# Opinion on the welfare implications of current and emergent feline breeding practices.

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Animal Welfare Committee
Second Floor, Seacole Building
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The Animal Welfare Committee is an expert committee of the Department for Environment, Food and Rural Affairs, the Scottish Government and the Welsh Government. Information about the Committee may be found at: https://www.gov.uk/government/groups/animal-welfare-committee-awc

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## Introduction and scope

1. This Opinion principally aims to identify risks and impacts (positive and negative) to breeding cats (both male and female), their offspring, and future generations from current and emergent feline breeding practices within Great Britain.

2. The AWC has also been asked to consider whether domestic cats and their offspring with genetic conditions can have their welfare needs adequately met as pets.

3. The AWC has also been asked to consider the risks and impacts from poor selection of breeding cats and/or from breeding high volumes of litters from a limited pool of breeding cats.

4. The AWC has also been asked to analyse the extent to which the practice of breeding hybrid cats, and cats with other genetic conditions, is undertaken in Great Britain.

5. The AWC has also been asked to consider whether hybrid cats and their offspring can have their welfare needs adequately met as pets.

6. The AWC has also been asked to consider whether current hybrid keeping practices have impacts on or pose a risk to other pets, wildlife, or to public safety.

7. The AWC has also been invited to offer any other ideas or views on this topic.

8. This Opinion does not cover free-living cats.

### One Health, One Welfare

9. Companion animals, including cats, are impacted by - and also impact upon - climate change through their intrinsically linked relationships to human society. Unpredictable, fluctuating and extreme weather conditions can result in physiological and psychological stress and distress to animals. Some breeds/types of cat with certain phenotypic characteristics and/or diseases/ conditions will be at greater risk than others of being unable to cope with different conditions. For example, animals with long/heavy coats or those who are brachycephalic may be less able to cope with extreme heat. Conversely, hairless cats may struggle to be thermally comfortable in cold temperatures (see paragraphs 59-65 'Welfare impact of genetic issues' for further information). Where breeding or other cats are kept in purpose-built accommodation, the effects of climate change may be mitigated to some extent by improved building design, temperature-controlled buildings with appropriate ventilation and equipment (e.g. fans), heat/sun reflecting roofing etc. Similarly, any outdoor exercise areas are likely to require improved provision of shelter from direct sun, wind and rain. In hot weather an animal's increased water intake requirements need to be understood and reliably met. The impact of climate change is also of

relevance when planning and undertaking any transportation of animals, including cats being used for breeding and their offspring.

10. All cats, whether kept as companions, for breeding or for other purposes, impact on the environment [1] with rising numbers increasing the associated sustainability challenges. Certain cat-focused practices and characteristics of the animals themselves have particular implications for environmental parameters and sustainability. Any additional veterinary or similar procedures (such as those associated with breeding) are likely to be associated with production of non-biodegradable waste and, potentially, veterinary medicines. Cats needing grooming services (e.g. long coated breeds) has implications for use of power, water and transport whilst increases in numbers of cats will result in consumption of more resources and necessitate greater transportation of food and other goods. Cats with outdoor access also have a significant impact on the environment through predation of wildlife. Studies suggest that domestic cats in the UK are responsible for taking millions of birds, small mammals, reptiles and amphibians from the wild every year [2], most of whom will die at the time or subsequently, even if 'rescued' before death. This risks not only negative ecological impact but also causes suffering to huge numbers of animals. Proposals for mitigating strategies to reduce this impact have aimed to suggest approaches that are not only effective but also acceptable to cat owners/society and likely to be implemented [3]. The need for recognition that cats are both a central component of human societies and an important, often adverse, influence on ecosystems has also been highlighted [4]. However, challenges remain. These include varying cat owner attitudes towards/perceptions of the scale and impact of predation [5], and the conflict between meeting the behavioural needs of cats and safeguarding the lives and welfare of wild animals.

11. As is outlined in relevant sections of this report, decisions about the selection of the male and female cats for use in breeding has an enormous influence on the health, welfare and behaviour of the resulting kittens. The monetary cost of veterinary or behaviourists' fees for cats suffering from health and/or behavioural problems resulting, for example, from their genotype, phenotype and/or experiences during rearing, can be significant. Those who are unable to deal with the challenges and who relinquish their animals for rehoming (or euthanasia) may experience guilt and regret [6]. Given this, the impact on human wellbeing is an important consideration during decision-making around selection of cats for breeding and approaches to care and management of breeding queens and kittens in early life. Similarly, ensuring sufficient knowledge amongst current and prospective cat owners of the possible challenges of cat ownership - and how best to avoid or manage difficulties - is a key consideration in supporting both human and cat welfare.

12. Published studies have highlighted the risks that hybrid cats pose to native wildlife with their higher levels of aggression and hunting tendencies compared to domestic cats [7].

13. Hybrid cats could introduce enhanced hunting skills, increased body size, and increased levels of aggression into feral cat populations through uncontrolled breeding, putting native species at increased extinction risk. For these reasons Savannah cat imports have been banned in Australia since 2008, a decision validated by a review of hunting strategies in Savannahs by Dickman et al., in 2019 [7].

14. In a study by Martinez-Caja et al.,[8] of Bengal cats, 33.2% of F2 hybrids and generations below this still showed destructive behaviours, 89.5% demonstrated climbing behaviours, and 78.9% showed strong hunting behaviours. There were no differences seen between indoor and outdoor housed cats. This suggests that even with lower generations of hybrid cats such as Bengals, but particularly with the larger more aggressive Savannah cats, it is difficult to adequately meet their behavioural needs without them posing a risk to native wildlife and domestic cats and other domestic animals. It is interesting to note that Bengal cats are viewed as one of the most physically active breeds and in one study they were a breed viewed as the most fearful and most extroverted along with Russian blues [9].

**Definitions**

15. In this Opinion, key terms are used as follows:

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| altricial | Altricial species are born in an immature state and unable to care for themselves |
| azoospermia | Absence of sperm in the semen |
| biosecurity | Measures taken to prevent the introduction of infectious agents into an environment and/or stop the spread of harmful organisms between individuals. |
| brachycephalic obstructive airway syndrome (BOAS) | Condition associated with flat-faced cats that includes narrow nostrils, an elongated soft palate, and an excess of soft tissue that can block the movement of air through a cat's nose and throat. This can prevent affected cats from breathing normally and cause lifelong problems with everyday behaviours including exercise, play, eating and sleeping. |
| brachycephaly | A relatively broad, short skull (typically with the breadth at least 80 per cent of the length). This gives the appearance of a flattened face. |
| breed | A group of cats with defined characteristics and that are bred from within a closed gene pool. |

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| breed standard | A description of both the physical attributes and temperament of a pedigree breed. |
| breeding (gene) pool | The different genetic variants within a breed. A small gene pool has fewer variants |
| carrier | A cat that has one normal and one altered recessive gene variant. These cats do not show features of the recessive trait, but a proportion of the offspring from the mating of two carriers (those that inherit the altered gene variant from both parents) are predisposed to express the recessive trait. |
| characteristic | An inherited physical appearance or behaviour that is associated with a breed. Synonymous with a trait. |
| chiari malformation (CM) | A developmental abnormality where the brain is too large to fit into the skull which is too short. It alters the flow of cerebrospinal fluid resulting in syringomyelia. Brachycephalic breeds including Persians may be predisposed to this condition. |
| coefficient of inbreeding (CoI) | The degree of inbreeding. The CoI indicates the probability that two copies of a gene variant have been inherited from an ancestor that is common to both the sire and the dam. The lower the degree of inbreeding, the lower the inbreeding coefficient. The higher the percentage value, the more common ancestors there are in a cat's pedigree. |
| crepuscular hunter | Animals (such as cats) who are more active hunters during twilight hours (i.e. dawn and dusk) |
| crossbreed (or ‘moggy’) | A cat whose parents are of two different breeds (crossbreed), or a mixture of several breeds (often colloquially referred to as a ‘moggy’). Crossbreeds may inherit the gene variants of each parent, including any harmful mutations. They often display a mixture of their parents' traits. |
| dermatitis | Inflammatory skin condition that can cause excessive itchiness. It can be a lifelong condition. Some forms can be inherited. |
| DNA testing | A laboratory test that can identify different genetic variants. |
| dolichocephalic | Having a relatively long skull (typically with the breadth less than 80 (or 75) per cent of the length). |

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| dominant | A form of inheritance of genes where only one copy of an altered variant of a gene needs to be inherited for the offspring to express the trait. |
| dystocia | Abnormal or difficult birth. Dystocia can occur for a range of reasons including a problem with the mother, a problem with the foetus, malpositioning of the foetus or a mismatch between the size of the birth canal and the foetus. |
| epigenetics | Changes in gene expression that do not involve alterations (mutations) to the DNA sequence. It provides a mechanism by which early experiences and environmental influences, both before and after birth, can have lifelong consequences. |
| genomic DNA | Chromosomal DNA. |
| genotype | The genetic constitution of an individual. |
| hip/elbow dysplasia | A deformity of the hip or elbow that occurs during growth. The joint becomes unstable. This may cause pain, swelling, stiffness and eventually arthritis. |
| hybrid cat | Any cats produced by breeding between domestic cats and other feline species (F1 generation), and their offspring (F2 generation). |
| inbreeding | Occurs when kittens are produced from two related cats. Inbreeding increases the likelihood of harmful recessive genetic mutations being expressed. It is also associated with lower fertility and reduced litter sizes and kitten survival. |
| mesocephalic (or ‘mesaticephalic’) | Having a medium length and width of skull. |
| mitochondrial DNA | DNA found in mitochondria - the organelles in a cell that generate the energy necessary to power its functions. Mitochondria are inherited almost exclusively from the mother. |
| modes of inheritance | The manner in which a genetic trait or disorder is inherited from one generation to the next. |
| monogenic | A single gene controls a genetic trait or disorder. |
| oligospermia | Deficiency of sperm in the semen |

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| pedigree cat | Offspring of two cats from the same breed that is eligible to be registered with a recognised club or society that maintain a breeding register for cats of that description. |
| penetrance | Penetrance in genetics is the proportion of individuals carrying a particular variant (or allele) of a gene (genotype) that also expresses an associated trait (phenotype) |
| phenotype | The observable characteristics of an individual resulting from the interactions of its genotype with the environment. |
| pleiotropic | Pleiotropic genes are those in which variation can cause observable change in two or more body systems that may often appear unrelated at first. |
| polygenic | Two or more genes control a genetic trait of disorder. Because multiple genes are involved, polygenic traits do not follow the "textbook" (Mendelian) patterns of inheritance. |
| recessive | A form of inheritance of genes where two altered variants of a gene must be inherited – one from each parent – for the offspring to express the trait. |
| trait | An inherited physical appearance or behaviour that is associated with a breed. Synonymous with a characteristic. |
| type | A general description of a cat based on its purpose, function, appearance and/or temperament. A ‘type’ is different from a ‘breed’ as the latter is bred from within a closed gene pool, while the former does not require this restriction. |

## Legal context

16. Vertebrate animals under the control of humans, except those in the foetal or embryonic stages, are protected from unnecessary suffering and damaging practices, such as non-exempt mutilations, by the Animal Welfare Act 2006 (which applies in England and Wales) and by the Animal Health and Welfare (Scotland) Act 2006 (which applies in Scotland).

17. Both Acts also oblige those responsible for animals to take reasonable steps to ensure their welfare needs are met to the extent required by good practice. In line with the relevant legislation, each of the national administrations has published

codes of practice for the welfare of cats which provide owners and keepers with general welfare information, including how to provide the correct environment for their cat and protect them from pain, suffering, injury and disease.

18. In England, the Animal Welfare (Licensing of Activities Involving Animals) (England) Regulations 2018 introduced a new licensing regime for eight licensable animal activities, including the selling animals as pets. Anyone in the business of selling animals as pets, including selling kittens as pets, requires a pet selling licence issued by their local authority. Licensed pet sellers are prohibited from selling kittens unless they have bred them themselves.

19. In Wales, the Animal Welfare (Licensing of Activities Involving Animals) (Wales) Regulations 2021 introduced new requirements in relation to the sale of animals as pets in the course of a business. This includes a prohibition on the sale of kittens unless the licence holder bred the kittens at the licensed premises.

20. In Scotland, the breeding of cats is a licensable activity under the Animal Welfare (Licensing of Activities Involving Animals) (Scotland) Regulations 2021. Aside from a single exemption, (keeping a cat on any premises pursuant to a requirement imposed under, or having effect by virtue of, the Animal Health Act 1981), the Scottish Regulations require anyone who breeds three or more litters of kittens in any twelve-month period to hold a breeding licence issued by their local authority. The Scottish Regulations include general and specific conditions which licence holders must meet.

21. In addition, the Scottish Government requires applicants who intend to breed from a breed with any of eight listed characteristics that have associated health issues to provide evidence of significant skills and experience in their breeding as part of the licensing scheme. Breeders must also ensure careful selection of parents to avoid conformation issues, inherited diseases, or behavioural issues.

22. Statutory guidance published by the Scottish Government to support local authorities in their application of the licensing scheme states that the Scottish Government considers that the breeding of the Munchkin and Scottish Fold breed of cats would likely represent a breach of the condition protecting the breeding cats and their offspring suffering from genotype, conformation, behavioural or health issues as a result of the breeding.

23. The guidance also lists other cat breeds that regularly suffer health issues and states that breeders of these cat breeds will need to show sufficient knowledge of the breed and, preferably, a demonstrable history of successfully breeding the breed in question in order to secure a licence from the relevant local authority to breed them.

24. Across Great Britain, anyone convicted of causing unnecessary suffering faces a maximum custodial penalty of five years' imprisonment and/or a fine, and anyone convicted of failing to ensure an animal's needs are met faces up to six months' imprisonment or a fine. Similarly, anyone convicted of carrying out a licensable activity without a licence faces a maximum custodial penalty of six months' imprisonment or an unlimited fine in England and Wales, or up to 12 months' imprisonment and/or a fine not exceeding £40000 in Scotland.

25. A failure to comply with a provision in any code of practice mentioned in paragraph 17 is not an offence itself, but if proceedings are brought against someone for an offence under the relevant national animal welfare legislation, the court will be able to look at whether or not they have complied with the relevant code in deciding whether they have committed an offence. Following a conviction, courts may also ban an offender from keeping animals or certain types or animals and/or order that their animals are removed from them. Across the UK, the Veterinary Surgeons Act 1966 (VSA) limits the legal undertaking of acts of veterinary surgery to qualified and registered veterinary surgeons who are members or fellows of the Royal College of Veterinary Surgeons (RCVS). Transport orders in place in England, Wales and Scotland make it an offence to transport any animal in a way which causes, or is likely to cause, injury or unnecessary suffering to that animal. The commercial movement of cats is also covered by assimilated Council Regulation EC No 1/2005.

26. Local authorities are responsible for enforcing each of the licensing schemes and have several options available to them. These include the ability to guide licence holders back into compliance as well as powers to refuse, vary or revoke a licence. Each of the schemes also restricts the ability to apply for a licence to people of good standing who have not been disqualified from keeping animals under the Animal Welfare Act 2006 or the Animal Health and Welfare (Scotland) Act 2006.

27. Additionally, assimilated Council Regulation EC No 1/2005 applies throughout Great Britain to transport in connection with an economic activity and requires that no person should transport any animal in a way likely to cause injury or undue suffering to them, and prohibits the movement of animals in the last 10% of their expected gestation period (unless for veterinary treatment) or cats that are less than 8 weeks of age unless accompanied by their mother.

28. Some species of cat in private ownership are subject to the Dangerous Wild Animals Act 1976. Serval (Leptailurus serval) used in the breeding of Savannah cats, Asian leopard cat (Prionailurus bengalensis) used in the breeding of Bengals, and Jungle cats (Felis chaus) used in the breeding of Chausies, as well as the first generation of hybrid cats (F1) are subject in England, Scotland and Wales to the provisions of the Dangerous Wild Animals Act 1976.

29. An F1 hybrid cat cannot enter Great Britain using the pet travel rules. These cats need an import licence and must enter an approved quarantine premises, such as a licenced zoo. An import licence will only be issued after the quarantine premises and carrying agent have confirmed they will house and transport the animals when they arrive into Great Britain.

30. To import or export hybrid cats outside the UK CITES import and export permits are required for F1 – F4 hybrids. From F5 generation on, no CITES permit is needed, instead a TICA (The International Cat Association) 5 generation pedigree to prove the cat is 5 generations removed from the wild cat is required.

## Background

### Breeding of domestic cats

31. The commercial breeding of cats is not regulated as a separate licensable activity in England. Instead, under the Animal Welfare (Licensing of Activities Involving Animals) (England) Regulations 2018 ("the 2018 Regulations") anyone in the business of selling cats or kittens as pets is required to hold a valid pet selling licence issued by their local authority. Licensed pet sellers who offer cats or kittens for sale must meet the 2018 Regulations' general and specific conditions. However, the specific conditions for selling animals as pets contain few protections for cats except to prohibit the third-party sale of kittens (defined in the 2018 Regulations as cats under 6 months of age).

32. Since the coming into force of the 2018 Regulations, a number of animal welfare organisations have joined together and continued to develop their own cat breeding guidance and a Kitten Checklist [10] (which the Government's Petfished [11] campaign points towards as a tool to help prospective cat owners get the information they need when looking to buy a kitten), and to campaign for the regulation of cat breeding as a separate licensable activity based on concerns for the welfare of the breeding cats involved and their offspring, including inherited disease and extreme conformation.

33. Further examples of the sector taking steps to protect cats and their offspring include the work of the Pet Advertising Advisory Group, whose advertising standards help online sales platforms to locate and remove irresponsible breeder adverts, and the Governing Council for the Cat Fancy (GCCF) who no longer recognise and register the Scottish Fold and Munchkin breeds [12].

34. The Scottish Government's supporting statutory guidance indicates that Scottish Fold and Munchkin cat breeders are unlikely to be able to satisfy the licence condition in the Animal Welfare (Licensing of Activities Involving Animals) (Scotland) Regulations 2021 that 'No cat may be kept for breeding if it can reasonably be

expected, on the basis of its genotype, conformation, behaviour or state of health, that breeding from it could have a detrimental effect on its health or welfare or the health or welfare of its offspring.'

35. In the UK there are stakeholder groups looking specifically at brachycephalic dog breeding and other health and welfare aspects related to brachycephalic dogs. Although the AWC is not aware of equivalent groups for brachycephalic cats, in our engagement with stakeholders we were made aware of concern amongst some breeders about extreme feline phenotypes.

**Breeding of hybrid cats**

36. There is no single definition of hybrid cats accepted by all authorities and sources. Hybrid cats in the context of this Opinion are taken to mean any cats produced by breeding between domestic cats and other feline species (F1 generation), and their offspring (F2 generation).

37. The most commonly kept hybrid cats in the United Kingdom are Bengal cats (domestic cats crossed with the Asian leopard cat Prionailurus bengalensis), Savannah cats (domestic cats crossed with the Serval Leptailurus serval) and the Chausie (domestic cat crossed with the Jungle cat Felis chaus) [13].

38. The experience of some AWC members is that some hybrid cats who should be subject to the Dangerous Wild Animals Act 1976 are being sold as such, but then subsequently presented to veterinary surgeons as being of a later generation, to circumvent the requirements of that Act.

**International perspective**

39. There is significant variation between countries internationally. Whilst most EU member states and many other countries have national laws on feline welfare, laws and licensing specifically pertaining to breeding vary in their content and compliance between countries (e.g. [14],[15]) and within countries (e.g. compare citations relevant to cats within [16]).

40. Interest in animal welfare issues relating to feline breeding has been reflected in recent legislation across a number of countries. The EU has proposed regulations to protect the welfare of dogs and cats that will apply to all member states and, amongst other things, limit the ability to import low welfare or mutilated kittens from third countries [17],[18].

41. Many laws about feline breeding relate primarily to phenotypes and their genetic causes rather than to breeding practices. As examples, Section 25 of the Norwegian Animal Welfare Act prohibits breeding which negatively affects animals' functioning

or reduces the possibility of natural behaviour. In Switzerland ‘adequate care’ is required when breeding any animal to ensure that they are free from ‘traits that cause strain’ [19]. Dutch regulations require that breeders ensure "parents do not pass on serious hereditary defects and diseases, harmful external characteristics or serious behavioural abnormalities to the progeny, and that reproduction happens in a natural way” [20].

42. Some countries’ legislation, such as the German and Austrian Animal Welfare Acts, reference the concept of ‘Qualzucht’ (roughly translated as “torture breeding") in relation to animals who have been bred in ways that will cause future pain, suffering, injury or anxiety - such as conformational and heritable conditions that can be passed onto the next generation. Some specific breeds, such as Scottish folds, Munchkin cats and Sphynxes, are also variously explicitly banned in countries or states, for example in Flanders [21],[22], the Netherlands [20] and the Australian state of Victoria [23].

43. Regarding hybrid cats, the Australian government banned the importation of Savannah cats, as they were deemed to pose a threat to native wildlife species not at risk from smaller domestic cats. It was felt that importation of Savannah cats could introduce enhanced hunting skills, increased body size, and increased levels of aggression into feral cat populations, putting native species at increased extinction risk.

44. The United States Department of Agriculture (USDA) in their position statement ‘Large Wild and Exotic Cats Make Dangerous Pets’ state that “only qualified, trained professionals should keep these animals… Care and handling of these wild and exotic cats should be left to trained professionals who have the knowledge and means to maintain them properly.”

# Current feline breeding in Great Britain

### Current breeding of domestic cats

45. Based on 2022 - 2024 figures, there are approximately 11 - 12.5 million cats in the UK [13], [24], [25]. Numbers appear to have stabilised over the past couple of years, following a previous significant increase between 2020 – 2021 [26]. Over the past five years or so, there has been a year-on-year rise in the number of pedigree/purebred cats, with the overall percentage now being approximately 28 per cent of the total UK cat population [13].

46. There is a trend towards cats being obtained through purchasing as opposed to other sources, particularly amongst younger cat owners, with buying online accounting for 63 per cent of bought cats during March 2022 - March 2023, often

from those identified as not being a specialist breeder [13]. There has been a concurrent fall in numbers obtained via adoption from animal rescue organisations (only 15 per cent over the same period) and a recent overall reduction of over 5 per cent in cats being rehomed. This has coincided with an increase in the relinquishment of cats to such organisations, heightening capacity difficulties. Available figures suggest that only a small percentage of cats (around 3% or 50 thousand animals, March 2022 - March 2023) are bought or adopted from overseas [13].

47. Key drivers of breeding rate are owned cat survival and shifts in owned cat husbandry (such as whether cats have outdoor access and hence can mix with other cats), and in particular neutering rates [27]. Recent estimates suggest that between 6-15 per cent of female cats have a litter in a period of 12 months with almost half of these having been unplanned. This is down from nearly 80 per cent unplanned during 2020 and 2021 when many veterinary surgeons suspended non-emergency neutering due to covid restrictions. Of the planned litters in 2022 - 2023, 65% were from pedigree cats [13], suggesting most unplanned are non-pedigree. Cats can produce several litters per year with an average of four - six kittens per litter (depending on breed and other variables), so a single healthy unneutered female could produce many hundreds of offspring during her lifetime.

48. Trends in breeds and breeding of pedigree cats are influenced by several factors. In the UK, the General Council of Cat Fanciers (GCCF) recognises and registers 40 individual breeds [28] and sets out a number of rules for breeders who wish to register their cats/kittens with the organisation (see ‘Impact of genetics’ paragraphs 59-66 and ‘Impact of selection of breeding animals’ paragraphs 71-88 for further details). The GCCF has seen a fall in registrations across all breeds of about 3 per cent since 1997 (when there were over 32 thousand cats registered) and 11 per cent between 2022 (almost 25 thousand) and 2023 (22 thousand) [29]. The majority (72 per cent) of GCCF registered breeders breed only two or fewer litters per year with just over 2 per cent producing ten or more litters annually (GCCF 2022 figures). Other registration organisations include the International Cat Association (TICA) which recognises 71 breeds (TICA 2024) and the recently founded body, Loving Cats Worldwide. The majority (85%) of recognised cat breeds arose recently (in the last 85 years), primarily through selection on single-gene aesthetic traits [30] but new breeds continue to be developed.

49. Pedigree animals can command increasingly high prices, from several hundred pounds upward, with new and/or rare breeds or breed variations reportedly being sold for as much as £1,500 (GCCF personal communication). The most common breeds registered with the GCCF are British Shorthair, Ragdoll, Maine Coon, Siamese and Burmese. Whilst the organisation has seen a sharp decline in registration of certain breeds such as Persians in the last few years [29]), some animal rescue organisations have noted a significant increase in the numbers of

Persians and other pedigree cats coming into their centres [31] . However, as the AWC heard from stakeholders, some cats described by their owners as purebred/pedigree are not registered with the GCCF or other registration bodies and almost half have no paperwork or other means of verifying their origins/genetics [13].

50. Cat shows held under the auspices of cat registration bodies involve cats being on display and subject to examination by judges to assess their adherence to the bodies' 'breed standards'. Cats who win awards at such shows can influence the direction of future breeding and hence judging decisions can have significant impact on future genotype and phenotype within a breed (see: 'Selection of breeding animals' section paragraphs 71-88 for further details).

**Current breeding of hybrid cats**

51. A Freedom of Information request survey from Local Authorities by Born Free in 2023 found that from those that replied, there were 187 Dangerous Wild Animal Act (1976) licences for Felidae, issued by 48 local authorities, in relation to the keeping of a total of 219 animals. These included: 53 Servals, 42 F1 generation Savannah cats, 6 Leopard cats, 2 Jungle cats, and 1 Bengal cat.

52. Despite the AWC's efforts to engage with stakeholders, it has been difficult to get first-hand experience of hybrid cat breeding, aside from that experienced by committee members themselves who have previously undertaken Dangerous Wild Animal Act (1976) licence inspections in personal capacities, out with the capacity of the AWC's work.

53. There is no commercially available genetic testing to prove which generation a hybrid cat is. Such assessment therefore currently relies on expert review of the felid's characteristics and morphology, and where available their breeding records. The AWC deems these inherently unreliable in nature.

54. Hybrid cats also appear anecdotally to be presented to veterinary practices by their owners less frequently than domestic cat breeds. When they are presented, they are almost invariably referred to as F2 and later generations, despite cases where expert opinion has deemed these to be more likely to be F1 hybrids.

55. Whilst in 2001 The International Cat Association (TICA) accepted Savannah cats as a registered breed, the large UK-based purebred cat registration organisation the Governing Council of the Cat Fancy (GCCF), does not accept the breed, on ethical grounds. Neither the World Cat Congress, nor any of its national member organisations, including GCCF, Australian, New Zealand, and South African organisations (with the exception of TICA) accept the Savannah cat as a recognised breed. For TICA cat show and registration purposes the fourth generation (F4)

Savannah cat is the first generation that can be classified as a "stud book tradition" (SBT) cat and is considered "purebred".

56. The Bengal cat has now been bred hybrid to hybrid to the point at which the GCCF accepted it as a breed type in 1997 and the Cat Fancier's Association also accept Bengals, providing they are an F6 generation or later.

57. The AWC heard evidence from some stakeholders about hybrid cats and the wild cats kept for their breeding sometimes requiring rescue and rehoming by zoos and other organisations.

## Prominent Health and Welfare issues

58. The short- and long-term health and welfare of kittens is greatly influenced by the health status, genotype and phenotype of both their parents. Hence, selection of both the male and female breeding animals has a highly significant impact on lifelong wellbeing of the resulting offspring. The welfare of the parent animals themselves, especially the females ('queens'), during the breeding process is also influenced by these and other factors. Whilst modes and levels of inheritance of certain traits and conditions vary greatly (and in many cases, are still unknown), information is available regarding the effects - on parents and/or offspring - of various physical and temperamental characteristics. Furthermore, environmental and other external factors can also influence gene expression (and therefore expression of a particular trait) via epigenetic modifications. This is one mechanism by which the care and management practices experienced throughout the breeding process can result in both short-and long-term consequences for the queen and her offspring (see paragraphs 95-117: 'Management of breeding animals').

### Welfare impacts of genetic issues in cats

59. Cats inherit one half of their genes from their mother and the other half from their father and these will determine their genotype (or genetic makeup). In turn, this controls what traits will be inherited by the animal, such as coat colour, disease resistance - or predisposition - and conformation. A trait can be inherited in a dominant, recessive or sex-linked manner. Sexually reproducing animals have two copies (alleles) of most genes, which may be the same (homozygous) or differ slightly (heterozygous). A dominant trait requires only one copy of the mutant allele in order to be expressed phenotypically whereas a recessive trait will only be expressed phenotypically in an individual with two copies of the variant allele. If only one copy is present, the animals will instead be a 'carrier' of the trait, so whilst it will not be expressed in them, they can still pass it on to their own offspring. Many diseases and conditions are inherited. These can result in anatomical, physiological and/or temperamental abnormalities and may either be apparent at birth or develop later in life, with some being influenced by the animals' environment and

management throughout their lives. In many such cases, the quality of life of the animal is affected, sometimes severely.

**Welfare impacts of genetic issues in domestic cats**

60. All cats, whether purebred or otherwise, are at risk of inheriting genetic diseases and the most common conditions are neither breed-specific nor single-gene [32]. Complexly inherited conditions where multiple genes interact with the environment include feline lower urinary tract disease [33], diabetes mellitus [34], [35], and certain inflammatory diseases [36], [37]. These are chronic conditions that can significantly negatively affect welfare and usually require lifelong treatment and management.

61. In addition to potentially experiencing conditions that can affect any cat, purebred cats can also suffer from specific, often single-gene inherited conditions due to breeding selection/inbreeding. Certain diseases/conditions are more prevalent in particular breeds [32] [38] and some experience several different inherited conditions. A recent study exploring annual life expectancy and risk factors for mortality in almost 8000 cats in the UK found that overall, being purebred was significantly linked to a decreased lifespan (as was being unneutered and having a non-ideal body weight). Among the 12 breeds (including crossbred) analysed, Burmese and Birman had the longest life expectancy at year 0 (14.42 years and 14.39 years respectively) whilst Sphynx had the shortest life expectancy at age 0 (6.68 years) [39]. Another study of over 4000 cats in England also found that crossbred cats had a higher median longevity than purebred cats, but that individual purebred cat breeds varied substantially in longevity [40]. Some breeds have become predisposed to health and welfare problems as a result of intense selection for specific traits with a focus on appearance rather than function or health. This has led to sometimes extreme phenotypes. Breeding to meet ‘breed standards’ for particular aesthetic traits such as brachycephaly (with shortened muzzles and ‘flat’ faces), taillessness, folded ears or short limbs has predisposed some cats to specific inherited anatomical conditions that have significant welfare implications (see below). Also, some combinations of coat and eye colours are associated with co-occurring nervous-sensory conditions including deafness. Inbreeding and restricted breeding pools increase the risk of defects being perpetuated within a breed (see also ‘Welfare impact of selection of breeding animals’ paragraphs 71-88). The selection of very prescriptive sometimes single physical characteristics limits the number of cats that can be used when founding a breed [41] and several cat breeds were established using only a single cat with a ‘desired’ trait - for example the Sphynx, Devon Rex, Scottish Fold, Munchkin and Bobtail. The direct result is inbreeding and reduced genetic variability. In such cases, inherited problems associated with a breed may become widespread and sometimes ‘normalised’/accepted.

62. A few examples of known existing breed-specific inherited diseases, conditions and traits in various breeds of domestic cat - and their consequences for health and welfare - include (but are not limited to) the following:

- **Brachycephaly**: Persians and other related breeds including British Short Hair and some exotic breeds have been selectively bred for brachycephaly for aesthetic purposes. This predisposes many such individuals to a number of potentially serious health and welfare problems, especially when the brachycephaly is severe. Brachycephalic skulls are characterised by a mildly to profoundly shortened muzzle and there are concomitant changes to internal upper airway structures, which together can restrict airflow and cause breathing difficulties [42]. Brachycephalic obstructive airway syndrome, which refers to a particular set of upper airway abnormalities that affect brachycephalic animals can also be present in flat faced cats [43]. This condition is characterised by difficulties in breathing as a result of very narrow external openings of the nose (stenotic nares), narrow nasal passages (or nasopharynx) and/or a relatively long soft palate. Such breathing problems may contribute to difficulties during certain stages of the breeding cycle. A survey-based study reported that increasingly extreme feline brachycephaly (with regard to the decreasing length of the foreface) was associated with increased respiratory noise when the cat was sleeping, breathing difficulty following exercise, and a sedentary lifestyle [44]. Brachycephalic cats are also prone to ophthalmological problems [45]. They may have large protruding eyes with reduced ability to close the eyelids and resultant increased exposure - and ulceration - of the cornea [46]. Persistent ocular discharge (epiphora) often occurs due to tear ducts becoming deformed as a result of the facial shape [44]. Flat faced cats also experience dental problems [45] as the teeth no longer align properly, leading to difficulties with chewing and eating and associated dental disease. Severe brachycephaly also causes excessive skin folds on the face with associated risk of skin infections [45] and potentially contributing to the development of idiopathic facial dermatitis. Some reports also indicate that brachycephalic conformation increases the likelihood of cats undergoing a Caesarean section [47] (see: ‘Procedures’ section, paragraphs 89-94). Persian cats may also have a predisposition to Chiari-like malformation (where the brain is too large to fit into the skull) with associated neuropathic and posture-related pain [48].

- **Scottish Fold osteochondrodysplasia (SFOCD)**: The Scottish Fold is a purebred cat with forward-folded ears, an autosomal-dominant inherited trait caused by generalised defective cartilage formation [49]. All individuals in this breed suffer from the inherited disorder osteochondrodysplasia. This causes the animals to experience skeletal deformities such as short, thick, and inflexible tails and shortened splayed feet [50] [51]. It also creates painful

degenerative osteoarthritis [52]. As a result, Scottish Fold cats will almost inevitably suffer physical pain - from mild to severe - and associated restriction of physical activity and natural behaviour. As every individual in the breed is affected [51] and the trait is inherited in a dominant manner, the condition and associated welfare problems cannot be eliminated through selective breeding within the Scottish Fold breed or by outcrossing [53]. Several cat registries, including the GCCF, do not permit registration of Scottish Fold cats due to the inherent health and welfare problems they experience [54].

- **Spina Bifida**: Cats of the Manx breed and several others are selected to be nearly or completely tailless. The 'true' (or 'rumpy') Manx has only a small hollow where the tail would have been, although cats with residual (stumpy) tails are also born [55]. In the case of the Manx, the mutation is dominant and can result in serious health and welfare problems since the defective gene also affects other parts of the spine. Whilst some individuals are unaffected, the mutation may cause severe spinal and/or neurological problems including a form of spina bifida – a developmental abnormality of the spine, with associated urinary and faecal incontinence, rectal prolapse, and locomotor abnormalities [52]. These problems may all be related to a disturbance affecting the development of the central nervous system in early embryonic life [56]. When two completely tailless Manx cats are mated, the defects may be so severe that many of the offspring may be born dead or die shortly after birth [38]. Similar conditions occur in other tailless cats (such as Pixie-Bobs) though less direct information is available about these other breeds.

- **Dwarfism**: As a result of a genetic mutation, standard Munchkin cats are characterised by disproportionate dwarfism (chondrodysplasia) in which the limb bones fail to grow normally and all four legs are short [57]. Breeding data suggest a dominant mode of inheritance and that embryos that have two copies of the Munchkin gene are not viable and do not develop in utero i.e. the homozygous state is lethal at an early embryonic stage [58]. The Munchkin's phenotype can impair aspects of the animal's mobility and expression of other natural behaviours may also be impeded. For example, Munchkins may lack the flexibility to groom themselves properly, causing problems for long haired varieties in particular. In some cases, the leg deformities may be painful and debilitating due to development of abnormal joints. There can also be a predisposition to osteoarthritis and intervertebral disc disease in the breed [59], requiring long term pain relief and joint supplements to reduce suffering. Several other short legged breeds are also recognised - such as the Napoleon (produced by crossing a Persian with Munchkin) and these will suffer from similar health and welfare problems. The welfare concerns experienced by cat breeds with dwarfism had led to some

breed registration organisations refusing to ‘recognise’/register Munchkins and other dwarf breeds [12].

- **Hypertrophic cardiomyopathy**: Hypertrophic cardiomyopathy (HCM), which involves thickening of the muscle walls of the heart, is the commonest form of heart disease in cats and it is very common in certain breeds including Ragdoll, Ragmuffin and related outcrosses, and Maine Coon [60] with a significant minority in some breeds having a genetic mutation that makes it likely that they will develop HCM [61], [62]). Cats with two copies of the disease-associated mutation (i.e. homozygous) are at high risk of developing severe signs of HCM, usually between 1-2 years of age, and have a greater likelihood of early cardiac death. The presence of fluid inside the lungs (pulmonary oedema) in severe and terminal heart failure makes breathing very difficult and laboured. The condition can also lead to other complications such as increased risk of blockage of major blood vessels by blood clots, associated with severe pain. The severity of the welfare impacts of this disease depends on the degree of heart failure and secondary effects that it causes. Cats who are heterozygous for the mutation (i.e. carry only one copy of the variant gene) are not likely to show signs of the disease and may live a normal lifespan, highlighting the importance of genetic testing of susceptible breeds before selecting individuals for breeding [61].

- **Hereditary Deafness**: Breeding studies have defined the relationship between deafness in white cats and blue eye colour. The gene responsible is an autosomal dominant gene that appears to be pleiotropic (i.e. it has more than one effect), being responsible for the white coat colour and also blue eyes and deafness. Deafness is, therefore, strongly linked to the combination of white coat and blue eye colour. However, not all white cats or white cats with blue eyes are necessarily deaf and equally, some cats with only one blue (and one other coloured) eye - or two non-blue eyes - may also suffer deafness [63]. The variable penetrance of deafness and eye colour may be caused by interplay with other genes and/or environmental factors [64]. Nonetheless, selective breeding to produce blue eyed white cats in some breeds puts the resulting animals at high risk of inherited deafness which in turn, may impact on their quality of life in various ways (e.g. not being given outdoor free roaming access due to concerns about their safety). The risk of deafness in white cats is well recognised by purebred cat registration bodies, with the GCCF, for example, requiring testing of kittens/cats for uni- or bilateral deafness before they can be registered.

- **Coat types**: Cats with a ‘rex’ or wire coat - such as the Devon and Cornish Rex breeds - have hairs and often whiskers which are crimped, hooked or bent. This can make the hair fragile and easily broken when brushed. The skin may be sensitive and itchy and it may be prone to yeast infections.

Some breeds of cat such as the Sphynx are almost hairless and also lack whiskers and eyebrows. They therefore need special care with regard to temperature control and avoidance of exposure to ultraviolet light/the sun. The lack of protective hair also makes them more at risk of sustaining injury to their skin, which is also wrinkled in some areas [65]. Long coated cats such as Persians and Birmans also have special care needs if they are to be kept free from mats and tangles which if left unattended, will lead to discomfort and potentially restrict mobility and natural behaviour. 'Haircoat disorders' was the most commonly recorded disorder in one study of over 3000 Persian cats under veterinary care in the UK [45].

- **Other inherited traits/conditions:** Many other heritable conditions are found in various cat breeds. Some examples include hereditary myopathy, an autosomal recessive in Sphynx cats. It is characterised by generalised muscle weakness and affected cats may be unable to walk and exercise normally due to muscle weakness, thereby resulting in restricted mobility and expression of natural behaviour [62]. Other inherited conditions found more commonly in certain cat breeds include several eye conditions [66] such as two forms of progressive retinol atrophy (which can lead to blindness) particularly in Abyssinian, Oriental and Siamese breeds. Inherited polycystic kidney disease is found in some Persians [66] and periodic hypokalaemia poly myopathy in Burmese, an autosomal recessive disease affecting muscle function and causing affected cats to have problems walking and holding their head correctly[67]. However, tests are available for several of these conditions. This provides the opportunity to reduce or eliminate them if their use and application of results is widespread and consistent enough amongst breeders (see: Screening and Genetic testing' paragraphs 69-70), and progress has already been made in some breeds with certain inherited diseases [68].

63. Kittens produced by cross-breeding two different established breeds are also at risk of inheriting any genetic mutation present in either of the parents. This can result in crossbreed offspring with multiple inherited disorders. Examples include the Napoleon breed produced by crossing a Persian with a Munchkin. Recognised health and welfare concerns in this breed include achondroplasia (characterised by thickened joints, undersized jaw, curved spine, bowed legs, knock-knee posture) which further predisposes the breed to lordosis (exaggerated inward curve of the spine that affects the lower back) and/or pectus excavatum (inward growth of the ribs and sternum (breastbone) to form a dent in the chest). As in the case of the Munchkin, Napoleon cats also have increased risk of osteoarthritis and as they are brachycephalic (inherited from their Persian parent) they also experience the health issues associated with of a brachycephaly (see above) [69].

64. Study of the inheritance of temperamental characteristics and associated behaviour within cat breeds has yielded mixed results. Nonetheless, studies indicate

sometimes significant differences between breeds in characteristics such as fearfulness, sociability, activity levels and aggression towards people with moderate heritability of certain behavioural traits [9]. Some research has suggested a link between certain coat colours and temperamental characteristics, such as increased interest in prey shown by red coated cats [70]. In addition, the indirect impact of inherited physical traits, such as brachycephaly or abnormal/short limbs, on cat behaviour is also an important consideration when evaluating the respective contributions of 'nature' and 'nurture' to the way in which certain breeds of cat may tend to behave. For example, individuals in some breeds may be forced to restrict their movement due to conditions that cause physical pain, rather than choosing to do so due to any temperamental inclination, but may still be considered to be quiet/relaxed and/or having low activity levels.

65. Studies have also stressed the impact of both genetics and environment - and the interaction between the two - in influencing cat behaviour regardless of breed [9]. Research aimed at assessing specifically the independent and combined influence of 'nature' and 'nurture' on cats' behaviour found that offspring from 'friendly' (categorised as 'bold') fathers were more vocal in response to, quicker to approach, touch and rub, and more likely to stay close to, a familiar human or a novel object compared with those from 'unfriendly' fathers [71]. This suggests a direct inheritance of the 'boldness' temperament trait. In addition, cats who had received early socialisation were also more interactive with human strangers than those who hadn't, indicating the impact of early experiences on behaviour. Cats who had both friendly fathers and early socialisation were quickest to approach/rub etc. a human and stayed near them for longest, highlighting the interaction between early experiences and inherited temperament traits in influencing future behaviour. The extent to which temperament is inherited from (rather than learnt from) the mother is harder to ascertain, given that in most cases, the female is involved in rearing the kittens and hence will be an integral part of their early life experiences [71] (see also paragraphs 95-117 'Management of Breeding Animals').

**Welfare impact of genetic issues in hybrid cats**

66. Hybrid cat numbers are far fewer than domestic cats, and so fewer research studies have investigated hybrid cat genetic diseases, and their welfare impacts, compared with the number of studies in domestic cats.

67. Hybridisation of animal species in general is well recognised as resulting in adverse genetic effects such as sterility and disease, but there is limited research on the frequency of specific health conditions and the adverse welfare effects these have on hybrid cats.

68. Despite these limitations, a number of genetic and potentially hereditary diseases have been reported in hybrid cats, even in later generations. These include:

a. Bengal cats:
    - Hereditary cataracts and progressive retinal degeneration [72],[73].
    - Hypertrophic cardiomyopathy [74], a form of constrictive heart failure.
    - Polyneuropathies [75].
    - Increased incidence of thoracic wall deformities in related Bengal cats [76]
b. Savannah cats:
    - Histiocytoid cardiomyopathy, a form of heart disease, has been reported [77].
    - Erythrocyte pyruvate kinase deficiency, an inherited haemolytic anaemia resulting in severe lethargy, weakness, weight loss, jaundice, and abdominal enlargement [78].
    - Fibrodysplasia ossificans progressive, a progressive and painful disease resulting in debilitation and a shortened lifespan [79].

**Screening and Genetic Testing**

69. Where available, use of genetic tests and screening programmes to determine whether a cat has certain genetic mutations or conditions associated with conformational characteristics that may be inherited by their offspring, can facilitate the reduction or in some cases, elimination of certain diseases or conditions from a breed. However, whether this is achieved is dependent upon a number of factors. These include the efficacy of the tests, size and diversity of the gene pool within the breed, the prevalence of a condition within the breed, the mode of inheritance (dominant or recessive) and the extent to which the results of any tests are effectively used. There are, in broad terms, two types of test available - physical tests that determine whether a cat actually manifests a phenotypic defect (that may or may not have yet progressed to cause a physical problem), and tests which use DNA testing.

70. Genetic testing of cats can be undertaken to evaluate them for specific DNA variants known to have the potential to affect health. As well as helping to inform breeding decisions, it may enable early diagnosis in the individual, facilitating prompt treatment (where possible) and informing management of environmental factors to minimise the likelihood of them triggering or exacerbating the condition. Over 70 genetic variants have been defined in the cat, many involving diseases and structural anomalies, as well as coat colour and texture, and including numerous that are clinically relevant [41]. However, there are currently various limitations to the efficacy of feline DNA testing. Tests are not available for some of the many inherited feline conditions and the laboratories offering these services are not regulated. Crucially, the value of DNA testing in improving the future genetic health of breeds and the general cat population also relies on well informed and responsible use of the results

by cat breeders when selecting queens, studs and combinations of the two for the breeding of future generations.

## Welfare impact of selection of breeding animals

### Breeding females ('queens')

71. The welfare of female cats as well as that of their kittens (during (and potentially after) the breeding process can be significantly affected by the females' genotype, phenotype, and physical and mental health status at the time of breeding. Queens selected for breeding need to have good nutritional status and appropriate body condition throughout if they are to be able to sustain a pregnancy to term and give birth successfully without negative impact on their own or their kittens' wellbeing. Provision of appropriate quantities of a nutritionally appropriate diet for breeding animals before, during and after breeding is therefore crucial in supporting positive welfare outcomes (see: 'Management of breeding animals' paragraphs 95-117). Equally, selection of overweight animals can result in welfare problems. Obesity in pregnant cats is reported to increase the risk of dystocia and stillbirths ([80], [81] so weight management before and during gestation is also important.

72. A breeding queen's health status affects not only her ability to cope with and sustain pregnancy, parturition and lactation but also the health, wellbeing and and potentially survival of her kittens. There are, therefore, many benefits to be gained from testing females selected for breeding before mating, for the presence of diseases, infections, endo- and ectoparasite infestations and any other health conditions that could adversely affect them and/or their offspring. The kittens can be impacted by their mother's diseases either as a result of transmission in utero - sometimes resulting in embryonic death/reabsorption [82] - or at some stage after birth [83], [84]. In addition, if lactation is adversely affected by poor health status in the mother, the kittens' ability to obtain sufficient nutrition prior to weaning will also be impaired. Conversely, where available, validated vaccinations can be administered in connection with mating, to ensure a high level of maternal antibodies in the colostrum to protect the kittens [82].

73. The queen can also pass on infectious diseases to the stud cat during mating. The mating process is often associated with a certain degree of stress, not least because queens are often taken to the stud cat's premises, therefore experiencing transportation and introduction into a new environment (see: paragraphs 95-117 'Management of breeding animals') in addition to meeting an unfamiliar stud cat. As stress can lead to reactivation and increased shedding of certain infectious agents (e.g. herpes virus), the mating process is a time of high risk with regard to transmission of such agents between the queen and the stud [82].

74. The genotype of queens with regard to inherited disease conditions has a highly significant influence on her offsprings' wellbeing (see paragraphs 59-65 'Welfare impact of genetic issues'), as does that of the male parent and the combination of the two. In the case of recessive inherited disorders, mating between two animals who are both carriers of the mutated gene but may not themselves be affected will risk a proportion of the offspring inheriting the affected gene from each parent (and hence being homozygous for the disorder) and being affected by the condition as a result. Testing for known genetic disorders (where validated tests are available) of all animals selected for breeding can help to avoid such an outcome, though the impact of selection based on a single health issue on increasing inbreeding also needs to be considered. Queens suffering from inherited conditions may find the rigours of pregnancy and lactation even more challenging, depending on the nature of the disorder, resulting in negative impact on their welfare.

75. Certain aspects of the conformation (and hence, the breed or type) of a female cat can influence her risk of experiencing problems during parturition. This in turn may impact upon the kittens' health and welfare. Reports suggest that the incidence of dystocia among pedigree breeding cats is typically under 10 per cent but there is a significant variation between breeds, pointing to a genetic component [85]. Higher incidence rates have been described in several breeds, including Birman, British Shorthair, Ragdoll, Abyssinian and Oriental breeds. Dystocia is also associated with both small and large sizes [86]. Research assessing the pelvic dimensions of several breeds of cats found a correlation between pelvic size and head type, with brachycephalic cats having pelvic measurements that were significantly smaller than those of the mesocephalic females, including smaller pelvic inlet and outlet areas and a smaller pelvic canal shape [87]. This coupled with the wider heads and flatter faces of brachycephalic kittens can lead to the conformation of both mother and offspring contributing to parturition difficulties. In turn, the likelihood of a Caesarean section being required to deliver kittens is influenced by conformation, being more prevalent in dolichocephalic and brachycephalic breeds than in mesocephalic breeds. Overall, pedigree breeds have a significantly higher prevalence of Caesarean sections than mixed breeds, with reports suggesting that approximately 7 to 8 per cent of purebred kittens are delivered by Caesarean section [47],[88] .The consequences of dystocia for both mother and kitten welfare can be very serious. Medical treatment of dystocia is generally considered less successful in queens than in bitches, succeeding in approximately 30% of cases, and significant mortality rates in kittens can result [89].

76. There is little information available regarding the relationship between minimum breeding age and welfare parameters in female cats. Nonetheless, some evidence indicates that breeding should only be undertaken when the cat is fully grown [90]. One study found that postnatal kitten mortality was significantly higher in litters born to female cats under one year old. This was due to a significantly higher risk of post-partum dead kittens when compared to older females' litters [86]. The European

Food Safety Authority (EFSA) have concluded from available information that queens should not be bred from until they reach skeletal maturity - which may not be achieved until sometime after puberty - as the energetic demand for a pregnancy would impact the growth of the mother. EFSA recommends that as skeletal maturity is breed-specific, this should be checked before breeding is initiated [91]. Information is also scarce regarding the impact of frequency of breeding on welfare, though study of the reproductive capacity of free-roaming cats suggests that production of multiple litters per year can be negatively associated with the survival of kittens and should be avoided [92]. Given the huge energy requirements associated with pregnancy and lactation, time to recover body condition and health between litters is clearly of benefit to both the mother and subsequent offspring.

77. The ability of female cats to cope satisfactorily with the various stages of the breeding process will be influenced by their temperament and their mental state/stress levels at the time of breeding. The procedures experienced before, during and after conception and parturition can all impact on short and/or long-term mental health and in turn affect the kittens both whilst in utero and after birth (see paragraphs 95-117 ‘Management of breeding animals’).

78. A cat’s temperament and behaviour are shaped by many genes as well as an animal’s life experiences/environment, and the interaction between the two. Study of the heritability of temperament traits and associated behaviours in cats has indicated variable heritability of various traits (see paragraphs 59-65 'Welfare impact of genetic issues’) and significant differences between certain breeds and breed groups on traits. These include sociability (relating to display of aggression, extroversion, and shyness with humans and other cats), activity levels and likelihood of owner-evaluated behavioural problems [9]. Notably, Bengal cats were found in one study to be in the most fearful, most active, most extroverted cluster of breeds [9]. The fact that certain temperament traits in cats (such as shyness/fearfulness) are both heritable and likely to be detrimental to mental welfare highlights the importance of considering temperament when selecting cats for breeding. This is particularly the case for female cats since in addition to imparting genetically inherited temperament traits to her offspring, the mother’s behaviour towards her kittens post-partum will have significant influence on their physical and mental welfare short and long term (see paragraphs 95-117 ‘Management of breeding animals’),

79. Regardless of breed/type, behavioural differences between cats in different environments (e.g. kept indoors vs given outdoor access) have also been found [9], illustrating the importance of both genetics and housing/management - individually and combined - in influencing behaviour (see paragraphs 95-117 ‘Management of breeding animals’).

**Stud cats**

80. The considerations and welfare consequences associated with selection of stud cats mirror many of those outlined above for breeding queens. In addition, within some breeds, there is sometimes extensive use for breeding of certain popular males. This results in widespread dissemination of the animals' genetics within those breeds. Hence, ensuring that those animals are genetically, conformationally and temperamentally sound, and physically healthy, is of particular importance, since any genotypic, phenotypic or temperamental problems may impact on such large numbers of offspring. Extensive use of individual males within a breed can also lead to a high degree of inbreeding, especially in those breeds that are numerically small [93]. A high coefficient of inbreeding reduces genetic diversity, increases homozygosity (and hence genetic diseases) and malformations, and can also increase teratospermia in male cats (i.e. sperm with abnormal form reflecting a defect in maturation) [81]. The deleterious effects associated with inbreeding start to be seen when the coefficient of inbreeding is higher than 5%, which is just below the value obtained for the offspring of a mating between two cousins (=6.25%) [94].

81. The state of nutrition and health of stud cats selected for breeding, as well as their conformation, may impact their ability to breed successfully and avoid welfare problems for themselves and/or their kittens. For example, unbalanced diets have been shown to result in oligo- and even azoospermia in felids [95]. If males are suffering from or carrying contagious diseases, infections (bacterial, fungal or viral) or parasites, these may be transmitted to the queens either through close contact when they are placed together or during mating itself. Males may themselves sometimes be asymptomatic, highlighting the importance of health testing all prospective stud cats before the breeding goes ahead. Certain aspects of the phenotype and some inherited health conditions of some breeds may cause difficulties in mating naturally. Examples include unusual body or limb confirmation, conditions causing joint abnormalities and/or pain, or breathing difficulties in brachycephalic animals.

82. The genotype of stud cats with regard to inherited disease conditions has significant implications for the wellbeing of the resulting kittens (see paragraphs 59-65 'Welfare impact of genetic issues'). Phenotypic characteristics in the stud cat can also negatively impact his kittens should they inherit physical characteristics associated with health and welfare problems (see paragraphs 59-65 'Welfare impact of genetic issues'). The risk of dystocia in female cats can also be heightened by certain male phenotypes and mismatches in size/shape between stud cats and queens e.g. where the female has a narrow pelvis and the kittens have broad heads (see paragraphs 71-79 'Breeding females ('queens')' above).

Temperament and behaviour of stud cats impact upon their own welfare during the breeding process and may also affect the queen and kittens. For example, males

with fearful temperaments will be more negatively affected by and less able to cope with any stressors they may experience during the breeding process. This in turn may reduce successful mating and be detrimental to the animal's mental wellbeing. If a male shows aggressive behaviour during times of stress, this may have negative consequences for the queen during mating. In addition, evidence indicates that at least some temperamental characteristics of male cats are strongly heritable, with friendly (bold) or unfriendly (unbold) fathers tending to produce bold or unbold offspring respectively [71] (see paragraphs 59-65 'Welfare impact of genetic issues'). Socialisation, or absence of this, at a young age has been shown to further enhance - or reduce - boldness/friendliness in cats, indicating the epigenetic interplay between early experiences and genetics in influencing future behaviour [71].

**Kittens**

83. The welfare of kittens during pregnancy, parturition, rearing and, in many cases, throughout their lives is influenced by a combination of the health, nutritional status, temperament, genotype and phenotype of both their parents and also by their mother's behaviour during rearing.

84. Offspring of two carriers of a recessive genetic mutation are at risk of inheriting the defective copy of the gene from each parent, making them homozygous for the condition. Whilst the parents, as carriers, will often be unaffected, homozygous kittens are likely to suffer from the disorder as a result. In the case of some conditions, homozygosity is fatal either in utero or postpartum. When conditions are inherited through a dominant mode, only one parent needs to have the defective gene for offspring to inherit and be affected by the disorder in question. Examples of inherited conditions that kittens may experience and details of mode of inheritance etc. are outlined in detail in paragraphs 59-65 'Welfare impact of genetic issues'.

85. The conformation of each of a kitten's parents and the combination of the two will influence the kitten's conformation. Extreme conformational traits in turn affect the animals' health and welfare, including in some cases their ability to express natural behaviour throughout their lives (e.g. due to severely reduced limb lengths in 'dwarf' breeds, breathing difficulties in brachycephalic cats and pain associated with joint conditions in breeds such as the Scottish Fold) (see paragraphs 59-65 'Welfare impact of genetic issues'). Certain conformational characteristics can also affect the welfare and even survival of the mother and kittens themselves at birth due to increasing the risk of dystocia (see paragraphs 71-79 'Breeding females ('queens')' above). One report indicated that feline dystocia can result in up to 34 per cent neonatal mortality for kittens delivered via both medical and surgical means, whilst survival of affected queens is also not always achieved [89].

86. As outlined in the 'Breeding females' (paragraphs 71-79) and 'Stud cats' (paragraphs 80-83) sections above, certain temperament traits in cats have been

found to be moderately or even strongly heritable, including boldness, fearfulness and activity levels (see also paragraphs 59-65 ‘Welfare impact of genetic issues’). This indicates the value of considering temperament traits of both parents in breeding animal selection decisions. In addition, kittens during rearing can be influenced by the queen’s behaviour which in turn will be affected both by her temperament, management/environment and life experiences. Further information on this aspect of kitten welfare can be found in paragraphs 95-117 “Management of breeding animals”.

### Cross breeds

87. Some newly established breeds of cat have been produced via deliberately crossing two established breeds. Decisions about which breeds to use to produce such crossbreeds are likely driven by demand for certain physical traits relating to appearance of the offspring and possibly some potentially unfounded perceptions about their health and behaviour. In reality, the welfare impact of ‘designer’ or selective cross breeding is mixed, since the offspring of a first cross of two breeds will inherit genetic and phenotypic characteristics from both their parents to a lesser or greater degree. This may result in either improvements to or a compounding of any health and welfare problems experienced by the parent animals. Hence, considerations around selection of both parents for planned crossbreeding should be the same as those applied when choosing two parents of the same breed. In some cases, some cross breed kittens may experience the genetic and/or phenotypic problems of both breeds and/or new problems as a result of the combination of the parents’ characteristics. For example, the Napoleon breed (Persian/Munchkin cross - see paragraphs 59-65 ‘Welfare impact of genetic issues’) inherits both brachycephaly and shortened limbs and is at risk of the health and welfare concerns associated with both these traits. They may also be susceptible to polycystic kidney disease like their Persian ancestors. Recent statistics suggest that there has been little change in the level of crossbreeding of pedigree cats in the UK, which reports suggest stands at around 5 per cent of the total cat population [13].

## Welfare impacts of reproductive procedures.

88. Reproductive procedures reported in the literature as being used for feline breeding include: artificial insemination (AI) [96] [97] [98]; ultrasound scanning for pregnancy [99]; Caesarean section [47]; semen collection [100] and embryo transfer [101]. All of these techniques can cause both direct and indirect welfare impacts. Embryo transfer will not be further discussed in this Opinion because it seems to be used largely in a laboratory (rather than commercial / clinical setting). Semen collection and artificial insemination of non-domesticated felids in a conservation context is out with the scope of this Opinion. Ultrasound scanning for pregnancy diagnosis and Caesarean sections in female domestic cats are recognised techniques of veterinary practice in the UK. In the course of our evidence gathering

and interactions with stakeholders, the AWC has not been able to find any evidence that artificial insemination, embryo transfer or semen collection of / from domestic cats is being undertaken in the UK. Nonetheless, we did hear some anecdotal reference to interest in the importation of semen to be used for artificial insemination of domestic cats in the UK, indicating that a demand for the use of artificial reproductive techniques/ provision of such services may develop in the UK as it seems already to have done internationally (see, for example, the review article [102]).

89. Peer-reviewed literature-based evidence on the welfare impacts of feline reproductive techniques is sparse. Based on what is available, the AWC assesses the direct welfare impacts of feline reproductive practices as follows:

90. **Semen collection**

Semen collection from male cats is undertaken using one of three methods:

- Training a Tom cat to have semen collected using an artificial vagina, in the presence of a 'teaser' Queen in oestrus.
  This is undertaken in an unsedated / unanaesthetised male. A period of training to use the artificial vagina is necessary. Whilst some male cats may be successfully collected from multiple times a week using this method [102], the procedure is poorly tolerated by many male cats [100]. Possible adverse welfare effects include psychological stress; damage to the male cat's external reproductive organs; psychological insult if the cat is inappropriately handled. The severity of these adverse effects should they occur depends upon individual circumstance and sequelae.

- Electroejaculation
  The male cat is anaesthetised and an electrical probe is inserted into his rectum [103]. Semen is collected into sterile receptacles positioned over the exposed penis when a series electrical impulses cause ejaculations in the anaesthetised animal. The efficacy of electrical stimulation is assessed by an involuntary extension of the hind limbs [102]. The use of this technique necessitates a general anaesthetic, which always carries risk of physical welfare harms due to complications, and of psychological welfare harms due to stress during induction. The latter may be heightened in cats compared to other species who more easily tolerate intravenous injections. It also risks damage to the internal and external anatomy of the male cat, with consequent pain.

- Semen collection by urethral catheterisation after pharmacological induction.
  Semen collection using this technique [104] involves treating the male cat with one or more α2 agonist drugs, which act as sedative and also stimulate contraction of the vas deferens, with consequent release of sperm cells into the urethra. Possible adverse welfare effects include cardiovascular suppression as

the result of the pharmacological treatment, psychological welfare harms due to stress during induction (which may be heightened in cats compared to other species who more easily tolerate intravenous injections) and anatomical damage (with consequent pain) to the penis during semen collection.
In addition to the direct welfare harms described above, all methods of semen collection from male cats carry risks of disease transmission; and risk of misdiagnosis of fertility or subfertility based on examination of semen samples.

91. **Artificial insemination**

Artificial insemination in cats may be carried out during a natural or artificially induced oestrus period. Oestrus may be induced using modification of the light to which the female cat is exposed +/- injecting drugs which promote ovarian follicular development [102]. Artificial insemination of female cats in clinical practice has been described using both intravaginal and intrauterine (transcervical) techniques.

- Intravaginal insemination

  The female cat is heavily sedated or anaesthetised. Semen is deposited in the vagina using a syringe and flexible catheter with a modified needle ending [97] . The female cat is kept on her back with her hindquarters elevated for 15-20 mins post-insemination to minimise backflow and loss of spermatozoa. Possible adverse welfare effects include cardiovascular suppression as the result of the pharmacological treatments, complications of general anaesthesia, psychological welfare harms due to stress during induction (which may be heightened in cats compared to other species who more easily tolerate intravenous injections) and anatomical damage (with consequent post-recovery pain) to the female cat during insemination.

- Intrauterine insemination

  Intrauterine insemination of female cats using both surgical and non-surgical methods has been described. Surgical deposition of semen directly into the uterus may be either via laparotomy [105] or laparoscopy [106]. Both surgical methods carry attendant welfare risks including those associated with general anaesthesia, peri- and post-operative haemorrhage and infection, and post-operative pain and adhesion formation.

  More commonly, intrauterine insemination of cats is performed in clinical practice by non-surgical methods, via a transcervical approach whereby semen is deposited into the uterus following catheterisation of the cervix [102]. This may be performed either using an endoscope [107] or ‘blind’. Associated risks to welfare include complications of general anaesthesia, psychological welfare harms due to stress during induction (which may be heightened in cats compared to other species who more easily tolerate intravenous injections) and anatomical damage (with consequent post-recovery pain) to the female cat during insemination.

Artificial insemination has been carried out in a number of species of non-domestic felid. It is invasive and requires endoscopic laparoscopic surgery for the procedure to be successful and therefore a full general anaesthetic. It is not believed that any hybrid cats are being bred by artificial insemination in the UK at the current time.

92. **Scanning for pregnancy diagnosis**
Scanning for pregnancy diagnosis in cats is a recognised act of veterinary practice which facilitates monitoring of foetal and placental structures as well as assessment of the number and viability of embryos [108]. It is performed transabdominally and is in itself painless, but may cause indirect stress due to the fact that cats have to be restrained, unfamiliarity of the sensation of the ultrasound probe upon the body, and the need to clip hair to achieve a diagnostic image. There are risks to the health and welfare of queens and kittens associated with misdiagnosis.

93. **Caesarean section**
Caesarean section is a surgical method of resolving dystocia in the cat. Like all surgeries it carries risks, including those associated with general anaesthesia and of peri- and post-operative haemorrhage and infection and post-operative pain and adhesion formation. Caesarean sections carry additional, specific risks relating to poor or delayed post-operative mothering behaviour by the queen, which may compromise the health and welfare of kittens, and possible decrease in milk production / let down. All of these risks are significant, even when the procedure is being performed correctly, with veterinary nursing and aftercare available.

Although one paper did not find breed to be a risk factor for requiring a Caesarean section [88], more recent research has shown that pedigree cats are more likely to require a Caesarean Section than non-pedigree cats [47], [85]. Extreme conformation resulting in dystocia is a recognised risk factor for not being able to give birth naturally [47], [85], with both brachycephalic and dolichocephalic breeds requiring Caesarean Section more frequently than mesocephalic breeds (see also paragraphs 71-88 ‘Welfare impact of selection of breeding animals’).

# Management of breeding animals

### Management of domestic breeding cats

94. The ways in which breeding queens, male stud cats and kittens are managed is critical for their welfare, including future welfare and behavioural development in the case of kittens. When considering the management of feline breeding it is helpful to consider the reproductive biology of the domestic cat, Felis silvestris catus, as this knowledge should inform how they are managed. Female cats are seasonally polyoestrous, with the season commencing with increasing day length, and cats typically starting to cycle when the day length is greater than 12 hours [109]. This

means that during the season they will have multiple oestrous cycles, and therefore the potential to have a high reproductive output and produce multiple litters. Oestrous cycles occur at intervals of around 14-21 days, with a wide range of individual variation between cats in the exact timing of these [109]. In terms of breeding management, queens can also be induced to cycle all year round by providing 14 hours of continuous artificial lighting in indoor managed cats [109]. An interesting characteristic of cat reproductive biology is that they are induced ovulators, meaning they typically require mating to induce ovulation, although non-copulatory stimulation can also cause ovulation.

95. The oestrous cycle consists of five phases; proestrus, oestrus, inter-oestrus, dioestrus and anoestrus. The phases are characterised by changes in behaviour, hormones, and structural changes to the reproductive tract.

> During the first phase, proestrus, queens attract toms but are not sexually receptive to them. Physiologically this phase comprises ovarian follicular development and oestradiol hormone synthesis. This leads into the oestrus phase during which the queen is sexually receptive and accepts to be mated. Oestrus typically lasts between 4-7 days and comprises high levels of oestradiol. There may be a distinct vulvar discharge during oestrus, although this may not be observed due to the grooming behaviour of cats. If a queen has been mated and ovulates then dioestrus will occur, during which hormone levels change, with progesterone levels rising.
>
> If a successful pregnancy occurs, the gestation period is 63-65 days [110]. Female cats typically reach puberty between 4 and 12 months of age, at a weight that is around 80% of adult weight. However, there is considerable breed and individual variation, with smaller breeds reaching puberty sooner. Male cats typically reach sexual maturity between 9 and 12 months of age [110]. In summary, the reproductive biology of cats means they are considered prolific breeders that can give birth early in life, before they are fully grown [91]. This has important implications for their welfare.

96. At present, there is a lack of direct scientific literature related to the management of domestic feline breeding and welfare. However, there is a good evidence base of existing relevant academic literature regarding the welfare effects of managing cats in a range of environments, which the AWC has drawn on to discuss welfare relevant aspects of feline breeding management in the sections below.

**The housing environment**

97. The AWC recognises that cats being used for breeding will be maintained in a range of environments. Data which the AWC received from stakeholders, notably the GCCF, indicates that the majority comprises small scale breeders maintaining

animals largely in a home environment especially in the case of the females, though stud cats are often kept in separate accommodation. There are also larger scale breeders maintaining animals in a cattery type environment.

98. The AWC has concerns regarding the suitability of some of these environments to meet cats' behavioural welfare needs. Although evolved from a solitary ancestor, domestic cats show a spectrum of sociality towards humans and other cats. In this regard they are facultatively social, meaning that their social behaviour is highly flexible and influenced by their early life development and later life learning [111].

99. Cats used for breeding will often be managed in an indoor environment, including a cattery type environment, with a lack of outdoor access, the latter of which has benefits for welfare [112]. Therefore, environmental enrichment of the indoor environment is important for breeding cat welfare [112], [113]. Environmental enrichment involves modifying a captive animal's environment to promote natural behaviour and improve biological functioning and welfare [114]. For cats, the types of environmental enrichment can be classified as social enrichment, sensory enrichment, physical enrichment, and feeding enrichment [113].

100. Social enrichment can be either intraspecific involving interaction with other cats, or interspecific involving interaction with humans. A range of studies have demonstrated beneficial effects of social contact with humans for cats [113]. For example, in a study comparing the preference of cats for different types of enrichment, they were found to prefer social interaction with humans over other forms of enrichment that included food, toys, or scent [115]. Furthermore, social interaction with humans has been shown to reduce behavioural and physiological indicators of stress in cats [116]. Sessions of positive human interaction in shelter cats have been found to improve behavioural indicators of welfare, as well as reducing the incidence of upper respiratory disease [113] . An important consideration is the quality of human contact, as a person's behaviour and attitudes may impact the value of the social interaction. For example, shelter cats that had been handled consistently and positively by the same people displayed lower behavioural indicators of stress and were more likely to be adopted compared with other cats that had been handled inconsistently by various people [113]. The importance of human-animal interactions for welfare is recognised in the updated version of the Five Domains model of animal welfare assessment [149]. For example, in farm animals there is good evidence demonstrating the importance and effect of human caretaker attitudes and behaviours for the welfare of animals under their management [117]. The importance of this aspect is recognised in cats e.g.[113] and regarding cat breeding, the levels and quality of human interaction is an important consideration for welfare and one that requires further research. It is also important to consider that individual cats vary considerably in their sociality towards humans [111], [118] and this needs to be considered in the management of breeding cats.

101. Intraspecific social interactions with other cats are also important for welfare [112] and relevant to the management of breeding cats. In group managed cats, affiliative behaviours are observed between certain individuals and include allo-grooming, allo-rubbing, play, nose touching and maintaining physical contact [112]. Cats housed alone in a cattery type environment have been found to display higher levels of a physiological indicator of stress than those housed with conspecifics [119]. However, group housing can also involve negative social interactions, particularly if space is restricted [113]. Therefore, if breeding cats are housed with conspecifics, consideration should be given to personal space and group composition to ensure it is composed of individuals that have been well socialised with - and are comfortable with being near - other cats.

102. Physical enrichment is another important aspect of housing management. A number of studies have demonstrated the value of providing cats with hiding opportunities (e.g. a hiding box) and opportunities to use vertical space [112], [113]. Part of a cat's natural behavioural repertoire includes climbing and jumping, with a preference to have an 'off the ground' vantage point [112]. Furthermore, when entering a novel environment, cats have been found to show a preference for concealed areas and raised vantage points [116]. Therefore, when managing breeding cats in confined environments opportunities to hide and use vertical space should be provided, and can include shelves and climbing poles. The physical environment can also be made more enriching by including suitable cat toys. However, cats rapidly habituate to object play and regular rotation of toys used for enrichment is recommended [112]. Sex differences in how cats respond to a new housing environment have also been documented, with Rehnberg et al. [116] finding that males showed higher behavioural stress scores. This could have implications for the management of male cats used for breeding if they are moved between different enclosures and / or premises.

103. Another useful form of enrichment relevant to the management of breeding cats is feeding enrichment. This aims to allow cats to display aspectsClick here to enter text. of their predatory behaviour and work to acquire food [120]. This form of enrichment can include hiding of food and food puzzles and has been shown to have a range of beneficial effects including decreased aggression towards humans and other cats, reduced fear and anxiety, reduced attention seeking behaviour, reduced litter box issues, while also have a beneficial effect on weight loss [120]. Given the high prevalence of obesity in cats managed in confined environments [32], the beneficial effect on weight management is useful.

104. When managing cats there are also opportunities for sensory enrichment. For example, given the importance of olfaction in the behaviour of cats, a small number of studies have investigated opportunities to provide olfactory enrichment. They demonstrate some beneficial effects on levels of behavioural engagement with

objects containing particular scents [113]. There has also been some limited research on visual and auditory enrichment. However, this has been in the context of shelter cat management and the topic requires further investigation. Finally, it is possible that enabling the queen to breed and raise a litter could be viewed as a form of behavioural enrichment as it provides an opportunity to express natural behavioural repertoires associated with maternal care and bonding with offspring. Aspects of this are likely associated with positive affective states, although this remains to be better understood in cats. In addition, on the contrary, if the breeding environment is not well managed, it has the potential to severely compromise the welfare of the queens and her kittens, including effects of prenatal stress that remain to be investigated in cats.

105. Another important welfare aspect to consider in the management of cat breeding is thermal comfort. While many breeding animals will be managed in indoor environments that should meet their thermal needs, others housed in cattery type facilities have scope to experience thermal stress. For most adult cats, a temperature between 15 and 26°C prevents negative welfare consequences associated with thermal stress [91]. However, there will be breed differences and adequately managing thermal comfort is particularly important for those breeds that lack hair (e.g. Sphynx). In addition, there have been calls for research to provide additional information on animal-based measures of thermal stress in cats [91]. It is also important that the housing environment is equipped to adequately address the thermal needs of the kittens, which differs from adult cats. Young kittens are unable to adequately regulate their body temperature and rely on their mother, littermates and external factors associated with the kittening area for thermoregulation during the first few weeks of life [91]. If not adequately managed, kittens are therefore at significant risk of hypothermia. Recently there has been a call for more research to better understand the optimal temperature and conditions for managing kittens in the kittening area during the first three weeks of life [91].

**Nutrition**

106. Nutrition has a profound impact on cat health and welfare at all stages of the breeding cycle. Ensuring appropriate levels of nutritionally complete and safe diets for breeding animals before, during and after breeding is crucial, not only to their own wellbeing but also to that of their offspring from conception onwards. Provision of suitable food during and after weaning of kittens is also an essential element in supporting their growth, health and welfare [121]. Cats are obligate carnivores. As a result of this specialisation, they have very specific nutritional needs and a narrow range of tolerance for various dietary components, making dietary deficiency and toxicity more common than in omnivorous species [122]. For example, cats require taurine to support both good health and reproduction, with deficiency causing serious health problems. Taurine-depleted females suffer from severe retinal degeneration, and their surviving offspring exhibit neurological abnormalities [90].

107. The way in which the food is offered also affects a cat's welfare in many ways so needs to be in accordance with their natural feeding behaviour and physiology [122] in order to promote both physical and behavioural wellbeing [123]. There is still some debate over the optimal feeding frequency of cats from a behavioural and physiological perspective [32]. Some research indicates this may differ depending on the exact nature of the food provided [124] [125], though higher frequency feeding appears to be associated with higher activity levels [124], [125]. Enrichment during feeding, including by hiding food, use of puzzle feeders etc. may provide a balance between simulation of natural cat foraging and feeding behaviours. It may also facilitate maintenance of a healthy weight and hence avoid the most common domestic feline nutritional problem, obesity [126], [127], by decreasing intake and increasing expenditure of energy [123].

108. Breeding queens need to be in good condition when mated. Their energy requirement increases continuously (by about 10 per cent per week) throughout pregnancy, meaning that by the end of the gestation period, their energy intake should be 25–70% above maintenance levels [90], [128]. Pregnant queens should therefore be fed ad libitum. Furthermore, the energy requirement increases by 100-300% during lactation depending on the stage [128] . However, obesity in pregnant cats is reported to increase the risk of dystocia and stillbirths (cited by [81]) so weight management during gestation is also important.

109. Appropriate nutrition is also crucial for stud cats. Unbalanced diets have been shown to result in oligo- and even azoospermia in felids [95]. Also, male cats who are exposed to cycling queens over prolonged periods may lose weight due to reduced food intake and increased stress. Heavily used studs therefore require high nutrient density rations [90].

**Biosecurity**

110. Protecting breeding cats and kittens against exposure to diseases, infections and parasites is a vital component of overall health and welfare management. As reflected in licensing regulations, biosecurity measures are of particular importance in larger scale breeding establishments where any diseases could spread amongst and affect large numbers of animals. Many common diseases can have devastating effects on both adults and kittens, including high levels of morbidity and mortality in neonates [90]. Regardless of the scale of the breeding activity, development and consistent implementation of bespoke biosecurity plans are of great value in supporting avoidance of entry and spread of disease. Such plans benefit from cooperation with, and input from, the veterinary profession [90] and taking account of any particular risks in the local area is also important. In addition, regular health checks of all animals on the premises along with those with whom they have contact (e.g. queens visiting stud cats) contribute to effective protection.

## Transport

111. The AWC has not been able to find any documented information regarding the frequency and nature of transportation of cats during the course of the breeding process. However, the AWC heard from several stakeholders, including breeders, that when the male and female breeding animals are not from the same location, it is usual for females to be taken to the stud cats' premises for mating, though sometimes males are taken to females.

112. Little research has been undertaken regarding cat welfare during transport, with studies to date tending to focus on transporting for the purpose of receiving veterinary treatment [129]. However, evidence-based knowledge of cat behaviour in general would suggest that any live transport of cats is likely to be stressful to some degree [130]. Factors such as the animal's fitness to travel, temperature/humidity, ventilation, size of - and level of comfort within - the transport container, and frequency and duration of the journey all influence the animals' welfare in transit, highlighting the importance of ensuring appropriate practices through regulation and guidance.

## Maternal behaviour, early life and socialisation

113. For breeders, parturition is a critical stage in the reproductive cycle of the queen. It is also an important time for the welfare of the queen and her kittens. As an altricial species, kittens are born in an immature state, and early life is a vital period shaping behavioural development. In the first two weeks of life they are reliant on thermal, tactile and olfactory stimuli, with their eyes usually opening during the second week [110]. Kittens are relatively immobile during the first two weeks after birth, with simple walking patterns beginning during the third week, although it is not until around four weeks that they can move any significant distance from the nest. After six weeks of age they will have started to use the repertoire of gaits found in adult locomotion [110]. During this early life period maternal behaviour including nursing is vital to support the development of kittens [110]. It is therefore important that the queen has a suitable environment to support maternal care, including sufficient nutrition (see paragraphs 107-110 'Nutrition' above) and lack of disturbance.

114. The importance of maternal care for kitten development is evidenced by studies comparing behavioural development in kittens raised with their siblings by their mother, compared to kittens that had been hand-raised by a human carer either with their siblings or as orphan singletons. The scenario of hand-raising kittens by a human carer is a situation often faced by rescue and rehoming shelters. Using this study approach, Martinez-Byer et al. [131] found differences in behaviour of the kittens when tested at nine weeks of age. Those from the hand-raised orphan groups struggled more quickly in a restraint test, while also vocalising more and being more

active in a separation / confinement test. Importantly, the kittens from the three groups did not differ in body weight at weaning, indicating that they all received adequate nutrition and that this aspect could not explain the observed behavioural differences. These findings were consistent with those from Lowell et al.[132] who found orphan kittens vocalised more and showed increased motor activity compared to mother-reared individuals during a social separation test at one and three weeks of age. Furthermore, laboratory cats separated from their mother and siblings at two weeks of age showed behavioural deficits in later life, including behaving anxiously in novel environments, and showing increased aggression towards humans and other cats [133]. Similar results were also found from another study in which laboratory kittens were reared in isolation in a brooder [134]. At present there is a lack of studies comparing how variation in levels of maternal care influence kitten behavioural development, unlike in dogs where this has been clearly demonstrated (e.g.[135]). Given the importance of the early life socialisation period in kittens, it is likely that behavioural differences resulting from variations in levels of maternal care would persist into later life [110].

115. Related to maternal behaviour, an important breeding management decision is the weaning age of removing kittens from the queen. The critical early life socialisation period in kittens occurs between two and eight weeks of age [136]. Therefore, a weaning age of eight weeks of age has previously been recommended [136]. However, the rationale for this age has been challenged. For example, in a questionnaire-based survey of over 5000 cat owners [136] Ahola et al. found there were significant associations between early weaning age and subsequent behavioural problems including aggression and stereotypic behaviour. More specifically, cats weaned before eight weeks of age were significantly more likely to behave aggressively towards human strangers than cats weaned at 12 weeks of age and were also more likely to be categorised as having a behavioural problem in later life. Furthermore, cats weaned after 14 weeks of age were less likely to show excessive grooming behaviour than those weaned at 12 weeks of age. These results of an association between early life weaning age and later life problem behaviour led the authors to recommend that breeders use a weaning age of 14 weeks, advocating that this would be a practical way to improve cat welfare. Aligned to this recommendation of a later weaning age, the GCCF strongly recommends that no kitten should be permitted to go to a new home before 13 weeks of age [137]. Important knowledge gaps remain regarding the influence of weaning age on behaviour development, with much of the existing evidence relying on associative studies that cannot infer causal mechanisms and there is a need for further empirical studies in this area.

116. Regardless of weaning age, the timing of the critical socialisation period occurs whilst kittens are under the care and management of the breeder. This highlights the necessity for an appropriate socialisation plan to expose kittens to the environmental

and human stimuli they will face in later life. If this aspect is not adequately managed it will have detrimental welfare consequences for kittens in later life.

## Management of hybrid breeding cats

117. There is a significant difference in the gestation (pregnancy) length between servals (approximately 75 days) versus domestic cats (65 days on average). If domestic cat females are used to produce hybrids, they may give birth to effectively premature kittens that require hand-rearing or may not survive. In the obverse, a male domestic cat mated with a female wild cat may result in smaller than expected kittens which the wild cat female may reject or attack.

118. Wild and domestic cats often refuse to pair or mate, and repeated frequent matings are often required for successful fertilisation. Refusal to mate may result in aggression and injuries to the cats involved. Servals are considerably larger than domestic cats, with males weighing up to 15kg, and may severely injure or kill domestic female cats they are mating.

119. Breeders recognise that many hybrid pregnancies do not carry to full term, and kittens may be aborted or born prematurely [138].

120. It is also recognised that early generation Savannah cats, like many mammalian hybrids, suffer from a degree of hybrid inviability, and male Savannah cats of early generations are frequently sterile [138].

121. Because of breeding difficulties, breeding servals and F1 Savannah cats are often subjected to frequent breeding attempts and handling by humans.

122. Hybrid cats have very complex welfare needs, many of which relate to the natural behaviours of the wild cats from which they are derived, as explained in the following paragraphs.

123. The Serval (Leptailurus serval) is a sub-Saharan species which has minimum home ranges of around 9.5km$^2$ for females and 11.6km$^2$ for males although this can double in less ideal/prey dense habitats [139]. As a species they are renowned for jumping, often 1-4 metres, in order to catch rodents and other small prey items. Entire males are highly territorial and will scent mark around 45 times per hour. They are significantly bigger than the domestic cat, with males weighing up to 15kg, and are predominantly day/crepuscular hunters of grasslands and are very active during these periods. Inheritance of these behaviours and environmental needs by their hybrid offspring can result in difficulties in catering for them in a captive pet setting.

124. The Asian leopard cat (Prionailurus bengalensis) is listed as a cat species that is considered both terrestrial and arboreal in nature by the Association of Zoos and

Aquaria (AZA) and therefore requires the ability to climb within its enclosure/habitat [140].

125. The jungle cat (Felis chaus) is the closest species, evolutionary speaking, considered here to the domestic cat (Felis catus) but is still much more distantly related to it than the European wildcat (Felis silvestris). Its natural habitat includes wetlands and dense mature riparian vegetation. Consequently it is both an effective swimmer and likes to climb.

126. The last common ancestor of the Serval and the domestic cat occurred over 8 million years ago [141]. In contrast, the domestic dog and wolf last shared a common ancestor only around 20 - 40,000 years ago [142].

127. All three of these wild cat species, used to breed hybrid cats, are currently classified in the ‘least concern’ conservation category by the International Union for the Conservation of Nature (IUCN), and so there is no conservation need for the private keeping of these species in the UK.

128. The hybrids of all three species (Savannah cats, Chausies, and Bengals) have complex environmental needs to ensure sufficient mental and physical stimulation and are not suited to life as pets in small indoor dwellings. They are all larger than the average domestic cat and have assertive, sometimes aggressive play behaviours. Many are highly territorial and do not easily tolerate other cats.

129. Many of the other hybrids beyond F1 and free from the keeping constraints of the DWA (1976) still maintain many of their wild-type anatomical and behavioural characteristics and these can make them challenging to keep as pets. This is true even of hybrid cats beyond F5/6 generations. Chausies and Savannahs are much bigger than the average domestic cat and Savannahs in particular can jump significant distances. All are more aggressive with more active hunting drives than domestic cats. For this reason, it is generally not recommended to allow them to roam freely. This in itself can lead to issues regarding frustration.

130. Wild small cat species require a balanced diet that differs from that offered to domestic cats. The British and Irish Association of Zoos and Aquaria (BIAZA) guidelines for the keeping of Servals recommend the primary diet consists of whole prey items including rabbit, chicken, quail, mice, chicks, or rat. These also allow wild cats to manifest normal feeding behaviours, not possible with commercial domestic cat foods. Adequate and appropriate nutritional provision for hybrid cats can be difficult. Nutritionally there is some evidence that beef-based and dry/pelleted diets may not be as efficiently digested in non-domestic felids and their crosses, leading to the potential of nutritional deficiencies and requiring the cats to consume more food per kilogram body weight than their domestic felid counterparts [143]. Secondary nutritional hyperparathyroidism (metabolic bone disease) has been reported in

Bengal cats and is commonly seen in larger species of felid due to their rapid growth rates [144].

131. In our interactions with stakeholders, the AWC understood from the Cats Protection that they will not take in Savannah cats as they do not feel they can provide a suitable environment in their rescue centres to adequately meet their welfare requirements. They also have concerns about the difficulties in finding suitable homes. Cats Protection, as the AWC understood it, will take in Bengal cats, but believe these hybrid cats - even if later generations - have special requirements and can only be placed in homes that are aware of and able to meet these needs.

132. According to Martinez-Caja et al [8], 33.2% of F2 hybrids and below showed destructive behaviours, 89.5% climbing behaviours, 78.9% hunting behaviours and no differences were seen between indoor and outdoor access strongly suggesting the current situation within the UK does not suit their captive management.

133. The Code of Practice for the Welfare of Cats [145] is worded such that it applies to all cats, irrespective of species, providing practical guidance in complying with section 9 of the Animal Welfare Act 2006 and section 24 of the Animal Health and Welfare (Scotland) Act, 2006. These sections of the relevant Welfare Acts identify the five animal welfare needs, one of which is the need to be able to exhibit normal behaviours. Prima facie, this appears particularly difficult to achieve in hybrid cats. There is currently a relative paucity of detailed research into the welfare of hybrid cats particularly in relation to their behavioural needs, and thus an inadequate evidence base to inform their care.

## Combined impact of health and welfare on Quality of Life

134. On-going monitoring and assessment of animal health and welfare is vitally important in facilitating both an understanding of an animal's welfare state and an effective response to indications that needs are not being met. Animal welfare can be defined as a subjective state within the animal themselves that reflects the integrated outcome of all their mental ('affective') experiences at a given point in time [146]. In other words, 'welfare' refers to how the animal is experiencing their own life at that time [147]. However, assessment of an animal's welfare state is challenging, both in theory and in practice.

135. There is currently no universally accepted approach to assessing animal welfare. Nonetheless, the Five Domains model - which includes consideration of nutrition, environment, health, behaviour and based on these, an animal's likely mental state - is widely acknowledged as facilitating a meaningful holistic assessment of welfare. The original model has been further extended to include consideration in each domain of positive experiences that may enhance welfare, in addition to those which may compromise it [148]. The latest version also includes

specific guidance on how to evaluate the negative and/or positive impacts of human behaviour on animal welfare [149]. Specifically, the model has been extended to facilitate explicit and detailed assessment of the welfare impacts that humans may have on the animals in their care or control - including owners/breeders, veterinary surgeons, trainers and other service providers. Inclusion of positive (i.e. what an animal likes and wants) as well as negative considerations, is now recognised as being at the heart of effective animal welfare assessment, with contemporary animal welfare thinking increasingly emphasising the promotion of positive states rather than simply the absence of suffering.

136. It is generally accepted now that the welfare of cats (and other species) is impacted by other elements beyond physical health and disease, and that mental experiences largely determine an animal's welfare status. However, this has not always been the case. Until recently, many considered physical health and biological function to be the major determinants of welfare status, and tools developed to assess animals' 'quality of life' still often relate only to clinical health and illness (generic or disease specific).

137. Research suggests that understanding of the behaviour and behavioural needs of cats can be poor. The often perception-based, subjective, human-centric interpretation of cats' behaviour and poorly evidenced but widely held beliefs about their physical and behavioural needs [32], [111], can result in poor decision-making, care and management by owners, breeders and service providers with associated negative consequences for the animals' quality of life. For example, studies suggest that many cats living in private homes may be receiving only minimal environmental enrichment and that better education of cat owners could therefore benefit the welfare of cats living in such circumstances [150]. Given the dearth of data - but likely variability - regarding conditions for breeding cats held in cattery-type premises (as outlined in paragraphs 95-117 'Management of breeding animals'), it is reasonable to conclude that at least some cats kept in this way will experience similar inadequacies of care and understanding. Similarly, even basic physical care such as provision of suitably nutritious diets in appropriate quantities is often not achieved, as evidenced by the huge problem of cat obesity (and associated health and welfare problems) [151], [152]. The mismatch noted between the levels of obesity diagnosed by veterinarians compared with pet owners provides further evidence of the influence of perception and subjective judgement about their cat's wellbeing in the latter demographic [151].

138. Several tools have been developed aimed at assessing the quality of life of various species such as dogs (e.g. The Field Instantaneous Dog Observation (FIDO) tool [153]), but to date, there has been less focus on producing equivalent validated approaches for cats. One such tool, the Animal Welfare Assessment Grid (AWAG), is available for dogs [154], horses and several other species on an accessible online platform. The AWAG assesses the four parameters of physical health, psychological

wellbeing, environmental comfort, and veterinary and managemental procedural events over time. It encompasses the five domains of animal welfare and, crucially, also monitors cumulative lifetime experience. Hence, it highlights the important but frequently overlooked temporal component of any suffering [155]. However, to date, a feline-specific AWAG has not been developed.

139. The changing role of companion animals including cats, as well as changes in human lifestyle and demands, places the animals at risk of poor lifetime welfare. As outlined in this Opinion, breeding cats and their resulting offspring may be subjected to multiple physical and mental stressors before, during and after breeding and throughout their lives, resulting in many health and welfare problems which may often remain unnoticed and/or unresolved [156]. A better understanding of cat behaviour by all owners/keepers/caregivers would facilitate more effective recognition of their health and welfare problems and support more successful meeting of their needs. This includes improvements in the multiple elements involved in cat breeding, from focusing on selection for traits that support (rather than directly or indirectly harm) welfare of the breeding animals and their offspring, through to provision of optimal species-specific environments and management throughout life. Objective assessment of welfare and acting upon the outcome would facilitate improved overall quality of life for the animals. It would support decision-making and action based on evidence, in order to minimise risk of suffering and maximise positive welfare.

## Ethical analysis

140. In line with its previous work and Opinions, the ethical approach which AWC has adopted in considering this issue is a primarily utilitarian one in which the human use of animals is considered permissible to achieve important benefits, providing that animal welfare is safeguarded as far as possible and, as a minimum, in accordance with national and, where relevant, international legislation. The utilitarian approach adopted by AWC is qualified in that the justification of harms is considered in relation to both the magnitude and importance of the benefits that accrue, within the context and situation under consideration. AWC recognises that there are some harms which, due to their severity, should not be inflicted upon animals under normal circumstances. Animal welfare should be maximised as far as possible in each and every situation to ensure that animals have 'lives worth living' and ideally 'good lives'[1,2].

141. Feline breeding practices have the potential to affect not only current but also future generations of cats.

142. Selection and management of breeding cats should aim to optimise welfare benefits, and to effectively prevent welfare harms being inflicted upon queens, toms and kittens.

143. In relation to the use of assisted breeding technologies, the harms associated with such practices are likely to be significantly greater for cats than they are for some other species, and cannot be outweighed by possible benefits to either cats or humans. The AWC therefore considers such use unethical.

144. Based on scientific evidence, the AWC does not believe that the welfare needs of hybrid cats can be met in a domestic setting. The harms caused to hybrid cats by being kept as pets cannot be outweighed by the benefits to humans of using them in that way. The AWC therefore does not find it ethically acceptable that hybrid cats should be kept as pets, nor bred from nor imported for that purpose.

145. Based on scientific/veterinary evidence, selection for the defining phenotypic characteristics of certain breeds of cat inevitably results in the animals suffering significant health and welfare problems. The harms caused to such cats cannot be outweighed by the benefits to humans who breed and/or own them. The AWC therefore does not believe that such breeds should continue to be bred.

[1] Wathes, C. (2010), Lives worth living?. Veterinary Record, 166: 468-469. https://doi.org/10.1136/vr.c849

[2] Mellor, D.J. Updating Animal Welfare Thinking: Moving beyond the “Five Freedoms” towards “A Life Worth Living”. *Animals* **2016**, *6*, 21. https://doi.org/10.3390/ani6030021

# Conclusions

## General conclusions

146. The breeding of cats covers a wide range of topics including selection of breeding animals and management.

147. Decisions and actions relating to selection and management of cats for breeding have implications for the health and welfare of the animals and their offspring, the environment (e.g. climate change, sustainability of natural resources, wildlife) and human wellbeing.

148. Numbers of cats in the UK rose sharply in 2020 - 2021 but appear to have stabilised at around 11 - 12 million. There has been a significant increase in the number of pedigree cats in recent years and they now make up around 28 per cent of the UK cat population.

149. There is an increasing trend towards purchasing cats rather than obtaining them through other means such as adoption from rescue organisations, with around 40 per cent being bought (2022-2023). Much of the buying (nearly two thirds) is undertaken online. A small percentage of cats is obtained (via adoption or purchasing) from overseas sources.

150. Recent figures suggest that up to half of litters born are unplanned. Nearly two thirds of planned litters are from pedigree cats.

151. Trends in cat ownership in general and individual breed popularity are impacted by multiple social factors and perceptions. In addition, winning at high profile breed shows can result in individuals being in demand for breeding.

152. There is a general lack of high quality available/transparent evidence regarding the nature and scale of feline breeding in Great Britain with much of the available information being gleaned from owner surveys. Nonetheless, it is clear based on the range of available evidence which the AWC has considered that feline breeding is currently inadequately and ineffectively regulated.

153. Across Great Britain, large numbers of kittens are bred by breeders who do not fall within scope of the current licensing requirements.

154. Due to the lack of regulation and oversight of cat breeding, there is a lack of evidence and data about the scale and severity of health and welfare issues for breeding queens, stud cats and kittens.

155. There is currently insufficient awareness and knowledge amongst the public about all aspects of the breeding and management of breeding cats, which is compounded by confusion arising from the existence of multiple sources of sometimes misleading information in the public domain. This makes it difficult for consumers to make well-informed welfare-orientated choices regarding sourcing a kitten.

Little official guidance exists providing detailed advice on cat breeding and there is a general lack of awareness of best practice. Moreover, available guidance is mainly voluntary, leading to variable uptake.

**Conclusions about risks and impacts (positive and negative) to breeding cats (both male and female), their offspring, and future generations from current and emergent feline breeding practices within GB**

156. Semen collection, artificial insemination, ultrasound diagnosis of pregnancy and Caesarean section are all associated with a higher risk of psychological welfare harms in cats compared to some other species in which these techniques are better tolerated. These harms may be short or long-term in their duration.

157. The AWC could not find evidence of semen collection or artificial insemination currently being undertaken to breed domestic cats in the UK, but those techniques are being used abroad and a demand for them could therefore develop in the UK.

158. Semen collection and artificial insemination are more technically challenging to perform in cats compared to some other species, and usually (with the exception of male cats who have been trained to the use of an artificial vagina) require heavy sedation or general anaesthesia (which is not required in many other species). Consequently, the use of these techniques carries significant risks of physical welfare harms, which are greater than those associated with the use of the same techniques on many other species.

159. These harms associated with the use of semen collection and artificial insemination (and which would also be associated with the use of other assisted reproductive techniques including embryo transfer) are not outweighed by the proclaimed benefits (such as facilitating breeding of animals who are geographically distant, using frozen semen of dead males and reducing the spread of non-venereal infectious disease) of undertaking such procedures in cats (see ‘Ethics’ section above).

160. Ultrasound scanning for pregnancy is a more stressful procedure in cats than it is in some other species.

161. Caesarean section is necessary to resolve dystocia, but carries risk of significant harms. Pedigree cats appear to be at greater risk of needing a Caesarean section than non-pedigree cats. Extreme conformation increases the risk of cats not being able to give birth naturally.

**Conclusions about the risks and impacts from poor selection of breeding cats and/or from breeding high volumes of litters from a limited pool of breeding cats, and whether domestic cats and their offspring with genetic and/or phenotypic conditions can have their welfare needs adequately met as pets**

162. The welfare of breeding cats, as well as that of the resulting kittens, is greatly influenced by their health status, genotype, phenotype, behaviour and the environment and management practices under which they are kept.

163. All cats are at risk of inheriting genetic diseases but deliberate selection for specific individual traits/characteristics within purebred cat breeds results in diminished gene pools/inbreeding with associated increased risk of inherited breed-specific health and welfare conditions.

164. Several breeds of cat suffer from one or more inherited conditions that can result in sometimes severe suffering and/or the need for veterinary intervention.

165. Some breeds have inherited disorders - genetic and/or phenotypic - as a direct result of selection for characteristics that define the breed (e.g. folded ear in Scottish Fold cats) but which are associated with inevitable negative impact on the health and welfare of all individuals to a greater or lesser degree. Examples include the Scottish Fold and Munchkin-type breeds. In such cases, it is not possible to 'breed out' the harmful traits by selecting unaffected or 'carrier' individuals or even by cross breeding (due to the mode of inheritance of the affected allele), so the breed itself is inherently associated with suffering.

166. Some other breeds include both individuals who are free from trait-associated health problems and those who suffer from serious health and welfare concerns as a result of selection for a particular trait (e.g. taillessness in the Manx). In such cases, well informed, welfare-focused decision-making regarding the genetics and health status of breeding animals is essential if problems are to be minimised in offspring.

167. Current legislation provides insufficient protection to the progeny of cat breeding activities from avoidable hereditary health and welfare conditions. This is due both to the limited scope of national animal activity licensing regulations and of national animal welfare legislation regarding cat breeding.

168. The use of available validated health testing and the application of results in decision-making ahead of selection of breeding animals is variable between different

inherited conditions. Furthermore, the laboratories offering DNA testing are not regulated.

169. Objective assessment of cat and kitten welfare and quality of life both during each stage of the breeding process, and when living as companions, is hampered by the lack of feline-specific assessment protocols and by the frequently poor understanding of cat welfare and behaviour amongst many pet owners, breeders and pet services professionals.

170. Breeding queens, stud cats, and kittens are kept in a range of settings and under diverse management conditions. All have the potential to compromise welfare depending on the specifics of the environment and management practices that are used. However, the risk of negative welfare impacts during breeding can be reduced by using a range of management approaches and environmental conditions, including enrichment as outlined in this Opinion.

171. There is a significant evidence gap regarding the management conditions in which cats are kept for breeding, including the number of breeding cats being maintained and litters per breeder.

172. There is a significant evidence gap regarding stud cat management.

173. The quantity and quality of human interaction with breeding cats and kittens is thought to have a significant impact on their welfare. However, there is a lack of empirical research on this topic directly related to breeding cat management.

174. In general, there is a lack of empirical research and controlled studies related to breeding cat and kitten welfare. Much of the existing evidence to support this Opinion has been drawn from other relevant research on general cat management.

175. Many breeding cats are likely to be transported, during the course of the breeding process. Little research has been undertaken specifically focused on cat welfare in transit, though the experience is likely to be stressful and influenced by a range of factors relating to duration, frequency and quality of transport conditions.

**Conclusions about the extent to which the practice of breeding hybrid cats, and other cats with genetic conditions, is undertaken in GB**

176. Due to difficulties in engaging with stakeholders, varying definitions of ‘hybrid’, difficulty in identifying which generation a hybrid cat belongs to and uncertainty over whether hybrid cats are registered as required by regulation, the AWC is unable to reliably quantify the extent to which hybrid cats are being bred within the UK.

177. A Freedom of Information request survey from Local Authorities by Born Free in 2023 found that from those that replied, there were 187 Dangerous Wild Animal Act (1976) licences for Felidae, issued by 48 local authorities, in relation to the keeping of a total of 219 animals. These included: 53 Servals, 42 F1 generation Savannah cats, 6 Leopard cats, 2 Jungle cats, and 1 Bengal cat.

178. The AWC was made aware by feline charities that they had been presented with hybrid cats.

**Conclusions about whether hybrid cats and their offspring can have their welfare needs adequately met as pets**

179. Hybrid cats and their offspring cannot have their welfare needs adequately met when kept as pets in the UK.

180. There is no justification for the continued production of early generation (F1 and F2) hybrid cats: it is being undertaken simply for the perception of improved cosmetic appearance of new show and sale cats, and associated financial incentives.

181. Repeated forced matings, due to incompatibility between the different species, and low conception rates result in severe welfare compromises. Artificial insemination is not a reasonable alternative, as it results in other different adverse welfare outcomes and is invasive.

182. Hybrid cats and the wild cats kept for their breeding appear to be commonly presented for rehoming to zoos and specialist organisations due to difficulties in managing their often more aggressive behaviours and needs for extra room for housing.

183. Veterinary treatment of hybrid cats is problematic. Hybrid cats appear to have a lower rate of presentation by their owners to veterinary surgeons than domestic cat breeds.

**Conclusions about whether current hybrid keeping practices have impacts on or pose a risk to other pets, wildlife, or to public safety**

184. Generally, the first generation (F1) of hybrid cats are deemed a threat to public safety and are included under the schedules to the Dangerous Wild Animals Act 1976.

185. Hybrid cats and their offspring pose a risk to other domestic animal pets due to their higher levels of aggression.

186. Hybrid cats and their offspring pose a higher risk to native UK wildlife species than domestic cats due to their larger size, stronger hunting behaviour and higher levels of aggression. They risk introducing these characteristics into feral cat populations, with a risk of subsequent increased harms to UK native wildlife populations.

# Recommendations

### General recommendations

187. Legislation, guidance and advice on the issues of selection for breeding and management practices relating to breeding cats and offspring, should take account of the wide-ranging and profound impact of these on the welfare of breeding cats and kittens, as well as on the environment and human wellbeing.

188. Further research and new/improved information-gathering mechanisms are required to gather good quality data about the scope, nature and impact of current feline breeding practices. Important knowledge gaps which AWC recommends need addressing include: a lack of data regarding the size, scale and current management practices related to cat breeding; a lack of research on the socialisation practices used by breeders and how these influence kitten development; a lack of information on weaning age used by breeders and how this influences kitten development; and a lack of information of the welfare effects of the quality and quantity of human-cat interactions.

189. An online centralised information hub with governmental oversight and endorsement should be developed. This should consolidate existing evidence-based, robust information sources provided by governments and individual organisations, to provide key information, best practice guidelines and learning resources / training to cat breeders, kitten purchasers and cat services providers on all the aspects of cat breeding covered in this Opinion. Concurrent development of an effective communications strategy to highlight the existence and usefulness of this resource to target audiences should also be undertaken.

### Recommendations about risks and impacts (positive and negative) to breeding cats (both male and female), their offspring, and future generations from current and emergent feline breeding practices within Great Britain

190. Legislation should be enacted to prevent all artificial reproductive procedures, including semen collection and artificial insemination, being used in domesticated cats.

191. Ultrasound scanning of domestic cats for pregnancy diagnosis should only be undertaken by a veterinary surgeon who is a Member or Fellow of the Royal College

of Veterinary Surgeons, and then only after careful consideration of whether the value of scanning for diagnostic purposes outweighs the welfare harms associated with using the technique, according to individual situation and clinical indications.

192. Emergency Caesarean sections are necessary surgeries to relieve dystocia. However, the availability of Caesarean sections should never be used by breeders as an elective option to enable breeding from cats with extreme conformation who are not able to give birth naturally. Such cats should not be bred from (paragraph 196).

**Recommendations about the risks and impacts from poor selection of breeding cats and/or from breeding high volumes of litters from a limited pool of breeding cats, and whether domestic cats and their offspring with genetic and/or phenotypic conditions can have their welfare needs adequately met as pets**

193. The health and welfare of both male and female parent cats should be adequately safeguarded throughout the breeding process, including during any interventions and procedures.

194. Selection of parents should not worsen but rather be aimed at improving the overall health and welfare of the next generation. Selection of breeding animals should always include: a focus on reducing the coefficient of inbreeding (COI) to achieve a COI below 10 percent (and ideally under 5 percent) and widening of the gene pool; the use of validated health testing (taking account of COI considerations, especially in breeds with small gene pools) to facilitate informed decisions about selection of individuals and combinations of parents; and the avoidance of any harmful heritable conditions including extreme morphologies (including head type, size, skin folds, coat type, leg and back length, taillessness).

195. For all cat breeding regardless of scale, cats with severe heritable health/welfare issues should not be used for breeding, to avoid welfare compromises. Such issues include, for example, a reduction /alteration of function/normal feline behaviour, painful conditions and/or those necessitating veterinary treatment (including surgery, long term anti-inflammatory/pain relief therapies).

196. For all cat breeding regardless of scale and throughout Great Britain, breeding should not be undertaken where the breeding or associated husbandry creates a significant risk to the parents' welfare and/or to that of their progeny. Measures should include taking responsibility to avoid unplanned litters.

197. Legislation should be introduced in England and Wales (and reflecting that already in place for cat breeding in Scotland) regulating cat breeding in line with the provisions in place for dogs in Schedule [6] Animal Welfare (Licensing of Activities Involving Animals) (England) Regulations 2018 and Schedule 6 [8] of the Animal Welfare (Licensing of Activities Involving Animals) (Scotland) Regulations 2021. In particular, this should include a regulation stating that: “No cat may be kept for breeding if it can reasonably be expected, on the basis of their genotype, phenotype or state of health that breeding from them could have a detrimental effect on their health or welfare or the health or welfare of their offspring.” This regulation should apply to all cat breeders, including those who are currently legitimately ‘unlicensed’ and out with the scope of the above pieces of legislation.

198. Consideration should be given to increasing the minimum age at which kittens can be legally sold - from 8 weeks to 12 weeks.

199. A requirement should be introduced throughout Great Britain for stud cats to be licensed with associated regulation on standards of care.

200. Extensive use of individual stud cats within a breed should be avoided due to the risks this poses to genetic diversity and the potential for widespread dissemination of harmful inherited conditions.

201. Breeders of pure bred (single breed) kittens in breeds that currently suffer from extreme conformation or other health and welfare-damaging traits, and/or small gene pools with a high average COI, should outcross with cats in which such characteristics are absent and which improves the COI / where the crossing has a lower COI than the breed. Such efforts to reduce inherited welfare problems and widen gene pools within breeds should be facilitated by breed registration organisations and clubs by allowing some form of registration of such cats.

202. Breeds should not be perpetuated where they suffer from health and welfare problems linked to characteristics selected for / associated with that breed. Licensing legislation should explicitly prevent licensing of those breeding these animals throughout the UK. Specifically, it is recommended that there is sufficient evidence to justify inclusion of the Scottish Fold, Munchkin and other dwarf breeds within this prohibition, due to the almost inevitable and frequently severe physical suffering and behavioural restrictions highly likely to be experienced by all individuals within these breeds.

203. In breeds where at least some individuals suffer from serious health and welfare concerns as a result of selection for a particular trait (e.g. taillessness in the Manx), the phenotype and health status of potential breeding animals should be assessed and verified as sound by a veterinary surgeon before they can be licensed for breeding.

204. A communication strategy to raise awareness amongst kitten buyers of the serious welfare problems associated with certain breeds should also be developed and implemented.

205. All cat breeders should have to provide information about feline health testing including which tests have been conducted or not conducted (and any results and their significance) to prospective owners of kittens.

206. Information for breeders about which genetic health tests have been validated for specific breeds and which laboratories undertaking such testing have demonstrated high quality control should be included in the online information hub (see paragraph 191).

207. Facilities that are used to house breeding queens, stud cats and kittens need to be designed with feline welfare in mind and this should be reflected in legislation covering cat breeding. These facilities will range from home to cattery type environments and the management practices will need to be tailored to the specific circumstances. Environmental enrichment options should be used to optimise the breeding environment. In addition, the facilities should be designed to provide suitable evidence-based temperatures, ventilation, quantity and quality of space, including opportunities to hide and use vertical space, while giving consideration to noise levels. Biosecurity procedures should be used to minimise the risk of disease introduction and spread.

208. The frequency and duration of transportation of breeding cats and kittens should be minimised and the quality of transport conditions optimised.

209. Additional species-specific provisions that better safeguard the welfare of cats and kittens during transport should be researched and added to current live animal transport legislation.

210. All those involved in caring for stud cats, breeding queens and kittens should ensure they are sufficiently well informed (including through use of the information hub learning resources (paragraph 191)) in cat health and welfare to enable them to deliver adequate environmental conditions and care, and to recognise physical and behavioural signs that may indicate a welfare problem that requires action.

**Recommendations about hybrid cats**

211. Legislation should be enacted banning any further deliberate breeding of domestic cats with any non-domestic felid species, or breeding with first two generation hybrid cats (F1 and F2).

212. Legislation should be enacted banning the importation of any domestic wild cat hybrids, with the exception of low hybrid generations of Bengal cats (generation F5 or later).

# References


1. Protopopova, A. *et al* (2021) *Climate change and companion animals: identifying links and opportunities for mitigation and adaptation strategies.* Integrative and Comparative Biology, 2021. **61**: p. 166-181. [cited 16.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/33871032/ .

2. Woods, M. *et al* (2003). *Predation of wildlife by domestic cats Felis catus in Great Britain. .* Mammal Review. **33**: p. 174-188. [cited 16.7.2024]; Available from: https://onlinelibrary.wiley.com/doi/abs/10.1046/j.1365-2907.2003.00017.x .

3. Cecchetti, M.*et al* (2021) *Provision of High Meat Content Food and Object Play Reduce Predation of Wild Animals by Domestic Cats Felis catus.* Current Biology, 2021. **31**(5): p. 1107-1111. [cited 16.7.2024]; Available from: https://www.sciencedirect.com/science/article/pii/S0960982220318960 .

4. Crowley, S. *et al (2020), Our Wild Companions: Domestic cats in the Anthropocene. .* Trends in Ecology & Evolution. **35**(6): p. 477-483. [cited 16.7.2024]; Available from: https://www.sciencedirect.com/science/article/pii/S0169534720300100.

5. Crowley, S. *et al* (2019) *Hunting behaviour in domestic cats: An exploratory study of risk and responsibility among cat owners.* People and Nature. **1**(1): p. 18-30. [cited 16.7.2024]; Available from: https://besjournals.onlinelibrary.wiley.com/doi/full/10.1002/pan3.6.

6. Jacobetty, R. *et al* (2019) *Psychological correlates of attitudes toward pet relinquishment and of actual pet relinquishment: the role of pragmatism and obligation.* Animals (Basel), **10**(1): p. 63. [cited 16.7.24]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7022558/.

7. Dickman, C.R. *et al* (2019) *Assessing Risks to Wildlife from Free-Roaming Hybrid Cats: The Proposed Introduction of Pet Savannah Cats to Australia as a Case Study.* Animals. **9**(10): p. 795. [cited 22.7.2024]; Available from: https://doi.org/10.3390/ani9100795.

8. Martinez-Caja, A.M *et al* (2021) *Behavior and health issues in Bengal cats as perceived by their owners: A descriptive study* Journal of Veterinary Behavior p. 12-21. [cited 22.7.2024]; Available from: https://doi.org/10.1016/j.jveb.2020.10.007.

9. Salonen, M. *et al* (2019*) Breed differences of heritable behaviour traits in cats.* Nature Scientific Reports 9. p. 7949. [cited 16.7.2024]; Available from: https://www.nature.com/articles/s41598-019-44324-x.pdf.

10. Anon (2024) The Kitten Checklist. [cited 19.7.2024] Available from: https://www.cats.org.uk/media/3722/the-kitten-checklist.pdf.

11. Anon (2024). Get Your Pets Safely Campaign [cited 16.7.2024] Available from: https://getyourpetsafely.campaign.gov.uk/

12. Governing Council of the Cat Fancy (2024) *Cat breeds not recognised by the GCCF. Cat Breeds not recognised by GCCF but with some recognition by WCC members.* [cited 16.7.2024]; Available from: https://www.gccfcats.org/wp-content/uploads/2021/10/Unrecognised-breeds.pdf.

13. Cats Protection (2023) *CATS Report 2023: Cats and their Stats.*[cited 16.7.2023]; Available from: https://www.cats.org.uk/media/cjcekhtq/ed_685-cats-report-2023_uk_digi.pdf.

14. DG Sanco (2015) *Study on the welfare of dogs and cats involved in commercial practices.* [cited 2.2.2024]; Available from: https://food.ec.europa.eu/system/files/2016-10/aw_eu-strategy_study_dogs-cats-commercial-practices_en.pdf

15. Eurogroup for Animals (2023) *Extreme breeding in Europe - mapping of legislation.* [cited 16.7.2024]; Available from: https://www.eurogroupforanimals.org/files/eurogroupforanimals/2023-11/2023_11_30_Extreme%20breeding%20in%20Europe%20-%20Mapping%20of%20legislation%20FINAL.pdf.

16. University of Michigan (2024)*Table of State commercial pet breeders laws.*[cited 2.2.2024]; Available from: https://www.animallaw.info/topic/table-state-commercial-pet-breeders-laws.

17. European Commission (2023) *Proposal on the welfare of cats and dogs and their traceability.*.[cited 2.2.2024]; Available from: https://food.ec.europa.eu/system/files/2023-12/aw_reg-proposal_2023-769_dog-cat-trace.pdf .

18. European Commission (2023) *Proposed new rules to improve animal welfare.* [cited 2.2.2024]; Available from: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_6251.

19. Federal Food and Safety Veterinary Office(2024) [cited 5.2.24]; Available from: https://www.blv.admin.ch/blv/en/home/tiere/tierschutz/zuechten.html

20. NVLA Netherlands (2024) *Breeding with Cats.*[cited 16.7.24]; Available from: https://www.nvwa.nl/onderwerpen/honden-en-katten/fokken-met-uw-hond-of-kat/fokken-met-katten.

21. The Flemish Government (2007) *Ministerial Decree determining the animals that display a hereditary condition* [cited 16.7.24]; Available from: https://codex.vlaanderen.be/PrintDocument.ashx?id=1035502&datum=&geannoteerd=false&print=false.

22. Department of the Environment, Belgium (2024) *Ban on breeding and trading of Fold Cats.* [cited 16.7.2024]; Available from: https://www.vlaanderen.be/natuur-milieu-en-klimaat/dieren/huisdieren-en-landbouwhuisdieren/verbod-op-de-kweek-en-het-verhandelen-van-fold-katten.

23. Victorian Government, Australia (2024) *Code of Practice for the Breeding of Animals with Heritable Defects that Cause Disease.* [cited 16.7.2024]; Available from: https://agriculture.vic.gov.au/livestock-and-animals/animal-welfare-victoria/pocta-act-1986/victorian-codes-of-practice-for-animal-welfare/code-of-practice-for-the-breeding-of-animals-with-heritable-defects-that-cause-disease#h2-4.

24. UK Pet Food (2024) *UK Pet Population* 2024 [cited 22.4.2024]; Available from: https://www.ukpetfood.org/information-centre/statistics/uk-pet-population.html.

25. PDSA (2023), *Animal Wellbeing (PAW) Report 2023.* [cited 1.8.2024;] Available from: https://www.pdsa.org.uk/what-we-do/pdsa-animal-wellbeing-report/paw-report-2023.

26. Statista (2023) *Cat Population in the UK.* cited 22.4.24]; Available from: https://www.statista.com/statistics/1289937/cat-population-by-breed-uk/.

27. McDonald, J. et al (2023) *Empirical modelling of Felis catus population dynamics in the UK* PLOS One, [cited 16.7.2024]; Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0287841.

28. General Council of the Cat Fancy (GCCF) (2024) *Cat Breeds.*[cited 16.7.2024]; Available from: https://www.gccfcats.org/getting-a-cat/choosing/cat-breeds/.

29. General Council of the Cat Fancy (GCCF) (2023) *Registered Cats by Breed.* 2023,[cited 22.7.2024]; Available from: https://www.gccfcats.org/breeding-cats/stats-and-policies/analysis-of-breeds-registered/.

30. Kurushima, J.D. (2013) *Variation of cats under domestication: genetic assignment of domestic cats to breeds and worldwide random-bred populations.* Animal genetics **44**(3): p. 311-324.

31. RSPCA (2024) *RSPCA reveals number of pedigree cats has soared over last six years'.* [cited 16.7.24]; Available from: https://www.rspca.org.uk/local/oxfordshire-branch/latest/detail?newsTitle=%E2%80%98designer%E2%80%99-cat-numbers-in-rspca-care-soar-by-up-to-300%25&newsId=9896#:~:text=The%20most%20common%20pedigree%20cat,over%20the%20last%20six%20years.

32. Udell, M. et al (2023) *CATastrophic myths part 2: Common misconceptions about the environmental, nutritional, and genetic management of domestic cats and their welfare implications.* The Veterinary Journal 300-302, 106029. [cited 16.7.2024]; Available from: https://www.sciencedirect.com/science/article/pii/S1090023323000801#bib37.

33. Defauw, P.A. et al (2011) *Risk factors and clinical presentation of cats with feline idiopathic cystitis.* Journal of Feline Medicine and Surgery, 2011. **13**: p. 967-975. [cited 16.7.2024]; Available from: https://journals.sagepub.com/doi/full/10.1016/j.jfms.2011.08.001.

34. Ball, J et al (2012) *Veterinary medical guide to dog and cat breeds*. 1st ed. New York: CRC Press.

35. Nelson, R.W.R. and Reusch, C. E. (2014) *Animal models of disease: classification and etiology of diabetes in dogs and cats.* Journal of Endocrinology **222**: p. T1-T9. [cited 16.7.2024]; Available from: https://joe.bioscientifica.com/view/journals/joe/222/3/T1.xml.

36. Harley, R. et al (2011) *Immunohistochemical characterization of oral mucosal lesions in cats with chronic gingivostomatitis.* Journal of Comparative Pathology **144**: p. 239-250. [cited 16.7.2024]; Available from: https://www.sciencedirect.com/science/article/abs/pii/S002199751000304X.

37. Jergens, A.E. (2012) *Feline idiopathic inflammatory bowel disease: what we know and what remains to be unraveled.* Journal of Feline Medicine and Surgery **14**: p. 445-458. [cited 16.7.2024]; Available from: https://journals.sagepub.com/doi/full/10.1177/1098612X12451548.

38. International Cat Care (2018) *Inherited Disorders in Cats*[cited 16.7.2024]; Available from: https://icatcare.org/advice/inherited-disorders-in-cats/.

39. Teng, K.T.et al (2024) *Life tables of annual life expectancy and risk factors for mortality in cats in the UK.* Journal of Feline Medicine and Surgery **26**(5): p. 1098612X241234556. [cited [cited 16.7.2024]; Available from: https://journals.sagepub.com/doi/full/10.1177/1098612X241234556.

40. O'Neill, D.G. et al (2014) *Longevity and mortality of cats attending primary care veterinary practices in England.* Journal of Feline Medicine and Surgery **17**(2): p. 125-133. [cited 16.7.2024]; Available from: https://journals.sagepub.com/doi/full/10.1177/1098612X14536176.

41. Gandolfi, B. et al (2015) *Investigation of inherited diseases in cats: Genetic and genomic strategies over three decades.* Journal of Feline Medicine and Surgery **17**(5): p. 392-444.[cited 16.7.24]; Available from: https://journals.sagepub.com/doi/10.1177/1098612X15581133.

42. Ginn, J.A. et al (2008) *Nasopharyngeal Turbinates in Brachycephalic Dogs and Cats.* .Journal of the American Animal Hospital Association **44**(5): p. 243-249. [cited 16.7.24]; Available from: https://meridian.allenpress.com/jaaha/article-abstract/44/5/243/176553/Nasopharyngeal-Turbinates-in-Brachycephalic-Dogs.

43. Weir, M. et al (2023), *Brachycephalic Airway Syndrome in Cats.* [cited 16.7.2024]; Available from: https://vcahospitals.com/know-your-pet/brachycephalic-airway-syndrome-in-cats#:~:text=What%20is%20brachycephalic%20airway%20syndrome,congenital%20obstructive%20upper%20airway%20disease.

44. Farnworth, M.J. et al (2016) *Flat feline faces: Is brachycephaly associated with respiratory abnormalities in the domestic cat 'felis catus'?* PLoS ONE **11**: p. e0161777 [cited 16.7.2024]; Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0161777.

45. O'Neill, D.G. et al (2019) *Persian cats under first opinion veterinary care in the UK: demography, mortality and disorders.* Nature - Scientific Reports 9 **9**.

46. La Croix, N.C. (2001) *Nonhealing corneal ulcers in cats: 29 cases (1991–1999).* Journal of the American Veterinary Medical Association**18**: p. 733-735. [cited 16.7.2024]; Available from: https://avmajournals.avma.org/view/journals/javma/218/5/javma.2001.218.733.xml.

47. Robertson, S., (2016) *Anaesthetic management for caesarean sections in dogs and cats.* In Practice **38**(7): p. 327-339. [cited 16.7.2024]; Available from: https://bvajournals.onlinelibrary.wiley.com/doi/10.1136/inp.i3201.

48. Korff, C.P.W. and Williamson B.G. (2020) *Clinical Presentation of Chiari-like Malformation in 2 Persian Cats.* Topics in Companion Animal Medicine **41**: p. 100460. [cited 16.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/32823159/.

49. Mathews, K.G. et al (1995) *Resolution of lameness associated with Scottish Fold osteodystrophy following bilateral ostectomies and pantarsal arthrodeses: a case report.* Journal of the American Animal Hospital Association **31**: p. 280-288.[cited 25.7.2024]; Available from: https://meridian.allenpress.com/jaaha/article-abstract/31/4/280/174820/Resolution-of-lameness-associated-with-Scottish.

50. Allan, G.S. (2000) *Radiographic features of feline joint disease.* Veterinary Clinics of North America: Small Animal Practice **30**: p. 281-302. [cited 25.7.2024]; Available from: https://www.sciencedirect.com/science/article/abs/pii/S0195561600500230.

51. Malik, R. at al (2008) *Osteochondrodysplasia in Scottish Fold cats.* Australian Veterinary Journal **77**: p. 85-92. [cited 16.7.2024]; Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1751-0813.1999.tb11672.x.

52. Gunn-Moore, D. at al (2008) *Breed-related disorders of cats.* Journal of Small Animal Practice, 2008. **49**: p. 167-168. [cited 16.7.2024]; Available from: https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1748-5827.2008.00572.x?src=getftr.

53. Takanosu, M. & Hattori, Y (2022) , *Osteochondrodysplasia in Scottish Fold cross-breed cats.* Journal of Veterinary Medical Science **82**(12): p. 1769-1772. [cited 16.7.2024]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7804039/.

54. General Council of the Cat Fancy (2024) *Welfare statement*.[cited 16.7.2024]; Available from: https://www.gccfcats.org/wp-content/uploads/2023/01/GCCFs-Welfare-Statement.pdf.

55. General Council of the Cat Fancy (2024) *Recommended breeding policy for the Manx cat.* [cited 16.7.2024]; Available from: https://www.gccfcats.org/wp-content/uploads/2021/10/UK_MANX_BREEDING_POLICY_25_05_13.pdf.

56. DeForest, M.E. and Basrur, P.K. (1979) *Malformations and the Manx Syndrome in Cat.* Canadian Veterinary Journal. **20**(11): p. 304-314. [cited 16.7.2024]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1789620/.

57. Struck, A.K. et al (2020) *A structural UGDH variant associated with standard Munchkin cats.* BMC Genetics **21**: p. 67. [cited 16.7.2024]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7325026/.

58. Bell, J. et al (2012) *Veterinary medical guide to dog and cat breeds.* 1st ed., New York: CRC Press.

59. Buckley, R.M. et al (2020) *A new domestic cat genome assembly based on long sequence reads empowers feline genomic medicine and identifies a novel gene for dwarfism.* PloS Genetics **16**: Article e1008926. [cited 16.7.2024]; Available from: https://journals.plos.org/plosgenetics/article?id=10.1371/journal.pgen.1008926.

60. Kittleson, M.D. et al (1999) *Identification of a hereditary form of hypertrophic cardiomyopathy in Maine Coon Cats: an animal model of human disease.* Circulation, 1999. **99**: p. 3172–3180. [cited 16.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/10377082/.

61. Borgeat, K. (2014) *Association of the myosin binding protein C3 mutation (MYBPC3 R820W) with cardiac death in a survey of 236 Ragdoll cats.* Journal of Veterinary Cardiology **16**: p. 73-80. [cited 16.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/24906243/.

62. Universities Federation of Animal Welfare (UFAW) (2011) *Genetic welfare problems of companion animals.* [cited 16.7.2024]; Available from: https://www.ufaw.org.uk/cats/munchkin-limb-deformity.

63. Strain, G.M. (2007) *Deafness in blue-eyed white cats: The uphill road to solving polygenic disorders.* The Veterinary Journal (Guest Editorial) **173**: p. 471-472.

64. General Council of the Cat Fancy (2024) *BAER Testing for white cats.* [cited 16.7.2024]; Available from: https://www.gccfcats.org/breeding-cats/new-to-breeding/testing/baer-testing-for-white-cats/.

65. International Cat Care (2024) *Advice, Sphynx* [cited 25.07.2024]; Available from: https://icatcare.org/advice/sphynx/.

66. Narfström, K. (1999) *Hereditary and Congenital Ocular Disease in the Cat.* Journal of Feline Medicine and Surgery **1**(3): p. 135-141. [cited 16.7.2024]; Available from: https://journals.sagepub.com/doi/10.1016/S1098-612X%2899%2990202-4.

67. Langford Vets (2024) *Burmese Hypokalaemia.* [cited 16.7.2024]; Available from: https://www.langfordvets.co.uk/media/nivftjf1/burmese-hypokalaemia.pdf.

68. General Council of the Cat Fancy (2024) *Gene testing.* [cited 16.7.2024]; Available from: https://www.gccfcats.org/breeding-cats/new-to-breeding/testing/gene-testing/.

69. Adams, C. (2024) *7 Cat Breeds With Very Short Legs: Vet-Approved Guide With Pictures* [cited 24.4.24]; Available from: https://www.catster.com/cat-breeds/cat-breeds-with-short-legs/.

70. Wilhelmy, J. et al (2016) *Behavioral associations with breed, coat type, and eye color in single-breed cats.* Journal of Veterinary Behaviour **13**: p. 80-87. [cited 16.7.2024]; Available from: https://www.sciencedirect.com/science/article/abs/pii/S1558787816300284.

71. McCune, S. (1995) *The impact of paternity and early socialisation on the development of cat' behaviour to people and novel objects.* Applied Animal Behaviour Science **45**(1): p. 109-124. [cited 16.7.2024]; Available from: https://www.sciencedirect.com/science/article/abs/pii/016815919500603P.

72. Kucharczyk, N. et al (2020) *Hereditary cataract in the Bengal cat in Poland.* BMC Vet Res **16**: p. 293. [cited 25.7.2024]; Available from: https://doi.org/10.1186/s12917-020-02517-x.

73. Bourguet, A. et al (2018) *Cataracts in a population of Bengal cats in France* Vet Ophthalmol **21**: p. 10-18. [cited 25.7.24]; Available from: https://doi.org/10.1111/vop.12470.

74. Scansen, B.A. & Morgan, K.A. (2015) *Reference intervals and allometric scaling of echocardiographic measurements in Bengal cats.* Journal of Veterinary Cardiology **17**: p. S282-S295. [cited 25.7.24]; Available from: https://doi.org/10.1016/j.jvc.2015.02.001.

75. Bensfield, A.C. et al (2011) *Recurrent demyelination and remyelination in 37 young Bengal cats with polyneuropathy.* J Vet Intern Med **25**: p. 882-9, doi: 10.1111/j.1939-1676.2011.0740.x

76. Charlesworth, T.M. & Sturgess, C.P. (2012) *Increased incidence of thoracic wall deformities in related Bengal kittens.* J Feline Med Surg **14**(6): p. 365-8. doi: 10.1177/1098612X12437351.

77. Tanner, F.C. & Jenni R. (2009) *Ventricular Noncompaction in a Savannah Kitten.* Veterinary Pathology **46**: p. 1306. doi:10.1354/vp.09-VP-0130-J-LTR.

78. Grahn, R.A. et al (2012) *Erythrocyte Pyruvate Kinase Deficiency mutation identified in multiple breeds of domestic cats.* BMC Vet Res **8**: p. 207.doi.org/10.1186/1746-6148-8-207.

79. Jacobsen, K.L. et al (2023) *Use of Enrofloxacin and Hydrotherapy in the Management of Fibrodysplasia Ossificans Progressiva (FOP) in a Savannah Cat.* Top Companion Anim Med. **52**: p. 100757. doi: 10.1016/j.tcam.2022.100757.

.

80. Bilkei, G. (1990)*The influence of body condition on the parturition of the queen.* Berliner und Muenchener Tieraerztliche **103**(2): p. 49-51. [cited 16.7.2024]; Available from: https://agris.fao.org/search/en/providers/122438/records/647753b05eb437ddff7505fa.

81. Strom Holst, B. (2022) *Feline breeding and pregnancy management: What is normal and when to intervene.* Journal of Feline Medicine and Surgery, 2022. **24**(3): p. 21-231. [cited 16.7.2024]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9099157/#bibr51-1098612X221079708.

82. Strom Holst, B. (2002) *Disease Transmission by Mating or Artificial Insemination in the Cat: Concerns and Prophylaxis.* In: Recent Advances in Small Animal Reproduction. [cited 16.7.2024]; Available from: https://www.researchgate.net/publication/241657527_Disease_Transmission_by_Mating_or_Artificial_Insemination_in_the_Cat_Concerns.

83. Sherding, R.G. (2006) *Feline Immunodeficiency Virus.* Saunders Manual of Small Animal Practice (Third Edition) [cited 16.7.2024]; Available from: https://www.sciencedirect.com/topics/veterinary-science-and-veterinary-medicine/feline-immunodeficiency-virus#:~:text=Queen%2Dto%2Dkitten%20(prenatal,increase%20the%20risk%20of%20transmission.&text=Diagnosis%20of%20FIV%20infection%20in,the%20whole%20litter%20is%20infected.

84. Wasmoen, T. et al (1992) *Transmission of feline immunodeficiency virus from infected queens to kittens.* Veterinary Immunology and Immunopathology **35**(1-2): p. 83-93. [cited 16.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/1337404/.

85. Holst, B.S. et al (2017) *Dystocia in the cat evaluated using an insurance database.* J Feline Med Surg. **19**(1): p. 42-47. [cited 17.7.2024]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10816746/.

86. Ström Holst, B & Frössling, J (2009) *The Swedish breeding cat: population description, infectious diseases and reproductive performance evaluated by a questionnaire.* Journal of Feline Medicine and Surgery **11**: p. 793-802. [cited 16.7.2024]; Available from: https://journals.sagepub.com/doi/abs/10.1016/j.jfms.2009.01.008.

87. Monteiro, C.L.B. et al (2013) . *Pelvic differences between brachycephalic and mesaticephalic cats and indirect pelvimetry assessment*. Veterinary Record, 2013. **172**(1): p. 16. [cited 16.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/23118051/.

88. Sparkes, A.H. et al (2006) *A questionnaire-based study of gestation, parturition and neonatal mortality in pedigree breeding cats in the UK.* Journal of Feline Medicine and Surgery, **8**(3): p. 145-157. [cited 16.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/16442825/.

89. Bailin, .H.G. et al (2022) *Retrospective evaluation of feline dystocia: clinicopathologic findings and neonatal outcomes in 35 cases (2009–2020).* Journal of Feline Medicine and Surgery **24**(4): p. 344-350. [cited 16.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/34124965/.

90. Goericke-Pesch S. and Packeiser E-M. (2022) *Reproductive management in catteries: optimising health and wellbeing through veterinarian-breeder collaboration.* Journal of Feline Medicine and Surgery**24**: p. 881-904. [cited 16.7.2024]; Available from: https://journals.sagepub.com/doi/full/10.1177/1098612X221118760.

91. Candiani, D. et al (2023) *Scientific and technical assistance on welfare aspects related to housing and health of cats and dogs in commercial breeding establishments.* Scientific Report, European Food Safety Authority (EFSA) Journal 2023, [cited 16.7.2024]; Available from: https://efsa.onlinelibrary.wiley.com/doi/full/10.2903/j.efsa.2023.8213.

92. Nutter,F.B. et al (2004) *Reproductive capacity of free-roaming domestic cats and kitten survival rate.* Journal of the American Veterinary Medical Association **225**: p. 1399–1402. [cited 16.7.2024]; Available from: https://avmajournals.avma.org/view/journals/javma/225/9/javma.2004.225.1399.xml.

93. Matsumoto, Y et al (2021) *Genetic relationships and inbreeding levels among geographically distant populations of Felis catus from Japan and the United States.* Genomics, **113**: p. 104-110. [cited 16.7.2024]; Available from: https://www.sciencedirect.com/science/article/pii/S0888754320320164.

94. University of Montreal Laboratory of Veterinary Genetics (2024) *Cat genetics 4.0: Evolution, Breeds, Breeding Strategies and Inbreeding.*

[cited 16.7.2024]; Available from: https://labgenvet.ca/en/cat-genetics-4-0-evolution-breeds-breeding-strategies-and-inbreeding/#:~:text=Avoid%20incestuous%20breedings%2C%20with%20coefficients,inbreeding%20coefficients%20lower%20than%205%25.

95. Howard, J. & Allen,M.E (2007) *Nutritional factors affecting semen quality in felids*, in *Zoo and wild animal medicine: current therapy VI.* . p. 272-283.

96. Tsutsui, T. (2006) *Artificial insemination in domestic cats (Felis catus).* Theriogenology **1**(66) [cited 16.7.2024]; Available from: https://www.sciencedirect.com/science/article/abs/pii/S0093691X06001919.

97. Tanaka, A. et al (2000) *Artificial intravaginal insemination using fresh semen in cats.* J Vet Med Sci **62**(11): p. 1163-7. [cited 16.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/11129859/.

98. Villaverde, A.I. et al (2009) *Comparison of efficiency between two artificial insemination methods using frozen-thawed semen in domestic cat (Felis catus): artificial insemination in domestic cats.* Anim Reprod Sci. **114**: p. 434-42. [cited 16.7.2024]; Available from: https://www.sciencedirect.com/science/article/abs/pii/S037843200800434X.

99. Zambelli, D. et al (2002) *Ultrasound Aspects of Fetal and Extrafetal Structures in Pregnant Cats.* Journal of Feline Medicine and Surgery **4**(2): p. 95-106. [cited 16.7.2024]; Available from: https://journals.sagepub.com/doi/10.1053/jfms.2001.0153.

100. Zambelli, D. & Cunto, M (2006) *Semen collection in cats: Techniques and analysis.* Theriogenology**66**(2): p. 159-165. [cited 6.6.2024]; Available from: https://doi.org/10.1016/j.theriogenology.2006.01.05.

101. Tsutsui, T. et al (2000) *Feline embryo transfer during the non-breeding season.* J Vet Med Sci **62**(11): p. 1169-75. [cited 16.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/11129860/.

102. Zambelli, D. and Cunto, M (2022) Artificial Insemination in Queens in the Clinical Practice Setting: Protocols and challenges. Journal of Feline Medicine and Surgery. **24**(9): p. 871-880. [cited 16.7.2024]; Available from: https://journals.sagepub.com/doi/10.1177/1098612X221118756.

103. Johnstone, I. (1984) *Electroejaculation in the domestic cat.* Aust Vet J, 1984. **61**(5): p. 155-8. [cited 17.7.2024]; Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1751-0813.1984.tb07220.x.

104. Zambelli, D. et al (2006) *Collection of semen by urethral catheterization after pharmacologically induced spermatozoa releasing in the domestic cat.* Proceedings of the 5th Biannual Congress of the European Veterinary Society for Small Animal Reproduction (EVS- SAR), 2006: p. 300.

105. Tsutsui, T. et al (2000) Unilateral intrauterine horn insemination of frozen semen in cats. J Vet Med Sci **62**: p. 1247-1251. [cited 17.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/11193339/.

106. Howard, J.G. (1992) *Feline semen analysis and artificial insemination*, in Kirk's current veterinary therapy XI: small animal practice. Kirk RW &Bonagura JD, Editors. 1992, WB Saunders Philadelphia, PA.

107. Zambelli, D. et al (2015) *First deliveries after estrus induction using deslorelin and endoscopic transcervical insemination in the queen.* **84**: p. 773-778. [cited 17.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/26092701/.

108. Zambelli, D. et al (2002) *Ultrasound Aspects of Fetal and Extrafetal Structures in Pregnant Cats.* Journal of Feline Medicine and Surgery **4**(2): p. 96-106. [cited 17.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/12027508/.

109. Johnson, A.K (2022) *Normal feline reproduction: the queen.* Journal of Feline Medicine and Surgery, 2022. **24**: p. 204-211.

110. Bateson, P., *The Domestic Cat: The biology of its behaviour*, D.C. Turner and P. Bateson, Editors. 2014, Cambridge University Press: Cambridge, U.K. p. 12-26.

111. Croney, C. et al (2023) *CATastrophic Myths Part 1: Common misconceptions about the social behaviour of domestic cats and implications for their health, welfare and management.* Veterinary Journal **6**: p. 1060287.[cited 17.7.2024]; Available from: https://pubmed.ncbi.nlm.nih.gov/37683761/.

112. Ellis, S.L. (2009) *Environmental enrichment: practical strategies for improving feline welfare.* Journal of Feline Medicine and Surgery **11**: p. 901-912.

113. Houser, B.V. & Vitale, K. R (2022) *Increasing shelter cat welfare through enrichment: A review.* Applied Animal Behaviour Science **248**: p. 105585.

114. Newberry, R.C. (1995) *Environmental enrichment: Increasing the biological relevance of captive environments.* Applied Animal Behaviour Science **44**: p. 229-243.

115. Vitale Shreve, K.R. et al (2017) *Social interaction, food, scent or toys? A formal assessment of domestic pet and shelter cat preferences.* Behavioural Processes **141**: p. 322-328.

116. Rehnberg, L.K. et al (2015)*The effects of social interaction and environmental enrichment on the space use, behaviour and stress of owned housecats facing a novel environment*. Applied Animal Behaviour Science, 2015. **169**: p. 51-61.

117. Hemsworth, P.H. et al (1994) *Improving the attitude and behaviour of stockpersons towards pigs and the consequences on the behaviour and reproductive performance of commercial pigs.* Applied Animal Behaviour Science **39**: p. 349-362.

118. Finka, L.R. (2022) *Conspecific and Human Sociality in the Domestic Cat: Consideration of Proximate Mechanisms, Human Selection and Implications for Cat Welfare.* Animals (Basel), **12**: p. 298. doi: 10.3390/ani12030298.

.

119. Foster, S.I.& Ijichi C. (2017) *The association between infrared thermal imagery of core eye temperature, personality, age and housing in cats.* Applied Animal Behaviour Science,**189**: p. 79-84.

120. Dantas, L.M. et al (2016) *Food puzzles for cats: feeding for physical and emotional wellbeing.* Journal of Feline Medicine and Surgery p. 1098612.

121. Acevedo, N., B. et al (2021) *Perinatal and early-life nutrition, epigenetics, and allergy.* Nutrients **13**: p. 724. [cited 26.7.2024]; Available from: https://www.mdpi.com/2072-6643/13/3/724.

122. Sturgess, K.H. & Hurley, K.J (2007) K.J. *The Welfare of Cats: Nutrition and welfare*, in *AWNS*. 2007, Stringer.

123. Delgado, M.D.& Dantas L.M (2020) *Feeding cats for optimal mental and behavioral well-being.* Veterinary Clinics: Small Animal Practice**50**: p. 939-953. [cited 26.7.202024]; Available from: https://www.sciencedirect.com/science/article/abs/pii/S0195561620300437.

124. Camara, A. et al (2020) *The daytime feeding frequency affects appetite-regulating hormones, amino acids, physical activity, and respiratory quotient, but not energy expenditure, in adult cats fed regimens for 21 days.* PlosOne, 2020. **15**: p. e0238522. . [cited 27.7.2024]; Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0238522.

125. Deng, P. et al (2013) *Effects of dietary macronutrient composition and feeding frequency on fasting and post prandial hormones response in domestic cats.* Journal of Nutritional Science **2**: p. 1-10. [cited 26.7.2024]; Available from: https://www.cambridge.org/core/journals/journal-of-nutritional-science/article/effects-of-dietary-macronutrient-composition-and-feeding-frequency-on-fasting-and-postprandial-hormone-response-in-domestic-cats/733585584D8347764ABB2FC7CA8E790F.

126. Colliard, L. (2009) *Prevalence and risk factors of obesity in an urban population of healthy cats.* Journal of Feline Medicine and Surgery**11**: p. 135-140. [cited 26.7.24]; Available from: https://www.sciencedirect.com/science/article/abs/pii/S1098612X08001587.

127. Courcier, E.A. (2010) *Prevalence and risk factors for feline obesity in a first opinion practice in Glasgow, Scotland.* Journal of Feline Medicine and Surgery **12**: p. 746-753. [cited 26.7.2024]; Available from: https://www.sciencedirect.com/science/article/abs/pii/S1098612X10001671.

128. Fontaine, E (2012) *Food intake and nutrition during pregnancy, lactation and weaning in the dam and offspring.* Reproduction in Domestic Animals **47**: p. 326-330.

129. Haaften, K. et al (2017) *Effects of a single preappointment dose of gabapentin on signs of stress in cats during transportation and veterinary examination.* JAVMA **251**(10): p. 1175-1181. [cited 29.7.2024]; Available from: https://journals.sagepub.com/doi/full/10.1177/1098612X221091736.

130. Canine and Feline Sector Group (2021) , *Setting standards on commercial transportation of dogs and cats.* [cited 26.7.24]; Available from: https://www.cfsg.org.uk/wp-content/uploads/2021/07/Setting-Standards-on-Commercial-Transport-of-Cats-and-Dogs-June-2021.pdf.

131. Martinez-Byer, S. et al (2023) *Effects of early social separation on the behaviour of kittens of the domestic cat.* Applied Animal Behaviour Science **59**: p. 105849.

132. Lowell, K.J. et al (2020), *The effect of premature maternal separation on distress vocalizations and activity in kittens (Felis catus) during a brief nest separation.* Applied Animal Behaviour Science **232**: p. 105130.

133. Seitz, P.F.D. (1959( *Infantile experience and adult behaviour in animal subjects: 2. Age of separation from the mother and adult behaviour in the cat.* Psychosomatic Medicine **21**: p. 353-378.

134. Guyot, G.W. et al (1980) *The effects of social isolation on the behaviour of juvenile domestic cats.* Developmental Psychobiology **13**: p. 317-329.

135. Foyer, P. et al (2016) *Levels of maternal care in dogs affect adult offspring temperament.* Scientific Reports **6**: p. 19253. [cited 29.7.24]; Available from: https://www.gccfcats.org/getting-a-cat/caring-for-your-cat/caring-for-your-kitten/#:~:text=Recommendations,before%2013%20weeks%20of%20age.

136. Ahola, M.K. (2017) *Early weaning increases aggression and stereotypic behaviour in cats.* Scientific Reports **7**: p. 10412.

137. Governing Council of the Cat Fancy (2024) *Caring for your kitten.* [cited 16.7.2024]; Available at: https://www.gccfcats.org/getting-a-cat/caring-for-your-cat/caring-for-your-kitten/

138. Eckermann-Ross, C. (2014) *Small Nondomestic Felids in Veterinary Practice* Journal of Exotic Pet Medicine. **23**(4): p. 327-336. [cited 29.7.2024]; Available from: https://doi.org/10.1053/j.jepm.2014.07.016.

139. Geertsema, A.A. (1985) *Aspects of the ecology of the serval Leptailurus serval in the Ngorongoro Crater, Tanzania.* Netherlands Journal of Zool **35**(4): p. 527-610.

140. Mellen, J.D. (1997) *Minimum Husbandry Guidelines for Mammals: Small Felids.* American Association of Zoos and Aquariums[cited 29.7.24]; Available from: https://nagonline.net/wp-content/uploads/2013/12/Zoo-Standards-for-Keeping-Small-Felids-in-Captivity.pdf.

141. Johnson, W.E. et al (2006) *The late Miocene radiation of modern Felidae: A genetic assessment.* Science **311**: p. 73-77.

142. Lallensack, R. (2017) *Ancient genomes heat up dog domestication debate.* Nature p. 22320. [cited 29.7.24]; Available from: https://doi.org/10.1038/nature.2017.22320.

143. Vester, B.M. et al (2008) *Nutrient digestibility and fecal characteristics are differentamong captive exotic felids fed a beef-based raw diet.* Zoo Biol. **27**: p. 26-136.

144. Taylor-Brown, F. et al (2016) *Secondary nutritional hyperparathyroidism in Bengal cats.* Vet. Rec. **179**: p. 287-288. [cited 29.7.24]; doi: 10.1136/vr.i4946.

145. Anon (2018) *Code of Practice for the Welfare of Cats.* [cited 29.7.24]; Available from: https://www.gov.uk/government/publications/code-of-practice-for-the-welfare-of-cats.

146. Mellor, D.J. et al (2009) , *The sciences of animal welfare*. UFAW Animal Welfare Series.Oxford, UK: Wiley-Blackwell.

147. Fraser, D & Duncan I.J.H. (1998) *'Pleasures', 'Pains' and animal welfare: Toward a natural history of affect.* Animal Welfare **7**: p. 383-396. [cited 17.7.2024]; Available from: https://www.cambridge.org/core/journals/animal-welfare/article/abs/pleasurespains-and-animal-welfare-toward-a-natural-history-of-affect/D880862F5BFD50A2FC3E6169F485C74E.

148. Mellor, D.J. & Beausoleil, N.J. (2015) *Extending the 'Five Domains' model for animal welfare assessment to incorporate positive welfare states.* Animal Welfare **24**: p. 241–253.

149. Mellor, D.J. et al (2020) *The 2020 Five Domains Model: Including Human–Animal Interactions in Assessments of Animal Welfare.* Animals. **10** (10): p. 1870. [cited 17.7.2024]; Available from: https://www.mdpi.com/2076-2615/10/10/1870.

150. Grigg, E.K. and Kogan L.R. (2019) *Owners' Attitudes, Knowledge, and Care Practices: Exploring the Implications for Domestic Cat Behavior and Welfare in the Home.* Animals (Basel) **9**(11): p. 978. [cited 17.7.2024]; Available from: https://www.mdpi.com/2076-2615/9/11/978.

151. Öhlund, M. et al (2018) *Overweight in adult cats: a cross-sectional study.* Acta Veterinaria Scandinavica **60**: p. 5. [cited 17.7.2024]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5775588/.

152. Wall, M et al (2019) *Owner and cat-related risk factors for feline overweight or obesity.* Frontiers in Veterinary Science **6**: p. 266. [cited 17.7.2024]; Available from: https://www.frontiersin.org/journals/veterinary-science/articles/10.3389/fvets.2019.00266/full.

153. Mugenda, L. et al (2019) *Refining canine welfare assessment in kennels: Evaluating the reliability of Field Instantaneous Dog Observation (FIDO) scoring.* Applied Animal Behaviour Science **221**: p. 10487. [cited 17.7.2024]; Available from: https://doi.org/10.1016/j.applanim.2019.104874

154. Malkani, R. et al (2022) *Preliminary validation of a novel tool to assess dog welfare: The Animal Welfare Assessment Grid.* Frontiers in Veterinary Science **9**: p. 940017. [cited 17.7.2024]; Available from: https://www.frontiersin.org/journals/veterinary-science/articles/10.3389/fvets.2022.940017/full.

155. Wolfensohn, S. et al (2018) *Assessment of Welfare in Zoo Animals: Towards Optimum Quality of Life.* Animals **8**: p. 110. [cited 17.7.2024]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6071229/.

156. Sonntag, Q. & Overall,, K.L. (2014) *Key determinants of dog and cat welfare: behaviour, breeding and household lifestyle.* Revue Scientifique et Technique de OIE **33**: p. 213-30.

# Appendix 1: AWC membership

*Prof Madeleine Campbell—Chair

*Dr Gareth Arnott

Dr Emily Craven

Dr Jane Downes

Dr Troy Gibson

*Prof Simon Girling

Dr Julian Kupfer

Stephen Lister

Dr Dorothy McKeegan

*Dr Romain Pizzi

Dr Pen Rashbass

Prof Sarah Wolfensohn

*Dr Julia Wrathall

*Dr James Yeates

* = member of the Working Group for this Opinion

**Co-opted Working Group members**

AWC is grateful to the AWC Secretariat and APHA and Defra staff who gave assistance.

## Appendix 2: Those who gave evidence and assistance

Steve Crow, The Governing Council of the Cat Fancy

Anthony Nicols, The Governing Council of the Cat Fancy

Rennie Fairs, The Governing Council of the Cat Fancy

Professor Kym Jarvis, The Governing Council of the Cat Fancy

Two independent pedigree cat breeders

The Surrey & Sussex Cat Association

The British Small Animal Veterinary Association

The Canine and Feline Sector Group

Cats Protection

International Cat Care

Battersea Dogs and Cats Home

RSPCA

The Wildheart Animal Sanctuary

City of London Animal Health & Welfare Services

The Institute of Licensing