

Effect of captivity and management on behaviour of the domestic ferret (*Mustela putorius furo*)



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ABSTRACT

The domestic ferret (*Mustela putorius furo*) is becoming an increasingly popular companion animal in Australia and overseas yet very little is currently known about the effects of different management factors (such as housing and enrichment) on domestic ferret behaviour and welfare. Hence, the aims of this study were to investigate the relationship between housing and management and the incidence of play and undesirable behaviours in order to ultimately improve welfare in the domestic ferret. An online survey was constructed which focused on different housing and management strategies utilised by ferret owners and required owners to score the frequency of a range of behaviours observed. Ferret owners were also able to report what behavioural aspects they believed particular ferret behaviours were associated with. There were 466 ferret owners who participated in this survey study. Generalised linear mixed models (GLMMs) were used to identify significant relationships between sex, de-sexing, housing, enrichment, and the frequency of behaviours reported by owners. It was found that the overall frequency of undesirable behaviours, on a scale of 0 (never) to 4 (always), was quite low, with ferret owners reporting that these behaviours 'rarely' to 'never' occurred (mean score (MS)=0.73). In contrast, the frequency of overall play behaviours was reported as 'frequently' to 'occasionally' (MS=2.35). It was also found that male ferrets showed more play behaviour (weasel war dance) than females (male MS=2.66; female MS=2.61; $P=0.04$) and that de-sexed ferrets had a lower incidence of repetitive behaviour compared to entire ferrets (de-sexed MS=0.54; entire MS=0.79; $P=0.01$). Ferrets provided with a higher level of enrichment demonstrated a higher occurrence of play behaviour such as dooking (MS for less than two enrichment items = 1.47; MS for three to five enrichment items = 1.96; MS for more than six enrichment items = 2.18; $P=0.01$) and weasel war dance (MS for less than two enrichment items = 2.34; MS for three to five enrichment items = 2.59; MS for more than six enrichment items = 2.70; $P<0.01$). There was also a significant interaction between number of hours ferrets spent confined and number of enrichment items (GLMM, $F_{4,329} = 10.2$, $P=0.03$) on the incidence of bite-hurt (an undesirable behaviour) suggesting that generally, higher levels of enrichment in conjunction with less hours spent confined results in less bite-hurt behaviour. Surprisingly, size of enclosure had no significant effect on any behaviour (all $P>0.1$). Although ferrets display a higher incidence of play behaviour than undesirable behaviour, which may be seen as a

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positive sign, factors such as the level of enrichment provided, amount of time ferrets are confined and de-sexing should be carefully considered when implementing management plans for this companion animal as they exert an influence on ferret behaviour.

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1. Introduction

The domestic ferret (*Mustela putorius furo*) is a small mustelid considered to be the same species as the European polecat (Plant and Lloyd, 2010) and was domesticated between 2000 and 3000 years ago (Church, 2007; Plant and Lloyd, 2010). Since about the 1970s, the domestic ferret has become increasingly popular as a companion animal across Europe, the United States of America and more recently, Australia (Ball, 2006). Ferrets are described as highly intelligent, agile, playful, lively, curious, and highly inquisitive with a natural instinct to explore (Vinke and Schoemaker, 2012). As with other mustelids, the welfare of domestic ferrets can be compromised if their housing, enrichment, socialisation and handling, diet and health care, is inadequate (Forbes et al., 2007). Therefore, housing of ferrets needs to have an adequate degree of complexity and environmental stimulation to cater for their inquisitiveness and intelligence (Plant and Lloyd, 2010). The provision of various enrichment items which easily elicit play behaviour is recommended (Vinke and Schoemaker, 2012). On the whole, however, little is known about the effects of different housing conditions on ferret behaviour and welfare but the European Commission (2007) recommends that ferrets should be provided with a confinement size of 4500–6000 cm², minimum floor space of 1500–6000 cm², and a height of at least 50 cm, depending on the size and sex of the ferret.

The domestic ferret exhibits very similar play behaviours to the European polecat, which has been reported to consist of a frenzied dance of sideways jumps (weasel war dance) performed in conjunction (but not always) with chuckling vocalisations (dooking), as well as play chasing, wrestling, and pouncing (Poole, 1970; Fisher, 2006; Plant and Lloyd, 2010). Play behaviour can be used as a positive welfare indicator as it does not typically occur in animals under stress (Hinton and Dunn, 1967; Müller-Schwarze et al., 1982; McCune, 1992; Thornton and Waterman-Pearson, 2002). Play is usually associated with a relaxed environment (Grier and Burk, 1992; Broom and Johnson, 1993) when other primary behavioural needs are being met (Boissy et al., 1983). Absence of play behaviour in ferrets may indicate reduced welfare and be due to illness, pain, stress or unfulfilled needs (Vinke and Schoemaker, 2012).

Companion animals perform certain behaviours which their human owners can perceive as undesirable, for instance, aggression towards human handlers and other animals or repetitive behaviours which may be considered destructive (Wells and Hepper, 2000). Therefore, these types of behaviours have been labelled 'undesirable' throughout this study. There is a common misconception that domestic ferrets are highly aggressive, even vicious (Schilling, 2007). Ferrets may play roughly with each other, but like any other companion animal, they can be friendly

and affectionate towards humans if handled and socialised frequently and from a young age (Ball, 2006). It is a common understanding amongst ferret owners that if they are not handled regularly ferrets are likely to bite, which may result in extensive periods of confinement, euthanasia, or abandonment.

Little is known about the repetitive behaviour (such as stereotypies) displayed by the domestic ferret, but there have been numerous studies conducted on mink. Common repetitive behaviour observed in mink under farming conditions includes pacing along the wall of the cage and repetitive intensive scratching at the cage wire mesh with the front paws (Heller, 1991; Hansen, 1993; Mason, 1993). These behaviours may be considered as indicative of frustration (Mason, 1991). Various studies have supported the notion that the incidence of stereotypies and stress levels are reduced if more environmental enrichment is provided (Hansen, 1989; Mason et al., 2001; Poessel et al., 2011). Although most of these studies have been conducted in mink, it is assumed that this would also be the case for domestic ferrets due to these species being closely related.

The main aims of this study were to determine the incidence of play and undesirable ferret behaviour and to investigate the management factors associated with these behaviours. The frequencies of various behaviours considered undesirable or play for a large sample of ferrets was scored on a scale of 0 (never) to 4 (always) by owners. In addition, owner opinions were sought on the motivation underlying the various behaviours. A survey was designed to (1) describe ferret behaviour, (2) describe housing and enrichment practices used by ferret owners, and (3) investigate owner opinions.

2. Methods

2.1. Participant recruitment

To recruit participants, 62 veterinary clinics across Australia that were known to treat ferrets (listed on websites of Australian ferret societies) were utilised for advertising the online survey. This was achieved by asking each business to place a poster advertising the details of the survey, in their practice. The survey was also advertised using social media, that is, the advertisement was placed on six ferret welfare societies and group web pages and shared amongst ferret owners. The advertisement provided brief details for potential participants and provided the internet link for participants to complete the survey. The survey was made available for completion for approximately 8 weeks from May to July 2012.

2.2. Survey design

The survey consisted of 60 questions which were a combination of simple yes or no, multi-item, scale, and

Table 1

Definitions of undesirable and play behaviours as described by Hansen (1993), Schilling (2007), Vinke et al. (2008), Vinke and Schoemaker (2012), and Meagher et al. (2013).

Behaviours	Definition
<i>Undesirable behaviours</i>	
Bite-drag	Biting and dragging, whether attempting to drag the human handler or dragging other animals around
Bite-hurt	Biting that hurts whether towards human handler or biting that appears to hurt another animal and may result in injury to the handler or other ferrets
Compulsive scratching	Persistently scratching at something such as a door
Repetitive behaviours	Any unvarying, repetitive behaviour such as pacing
<i>Play behaviours</i>	
Dooking	A distinct chuckling vocalisation
Weasel war dancing	Gallop and jumping from side to side, often with mouth open and in conjunction with dooking

open-ended questions (Groves et al., 2009). The overall survey was divided into six sections focusing on different management or behavioural components. Section A was designed to obtain demographic information of participants such as their location, and number of ferrets owned. Section B gathered information on the housing and enrichment provided to ferrets, i.e. size and type of confinement, whether small (2 m² or less), medium (3–5 m²) or large (6 m² or more), and how many enrichment items that were provided. Enrichment items included objects such as balls, squeaky toys, bells, scratching posts, substrate boxes, soft toys, old clothes, ropes, and cardboard boxes. Sections C and D queried about diet and health care given to ferrets. Section E enquired about ferret background (i.e. sex and if de-sexed). Section F comprised a list of play and undesirable behaviours with brief descriptions and respondents were asked to report on a 5-point scale (4 = always, 3 = frequently, 2 = occasionally, 1 = rarely, and 0 = never) the frequency with which they observed each of these behaviours to occur, in each of their ferrets, within the fortnight preceding the completion of the survey (see Table 1 for a description for each of these behaviours). Participants were also asked to select from a list provided, the motivations or function with which they believed these behaviours to be associated. The list was developed in consultation with ferret owners and included aggression, fear, play, social interaction, escape behaviour, exploration, and abnormal behaviour. We also included a 'none of these' categories in order to accommodate differing opinions from owners. Multiple motivations/functions could be selected for each behaviour, making it possible for each to contain numbers of respondents exceeding the total who actually participated in the survey. Pretesting was conducted using three known ferret owners prior to making the survey available for completion online.

2.3. Statistical analysis

Owner-reported frequency of occurrence of the several behavioural elements under investigation was on an

Table 2

Statistics pertaining to reports by respondents on the types of housing and enrichment they provide to their ferret(s).

	Number of respondents	Percentage
Size of confinement		
<2 m ²	74	15.9
3–5 m ²	121	26.0
>6 m ²	169	36.3
Hours spent confined		
18	128	27.5
19–21	182	39.1
>22	127	27.3
Number of enrichment items provided:		
<2	33	7.1
3–5	161	34.5
>6	245	52.6

ordinal scale, with some owners reporting on the behaviour of multiple ferrets, and was analysed in a repeated-measures ordinal logistic regression model. We performed the repeated-measures tests using a Generalised Linear Mixed Model in SPSS for windows (version 20). Ferret owner was used as the random effect to account for owners reporting on multiple ferrets. Main effects of sex, de-sexing, size of enclosure, hours spent confined and number of enrichment items were included in the model. Interaction effects of sex/de-sexed status, hours spent confined/size of enclosure, hours spent confined/number of enrichment items and number of enrichment items/size of enclosure were also included in the model. A test of parallel lines was undertaken for each behavioural variable to test the null hypothesis that the odds for each explanatory variable are consistent across different thresholds of outcome variable.

3. Results

3.1. Descriptive findings

A total of 466 questionnaires were returned which described 1649 ferrets. Participants were drawn from Australia (46.6%) as well as overseas (53.4%). It was common to own more than one ferret (86.0%) with a maximum of six ferrets. A large number of respondents reported owning ferrets for 6 or more years (41.4%). Almost half the ferrets were acquired through a formal rescue such as being adopted through a ferret welfare organisation (44.7%), whilst a large part of the remaining ferrets (42.2%) were acquired commercially (i.e. through a pet shop or breeder). Adding to ferret collections was reasonably common with at least one new ferret acquired in the last 6 months by 42.0% of participants. Out of the entire sample there were slightly more male ferrets (54.7%) than female ferrets (45.3%) and the majority of all ferrets were de-sexed (80.2%). Few ferrets (11.1%) were unconfined; however, more than two-thirds were allowed to roam for at least a couple of hours per day. Most ferrets were also given a variety of enrichment items (Table 2).

Many ferrets were assessed by their owners as 'rarely' to 'never' exhibiting behaviours that they perceived as undesirable (mean score (MS) = 0.73). Of the undesirable

Table 3

Statistics pertaining to the frequencies of undesirable and play behaviours observed in ferrets as reported by owners (scores range from 0 = never to 4 = always).

Behaviours	Mean score	SE of mean	Median	IQR	Position of median on five point scale
<i>Undesirable behaviours</i>					
Bite-hurt	0.56	0.02	0.00	1.00	'Never'
Repetitive behaviours	0.58	0.03	0.00	1.00	'Never'
Bite-drag	0.84	0.03	1.00	2.00	'Rarely'
Compulsive scratching	0.94	0.03	1.00	2.00	'Rarely'
<i>Play behaviours</i>					
Dooking	2.06	0.03	2.00	2.00	'Occasionally'
Weasel war dancing	2.64	0.02	3.00	1.00	'Frequently'

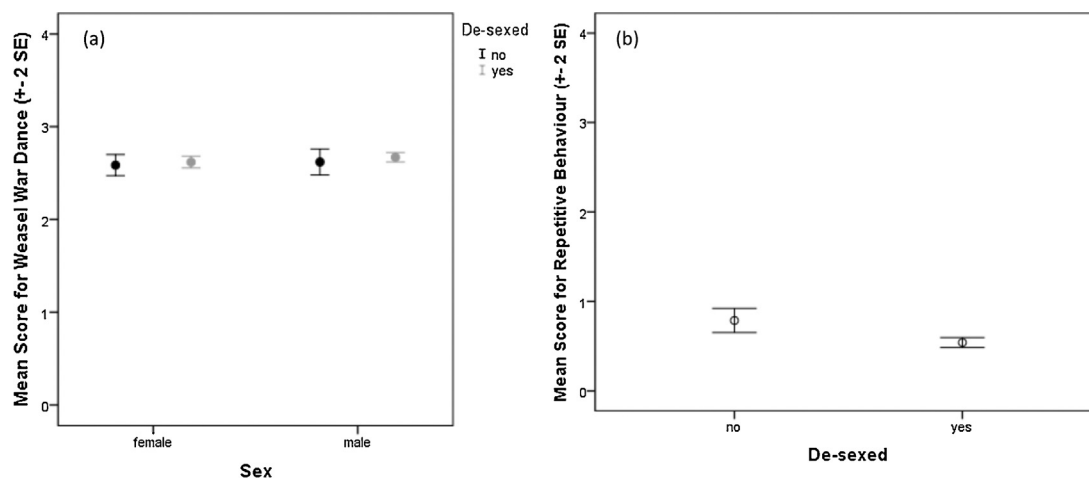


Fig. 1. Error plots showing the frequency of (a) weasel war dance behaviour according to de-sexed status and sex and (b) repetitive behaviour according to de-sexed status (scores range from 0 = never to 4 = always).

behaviours reported, the most common was scratching compulsively (Table 3). Play behaviours were more commonly reported by ferret owners than undesirable behaviours, with the overall MS indicating that play occurs 'frequently' to 'occasionally' (MS = 2.35). The most common play behaviour reported was weasel war dancing (Table 3).

3.2. Sex differences in behaviour and effect of de-sexing

Male ferrets showed slightly more weasel war dance than female ferrets (GLMM, $F_{1329} = 4.3$, $P = 0.04$; Fig. 1a). No significant differences were observed between males and females for bite-drag (GLMM, $F_{1329} = 0.2$, $P = 0.65$), bite-hurt (GLMM, $F_{1329} = 1.6$, $P = 0.21$), dooking (GLMM,

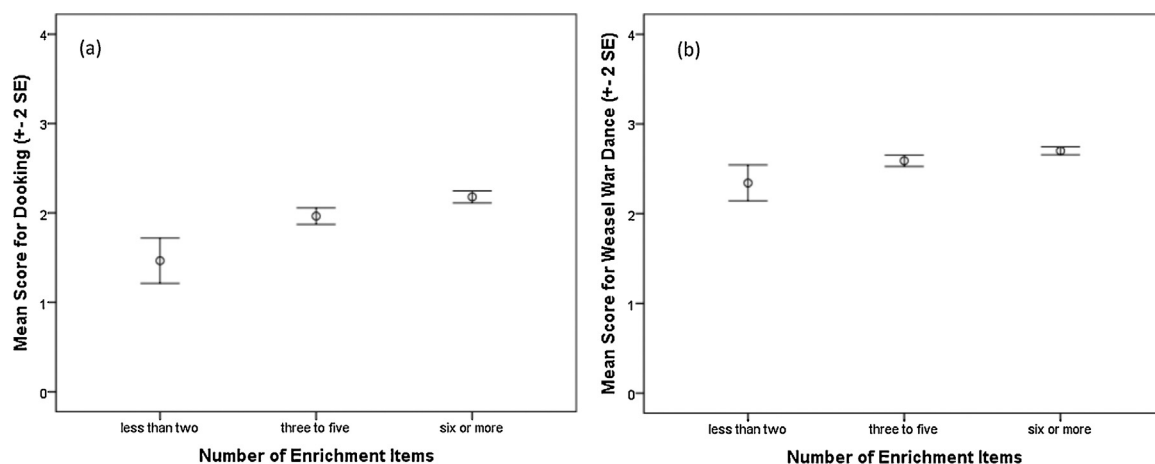


Fig. 2. Error plots showing the frequency according to number of enrichment items provided for (a) dooking and (b) weasel war dance (scores range from 0 = never to 4 = always).

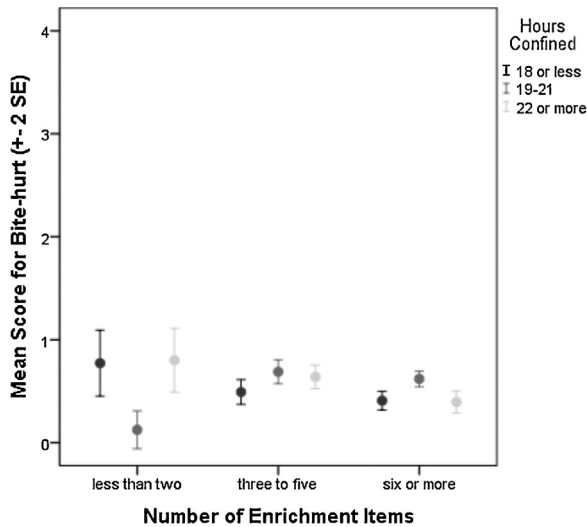


Fig. 3. Error plot showing the frequency of bite-hurt behaviour according to number of enrichment items provided and number of hours confined (scores range from 0 = never to 4 = always).

$F_{1329} = 0.4$, $P = 0.54$), compulsive scratching (GLMM, $F_{1329} = 1.5$, $P = 0.22$) or repetitive behaviour (GLMM, $F_{1329} = 1.3$, $P = 0.25$). De-sexing significantly reduced the incidence of repetitive behaviour (GLMM, $F_{1329} = 6.2$, $P = 0.01$; Fig. 1b), but de-sexing had no significant effect on bite-drag (GLMM, $F_{1329} = 0.2$, $P = 0.63$), bite-hurt (GLMM, $F_{1329} = 2.6$, $P = 0.11$), dooking (GLMM, $F_{1329} = 1.9$, $P = 0.17$), compulsive scratching (GLMM, $F_{1329} = 1.1$, $P = 0.30$) or weasel war dance (GLMM, $F_{1329} = 0$, $P = 1.00$). No significant interactions were found between sex and de-sexed status (all $P > 0.10$).

3.3. Effect of management on behaviour

Providing more enrichment items increased the incidence of play behaviour: dooking (GLMM, $F_{2329} = 8.3$, $P = 0.01$; Fig. 2a) and weasel war dance (GLMM, $F_{2329} = 10.0$, $P < 0.01$; Fig. 2b). Of the undesirable behaviours, only bite-hurt appeared to be influenced by the number of enrichment items (GLMM, $F_{2329} = 6.4$, $P = 0.04$). However, a significant interaction between number of hours in confinement and number of enrichment items (GLMM, $F_{4329} = 10.2$, $P = 0.03$) suggests that although the number of enrichment items reduced the incidence of bite-hurt when confined for long or short periods of time, ferrets showed less bite-hurt with fewer enrichment items when confined between 19 and 21 h (Fig. 3). The number of enrichment items had no significant effect on bite-drag (GLMM, $F_{2329} = 4.2$, $P = 0.12$), compulsive scratching (GLMM, $F_{2329} = 2.7$, $P = 0.27$) or repetitive behaviour (GLMM, $F_{2329} = 2.3$, $P = 0.30$). Similarly, the number of hours spent confined had no significant effect on weasel war dance (GLMM, $F_{2329} = 4.3$, $P = 0.12$), dooking (GLMM, $F_{2329} = 0.4$, $P = 0.83$), bite-drag (GLMM, $F_{2329} = 0.1$, $P = 0.97$), compulsive scratching (GLMM, $F_{2329} = 4.0$, $P = 0.13$) or repetitive behaviour (GLMM, $F_{2329} = 2.4$, $P = 0.30$).

Surprisingly, size of enclosure had no significant effect on bite-drag (GLMM, $F_{2329} = 2.0$, $P = 0.40$), bite-hurt (GLMM,

Table 4

The number (and percentage) of respondents that associated each behaviour with particular motivations/functions (note that some associations exceed the 466 participants which completed the survey because some respondents selected more than one motivation/function to explain ferret behaviour).

	Aggression	Fear	Play	Social interaction	Escape behaviour	Exploring	Abnormal behaviour	None of these
Bite-drag	171 (36.7%)	105 (22.5%)	242 (51.9%)	168 (36.1%)	12 (2.6%)	73 (15.7%)	15 (3.2%)	16 (3.4%)
Bite-hurt	218 (46.8%)	214 (45.9%)	154 (33.0%)	77 (16.5%)	26 (5.6%)	45 (9.7%)	20 (4.3%)	16 (3.4%)
Repetitive behaviours	32 (6.9%)	47 (10.1%)	64 (13.7%)	31 (6.7%)	126 (27.0%)	41 (8.8%)	254 (54.5%)	33 (7.1%)
Scratching compulsively	11 (2.4%)	18 (3.9%)	62 (13.3%)	20 (4.3%)	156 (33.5%)	121 (26.0%)	190 (40.8%)	25 (5.4%)
Doocking	8 (1.7%)	4 (0.9%)	386 (82.8%)	265 (56.9%)	5 (1.1%)	89 (19.1%)	7 (1.5%)	1 (0.2%)
Weasel war dance	1 (0.2%)	0 (0.0%)	55 (11.8%)	368 (79.0%)	4 (0.9%)	106 (22.7%)	10 (2.1%)	7 (1.5%)

$F_{2329} = 0.06, P = 0.90$), dooking (GLMM, $F_{2329} = 1.8, P = 0.42$), weasel war dance (GLMM, $F_{2329} = 0.3, P = 0.90$), compulsive scratching (GLMM, $F_{2329} = 2.8, P = 0.25$) or repetitive behaviour (GLMM, $F_{2329} = 3.9, P = 0.10$). No significant interactions were found between the number of enrichment items, number of hours spent confined and size of enclosure (all $P > 0.1$).

3.4. Owner opinions on the function/motivation associated with ferret behaviour

Participants generally agreed that bite-drag could be associated with play (51.9%) or social interaction (36.1%) (Table 4). Several respondents also reported that they believed this behaviour to be associated with aggression (36.7%) and fear (22.5%). Likewise for bite-hurt, participants associated this behaviour with play (33.0%), social interaction (16.5%), aggression (46.8%) and fear (45.9%). Many respondents placed compulsive scratching in the abnormal behaviour category (40.8%) or associated it with escape behaviour (33.5%). Conversely, others believed it to be associated with exploring (26.0%). Numerous respondents associated repetitive behaviours (i.e. pacing) with the broad category of abnormal behaviour (54.5%) or escape behaviour (27.0%). There was general agreement amongst participants for the play behavioural associations. Many participants believed dooking to be associated with play (82.8%) or social interaction (56.9%) and weasel war dancing to be associated with social interaction (79.0%) or exploring (22.7%).

4. Discussion

In summary, the overall incidence of play behaviour ($MS = 2.35$) was reported to be higher in ferrets than the undesirable behaviours ($MS = 0.73$). Although males were observed to perform a higher occurrence of weasel war dancing than females, there was otherwise generally little difference in behaviour between sexes. De-sexing was found to reduce the incidence of repetitive behaviour in both sexes. More play behaviour (dooking and weasel war dance) was observed in ferrets provided with more enrichment items. Although the number of enrichment items reduced the incidence of bite-hurt when confined for long or short periods of time, ferrets showed less bite-hurt with fewer enrichment items when confined for between 19 and 21 h. Surprisingly, size of enclosure had no significant effect on any of the behaviours studied. Finally, participants generally agreed upon what each of the behaviours was associated with, but also acknowledged that these behaviours were not associated with a single behavioural aspect, but rather multiple factors.

The overall MS's for undesirable behaviours were uniformly low and since the lowest point on the scale was labelled 'never' and the midpoint was labelled 'occasionally', the ferrets surveyed 'rarely' to 'never' performed many of the undesirable behaviours investigated in this study. Conversely, the overall MS's for play behaviours were higher than for the undesirable behaviours, with the average score indicating ferret owners in this study

observed these play behaviours 'frequently' to 'occasionally'. If we regard play behaviours as indicative of a positive state, then combined these results suggest that domestic ferrets generally adapt well to captivity, though it should be noted that overall prevalence of behaviour tells us little about how important even small displays of play or undesirable behaviours are to ferrets.

The occurrence of behaviours studied did not differ between sexes, except for the incidence of weasel war dance behaviour being higher in males. This is not surprising considering that males have been shown to play more than females in another species, the rat (Thor and Holloway, 1986; Hole, 1988; Pellis and Pellis, 1990). In rats it has been shown that males tend to display and receive more play-soliciting behaviour compared to females (Thor and Holloway, 1986; Hole, 1988). Additionally, males are less likely to withdraw from play initiation and once involved in play, are also less likely to withdraw than females (Meaney and Stewart, 1981).

De-sexing was commonly undertaken and this procedure may have been responsible for the lower levels of repetitive behaviour observed in de-sexed ferrets. One possible mechanism to explain this is that, like dogs, de-sexed ferrets may be less motivated to roam and find mates and so may not have as strong an underlying motivation for locomotion as intact ferrets. It should therefore be remembered that de-sexing can not only be a useful management tool in controlling pregnancies but also as a means to reduce repetitive behaviour patterns, as the above finding suggests. However, as word of caution, recent studies suggest that surgically de-sexing ferrets can be associated with an increased risk of developing hyperadrenocorticism (hyperfunctioning of the adrenal cortex due to neoplastic changes) and chemical sterilisation using a slow releasing GnRH agonist deslorelin implant is therefore recommended (Vinke et al., 2008).

The increase in the incidence of play behaviours with a greater number of enrichment was expected as the enrichment items that we enquired about were all expected to elicit play. This increase most probably reflects the interaction of the ferrets with the objects (including biting and dragging the items around) rather than with people or other ferrets. This may also explain why the number of enrichment items had no effect on bite-drag, which was supported by 51.9% of survey participants who associated bite-drag with play. Providing six or more enrichment items probably increases arousal, which may not only be expressed as play behaviour, but may also be channelled into undesirable behaviours as well (such as bite-drag). This trend is somewhat in agreement with the findings of Dallaire et al. (2012) where mink that were initially inactive and displayed low levels of locomotor stereotypic behaviour in non-enriched housing, became more aroused and active when provided with enrichment items.

Ferrets have quite a complex behavioural repertoire and it is clear that owners considered that there were different underlying motivations and causes of different behaviours. Although for each behaviour there was usually a large amount of participants who selected one key aspect

with which that behaviour was probably associated, many respondents stated that these behaviours can be associated with a number of factors. For instance, certain behaviours that owners consider as being undesirable, such as biting, were also associated with play or aggression depending on the context in which it was exhibited. Curiously, only about half of owners considered that repetitive behaviour or compulsive scratching were associated with the abnormal behaviour category. Human perception of farm animal behaviour may be relatively accurate (Wemelsfelder et al., 2000; Wemelsfelder and Lawrence, 2001; Wemelsfelder, 2007); however, this is not necessarily true for companion animals. Exploring owners' perceptions has raised the interesting question that apparently similar behaviours in ferrets may have different underlying motivations.

Although this study yielded some interesting results, there are certain limitations of this study that must be taken into consideration. One issue was that many participants were sourced from ferrets clubs and societies. Ferrets belonging to these people are possibly well cared for, due to information, advice and knowledge on the appropriate care of ferrets as well as their behaviour, being easily accessible for club members. Further, only dedicated ferret owners were expected to take the time to complete a survey that may have taken approx. 45 min to complete, depending on the number of ferrets owned. As with many survey studies of this type, we cannot exclude the possibility that our sample was not representative of the whole ferret companion animal population.

5. Conclusions

This study has revealed key information about how ferrets are currently managed and the incidence of play and undesirable behaviour. Within the population of ferrets surveyed, play behaviours were described as occurring 'frequently' to 'occasionally', whereas undesirable ones were described as occurring 'rarely' to 'never'. Although management factors relating to housing and enrichment were found to influence ferret behaviour, it only appears to do so up to a certain point. Nonetheless, the information revealed in this study could potentially be used as a welfare indicator and to assist in formulating appropriate guidelines and implementing management plans for domestic ferrets.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.applanim.2013.11.017>.

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