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Does Observer Presence Modify the Behavior and Enclosure Use of Captive Edwards' Pheasants?

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Simple Summary: It is well known that captive animals change their behavior and space use when watched by visitors. However, there is limited research on the potential effects of an observer who sits close to the captive animal's enclosure. This study investigates the observer effect in two pairs of Edwards' pheasants (*Lophura edwardsi)* and their offspring at Sparsholt College, United Kingdom. The impact of an observer (as opposed to camera) on behavior and enclosure use of pheasants was observed. Statistical tests were used to investigate observer impact, alongside the additional variables of keeper and visitor presence, temperature, and individual bird differences. Overall, the behaviors of resting and clustering were significantly increased during observer presence, whereas feeding and locomotion were significantly decreased. The behaviors of preening and standing were not affected by observer presence, though they were influenced by keeper and visitor presence. Enclosure use was also affected by observer presence, though the effect size was small. Animal researchers should consider how the presence of an observer might affect the behavior of their observed animals.

Abstract: It is well known that captive animals alter their behavior and space use when observed by visitors, with the concept coined the 'visitor effect'. The 'observer effect', described as any alteration in behavior and enclosure use as a result of a quiet, stationary observer, has been less studied. This study investigates the observer effect in two pairs of Edwards' pheasants (*Lophura edwardsi)* and their offspring at Sparsholt College, United Kingdom. The impact of an observer (as opposed to camera) on behavior and enclosure use of pheasants was observed, using instantaneous focal sampling. Enclosure use was measured by converting both enclosures into unequal zones and then assessing the evenness of enclosure use through modified Spread of Participation Index. Poisson regression analysis was used to investigate observer impact, alongside the additional variables of keeper and visitor presence, temperature, and individual bird differences. Overall, the behaviors of resting and clustering were significantly increased during observer presence, whereas feeding and locomotion were significantly decreased. The behaviors of preening and standing were not affected by observer presence, though they were influenced by keeper and visitor presence. Enclosure use was also affected by observer presence, though the effect size was small. This suggests that pheasants may perceive the presence of humans near their enclosures as a potential threat, and may alter their behavior to reduce detection, similar to their wild counterparts. Animal researchers should consider the potential impact of observer presence on their subjects, particularly when observing species such as pheasants.

Keywords: *Lophura edwardsi*; enclosure use; Spread of Participation Index; pheasantry; welfare

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1. Introduction

Behavioral research is a common, non-invasive method used to investigate zoo and aquarium animal welfare [1–4]. However, there is increasing evidence to suggest that some animals may be affected by the presence of human observers [5–9]. Whilst technological alternatives such as cameras are available, considerable emphasis is still placed on the value of human observers in behavioral observations [6,8–10]. Currently, the potential impact of human presence has not been fully explored in the zoo setting [3,11].

The 'observer effect' is any change in a subject's behavior caused by the visual, olfactory, or auditory presence of an observer [8]. Investigations regarding the observer effect have reported that some species present signs of either curiosity or stress [9], or adjust their behavioral repertoire when being observed [12]. For example, Iredale et al. [9] found that direct observations inhibited feeding and drinking behavior in captive baboons (*Papio hamadryas*) and rhesus macaques (*Macaca mulatta*). This response suggested that the observer's presence reduced the subject's motivation to express specific behaviors [13,14] and influenced the interpretation of results by altering 'normal' captive behavior patterns [8]. Lion-tailed macaques (*Macaca silenus*) were reported to utilize enriched enclosure areas (e.g., trees, shrubs, and water bodies) significantly less when under direct observations from visitors [5]. A decrease in utilization of enclosure resources correlates with the proposal that observers can elicit negative responses in captive animals by preventing species-specific behavioral displays and environment manipulation [4,15].

Many bird species in captivity respond negatively to observers and may display vigilance or antipredator behaviors [8,14,16]. For example, greater rhea (*Rhea americana*) performed more vigilance and increased stress-related behaviors when visitors were viewing their enclosure [17]. The expression of vigilance requires energy expenditure in birds and reduces the amount of time available to spend on maintenance behaviors [14]. This suggests that the observer effect may have a negative impact on the overall welfare on some bird species [4]. It is possible that, as with some wild birds, the negative impact may be fear-induced (for further information on fear and its heritability in birds, see [6]). Conversely, in captivity, it is possible that birds may habituate to visitor presence, especially if visitors are not able to enter enclosures or come within the bird's flight distance.

Human presence may not always result in changes in behavior in birds, but rather a change in location. This is particularly true for many wild bird species who show avoidance of habitat zones when observers are present. In captive research, Blanchett et al. [18] reported that 24 zoo-housed bird species increased use of vegetation cover under periods of high visitor numbers. Favoring sheltered areas could be interpreted as an individual's attempt to avoid human observers and could consequently restrict performance of its 'normal' behavior routine [19]. Use of enclosure space could therefore be an effective indicator of reduced welfare when evaluating the observer effect. Studies investigating the observer effect should therefore consider not only animal behavior, but also space use.

The Edwards' pheasant (*Lophura edwardsi*) is listed as Critically Endangered on the International Union for Conservation of Nature (IUCN) Red List [20]. A 2022 search revealed that the species is housed in 102 international zoological institutions [21] for the purpose of captive breeding. While gaps remain in the natural history of *L. edwardsi* [22], the species is known to inhabit lowland, closed-canopy evergreen forests on level ground or hills [23,24]. *L. edwardsi* display similar daily activity patterns to other forest-dwelling pheasants, foraging from morning to late afternoon and roosting in trees overnight [22]. Observations of wild *L. edwardsi* also suggest that the birds occupy dense cover underbrush, perhaps to avoid predation [22–24]. *L. edwardsi* is often described as flighty and secretive in captivity [22], so it is important to understand the potential impacts of human presence on their behavior. This study aimed to determine whether the presence of an observer influenced the behavioral repertoire and enclosure use *of L. edwardsi* in a captive animal setting.

2. Materials and Methods

2.1. Study site and Species

The study investigated two *L. edwardsi* groups at Sparsholt College Animal Management Centre (AMC). Observations focused on two pairs of pheasants along with their juvenile chicks which hatched earlier in 2019 (Table 1). The study took place between 6 August 2019 and 14 November 2019.

Table 1. Age and sex of study subjects.

Aviary	Sex	Life Stage	Hatch Location
1	Male	Adult	Private Collection
1	Female	Adult	Private Collection
1	Female	Juvenile	Sparsholt College
1	Female	Juvenile	Sparsholt College
1	Female	Juvenile	Sparsholt College
1	Female	Juvenile	Sparsholt College
1	Male	Juvenile	Sparsholt College
1	Male	Juvenile	Sparsholt College
2	Male	Adult	Private Collection
2	Female	Adult	Private Collection
2	Female	Juvenile	Sparsholt College
2	Female	Juvenile	Sparsholt College

2.2. Behavior

Two study conditions were tested: observer present and observer absent (camera), using a repeated measure design across both *L. edwardsi* groups. Observations under the presence of an observer were collected with the observer sitting or standing quietly one meter away from the aviary front. In the observers' absence, four 'Crosstour 1080P 170 wide-angle sports cameras' were positioned in and around the aviaries for optimal viewing (Figure 1). Video recording did not start in either aviary until two days after cameras were fitted to allow birds the opportunity to habituate to the novel objects (Baugh et al., 2017). A total of 64 h of data were collected, with 16 h of camera footage and 16 h of observer data completed for each *L. edwardsi* group. Observations were carried out on weekdays and weekends, between the hours of 11:00 and 17:00. Extraneous variables (including date, time, temperature, and weather, as recorded by a local weather station) were noted at the start of each hour's observations, and the presence of keepers and visitors were recorded in number of minutes per hour, prior to and during observations. Birds could be individually identified due to sexually dimorphic differences in plumage.

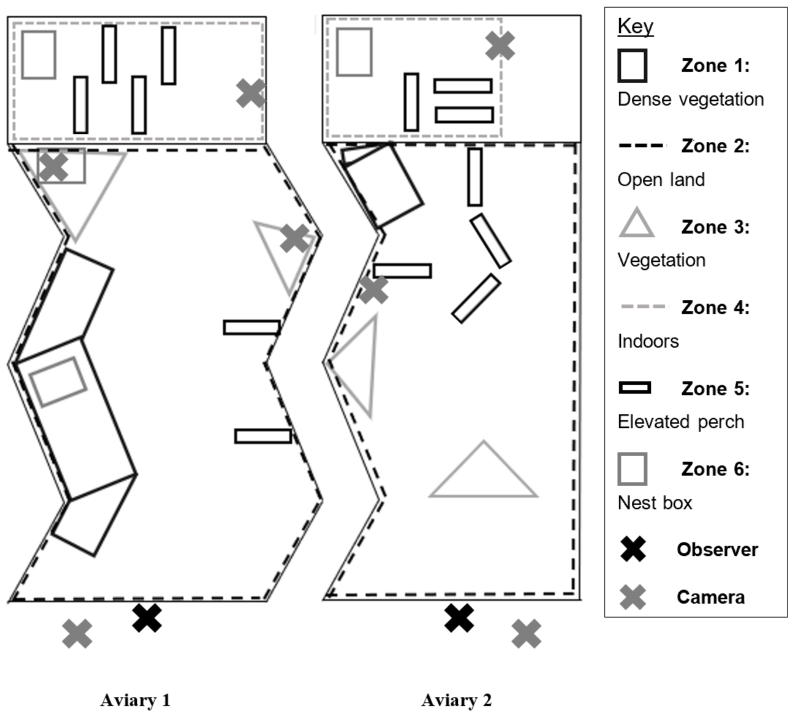

Figure 1. Enclosure layout for Aviary 1 (**left**) and Aviary 2 (**right**) with habitat zones and observer and camera positions highlighted in the key.

Under both observer conditions, state behaviors of adult *L. edwardsi* were identified with the prepared ethogram (Table 2) and recorded using instantaneous focal sampling at one-minute intervals across each one-hour observation period [25,26]. Additionally, adult bird event behaviors were recorded using continuous sampling [27]. However, the study did not record state or event behaviors of juvenile birds due to individuals being indistinguishable from one another.

Table 2. *L. edwardsi* ethogram. Adapted from [28,29].

Behavior	Description
State behaviors	
Clustering	Birds get together and remain near to one another.
Feeding	Individual feeds from a trough, scratches litter back with feet and pecks the ground or pecks plants which are elevated from the ground. Includes the act of ingesting water or manipulating a water source.
Locomotion	Bird takes two or more steps, moving from one point to another. This action may be performed at a slow or fast pace, with head held forward. Behavior also includes flying; individual flaps wings to gain height from the ground and has all limbs off the ground for a period longer than two seconds or glides with wings stationary in mid-flight.
Preening	Cleaning of the feathers; moving beak across the body and individually through feathers (perhaps trimming or re-arranging feathers) in a standing or lying position.
Resting	Individual shows a relaxed posture, standing, sitting or lying down. Head may be close to the body. Includes sleeping and eyes closed for longer than two seconds.
Standing	Bird remains still in an upright position with legs extended.
Out of sight	Bird is not visible or is partially obstructed from observer's vision.
Event behaviors	
Alarm call	Occurs when a threat or unusual sound/sight is present. Individuals repeat the call back to one another at approximately a 1/2 second apart until call slowly diminishes.
Brood gathering call	Can occur alongside a brood caution call. Vocal sounds include the parent clucking, barking, and "kee kee" noises. Chicks are silent and begin cheeping while returning to mother.
Chase	Aggressor runs toward opponent and opponent flees.
Dust bathing	Individual rolls in or covers body in dust/ground substrate to bathe.
Feather rustle	Bird shakes body laterally and causes feathers to appear larger and untidy.
Ground peck	Individual pecks ground with beak, once or more than once.
Scratching ground	Individual moves feet back and forth to scrape the ground, enclosure walls or feed trough.
Threat	Aggressor steps forward and lunges towards opponent. Opponent may flee but aggressor will not chase. Alternatively, aggressor may flap wings at opponent and may also produce a hoarse "krrrrah" sound.
Wing flapping	Bird extends wings and repeatedly moves them back and forth whilst standing, sitting, or lying down.

2.3. Enclosure Use

Enclosure utilization was assessed using Plowman's (2003) modified SPI technique. Prior to observations, each aviary was divided into zones based upon habitat biology and resources (Figure 1) [30,31]. Locations of male and female adult *L. edwardsi* from each group were identified through assessment of their position in relation to the enclosure zones and were recorded every one-minute. As juveniles were difficult to individually identify, they were evaluated as a collective group and the zone in which most individuals resided was noted every one-minute.

Data from each aviary were assessed using the modified SPI formula (Plowman, 2003):

$$SPI = (\Sigma \mid fo\text{-}fe \mid)/(2(N\text{-}fe_{min}))$$

In the equation, fe and fo refer to the expected and observed use of an enclosure zone, and femin refers to the expected amount of time that the animal would spend in the smallest zone [30,31]. N refers to the number of times each animal was observed per observation. Results range from zero to one [31], with SPI values of 0.3 and below being deemed as relatively even enclosure use and those above 0.7 considered uneven enclosure use. The difference between SPI values across conditions was calculated by subtracting readings from video observations away from those under direct observations for each aviary.

2.4. Data Analysis

Data were initially uploaded to Microsoft Excel™ 2016 and analysis was conducted using Minitab® version 19. *L. edwardsi* behavior was displayed graphically using activity budgets to compare observer presence and absence. To investigate influences on behavior, Poisson regressions were run, with observer presence used as the predictor, alongside the additional predictors of individual bird, keeper presence (minutes per hour), visitor presence (minutes per hour), and temperature. The model fit was tested using Deviance R^2. For enclosure use, SPI values per observation were inputted into General Linear Mixed Models (GLMM) with keeper, visitor presence, and individual bird used as predictors, and temperature as a random factor.

3. Results

3.1. Behavior

Activity budgets were developed for birds in both aviary 1 and 2 to display the impact of observer presence on pheasant behavior (Figures 2 and 3). The presence of a human observer significantly affected the prevalence of clustering, feeding, locomotory, and resting behavior, but not preening or standing (for full details of significant predictors, see Table 3). Several bar charts were developed for graphical representation of event behavior comparison between the two aviaries, and between the observer present and camera conditions (Figures 4 and 5). Statistical tests were not run on the event behaviors because the results were zero-inflated due to their rarity of occurrence.

3.2. Enclosure Use

SPI values were generated for all observations of all birds. The average SPI value per bird and per condition (camera versus observer) was generated (Figure 6). Overall, the GLMM model was significant, and temperature and observation type (camera versus observer) were both significant predictors of enclosure use (Table 4).

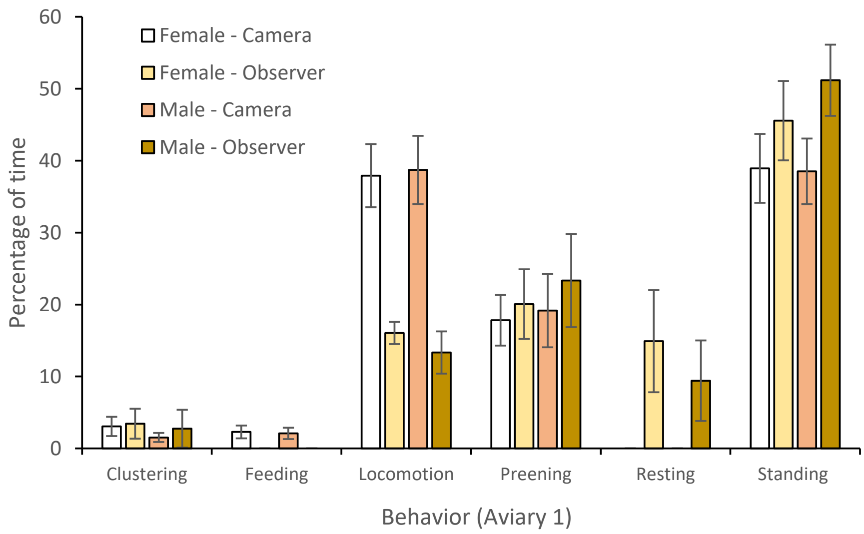

Figure 2. State behavior of pheasant pair housed in aviary 1 (+/− standard deviation), as compared between observer and camera conditions.

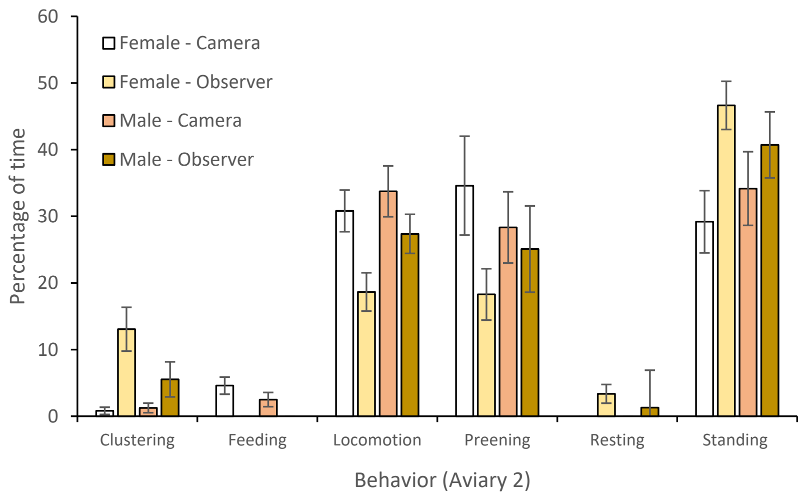

Figure 3. State behavior of pheasant pair housed in aviary 2 (+/− standard deviation), as compared between observer and camera conditions.

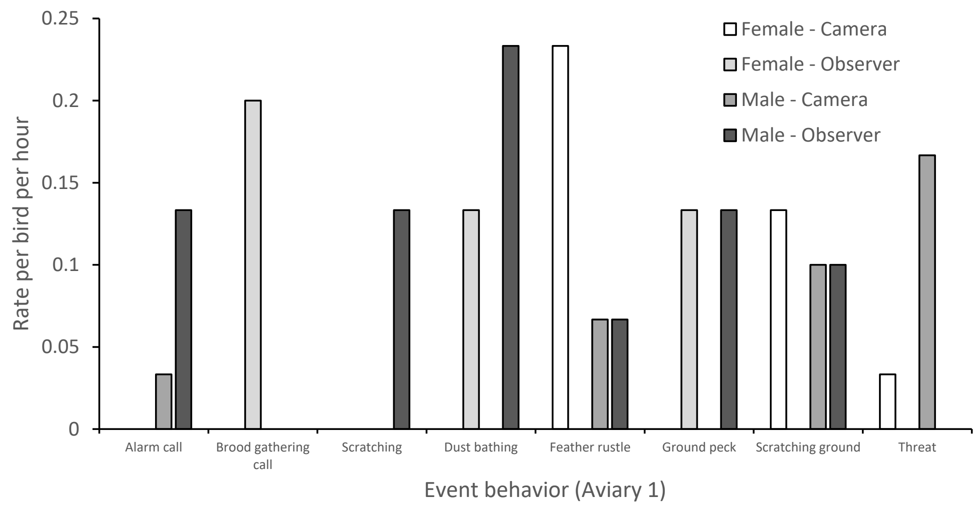

Figure 4. Rate of event behavior of pheasant pair housed in aviary 1, as compared between observer and camera conditions.

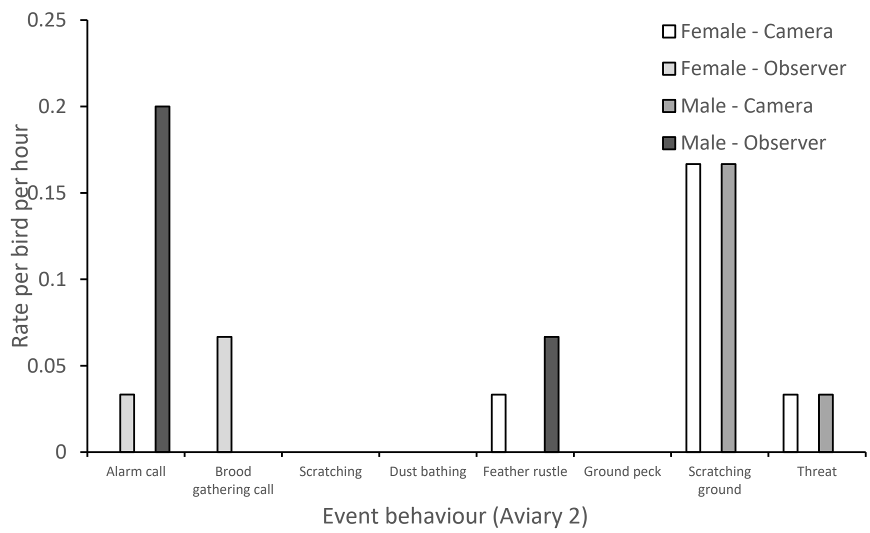

Figure 5. Rate of event behavior of pheasant pair housed in aviary 2, as compared between observer and camera conditions.

Table 3. Output of Poisson regressions for Edwards' pheasant state behavior. * indicates a significant value.

Behavior	R^2 (P)	Predictor	SE Predictor	X^2	DF	*p* Value
Clustering	25.74	Model	0.529	81.48	7	<0.001 *
		Temperature	0.013	0.76	1	0.383
		Visitor presence (min)	0.015	12.01	1	0.001 *
		Keeper presence (min)	0.004	0.35	1	0.557
		Individual bird	0.109	1.54	3	<0.214
		Observation type	0.071	69.05	1	<0.001 *
Feeding	41.91	Model	0.636	18.83	7	0.004
		Temperature	0.052	1.85	1	0.174
		Visitor presence (min)	0.127	1.78	1	0.183
		Keeper presence (min)	0.038	4.64	1	0.031 *
		Individual bird	0.283	0.08	3	0.774
		Observation type	1.09	12.02	1	0.002 *
Locomotion	36.98	Model	0.136	135.99	7	<0.001 *
		Temperature	0.001	0.05	1	0.828
		Visitor presence (min)	0.0158	1.76	1	0.185
		Keeper presence (min)	0.005	15.71	1	<0.001 *
		Individual bird	0.065	33.43	3	<0.001 *
		Observation type	0.102	30.35	1	<0.001 *
Preening	6.07	Model	0.153	41.04	7	<0.001 *
		Temperature	0.013	0.49	1	0.485
		Visitor presence (min)	0.015	0.06	1	0.809
		Keeper presence (min)	0.004	8.62	1	0.003 *
		Individual bird	0.109	28.63	3	<0.001 *
		Observation type	0.071	2.66	1	0.265
Resting	42.27	Model	0.842	56.26	7	<0.001 *
		Temperature	0.039	10.96	1	0.001 *
		Visitor presence (min)	0.307	21.72	1	<0.001 *
		Keeper presence (min)	0.009	1.34	1	0.246
		Individual bird	0.185	1.98	3	0.159
		Observation type	842	34.84	1	<0.001 *
Standing	16.32	Model	0.122	65.06	7	<0.001 *
		Temperature	0.122	6.27	1	0.012 *
		Visitor presence (min)	0.009	1.45	1	0.229
		Keeper presence (min)	0.011	4.55	1	0.033 *
		Individual bird	0.003	28.46	3	<0.001 *
		Observation type	0.050	2.84	1	0.241

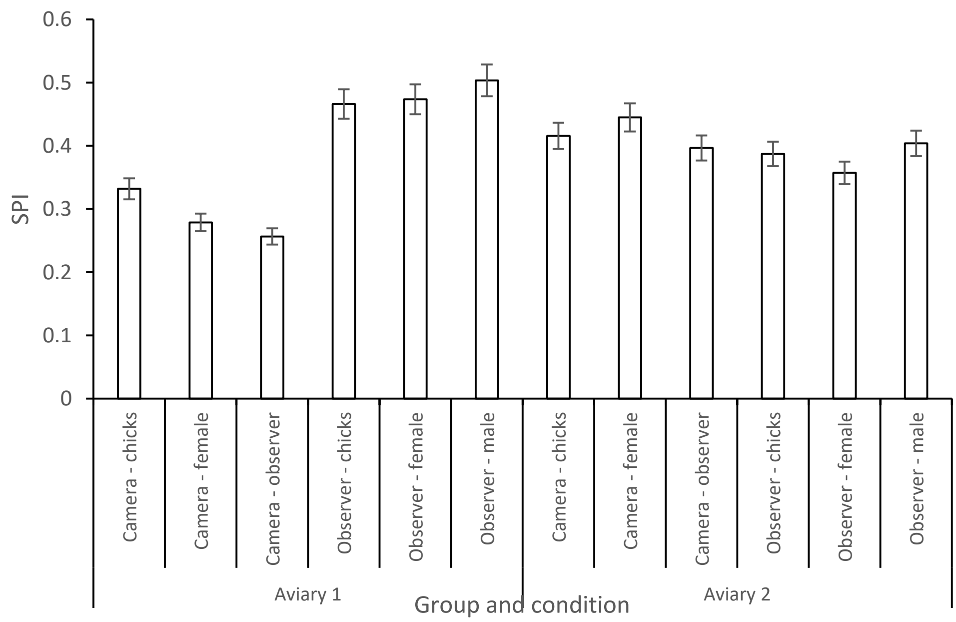

Figure 6. SPI values for birds in both aviaries (+/− standard deviation), compared between observer and camera conditions.

Table 4. Output of GLMM predictors for *L. edwardsi* SPI scores.

R^2	Predictor	SE Predictor	DF	*p* Value
	Model	0.001	9	0.014 *
5.5	Temperature	0.005	1	0.013 *
	Visitor presence (min)	0.005	1	0.686
	Keeper presence (min)	0.001	1	0.215
	Individual bird	0.039	5	0.498
	Observation type	0.031	1	0.001 *

* indicates significant values.

4. Discussion

Overall, *L. edwardsi* behavior was impacted by the presence of a human observer. In terms of behavioral change, clustering, feeding, locomotion, and resting were significantly affected by observer presence, whereas preening and standing were not. Enclosure use was also impacted by the presence of an observer, though the overall impact was relatively small.

4.1. Behavior

Four behaviors were significantly affected by the presence of the observer: these consisted of clustering, feeding, locomotion and resting. Preening and standing, by contrast, were influenced not by observer presence, but by other factors (such as keeper and visitor presence). Overall, the behavior of the studied pheasants was heavily influenced by human presence.

Feeding activities were greatly influenced by the observer, with a considerable drop in feeding behavior in conditions where observers were present. Overall, 41.91% of variation in feeding behavior was explained by the model. This result may be related to avoidance of perceived threat from humans, as direct observations have been shown to inhibit and reduce feeding behaviors in many taxa [9,18,32,33]. The theory of behavior 'trade off' in birds which perceive themselves to be in danger [7] could be used to explain the foraging reduction seen in captive *L. edwardsi*. Not only were study subjects shown to spend less time foraging in the presence of an observer but locomotory behaviors also significantly decreased. Both feeding and locomotory behaviors can make an animal more visible to potential predators [28]. Therefore, it could be suggested that the 'observer effect' can naturalize captive *L. edwardsi* behavior by enhancing predator-related avoidance behaviors in individuals [14,34,35].

In keeping with the theory of threat avoidance, resting behavior occurred much more commonly when an observer was present; 42.27% of variation was explained by the model. In nature, this species may spend prolonged periods of time resting in undergrowth when other animals or observers are present (Birdlife, 2014). Additionally, the behavior of clustering occurred more commonly during time periods when the observer was present. Clustering relates to chick location: when individuals are clustered, they are in close proximity to one another. This clustering behavior may indicate that the parent bird is attempting to protect her offspring by keeping them close, and therefore reducing potential predation threats [23,24].

The behaviors of preening and standing were influenced by keeper and visitor presence, though not by the presence of the observer. However, only a small amount of variation for each behavior was explained by the models, at 6.07% and 16.32%, respectively. These behaviors may therefore be explained by other variables not covered in this study, such as time of day or weather condition.

It has often been suggested that captive animals can habituate to a neutral stimulus that they regularly come into contact with [2,4]. If the birds had become habituated to human presence, no behavioral changes would have occurred. It is interesting to note that visitor effect significantly affected only two behaviors (resting and clustering) whereas observer presence affected four behaviors (clustering, feeding, locomotion, and resting).

This may be because the presence of an observer was a relatively novel stimulus. The presence of a keeper also influenced four behaviors (standing, preening, feeding, and locomotion). However, it is less likely that the birds would have habituated to keeper presence, as keepers are not a neutral influence (due to their provision of food for the birds, or their entry into exhibits).

Overall, the behavior of the studies' pheasants was impacted by observer presence, and the best explanation of behavioral changes is the theory of behavioral 'trade off', in which the birds were more active and spent more time feeding during time periods when observers were absent [24]. It should be noted that this avoidance of other, potentially predatory species is a natural behavior for the pheasant and does not necessarily confer poor welfare. However, the findings do suggest that the birds should be given sufficient space that they can avoid continual exposure to visitors and should not be placed in enclosures where they will be exposed to continuous, high numbers of visitors [23,35,36]. Additionally, consideration should be given to the fact that many rare reproductive behaviors are unlikely to occur under human presence for this species. Use of cameras, therefore, has value in better understanding pheasant communication and reproduction.

4.2. Enclosure Use

Using the modified SPI analysis technique [31], the study aimed to identify the effects of direct observations on *L. edwardsi* enclosure utilization. Figure 6 shows that observation type prompted changes in enclosure use and these differences were statistically significant ($p < 0.001$). Aviary 1 used their enclosures significantly less evenly when the observer was present. The change is less obvious for those birds in enclosure 2. Observation type and temperature were both significant predictors, but the model only explained 5.5% of variance in SPI value.

SPI readings of 0.3 and 0.2 suggest that *L. edwardsi* used enclosure space relatively evenly when the observer was absent, but SPI values increased, and birds were found to use just a couple of zones in the observer's presence. Research has found this to be the case with many captive prey species and suggests that animals favor sheltered zones and areas of the exhibit which were out-of-sight in the event of human disturbance [18,37,38]. This was true for the subjects of this study as *L. edwardsi* in aviary 1 spent 64% of the time in dense vegetation when the observer was present, compared to 24% in the observer's absence. However, aviary 2 contradicts this finding, with open land being the most utilized zone during direct observations. An explanation for this could be due to the enclosures' design (refer to Figure 1); the largest area of vegetation was made up of sparsely planted Bambusoideae and was situated directly in front of the observer. This perhaps discouraged birds from utilizing the enriched habitat due to the little cover it provided and provoked greater use of the open land behind.

Enclosure design, therefore, may influence overall zone use. In this case, enclosure 2 is a little more reflective of the wild habitat of the species [23], so may allow for a greater range of opportunities and hiding zones. To support this, the time in which *L. edwardsi* spent in vegetation increased by 10.5% when the observer was absent and open land use decreased. These results correlate with previous studies in other species [18] by suggesting that direct observations could significantly reduce *L. edwardsi* exploitation of all environmental resources, potentially restricting individuals' use of enriched areas (e.g., vegetation). An exhibit, therefore, that is well designed with knowledge of the wild habitat of a species, may provide buffer zones in which an animal can avoid the full impact of observer presence [23,24]. Considering the location of furnishings, as well as in keeping with knowledge of the flight distance of the species, may be critical in good enclosure design.

4.3. Future Directions

While a relatively small sample size, this study is an initial investigation into the potential impact of human presence on captive *L. edwardsi*. The reduction in both feeding behavior and locomotion suggests that the impact of human presence is relatively high. To develop this work further, studies could be implemented to investigate the observer effect across a much wider range of zoo-housed aves, such as other Galliformes, or Passeriformes and Psittaciformes, who may also be sensitive to human presence (Blanchett et al., 2014). Particular attention should be paid to vigilance behavior and to space use, as previous studies have showed that many aves change their location, rather than their behavior, when visitors are present [18].

Further research could also identify whether the visual presence or auditory presence of observers has a greater impact. This could be achieved by making use of decibel readers to measure the noise level of zoo visitors or observers. Similarly, weather has been seen to affect the behavior of other zoo-housed species, such as lemurs [39]. Whilst temperature was available for this study, the potential effects of humidity, wind speed or weather condition were not explored.

5. Conclusions

Overall, pheasant behavior is impacted by human presence, with observer, visitor, and keeper presence all influencing the types of behaviors displayed by the birds. The reduction of both feeding and locomotory behavior during the observer condition is of particular note, as it suggests that *L. edwardsi* may avoid engaging in behaviors that make them more visible when observers are present. From a captive setting, this suggests that pheasants may need access to areas far removed or out of sight of the public when they are housed in captivity. From a research standpoint, efforts should be made when observing pheasants to reduce the presence of observers, and where possible, to make use of technological alternatives such as cameras. This may allow researchers to make more informed observations regarding the behavior of captive pheasants.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Association for the Study of Animal Behaviour, and approved by the Ethics Committee of University Centre Sparsholt (protocol code UCS1909 and 20 June 2019).

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