

Chapter 7

HOUSING AND WELFARE

Irene Rochlitz

Animal Welfare and Human-animal Interactions Group, Department of Veterinary Medicine, University of Cambridge, Madingley Road, Cambridge CB3 0ES, UK

Abstract: The way a cat is housed will have a significant impact on its welfare. The range of housing conditions in which cats may be kept include boarding, breeding and quarantine catteries, shelters, research facilities, veterinary practices and the home. Drawing on ethological principles, the evolutionary history of the cat and studies of cats kept in different conditions, the housing requirements of cats are described with regard to the quantity and quality of space, contact with conspecifics and with humans, and the sensory, occupational and nutritional environments. Features specific to research facilities, shelters and the home are considered, as are the advantages and disadvantages of confining pet cats indoors or allowing them outdoor access.

1. INTRODUCTION

A number of publications on cat behaviour, welfare, human-cat interactions, and other cat-related topics, including housing, have emerged in the last few decades, though research in this area remains limited. Most studies about cat housing have been conducted in laboratories, boarding and quarantine catteries and shelters (e.g. McCune 1995; Rochlitz *et al.* 1998; Ottway & Hawkins 2003). A few publications make recommendations about the enrichment of the home environment for cats confined indoors, with the aim of preventing behavioural problems (e.g. Schroll 2002). Others describe aspects of cat behaviour (Bernstein & Strack 1996; Barry & Crowell-Davis 1999), and interactions between humans and cats (Mertens & Turner 1988; Mertens 1991) in the home setting. This chapter aims to bring together research findings that contribute to our understanding of how cats should be housed and cared for in order to maximize their welfare.

It is obvious that the way a cat is housed and looked after will have a profound influence on its welfare (see Chapter 2). It may initially seem particularly important that housing should be good where cats spend their entire life confined there, such as pet cats kept indoors or cats in laboratories. However, whether the cat will be housed in a particular environment for two days (for example, in a veterinary hospital), for two weeks (in a boarding cattery), two months (in a shelter) or two years (in a laboratory) is of little relevance to the animal. Its welfare is largely determined by the conditions it lives in day-by-day, so high standards of housing and care should apply to all the situations in which cats are kept.

This chapter first describes the main types of housing used for cats, and then considers their most important characteristics with regard to quantity of space; quality of space; and the social, sensory, occupational and nutritional environments. Features of three specific housing conditions, research facilities, shelters and catteries, and the home environment (including whether cats should be confined indoors or allowed outdoor access), are presented.

2. MAIN HOUSING CONDITIONS

The main housing conditions in which cats may be kept are shown in Table 1. In many countries, research facilities and most catteries are required to meet certain minimum standards and are therefore licensed and inspected on a regular basis, while other types of housing, such as shelters, are exempt from regulation. The need to license animal shelters and sanctuaries has been recognised (Patronek & Sperry 2001; Companion Animal Welfare Council 2004). Replacing the Protection of Animals Act 1911 with an Animal Welfare Bill, which would allow the creation of a new offence of 'likely to cause unnecessary suffering', is currently under discussion in the United Kingdom (Department for Environment, Food and Rural Affairs 2002). Under this bill, owners of companion animals would be required to provide a minimum standard of care, which includes adequate housing conditions (a similar bill has already been enacted in Queensland, Australia). The introduction of a Practice Standards Scheme is also planned in the United Kingdom, and will require veterinary practices to provide a minimum standard of accommodation for their hospitalised patients (Royal College of Veterinary Surgeons 2004).

Table 1. The main housing situations in which cats may be kept, the principal caregiver and whether regulatory legislation exists in the United Kingdom.

Housing situation	Principal caregiver	Regulatory legislation (United Kingdom)
research facility	facility staff	yes
boarding or quarantine cattery	cattery staff	yes
breeding cattery	owner and/or cattery staff	yes (if large scale)
shelter or sanctuary	shelter staff and/or volunteers	no
veterinary practice	veterinarian and/or nurse	no
home	owner	no

3. HOUSING REQUIREMENTS

3.1 General Recommendations

Traditionally, much of the advice on cat housing has been based on what is generally practised and what is most convenient for caretakers. Current recommendations can draw on this traditional approach, as well as on recent research (which largely relies on observational studies) and advice from those experienced in the field, such as ethologists and animal behaviour counsellors. More research is needed on the requirements of cats in different housing conditions, so it is likely that recommendations will be modified as further knowledge is gained.

An important objective of good housing is to improve welfare by giving the animal a degree of control over its environment (Broom & Johnson 1993). While housing in a barren environment leads to apathy and boredom (Wemelsfelder 1991), cats do not like unpredictability such as irregular contact with unfamiliar cats or humans, or an unfamiliar and unpredictable routine (Carlstead *et al.* 1993). How the cat responds to the level of stimuli, or predictability, in the environment will depend on many factors, including the cat's temperament (Lowe & Bradshaw 2001) and previous experiences. Providing extremes are avoided, a cat that has a variety of behavioural choices and is able to exert some control over its physical and social environment will develop more flexible and effective strategies for coping with stimuli.

Cats are more likely to respond to poor housing conditions by becoming inactive and by inhibiting normal behaviours such as self-maintenance (feeding, grooming and elimination), exploration and play, than by overtly showing abnormal behaviour (see Chapter 2). Sick cats will modify their behaviour in a similar way (see Chapter 8). Keeping cats in an environment

that encourages a wide range of normal behaviours will, therefore, make it easier for caretakers or owners to detect when cats are unwell.

The control of infectious disease is very important, particularly when cats are housed in groups and where the composition of the group is unstable (see Chapter 8). Care should be taken that management and environmental enrichment procedures do not increase the risk of disease transmission. Over-emphasis on the need for sanitary conditions, however, can lead to a barren housing environment.

3.2 Quantity of Space

Barry and Crowell-Davis (1999) examined gender differences in the social behaviour of the neutered indoor-only cat. While this study did not set out to establish the amount of space cats require, indirectly it gives us some clues. Sixty pairs of cats were studied: 20 were male-male pairs, 20 were female-female and 20 were female-male pairs (47 of the 60 pairs were not related). All the cats were neutered, were never allowed outside, were between 6 months and 8 years of age, and had lived together for at least 3 months. While the cats spent half of their time out of each other's sight, for most of the time that they were together (25 to 31% of observed time) they kept a distance between themselves of 1 to 3 metres. Intriguingly, the male-male pairs spent more time in close proximity (0 to 1 metre; 19% of observed time) than female-female (8.8% of observed time) and female-male (8.6% of observed time) pairs. All cats spent more than 35% of the time within 3 metres of each other. Gender had little effect on the cat's social behaviour, and there were low levels of aggression; the cats regularly ate together and shared resting areas. A reasonable conclusion from this study is that when cats are together, there should be enough space so that they can maintain distances between themselves of at least 1 metre (this can include vertical distance).

Other studies have attempted to determine the minimum size of enclosure (the term enclosure refers to a cage or pen in a cattery, animal shelter or laboratory as well as to the home environment) that cats need, particularly in situations where space is at a premium. Kessler and Turner (1999b) suggest that there should be at least 1.7 m² per cat for group-housed cats in shelters (see section 4.2.1). The working party for the review of the European Convention for the Protection of Vertebrate Animals used for Experimental and Other Scientific Purposes (ETS 123), Appendix A, Council of Europe (1986), recommends that one cat can be housed in a cage with a minimum floor area of 1.5 m², with another 0.75 m² for every additional cat; the cage should be high enough for humans to enter (walk-in) (R. Hubrecht, personal communication).

Domestic cats, having evolved from the semi-arboreal African wild cat, spend less time on the floor of their pens than on raised surfaces (Podberscek *et al.* 1991; Rochlitz *et al.* 1998), and high structures, which provide vantage points, are used more frequently than low ones (Durman 1991; Roy 1992; Smith *et al.* 1994). As the vertical dimension is so important for cats enclosures should be of adequate height, at least 1.5 m so that the cat can stretch fully and jump freely. Walk-in enclosures are ideal, as they also allow caretakers to enter and interact closely and comfortably with the cats. If an enclosure is too small, there may be an increase in agonistic encounters or cats will attempt to avoid each other by decreasing their activity (Leyhausen 1979; van den Bos & de Cock Buning 1994a).

In some instances, it may be necessary to house cats singly in small cages, for example when they are recovering from an experimental procedure or are hospitalised in a veterinary practice. The cage should have at least 1.5 m² of floor space, and ideally should be no less than 1 m high and contain at least one shelf (unless this is contraindicated by the procedure), which will allow the cat to rest on an elevated surface and still be able to stretch in the vertical direction. Placing the cage on a shelf at waist height or higher will make access easier for the caretaker. A litter tray should be provided, as well as a semi-enclosed retreat area such as a box or deep-sided tray (see next section).

3.3 Quality of Space

Beyond a certain minimum size of enclosure, it is the quality rather than the quantity of space that is most important. Most cats enjoy climbing and jumping and, as mentioned previously, spend much of their time off the floor; they use elevated areas as vantage points from which to monitor their surroundings (DeLuca & Kranda 1992; Holmes 1993; James 1995). There should, therefore, be structures within the enclosure that enable cats to use the vertical dimension, such as shelves, climbing posts, walkways, windowsills and platforms.

Cats spend a large portion of their day either resting or sleeping, so it is important that the rest areas have comfortable surfaces (Figure 1). One study noted an improvement in welfare when laboratory cats were provided with soft resting surfaces in the form of pillows (Crouse *et al.* 1995), while another found that cats preferred polyester fleece to cotton-looped towel, woven rush-matting and corrugated cardboard for lying on (Hawthorne *et al.* 1995). In a study of environmental enrichment of cats in rescue centers, Roy (1992) found that cats preferred wood as a substrate to plastic, and also liked materials that maintain a constant temperature such as straw, hay, wood shavings and fabric. As cats are more likely to rest alone than with others

(Podberscek *et al.* 1991), there should be a sufficient number of comfortable resting areas for all cats in the enclosure.



Figure 1. Cats should have comfortable resting areas. This cat is lying in a hammock, which is hung over a radiator. (Courtesy of Cerian Webb).

Hiding is a coping behaviour that cats often show in response to stimuli or changes in their environment (see Chapters 2 and 4). It is commonly seen when cats want to avoid interactions with other cats or people, and in response to other potentially stressful situations (Carlstead *et al.* 1993; James 1995; Rochlitz *et al.* 1998). As mentioned previously, the study by Barry and Crowell-Davis (1999) of 60 pairs of neutered, indoor-only cats, found that they spent between 48 and 50% of the observed time out of each other's sight. Therefore, in addition to open resting areas (such as shelves) there should be resting areas where cats can retreat to and be concealed, such as high-sided cat beds, 'igloo' beds and boxes. Visual barriers such as vertical panels, curtains and other room divisions, can also be useful to enable cats to get out of sight of others. Vertical room dividers will also break up the space into compartments, making it more complex and giving the cat more choice about where it wants to be.

There should be a sufficient number of litter trays, at least one per two cats and preferably one per cat, sited away from feeding and resting areas. Cats can have individual preferences for litter and tray characteristics, so it may be necessary to provide a range of litter types and designs of litter trays (covered or open) (see Chapter 4).

3.4 The Social Environment

3.4.1 Conspecifics

The cat is a social carnivore that regularly interacts with conspecifics (Leyhausen 1979). In research facilities, multi-cat households and some animal sanctuaries, cats are expected to spend most of their lives together. The majority of cats can be housed in groups providing that they are well socialized to other cats, and that there is sufficient good-quality space, easy access to feeding and elimination areas and a sufficient number of concealed retreats and resting places. Ideally, the composition of the group should be stable, with minimal additions or losses of cats (see section 4.3.2 for a discussion of environmental stressors due to social factors, and Chapters 1, 2 and 4 on socialization). Many factors will determine the ideal group size, but it seems that 10 to 12 for shelters and 20 to 25 for cats in laboratories is an appropriate maximal number (James 1995; Hubrecht & Turner 1998). Cats that fail to adapt satisfactorily to living in groups should be identified and housed in pairs or singly.

When there are many cats housed together, it may be necessary to distribute feed, rest and elimination areas in a number of different sites to prevent certain cats from monopolising one area and denying others access (van den Bos & de Cock Buning 1994b). Conflict between cats may arise, for example, if feeding bowls are concentrated in a small area or all the litter trays are placed together.

Neutered cats can be kept together in groups, as can entire females. While some authors suggest that entire males should be housed singly, others have shown that they can be housed successfully with other entire males (Hart 1980) and with neutered males (Podberscek *et al.* 1991); they can also be kept with neutered females.

3.4.2 Humans

The caregiver, whether a member of shelter staff, an animal technician, an owner or a veterinary nurse, is the most important determinant of the cat's welfare, and the best housing conditions cannot substitute for the caregiver's

compassionate care and attention. Unfortunately, it is often this direct involvement of staff in animal care that is curtailed, especially in situations where there are limits on financial resources, shortage of time or high work demands. While interactions with conspecifics or other animals are also important and rewarding to the cat, they are not a substitute for human attention. Randall *et al.* (1990) found that laboratory cats organized their daily activity patterns around human caregiver activity, and responded strongly to humans in their environment. Cats in enriched conditions in a laboratory facility demonstrated a clear preference for human contact over toys (DeLuca & Kranda 1992). Periods of time, which are not part of routine care-taking procedures (such as feeding or cleaning), should be available every day for cats to interact with their caregiver (Figure 2). Some cats may prefer to be petted, groomed and handled while others may prefer to interact via a toy (Karsh & Turner 1988).



Figure 2. A period of time, which is not part of routine care-taking procedures, should be set aside every day for cats to interact with their care-giver.

In order to care for them properly, the caregiver should like cats and be knowledgeable about them. This knowledge can be acquired from many sources, such as books and other printed information, internet sites,

veterinary practices, animal behaviour courses, animal behaviourists, animal rescue charities, and from mentoring and supervision by peers. Because some information may be controversial, contradictory or wrong, inexperienced caregivers will require guidance from reputable sources.

In situations where cats are kept as companion animals in the home, the benefits to humans from caring properly for their pet are obvious (see Chapter 3). Benefits can also arise in other, less obvious conditions, such as in a shelter or laboratory. Allowing caregivers to enrich the environment of cats under their care can also enrich their own lives (Young 2003). This involvement introduces variation in their work, provides them with opportunities to learn about the species, to devise the enrichment and to observe its effects, and, by improving the cats' welfare, makes their work more rewarding.

3.5 The Sensory Environment

The quality of the external environment is very important to cats, whose senses are highly developed (Bradshaw 1992). Cats spend a lot of time observing the environment immediately outside their enclosure; they will often settle on windowsills if they are wide and comfortable enough, but other suitable vantage points, such as climbing platforms and shelves placed near windows, may be used. DeLuca and Kranda (1992) found that research cats housed as a group in a room spent most of the day sitting on a window perch, watching activity in the outside hallway. If cats do not have free access to the outdoors they should have access to enclosed outdoor runs or, if this is not possible, their enclosure should have windows so that they can look outside (Figure 3).

Olfactory enrichment is relatively underused in animal housing, perhaps because of the relatively poor sense of smell of humans compared with many other species. Recently, Wells and Egli (2003) examined the effect of introducing four odours on the behaviour of six zoo-housed black-footed cats (*Felis nigripes*). The odours were nutmeg, catnip (*Nepeta cataria*), body odour of prey (quail), and no artificial odour (as a control) and were introduced individually into the cats' environment on impregnated flannel cloths. There was an increase in the amount of time cats spent in active behaviours and a decrease in time spent in sedentary behaviours, though the response to the odours waned over the 5-day observation period. Nutmeg caused less of an effect than catnip or odour of prey. Catnip is well known as a stimulant for cats, though not all cats are affected by it. It is usually supplied as a dried herb or in toys, and can be grown as a fresh plant in pots.

Cats have an excellent sense of smell and olfactory communication is important in this species (Bradshaw & Cameron-Beaumont 2000), although

the role that odours play within social groups is not well understood (Bradshaw 1992; see Chapter 1). Sebaceous glands are located throughout the body, especially on the head and the peri-anal area, and between the digits. Scratching, which causes scent to be deposited from the inter-digital glands, is frequently observed in cats; this marking behaviour also leaves visual signals (striations) and helps to maintain the claws in good shape (see Chapter 4). Surfaces for the deposition of these olfactory and visual signals and for claw abrasion, such as scratch posts, rush matting, pieces of carpet and wood, should be provided.



Figure 3. Cats should have access to natural light, and be able to observe the outside environment. (Courtesy of Cerian Webb).

In some animal houses auditory enrichment using a radio, to provide music and human conversation, is thought to prevent animals from being startled by sudden noises and habituate them to human voices, and to provide a degree of continuity in the environment (Benn 1995; James 1995; Newberry 1995). Video recordings of images and sounds that are thought to appeal to cats are available, though their effectiveness has not been evaluated.

3.6 The Occupational Environment

Many cats play alone or with their owners, rather than with other cats (Podberscek *et al.* 1991), so there should be enough space for them to play without disturbing others. A variety of toys should be available, and they should be replaced regularly as novelty is important to cats. Many toys are made to resemble mice and other small animals and to look attractive to humans, but they are often not very effective at eliciting play or pseudo-predatory behaviour in the cat. The qualities of the toy are more important than its appearance: it does not matter if it looks artificial, providing it elicits the desired behaviour. Objects which are mobile, have complex surface textures and mimic prey characteristics are the most successful at promoting play (Hall & Bradshaw 1998). For laboratory cats caged singly, de Monte and Le Pape (1997) found that a tennis ball was a more effective enrichment tool than a wooden log.

Cats also benefit from opportunities to explore, so suitable novel objects such as boxes, large paper bags and other structures can be introduced into their environment intermittently.

3.7 The Nutritional Environment

Domestic cats are usually offered two or three meals a day and seem to adapt well to this, although their preferred pattern of feeding is one of frequent small meals (Bradshaw & Thorne 1992; see Chapter 9). Frequent feeding may not always be possible in the home environment, and *ad libitum* feeding may lead to obesity.

Another environmental enrichment technique is to increase the time animals spend in pseudo-predatory and feeding behaviour. Studies have examined the effects of food presentation in a number of species, including captive small wild cats (Markowitz & LaForse 1987; Law *et al.* 1991; Shepherdson *et al.* 1993). McCune (1995) suggests putting dry food into containers with holes through which the cat has to extract individual pieces. For the cat that is food-orientated, small amounts of dry food can be hidden in the environment to make it more interesting to explore. Toy-like objects that are destructible and have nutritional value may be of interest to cats, but there are few such items available commercially.

Cats often prefer to drink away from the feeding area, so bowls of water should be placed in a number of locations, both indoors and outdoors. Schroll (2002) states that cats like to be in a slightly downward position when drinking, and some like drinking running water, such as from a dripping tap or small water fountain.

Grass grown in containers can be provided for indoor-only cats; some cats like to chew it and it is thought that this can help with the elimination of furballs (trichobezoars) (Figure 4).



Figure 4. Grass can be grown in pots for cats confined indoors; some cats like to chew it and it is thought that this can help with the elimination of furballs.

4. SPECIFIC HOUSING CONDITIONS

4.1 Research Facilities

Whenever animals are to be used in biomedical research, consideration should be given to the implementation of the ‘Three Rs’: replacement, reduction and refinement (Russell & Birch 1959). While the ultimate aim should be to replace all live animal use in experiments with non-sentient material, it is likely that cats will continue to be used in such research in the

near future, albeit in reducing numbers, and refinement remains very important. Refinement applies both to experimental procedures and to the way cats are housed and looked after. While much attention, justifiably, is paid to the regulation of experimental procedures, with the emphasis on the control of pain, housing conditions also have a major impact on the cats' welfare so they too should be well regulated to the highest standard (Figure 5). Keeping cats in an enriched, stimulating environment that encourages a wide range of normal behaviours will, by enhancing their welfare, make them better subjects for scientific investigation (Poole 1997), have a positive effect on the public perception of the treatment of animals in laboratories (Benn 1995) and, when these cats are no longer required for research and are re-homed, they will be more likely to adapt successfully to their new home environment.

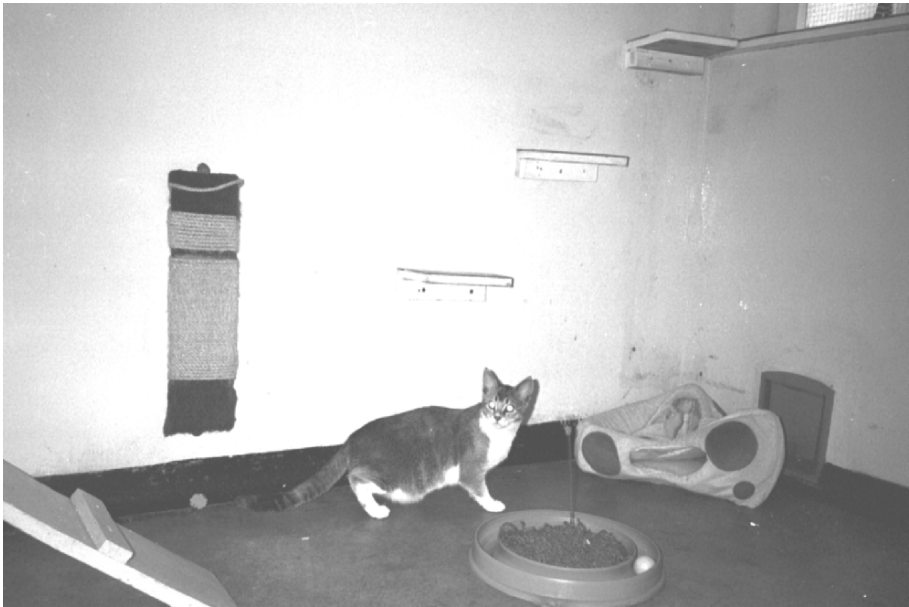


Figure 5. There are toys, shelves, a scratch post and access to an outdoor pen (via a cat-flap) in this research facility.

It has been suggested that the emphasis in laboratory animal housing should be shifted from an 'engineering' approach (providing cages of certain dimensions and features, and defined management procedures) to a 'performance' approach (providing housing conditions and management procedures that enable the animals to reach certain performance standards) (National Research Council 1996). While the performance approach is more flexible and less prescriptive, the engineering approach is sometimes useful

to establish a baseline. Because cage space in laboratories is costly, a number of studies have examined the effect on animals of enlarging cage size (see Reinhardt & Reinhardt (2001) for a summary). Assessing only the effect of the quantity of cage space on the behaviour of animals is of limited value, because the usefulness of the space depends mostly on the quality of the cage contents that enable the animal to make use of the additional space. A small cage that is barren will still be barren if it is a little bigger. Using the engineering approach, a minimum cage size that is able to contain the basic features which are necessary to make the quality of the space appropriate for cats can be specified, but thereafter the performance approach can be used to develop more imaginative and flexible ways of enriching the cage.

Because of security concerns, the need to control costs and other factors, the trend in housing cats in research facilities has been towards keeping them in rooms, often without windows, within buildings rather than in enclosures with outdoor runs. Depriving cats of sensory access to the external environment around their enclosure is likely to have a detrimental effect on their welfare.

4.2 Shelters and Catteries

The Chartered Institute of Environmental Health has published model licence conditions and guidance for cat boarding establishments in the United Kingdom (CIEH Animal Boarding Establishments Working Party 1995), which serve as a basis upon which local environmental health officers issue licences to boarding catteries. The Feline Advisory Bureau (a cat charity) in the United Kingdom has published two manuals, one on how to set up and manage a boarding cattery (Bessant 2002) and another on how to set up and manage a shelter (Haughie 1998). While much of the advice is sound and based on experience and current practice, there is a need for more scientific input into the best way to house cats in catteries and shelters. Although more studies have been carried out in shelters than in boarding catteries, research findings can, in most instances, be extrapolated from one environment to the other.

4.2.1 Role of Shelters

The function of shelters is to provide housing, food and care for cats that are abandoned and unwanted and, providing the cats are healthy, to find them homes as quickly as possible. A cat's stay in the shelter should be kept short and the cat subjected to as little stress as possible. The population of cats entering shelters is often extremely heterogeneous (Evans 2001), differing, for example, in origin (feral, stray, owned), socialization status,

age, vaccination status and health. In most shelters, the control of infectious disease is a major challenge (see Chapter 8). In a study of respiratory and enteric viruses in 162 cats entering shelters in the United States, feline calicivirus (FCV) was isolated from 11% of healthy cats upon entry, feline herpesvirus (FHV) from 4% and feline enteric coronavirus (FECV) from 33% of cats (Pedersen *et al.* 2004). The subsequent spread of all three viruses was rapid: 15% of cats were shedding FCV, 52% FHV and 60% FECV after one week. Although the shelter environment may not be the primary source of these viruses, it serves to spread viruses between infected and non-infected cats, to reactivate latent infections and to enhance the severity of disease through stress and increased exposure.

The Cat-Stress-Score (CSS), which is based on body movements, postures and other features such as pupil size, has been widely used in studies of cats in shelters and catteries (see Chapter 2). It is most useful for assessing the stress levels of cats confined to a small space such as a cage or pen; changes in scores for an individual cat, taken over a period of time, can reflect how it is adapting to the new environment.

Cats with previous experience of boarding in catteries or shelter-like accommodation, as well as those that have short traveling times to the premises and short waiting times before being admitted, will settle in more quickly and be less stressed (McCune 1992). While Kessler and Turner (1997) did not find that the age of the cats affected their adjustment to being housed in shelters and boarding catteries, in McCune's study (1992) the stress levels of older cats declined more rapidly. Kessler and Turner (1999b) examined how the density at which cats were housed in groups in a shelter affected their stress levels. There was a positive correlation between CSS and group density, and a minimum floor space of 1.7 m² per cat was recommended to ensure acceptable stress levels. However, these cats were socialized to conspecifics, the composition of the groups was relatively stable, and the enclosures well adapted for cats. In other situations, more space per cat may be required.

Some cats may be housed in shelters for long periods of time (months or even years), especially if the shelter has a 'no-kill' policy, that is they will not euthanise a healthy animal. Due to the social disruption, lack of control, and both acute and chronic fear-inducing situations that may exist in the shelter environment, concerns about the welfare of these long-stay animals have been raised (Patronek & Sperry 2001). Ensuring that the cat has daily, rewarding contact with humans is important, and may have other beneficial effects. Hoskins (1995) examined the effect of human contact on the reactions of cats in a rescue shelter: cats that received additional handling sessions, where they interacted closely with a familiar person, could subsequently be held for longer by an unfamiliar person than cats that did

not receive additional handling sessions. This is likely to improve their rehoming potential. Siegford *et al.* (2004) describes a behavioural test that could be used to better match cats with prospective owners (see Chapter 3).

4.2.2 Single versus Group Housing

There has been much discussion and some research on whether cats should be housed discretely or in communal groups in shelters.

Ottway and Hawkins (2003) studied 72 cats living long-term (over one month) in shelters. Thirty-six were housed communally with non-familiar conspecifics and 36 in discrete units, either singly or with another one or two previously familiar conspecifics. The mean CSS was higher in communal than in discrete-unit housing, though very high stress scores (more than 5 out of 7) were not recorded in cats housed under either condition. Cats housed communally spent more time hidden, while cats in discrete housing were more likely to play and spent more time resting or sleeping in contact with another cat. They concluded that communal housing may be undesirable in a shelter situation, because of the inappropriate social grouping of unrelated adult cats and inherent instability of the group.

Durman (1991) studied the behaviour of cats housed communally in small groups (between four and seven cats) in rooms in a shelter. Newly introduced cats were aggressive towards others, and showed behaviours indicative of high levels of stress (such as vocalizing and attempting to escape). These behaviours had largely disappeared after four days while other behavioural measures (such as sitting underneath a shelf, exploring the room and sitting alertly) changed more slowly, but all had reached equilibrium after two weeks. Some cats, who had been at the shelter for more than a few months, had access to large outdoor pens. The most recently-introduced cats to the group were the most vigilant and aggressive, while those present in the shelter for more than one year were more likely to rest in contact with another cat, to approach other cats, and to initiate rubbing and mutual grooming. While Smith *et al.* (1994) did not find behaviour patterns indicative of high stress levels in a group of unrelated cats in a shelter, these cats were part of a stable group living together long-term and there was not a constant influx of new cats.

Gourkow (2001) examined the effects of four different housing conditions, or treatments, on the behaviour and stress levels of cats in a shelter, and on the outcome for these cats (whether they were adopted, became ill or were euthanised). The first treatment, T1, consisted of a small stainless-steel cage containing food and water bowls, a litter tray and a folded towel as bedding. The second treatment, T2, was the same cage enriched with a wooden shelf and hiding area underneath it. In these first

two treatments cats were housed singly. The third treatment, T3, was a walk-in cage converted from a dog kennel, where cats were housed in groups of eight. The cage had ten shelves, five hiding areas, bedding and a small chair, as well as food and water bowls and litter trays. The fourth treatment, T4, was the same as T3 except that it contained more furniture items, such as a plastic cat playhouse, toys and a scratching post. Cats in T1 were handled by a number of caretakers, each of whom handled the cat in their own way, whereas cats in the other treatments were handled by only one or two people and in a more consistent manner.

Cats in T1 had higher stress scores, were less likely to be adopted, and were adopted at a later stage than cats in the other treatments. They were also more likely to be euthanised. Compared to cats in the other treatments, T1 cats were less likely to display behaviours that potential adopters described as desirable (such as interacting with another cat). While there were a number of variables that differed between treatment groups, and these were not controlled for in comparisons, this study illustrates the effects of housing and of contact with humans on the welfare of cats, both in terms of the levels of stress they experienced while in the shelter and on their ultimate fate.

Cats entering a shelter have to cope with the stress of leaving their own familiar environment (in the case of owned cats), of entering a strange new environment, of being handled by strangers and, in most cases, undergoing a veterinary examination. They will be aware that there are other unfamiliar animals nearby. In the first few weeks following arrival, it is unlikely that they will benefit from being housed with unfamiliar conspecifics or in a group of cats whose composition is constantly changing. During this period, it is probably preferable to house cats in discrete units, that is to keep them in their original groups (four or more cats from the same household can be split into smaller groups of two to three cats), rather than introduce incoming cats into groups of cats with whom they are not familiar (Figure 6). This period of discrete housing will also allow caretakers to find out more about the individual cat's health, behaviour and personality, and to identify, treat and control disease. If adoption is not imminent or if there are constraints on space, it may then be worth considering moving the cat into communal housing providing that the group is not too large, there is plenty of space that is suitably enriched, and that there is some stability in group composition. Cats previously socialized toward people and conspecifics will adapt better to housing in groups than non-socialized cats (Kessler & Turner 1999a). There will be some cats that are unable to adapt to communal housing; they should be identified and housed in pairs if possible, or singly.



Figure 6. Cats entering this shelter are housed in their original groups, and not mixed with cats with whom they are not familiar.

4.3 Home Environment

4.3.1 Indoor-only versus Outdoor Access

In the United Kingdom, the majority of cats are allowed access to the outdoors; it is generally considered that this is the natural thing for cats to be able to do. In a questionnaire survey of owners of 1,070 cats, 90 cats (8.4%) were confined indoors; 70% were under a year of age and it was likely that most of the young, entire animals would eventually be allowed out once neutered (I. Rochlitz, unpublished data). In the United States, between 50 and 60 per cent of pet cats are kept permanently indoors (Patronek *et al.* 1997). The American Veterinary Medical Association has stated that it strongly encourages owners of domestic cats in urban and suburban areas to keep them confined indoors; the Humane Society of the United States and many American shelters also commonly advise this, as do American

veterinarians (Buffington 2002). In many areas of Australia, concerns about the effects of cat predation on wildlife have led to the adoption of regulations restricting pet cats' access to the outdoors. In addition, the population of Australian cats is declining due to neutering (de-sexing) being compulsory in many areas (C. Phillips, personal communication).

It is generally assumed that cats confined indoors will be healthier and live longer, as they are protected from hazards associated with the outdoors (Table 2). Different hazards, however, may be present in the home. The Blue Cross animal charity found that household accidents were the second most common reason that puppies and kittens were brought into its flagship hospital (Veterinary Department, The Blue Cross, London, personal communication). The accidents included falls from balconies and windows, kitchen scalds and burns, and access to cleaning products.

Buffington (2002) recently reviewed the veterinary literature for epidemiological data on cats confined indoors and disease risk (Table 2). He found that conditions such as feline urologic syndrome (a urinary tract disease), odontoclastic resorptive lesions (a dental disease), obesity, hyperthyroidism (an endocrine disease), and behavioural problems (such as inappropriate elimination) were associated with keeping cats indoors in some studies, while others did not find that indoor cats were at increased risk of developing these conditions. The difficulty with conducting these studies is that there are likely to be confounding factors and interactions. For example, pedigree cats may be more likely to be kept indoors, may be predisposed to certain inherited diseases, and may be treated differently by their owners compared with non-pedigree cats.

Table 2. Conditions and diseases that may be associated with confining a cat indoors or allowing it access to the outdoors

Cat is confined indoors	Cat has access to the outdoors
feline urologic syndrome	infectious diseases (e.g. viral, parasitic)
odontoclastic resorptive lesions	road traffic accidents
hyperthyroidism	other accidents (e.g. falling from a tree)
obesity	fight with other cats
household hazards	attacks by humans, dogs and other animals
behavioural problems (e.g. inappropriate elimination/toileting)	poisoning
boredom	theft
inactivity	going astray

While a pet cat with outdoor access can probably compensate to some degree for poor conditions in the home (Turner 1995b), eventually the cat may leave the home to find better conditions elsewhere, become a stray and end up in a shelter. Only a small proportion of cats are identified with a

microchip or collar, and the majority of stray cats entering shelters are not reclaimed (Evans 2001; see Chapters 5 and 6). Owners of lost cats often find it very difficult to trace them, especially if the cats do not have a form of identification.

The main concern with an indoor environment is that, compared with the outdoors, it is relatively impoverished, predictable and monotonous and may cause the cat to experience boredom and stress. While we often do not know what cats do when they are outdoors, it is generally assumed that indoor cats are less active and that this inactivity can lead to obesity and other problems. Certain behaviours, such as scratching items and spraying urine, may be considered normal when performed by a cat outdoors but become problematic when performed indoors (see Chapter 4).

As discussed previously, most cats seem to be able to adapt to indoor living well providing they have been kept in this kind of environment from an early age. Some geriatric cats, or those with disabilities, may also benefit from being confined indoors but cats used to having outdoor access may have difficulty adapting to an entirely indoor existence when adult (Hubrecht & Turner 1998). The recent increase in popularity of the cat as a companion animal in many countries has been partly ascribed to the fact that it requires relatively little care compared with the dog, not having to be taken out for walks or be trained. Also, it can be kept in a smaller space, such as an apartment, and will use a litter tray. Nevertheless, cats require a certain level of social interaction with their owners and this requirement may be increased when their physical environment is restricted (see Chapter 4). Cats confined indoors spend proportionately more time with people than cats with access to the outdoors, which has been interpreted as cats seeking additional stimulation in an environment that is relatively less stimulating (Turner & Stambach-Geering 1990). There are a number of websites that give advice to owners on how to enrich the indoor environment for their cat (for example www.nssvet.org/ici).

One reason for keeping cats indoors is to protect them from road traffic accidents. In a study of factors that may predispose cats to road traffic accidents in Cambridgeshire, United Kingdom, 115 owned cats that had been in a road traffic accident (RTA) were compared with a control population of 794 cats that had never been in a RTA (Rochlitz 2003a). RTA cats tended to be younger (46% were between 7 and 24 months of age), male (both neutered and entire, 62%) and non-pedigree (97%). For every one year increase in age, the odds of a road accident decreased by 16 per cent; the odds for males (entire and neutered) being in a road accident were 1.9 times the odds for females (entire and neutered), and the odds for pedigree cats were 0.29 those for non-pedigree cats. Proportionately more of the RTA cats lived in areas with higher levels of traffic and there was a trend for more

accidents to happen during the night than the day (Rochlitz 2003b). In view of these findings, it may be appropriate to advise owners who are worried about their cat being involved in a RTA to adopt an older, neutered female, possibly of a pedigree breed, to keep it in at night and, if feasible, to live in an area with low levels of traffic.

The effects of predation by cats on wildlife should also be considered when evaluating indoor versus outdoor living. Solutions to enable the cat to benefit from outdoor access without risk to itself or others include restricting outdoor access to certain parts of the day, creating secure, yet stimulating and complex, cat-proof enclosures within a garden (for example, walk-in cages or modular structures extending through a garden, secure perimeter fences) or training a cat to go for walks on a leash, but they may not be possible in many situations. The effectiveness of bells or ultrasonic devices on collars, to alert wildlife to the cat's presence, appears to be limited.

With the current state of knowledge it is not possible to definitively say that confining cats indoors is preferable to allowing them outdoor access; each situation should be assessed individually, taking into account the cat, its owner and the local environment.

4.3.2 Requirements of Cats Kept in the Home

The home range of the pet cat confined indoors is inevitably very small compared to that of cats allowed to roam freely. Mertens and Schär (1988) recommend that an indoor-only cat should have access to at least two rooms. Bernstein and Strack (1996) described the use of space and patterns of interaction of 14 unrelated, neutered domestic cats, who lived together in a single-storey house at a density of one cat per 10 m², and did not have access to the outdoors. Most of the cats had favourite spots within the rooms that they used. Some individuals had their own unique place, but more commonly several cats chose the same favourite spot. These areas were shared either physically, by cats occupying the space together or, more often, temporally by cats occupying them at different times of the day. There was very little aggression and no fighting between the cats. Individuals seemed to peacefully co-exist with each other by avoiding each other for most of the time. Neutered males had an average home range of four to five rooms (out of 10), and neutered females a range of three to 3.6 rooms. While Mertens and Schär (1988) state that female cats may be more suited to an indoor existence than male cats, because feral males have bigger home ranges than feral females, it seems that both neutered males and neutered females can be successfully housed indoors providing there is sufficient quantity and quality of space and that they are used to these conditions from an early age.

Schroll (2002) suggests that there should be at least two types of resting places per cat, one on the floor enclosed by three sides and another elevated with a good view, and that this is particularly important to prevent behavioural problems in the multi-cat household. She also advises placing a scratching surface in more than one location, for example at places of entry and exit in the home, and also next to the resting or sleeping area, as these are locations that the cat will want to mark as part of its environment (see Chapter 4).

Litter trays should be positioned in a quiet place in the house, and cleaned at least once a day. Cats with easy access to the outdoors may not need a litter tray, although older cats, those who do not like to go out in bad weather, and cats that are unwell may require one.

Cats are often kept in the home together with another companion animal, such as a dog. Providing the cat is habituated to dogs, it is likely that the cat's social environment is enriched by this contact but there are few studies specifically examining the benefits to the cat from this interaction.

The more an owner responds to their cat the more likely it is to respond to them, and interactions initiated by the cat last longer than those initiated by the owner (Turner 1995a). In a study of interactions between cats and their owners in the home (Mertens 1991), cats in single-cat households stayed closer to their owners for longer, and had more social play and more interactions in general with them, than did cats in multi-cat households (see Chapter 3 for a discussion of the human-cat relationship).

Group-living cats lack distinct dominance hierarchies, signals for diffusing conflict and post-conflict mechanisms such as reconciliation (van den Bos & de Cock Buning 1994b; van den Bos 1998). They are not adapted to living in close proximity to each other, and in the wild would reduce the likelihood of aggression by dispersing or avoiding each other (Leyhausen 1979); this is often not possible in the multi-cat household. Recent evidence from clinical behavioural studies suggests that one of the major reasons for the development of behavioural problems, such as fearful or avoidance-related behaviours, are environmental stressors and that a high proportion of these relate to social factors (relationships with other cats or with humans) (Casey & Bradshaw 2000). The environment in which the cat is housed will affect the development and maintenance of these behavioural problems. Sibling pairs of cats have more amicable relationships than unrelated cats living together (Bradshaw & Hall 1999). The incidence of behavioural problems tends to increase when there are four or more cats in a household, particularly if the cats are unrelated. When cats are introduced to each other as adults, they may not regard each other as part of the same social group but they are forced to live together in relatively close proximity. When there is a high density of cats in a neighbourhood, cats may be frequently involved in

aggressive encounters with others, and some cats may become frightened of going outdoors. Owners should be aware of the social dynamics between cats in their household, and be prepared to seek professional advice if it appears that the welfare of their cats is compromised (see Chapter 4).

5. CONCLUSIONS

Traditionally, because cats are small animals it was thought acceptable to house them in small enclosures. With the development of an understanding of the ethology of the cat, its evolutionary history and findings from studies of cats housed in different conditions, we recognise that this approach is unsatisfactory. A certain minimum amount of space, which is more generous than previously assumed, is needed in order to provide a good quality of space, enriched with places to hide and structures that enable use of the vertical dimension, a stimulating sensory environment and opportunities to explore and play. While most cats can live with conspecifics, in order to do so successfully they need enough space to be able to keep a certain distance, and to get out of sight of each other. The care and attention from the human caregiver is the crucial determinant of a cat's welfare in any housing condition.

While the aim in biomedical research should be to eventually end all live animal use, the way cats are kept in research facilities should be refined to optimise their welfare. This will also lead to better science, positively influence the public perception of research using animals and improve the cats' chances of being re-homed when the research is completed. For cats in shelters, providing an enriched environment that minimizes stress, reduces the risk of disease transmission, and increases the likelihood of being adopted, remains a formidable challenge. It is being increasingly recognised that some cats suffer from severe social stress when housed in groups, for example in multi-cat households and shelters. As more and more cats are kept as pets in many countries, studies of cats in the home setting and studies comparing the welfare of indoor-only cats with that of cats allowed outdoors, are urgently needed.

6. REFERENCES

- Barry, K. J. and Crowell-Davis, S. L. (1999) Gender differences in the social behaviour of the neutered indoor-only domestic cat. *Applied Animal Behaviour Science* **64**, 193-211.
- Benn, D. M. (1995) Innovations in research animal care. *J. American Veterinary Medical Association* **206**, 465-468.

- Bernstein, P. L. and Strack, M. (1996) A game of cat and house: spatial patterns and behaviour of 14 cats (*Felis catus*) in the home. *Anthrozoös* **9**, 25-39.
- Bessant, C. (2002) *Boarding Cattery Manual*. Feline Advisory Bureau, Tisbury, Wiltshire, UK.
- Bradshaw, J. W. S. (1992) *The behaviour of the domestic cat*. CAB International, Wallingford, Oxon.
- Bradshaw, J. W. S. and Cameron-Beaumont, C. L. (2000) The signalling repertoire of the domestic cat and its undomesticated relatives. In Turner, D.C. and Bateson, P. (eds.). *The Domestic Cat: the biology of its behaviour*, 2nd edn., Cambridge University Press, Cambridge, pp. 68-93.
- Bradshaw, J. W. S. and Hall, S. L. (1999) Affiliative behaviour of related and unrelated pairs of cats in catteries: a preliminary report. *Applied Animal Behaviour Science* **63**, 251-255.
- Broom, D. M. and Johnson, K. G. (1993) *Stress and animal welfare*. Chapman and Hall Ltd., London.
- Buffington, C. A. T. (2002) External and internal influences on disease risk in cats. *J. American Veterinary Medical Association* **220**, 994-1002.
- Carlstead, K., Brown, J. L. and Strawn, W. (1993) Behavioural and physiological correlates of stress in laboratory cats. *Applied Animal Behaviour Science* **38**, 143-158.
- Casey, R. and Bradshaw, J. W. S. (2000) Welfare implications of social stress in the domestic cat. *Issues in Companion Animal Welfare*, Amsterdam, International Society for Anthrozoology, p. 12.
- CIEH Animal Boarding Establishments Working Party (1995) *Model licence conditions and guidance for cat boarding establishments (Animal Boarding Establishments Act 1963)*. The Chartered Institute of Environmental Health, London.
- Companion Animal Welfare Council (2004) *The report on companion animal welfare establishments: sanctuaries, shelters and re-homing centres*, Companion Animal Welfare Council, Devon.
- Crouse, S. J., Atwill, E. R., Lagana, M. and Houpt, K. A. (1995) Soft surfaces: a factor in feline psychological well-being. *Contemporary Topics in Laboratory Animal Science* **34**, 94-97.
- de Monte, M. and Le Pape, G. (1997) Behavioural effects of cage enrichment in single-caged adult cats. *Animal Welfare* **6**, 53-66.
- DeLuca, A. M. and Kranda, K. C. (1992) Environmental enrichment in a large animal facility. *Laboratory Animals* **21**, 38-44.
- Department for Environment, Food and Rural Affairs (2002) *The consultation on an animal welfare bill*. Animal Welfare Division, DEFRA, Page Street, London, pp. 1-7.
www.defra.gov.uk/animalh/welfare/domestic/index.htm.
- Durman, K. J. (1991) Behavioural indicators of stress. B.Sc. thesis, University of Southampton.
- Evans, R. H. (2001) Feline animal shelter medicine. In August, J. R. (ed.). *Consultations in Feline Internal Medicine*, 4th Edn., W.B. Saunders Company, Philadelphia, pp. 571-576.
- Gourkow, N. (2001) Factors affecting the welfare and adoption rate of cats in an animal shelter. M.Sc. thesis, University of British Columbia.
- Hall, S. L. and Bradshaw, J. W. S. (1998) The influence of hunger on object play by adult domestic cats. *Applied Animal Behaviour Science* **58**, 143-150.
- Hart, B. L. (1980) *Feline Behaviour: A Practitioner Monograph*. Veterinary Practice Publishing Company, Santa Barbara.
- Haughie, A. (1998) *Cat Rescue Manual*. Feline Advisory Bureau, Tisbury, Wiltshire, UK.
- Hawthorne, A. J., Loveridge, G. G. and Horrocks, L. J. (1995) The behaviour of domestic cats in response to a variety of surface-textures. In Holst, B. (ed.). *Proceedings of the second*

- international conference on environmental enrichment*, Copenhagen Zoo, Copenhagen, pp. 84-94.
- Holmes, R. J. (1993) Environmental enrichment for confined dogs and cats. In Holmes, R. J. (ed.). *Animal Behaviour-The TG Hungerford Refresher Course for Veterinarians, Proceedings 214*, Post Graduate Committee in Veterinary Science, Sydney, Australia, pp. 191-197.
- Hoskins, C. M. (1995) The effects of positive handling on the behaviour of domestic cats in rescue centres. M.Sc. thesis, University of Edinburgh.
- Hubrecht, R. C. and Turner, D. C. (1998) Companion animal welfare in private and institutional settings. In Turner, D. C. (ed.). *Companion Animals in Human Health*, Sage Publications Inc, Thousand Oaks, CA, pp. 267-289.
- James, A. E. (1995) The laboratory cat. *ANZCCART News* **8**, 1-8.
- Karsh, E. B. and Turner, D. C. (1988) The human-cat relationship. In Turner, D.C. and Bateson, P. (eds.). *The Domestic Cat: the biology of its behaviour*, 1st edn., Cambridge University Press, Cambridge, pp. 159-177.
- Kessler, M. R. and Turner, D. C. (1997) Stress and adaptation of cats (*Felis silvestris catus*) housed singly, in pairs and in groups in boarding catteries. *Animal Welfare* **6**, 243-254.
- Kessler, M. R. and Turner, D. C. (1999a) Socialisation and stress in cats (*Felis silvestris catus*) housed singly and in groups in animal shelters. *Animal Welfare* **8**, 15-26.
- Kessler, M. R. and Turner, D. C. (1999b) Effects of density and cage size on stress in domestic cats (*Felis silvestris catus*) housed in animal shelters and boarding catteries. *Animal Welfare* **8**, 259-267.
- Law, G., Boyle, H., Johnston, J. and Macdonald, A. (1991) Food presentation, part 2: cats. In *Environmental enrichment: advancing animal care*. Universities Federation for Animal Welfare, Potters Bar, Herts, pp. 103-105.
- Leyhausen, P. (1979) *Cat behaviour: the predatory and social behaviour of domestic and wild cats*. Garland STPM Press, New York.
- Lowe, S. E. and Bradshaw, J. W. (2001) Ontogeny of individuality in the domestic cat in the home environment. *Animal Behaviour* **61**, 231-237.
- Markowitz, H. and LaForse, S. (1987) Artificial prey as behavioural enrichment devices for felines. *Applied Animal Behaviour Science* **18**, 31-43.
- McCune, S. (1992) Temperament and the welfare of caged cats. Ph.D. thesis, University of Cambridge.
- McCune, S. (1995) Enriching the environment of the laboratory cat - a review. In Holst, B. (ed.). *Proceedings of the second international conference on environmental enrichment*, Copenhagen Zoo, Copenhagen, pp. 103-117.
- Mertens, C. (1991) Human-cat interactions in the human setting. *Anthrozoös* **4**, 214-231.
- Mertens, C. and Schär, R. (1988) Practical aspects of research on cats. In Turner, D.C. and Bateson, P. (eds.). *The Domestic Cat: the biology of its behaviour*, 1st edn., Cambridge University Press, Cambridge, pp. 179-190.
- Mertens, C. and Turner, D. C. (1988) Experimental analysis of human-cat interactions during first encounters. *Anthrozoös* **2**, 83-97.
- National Research Council (1996) *Guide for the care and use of laboratory animals*. National Academy Press, Washington.
- Newberry, R. C. (1995) Environmental enrichment: increasing the biological relevance of captive environments. *Applied Animal Behaviour Science* **44**, 229-243.
- Ottway, D. S. and Hawkins, D. M. (2003) Cat housing in rescue shelters: a welfare comparison between communal and discrete-unit housing. *Animal Welfare* **12**, 173-189.
- Patronek, G. J., Beck, A. M. and Glickman, L. T. (1997) Dynamics of dog and cat populations in a community. *J. American Veterinary Medical Association* **210**, 637-642.

- Patronek, G. J. and Sperry, G. (2001) Quality of life in long-term confinement. In August, J. R. (ed.). *Consultations in Feline Internal Medicine*, 4th Edn., W.B. Saunders Company, Philadelphia, pp. 621-634.
- Pedersen, N. C., Sato, R., Foley, J. E. and Poland, A. M. (2004) Common virus infections in cats, before and after being placed in shelters, with emphasis on feline enteric coronavirus. *J. Feline Medicine and Surgery* **6**, 83-88.
- Podberscek, A. L., Blackshaw, J. K. and Beattie, A. W. (1991) The behaviour of laboratory colony cats and their reactions to a familiar and unfamiliar person. *Applied Animal Behaviour Science* **31**, 119-130.
- Poole, T. B. (1997) Happy animals make good science. *Laboratory Animals* **31**, 116-124.
- Randall, W. R., Cunningham, J. T. and Randall, S. (1990) Sounds from an animal colony entrain a circadian rhythm in the cat, *Felis catus* L. *J. Interdisciplinary Cycle Research* **21**, 55-64.
- Reinhardt, V. and Reinhardt, A. (2001) Legal space requirement stipulations for animals in the laboratory: are they adequate? *J. Applied Animal Welfare Science* **4**, 143-149.
- Rochlitz, I. (2003a) Study of factors that may predispose domestic cats to road traffic accidents: Part 1. *Veterinary Record* **153**, 549-553.
- Rochlitz, I. (2003b) Study of factors that may predispose domestic cats to road traffic accidents: Part 2. *Veterinary Record* **153**, 585-588.
- Rochlitz, I., Podberscek, A. L. and Broom, D. M. (1998) The welfare of cats in a quarantine cattery. *Veterinary Record* **142**,
- Roy, D. (1992) Environmental enrichment for cats in rescue centres. B.Sc. thesis, University of Southampton.
- Royal College of Veterinary Surgeons (2004) New practice standards scheme takes place. *RCVS news* **March**, 2.
- Russell, W. M. and Birch, R. L. (1959) *The principles of humane experimental technique*. Methuen, London.
- Schroll, S. (2002) Environmental enrichment for indoor cats as prevention and therapy-practical advice for quality of life. *Companion Animal Behaviour Study Therapy Group*, Birmingham, pp. 43-45.
- Shepherdson, D. J., Carlstead, K., Mellen, J. D. and Seidensticker, J. (1993) The influence of food presentation on the behaviour of small cats in confined environments. *Zoo Biology* **12**, 203-216.
- Siegford, J. M., Walshaw, S. O., Brunner, P. and Zanella, A. J. (2004) Validation of a temperament test for domestic cats. *Anthrozoös* **16**, 332-351.
- Smith, D. F. E., Durman, K. J., Roy, D. B. and Bradshaw, J. W. S. (1994) Behavioural aspects of the welfare of rescued cats. *J. Feline Advisory Bureau* **31**, 25-28.
- Turner, D. C. (1995a) The human-cat relationship. In Robinson, I. (ed.). *The Waltham book of human-animal interaction: benefits and responsibilities of pet ownership*, Elsevier Science Ltd., Oxford, pp. 87-97.
- Turner, D. C. (1995b) The ethology of the domestic cat and its consequences for the human-cat relationship. *Proceedings of 7th International Conference on human-animal interactions: Animals, Health and Quality of Life*, p. 122.
- Turner, D. C. and Stambach-Geering, M. K. (1990) Owner assessment and the ethology of human-cat relationships. In Burger, I. H. (ed.). *Pets, benefits and practice*, British Veterinary Association Publications, London, pp. 25-30.
- van den Bos, R. (1998) Post-conflict stress-response in confined group-living cats (*Felis silvestris catus*). *Applied Animal Behaviour Science* **59**, 323-330.

- van den Bos, R. and de Cock Buning, T. (1994a) Social behaviour of domestic cats (*Felis lybica f.catus* L.): a study of dominance in a group of female laboratory cats. *Ethology* **98**, 14-37.
- van den Bos, R. and de Cock Buning, T. (1994b) Social and non-social behaviour of domestic cats (*Felis catus* L.): a review of the literature and experimental findings. In Bunyan, J. (ed.). *Welfare and Science-proceedings of the fifth FELASA symposium*, Royal Society of Medicine Press Ltd., London, pp. 53-57.
- Wells, D. and Egli, J. M. (2003) The influence of olfactory enrichment on the behaviour of captive black-footed cats, *Felis Nigripes*. *Applied Animal Behaviour Science* **85**, 107-119.
- Wemelsfelder, F. (1991) Animal boredom : do animals miss being alert and active? In Rutter, S. M. (ed.). *Applied Animal Behaviour: past, present and future*, Universities Federation for Animal Welfare, Potters Bar, Herts, pp. 120-123.
- Young, R. J. (2003) *Environmental enrichment for captive animals*. Blackwell Science Ltd., Oxford.