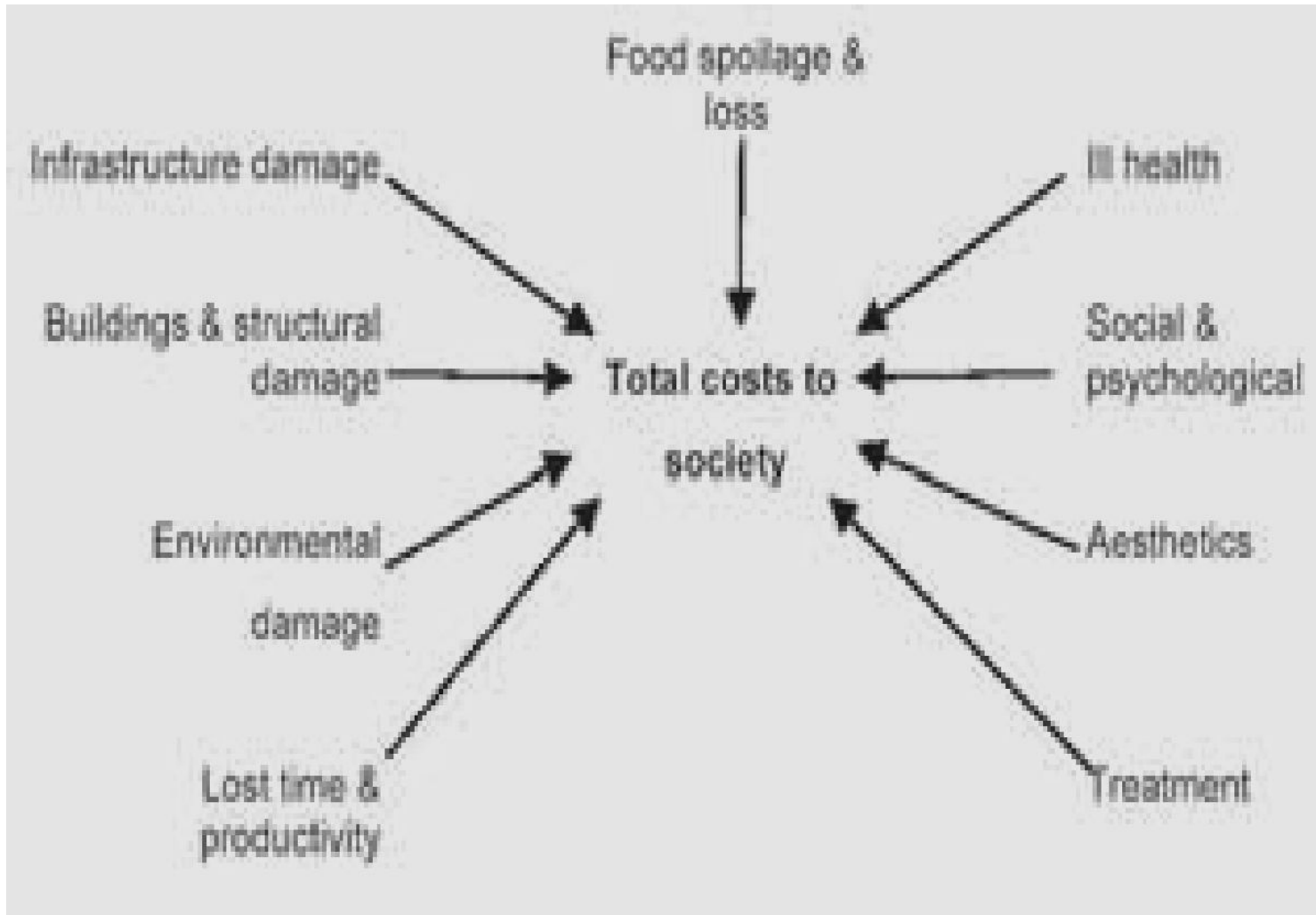
Two main factors – availability of harbourage and food. When populations are not completely exterminated there is evidence that they will breed at a much faster rate to restore the original numbers. There is more food available to current population. This increased breeding may also occur when there is a new food source.

- More rodents are found in areas where there is more litter, untidy gardens, neglected or vacant dwellings.
- Sewers and drains are perfect habitats – stable temperatures, protection from predation and ample food sources encourage breeding all year round.

Public Health Implications

- Over the last 10 centuries rat borne diseases may have taken more lives than all the wars ever fought.
- Estimated that about 40 diseases are carried by rats – leptospirosis especially among water sports, trichinelosis and rat-bite fever are examples.
- Ectoparasites (fleas) and endoparasites (worms) are also a problem.
- It is an offence under the Public Health Act 1961 not to control commensal rodents.

Societal Costs (Source: Battersby 2002)



Control

- Control can often be sporadic and reactive to complaints. The net result of this can be that populations quickly recover. An integrated approach is needed which is based on good knowledge of habitats and populations and species identification.
- Secondary baiting of sewers can achieve greater longer lasting benefit rather than one off baiting
- Pulse baiting where baits are removed and replaced over several periods can achieve almost complete eradication. It relies on the hierarchical feeding habits of rats.
- Other factors must be included in a control programme – repairs to buildings, sewers etc, removal of harbourage and food sources. Look at the risk factors and deal with the whole package – community based approach.

Conclusions

- Environmental Change is usually required – removal of sources of shelter and food. Effective collection, storage and management of waste. Building repair, landscaping, sewer and drain construction/management will all contribute to efficient pest control measures.
- Proper management and adequate numbers of trained staff within public authorities to assess rodent problems.
- Adequate time has to be allowed for professional PCO's to do job properly with monitoring of success.