



# Owner-ascribed personality profiles distinguish domestic cats that capture and bring home wild animal prey

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## ABSTRACT

In many ecological contexts, predation of wildlife by domestic cats *Felis catus*, combined with their abundance, is a threat to biodiversity conservation. The predatory behaviour of domestic cats shows remarkable between-individual variation. Many free-roaming cats living as companion animals capture, kill and/or bring home few or no prey, while others are prolific killers and likely contribute disproportionately to any impacts upon wild animal populations. Recent work has identified five owner-ascribed personality factors for cats (“The Feline Five”). We tested whether variation in scores for these five factors, quantifying owners’ characterisation of their cats, was associated with capturing and bringing home wild prey, and was related to variation among cats in numbers of recorded prey. We recruited owners of domestic cats kept as companion animals in southwest England. Owners completed a questionnaire assessing their cats’ behavioural traits, and recorded prey items brought home by their pets. Cats that hunted and brought home wild prey scored high for ‘extraversion’ or low for ‘neuroticism’, when compared to cats that did not bring home wild prey. However, variation in the numbers of prey items captured and brought home by hunting cats was not affected by scores for any of the factors. Owner characterisation of their cats’ personalities holds potential to refine approaches for managing hunting by cats, including approaches that do not compromise cat welfare while effectively reducing predation. For example, extraverted cats might be stimulated and encouraged in physical activity through object play in the home environment, with the aim of decreasing hunting motivation. Cat owners might also be more inclined to adopt strategies that they believe better suit their perceptions of their cat’s personality.

## 1. Introduction

Domestic cats *Felis catus* have one of the largest geographical distributions among terrestrial carnivores (Baker et al., 2010). Their close relationship with humans has allowed them to reach almost every corner of the globe, including remote islands where they have had significant impacts on the conservation status of multiple endemic species (Medina et al., 2011; Crowley et al., 2020a). In continental areas, owned and unowned domestic cats also have significant direct and indirect effects upon prey populations (Loss and Marra, 2017). The most common approach to attempting to decrease any impacts of unowned cats on island wildlife is to reduce their population size, or to eradicate them

(Cecchetti et al., 2021b). Both can be achieved using various methodologies, including lethal and non-lethal methods, that differ in their feasibility, efficacy and welfare implications (Cecchetti et al., 2021b). Short of eradication, attempts to effect general population reductions might nevertheless fail to reduce predation sufficiently and this may, in part, be attributable to the disproportionate predation pressure inflicted by a minority of prolific or specialised hunters (Moseby et al., 2015) or ‘problem individuals’ (Swan et al., 2017). Similarly, among owned cats, and unowned cats that are given food by people, general measures to reduce predation may be either ineffective or inefficient, given marked variation among individuals in their predatory behaviours. Prey specialization has been detected in cats, and attributed variously to cat

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sex, age, size and to variation in the personality of individuals (Dickman and Newsome, 2015). Thus, approaches to the identification of problem individual cats and more targeted approaches to their removal from the population have been advocated (Dickman and Newsome, 2015; Wilhelm et al., 2016).

Individual animals often behave in ways that distinguish them from others of their species. Behavioural patterns can distinguish one animal from others of same sex, age or class (Lowe and Bradshaw, 2001), and when such differences are consistently expressed over time, in a range of contexts, they can be referred to as ‘personalities’ (Gosling, 1998). Among free-roaming pet cats, there is remarkable individual variation in terms of hunting success and strategies (Kays and DeWan, 2004; Tschanz et al., 2011; Thomas et al., 2012; Loyd et al., 2013) and this may also be attributable in part to cat personality. Despite being fed by people, some free-roaming pet cats still kill wild animal prey, and some frequently bring them back to the human household (Lepczyk et al., 2003; Woods et al., 2003; Blancher, 2013; Loss et al., 2013; Murphy et al., 2019). Most domestic cats catch few or no prey (Churcher and Lawton, 1987; Baker et al., 2005) though a minority are much more proficient and prolific hunters (Kays and DeWan, 2004; Tschanz et al., 2011).

Given the emotional value of pet cats to their owners, perhaps unlike feral cats on islands, removal of problematic, owned cats for the benefit of wildlife is not desirable and does not constitute a feasible approach to management in many societies. Confinement indoors or within enclosures offers an alternative approach, and is often strongly advocated by wildlife conservationists (Mori et al., 2019). However, cat owners often consider permanent confinement as an impediment to cats expressing normal feline behaviours, and confinement can be a welfare concern because cat owners may not have appropriate, cat-friendly indoor environments (Tan et al., 2017; Crowley et al., 2019). Similar perspectives and motivations compromise the uptake of other strategies that inhibit cat hunting, such as collar-mounted devices, including bells, collar covers and bibs (Calver et al., 2013; Hall et al., 2016; Harrod et al., 2016; Crowley et al., 2019). Such devices have each been shown to be at least partly effective in reducing numbers of prey brought home, but some owners are concerned about their implications for cat safety and welfare (Ruxton et al., 2002; Nelson et al., 2005; Calver et al., 2007; Pemberton and Ruxton, 2019; Cecchetti et al., 2021a). Recently, examination of the nutritional and behavioural needs of cats (Cecchetti et al., 2021b) has prompted testing of novel management strategies for reducing cats’ motivations for hunting (Cecchetti et al., 2021a). Provisioning of cats with food with high meat protein and low-grain content, and engaging cats in object play, both separately decreased numbers of prey brought home by cats and recorded by householders, by 36% and 25% respectively (Cecchetti et al., 2021a).

Some management strategies might suit some cats because they better align with individual aspects of their hunting behaviour, or their preferences for and specialisation upon particular prey types (Dickman and Newsome, 2015). For example, Moseby et al. (2015) advanced the hypothesis that some cats with specific hunting preferences or acuities could be less vulnerable to trapping or baiting. For cats living as companion animals, it might also be that some management approaches better suit the cat’s personality, the owner’s perception of the cat’s personality, or indeed the owner’s personality (Finka et al., 2019). Tailoring approaches for reducing predation that suit the personality profile of hunting cats, and their welfare needs, might therefore find greater acceptance and uptake by owners.

Many cat owners perceive their cats as members of their family (Salman et al., 1998), therefore, the characterisation of a cat’s personality by owners will depend on the relationship between the human and the cat (Elvers et al., 2020). Similarly, the owner’s personality might influence the perceived personality of the pet itself (Evans et al., 2019). This potential source of bias might be partially overcome, for example by assessing animal personality with repeated standardised behavioural assay trials of the animals’ response to specific situations observed by a trained observer. However, the cat might react to the presence of an

unfamiliar researcher and modify the behaviour being measured (Ha and Ha, 2017). Despite the inherent subjectivity, the rating of comprehensive personality traits by people who know the animals well is a widely applied methodology, and it is considered reliable, practical and time efficient (Vazire et al., 2007; Litchfield et al., 2017).

The behavioural individuality and distinctiveness of cats are strongly apparent to their owners, and can reliably be measured with owner assessments (Gartner and Weiss, 2013). Litchfield et al. (2017) assessed 52 behavioural traits of 2802 cats, as rated by their owners. They identified five personality factors, which they referred to as ‘the Feline Five’, and which they compared to the ‘Five-Factor Model’ (FFM) also known as the ‘Big Five’ identified in human personality research (Costa Jr and McCrae, 1992; Gartner et al., 2014). Neuroticism, Extraversion, Openness to Experience, Conscientiousness and Agreeableness are the human personality dimensions comprised in the FFM. Such dimensions were derived from analyses of the natural-language terms people use to describe themselves and others (John and Srivastava, 1999), and from the necessity to have a common nomenclature in personality research (John and Srivastava, 1999). The FFM suggests the individual’s personality is a configuration along these dimensions, which each range in value along a continuum and are independent of one another (Watters and Powell, 2012). Before the research by Litchfield et al. (2017), other studies on feline personality identified between three (e.g. Gartner et al., 2014) and five personality factors (e.g. Gosling and Bonenburg, 1998), with a lack of a standardised use of terms like the well-established human FFM nomenclature, and inconsistency in the traits they represented.

Consequently, based on the clusters of traits, previous research and the FFM nomenclature, the labelling of The Feline Five by Litchfield et al. (2017) was: *Neuroticism* being insecure, anxious, fearful of people, suspicious and shy; *Dominance* reflecting bullying, dominant and aggressive behaviour towards other cats; *Impulsiveness* reflecting impulsive, erratic and reckless behaviour; and *Agreeableness* being affectionate, friendly to people, and gentle; and *Extraversion* including high scores for traits like active, vigilant, curious, inquisitive, inventive, and smart. Notwithstanding the potential for disagreement about their nomenclature, we follow Litchfield et al. (2017) for clarity and consistency. Litchfield et al. (2017) further suggested that accurate assessment by owners of pet cat personality might help owners to manage individual cats through solutions that optimise their welfare. For example, cats with high scores for extraversion (associated with curiosity, leading to boredom) may need more complex environmental enrichment to avoid boredom in the house (Litchfield et al., 2017). Thus, cats exhibiting this personality type, and most likely low neuroticism (boldness, leading to travelling and exploring) (Litchfield et al., 2017), might also be more likely to hunt wild prey.

To our knowledge there have so far been no investigations of any relationship between cat personality, as perceived by cat owners, and predatory behaviour by cats. Our study investigates whether scores attributed to the Feline Five personality factors, as identified and named by Litchfield et al. (2017), could distinguish the owner-ascribed personalities of hunting from non-hunting cats, and then explain variation between hunting cats in the scale of killing, as quantified by the numbers of prey captured, brought home and recorded by owners.

## 2. Methods

### 2.1. Participant recruitment

Cat owners were recruited through social, broadcast and print media across southwest England in two exercises, one carried out in 2017 as part of ‘The Small Cat Project’ a collaborative initiative to further the understanding of domestic cats and community views on their ownership and management; and the other in 2019 as part of an intervention study aimed at testing the efficacy of common and novel management strategies to reduce predation of wildlife by domestic cats (Cecchetti

et al., 2021a). In the first study, cat owners completed a questionnaire divided into three sections: information on the individual cat (including demographics, outdoor behaviours, hunting, diet, and owners' perception of hunting behaviour), on the owner-cat relationship, and on owner demographics. A subset of cats ( $n = 96$ ) in this first study also underwent a GPS tracking study, in which the numbers of prey captured and returned home were recorded over a two-week period. The second, intervention study was focused on owners whose cats regularly killed wild animals and brought them back home. At the beginning of the intervention trial, participants completed an online questionnaire regarding their cat, comprising details of sex, age, breed, health, feeding and roaming habits. For this study, we selected households in which at least one prey item had been brought home and recorded during two weeks of preliminary surveillance. Cat owners recorded the animals that were killed and brought home to the household for five weeks, before any intervention took place. They regularly uploaded prey records online, identifying the cat responsible for the kill where possible, or entering "unknown" in case of uncertainty in a multiple cat household, date of finding the item, animal type, species (an identification guide was provided for facilitating species identification), whether the prey was alive or dead, and other comments (including days when they were at home or not).

For both studies, cat owners completed a personality questionnaire on their cats based on The Cat Tracker Project Questionnaire (Litchfield et al., 2017), a 52-item measure of owner-ascribed domestic cat personality. The survey included specific definitions alongside each item to ensure similar understandings of the terms among participants, who were asked to rate the extent to which their cat demonstrated each personality trait along a seven-point, unipolar scale ranging from 'not at all' to 'very much so'. In the second study, four items (independent, individualistic, eccentric and vocal) that had been excluded from analyses by Litchfield et al. (2017) because they did not contribute to their factor structure, were not recorded in the questionnaire, resulting in scores for 48 of the 52 items. This also helped in slightly reducing questionnaire length, which had been highlighted as a possible limitation of the original study (Litchfield et al., 2017).

## 2.2. Statistical analyses

All analyses were conducted using R Development Core Team, 2018).

Personality factor scores were created for each cat, using the item loadings derived from factor analysis in Litchfield et al. (2017). The salient item loadings for each factor were multiplied by the score for each of the 48 survey items for each cat. The resulting values were then summed together to create factor scores for individual cats on all factors of the 'Feline Five'. For each personality factor, scoring quantiles were categorised into Low (includes score values <25% quantile); Typical ( $\geq 25\%$  and < 75% quantile); and High ( $\geq 75\%$  quantile).

All cats with one or more prey records during the surveys were classified as hunters (1), while those that did not return any prey were classified as non-hunters (0). We used five generalised linear models (GLMs) with binomial distributions to investigate whether being a hunter, or not, was related to scores for the 'Feline Five' owner-ascribed personality factors (Neuroticism, Extraversion, Dominance, Impulsiveness, Agreeableness). Fixed effects were the score obtained in each of the personality factors (continuous variables), age class (two levels: 6 months to 5 years, and 6 years to 16 years) and sex. Recording effort was calculated for each cat as the total number of days when owners were active in recording prey and was included as an offset ( $\log(\text{effort})$ ).

To analyse variation in the total numbers of prey brought home by cats as a function of any of the five personality factors, generalised linear models with a negative binomial distribution and log link function were used on the subset of hunter cats, defined as above. Fixed effects were the scores obtained in each of the personality factors (continuous variables), age class, and sex. Effort was included as an offset, as above.

Model residuals and proportion of variance in the dependent variable explained by each model expressed as  $R^2$  (or coefficient of determination) were evaluated using the package 'performance' (Lüdtke et al., 2020). Moreover, the binomial models were validated by calculating the percentage of correct classification (CC) and area under curve ROC analyses.

## 3. Results

In the first recruitment, owners of 96 cats completed the survey and had their cat prey returns recorded. 10 cats were excluded from analyses as owners neglected to score one or more behavioural traits. In the second recruitment, owners of 154 cats completed the personality test at the end of the primary study. Ten cats were excluded because of missing scores on one or more behavioural traits. Of the 144 cats left, the owners of 76 cats reliably attributed prey items to individual cats and reported their days of recording. Thus, a total of 162 cats (86 from study 1 and 76 from study 2; 73 females, 89 males) were included in the analyses. 95 cats were between 6 months and 5 years old, and 67 cats between 6 and 16 years (Table 1).

The median score for Neuroticism was  $-2.50$  (IQR =  $-9.35$  to  $6.98$ ), for Extraversion was  $21.79$  (IQR =  $17.35$ – $25.34$ ), for Dominance was  $9.41$  (IQR =  $4.61$ – $14.19$ ), for Impulsiveness was  $2.57$  (IQR =  $0.42$ – $5.62$ ), and for Agreeableness was  $10.75$  (IQR =  $6.83$ – $12.81$ ). Of young cats (0.5–5 years), 30% were rated highly for Extraversion (scores  $\geq 25.34$  and  $\leq 32.37$ ) while only 18% of older cats received high scores in the same factor (Table 1). 32% of young cats were also rated highly for Impulsiveness (scores  $\geq 5.62$  and  $\leq 12.21$ ) against 16% of older cats (Table 1), indicating that young cats are perceived as impulsive and erratic. 36% of females were scored highly for Neuroticism (scores  $\geq 6.98$  and  $\leq 26.11$ ), and so were perceived as more anxious and fearful of people and other cats compared to males, of which only 15% were accorded high scores for this factor (Table 1).

65 cats brought home no prey in a median of 16 days of recording and were categorised as non-hunters. 97 cats brought home more than one prey item (median = 3 prey; IQR =  $1$ – $9$ ) in a median of 42 days of recording (IQR =  $16$ – $49$ ). 40% of non-hunters were rated highly for Neuroticism (scores  $\geq 6.98$  and  $\leq 26.11$ ) and low for Extraversion (scores  $\geq 4.62$  and  $< 17.35$ ), while 34% of hunters were scored low for Neuroticism (scores  $\geq -18.75$  and  $< -9.45$ ) and 32% scored highly for Extraversion (Table 1, Fig. 1).

All binomial models performed better (lower AIC) without the variable sex, which was consequently excluded from later analyses. The binomial model including scores for Extraversion among the fixed effects showed that for one unit increase in the Extraversion score, the odds of being classified as a hunter increased by a factor of 1.08 (95% CI =  $1.04$ – $1.12$ ,  $p < 0.001$ ). The model showed 74% correct classification and AUC of 0.80, Nagelkerke's  $R^2$  was 0.15. Conversely, the binomial model including scores for Neuroticism among the fixed effects, showed that for one unit increase in Neuroticism score, the odds of being classified as a hunter decreased by a factor of 0.96 (95% CI =  $0.93$ – $0.98$ ,  $p < 0.001$ ). The model showed 68% of CC and AUC of 0.78, Nagelkerke's  $R^2$  was 0.16.

When considering only cats that brought home at least one prey item during the observation period, variation in the numbers of prey captured and brought home was not influenced by scores for any of the personality factors (Fig. 2). In all models, age class had a significant effect. Older cats tended to bring home fewer prey when compared to younger cats (in all models, cats in the older age class (6–16 years) brought home around 50% fewer prey items, compared to cats of 0.5–5 years).

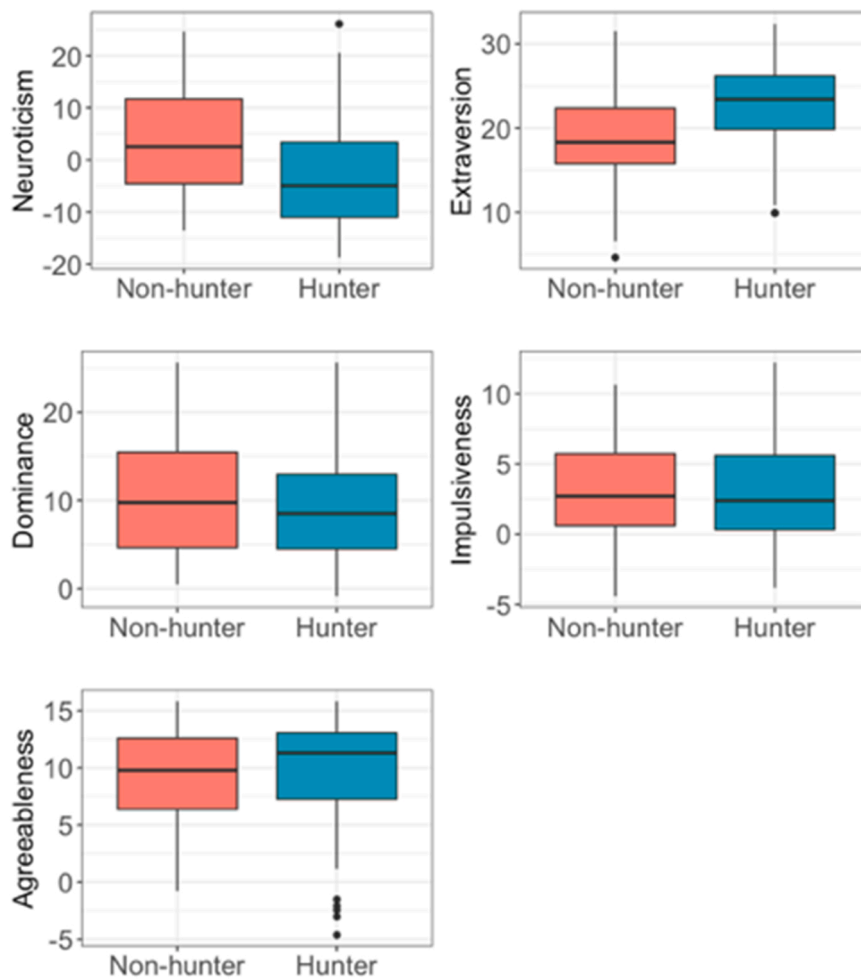
## 4. Discussion

Scores for two of The Feline Five personality types, Extraversion and Neuroticism, as ascribed to cats by their owners, were associated with hunting behaviour in domestic cats living as companion animals.

**Table 1**

Characteristics of the sample of the domestic cat population and distribution among five owner-ascribed personality factors. For each personality factor, scoring quantiles were categorised into Low (includes score values  $\geq 0\%$  and  $< 25\%$  quantiles); Typical (includes score values  $\geq 25\%$  and  $< 75\%$  quantiles); and High (includes score values  $\geq 75\%$  and  $\leq 100\%$  quantiles). Numbers of cats and the percentages falling into each score quantile is reported. L= Low; T = Typical; H= High. Quantile thresholds were: Neuroticism- Low:  $\geq -18.75$  and  $< -9.35$ , Typical:  $> -9.35$  and  $< 6.98$ , High:  $\geq 6.98$  and  $\leq 26.11$ ; for Extraversion - Low:  $\geq 4.62$  and  $< 17.35$ , Typical:  $> 17.35$  and  $< 25.34$ , High:  $\geq 25.34$  and  $\leq 32.37$ ; for Dominance- Low:  $\geq -0.87$  and  $< 4.46$ , Typical:  $> 4.40$  and  $< 14.19$ , High:  $\geq 14.19$  and  $\leq 25.63$ ; Impulsiveness- Low:  $\geq -4.42$  and  $< 0.42$ , Typical:  $> 0.42$  and  $< 5.62$ , High:  $\geq 5.62$  and  $\leq 12.21$ ; Agreeableness - Low:  $\geq -4.62$  and  $< 6.83$ , Typical:  $> 6.83$  and  $< 12.81$ , High:  $\geq 112.81$  and  $\leq 15.81$ .

		PERSONALITY FACTORS															
		Neuroticism			Extraversion			Dominance			Impulsiveness			Agreeableness			
	N	L	T	H	L	T	H	L	T	H	L	T	H	L	T	H	
Age class (years)	0.5-5	95	25	46	24	24	42	29	25	49	21	21	44	30	20	51	24
			26%	48%	25%	25%	44%	30%	26%	52%	22%	22%	46%	32%	21%	54%	25%
Sex	6-16	67	16	34	17	17	38	12	16	31	20	20	36	11	21	29	17
			24%	51%	25%	25%	57%	18%	24%	46%	30%	30%	54%	16%	31%	43%	25%
Hunting	Male	89	26	48	15	18	49	22	24	41	24	21	46	22	18	45	26
			29%	54%	17%	20%	55%	25%	27%	46%	27%	24%	52%	25%	20%	51%	29%
Hunting	Female	73	15	32	26	23	31	19	17	39	17	20	34	19	23	35	15
			20%	44%	36%	31%	42%	26%	23%	53%	23%	27%	47%	26%	31%	48%	20%
Hunting	Non-hunter	65	8	31	26	27	28	10	16	29	20	15	33	17	20	31	14
			12%	48%	40%	41%	43%	15%	25%	45%	31%	23%	51%	26%	31%	48%	21%
Hunting	Hunter	97	33	49	15	14	52	31	25	51	21	26	47	24	21	49	27
			34%	50%	15%	14%	54%	32%	26%	53%	22%	27%	48%	25%	22%	50%	28%

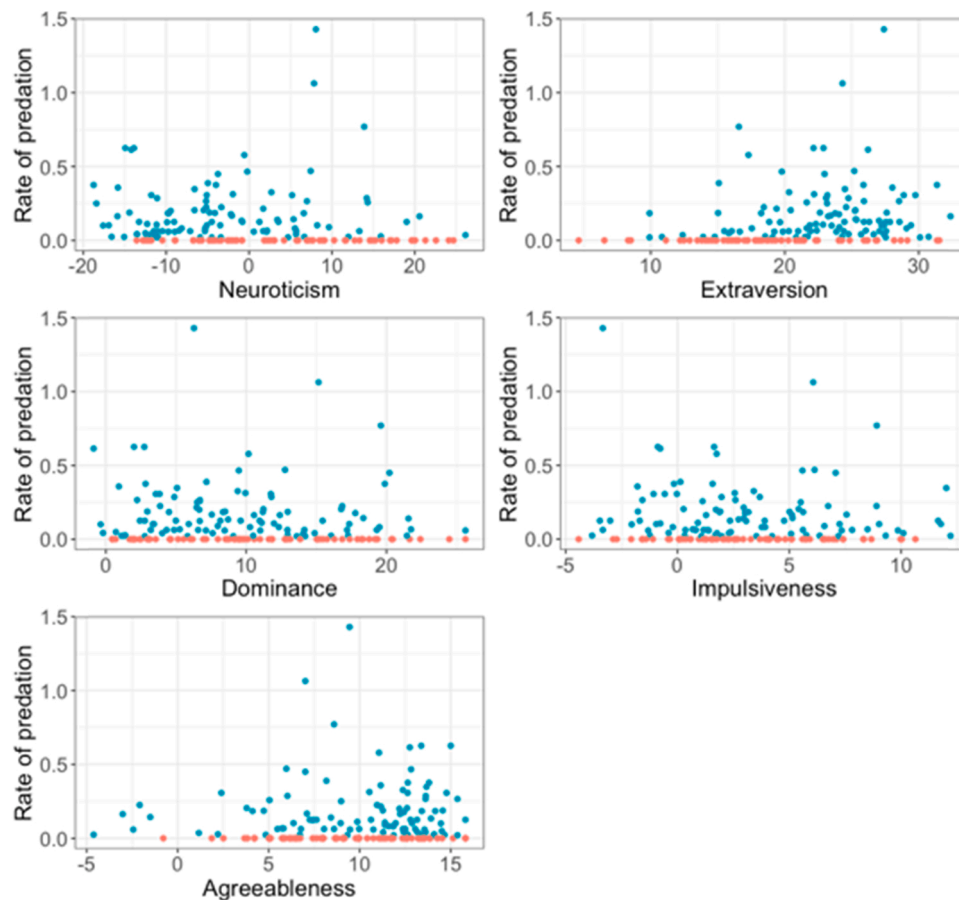


**Fig. 1.** Summary scores for the Feline Five personality types in non-hunting (no prey brought home, n = 65) and hunting (at least one prey item brought home, n = 97) cats. Each box represents the 25th and 75th percentiles and whiskers represent 1.5 times the interquartile range. Black dots represent outliers.

Specifically, cats that hunted and brought home wild animal prey were characterised by higher scores in Extraversion or lower scores in Neuroticism. However, none of the owner-ascribed personality factors

was associated with variation in the numbers of prey brought home by hunting cats, which instead was largely influenced by cat age, with younger cats bringing home more prey compared to older cats (van





**Fig. 2.** Scatterplots illustrating variation in non-hunting cats' scores (pink dots) and hunting cats' scores (light blue dots) for the Feline Five personality types and the rate of predation of wild animals. Rate of predation is the number of prey captured and brought home and recorded by householders, divided by owner recording effort in days.

Heezik et al., 2010). Hunting by domestic cats is a complex and multifaceted behaviour affected by evolutionary constraints, nutritional requirements, and environmental variation, providing opportunities for varying access to prey (Cecchetti et al., 2021b). Standardising such diverse factors in order to effectively evaluate the variance in scale of killing that might be attributable to animal personality is therefore challenging. However, the scale of killing was clearly not important in profiling cats, and owners were neither asked to rate their cats' personality based on their hunting habits, nor was the survey explicitly framed around specific personality traits associated with predation. Nevertheless, the habit of hunting and returning home prey was associated with the tendency for owners to perceive the personality profiles of hunter and non-hunter cats differently, potentially associating this behaviour with the individual attributes of the cat. A limitation of this study relates to the use of number of prey brought home as an approximation of total killing. Around 20–30% of killed prey is left or eaten in situ by domestic cats (Kays and DeWan, 2004; Loyd et al., 2013; Seymour et al., 2020), and so variation in prey brought home might not represent a good metric for detecting any influence of personality on hunting behaviour. For the same reason, our classification of hunter/non-hunter may have been subject to misclassification and been different if the non-hunters had been observed for longer.

These findings can be considered both in the context of cat welfare, and in terms of management strategies for reducing predation of wildlife by cats. To reduce adverse signs of stress in cats, meet their behavioural needs and to address some common pathologies such as obesity and diabetes mellitus, various behavioural enrichment strategies are recommended (Buffington, 2002; Buffington et al., 2006; Ellis, 2009). Hunting cats that showed higher scores for Extraversion or lower scores

for Neuroticism are most likely to benefit from being stimulated and encouraged in physical activity, and by opportunities to reproduce natural feline behaviour in the home environment. The most common behavioural enrichment strategies include object play with toys that engage cats in a pseudo-predatory activity, and feeding enrichment, for example hiding food and the use of puzzle feeders (Ellis, 2009; Ellis et al., 2013). Management approaches to reduce predation that are focused on feline personality might bring benefits to cat welfare, reduce hunting motivation, and find greater support among cat owners, who express interest in effective 'cat-friendly' measures to reduce predation upon wildlife (Crowley et al., 2019, 2020b; Linklater et al., 2019). Alternatively, owner perceptions of cat personality related to behavioural repertoire might also explain aversion towards the adoption of some commonly advocated mitigation measures, like permanent confinement (Tan et al., 2017; Crowley et al., 2019), which can be perceived as particularly limiting for highly extraverted cats (Litchfield et al., 2017). Moreover, while permanent confinement clearly would eliminate predation of wildlife, perhaps excepting commensal rodents, it is often believed by veterinarians and owners to negatively affect cat welfare (Linklater et al., 2019).

Cat personality can influence both the applicability of management approaches and their effectiveness. Among the emerging explanations for the low uptake by owners in the use of collar-mounted devices are a lack of acceptance by cats and perceived inefficacy at preventing hunting (Crowley et al., 2019). Extraverted or neurotic cats might be particularly likely to exhibit reluctance to wear a collar, and/or collar mounted devices (e.g. bells). The management approaches we identify are appropriate only for cats that are healthy and where the management is compatible with veterinary advice. Extreme scores in some

personality factors may indicate wider welfare issues, potentially related to environmental or medical causes. For example, high scores for neuroticism could indicate a stressed cat due to pain/frustration, while low levels of extraversion could be due to aging and health-related issues.

Future studies could be focused upon identifying predation management strategies that might suit specific cat personality profiles and thereafter testing to investigate whether tailored approaches differentially affect predatory behaviour. Effectiveness could be diagnosed in terms of reduction in number of prey returned home coupled with observational studies during hunting excursions (e.g. Dickman and Newsome, 2015), as well as through evaluation of changes in owner perceptions of their cats' behaviour.

## Ethical statement

The study protocol was approved by the ethics committee of the University of Exeter College of Life and Environmental Sciences (Reference 000181). The project also received specialist veterinary guidance from, and the protocol was approved by, an independent Project Advisory Group. The Small Cat project protocol was approved by the ethics committee of the University of Exeter College of Life and Environmental Sciences (References 2017/1943 and 2017/1925).

## CRediT authorship contribution statement

The study was conceived by MC, SLC and RAM. The Small Cat Project was conceived by JM. MC, SLC and JM collected the data. MC analysed the data and wrote the initial manuscript. All authors contributed to revision of the manuscript and agreed to the submission.

## Data Availability

The data used in this study are available at the Zenodo data repository <https://doi.org/10.5281/zenodo.7268985>.

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