WELFARE OF AFRICAN LION (*Panthera leo*) CUBS USED IN WILDLIFE TOURISM INTERACTION ACTIVITIES

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ABSTRACT

English

Wildlife interactions in tourism are criticised by some on welfare grounds due to the negative impacts on the individual animals, considered to be over-worked, poorly provided for and unable to express normal behaviours. Conversely, they may be used as a tool to create conservation awareness and generate revenue. Lion cub interactions have great appeal due to the charismatic nature of the species and the fact that they are so young. Lion cub interactions take place internationally but are more prolific in a country such as South Africa where the species is intensely farmed, with cubs being readily available for the attraction. A stakeholder workshop was held with a broad representation of the industry. The leading welfare concern was determined to be the lack of governance within the industry, with cub nutrition, cub social needs and the effects of removing the cubs from the mother, being some of the concerns. A set of non-negotiables were identified for the industry. Thereafter, an adaptive conjoint analysis was used in a wider online survey of stakeholders to rank and weight their importance. Social grouping of the cubs, followed by their ability to choose their own environment, were the top two weighted welfare issues. The value model recognises practices which do not contribute to the animal's welfare and identifies unacceptable poor practices which should be avoided. In a field study, the ethology of the lion cubs at three facilities in South Africa was recorded to determine the impact that interactions may have on their behaviour. Human interaction frequency was determined to have an impact on both the durations and diversity of behaviours exhibited and when high, the development of a behavioural pathology became evident. Abnormal behaviour in the form of stereotypic pacing also developed. The interacting tourists were interviewed and whilst most were unaware of any controversy around interacting with lion cubs, others were determined to experience the interaction regardless. Expectations of interactors were generally low with very few experiencing any form of reflection. Children clearly influenced the decision to participate in the activity.

Regrettably, education opportunities were lost with few being made aware of lion conservation issues. Interactors were attuned to selected welfare concerns but had conflicting views on freedom from discomfort. A harms-benefit analysis incorporating utilitarian ethics was tested for various lion cub interaction positions within South Africa. The best ethical practice identified, was one suggesting that an alternate more appropriate species should be considered.

Afrikaans

Die interaksie tussen mense en wilde diere as deel van toerisme-aktiwiteite, word om welsynsredes deur sommiges gekritiseer weens die negatiewe impak wat hierdie aktiwiteite op die individuele diere het. Sodanige impakte word beskou as uitputtend, swak versorging en die onvermoë van die diere om normale gedrag te openbaar. Daarenteen dien hierdie toerisme-aktiwiteite as 'n hulpmiddel vir bewaringsbewusmaking en inkomsteskepping. Interaksies met leeuwelpies het 'n groot aantrekkingskrag as gevolg van hul charismatiese aard. Die feit dat dit 'n jong dier is maak die aktiwiteit nog aantrekliker. Interaksies met leeuwelpies vind internasionaal plaasvind, maar is meer omvangryk in 'n land soos Suid-Afrika waar daar intensief met leeus geboer word en welpies geredelik beskikbaar is vir diè tipe aktiwiteit. 'n Werkswinkel vir belanghebbendes met wye verteenwoordiging uit die bedryf is aangebied. Die vernaamste welsynskwessie is as die gebrek aan bestuur in die bedryf geïdentifiseer, terwyl welpievoeding, maatskaplike behoeftes van die welpie, sowel as die gevolge van die verwydering van die welpies van die leeuwyfie (moeder) ook uitgewys is. 'n Stel ononderhandelbare praktyke vir die bedryf is bepaal. Daarna is 'n aanpasbare benadering tot saamgestelde analise in 'n breër aanlyn-opname van belanghebbendes gebruik om die belangrikheid van hierdie praktyke te orden. Sosiale groepering van die welpies, gevolg deur die vermoë om hul eie omgewing te kies, was die twee belangrikste welsynkwessies. Die waardemodel identifiseer praktyke wat negatief op die welstand van die dier inwerk en onaanvaarbare swak praktyke wat vermy moet word. Die etologie van welpies is in ‘n veldstudie by drie fasiliteite in Suid-Afrika opgeteken om die impak wat interaksies op hul

gedrag kan hê te bepaal. Daar is vasgestel dat die frekwensie van menslike interaksie 'n invloed op die duur en diversiteit van die gedrag wat getoon is, het. Verder is bepaal dat wanneer hierdie interaksiefrekwensie hoog is, die ontwikkeling van 'n gedragspatologie duidelik word. Abnormale gedrag in die vorm van stereotipe stap het ook ontwikkel. Deur onderhoudvoering met die interaksie-deelnemers is vasgestel dat die meeste deelnemers nie bewus was van enige omstredenheid rondom interaksies met leeuwelpies nie, terwyl ander vasbeslote was om ten spyte hiervan met die interaksie voort te gaan. Die verwagtinge van deelnemers was oor die algemeen laag en baie min het enige vorm van dieper betekenis ervaar. Die teenwoordigheid van kinders het die besluit om aan die interaksie-aktiwiteit deel te neem, duidelik beïnvloed. Ongelukkig het opvoedingsgeleenthede verlore gegaan en weinig van die deelnemers is van leeu-bewaringskwessies bewus gemaak. Deelnemers aan die interaksies was ingestel op selektiewe welsynskwessies, maar het teenstrydige menings oor vrywaring van ongerief van die diere gehad. ’n Skade-bate-analise wat utilitaristiese etiek insluit, is vir verskillende leeuwelpie-interaksies in Suid-Afrika getoets. Die uitkoms was dat die mees etiese praktyk sou wees om ’n alternatiewe, meer geskikte spesie te identifiseer en te oorweeg vir interaksies.

Sesotho

Likamano tsa liphoofolo tse hlaha le bohahlauli li nyatsuoa ke ba bang ka mabaka a boiketlo ka lebaka la litlamorao tse mpe ho liphoofolo ka bonngoe, tse nkoang li sebelisoa ho feta tekano, li sa fuoe hantle ebile li sa khone ho hlahisa boits'oaro bo tloaelehileng. Ka lehlakoreng le leng, li ka sebelisoa e le sesebelisoa sa ho hlahisa tlhokomeliso ea paballo le ho etsa chelete. Likamano tsa litau li na le boipiletso bo boholo ka lebaka la sebopeho se khahlisang sa mofuta ona le taba ea hore li nyane haholo. Tšebelisano ea tau ea likonyana e etsahala machabeng empa e atile haholo naheng e kang Afrika Boroa moo mofuta ona o lengoang haholo, ka malinyane a fumaneha habonolo bakeng sa ho hohela. Thupelo ea bankakarolo e ile ea tšoaroa e nang le boemeli bo pharalletseng ba indasteri. Matšoenyeho a ka sehloohong a boiketlo a

sechaba a ne a ikemiselitse ho ba khaello ea puso ka har'a indasteri, ka phepo e ntle ea bana, litlhoko tsa sechaba tsa bana le litlamorao tsa ho tlosa malinyane ho mme, e le tse ling tsa lintho tse tšoenyang. Sehlopha sa lintho tseo ho sa buisanoeng ka tsona li fumanoe bakeng sa indasteri. Kamora moo, tlhahlobo e kopanetsoeng ea kopanyo e sebelisitsoe phuputsong e pharalletseng ea inthanete ea bankakarolo ho lekanya le ho lekanya bohlokoa ba bona. Sehlopha sa sechaba sa malinyane, se lateloang ke bokhoni ba ho ikhethela tikoloho, e ne e le litaba tse peli tse holimo tsa boiketlo. Moetso oa boleng o amohela mekhoa e sa tlatselletseng boiketlong ba phoofolo mme e supa mekhoa e mebe e sa amoheleheng e lokelang ho qojoa. Phuputsong ea tšimo, thuto ea boitšoaro ea malinyane a litau litsing tse tharo tsa Afrika Boroa e ile ea hatisoa ho fumana tšusumetso eo litšebelisano li ka bang le eona boitšoarong ba bona. Maqhubu a tšebelisano ea batho a ne a ikemiselitse ho ba le tšusumetso ho nako le ho fapana ha boitšoaro bo bonts'itsoeng mme ha bo phahame, nts'etsopele ea lefu la boitšoaro e ile ea bonahala. Boitšoaro bo sa tloaelehang ka mokhoa oa stereotypic pacing le bona bo hlahile. Bahahlauli ba buisanang ba ile ba botsoa lipotso 'me ha ba bangata ba ne ba sa tsebe phehisano efe kapa efe e mabapi le ho sebelisana le malinyane a tau, ba bang ba ne ba ikemiselitse ho bona tšebelisano ho sa tsotelehe. Litebello tsa likhokahanyo ka kakaretso li ne li le tlase 'me ke ba fokolang haholo ba nang le mofuta ofe kapa ofe oa ponahatso. Ho hlakile hore bana ba ile ba susumetsa qeto ea ho nka karolo mosebetsing ona. Ka masoabi, menyetla ea thuto e ile ea lahleha ka ba fokolang ba ileng ba tsebisoa ka litaba tsa paballo ea tau. Basebelisi ba ne ba ikamahanya le mathata a khethiloeng a boiketlo empa ba ne ba e-na le maikutlo a loantšanang mabapi le tokoloho mathateng. Tlhatlhobo ea melemo ea kotsi e kenyelletsang boits'oaro ba ts'ebeliso e ile ea lekoa maemong a fapaneng a ts'ebelisano ea bana ba tau ka hare ho Afrika Boroa. Tloaelo e nepahetseng ea boits'oaro e khethiloeng, e ne e fana ka maikutlo a hore ho lokela ho nahanoe ka mofuta o mong o loketseng haholoanyane.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

DECLARATION

I hereby declare that the Thesis, with the title: **Welfare of African lion (*Panthera leo*) cubs used in wildlife tourism interaction activities**, which I hereby submit for the degree of PhD Environmental Sciences at the University of South Africa, is my own work and has not previously been submitted by me for a degree at this or any other institution.

I declare that the Thesis does not contain any written work presented by other persons whether written, pictures, graphs or data or any other information without acknowledging the source.

I declare that where words from a written source have been used the words have been paraphrased and referenced and where exact words from a source have been used, the words have been placed inside quotation marks and referenced.

I declare that I have not copied and pasted any information from the Internet, without specifically acknowledging the source and have inserted appropriate references to these sources in the reference section of the dissertation or thesis.

I declare that during my study I adhered to the Research Ethics Policy of the University of South Africa, received ethics approval for the duration of my study prior to the commencement of data gathering, and have not acted outside the approval conditions. I declare that the content of my thesis has been submitted through an electronic plagiarism detection program before the final submission for examination.

Signature:  Date: August 2021

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CHAPTER 1: INTRODUCTION

This chapter introduces the reader to the research background (section 1), which includes a brief concept of wildlife interaction-based tourism, the specificities of African lion (*Panthera leo*) cub interactions and the unique lion industry within South Africa, ending with basic lion ecology. Thereafter, the purpose, aims and objectives (section 2) of the research are presented and the chapter ends with a description of how the thesis is to be further presented (section 3).

1.1 Background

1.1.1 Animal-based tourism and welfare

Animal based tourism is a multibillion-dollar industry which appears to be increasing (Essen, Lindsjö and Berg, 2020) with wildlife tourist attractions accounting for 20-40% of all global tourism (Moorhouse *et al*., 2015). It is aimed at viewing or encountering wildlife in a range of locations, from free ranging to artificially housed, captive animals (Newsome, Dowling, & Moore, 2004). A review of public websites revealed that the majority (43%) of animal-visitor direct interactor opportunities, offered to the global tourist market, centre around the petting of captive wild animals while other direct interaction activities include feeding, walking or swimming with the animals, riding and attending performances (D'Cruze *et al.*, 2019). With growing financial pressure on tourism enterprises, the inclusion of wildlife interactions is being more actively promoted (D'cruze *et al*., 2017) as a revenue generator.

D'Cruze *et al.* (2019) determined through a review that while substantial literature exists on the effects of visitor presence on these wild animals, very little research has determined the effects of direct interaction activities on the animals themselves. It is this lack of research which they feel has resulted in the current lack of clarity which surrounds such animal interaction practices. Values of conservation, animal welfare, visitor

satisfaction, and profitability are often in conflict with each other (Reynolds and Braithwaite, 2001). Education, research and conservation are well-known objectives of the modern zoo, but so too is entertainment, with visitors seeking to not only learn about and view the animals from a distance, but to also interact with them in proximity (Fernandez *et al*., 2009). Interacting with wildlife has as a result become a part of many modern zoos and aquaria, with the public being willing to pay extra for the experience (Kreger and Mench, 1995). Interacting with wildlife is not restricted to zoos but also exists within a commercial environment, often solely for recreational and commercial purposes (Moorhouse, D'Cruze and Macdonald, 2017). This practice is driven by tourist demand, many of whom find interacting with a wild animal enjoyable (Shani and Pizam, 2009). It is seen as a form of entertainment and recreation allowing for a family orientated experience, and an opportunity to participate in a conservation type experience with potential for an educational outcome (Shani, 2009).

de Mori *et al*. (2019) identified a need for the ethical assessment of such animal interactions, which includes weighing up the impact on the animal's welfare with education and conservation outcomes. Similarly, D'Cruze *et al*. (2017) call for a balance between wildlife protection goals and wildlife ecotourism development. Fernandez *et al*. (2009) suggests that when the effects of animals on zoo visitors and vice versa are considered then opportunities for increased positive animal visitor interactions can be facilitated, thus supporting the goals of modern zoos which include conservation, research, animal welfare, education and entertainment. Perhaps simplistically proposed, Fernandez *et al*. (2009) concludes that when animals are provided more "seeming control" over their interactions within a zoo, then welfare requirements of the animals can be met with the benefit of achieving entertainment, education and conservation.

Moorhouse *et al*. (2015) scored 24 types of wildlife tourist attractions and deemed only six to have both positive conservation and welfare impacts. It was determined that welfare could be present without conservation value, and conservation value be present without welfare. The six which possessed positive traits for both consisted of five species

specific animal sanctuaries and a gibbon watching facility. van der Meer, Botman and Eckhardt (2019) concurred and considered most wildlife tourist attractions to be about making a profit with welfare, conservation and education lacking. Essen, Lindsjö and Berg (2020) go as far as to describe animals within animal-based tourism as "laborers in a global capitalist economy where they are conscripted into the service of the tourism industry". Pressure has been placed on travel companies to stop supporting the industry, to which some have responded (TripAdvisor, 2017; SATSA, 2019).

The latest Five domains model (Mellor *et al.*, 2020) has now included in its assessment of animal welfare 'human-animal interactions'. From this we conclude that human-animal interactions have both the capacity to improve and negatively impact on the welfare of animals. This seems obvious when looking at companion animals and perhaps even those used in the farming and production industry with substantial scientific evidence existing on the effects of stockman behaviour on these animals (Hemsworth and Coleman, 2010). But what are the effects of masses of strangers in the form of tourists, on the welfare of the wild animals they are interacting with? The use of wild animals in tourism is clearly emotive and this supports the need to scientifically review their welfare with the aim of understanding exactly how their welfare may be compromised and more importantly, improved. This research therefore sets out to evaluate the welfare of African Lion Cubs used in wildlife tourist interactions, within South Africa. While the study focusses and makes use of information gleaned from the South African interaction industry, the use of lion cubs in tourist attractions is global, with increased trends in the Middle East to own lion cubs as pets for personal interaction satisfaction (Bachmann, 2010).

1.1.2 Lion cub interactions in South Africa and the South African lion industry

Lion cub interaction encounters are a particularly popular international tourism activity. While exact numbers are unknown, it has been estimated that approximately 1000 – 10,000 lions are used internationally, with annual visitor numbers being 100,000 – 500,000 (Moorhouse *et al*., 2015). The extent of cub interaction activities offered to the

public in South Africa is also not precisely known but lion cubs are potentially readily available from approximately 297 (late 2016) captive lion breeding facilities (Williams and ‘t Sas-Rolfes, 2019).

There are approximately 7000 lions in captivity (Nowark, 2015) in South Africa, owing to their use in captive breeding and the utilization of the species. The types of lion cub interaction activities within this captive industry have not been documented, and not all captive bred cubs are interacted with. Also, not all the cubs that are interacted with go on to be used in other captive lion practices, such as walking with lions, lion hunting and the lion bone trade. Revenue may also be generated from lion cub interactions, which provide opportunities for international tourists and paying members of the public to interact with lion cubs. A wide range of interaction opportunities exist, which include bottle feeding, picking up and or stroking of the lion cubs, as well as photographic opportunities. The cubs may also be used in corporate functions, as well as organized school tours both on and off site. Lion cubs may be interacted with from birth to a maximum of seven months of age, thereafter, they become too boisterous and unsuitable for direct interactions as they pose a potential safety risk to the public.

Ethical debates around the use of wildlife in tourism are popular and those around the use of lion cubs for interacting purposes are particularly so (TripAdvisor, 2017). The practice of cub interaction activities has received much criticism on social media platforms, mostly because of the alleged supply of the cubs to zoos, captive breeding facilities, lion safari walks (where public walk with sub-adult lions), hunting outfitters (for captive bred lion hunts or ‘canned’ lion hunts) and processors, to produce lion bones for export to Asia (Nowark, 2015; NSPCA, 2013; Lewis-Balden, 2015; Williams *et al*., 2015). A ‘canned’ hunt is defined in the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) as when “a large predator is tranquillised, artificially lured by sound, scent, visual stimuli, feeding, bait, other animals of its own species, or another species, or any other method, for the purpose of hunting that predator; or a captive large predator is hunted”. Canned hunting, defined in this way, is illegal in South Africa, but this

is disputed by various advocacy groups, who interpret it differently (Hargreaves, 2010; South African Predator Association, n.d.). A report by the advocacy group Traffic and Wildcru (Williams *et al*., 2015) recently investigated the trade in African lion body parts and its possible impact on the conservation of wild lions. It concluded that it is unlikely that the trade in lion bones will be banned in South Africa soon. It acknowledges concerns for the welfare of lions in breeding facilities as well as other lions kept in captivity.

South Africa is pre-eminent in developing private wildlife ranching practices (Cousins, Sadler and Evans, 2008). According to the National Agricultural Marketing Council (NAMC) (2006), there were an estimated 9000 wildlife ranches in South Africa covering approximately 20.5 million ha, with an additional 15000 landowners involved in mixed ranching practices (a combination of domestic livestock and wildlife). These statistics are good for conservation biodiversity, reflecting positively the amount of land use under conservation management, but they also, according to the NAMC, support a much wider range of income possibilities from wildlife. According to Cousins, Sadler and Evans (2008), the main restrictions on biodiversity conservation are limited tourist preferences, persecution of predators to protect valuable game, and inadequate resources. The African lion in South Africa is influenced by all three of these limiting factors and is a pivotal species with regards financial gain opportunities. Being a member of the charismatic “Big 5”, (a common term in Southern Africa to refer to the African elephant (*Loxodonta Africana)*, Cape buffalo (*Syncerus caffer)*, African lion, Black Rhino (*Diceros bicornis)* and African Leopard (*Panthera pardus)*) makes the lion an even greater attraction to tourists. Land values have been estimated to be six times greater if these species are present (Falkena and Van Hoven, 2003). Ironically, predators on private game ranches, who through their presence, increase land value, still find themselves persecuted as they prey on species, which are financially important through hunting (Cousins, Sadler and Evans, 2008). The resulting effect is the containment of predators on game ranches to still attract tourists, whilst limiting their impact via predation. This situation maximizes revenue through wildlife experiences, including game viewing, interaction activities and hunting, from both local and international tourists.

The South African Government's Ministry of Environmental Affairs has issued a National Biodiversity Management Plan for the African Lion (Funston and Levendal, 2015), which draws a distinction between wild lions in national parks, managed wild lions in smaller reserves and captive lions. Although its main emphasis is the conservation of wild and managed lions, it acknowledges that there is a need to "ensure a well-managed captive lion population" and to "maximise the educational and research opportunities offered by captive lions". Ethical conduct is an envisaged requirement of the captive industry, but specific requirements for the welfare of lions, including public interactions with lion cubs, are not discussed. There is a distinct difference between wild and captive lion management strategies in South Africa (Funston and Levendal, 2015). Wild lions, due to their conservation value, are considered important to manage and conserve, whereas captive lions are considered a renewable resource. In 2006, the captive lion industry produced revenue in excess of R98 million (7.1 million USD) from hunting alone (Taljaard, 2009). Most is trophy hunting by overseas tourists, with jobs created by the industry supporting the country's drive for sustainable development (Department of Environmental Affairs, 2015).

1.1.3 Lion ecology

Lions are the only social felid, which live and hunt in large family groups of up to thirty individuals (Smuts, 1976). Lionesses form the nucleus of the family (Bertram, 1973), attended by on average two males per pride. Lions are predominantly nocturnal, including for their hunting activities (McBride, 1984) and daytime is largely spent lying inactive in compact groups. Home ranges vary depending on the type of vegetation, presence of water and availability of food, with prides being termed 'fission-fusion' units, based on their needs at a particular time (Schaller, 1972). As such, lion territories are not precisely defined, except that the zones between them are less intensely used (Schaller, 1972). Lions avoid encounters with other prides, using vocalization, scent marking and patrolling to secure a territory (Schaller, 1972). Fighting is common in males, however, when

competing for access to female prides (Bertram, 1973), and infanticide is common when there is a resulting change in the dominant male (Bertram, 1978).

Females are polyoestrous with no post-partum oestrus. If the female is able to raise her cubs to maturity then the mean interval between litters is about twenty months, but if the cubs die or are removed, the range is four to six months (Rudnai, 1973). Average litter size is 3.2, and the female will leave the pride with the cubs until they are four to eight weeks old (Smuts, Hanks and Whyte, 1978). The female only re-joins the pride if other cubs in the pride are not older than three months old, as any lactating female may suckle the cubs, and cubs greater than three months of age would dominate over the younger litter. Cubs suckle regularly for the first six to seven months of their lives with declining frequency thereafter. They remain with their mothers up until two years of age (Rudnai, 1973). Cub mortality can be as high as 50% when food is in short supply (Smuts, 1982).

The African lion is the largest felid in Africa, but its distribution has decreased from its original widespread occurrence in Europe, much of Asia and the entire African continent more than any other species (Skinner and Chimimba, 2005). The world population dropped from 200,000 to 20,000 in the last century, and there are now only seven countries known to contain more than one thousand lions (Panthera, 2019).

1.2 Purpose, aims and objectives

The purpose of the research presented in this Thesis was to interrogate the topic of lion cub welfare within tourism interaction facilities, using an interdisciplinary approach. Interdisciplinary research aims to make findings applicable to more than just the researchers, having broad societal and even economic impacts (Van Noorden, 2015) as it reaches into two or more disciplines for answers. The first two studies, namely the workshop with relevant stakeholders and the conjoint analysis survey used a participatory research approach. Such an approach makes use of ‘orientation to inquiry’ as its basis

for information generation (Reason and Bradbury, 2008, p1). Such an approach acknowledges that the participants have a significant contribution to make towards science (Bergold, 2007). The current practices in the lion interaction industry needed to be captured and the welfare concerns of the multiple stakeholders, recorded. The lion cubs' ethological study relied on traditional qualitative ethological techniques which consider motivational mechanisms and the experiences of the animals concerned in causing the behaviour repertoire displayed (Jensen and Toates, 1993). This granted an opportunity for the lion cubs to relay situational impacts of interaction environments on their behaviours. Next the interviews with tourists relied on tourism theory which seeks to understand the effects of reality on practice in tourism (Stergiou and Airey, 2018). The needs and motivations fuelling the practice of cub interactions was considered important as it was these which inevitably give rise to welfare concerns. The study ends with a harms-benefit analysis of the lion cub interaction industry, making use of utilitarian ethics as its assessment tool. Utilitarian theory was selected as a result of its welfarism application, the defining approach to this study. Utilitarianism theory considers both personal morality and public choice (Sen, Williams and Williams, 1982) as a method to judging the goodness of states of affairs (Sen, 1979). This analysis suggests a way forward for the interaction industry, based on the information attained from the study.

1.2.1 Stakeholder workshop

The initial aim of the research was to achieve an understanding of the lion cub interaction industry and cub welfare issues associated with the practice. To meet this aim, the following objectives were set:

- To gather information by those considered proficient in the field, through an expert stakeholder workshop
- To determine the association between the various stakeholder groups and the identified welfare issues
- And to conclude on non-negotiable practices for the industry.

1.2.2 Conjoint analysis survey

The second aim of the research was to prioritise through weight and rank, the identified welfare issues through a wider stakeholder survey. The following objectives supported this aim:

- To calculate attribute weighting scores for the identified welfare issues though an online conjoint analysis survey
- And to design a value model which can rate the welfare of lion cubs used in interaction activities

1.2.3 Cub ethology

The third aim of the research was to assess cub welfare through an ethological study of lion cubs used in the interaction industry. To answer this the following objectives were set:

- To determine the behaviours of lion cubs used in wildlife tourism interaction facilities
- To determine if facility management affects their behaviour
- To draw conclusions about their welfare from their behavioural responses
- To examine behavioural responses to human interaction frequency
- And to detect and describe any possible problem behaviours and speculate on possible emotional states.

1.2.4 Interactor questionnaire

The fourth aim of the research was to understand the needs and perceptions of those desiring to interact with lion cubs. The objectives identified to realise this aim were as follows:

- To determine the extent to which lion cub interaction controversies were known to interactors and whether this knowledge influenced their decision to interact

- To ascertain the importance value of the lion cub interaction by determining if it was the reason for visiting the facility and if the cubs were the most favoured animal interacted with, post interaction
- To determine the link between prior expectations and post interaction attitudes
- To recognize how children might influence the decision to interact
- To determine the educational outcomes of a visitation
- And finally, to ascertain the opinions of interactors about the perceived welfare of the lion cubs interacted with.

1.2.5 A utilitarian review

The final aim of the research was to conduct an ethical review on various positions on lion cub petting as a tourist attraction. The objective identified to realise this aim was as follows:

- To present an example of an ethical utilitarian framework, making use of a harms-benefit analysis, on various interaction positions regarding lion cub interactions.

1.3 Thesis outline

The thesis is presented through a traditional format of a literature review, methodology, results and discussion, with each of the five individual research aims and objectives being systematically reviewed in each. The conclusion integrates the five objectives to present an integrated overview of the welfare of African lion cubs used within the tourism interaction industry.

CHAPTER 2: LITERATURE REVIEW

This chapter will review the available literature for this study. It follows the outline of the aims and objectives reviewed in the previous chapter and will introduce the reader to background information on identifying lion cub welfare issues through a stakeholder workshop and the ranking of these issues through an online survey (section 2.1), describing and understanding lion cub ethology (section 2.2), interrogating the motivations and perceptions of the interacting tourist (section 2.3) and ending with a utilitarian review of various interaction positions (section 2.4).

2.1 Stakeholder workshop and conjoint analysis survey

A stakeholder is considered someone who can affect a decision or is affected by an action (Freeman, 1984) and stakeholder analysis in research has two important functions. The first is that it provides a means to identify balance and points of conflict. The second is that it ensures that research outputs meet the needs of those affected (Grimble, 1998). A wide array of stakeholders is typically sought for such workshops, given that they are expected to experience the topic differently. These differences result in a transdisciplinary approach to a topic through integrating social and scientific practices (Leventon *et al*., 2016).

Stakeholder workshops have been widely and successfully used in determining animal welfare concerns and standards with stakeholder knowledge informing scientifically accepted guidelines. This knowledge is relative to and influenced by the participant's interests such as costs, feasibility, effectiveness, competitiveness, the policy environment, the ability to monitor and implementation (Ingenbleek *et al*., 2012). Stakeholder groups assembled for animal welfare issues tend to have most of the following members present: veterinarians, animal welfare group representatives, staff who work directly with the animals, the animal business owners, government advisors and university researchers (Erian, Sinclair and Phillips, 2019; Chadwick *et al*., 2017;

Blokhuis, 2008; Fernie *et al.,* 2012). Welfare issues typically raised by stakeholders in such animal welfare studies include social structure of the animals, enclosure provision, staff expertise, nutrition, enrichment, healthcare and training (Fernie *et al.,* 2012; Gurusamy, Tribe and Phillips, 2014; Horseman *et al*., 2016).

There are two well-known models when it comes to understanding and defining animal welfare. The first to lead the way was the Five Freedoms, developed by John Webster in consultation with the Farm Animal Welfare Council (FAWC), and has since 1993 been presented in conjunction with the five provisions (FAWC, 1993). They read as follows: (1) Freedom from thirst, hunger and malnutrition – by ready access to a diet to maintain full health and vigour (2) Freedom from thermal and physical discomfort – by providing a suitable environment including shelter and a comfortable resting area (3) Freedom from pain, injury and disease – by prevention or rapid diagnosis and treatment (4) Freedom from fear and distress – by providing sufficient space, proper facilities and the company of the animal's own kind and (5) Freedom to express normal behaviour – by ensuring conditions which avoid mental suffering. The simplicity of this model, as explained by Webster (2016) gives it the comprehensiveness it requires especially in circumstances involving legislation. Webster has however conceded that perhaps the one Freedom which is stated 'to' as opposed to 'from' could be better expressed as the Freedom of choice. The Five Freedoms serve to identify and evaluate specific actions and promote wellbeing (Webster, 2016) and as such lend themselves well to this study which sought to answer that exact question in the context of the lion cub interaction industry.

The Five domains model developed by David Mellor, has been around since 1994 and has been updated seven times since its inception (Mellor, 2020). The latest 2020 model has included in it, a human-animal interactions assessment tool. This tool gives guidance on how to evaluate both the positive and negative impacts of human behaviour on animal welfare. This fundamentally is the main difference between the Five Freedoms and the Five Domains, that the Five Freedoms only seek to identify negative welfare

states whereas the Five Domains also evaluates positive impacts (Webster, 2016). The latest Five Domains now read as follows: (1) Nutrition (2) Physical environment (3) Health (4) Behavioural interactions and (5) Mental state. The behavioural interaction domain reflects on three different behavioural interactions and their associated affects, all of which are relevant to the topic of the welfare of lion cubs in interaction tourism. The first is interactions with the environment, second interactions with other animals and the third, interactions with humans. The corresponding effects of this fourth Domain, link with the fifth, namely the mental state of the animal.

Conjoint analysis is a tool widely used to rank and weight identified issues through a trade-off approach. This statistical technique which found its origins in consumer and market related research, is now applied to all areas of research where multi-criteria decision making is required. A pairwise comparison method, called PAPRIKA (Potentially All Pairwise RanKings of all possible Alternatives), developed by 1000minds (Hansen and Ombler, 2008), makes use of survey-based questions which allow the participant to select a preference from between two hypothetical scenarios. The underlying theory behind this is determining how important an issue is by how much the individual is prepared to 'forego' (two hypothetical situations are presented containing combinations of both good and poor traits and a choice must be made on which combination is better than the other – how much are you prepared to accept of the poor trait in order to retain the good one) on other issues. With this adaptive conjoint analysis, the web-based survey adapts its scenarios based on the previous choices made. Attribute weighting scores and a value model are the resulting outputs of such an analysis.

Conjoint analysis has been used in animal production related research where animal welfare contributes a cost to the production (Hobbs, 1996; Den Ouden *et al*., 1997; Stott *et al*., 2005; Norwood and Lusk, 2011), it has also been used in weighting and ranking animal welfare issues against each other Mactaggart, Waran and Phillips (2021) conducted a conjoint analysis survey to rank welfare issues in the thoroughbred racehorse industry, which determined that horsemanship, health and disease followed by

education of the horse to be the most important. Fernie *et al*. (2012) conducted a conjoint analysis survey on the great apes and found that different rankings existed for each of the species, but social structure, enclosure appearance and enclosure furnishings were among the top three for each. Gurusamy, Tribe and Phillips (2014) also conducted such a study focusing on captive elephants and enclosure substrate followed by group size and then healthcare, were ranked as the highest.

2.2 Cub ethology

Wildlife are believed to be affected by tourism interaction activities, because of their lack of domestication, the "process by which a population of animals becomes adapted to man and to the captive environment by genetic changes occurring over generations and environmentally induced developmental events recurring during each generation" (Price, 1984). Wild animals in their natural environments will typically exhibit avoidance behaviours when confronted by humans (Hediger, 1964). However, when in captivity wild animals exposed to frequent human presence may become tame, characterised by a decreased fear of humans (Hediger, 1964). Over time, husbandry has the capacity to unconsciously produce tamer individuals through selective breeding (McDougall *et al*., 2006), but this is highly dependent on management systems (Tennessen and Hudson, 1981), which in turn has associated welfare implications (Dawkins, 1988). Poor husbandry is likely to generate stress in those less tame individuals (McDougall *et al*., 2006). Animals in zoos, which accommodate interactions, are exposed to people in a different way to animals in other contexts, such as farms and laboratories. While all these have small groups of familiar people taking care of them, animals used in interactions are then exposed to large numbers of unfamiliar people, who all behave differently and respond to them uniquely (Hosey and Melfi, 2015).

Distance to humans, and the extent of social interactions with them, induces stress responses in many species (Fernandez *et al*., 2009). This response not only differs between species but also between individuals within them (Hosey, 2008). Therefore, individual differences should be considered in the management of captive wild animals

(Wielebnowski, 1999), especially those who as a part of their life encounter many humans daily. Adaptive behavioural responses of animals can relate directly to management strategies, with responses being shown by the animals to either real (fear) and or perceived (anxiety) threats (Boissy, 1995). Fear and anxiety in animals are undesirable emotional states which reduce welfare (Boissy, 1995).

Visitors to zoos have variable effects on the animals' welfare, known as the 'visitor-effect', with both behavioural and physiological components (Davey, 2007). The impact is not always negative and, in instances, may be considered enriching (Hosey, 2000). However, this visitor-effect is not easy to evaluate (Davey, 2007) and, while visitor behaviour and animal behaviour are associated, it is difficult to show causality (Margulis, Hoyos and Anderson, 2003). This may be as a result of animals causing a behavioural response in humans and vice versa, known as 'visitor attraction' (Davey, 2006). This bi-directional relationship will usually have a primary direction and is taxon specific (Margulis, Hoyos and Anderson, 2003).

In order to study the welfare of animals in a specific environment, one is required to assess both their 'physical and mental wellbeing', as defined by the Brambell Committee as far back as 1965 (Brambell, 1965). Applied ethology is a useful tool to assess these welfare states (Gonyou, 1994). The behavioural needs of the animals are of paramount importance, and where possible, facilities should allow for natural behaviours to be expressed (Ewbank,1988). However, Veasey, Waran and Young (1996) caution on the direct comparison of captive behaviours with wild ones. Captive animals can modify their behaviour to fit their circumstances and so while the presence or absence of a behaviour may suggest a welfare concern, it does not prove that it is one (Veasey, Waran and Young, 1996). Many behaviours, being stimulus driven (Ewbank, 1985), do not imply by their presence or lack thereof, that the animal's welfare is inadequate (Baxter, Baxter and MacCormack, 1983), for example the unnatural act of a cub playing with a human. What appears to be more important therefore than the act of the behaviour, are the emotional states which motivate animals to perform them. The presence of problem

behaviours as indicators of mental states therefore reflect welfare compromise (Gonyou, 1994).

Behavioural durations and diversity are likely to be useful in determining the psychological state (Mellor and Beausoleil, 2015) of the cub. When faced with an aversive stimulus, they will display coping behaviour that tries to reduce the effect of the aversive state (Wechsler, 1995). If the cub is unable to cope with the aversive situation, then behavioural problems arise, indicative of psychological distress (Bacon, 2018). Abnormal repetitive behaviour stems from a behavioural problem, resulting in stereotypy such as pacing, self-directed behaviour like over grooming or externally directed behaviour such as increased conspecific aggression (Bacon, 2018). Stereotypies performed for long periods of time represent the inability of an animal to do a behaviour it wants to, but cannot (McBride and Craig, 1985).

Assessing positive emotions in animals, and not just negative ones, is important in determining welfare (Duncan, 1996; Seligman and Csikszentmihalyi, 2014). The implications for animals are substantive in that it is better for the animal to have positive experiences included in its life and not simply the absence of suffering (Lawrence, 1987). Boissy *et. al.*, (2007) relays that physiological and behavioural indications of pleasure in humans has been confirmed in animals too and as such these positive emotional states should be validated in studies.

To measure management effects on welfare, the cumulative effects of management and husbandry choices on the cub's behaviour must be assessed. The principle of additivity of multiple concurrent stressors has been demonstrated in the livestock production industry (Hyun *et.al*., 1998). At lion cub interaction facilities, the effect of keeper relationships, interaction numbers and frequency, interactor behaviour, the weaning age of the cubs, starting age of interactions and effects of training styles, all have the potential to affect the behaviour of the cubs and may also be cumulative.

Animal keepers and their manner of handling farm animals has been linked to productivity, with a fear of humans as a result of rough and inappropriate handling, resulting in effects such as chronic stress, reduced reproduction rates in pigs, chicken and foxes and decreased milk production in dairy cows (Carlstead, 2009). Relationships between zoo animals and their keepers show that they can affect reproductive success, with increased positive keeper time and contact (Mellen, 1991). Positive relationships can lead to improved social behaviours amongst chimpanzees and a decrease in abnormal behaviour (Baker, 2004). Behavioural responses of zoo animals towards the interacting public are also dependent on the quality of interactions, except that the public are strangers who respond uniquely each time (Hosey and Melfi, 2015). Crowd size, visitor frequency and proximity to the zoo animal being interacted with all affect behavioural responses (Fernandez *et.al*., 2009). Behaviours are influenced by the personalities of the individual animals (Gosling, Kwan & John, 2003), modified by their temperament and experiences. Animals weaned early and provided milk artificially are likely to be more motivated to interact with humans (Jago, Krohn and Matthews, 1999), as are animals which are handled from an early age (Markowitz *et.al*., 1988). Improvement of the human-animal relationship through positive reinforcement training is possible (e.g. in chimpanzees, Pomerantz & Terkel 2009). Therefore, assessing the welfare of lion cubs used in interaction facilities requires investigation into the effect of management on their behaviour, with the aim of inferring their resultant emotional states.

2.3 Interactor questionnaire

The use of wildlife in tourism remains a controversial topic (Macdonald *et.al*., 2017), with some acknowledging that it allows for both locals and tourists to be positively influenced about the plight of animals and their habitat (Higginbottom and Tribe, 2004). Predator focused tourism has the capacity to support predator conservation, as long as there is both public and political support to ensure the regulation of management and monitoring bodies (Macdonald *et.al*., 2017). Conversely, others believe that animals used in tourism are exploited for human entertainment, with lion cub interactions being labelled

as one of the “cruellest activities” tourists can participate in (World Animal Protection, n.d.). Thus, poor welfare of animals in tourism is a global concern and there is much controversy around their use. The second controversy, specific to the use of lion cubs in South African tourism, centres around the post interaction use of some lion cubs in the captive lion industry (Williams and ‘t Sas-Rolfes, 2019).

Humans are known to be naturally drawn to viewing and interacting with animals, both domesticated and non-domesticated (Fawcett and Gullone, 2001). An emotional connection with animals represents a humanistic characteristic within a connection to nature (Kellert, 1983). This desire for close animal interactions seems to reflect a romantic and anthropomorphic view of animals (Curtin, 2005). The biophilia hypothesis suggests that to exclude wild animals (not only in wildlife tourism interactions) from the lives of people can potentially upset their cognition, personality and inner life (Kellert, 1983). It is therefore understandable that people are attracted to interact with wildlife through wildlife interaction tourism. However, when media depicts such interactions it can easily blur the publics’ perceptions about such animals, making them appear to be friendly domesticated animals and less like the potentially dangerous animals they are (van der Meer, Botman and Eckhardt, 2019). When expectations of interacting with wildlife are then not met, as a result of a misperception, it could affect the human experience. Phenomenological research attempts to understand the significance of an event on the human experience as an aspect of their life (Van Manen, 1990). Psychological benefits of participation in an activity are considered the ultimate reward, but increased understanding also leads to a greater sense of environmental awareness (Schänzel and McIntosh, 2000).

Individuals are attracted to different animal species, a phenomenon which is applied in the tourism industry where different species are managed by wildlife operators to attract certain types of visitor (Woods, 2000). Carr (2016a) summarises for us that an animals’ attractiveness to a person can be a result of their charismatic identity (Small, 2011), their larger body size (Moss, and Esson, 2010), their activeness (Puan and

Zakaria, 2007), their rarity (Whitworth, 2012) and/or their strength (Sommer, 2008). Carr (2016b) then suggests that it might also be a complex interaction of characteristics which makes them attractive to the visitor, giving the example of being both cute and cuddly. Lion in western countries are regarded as the second most charismatic species in the world, after tiger, and the traits which awarded them this ranking are beauty, impressiveness and their dangerousness (Albert, Luque and Courchamp, 2018).This suggests that lion cubs are suited for attracting visitors as they embody all these traits along with the benefit of being juveniles, another attracting trait (Small, 2012).

The mission of most zoos is to conserve species, provide educational opportunities, conduct research and exhibit animals for entertainment (Cain and Meritt Jr, 1998). The reasons for visiting a zoo, however, may vary, with some seeking family or friend bonding time (Rajack and Waren, 1996; Holzer, Scott and Bixler, 1998), others' education (Andereck and Caldwell, 1994), and others a day out (English Tourist Board, 1983). Giving children the opportunity to play at a zoo exhibit allows them to play in a more educational and imaginative context than typical play, thus there is also a desire for adults to visit with the family (Oxarart, Monroe and Plate, 2013). Positive childhood experiences, such as observing, exploring and interacting with natural objects encourages conservation interests later in life (Vadala, Bixler and James, 2007). Opposing opinions also exist however, with a zoo being considered discordant with education and conservation about wild animals when they are exhibited and represented in captivity (Jamieson, 1985). As such, many zoos have been challenged to prove that they effect attitude or behaviour change, given these unnatural situations (Mason, 2000). Children who visited zoos in a formal setting, such as with a school, appear to recognise the educational and conservation roles better, whereas those that visited with family tend to be more anthropocentric in their views (Almeida, Fernández and Strecht-Ribeiro, 2017).

Many adults accept the social remit of the modern zoo, which emphasizes conservation and education functions, along with entertainment (Carr and Cohen, 2011). Other animal experiences attract similar support (Carr and Broom, 2018), while adding something memorable and unique to the experience (Curtin, 2005). Altman (1998) demonstrated that the more animated the animal's behaviour was at the zoo, the greater human attention it attracted, potentially improving the learning experience. Human-wildlife conflicts can be reduced with better public education (Carr and Broom, 2018). It would seem therefore that interaction facilities have the potential to produce experiences to teach not only the public but also affected communities about the conservation plight of these and many other species.

Most zoo visitors consider themselves capable of assessing animal welfare, citing enclosure style and animal behaviour (Melfi, McCormick and Gibbs, 2004). However, aesthetic characteristics, which appeal to visitors, do not always imply benefits for the housed animals (Seidensticker and Doherty, 1996), and most visitors do not observe the animals for sufficient a period of time to assess the meaning of observed behaviours (Melfi et al., 2004). Packer, Ballantyne and Luebke (2018) found in a study involving Gorillas that visitors confidently expressed their judgements on how the gorillas were coping with the conditions they were living in, through health and happiness indicators, whilst judgement on the way the gorillas were feeling, was correlated with the visitors' emotional connection with the gorillas and the overall satisfaction of the visitation. Despite the confidence with which the visitors appear to assess welfare, tourists to wildlife attractions have been determined to be poor judges of animal welfare, based on the lack of correct assessment of negative welfare (Moorhouse et al., 2015). Human attitudes towards animals directly affects how well they provide for animal welfare (Serpell, 2004) and, by association, their perceptions of welfare states. These human attitudes are proposed to be affected by the specific attributes of the animal in question, the characteristics and experiences of the evaluator and an array of cultural factors.

2.4 A utilitarian review

The understanding and assessment of lion cub welfare within wildlife tourism interactions is necessary in affording these cubs protection through appropriate welfare provision. Animal welfare legislation in most countries aim to prevent suffering and cruelty, yet many animals suffer legally and are cruelly treated despite this. From this it can be surmised that welfare provision, as much as it is legislated, is in its purest form, only an ethic. An ethic being a set of moral principles relating to a field or form of conduct. It is for this reason that most animal welfare legislation includes a clause stating that an action may not result in unnecessary suffering. This is considered a widely recognized moral principle which allows for animal use and their suffering as long as it can be considered necessary (Hurnik and Lehman, 1982). Marino (2016) asserts that welfarism as an ethic and moral principle, is responsible for animal suffering given that humans will always benefit when there is a conflict between human and non-human interests. Such ideas support the ethic of animal rights but animal rights as idealistic as they may appear would require a total end to animal use in science, termination of commercial agriculture and the elimination of the recreational use of animals (Regan, 1986). Welfare biology, the study of the welfare of living things and common sense, according to Ng (2016), can be used to reduce this so-called inevitable suffering. The notable use of the word ‘reduce’ as opposed to ‘prevent’ must be kept in mind and it is important to ask in the context of a recreational animal use system, such as lion cub interactions, whether this reduction alone is ethically acceptable or should we seek greater protection for the cubs, understanding that there will still be some form of welfare compromise on their part even in the best offering of the activity? The old philosophy of common sense by Reid (1863) states that “Common sense is that degree of judgment which is common to men with whom we converse and transact”. It is therefore determined that upon conclusion of a detailed welfare study that an ethical review be undertaken to provide such a value judgement, making use of common sense, on the welfare outcome and determinant of acceptability.

The ethical value afforded an animal used in tourism is comparable to the moral accountability of that industry (Fennel, 2012a). Ethical tourism guidelines are therefore as ethical as the extent to which they are accountable. Ethical tourism must take into account the sustainability of a practice by including a diverse stakeholder groups' behaviour and attitudes which should have equity in the decision-making process (Weeden, 2002). Stakeholder groups include host communities, tourism employees, product marketing to tourists and an attitude towards the natural environment. It is noted that animals are not specifically indicated as a stakeholder but would be considered a part of the natural environment. This is because ethical tourism which includes animals would make use of a utilitarian approach, which is a moral philosophy of action, promoting the greatest happiness for the greatest number, by allowing individuals to jointly improve collective welfare (Baujard, 2013). Ignorant to ecological principles however, individual innocent actions by man have unwittingly allowed utilitarianism to destroy the planet, threatening man's own survival (Hursthouse, 2011). The approach of environmental ethics therefore abandons moral principle for an incomparable, context-dependant, intrinsic value instead (Hursthouse, 2011). The intrinsic value of an animal or a species, makes it morally relevant, independent of its usefulness to man (Dol, 1999).

Virtuous people with virtuous habits are more likely to make the right choice when faced with an ethical challenge. Virtue ethics therefore is a character-based approach to dealing with ethical dilemmas; however it may be partial to benefitting some more than others, all while the action is deemed morally acceptable (Barnett, Carfaro and Newholm, 2005). According to Slote (2000), virtue ethics is challenged to combine care for others with care about others. Ethical consumption therefore differs from virtue ethics as it extends the scope of the concern beyond those closest to you to those who are distant and non-human when considering different types of consumption and certain commodities (Barnett, Carfaro and Newholm, 2005).

CHAPTER 3: METHODOLOGY

This chapter will describe the methodologies applied to the five aims of the study. The design of the stakeholder workshop (section 3.1) reveals welfare issues within the interaction industry and these factors are used in the construction of the conjoint analysis online survey (section 3.2). The ethology study used to assess the welfare of the lion cubs through their behaviour (section 3.3) is followed by the face-to-face questionnaires aimed at the participating lion cub interactors (section 3.4). The chapter ends with a harms-benefit review of various lion cub interaction positions (section 3.5).

3.1 Stakeholder workshop

3.1.1 Facilitated program

The aim of the research was to identify, prioritise and rank the animal welfare issues associated with lion cub interaction activities. To meet this objective a two-part approach was used. The first part comprised a panel of stakeholders, who were invited to participate in a one day facilitated workshop (31 May 2016). This workshop identified and prioritised the core welfare issues faced by lion cubs in wildlife tourism interaction facilities. Participation was voluntary and participants were not incentivised, nor were they financially reimbursed for any costs incurred by attending. Ethical approval was granted by the University of South Africa for this stakeholder workshop (2016/CAES/049).

Recognising that participatory diversity is vital to the success of an expert opinion workshop (Mathie and Greene, 1997), participants with varying interests and needs were invited and provided the substantive themes of the event, adding depth to the results. Some participants were known to the researcher whilst others were recommended by various organisations associated with such stakeholders. Thirty-three South African stakeholders were initially contacted via email and then by telephone, with the invitation to attend. Fifteen participants attended and 18 declined (of which six could not be granted

leave from work and eight lived too far from the venue; two of those who lived too far, attempted to participate virtually but poor connectivity did not allow this). The 15 participants represented nine stakeholder groups: nature conservationists (n = 2), one from an academic institution and one from a non-governmental organization; an animal ethologist (n=1); a wildlife rehabilitator with experience in lion cub rehabilitation (n=1), government organization officials responsible for both wild and captive wildlife legislation on their permissible use and their welfare (n=3), representatives of non-governmental animal welfare organizations (n=2), an animal rights advocacy representative (n=1), a wildlife veterinarian with captive lion experience (n=1), lion breeders (n=2) and lion cub handlers (n=2), one with zoo experience and the other from an interaction facility. Because in such a diverse group some participants may be perceived as having greater knowledge or interests and may dominate the proceedings (Mathie and Greene, 1997), a professional, independent facilitator was employed, as recommended by Phillips and Phillips (1993). The facilitator was experienced in managing events with participatory diversity and possible negative interactions.

The workshop commenced with a welcome from both myself the researcher and Professor Phillips, my supervisor, followed by the completion of consent forms, in which they could indicate whether their names and/or organisations that they were representing could be made publicly available (the program is presented as Appendix A). After participants introduced themselves, the objectives of the workshop were explained as:

1. Identify the key welfare issues within the lion cub interaction industry.
2. Prioritise the considered importance of these welfare issues.
3. Agree on non-negotiable welfare issues which should not be tolerated under any circumstances within the lion cub interaction industry.

A presentation on the meaning of the term “Animal welfare” followed, to ensure that participants could identify the welfare issues effectively. This followed the definitions and key principles outlined in Phillips (2008).

Stage 1 Identification of welfare issues:

Participants were provided with a set of adhesive notes, which were already numbered so that the researchers and facilitator alone, but not the other participants, could link a stakeholder group (not an individual in the case where more than one was present) with an identified welfare issue. The instructions given to the participants was that they should write one idea per note, and that the number of notes allowed was not limited. The purpose of this stage was to gather all the ideas from the group on what they thought the key welfare issues were within the cub interaction industry. Participants were given as much time as required to do this task. This method of collecting ideas was selected, as it ensured that all opinions were represented and that these were not influenced by other participants, which would be expected if only verbal responses were accepted. The facilitator then collected all the adhesive notes and placed them on the wall in clusters with similar themes for inspection by everyone. The stakeholders, assisted by the facilitator, then considered, amended and agreed upon the grouping of the themes and their descriptions. Stage 1 was completed in two hours.

Stage 2 Identifying and describing the core welfare issues:

The facilitator asked the participants to consider all the key welfare issues that had been identified in Stage 1, and which were grouped on the wall in front of them. Each participant was then given three stickers, which could be used by the researcher and facilitator to identify them. Stakeholders were then instructed to indicate their priorities by placing their three stickers on any three of the welfare themes they considered most important. The votes were then tallied and presented back to the group. This stage was concluded in half an hour.

The identified welfare themes were discussed to determine practices that commonly and currently take place in the lion cub interaction associated environments in South Africa

and to determine levels of welfare concern within each theme. This was done in order to describe and contextualize each of the key welfare issues identified.

Stage 3 Determining non-negotiable welfare issues:

Participants collectively discussed and agreed on non-negotiable welfare concerns, in terms of activities which violate the welfare of the lion cubs so seriously that they were considered unacceptable and must not occur under any circumstances.

3.2.1 Statistical analysis

It was hypothesized that there would be a relationship between the key animal welfare issues identified and the stakeholder group that had prioritised them through their vote. To test this, a χ^2 contingency table test in R (R Core Team, 2018) was used to test for association between participants' affiliation and votes cast per welfare issue. A non-metric multidimensional scaling (NMDS) ordination was run using the Vegan package (Oksanen et al., 2014) in R to plot similarities and dissimilarities in their responses.

3.2 Conjoint analysis survey

3.2.1 Survey design

Part two comprised an anonymous and voluntary, online adaptive conjoint analysis survey which was circulated to a wider stakeholder group for the purpose of ranking and prioritization of the identified welfare issues obtained through the stakeholder workshop. Ethical approval was granted by the University of South Africa for this survey (2018/CAES/068). The online survey sought the views of a wider range of stakeholders with varied experience of lions and or lion cubs. Stakeholders were required to be able to categorize themselves as one of the following in order to participate: a South African government official working for a department, especially DAFF (Department of Agriculture, Forestry and Fisheries) or DEA (Department of Environmental Affairs), a nature conservator, an academic with lion research experience, an animal welfare

organization representative, an animal rights advocacy group representative, a lion owner and or breeder, a lion cub handler, a wildlife ethologist, a wildlife veterinarian or a wildlife rehabilitation specialist.

Known individuals and or organisations who met this criterion were contacted directly via email and directed to the *1000Minds* (Hansen and Ombler, 2008) Internet-based software package. These individuals were also asked to snowball the survey to others whom they, in turn, might know and whom they believed would qualify in meeting the survey requirements, this method being known to work well in extending a small and unique cohort of initial participants invited (Morgan, 2008). These participants, through their networks, invited other participants who meet the eligibility criteria and could potentially contribute to this specific study. The total number of participants invited to participate is therefore not known.

The *1000Minds* system applies a method for deriving weights known by the acronym PAPRIKA (Potentially All Pairwise RanKings of all possible Alternatives). Participants were provided pairs of hypothetical scenarios of current lion cub interaction scenarios defined by two criteria and were then required to select the scenario that reflected their opinion of the better welfare state for the cubs. The criteria were developed from the information obtained at the stakeholder workshop based on the welfare issues raised and what takes place in practice at such facilities. Each pair of options had a better welfare criterion linked to a poor welfare criterion. This meant that participants were faced at each scenario with making a trade-off, which allowed for an importance rank to be developed for each individual. Such an example may appear as follows: ‘Select the situation which reflects a cub in a better welfare state, all else being equal (a) a cub is removed from its mother immediately after birth and has less than 100 interactions per day or (b) a cub is removed from its mother two days after birth and is interacted with in excess of 200 times per day or (c) they are equal’. The best welfare state would obviously be to have a cub with least interactions coupled with longest time with its mother before

removal. But by linking a poorer welfare criterion with a better welfare criterion, the respondent is forced to make a trade off, thus producing the ranking.

Twelve attributes were defined, each with three levels of ranked (lowest to highest) scenarios. This resulted in each participant completing, on average, 98 pairwise ranked questions and taking on average 30 to 40 minutes to complete. After completing the adaptive conjoint analysis portion of the survey, participants completed a further 4 demographic questions linking their results to their affiliation, years of experience in that affiliation, their gender and whether they resided in South Africa or not.

3.2.2 Statistical analysis

The 1000Minds software summarizes the data and presents relative weightings for each welfare attribute per participant (Hansen and Ombler, 2008). Demographic information was analysed using GraphPad InStat v. 3.06. A series of χ^2 contingency tables analysed the effects of each demographic criterion on the mean of the welfare issue weightings.

A non-metric multidimensional scaling (NMDS) ordination was run using the Vegan package (Oksanen et al., 2014) in R to plot similarities and dissimilarities in their responses. This determined associations between participants' affiliation and the mean weighted utility value of the attributes they selected.

3.3 Cub ethology

3.3.1 Sampling design

Three South African lion cub tourism facilities offering very different interaction experiences were used in the study. Names and locations have been withheld to provide anonymity as per the agreement with facilities. Ethical clearance was granted for the

study by the University of South Africa's College of Agriculture and Environmental Sciences, Animal Research Ethics Committee (reference number: 2017/CAES/053).

A standard method of continuous sampling was used across the three facilities irrespective of their management styles. This sampling method recorded the frequencies of short duration behaviours and time budgets for longer duration behaviours, all of which were mutually exclusive (Hartmann, 1982). Each sampled day had two recording periods, 0900-1200 and 1300-1600 h. The behaviour of each cub was recorded continuously for a 10 min period within each hour, totalling 60 minutes per cub per day. Study sites were visited three or four times per month for the duration that the cubs were used for interactions, with data being purposefully collected during both weekdays (when the facilities expected fewer interactors), and on weekends and public holidays (when there were increased numbers expected), so as to determine the relationships between interaction numbers and behaviours displayed by the cubs. Scan sampling, set at 10-minute intervals, was also applied across all individuals within the facility and took place during the same two recording periods during which time the continuous sampling was applied. This resulted in 36 scans per individual per recording day.

Cubs were randomly sampled, and in an attempt to minimise observer influence, the observer arrived 30 minutes prior to data collection, to allow the cubs to habituate to the presence of the observer, who watched the behaviour from inside the enclosure. The cubs were well habituated to the presence of humans on account of their living environments and daily interaction activities. The researcher never interacted with the cubs and moved around within the enclosure to ensure that all areas accessible to the cubs were visible, especially during interaction sessions when several people were in the enclosure at the same time. Inter-rater differences were eliminated by only using one observer (Hartmann, 1982). Trial runs during the construction and testing of the ethogram contributed to training the observer.

Facility A comprised three female sibling cubs that were recorded on 10 days (four weekdays, five weekend days and one public holiday) over a 13-week period. Facility B had four cubs, three siblings (one female and two males) and a single cub (male) from another litter, that were recorded on 15 days (10 weekdays and five weekend days) over a 21-week period. Facility C had five cubs, two siblings (one male and one female) and 3 single cubs all from other litters (2 males and 1 female) that were recorded on 12 days (eight weekdays, three weekend days and one public holiday) in a 21-week period.

The following ethogram (Table 1) was used to record the behaviours of the cubs. An exclusive ethogram design was initially constructed using available lion ethology literature. A pilot study allowed for the testing of the ethogram and adding any new observed and omitted behaviours. Rare behaviours were only added at later dates during actual recording sessions, as it became evident that they did not meet the descriptors of existing behaviours.

Table 1 Behaviour categories and detailed descriptors used to record duration of daily behaviour of the cubs.

Behaviour	Descriptor
Play	A voluntary action resulting in recreational pleasure and enjoyment; lion cub play includes running, quick turns, rolling, climbing and wrestling (Estes 2012; Bertram 1978)
Self-play	Play not involving any other living animal and or human
Conspecific play	Play with other lion cubs
Human play	Play with humans
Inactivity	Limited or no movement
Sleeping	Eyes closed, lying laterally or sternally recumbent
Resting	Eyes open but non-responsive to surroundings
Locomotion	Moving from one place to another, not included within play, grooming, aggression, submissive and excited behaviours
Flight	Alarmed reaction and hasty retreat from a perceived or real threat, to a new location
Movement	Purposefully walking or running to a new location
Grooming	Cleaning or maintenance of the body, involving head rubbing and social licking (Schaller 1972)
Self-grooming	Grooming behaviours only directed to self
Conspecific grooming	Grooming behaviours directed at other lion cubs
Human grooming	Grooming behaviours directed to a human
Aggression	Threatening or contact behaviour, which may or may not be harmful, includes growling, lunging, swiping, biting or a combination of these
Conspecific aggression	Aggressive behaviour directed at another lion cub
Human aggression	Aggressive behaviour directed at a human

Abnormal behaviours	Behaviour which deviates from what is considered normal and appears to have no obvious goal or function
Stereotypy	A repetitive behaviour such as pacing back and forth, usually along an enclosure edge and may include vocalization
Non-nutritive suckling	The act of suckling another cubs' ear or genitalia
Shaking and trembling	An involuntary behaviour resulting from a perceived threat indicating fear
Fence biting	Biting on the fence of the enclosure indicating frustration or boredom but not in the same manner as during teething
Attentive	Reacting to its surroundings
Alert	The cub although not moving is watchful of surroundings, the eyes are focused on the stimuli and ears move responsively to noises
Investigatory	The cub actively explores its environment by using its senses
Excited	Cub moves excitedly, sometimes vocalizing and mostly in a small area around an object or person
Other	A behaviour not able to be defined by any of the above
Mock mating	The imitating act of mating, not gender specific
Flehmen	Wrinkles the nose and curls the top lip in response to a smell, usually other cubs' urine
Elimination	The act of defecating and urinating and includes the act of being stimulated when a young cub by the caretakers to encourage bowel movement
Ingestion	The active consumption of food and liquid; includes drinking of water, bottle fed milk, any solid food such as cat pellets, chicken and meat and includes chewing on a carcass

3.3.2 Statistical analysis

A Generalised linear model with a negative binomial distribution and a log link function was developed. The Facility and Behaviour, as well as the interaction between these two, were included as the main effects in the model. The Individual animal, its sex and the observation day were included as random factors, and cub age and total number of people that encountered the cubs within each recording day were included as continuous predictors within the model. Repeated measures of each animal were accounted for statistically by nesting observation day within individual animal effects. The glmmTMB package in R (Brooks et al., 2017) was used to perform the analyses and model structures were compared using the Wald χ^2 test, through analysis of deviance type 3 testing, using the anova function in the car package (Fox and Weisberg, 2019), to investigate patterns of predictor significance.

For all significant predictors, pairwise comparisons were performed using the Wilcoxon rank-sum tests, to identify significant differences between factor states. All tests were two-tailed and considered significant for $p < 0.05$. P-values for the outcomes of the tests were adjusted for multiple test comparisons using the p.adjust() function in R (R Core Team, 2013) and the Benjamini-Hochberg correction method (Benjamini and Hochberg, 1995). The continuous predictor, cub age, was associated with a significant effect across facilities and so each broad ethological grouping was correlated (Pearson's correlation coefficient) and individually tested for significance.

A percentage activity budget (indicating the mean, SD and SEM) was constructed for all behaviours derived from the three facilities used in the study. All behaviour frequencies were tested against human interaction frequency, to ascertain strengths of correlations and significance within Facilities.

3.4 Interactor questionnaire

Three South African lion cub tourism interaction facilities gave their approval for the study (names and location are anonymised). Each facility offered a unique interaction experience, additionally offering interactions with other animals and various amenities which were specific to the facility. Facility A was mostly frequented by South Africans due to its location. Interactions were unrestricted and respondents interacted with a sister cohort of three cubs which would have been anywhere between 34 and 100 days of age depending on when the interaction was undertaken. The number of interactions per day were low and so interactors experienced the interaction at their ease and for as long as they wished.

Facility B was well known to both the international and local market and made additional use of tour operators. Interactions took place at set times and formed part of a tour, with interaction times generally not being limited. There was a mixed cohort of cubs but of very similar age and petting was restricted to the head and back, but other body positions would be allowed if not aversive to the cub and acceptable to the handler. Cubs interacted with would have been somewhere between the ages of 34 and 193 days of age depending on when the interaction was undertaken.

Facility C was also known to the international and local market, and also making use of tour operators at times. Interaction times were limited as was the extent of the interaction, only allowing the petting of the head and back. A mixed cohort of varied ages were available for interactions, with cubs between the ages of 57 and 271 days of age depending on when the interaction was undertaken.

3.4.1 Questionnaire design

In total 300 anonymous questionnaires were completed between March and September 2017. 300 was deemed a suitable sample size given that a relatable study by Shani and Pizam (2009) made use of 267 questionnaires and sought to determine

tourists' attitudes towards the use of animals in tourism. Any adult (>18 years) interactors who had completed their interaction experience were asked to participate. Whilst only consenting adults were interviewed, they were questioned about their children's experiences and this allowed the children's experiences to be included in the results. It was deemed to be inappropriate to question tourist minors who were not in the presence of their parents. A decision to interview all tourists, only after they had interacted was so that they might be able to fully reflect on the experience, something they would be unable to do prior to interacting. The first 100 respondents to consent and fully complete the questionnaire at each facility were included in the study and it was determined that the questionnaire had reached saturation at this point with no new answers being recorded. It was not recorded how many declined to be interviewed but an informal estimate might suggest 10%. Questions were asked by two interviewers, who completed the questionnaire on their behalf and in their presence (the principle interviewer who held a Master's degree in Nature Conservation, trained a second interviewer, who held a Master's degree in Educational Psychology). A decision to make use of interviewers was deemed more appropriate for the following reasons: 1) It was felt that tourists would not readily complete a questionnaire if left to do so themselves, seeing the questionnaire as an interruption of the day's activities 2) having the interviewers scribe the responses meant that answers could be clarified before the tourist had departed and 3) it allowed the respondent an opportunity to get clarification if they did not understand a question, though the interviewer was careful not to lead a specific response. It took on average 10 minutes to complete one questionnaire but could take longer if the respondent wanted to talk about the topic after. The interviewer remained neutral and impartial throughout such discussions. Ethical clearance was granted for the study by the University of South Africa's College of Agriculture and Environmental Sciences, Human Health Research Ethics Committee (reference number: 2016/CAES/106). In view of the novelty of the topic, most of the 18 questions were open-ended, in order to collect as much detail as possible while allowing for unexpected responses. These were then compared, contrasted and classified through a process of coding (O'Cathain and Thomas, 2004). The same three facilities which granted approval for the ethological study also granted approval for the

questionnaires. Participants were allowed to withdraw from the interview at any point, though non did.

Part one of the questionnaire (Appendix B) requested demographic information: age (grouped into 3 broad age classes), continental association (if they had lived on multiple continents, then the one they most associated themselves with), gender and current dwelling (urban, suburban or rural environment). Part two dealt with controversies around lion cub interactions, and respondents were asked to provide their reasons for interacting if they were aware of such controversies (the controversies were not specifically discussed in an effort not to lead the respondents). Part three asked about the prior expectations and post interaction impact. Part four attempted to determine what importance value the respondent placed on the lion cub interaction, including comparison with other animals interacted with. Part five examined whether children were involved in their experience and if so, how did the interaction influence their experience. Part 6 looked at education during the interaction to determine what was learnt; and Part 7 asked how interactors perceived the welfare of the cubs they interacted with.

3.4.2 Statistical analysis

Logistic regressions were applied to the binary response variables, such as yes/no responses. The glm() function in the stats() package R (R Core Team, 2013) was used to generate the model with a logit link function. Wald type 3 analysis of deviance testing was used to assess factor significance through the Anova () function using the car () package (Fox and Weisberg, 2019).

For multinomial responses the multinom () function in the nnet () package (Ripley, Venables and Ripley, 2016) was used to generate a model with a logit link function. The open-ended questions were manually coded from qualitative responses. Again, Wald type 3 analysis of deviance testing was used to assess factor significance of the demographic factors, through the Anova () function using the car () package (Fox and Weisberg, 2019).

3.5 A utilitarian review

The philosophies and associated ethics around animal rights differ substantively to that of animal welfare. The philosophy of animal rights seeks to award animals the right to be in possession of their own existence and as such are not available to be used nor owned by man (Taylor, 2009). This philosophy pairs well with deontological ethics, which states that an action is intrinsically right or wrong regardless of its consequences (Animal ethics, 2021), hence a strong deontological animal ethic will seek to abolish all animal use, irrespective of any good it may serve (Abbate, 2014). Conversely, the philosophy of animal welfare acknowledges that humans both own and use animals but emphasizes that their use should seek to minimise total suffering while maximizing enjoyment for both the humans and the animals concerned (Patterson-Kane and Golab, 2013). Utilitarianism is the conferring ethic to this philosophy, which states that the wellbeing of every individual (including animals) counts and that actions should create the greatest happiness for the greatest number (Veenhoven, 2010).

Preston (2001) developed an Ethical Decision-Making Model which provides a universal ethical framework to evaluate various positions and enable the most fitting ethical response to a given situation. Verrinder (2016) amended and simplified the model in a study to assess moral judgement on animal ethics issues, making use of both deontology and utilitarianism. This study will therefore apply a similar model to that used by Verrinder (2016) but considering that the overall design and objective of this study has been in line with the philosophy of animal welfare, it is only fair and meaningful that the concluding ethical review be a utilitarian one. The model is presented as a matrix where all possible stakeholders are accommodated down the first column and the various positions to be evaluated are presented across the first row. The stakeholders considered in the review included South Africa as a nation, lion breeders as suppliers to the industry, the interaction facility owners as the affected enterprise, interaction facility employees, volunteers who pay for the experience, veterinarians for the lion cubs, tourism operators who facilitate a certain percentage of the tours, associated industries who exist as a spin-

off from the interaction facility such as marketing companies and restaurants, the tourists who come for the experience of interacting, the lion cubs themselves and the lion cub mothers who are used to produce the cubs, wild lion populations and also the natural environment as a whole. The four positions evaluated were 1) an unregulated lion cub interaction industry 2) a lion cub interaction industry providing the best possible welfare as identified through this study, also adhering to all the non-negotiables identified 3) a wildlife interaction experience with a more appropriate species which is provided freedom to interact and which is provided the highest level of welfare possible, and 4) the banning of all wildlife interactions. The corresponding cells within the matrix considered whether there might be any benefits for, or harms against, any of the stakeholders and what these were anticipated to include. Amended from Verrrinder's (2016) model, in addition to benefits and harms alone being indicated, mixed states wherein both benefits and harms may exist for a stakeholder under a specific position were reflected as such. The rationale for this was to allow for an easier visual appraisal of the situation as is often seen in harms-benefit studies where the cells of such matrices are also colour coded (Puhan et al., 2012).

3.6 Summary

Five different methodologies were employed to address the five research aims. The first sought to workshop the topic of lion cub interactions making use of a wide range of stakeholders to understand the industry and associated welfare concerns for the cubs. The second made use of an online conjoint analysis survey to secure a wider stakeholder group who would then rank and weight the welfare issues. An ethological study was the method used in the third aim, which allowed for the behaviour of the cubs to be documented and the effect of interactions on their behaviour known. The fourth aim made use of face to face questionnaires which determined the motivations and perceptions of the interacting tourist. Finally, a harms-benefit analysis was applied to a utilitarian ethical review of the practice.

CHAPTER 4: RESULTS

The results presented in Chapter 4 will appear in the same order as the methodology presented in Chapter 3. The results from the stakeholder workshop (section 4.1) reveal what welfare issues are faced by the lion cub interaction industry and the results of their ranking and weighting through the online conjoint analysis presented (section 4.2). The ethology of the cubs is presented along with the presence of abnormal behaviours (section 4.3) and follows with results of the questionnaire (section 4.4) which reveal the perceptions and motivations of interactors. The chapter ends with the concluding of a harms-benefit analysis for various interaction positions (section 4.5)

4.1 Stakeholder workshop

Twelve of the fifteen participants indicated that they did not wish to be anonymous, and that the opinions they expressed, either in their professional and or personal capacities, should be acknowledged (Appendix C). This supports an assumption that most participants freely participated in and were neither hindered nor influenced in the information they provided. The clear instructions presented at the onset complimented the professional facilitation which ensured that opposing ideas were encouraged, heard, respected and noted. The professional facilitator had been brought in as it was anticipated that it may become a heated debate given the emotive topic. She maintained order and firmly managed the process, ensuring that each participant was allowed the opportunity to express themselves without fear of attack. The benefit to having the facilitator was that much was achieved and discussed within such a short period. It is thought that had she not been there, that there was an increased chance for discourse, and this may have resulted in less substantive information being obtained. It was interesting to see that certain groups did avoid meeting up or chatting with others during breaks and others kept within their own circles. The animal rights advocacy representative, animal welfare representatives, ethologist and rehabilitator for example did not mix with the lion breeders

and or handlers. This may have been influenced by the fact that they knew each other outside of the workshop.

Stage 1 nominated welfare issues:

The welfare issues identified by the 15 stakeholder participants during Stage 1 of the facilitated workshop are listed according to the votes received during Stage 2 of the same facilitated workshop (Table 2). Stakeholder participants who identified the original welfare issue as well as those who voted for them as important after having all the welfare issues at their disposal to review are presented.

Table 2 Animal welfare issues identified in Stage 1 and the stakeholders who identified them, listed in declining order of support in Stage 2 (abbreviations used: Nature conservationist (NC), Government organisation official (GO), Wildlife rehabilitator (WR), Animal rights advocacy representative (AR), Wildlife veterinarian (WV), Animal welfare organization representative (AW), Lion handler (LH), Animal ethologist (AE))

Identified animal welfare issue	**Stakeholder group who identified the issue in Stage 1**	**Stakeholder group who voted for the issue in Stage 2**	**Number of votes cast in Stage 2**
Lack of governance and regulation	NC GO	LB GO WR AR WV AW	9
Cub nutrition	LB NC GO LH WR AR WV	LB GO AR WV AW	7
Extent of interaction	GO LH WR AR AW	LB GO LH AW	6
Cubs ability to choose their environment (ability to retreat from an interaction)	LB NC GO	NC GO WR	5

		AW	
Inbreeding in the industry	LB NC GO	AE LB WV	4
Keepers understanding of cub behaviour	AE AW	NC LH	3
Species-specific needs of cubs	AE NC	AE NC WR	3
Impact of premature removal from mother	LB AR WV AW	AE AR AW	3
Exit strategy for cubs (the future of the cub once too old for interactions)	GO WV AW	WR AR AW	2
Hygiene in enclosure	LB GO LH AW	LH	1
Sleep needs of the cubs	LB AR	LH	1
Age of removal from the mother	LH WR AR AW	NC	1
Social needs of the cubs	LB NC		0
Affective states of the cubs	GO AW		0
Entry strategy of the cubs (where the cubs were sourced)	NC GO		0

‘Inadequate governance and regulation’ were identified in Stage 1 by only two groups, the Government organisation representatives and Nature conservationists, but was then rated to be the leading welfare concern during Stage 2 of the workshop having been raised by six of the nine stakeholder groups. Discussion focused on the lack of knowledge on the size and extent of the industry and the need for registration of facilities, the setting of standards supported by regulation, including compliance procedures and the training of handlers and caregivers.

All except the animal ethologist and the welfare non-governmental bodies identified nutrition as the next most important welfare issue. Both the quality and the quantity of the food provided were identified as core nutritional concerns, which was believed to lead to poor physiological development as a result. The wildlife rehabilitator further identified incorrect feeding techniques as a welfare concern, such as when inexperienced volunteers and or interaction participants bottle-feed the cubs, which can lead to aspiration pneumonia if milk enters the lungs.

The amount of time participants spent interacting with the cubs was the third most important concern. Participants reported that cubs need time to rest and institutions may have the cubs on display for long periods. This was perceived to lead to physical and mental developmental problems with the cubs, adding to future welfare concerns.

Having a lack of choice in their environment was identified next, which chiefly focused on the inability of the cubs to choose to retreat from the constant forced human interactions and seek refuge. Although it was reported that some institutions do have an area to which cubs can retreat, others have cubs permanently on display with constant access during opening hours.

Inbreeding in captive lions was identified as a further, but less important, welfare concern for the individuals affected by the associated side effects. It was considered to

originate from the desire to purposefully retain a genetic trait (such as a large black mane in males, a desirable trait for the hunting industry, and a possible destination for future cubs) but also linked to ineffective record keeping and stud book management, which in turn was related to inadequate governance and regulation.

The stakeholders' defined behavioural knowledge as the necessary knowledge of lion cub behaviour required in order to raise and handle the cub correctly. The lack of such knowledge by lion cub handlers, was recognised as a welfare problem. Animal welfare organisation representatives raised concerns around methods of training the cubs to ensure safe interactions with participants, particularly the use of negative reinforcement, and the animal ethologist identified imprinting, habituation and desensitisation of the cubs as welfare-related concerns. A further concern was raised regarding the species-specific needs of the cubs, related to their limited ability to express their natural behaviours within the constraints of the interaction environment.

Impact of forced removal of the cub from its mother was believed to cause welfare problems with the cub, whose development was likely to be affected, and the mother, who would potentially suffer separation anxiety, especially if done repeatedly. Participants reported that captive breeding mothers often reject their cubs, which was discussed as a further welfare concern.

Exit strategy for the cubs was nominated as an issue, relating to where the cubs go once they are too old for cub interaction activities, in particular, the future of hand-reared cubs. While no specific welfare concerns were listed, it is speculated that ethical issues pertaining to canned hunting and the bone trade were the underlying causes for concern.

Hygiene was cited as a welfare concern for two reasons: first, the hygiene of the housing facility and second, potential zoonotic disease transfer to and from the household

pets of interaction participants, who may then convey the disease to the cubs during the interaction.

Sleep time was believed to be compromised by the need for people to interact with the cubs over extended hours. The lack of sufficient sleep or even the quality of sleep were therefore identified as welfare concerns.

The nomination of ‘Age of removal’, as a separate concern to the ‘Impact of removal’ concern, was discussed and the stakeholders believed them to be two separate issues with their own separate welfare concerns. The age of removal specifically referred to whether access was given to colostrum and the mothers’ milk for an adequate enough time, prior to being removed. This welfare concern was therefore mainly linked with nutrition of the cub. The impact of removal was mentioned as possibly resulting in a psycho-physiological stress.

Another welfare issue nominated was the social needs of cubs, referring to the denial of the social interaction that they normally get from other lions in a pride, most pronounced being that from the mother. A particular case is that of isolated cubs on display, away from other cubs.

Affective states, in a psycho-physiological construct, was one of the final issues nominated, together with the entry strategy for the cub. It was reported that many cub interaction-offering facilities do not breed some or all of their own replacement cubs, and there is concern for the welfare of both the cubs coming from distant breeding facilities and the welfare of the mothers in those facilities.

Stage 2 nominated welfare issues:

Those who identified specific welfare issues during Stage 1 did not always vote for those issues when asked to rank their importance during Stage 2. Stakeholders initially identified welfare issues based on their experiences and or frames of reference. Upon having the wide array of welfare issues set up before them, stakeholders were able to consider all the welfare issues in relation to each other and were able to vote for them accordingly. There was no significant relationship (χ^2_{11}= 11.26; p = 0.42) between the 'Identified animal welfare issue' raised and the 'affiliation of the stakeholder'.

The NMDS ordination (Figure 1) indicated that there was an association between two specific clusters of stakeholders. The first being the lion handlers, lion breeders, wildlife veterinarian, animal rights advocacy representative and the animal welfare organization representatives, who are noted to typically all deal directly with captive lions. The associated issues for this cluster dealt with inbreeding, nutrition, interaction time management and governance. The second cluster comprised government organisation officials, the wildlife rehabilitator, animal ethologist and nature conservators, whose experiences are mostly with wild lions. The issues they considered most pertinent included the cub's ability to choose its environment, the exit strategy of the cubs and behavioural species-specific knowledge held by caretakers.

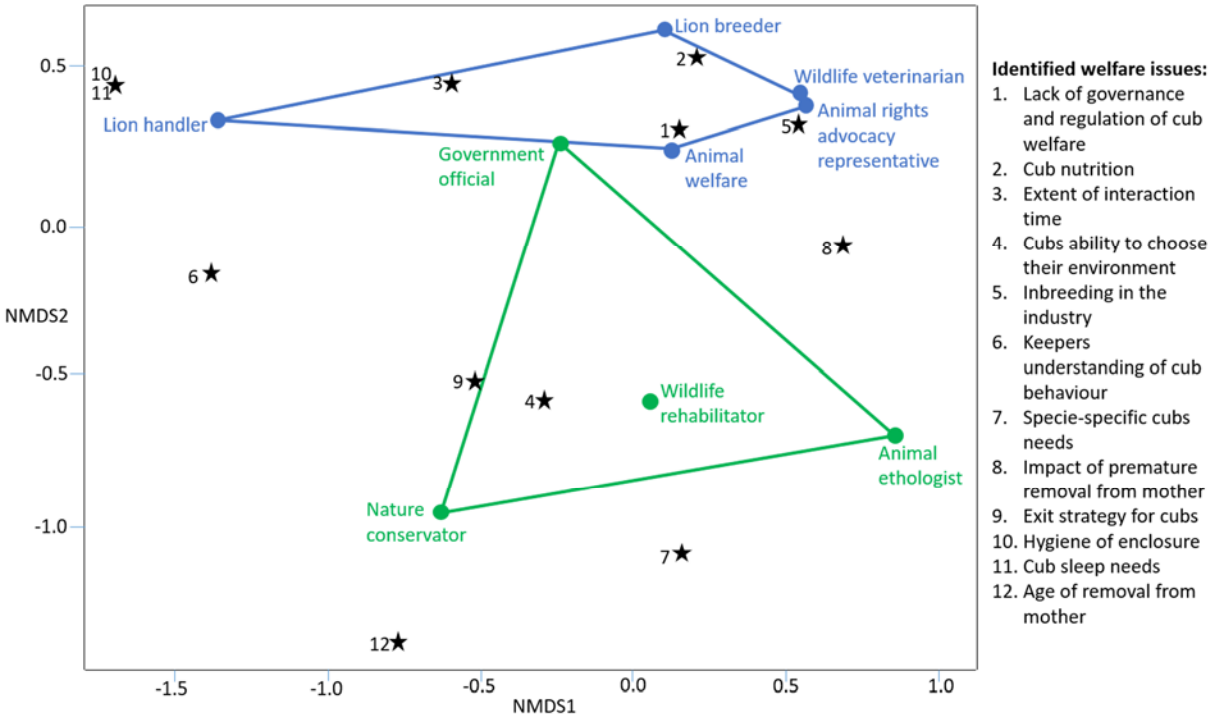

Figure 1 The non-metric multidimensional scaling ordination indicating the associations between the workshop stakeholder participants and the identified animal welfare themes

Stage 3 Non-negotiable welfare issues:

At the end of the workshop, during Stage 3, all the stakeholder participants conversed and unanimously agreed upon the following non-negotiable requirements for cub tourism interaction facilities:

1. cubs used in interaction activities should not be sedated
2. no cub should suffer prolonged misery if they are ill
3. no mutilations, such as declawing, may be allowed
4. no cubs interacted with should exit into the ranching industry
5. no cubs interacted with should exit into the animal parts trade
6. no forced interactions should be allowed

7. no untrained staff may be allowed to handle cubs
8. lion cub interaction facilities must have access to a wildlife veterinarian
9. no sick animals may be used in public displays

4.2 Conjoint analysis survey

Sixty participants completed the online survey and another 41 incomplete surveys were discarded because an adaptive conjoint analysis survey requires completion in order for analysis to be concluded. There were two possible reasons for the high attrition, the first being that 98 pairwise questions may have been considered too many to complete. However, a study by Fernie *et al*. (2012) on great apes had 17 attributes and was able to obtain 359 responses as did a study by Mactaggart, Waran and Phillips (2021) on racehorses with 14 attributes, generating 224 responses. The second reason may be through a misunderstanding about how the survey functioned, and not wanting to make a choice between “two evils” as one respondent noted in an email to the researcher afterwards. The demography of the participants (Table 3) were from all 10 qualifying affiliations invited, though groups such as Nature Conservators (25.0%) and Government officials from relevant Departments (18.3%) dominated the responses. Representation from wildlife veterinarians (10.0%), academics with lion research experience (11.7%) and animal welfare group representatives (11.7%) were similar. Experience in these affiliated fields was dominated by those with 16-20 years of experience (25.0%) and those with 6-10 years (21.7%). Experience was determined by the respondents themselves and did not relate to being employed in the sector. Females dominated the participants (65%) and most responses were received by South African residents (81.7%).

The normalized attribute weights and the mean utility values of the individual levels of attributes are presented in Table 4. The weight when multiplied with the single attribute score produced the mean utility values expressed in Figure 2. Utility values represent the relative importance (weights expressed in %) of the attributes, summarized by the attribute rankings. These utility values ranged from 6.0% to 11.2% and were ranked in

the following descending order: social grouping > cubs' ability to choose their environment > care takers > breeding > vaccinations and parasite control > nutrition linked to removal from mother > enrichment > number of interactions per day > training > extent of interaction > disease transfer > nutrition up until six months of age.

Table 3 Demographics of the online adaptive conjoint analysis survey participants (n=60)

Demographic	**No. of Respondents (%)**
Affiliated experience	
Lion cub handlers	2 (3.3)
Lion owners and or breeders	4 (6.7)
Nature conservators	15 (25.0)
SA government officials working for relevant Departments	11 (18.3)
Wildlife ethologists	4 (6.7)
Wildlife rehabilitation specialist	1 (1.7)
Wildlife veterinarian	6 (10.0)
Academics with lion research experience	7 (11.7)
Animal rights advocacy representatives	3 (5.0)
Animal welfare organization representatives	7 (11.7)
Years of experience	
<1 year	3 (5.0)
1-5 years	10 (16.7)
6-10 years	13 (21.7)
11-15 years	7 (11.7)
16-20 years	15 (25.0)
>20 years	12 (20.0)
Gender	
Females	39 (65.0)
Males	21 (35.0)
South African residents	
Yes	49 (81.7)
No	11 (18.3)

Table 4 Representation of the normalized attribute weights and their respective mean utility values

Attribute	**Attribute weight (sum=1)**	**Level**	**Single attribute score (0-100%)**
Breeding	0.098	Purposefully inbred to retain traits	0.0
		Ad hoc breeding	56.4
		Use of a studbook	100.0
Care takers	0.098	Multiple inexperienced volunteers and bottle fed by visitors	0.0
		Multiple semi-trained volunteers	55.0
		Trained full time handlers only	100.0
Nutrition linked to removal from mother	0.086	Removal after birth	0.0
		Removal after 2 days	48.5
		Removal after 2 weeks	100.0
Nutrition up until 6 months of age	0.060	Replacer milk until 2 months followed by chicken pieces then chicken carcasses	0.0
		Replacer milk until 4 months while introducing chicken pieces then chicken and meat carcasses	61.6
		Replacer milk until 6 months while introducing feline pellets then chicken pieces then chicken and meat carcasses	100.0
Number of interactions per day	0.077	> 200 interactions per day	0.0
		100 - 200 interactions per day	44.4
		< 100 interactions per day	100.0
Cubs' ability to choose their environment	0.101	Sleeping cub interacted with and prevented retreat from an interaction	0.0
		Sleeping cub interacted with but allowed to retreat from an interaction	62.6
		Sleeping cubs not disturbed and allowed to retreat from an interaction	100.0
Training	0.070	Inappropriate behaviour discouraged by handlers and interactors, as seen fit	0.0

		Tap on nose for inappropriate behaviour, applied by handler only	60.9
		No training & no repercussion for inappropriate behaviour	100.0
Social grouping	0.112	Cubs raised in isolation	0.0
		Cubs grouped but split during interaction hours	67.4
		Cubs always together	100.0
Extent of interaction	0.061	Carried and handled	0.0
		Entire body stroked	54.9
		Backs & abdomen only	100.0
Vaccinations & parasite control	0.093	No vaccinations & parasite control	0.0
		Parasite control only	51.0
		Vaccinations & parasite control provided	100.0
Disease transfer	0.061	No foot baths and hand disinfectants used	0.0
		Hand soap wash only	53.8
		Foot baths and hand disinfectants used	100.0
Enrichment	0.084	No toys or climbing structures provided	0.0
		Climbing structures only	64.0
		Toys and climbing structures provided	100.0

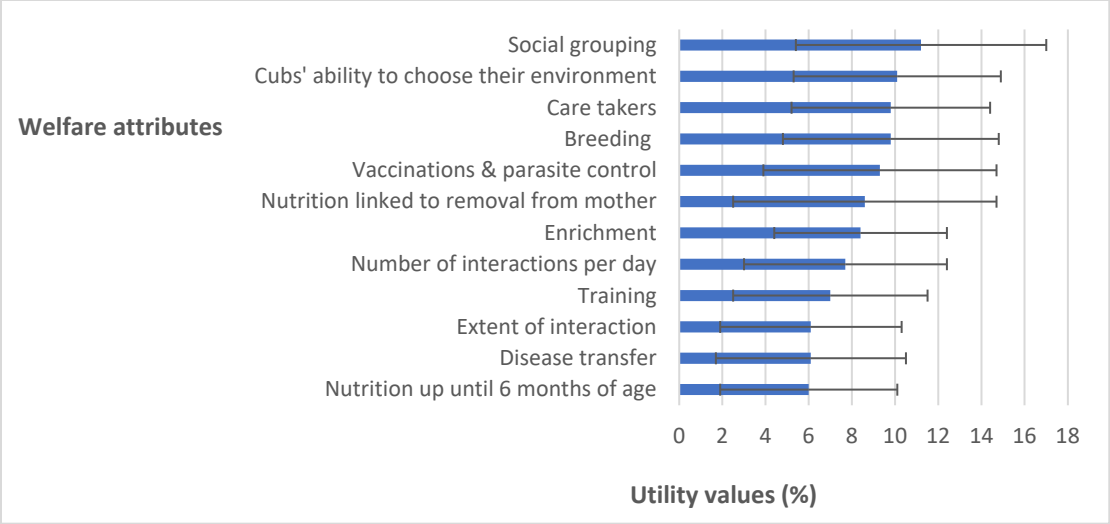

Figure 2 Utility values of the welfare attributes included in the online adaptive conjoint analysis survey, indicating their mean values and standard deviations.

Kendall's Coefficient of Concordance of the 60 participants' 24 marginal utility value rankings was 0.126 (range 0-1). A χ^2 test for independence revealed no significance between the mean weighted attributes and any of the demographic affiliations (χ^2_{88} = 66.961; p = 0.95) (Appendix D). Years of experience of an affiliate did not differ significantly (χ^2_{55} = 30.128; *p* = 1) for the mean weighted attributes (Appendix E). Gender too was not significant for the mean weighted attributes (χ^2_{11} = 0.9122; p = 1.00) (Appendix F) and residency in South Africa was not significant (χ^2_{11} =4.866; p = 0.94) for the mean weighted attributes (Appendix G).

The NMDS ordination (Figure 3) indicated that there was an association between the nature conservators, wildlife veterinarians, government officials, lion breeders, animal welfare organisation representatives and the lion handlers in terms of how they voted on the identified welfare issues. The animal rights advocacy group representatives, academics and animal ethologists appeared as outliers to the other stakeholder groups.

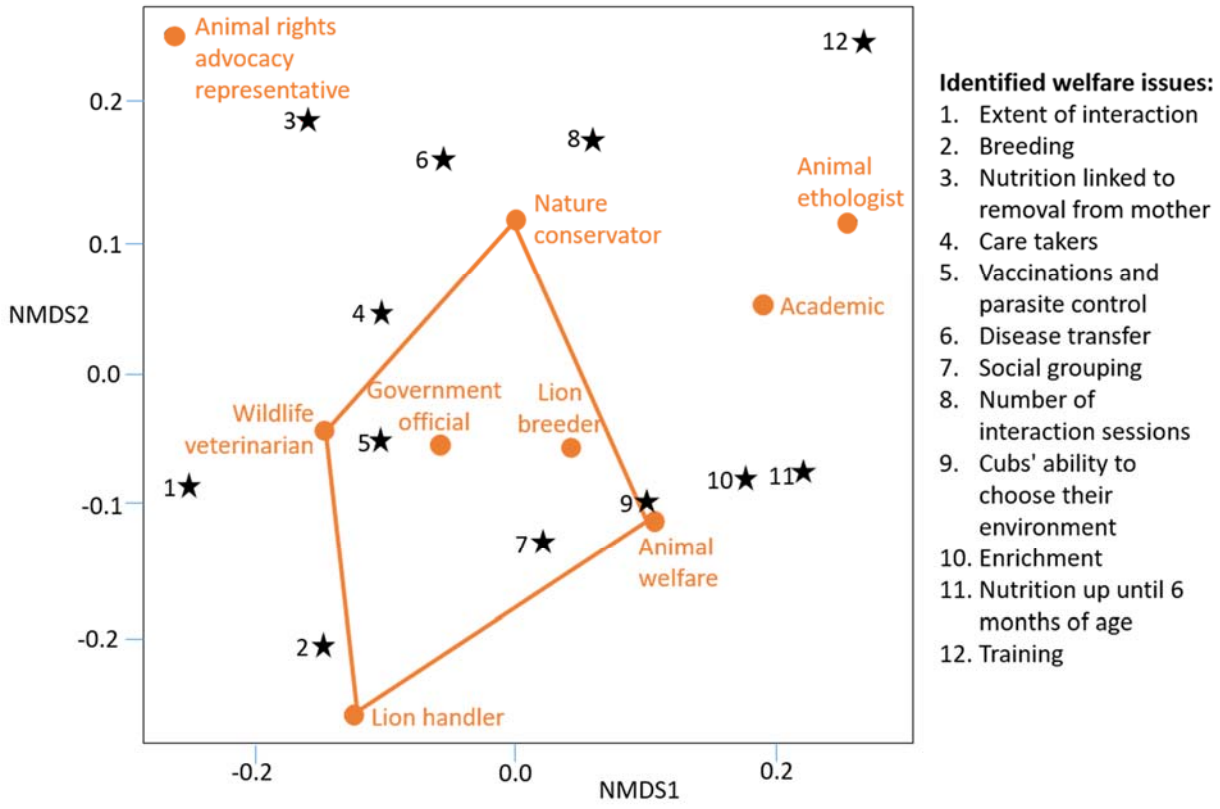

Figure 3 NMDS ordination indicating the associations between the conjoint analysis participants' affiliation and the mean weighted utility value of the welfare attribute

The *1000Minds* software package produces a value model to score a multi-attribute situation (Hansen and Ombler, 2008). This decision-making tool produces a value for each attribute by multiplying the weight of the attribute with its single attribute score. Within an attribute, the values are relative to each other. Using the 'Social grouping' attribute depicted in Table 5 below as an example, 'Cubs always together' score a welfare value of 11.2% and this means that it is 3.7% more important to a cub's overall welfare to be in this state than 'Cubs grouped but split during interaction hours' which scored 7.5%. This application does not necessarily provide evidence for a model's validity (Hansen and Ombler, 2008), but can be used to assist in decision-making. The following model (Table

5) shows how lion cub welfare can be scored at an institution taking into account the attributes used, calculated from the 60 respondents' weighted rankings.

Table 5 A value model (%) for rating the welfare of lion cubs used in tourism wildlife interaction facilities.

Attribute	**Weighted ranking**	**Score**
Social grouping		
Cubs raised in isolation	0.0%	
Cubs grouped but split during interaction hours	7.5%	
Cubs always together	11.2%	
Cubs' ability to choose their environment		
Sleeping cub interacted with and prevented retreat from an interaction	0.0%	
Sleeping cub interacted with but allowed to retreat from an interaction	6.3%	
Sleeping cubs not disturbed and allowed to retreat from an interaction	10.1%	
Care takers		
Multiple inexperienced volunteers and bottle fed by visitors	0.0%	
Multiple semi-trained volunteers	5.4%	
Trained full time handlers only	9.8%	
Breeding		
Purposefully inbred to retain traits	0.0%	
Ad hoc breeding	5.5%	
Use of a studbook	9.8%	
Vaccinations & parasite control		
No vaccinations & parasite control	0.0%	
Parasite control only	4.7%	
Vaccinations & parasite control provided	9.3%	
Nutrition linked to removal from mother		
Removal after birth	0.0%	
Removal after 2 days	4.1%	
Removal after 2 weeks	8.6%	
Enrichment		
No toys or climbing structures provided	0.0%	
Climbing structures only	5.4%	
Toys and climbing structures provided	8.4%	
Number of interactions per day		
> 200 interactions per day	0.0%	
100 - 200 interactions per day	3.4%	
< 100 interactions per day	7.7%	

Training		
Inappropriate behaviour discouraged by handlers and interactors, as seen fit	0.0%	
Tap on nose for inappropriate behaviour, applied by handler only	4.3%	
No training & no repercussion for inappropriate behaviour	7.0%	
Extent of interaction		
Carried and handled	0.0%	
Entire body stroked	3.4%	
Backs & abdomen only	6.1%	
Disease transfer		
No foot baths and hand disinfectants used	0.0%	
Hand soap wash only	3.3%	
Foot baths and hand disinfectants used	6.1%	
Nutrition up until 6 months of age		
Replacer milk until 2 months followed by chicken pieces then chicken carcasses only	0.0%	
Replacer milk until 4 months while introducing chicken pieces then chicken and meat carcasses	3.7%	
Replacer milk until 6 months while introducing feline pellets then chicken pieces then chicken and meat carcasses	6.0%	
Total utility score		

4.3 Cub ethology

Each facility was observed to manage their cubs and the interaction experience in a unique way. They differed in the number and type of staff responsible for the cubs' care, the ages of cubs used, their duration and frequency of interactions, the manner of the interaction allowed, and the disciplining of the cubs by staff (Table 6).

Table 6 The three lion cub facilities included in the study and the differences in the management of the lion cub interactions

Management action	Facility A	Facility B	Facility C
Cubs			
Cub starting age of interaction	34 d	34-38 d	57-103 d
Cub ending age of interaction	100 d	189 – 193 d	182 – 271 d
Interactions			
Interaction periods with the public	Predominantly weekends and public holidays; minimal midweek activity, anytime between 0800h - 1700h	Two set interaction sessions every day, at 0900h and 1500h	Predominantly continuous, every day of the week, from 0800h - 2000h
Number of interactors within a recording day	Range 0-65; $\bar{x}$=24	Range 9-71; $\bar{x}$=31	Range 0-298; $\bar{x}$=102
Extent of interaction	Unrestricted	Head and back petting encouraged but other interactions allowed if not aversive to cub	Head and back petting only, but occasionally deviated from when not observed by handler
Discipline	None by handler; occasionally by interactor when not observed by handler	Tap on the nose by handlers and communicated as acceptable for the interactor to use if required	Control seldom required by handlers due to inactive nature of cubs
Staff			
Rearing and feeding of cubs	Keeper	Volunteers	Keeper
Cleaning of enclosure	Non interacting staff	Non interacting staff	Non interacting staff

4.3.1 Cub activity budgets

An activity budget of the lion cubs studied at the three interaction facilities (Table 7) shows high variation in behaviour, with large SD values, but the low SEM values give confidence in the data (Barde and Barde, 2012).

Table 7 Activity budget as a % of total time (Sample mean; SD; SEM) of lion cubs (n = 12) used in three wildlife tourism interaction facilities

Behaviour	Sample mean (% of total time)	SD (% of total time)	SEM (% of total time)
Inactive	**62.6**	**19.75**	**1.71**
Sleeping	38.2	18.71	1.61
Resting	23.9	12.12	1.04
Play	**13.1**	**11.22**	**0.97**
Self-play	6.19	7.408	0.552
Conspecific play	5.54	6.417	0.552
Human play	1.62	3.049	0.262
Attentive	**13.0**	**8.41**	**0.73**
Alert	12.2	7.81	0.67
Investigatory	0.36	1.027	0.088
Excitement	0.59	2.344	0.202
Locomotion	**6.19**	**4.346**	**0.377**
Flight	0.24	0.551	0.047
Movement	5.97	4.091	0.352
Grooming	**1.38**	**1.831**	**0.159**
Self-grooming	1.06	1.690	0.145
Conspecific grooming	0.28	0.704	0.061
Human grooming	0.08	0.401	0.034
Abnormal	**0.82**	**3.460**	**0.300**
Stereotypy	0.55	3.329	0.286
Non-nutritive suckling	0.22	0.828	0.071
Shaking and trembling	0.04	0.488	0.042
Fence biting	0.01	0.141	0.012

Aggression	**0.39**	**0.872**	**0.076**
Conspecific aggression	0.26	0.660	0.057
Human aggression	0.15	0.524	0.045
Other	**2.44**	**5.085**	**0.441**
Mock mating	0.00	0.017	0.002
Flehmen	0.02	0.207	0.018
Elimination	0.13	0.301	0.026
*Ingestion**	2.37	4.966	0.427

**Ingestion not a true representation as may not have occurred within the recording periods but did occur each day*

Graphical depiction of the mean values for behaviour of the cubs at the three facilities (Figure 4) suggests that Facilities A and B were similar to each other and Facility C differed from these two for some behaviours. This visual interpretation is supported by the statistical analysis of the interaction between 'Facility and Behaviour' which was a significant predictor of the Generalised linear model outcomes (Wald $\chi^2_{14} = 100.78$; $p < 0.001$).

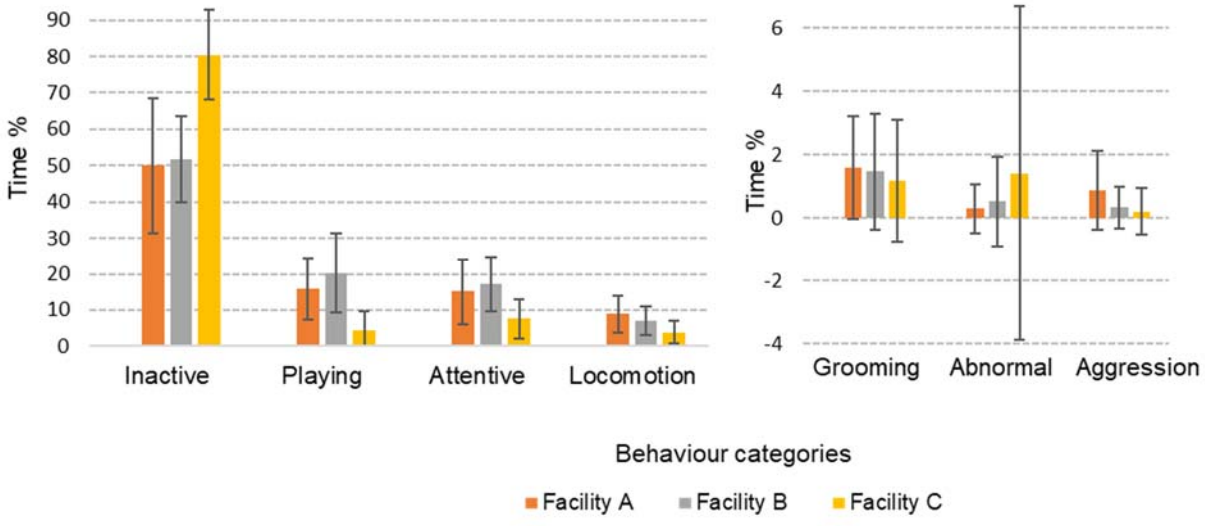

Figure 4 Sample mean ± SD % of time spent in behaviour categories by the lion cubs across the three interaction facilities

Wilcoxon rank sum tests applied to each pair of facilities revealed that Facility A and B were significantly different to Facility C ($p<0.005$), and not significantly different to each other for inactive, play, attentive, locomotion and aggression behaviour categories. Grooming and abnormal behaviour categories were not significantly different between Facilities (Table 8).

Table 8 The results of Wilcoxon rank sum tests applied to each pair of Facilities (AB, AC, BC) to determine significant differences across behaviour categories

Behaviour category	Facility pair AB	Facility pair AC	Facility pair BC
Inactive	W= 676, adj. p= 0.599	W= 1273, adj. p< 0.005	W= 2667, adj. p < 0.005
Play	W= 580, adj. p= 0.137	W= 187, adj. p< 0.005	W= 231.5, adj. p< 0.005
Attentive	W= 619, adj. p= 0.273	W= 348.5, adj. p< 0.005	W= 451.5, adj. p< 0.005
Locomotion	W= 876, adj. p= 0.142	W= 256, adj. p< 0.005	W= 689.5, adj. p< 0.005
Grooming	W= 846, adj. p= 0.293	W= 493, adj. p= 0.089	W=1240.5, adj. p= 0.293
Abnormal	W= 687, adj. p= 0.944	W=706, adj. p= 0.962	W=1343.5, adj. p= 0.944
Aggression	W= 941.5, adj. p= 0.031	W= 363.5, adj. p< 0.005	W= 962.5, adj. p< 0.005

4.3.2 Human interaction frequency

Human interaction frequency within a recording day had no significant effect on the behaviour categories of the lion cubs (Z = 1.137, p = 0.255).

There was a trend (*r* (79) = -0.19; p = 0.08) for sleeping behaviour to decline with increased human interaction frequency in Facility pair AB (Figure 5), while human interaction frequency did not have a statistically significant effect on resting behaviour for Facility pair AB (*r* (79) = +0.16; p = 0.15). High sleeping times were significantly associated with low resting times at Facility pair AB (*r* (79) = -0.27, p = 0.01) (Figure 6). Sleeping behaviour at Facility C was not influenced by human interaction frequency (*r* (50) = +0.03, p = 0.86), while a decrease in resting behaviour was significantly associated with an increase in human interaction frequency (*r* (50) = -0.03, p = 0.03) (Figure 7).

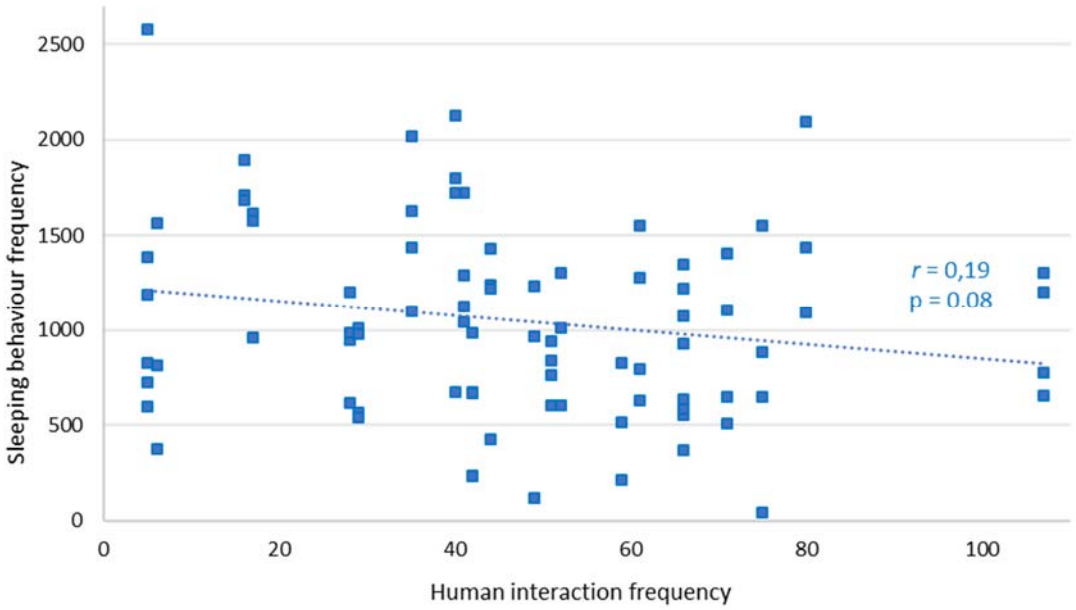

Figure 5 Relationship between sleeping behaviour frequency of cubs and the human interaction frequency within a recording day at Facility pair AB

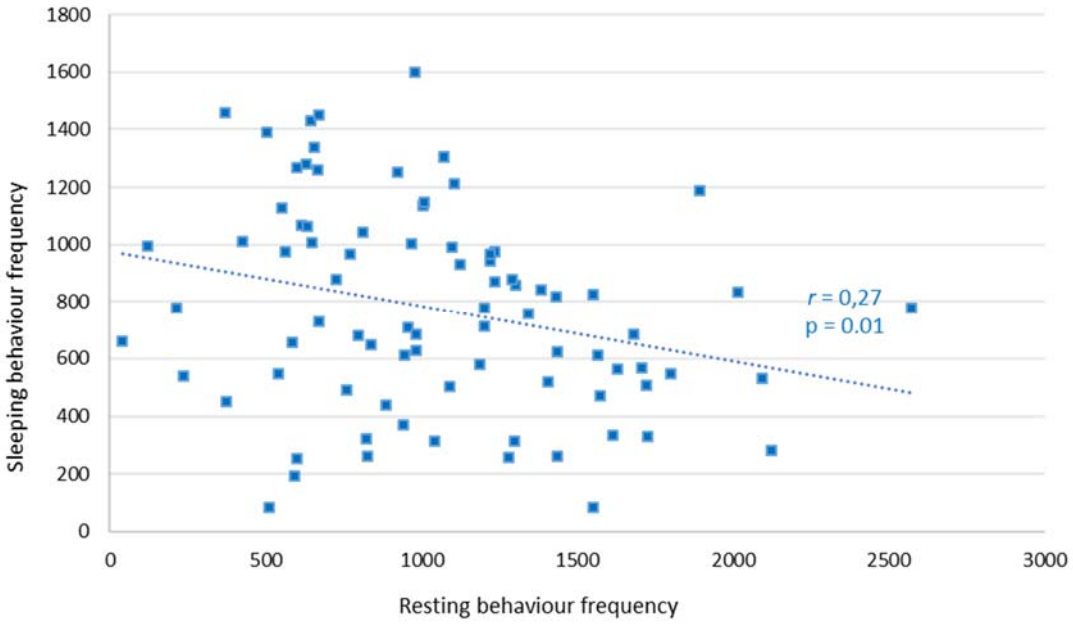

Figure 6 Relationship between sleeping behaviour frequency of cubs and the resting behaviour frequency of cubs within a recording day at Facility pair AB

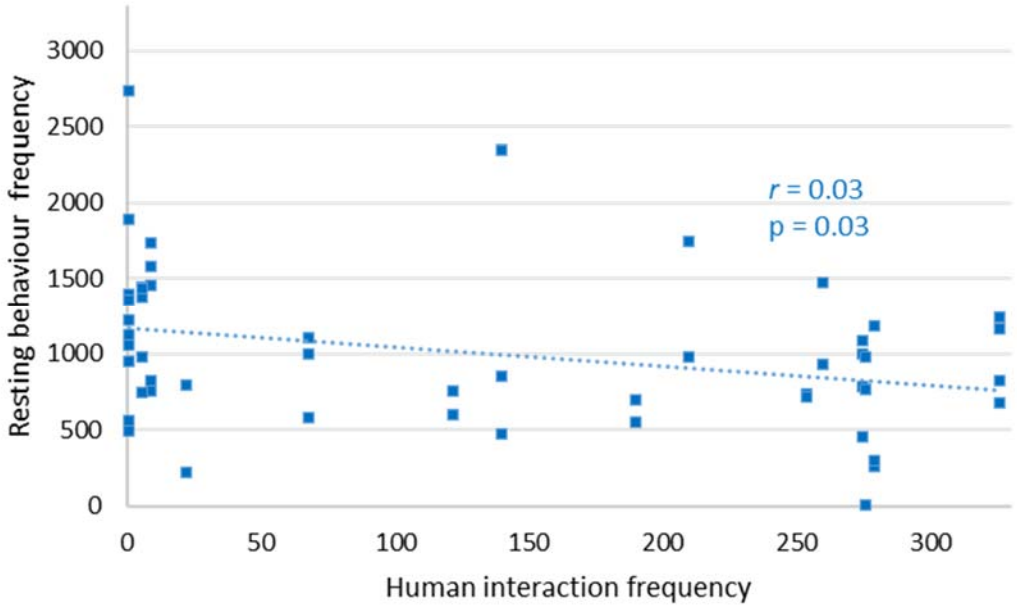

Figure 7 Relationship between resting behaviour frequency of cubs and human interaction frequency within a recording day at Facility C

Conspecific play behaviour decreased as human interaction numbers increased at Facility pair AB (r (79) = -0.25, p = 0.02) (Figure 8). Self-play behaviour frequency at this facility did not correlate with human interaction number (r (79) = +0.14, p = 0.21) and nor did that of human play (r (79) = +0.09, p = 0.44). Conspecific play at Facility C had no significant relationship with human interaction number (r (50) = +0.22, p = 0.11), and neither did self-play (r (50) = +0.22, p = 0.71). Play with humans at Facility C correlated positively with an increase in human interaction number (r (50) = +0.27, p = 0.05) (Figure 9).

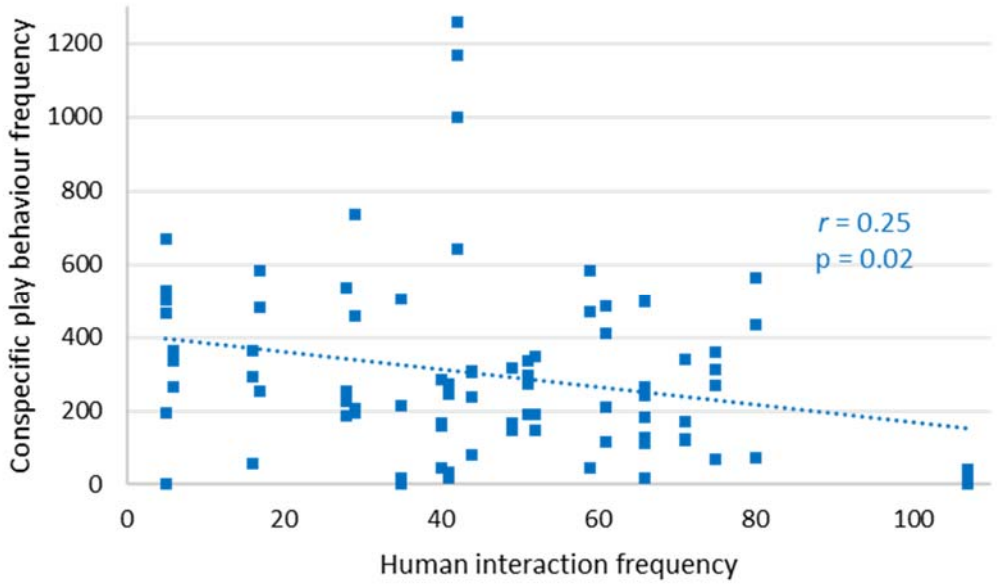

Figure 8 Relationship between conspecific play behaviour frequency of cubs and human interaction frequency within a recording day at Facility pair AB

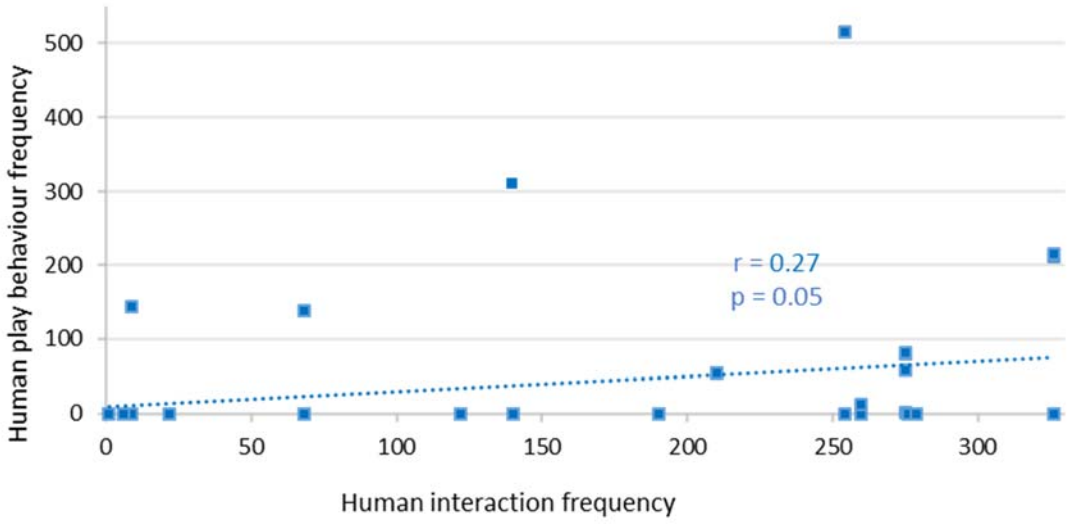

Figure 9 Relationship between human play behaviour frequency of cubs and human interaction frequency within a recording day at Facility C

Of all the Attentive behaviours, only alert behaviour frequency had a significant relationship with human interaction frequency at Facility pair AB (r (79) = +0.39, $p < 0.001$) (Figure 10). Investigatory behaviour (r (79) = +0.01, p = 0.94) and excitement (r (79) = +0.11, p = 0.31) had no significant relationships for Facility pair AB. Facility C had no significant relationships for alert (r (50) = +0.09, p = 0.52), investigatory (r (50) = +0.16, p = 0.31) nor excitement behaviours (r (50) = -0.14, p = 0.25).

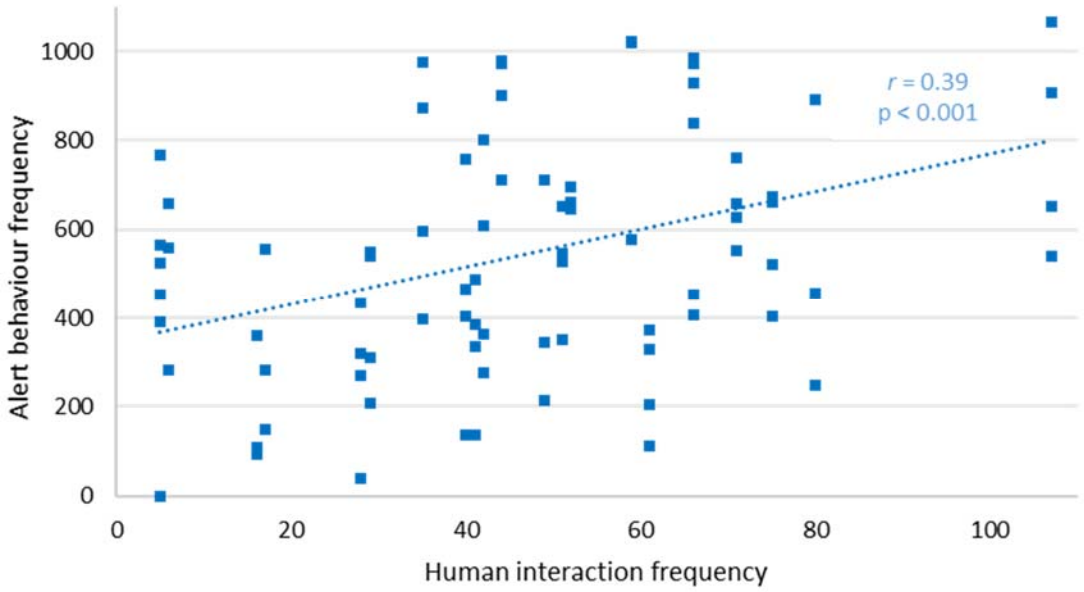

Figure 10 Relationship between alert behaviour frequency of cubs and human interaction frequency within a recording day at Facility pair AB

Human grooming by cubs was positively correlated with increased human interaction frequency (r (79) = +0.26, p = 0.02) in Facility pair AB (Figure 11). Neither self-grooming (r (79) = -0.13, p = 0.23) nor conspecific grooming (r (79) = -0.07, p = 0.54) were correlated with human interaction frequency. Cubs in Facility C showed no associations between self-grooming (r (50) = +0.03, p = 0.83), conspecific grooming (r (50) = +0.10, p = 0.47) nor human grooming (r (50) = +0.02, p = 0.88) with human interaction frequency.

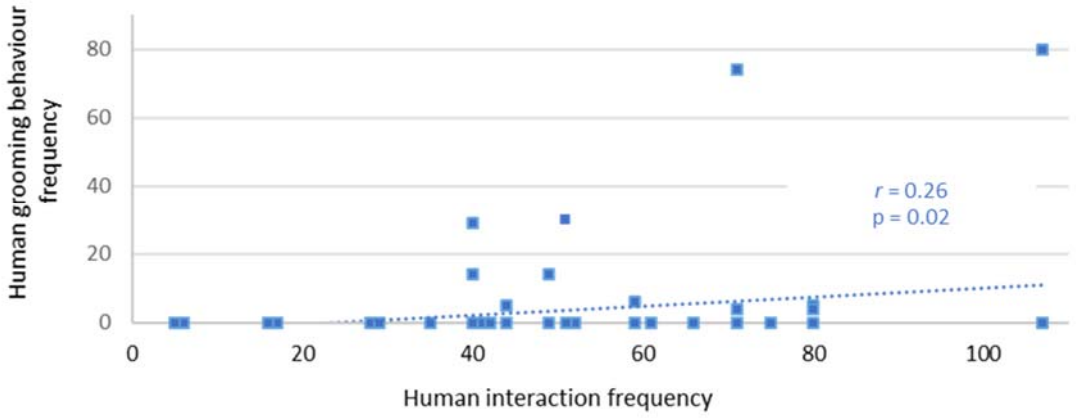

Figure 11 Relationship between human grooming behaviour frequency and human interaction frequency within a recording day at Facility pair AB

Increased human interaction frequency did not illicit an increase in either human-directed aggression (r (79) = +0.09, p = 0.37) or conspecific aggression (r (79) = +0.01, p = 0.90) in Facility pair AB, or in Facility C (human-directed aggression (r (50) = +0.14, p = 0.31), conspecific-directed aggression (r (50) = +0.04, p = 0.80)). However, in Facility pair AB, flight behaviour frequency correlated positively with human interaction frequency (r (79) = +0.55, p < 0.001) (Figure 12), but not in Facility C (r (50) = +0.02, p = 0.90). This flight behaviour frequency at Facility pair AB was correlated with human-directed aggression frequency at Facility pair AB (r (79) = +0.35, p = 0.001) (Figure 13).

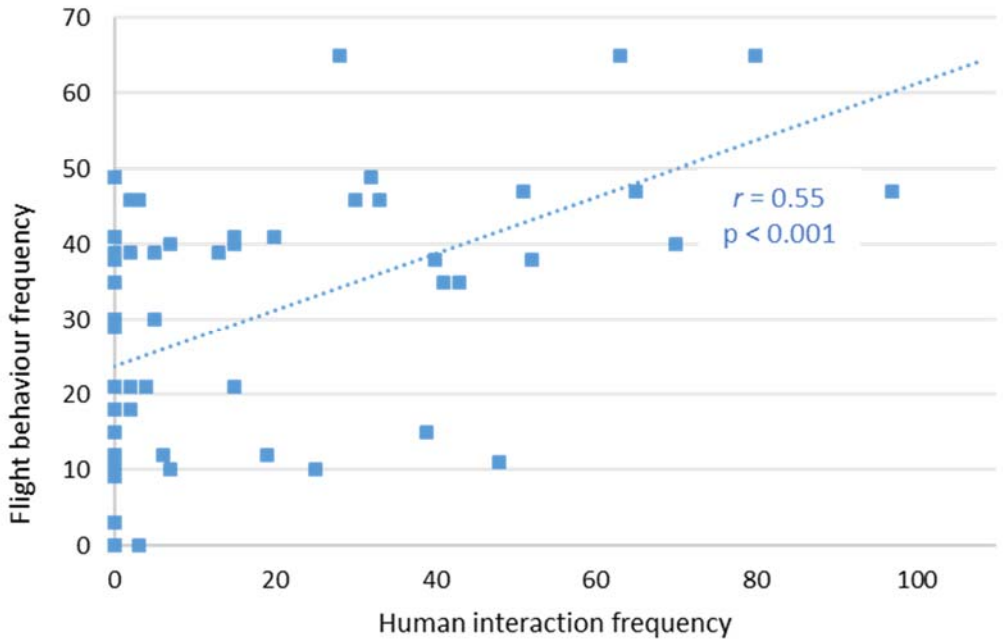

Figure 12 Relationship between flight behaviour frequency and human interaction frequency within a recording day at Facility pair AB

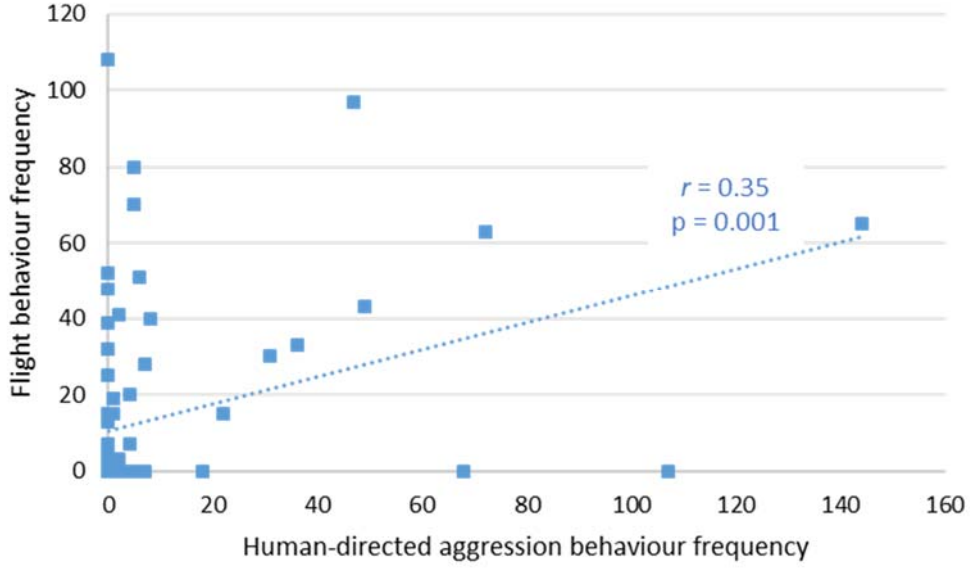

Figure 13 Relationship between flight behaviour frequency and human-directed aggression frequency for cubs within a recording day at Facility pair AB

4.3.3 Cub age effects

'Age of cubs', the second continuous predictor, had a significant effect on the behaviour categories ($Z = -2.835$, $p = 0.005$). Pearson correlation coefficients determined that age correlated positively with attentive, locomotion and aggression behaviour in Facility pair AB and with inactive, play and locomotion behaviour in Facility C (Table 9).

Table 9 Pearson correlation coefficients and significance for 'Age of cubs' applied across each behaviour category for Facility pair AB and Facility C

Behaviour categories	**Facility pair AB**	**Facility C**
Inactive	r (79) = +0.13, p= 0.253	r (50) = +0.34, p= 0.015
Play	r (79) = +0.03, p= 0.772	r (50) = +0.46, p< 0.001
Attentive	r (79) = +0.24, p= 0.031	r (50) = +0.02, p= 0.881
Locomotion	r (79) = +0.33, p= 0.003	r (50) = +0.44, p= 0.001
Grooming	r (79) = +0.10, p= 0.383	r (50) = +0.03, p= 0.851
Abnormal	r (79) = +0.09, p= 0.404	r (50) = +0.04, p= 0.752
Aggression	r (79) = +0.24, p= 0.028	r (50) = +0.11, p= 0.420

4.3.4 Rare behaviours

Some behaviours were too rarely recorded for statistical analysis and are only described. Pacing behaviour, as a possible form of stereotypy appeared to be unique to each facility in terms of causation and occurrence. Observations recorded during the scan sampling method, and which did not form part of the data used in the General linear model and subsequent Wilcoxon rank test, are also included. Facility A had only one incident of pacing which coincided with anxious behaviour during a positive encounter, that of meeting up with the keeper who had raised her. Pacing behaviour in Facility B (two observations) occurred when the cubs were confined to a travel crate, apparently resulting in frustrated behaviour and a desire to exit the confinement of the crate. One

female cub at Facility B paced after being prevented by the volunteers from performing non-nutritive suckling; she also paced during the time that a fire break was being burnt around the cubs' enclosure. Cubs in Facility C exhibited the most pacing observations (n=13) and for considerably longer periods of time (range 30 - 1316 s). Most pacing behaviours were observed when cubs were separated from each other into an adjoining enclosure with a visual barrier between (n=6). A possible frustration-induced pacing (n=2) was indicated by a focused and deliberate pacing along a fence line with another pacing (n=1) indicating anxiety shown towards a hissing cheetah in a neighbouring new enclosure. In another pacing incident, loud noises made by trucks and machinery, outside of the enclosure coincided with a fervent weaving type pacing action (n=1) being displayed at the gate, possibly indicating the desire to exit the enclosure. Finally, pacing was also observed by a cub (n=1) who recognized the keeper's voice outside that of the enclosure, and so this pacing appeared to reflect impatient anticipation for a positive experience. Appendix H details these pacing behaviours.

Non-nutritive suckling may also be an indicator of a potential problem behaviour. All three female cubs at Facility A exhibited this behaviour and it was restricted to the suckling of the ears. This suckling was observed six times (range 4 - 120 s and was no longer observed in these cubs after 66 days of age. Cubs in Facility B accounted for the most (n=15) non-nutritive suckling, consisting of both ear (33%) and genitalia (67%) suckling (range 2 - 265 s). This behaviour was actively stopped by management and volunteers if seen, suggesting that more and longer durations of suckling could have been observed if the cubs had been allowed. Non-nutritive suckling of ears was last observed in a cub at this Facility at 133 d of age, and at 168 d of age for genitalia suckling. Facility C only had one recorded attempt to ear suckle, but after 2 s the 108 d old cub spat out the ear.

Lastly, two rarely observed problem behaviours were observed. Female cub Shera at Facility B trembled for 204 seconds when she was 91 days of age. This was during the period described earlier, in which she also paced due to a firebreak being made around

the enclosure she was in. This behaviour was not observed again. Cub Amy at 85 d of age in Facility C was observed biting on the fence for 59 s, and again at 197 d of age (this observation lacks duration as it was recorded during a scan sampling session).

4.4 Interactor questionnaire

The demographics of the 300 respondents reveal that most were 31-50 years of age (61%), came from Africa (63%), lived in suburbia (72%) and 55% of the sample identified as female with the remaining 45%, identifying as male' (Table 10).

Table 10 Demographics of the questionnaire respondents (n = 300) at the three lion cub interaction facilities.

Demographics		**No. of respondents**	**(%)**
Age	31 - 50 years	183	61,0%
	18 - 30 years	77	25,7%
	> 51 years	40	13,3%
Continental association	Africa	188	62,7%
	Europe	50	16,7%
	North America	26	8,7%
	Asia	16	5,3%
	South America	12	4,0%
	Australasia	8	2,7%
Gender	Female	165	55,0%
	Male	135	45,0%
Dwelling	Suburbia	217	72,3%
	City	70	23,3%
	Rural	14	4,7%

Of the 300 respondents, 113 (38%) were aware of the controversy existing around the practice of interacting with lion cubs. The facility ($p = 0.72$), age of respondent ($p = 0.13$) and continental association ($p = 0.25$) were all non-significant predictors of this controversy knowledge. The coded reasons provided by the 108 of the 113 participants who responded to the question on why they still interacted with the cubs despite being aware of such controversies, included 74 respondents (69%) who indicated that they "still wanted the experience, irrespective of the controversy".

Referring to the controversy around the welfare of cubs at such venues, respondent 84 stated that he "*didn't want to go* [interacting] *because they have probably been petted excessively over the long weekend, but if not today, then when?*". Respondent 120 referred to the alternate controversy around the post interaction life of a cub and rationalised his decision to interact by stating that "*we would pet lambs and we know where they end up*". Respondent 46 did not elude to a specific controversy but stated that the "*experience is for my son despite the controversy*".

Fifteen (14%) said they had "verified the facility for themselves prior to visiting" and had felt the facility could not be associated with such controversy. Nine participants (8%) wished to "give the facility the benefit of the doubt" and so determine the situation for themselves. Eight participants (7%) felt secure in their decision to interact as a result of "recommendations provided by others who had interacted previously", and two participants (2%) were "dismissive of the controversy" and questioned its validity. The facility ($p = 0.10$), age of respondent ($p = 0.98$) and continental association of respondent ($p = 0.46$) were not significant as predictors of these coded responses.

Two hundred and twenty-one (74%) respondents indicated that they would still have visited the facility even if lion cub interactions were not offered, whilst the other 79 (26%) specifically visited to interact with the lion cubs. This response was not dependent on the facility visited ($p = 0.24$), age ($p = 0.23$), continental association ($p = 0.40$) or gender

of the respondents (p = 0.93). Four coded responses were derived from the 221 respondents as to why they had then decided to visit the facility. Eighty-two (37%) respondents visited the facilities “to experience the other wildlife”. Sixty-two (28%) respondents specifically visited for the “other facilities not associated with wildlife or lions” (28%), with the cubs becoming an addition to the day’s activities. Fifty-four (24%) were visiting for a general lion experience not necessarily interacting with the cubs and coded as “other lion activities”, while 22 (10%) were simply seeking something to experience for the day, “an outing”. These coded responses were not significant for age of respondent (p = 0.72) or the continental association of the respondent (p = 0.74) but differed between facilities (χ^2_{12} = 95.083; p < 0.0001). This significance is expected because of the very different facilities available at Facility A compared to those at Facility B and C, which were more similar.

Two hundred and fifty one of the 300 (84%) respondents felt that their expectations had been met through their interaction experience, while only 49 (16%) did not. Five coded responses were derived from the 300 respondents in response to their expectations around interacting with the lion cubs. Most respondents, 196 (65%), simply felt that “the interaction was the expectation” while 36 (12%) “expected to cuddle with smaller cubs but they were too big and/or rough”. However, 31 (10%) respondents “expected more action - cubs inactive and/or too small and/or time too short”.

Respondent 28, a 31-50-year-old female from Europe “*expected the cubs to be younger so that they could be held on the* [her] *lap”,* while Respondent 33, of similar demographics, reflected on a previous interaction she had had, stating that it was a *“pity they were not small, as I hoped to pick them up, as* [she had] *in Taiwan”.* A contrary opinion reflected by Respondent 259, a male over 51 years of age from Africa was that he “*expected them to be less tame and a bit more wild”*.

Twenty-six (9%) respondents felt that the “experience exceeded just interacting with the cub, it allowed for reflection”, whilst only 11 (4%) “had no expectations” about the interaction experience. Coded responses of the interactors were significant for the facility (χ^2_8 = 23.107; p = 0.003) which could be expected given that the different facilities attract different markets with associated advertising and activities. The continental association of the respondents (χ^2_{20} = 29.062; p = 0.09) indicated trends with all groups indicating that the “interaction was the expectation” as the leading response. The coded responses were not significant however for the age of respondent (p = 0.34) nor their gender (p = 0.11).

Respondent 223, a female from North America felt that her experience had exceeded just that of interacting and stated that she “*had the opportunity to engage rather than just observe the cubs; they behaved in a natural manner to being rubbed deeply; they weren't stressed or avoidant and this tells me they are in a good mental space*”. This also applied to respondent 245, a female from Africa, who said that she “*got to feel their coat, see their personalities, just like* [she would] *our cats at home*”.

One hundred and eighty-three (61%) respondents felt that the experience of interacting with the lion cubs had had no impact on them at all and saw it only as an experience, while 117 (39%) respondents felt that the interaction had been impactful on them. Of those who felt the experience to be impactful, six sets of reasons were provided: Forty-two respondents (36%) described the impact as an “emotional expression of the experience”, and 39 (33%) expressed their impact with a “sense of emotion towards the cubs”.

Respondent 3, a female from Asia articulated this personal emotional expression as being “*overwhelmed*” while respondent 9, also a female from Asia, used the word “*brave*”. Respondent 276, a female from South America felt “*privileged*” by the experience. There were respondents who reflected on emotions felt towards the cubs such as Respondent 84, a female from Africa which said “*I feel sorry for them*” and

Respondent 109, also a female from Africa who mentioned "*I feel a twinge of sadness, but maybe some are sacrificed for the greater good of others*".

Twenty-five (21%) felt they had "a desire to support conservation more" as a result of the impact the interaction had on them. Six (5%) indicated that the impact had resulted in a "desire to have a cub for themselves". Four (3%) respondents indicated a "religious associated impact" with only 1 (1%) saying it had a "negative impact". These coded responses indicated that a trend existed between the impact felt and the facilities (χ^2_{12} = 20.721; p = 0.06). Those visiting Facility A elicited more "sense of emotion towards the cubs", Facility B "a desire to support conservation more", and Facility C more of an "emotional expression of the experience"

These impacts had no association with the age of the respondents (p = 0.19), the continental association of the respondents (p = 0.78) or their gender (p= 0.42). There was however a significant relationship between the expectations of the respondents prior to interacting with the cubs and the impact the experience had on them (χ^2_{24} = 40.364; p = 0.02). When cubs were bigger and rougher than expected or smaller and more inactive than expected, then the experience resulted in having no impact on the interactor (Figure 14).

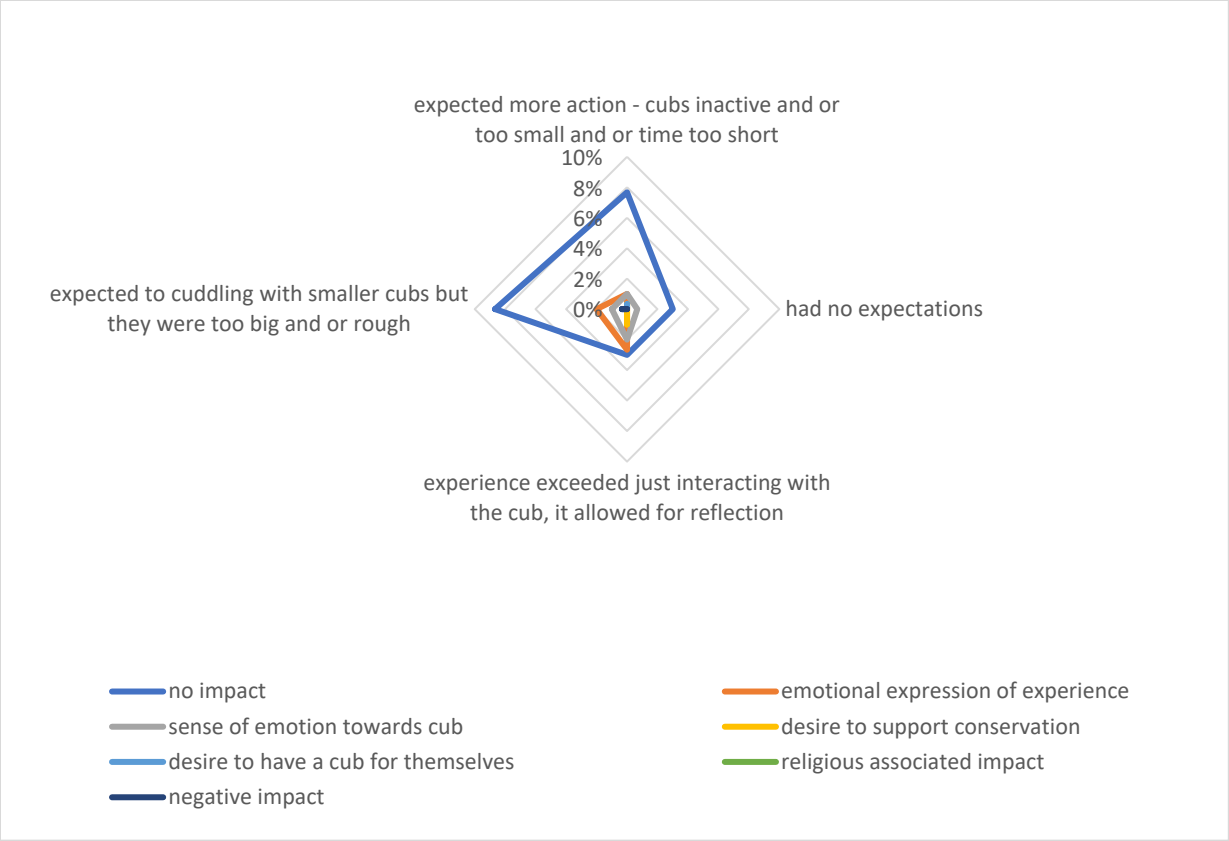

Figure 14 A radar plot depicting the relationship between expectations and resulting impacts of interactions on respondents.

Of the 300 respondents only 35 (12%) indicated that they would not interact with lion cubs again, whilst the majority (88%) would if given the opportunity. Of these, 59 (22%) indicated that while they would interact again, it would not be within the next two years. Two hundred and six (78%) interactors indicated that they would participate in the interaction again and were keen to have that repeat experience within two years. There was no statistical relationship between the decision on whether to interact within a two-year period or longer and their expectations prior to interacting ($p = 0.41$) or any impact the interaction may have had on them ($p = 0.42$).

One hundred and sixty of the 300 (53%) respondents also interacted with other animal species whilst visiting the facilities, and these included cheetah, hyena cub, rhino, leopard and giraffe. The animal species identified as being the favourite with which to interact was highly significant for facility (χ^2_{15} = 57.788; p = 0.000), which can be explained by the different animal species being available at the different facilities. Age of respondents (p = 0.24), continental association of respondents (p = 0.99) and gender of respondents (p = 0.95) had no significant effect on which animal would be indicated as the favourite with which to interact.

The reasons provided by respondents as to why an animal was their favourite with which to interact were significantly associated with the animals' traits (χ^2_{35} = 124.574; p < 0.0001) (Figure 15). One hundred and forty-six respondents provided reasons as to why a particular interaction with an animal was their favourite and these were coded. The most identified reason by 34 (23%) respondents was that the "animal interacted back with them / felt more natural and less commercial", associated most with giraffe and cheetah. Thirty-one (21%) reasoned because it was a "baby / cuter / playful and active", associated most with lion cubs, with another 31 (21%) saying that it was "calmer / quieter", associated most with cheetahs. Twenty (14%) said that it was due to it being a "rare animal / interaction experience uncommon / new experience". Fourteen (10%) enjoyed it as an "adult / bigger animal", associated most with cheetahs, 12 (8%) identified the animal as being "more dangerous" and lastly only 4 (3%) had felt it was their favourite animal to begin with, thus resulting it in being their favourite interaction experience.

Respondent 191, a 31-50-year-old female from Africa, on explaining why the giraffe interaction had been her favourite, said it was because the animal had "*voluntarily interacted with us and I appreciated that I didn't force myself on it*; *it* [the interaction] *felt more natural*". Words used by those who enjoyed the interaction because of the cubs being young, included "*cute*" by Respondent 234, a 31-50-year-old female from Europe and "*innocence*" by Respondent 115 a 31-50-year-old female from Asia.

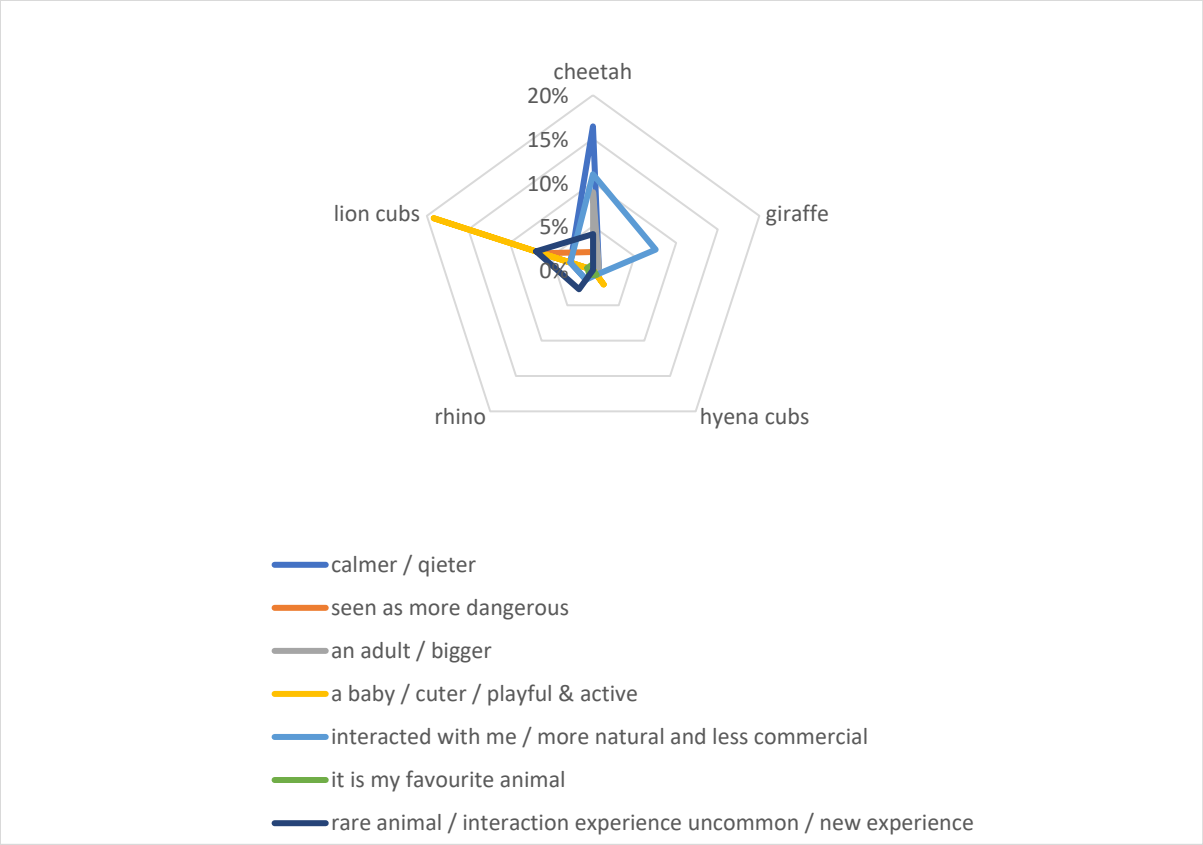

Figure 15 A percentage radar plot of the reasons why an animal was regarded as being the favourite one with which they interacted.

Of the 300 respondents interviewed, 147 (49%) were accompanied by children and of these 101 (69%) indicated that the children had influenced their decision to come and interact. This positive response was not significant for facility ($p = 1$), respondents' continental association ($p = 0.77$) or their residence ($p = 1$). The leading reason by 83 (82%) respondents for how the children had influenced them could be attributed to "a desire to experience a wild animal in such a proximity and to touch it".

Respondent 36, a mother of two children under the age of six, had brought the children to interact "*for the joy they* [the children] *get and to hold a lion cub, send photos all over the world*" and then questioned "*how many kids get to do that?*". Respondent 207,

a mother of a single child reasoned "*that it's* [lion cub interacting] *an experience for them* [children], *otherwise there is just the zoo and you can only see* [animals] *through fences*". Ten (10%) respondents were "supporting their child's love for animals" through the interaction experience, while nine (9%) respondents viewed the experience as an "educational opportunity" for the child, seeing the interaction as a teaching tool.

Respondent 273, a father of a boy aged between seven and nine years of age explained that his son "*loves animals"*, explaining that "*he* [the son] *doesn't watch cartoons, but he watches Animal Planet*". Another parent wanting to support her child's love of animals was the mother of two, respondent 35, who stated that "*the five-year-old is crazy about animals and I want to nurture the passion*". Respondent 20, a mother of two children aged between seven and 12 years of age said that she "*want*[s] *for them to understand how important nature conservation is and to have compassion for animals*". Another mother of three children aged between 7 and 16 years of age felt that it would be a "*unique experience for them, it's* [the interaction] *not TV, it's real, nature is a reality and species need to be protected*".

Responses from the 147 respondents with children accompanying them provided six main sets of responses on how the children had experienced the activity. These coded sets of responses were not significant for facility ($p = 0.74$), their continental association ($p = 0.94$) nor where they dwelt ($p = 0.77$). The majority of children, 57%, "enjoyed it" while 15% were "nervous / scared/ uncertain". Ten percent found the experience "impactful" while nine percent belonged to a mixed cohort, with "some children enjoyed it, and some did not". Five percent were "disappointed due to limited contact / inactive cubs" and four percent "disappointed as denied access".

This negative experience was at times caused inadvertently by the handlers, such as with Respondent 199 who said that her child between the age of 10 and 12 was "*scared because of what the handler said*" and then quoted "*be careful or they will bite*". Being ill-

prepared for the experience resulted in another negative response from respondent 96, a mother of a child aged four to six years of age, and it was explained that the child "*didn't like it* [the interaction] *and wanted to get out* [of the enclosure]" explaining how one "*didn't get the same interaction you get from domestic cats*".

Of the 300 respondents, 173 (58%) felt the interaction to also be an educational experience for them, and facilities had a highly significant effect ($p < 0.0001$) on this. The coded responses on what was learnt was also highly significant for the facility ($p < 0.0001$), a result of the different interaction experiences on offer. Eighty (46%) respondents did not learn anything from the guides but rather deduced facts from what they felt and witnessed through the experience, as such "they learnt indirectly from the experience itself". Sixty-four (37%) indicated that "facts about lions were learnt from the guide", 26 (15%)" learnt how they should conduct themselves around the cubs" while only three (2%) mentioned that "the plight of lions was learnt from the guide".

Some respondents had their existing environmental awareness reinforced through the interaction, such as Respondent 19, a 18-30-year-old male from Africa who mentioned that he felt "*a bit more passionate about their conservation*" as result of the interaction. Others, such as respondent 173, a 31-50-year-old male from Africa, experienced a change towards his traditional views, saying that he "*grew up killing wild animals, but now things are different, I can save it,* [the] *interaction changed my view*".

Good welfare identified by respondents and coded according to the Five Freedoms (Farm Animal Welfare Council, 1993), was not affected by the facility ($p = 0.46$), the age of the respondents ($p = 0.12$), their continental association ($p = 0.23$) or their gender (0.99). Similarly, poor welfare indicators identified and coded according to the non-adherence of the Five Freedoms, were also not affected by the facility ($p = 0.51$), age of respondents ($p = 0.94$) continental association of the respondents ($p = 0\ 1$) or their gender ($p = 0\ 1$). Figure 16 indicates the percentages of welfare-identified coded responses. The

leading good welfare indicators coded were “freedom from discomfort” (81 respondents, 35%) and “freedom from hunger and thirst” (63 respondents, 27%) while the leading poor welfare indicators noted a “lack of freedom to express normal behaviour” (48 respondents, 57%) and a “lack of freedom from discomfort” (19 respondents, 23%).

Respondent 37, a 31-50-year-old male from Africa, reflecting on positive welfare due to freedom from discomfort, stated that “*The life they* [the cubs] *are leading is fine*, *it is better than what some people have*, *they* [the cubs] *have shelter*”. Respondent 121, a 31-50-year-old male from South America, reflected differently on poor welfare due to a lack of freedom and discomfort, stating that “*For visitors it is a good experience, but for them* [the cubs], *it is not so good because they have to stay in a little area and wait for visitors. Not good to see them* [the cubs] *pacing, they should be released afterwards, but not sure that this is possible*”. Respondent 36, 31-50-year-old female from Africa reflected on poor welfare due to a lack of natural behaviour, stating that the situation was “*Awful and sad. They* [the cubs] *should be in the wild, but their parents are probably also caged. The cubs don't know what they are missing*”.

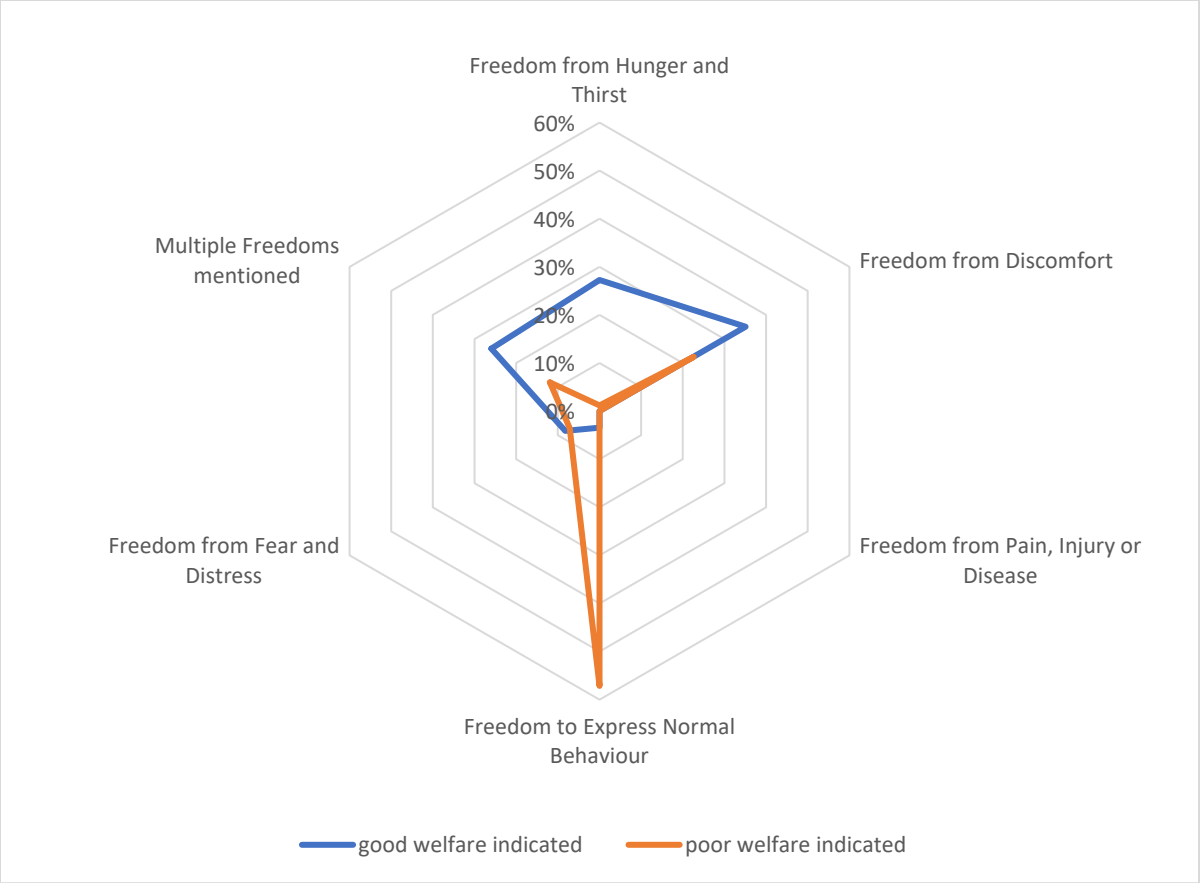

Figure 16 Percentage radar plot depicting the coded responses of respondents, towards their impression of both good and poor welfare indicators of the lion cubs at the various facilities.

4.5 A utilitarian review

The harms-benefit and mixed review analysis for each stakeholder against each of the positions presented allows insight into reasons for the various harms and benefits ascribed to each stakeholder (Table 11). Position one, an unregulated lion cub interaction industry, only truly benefitted the associated industries such as marketing companies and restaurants and their benefits were not limited to this position alone but were reliant on an interaction industry of some form. Five of the seven stakeholders within position one are financially reliant on the industry for their livelihood but this comes at a cost of having to work in an unfulfilling and negative environment. Volunteers and tourists spend money to participate in the activity, but the nature of position one may leave many disillusioned and unsatisfied with the experience. The five stakeholders who were truly negatively affected by position one, include all the non-human stakeholders and also South Africa as a nation. Position two which supports a strongly regulated industry improved the positions of five stakeholders. The South African nation is viewed more favourable while all those making a living from the lion cubs are still able to do so but with more job satisfaction and dignity. The non-human stakeholders benefit from this regulation except for the breeding lion mothers who remain harmed through the constant removal of their cubs. Position three is identified as providing the most good to the greatest number and as such meeting the requirement for it to be considered the one most ethical, according to utilitarian ethic principles. This is evident by the fact that no stakeholder is in a purely harmful situation as a result. The South African nation, the paying tourists and all the non-human stakeholders all benefit from this position. All those who generate an income from interactions are also benefitted with only volunteers and lion breeders facing a mixed situation. The last position representing the banning of all interactions has no benefitting stakeholders despite its idealistic position, with four stakeholders being outrightly negatively affected through the loss of an opportunity to generate an income. The full ethical review presented in Table 11 lends itself to a typical harms-benefit analysis where details are omitted and colours appropriate to the harm, benefit or mixed situation can be reflected. This allows for a faster and easier appraisal of the positions (Table 12 and Figure 17).

Table 11 A utilitarian review of four lion cub interaction positions across thirteen stakeholders. The matrix is purposefully colour coded to easily identify these three situations (green represents a pure benefit, red a pure harm and purple, a mixed assessment).

	Position 1: Unregulated lion cub interactions.	**Position 2:** Lion cub interactions with best possible practices as identified through the value model and considering the non-negotiables and unacceptable identified.	**Position 3:** A wildlife interaction with a more appropriate species than lion cubs; which is given freedom to choose to interact or not and which is provided the highest possible welfare within a well-regulated industry.	**Position 4:** Banning of all wildlife interactions.
1) South Africa: nations are judged on moral freedoms which consider their use of the nonhuman biological environment	Only contributes to a negative image of South Africa for its exploitation of lion cubs in question	While some may view the high welfare as an acceptable enough standard for the cubs, others may still feel it is ethically unacceptable given the act of removing the cubs from the mothers	South Africa can portray an industry abiding to high standards and concern for the nonhuman biological environment	While South Africa is seen to uphold high standards for its nonhuman biological environment, it may be seen to be at the expense of tourism opportunities and human development
2) Lion breeders: breeding lions for the industry creates an opportunity to make a living and profit	There is an opportunity to create a living and profit from breeding lions, but this comes with a great deal of negative publicity	There is still an opportunity to financially benefit but with lion cubs not being allowed to exit into the breeding, hunting and bone export industries, there may be less demand as the lifetime keep of the lions will deter the cub numbers currently seen	The cessation of lion cub breeding for interactions will have a negative impact on revenue, however breeders can be guided into more ethically acceptable and alternative enterprises which will have fewer negative connotations associated with it	The cessation of lion cub breeding for interactions will have a negative impact on revenue, however breeders can be guided into more ethically acceptable and alternative enterprises which will have fewer negative connotations associated with it
3) Interaction facility owners and lion cub owners: offering interactions brings in revenue and profit	There is an opportunity to create a living and profit from lion cub interactions, but this comes with a great deal of negative publicity	There is still an opportunity to financially benefit but with lion cubs not being allowed to exit into the breeding, hunting and bone export industries, the expense of maintaining lions for	A change in species allows for an opportunity to still bring in revenue and potentially increase profit as more appropriate species may be used for longer time periods of their lives as opposed	The loss of an opportunity to bring in revenue

		relatively long captive life spans will become exceptionally costly and may even cause the demise of the practice; there is still potential for negative publicity	to just 6 months; there is also freedom from negative publicity	
4) Employees at the interaction facility: Jobs and the ability to support their families	The opportunity to support oneself and one's family is positive, though negative work environments can affect workers wellbeing	The opportunity to support oneself and one's family and have greater job satisfaction including decent work providing dignity	The opportunity to support oneself and one's family and have greater job satisfaction including decent work providing dignity	The loss of a job and the ability to support one's family
5) Volunteers: pay for the experience of raising lion cubs with a desire to contribute to welfare and conservation	While there is an opportunity to experience the hand rearing of a lion cub, the possibility also exists for a poor experience and potential guilt by the reality of situation	Volunteers are not considered suitable for the hand rearing of lion cubs but there are many other volunteer causes for volunteers to choose from and those causes are less likely to result in guilt around the reality of the practice	While there is no opportunity to hand rear a lion cub, there are still many opportunities to volunteer for other worthy causes	While there is no opportunity to hand rear a lion cub, there are still many opportunities to volunteer for other worthy causes
6) Veterinarians: who gain employment from such facilities	An opportunity to gain employment but not fulfilling one to the profession and calling	An opportunity to gain employment with job satisfaction and decent work providing dignity	An opportunity to gain employment with job satisfaction and decent work providing dignity	The limited opportunity to be a wildlife veterinarian but still the ability to practice with other animals
7) Tourism operators: Jobs and an opportunity to provide for one's family	The opportunity to support oneself and one's family is positive, though negative work environments can affect workers wellbeing	The opportunity to support oneself and one's family and have greater job satisfaction including decent work providing dignity	The opportunity to support oneself and one's family and have greater job satisfaction including decent work providing dignity	The loss of a job and ability to support one's family
8) Associated industries such as marketing companies and restaurants: Jobs and an opportunity to provide for one's family	The opportunity to support oneself and one's family	The opportunity to support oneself and one's family	The opportunity to support oneself and one's family	The loss of a job and ability to support one's family

9) Tourists: the opportunity to experience the interaction	A poor experience though some may still enjoy them	A good experience	A rewarding tourism experience resulting in an environmental consciousness	A lost opportunity to interact yet other wildlife experiences to enjoy
10) Lion cubs: as core participants in the activity	Significant suffering with poor welfare	A full life in captivity with limited experiences, though some may be positive and some negative		
11) Captive breeding mother lions: as a source of lion cubs	Significant suffering with poor welfare and psychological trauma of cub removal	Suffering as a result of psychological trauma of cub removal		
12) Wild lion populations: as conspecifics	A captive industry supports increased trade which negatively affects wild populations through increased activities such as the poaching of wild conspecifics	A regulated captive industry may still support increased trade which negatively affects wild populations through increased activities such as the poaching of wild conspecifics; yet positive experiences by tourists may create awareness around the plight of wild lions thereby supporting conservation initiatives	Environmental awareness and environmental consciousness created by positive interactions leads to greater conservation of the wild lions	A lost opportunity to have environmental consciousness created around the plight of lions but this can still be achieved through wild experiences however this will be limited to those who can afford it and excluding the poor masses
13) Environment: Care for the natural environment and conservation	A wildlife experience lacking in ethics teaches exploitation	A regulated experience may highlight environmental concerns but does teach ethical values	A positive experience will result in environmental consciousness	A lost opportunity to have environmental consciousness created around the plight of lions but this can still be achieved through wild experiences however this will be limited to those who can afford it and excluding the poor masses

Table 12 A harms-benefit matrix, summarizing the utilitarian ethic review of four lion cub interaction positions across thirteen stakeholders' situations (green represents a pure benefit, red a pure harm and purple, a mixed assessment).

	Position 1: Unregulated lion cub interactions.	Position 2: Lion cub interactions with best possible practices as identified through the value model and considering the non-negotiables and unacceptable identified.	Position 3: A wildlife interaction with a more appropriate species than lion cubs; which is given freedom to choose to interact or not and which is provided the highest possible welfare within a well-regulated industry.	Position 4: Banning of all wildlife interactions.
1) South Africa				
2) Lion breeders				
3) Facility owners				
4) Employees at facility				
5) Volunteers				
6) Veterinarians				
7) Tourism operators				
8) Associated industries				
9) Tourists				
10) Lion cubs				
11) Breeding mother lions				
12) Wild lion populations				
13) Environment				

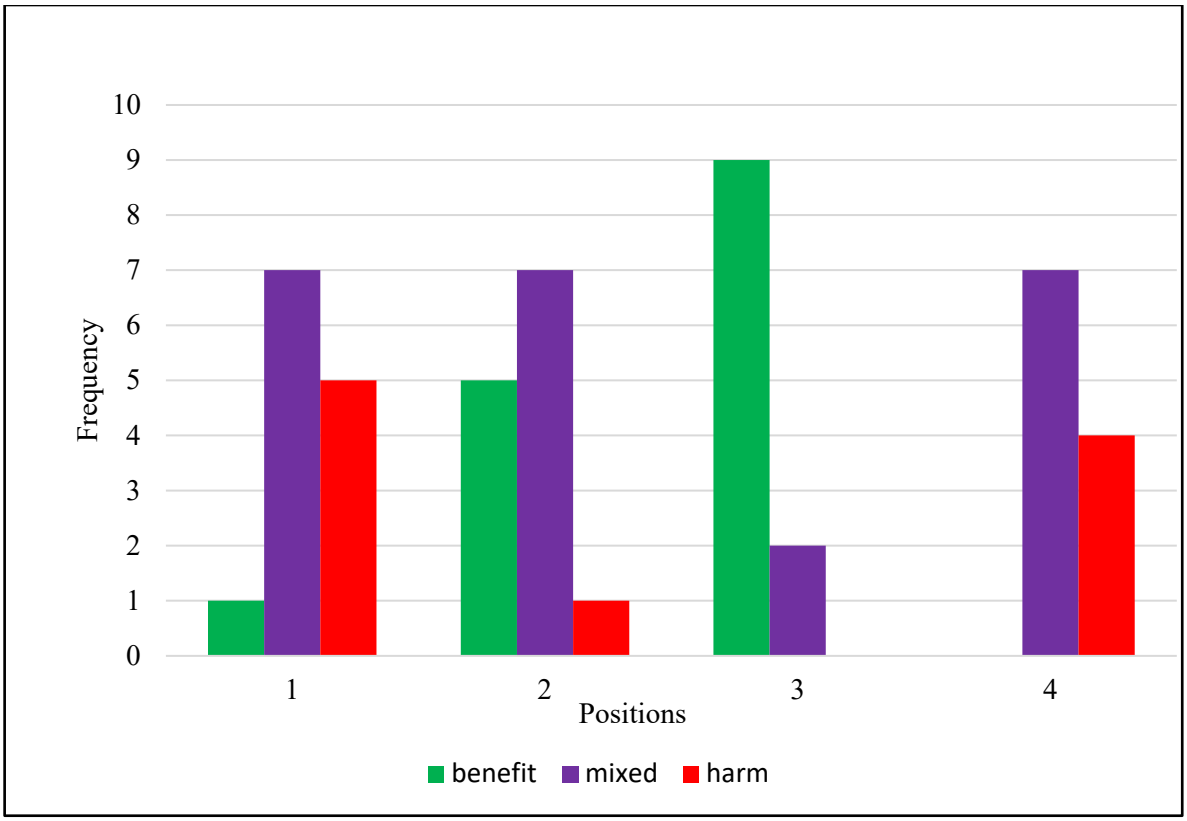

Figure 17: A graphical representation of harms-benefit matrix, summarizing the utilitarian ethic review of four lion cub interaction positions across thirteen stakeholders' situations.

4.6 Summary

The stakeholder workshop revealed that stakeholders were able to identify welfare concerns outside of their affiliations after informed discussions and opinions were shared. Opinions were more associated with whether their experience was with lion in a captive versus wild environment as opposed to their affiliation. The nine non-negotiables identified by the stakeholders clearly shows a need to distance the interaction industry from the canned hunting and the lion bone trade. Lack of governance was determined by the stakeholder group as the leading cause for welfare compromise.

The conjoint analysis survey was able to rank and weight welfare issues despite the low coefficient of concordance. The most weighted welfare attribute was identified to be the social grouping of the cubs followed by the ability of the cubs to choose their own environment.

The ethological study determined for the first time, the behaviour of lion cubs within such facilities. Interaction frequency change caused changes in sleep and rest behaviour frequencies, play, alert and grooming behaviour frequencies and also flight and aggression frequencies.

The questionnaires revealed that many interacted with the cubs despite knowing about the controversy surrounding the action as they simply wanted the experience irrespective of it effects. The expectations of interactors were not high and as such mostly met. The majority indicated that they would return to repeat the experience and that learning was done indirectly though the actual experience. The interactors felt strongly about two freedoms, the freedom from discomfort and the freedom to express normal behaviour.

The harms-benefit analysis showed that the one extreme of an unregulated lion cub interaction industry and opposite extreme, the banning of all animal interactions, were equally harmful and lacking in benefits. A strong welfare centred approach further improved upon by a suitable species choice indicated the least harm and greatest benefits for all stakeholders.

CHAPTER 5: DISCUSSION

In this chapter the results from the previous chapter are discussed. The results of the stakeholder workshop revealed welfare issues within the industry, and these are discussed here (section 5.1) along with their weighting and rankings in terms of importance (section 5.2) which emanated from the online conjoint analysis survey. The ethological profiles of the cub facilities are discussed in terms of the welfare issues they represent (section 5.3) and interactor responses are also discussed to explain motivators and impacts along with perceptions of the cubs' welfare (section 5.4). The utilitarian review and harms-benefit analysis results are contextualised (section 5.5).

5.1 Stakeholder workshop

Fraser *et al*., (1997) explain how people use many different criteria in judging what constitutes a good life for animals and how animals ought to be treated. Such criteria include a functioning based conception (the cubs are fed and medically provided for), a feelings based conception (the cubs show signs of frustrated behaviour) or a natural living based conception (how different the lives of the captive cubs are to their wild counterparts). These criteria are informed by frames of reference and experience and it appeared that the workshop stakeholders exhibited this. An example of this was the commonality of views of the nature conservationists and government officials, who identified governance and lack of regulations as a welfare issue, which is expected given that they both experience issues in this regard when working with the captive lion industry. As such, the diversity of the nine affiliated stakeholders and likelihood that each would judge welfare differently ensured that lion cub welfare was considered from a broad perspective, rather than just a scientific or legislative view alone. This also explains why general issues, like inadequate governance and regulation, were considered primary welfare considerations overall, due to their relevance to several stakeholder groups. The suitability of the identified wide range stakeholder group participants was proven by their ability to make informed decisions when discussing and voting on the welfare issues. This

explains why breeders, the rehabilitator, an animal rights advocate, veterinarian and animal welfare organisation representatives, who had not initially identified governance and regulation to be an issue, did so after discussions, and voted it as one of their top three welfare concerns.

Lack of governance and regulation and the problems of inbreeding:

The lack of governance and regulation in itself, is not an actual welfare issue, but the discussion identified that if the extent of the lion cub interaction industry was known and adequately governed, it would be accountable or could be made so for many of the actions affecting welfare. This idea was identified by Caporale *et al*. (2005) who found that effective implementation and enforcement of legislation in Europe was a vital part of ensuring good animal welfare in the region. The Biodiversity Management Plan for the Lion (*Panthera leo*) in South Africa (Funston and Levendal, 2015) identifies the need for a well-managed, captive lion population, with developed norms and standards, permit requirements and the mandatory identification of individual animals, including a database with DNA profiles.

Governance and regulation as an animal welfare issue needs also to be extended to persons working with the lion cubs and not only the owners of the facilities. Stakeholders felt that persons directly in contact with the cubs, such as handlers and caregivers, should be required to have some training, as inexperienced handlers and caregivers may cause harm through a lack of knowledge. Inappropriate handler behaviour towards animals can cause fear of humans, which in turn affects their long-term welfare (Hemsworth, Barnett and Coleman, 1993). Lion cubs are in contact with many humans on a daily basis, which could influence their health status and welfare. Training and selecting handlers and caregivers to have desirable attitudes and behaviours towards the animals in their care would substantively improve the animals' welfare (Hemsworth, Barnett and Coleman, 1993). In South Africa, caregivers and handlers at lion interaction facilities are often young adults with very little or no experience at the time of employment,

and many are overseas volunteers, who pay to raise and bottle-feed the cubs (One World 365, 2017; Gapyear.com, 2018).

Although inbreeding was identified as a lesser animal welfare concern, it can be linked to a lack of governance and regulations. Inbreeding as a welfare issue could be reduced if the objectives laid out in the Biodiversity Management Plan for the Lion (*Panthera leo*) in South Africa (Funston and Levendal, 2015) are achieved, especially the introduction of DNA profiling of all lions. Inbreeding can cause defects such as high cub mortality, poor reproductive performance, morbidity and susceptibility to infectious disease (Trinkel *et al.,* 2008).

There is a rare phenotype or colour variant of the African lion that produces a white coat colour, with either yellow, blue or green eyes. This is a result of a double recessive allele, and therefore white lions are not albinos (Cruickshank and Robinson, 1977). Despite the white lions only every occurring naturally in the Timbavati Private Nature Reserve and the adjoining Southern Kruger National Park, they are now commonly found in most captive lion breeding facilities in South Africa. The Association of Zoos and Aquariums (AZA; 2012) in accordance with their Lion Species Survival Plan, discourage the breeding or acquisition of white lions, as all individuals currently found in zoos are severely inbred.

Nutrition, Impact of removal from mother and Age of removal:

A properly balanced diet and fresh, clean water, supplied in adequate amounts, will avoid physical and psychological suffering from hunger and thirst (FAO, 2012). This FAO report further explains how correct nutrition is crucial for optimal performance and to sustain optimal fitness (i.e. welfare). It also explains how in many cases, it is not only the absence of feed which causes a welfare problem, but the feeding of an inappropriate diet. FAO argues that the disciplines of nutrition and animal behaviour need to be

integrated in order to more fully consider the implications of feeding behaviour and nutrition on animal wellbeing. Nutritional requirements are very specific to the age of the cub and it is essential to consider ‘nutrition’, ‘impact of removal’ and ‘age of removal’ concurrently.

Milk replacer, in the absence of mother’s milk, has to be carefully chosen, as cats do not synthesize vitamin D_3 in the skin and require a dietary source. Hand reared, bottle-fed lion cubs have developed nutritional secondary hyperparathyroidism (Van Rensburg and Lowry, 1988) as a result of having been fed homemade mixtures of cow’s milk and artificial milk blends. The Lion Care manual developed by the Association of Zoos and Aquariums (AZA Lion Species Survival Plan, 2012) recommends a formulation based on the mother’s milk to be optimal but cautions that, if the formulation does not include taurine, it should be supplemented (National Research Council, 2006). Esbilac puppy milk replacer, a veterinary endorsed product, has been noted in the Lion Care manual (AZA Lion Species Survival Plan, 2012) as being ideal for raising lion cubs (ANB Vet, 2014). Another such product, Zoologic Milk Matrix 33/40 (Drugs.com, 2021) is also recommended for lion cubs. However, the high cost of imported milk replacers may deter some establishments in providing the recommended products.

Some facilities wean cubs from a milk replacer bottle-fed diet to commercially available kitten pellets, soaked in milk, followed by pieces of chicken meat, then the complete chicken carcass and finally chunks of meat (donkey, cattle, and horse) and then to include carcass parts. Others wean the cubs from a milk replacer bottle-fed diet to a chicken meat diet and then the entire chicken carcass, with no variety or alternative meat sources thereafter. Sources of chickens may be a concern as they are typically not suitable for human consumption, according to the workshop attendees. Meat (non-chicken derivatives) comes from donations of animals typically that have been euthanized as a result of disease or injury, where the original owner could not or did not wish to proceed with veterinary treatment. Facilities who choose to feed such carcasses should be aware of the potential hazards associated with potential pharmaceutical drugs

administered to the animal prior to euthanasia, pesticide contamination, toxic compounds and bacteria contaminants (Harrison *et al*., 2006). In one such incident, captive cubs were fed a dead pony and developed botulism (Shamir et al., 2008).

The need for careful selection of mineral and vitamin supplements has been demonstrated in the identification of the human disease rickets in lion cubs fed horsemeat in London Zoo in 1889, which was treated by adding goat bones and milk to their diet (Chesney and Hedberg, 2010). Cod liver oil was also recommended for these cubs, since it contains the potentially deficient vitamins A and D_3, as well as bile salts and taurine, to allow the fat-soluble vitamins to be utilised. A diet restricted to beef meat only is deficient in thiamine, and lion cubs begin to indicate signs of ataxia, general weakness and seizure like episodes (Hoover and DiGesualdo, 2005). A Ca:P ratio of 1:1 to 2:1 is required for the normal skeletal development of a lion. Beef and horse meat result in a chronic calcium deficiency due to an excess of phosphorus, as their Ca:P ratios are 1:10 and 1:50 respectively (Herz and Kirberger, 2004). The side effect of this calcium depletion from the bones results in osteopaenia, muscle pain, and a tendency to develop fractures, which has been reported in captive bred lions (Herz and Kirberger, 2004).

Habituation to humans is central to close and intense encounters, such as is experienced in the interaction industry. Removal from the mother is an inevitable welfare concern which cannot be alleviated as a result of meeting the industry's needs and objectives. The removal of the cub from the mother potentially causes inadequate nutrition and psychological stress. Farmed mink, for example, are more likely to display abnormal behaviour, such as tail sucking and biting, if they are removed from their mothers at an early age (Mason, 1994). Striped mice removed from the mother and weaned early were more likely to develop stereotypy behaviour (Jones, Mason and Pillay, 2010). Early maternal separation in primates results in both behavioural and neurological responses that have been equated with depression in humans (Gilmer and McKinney, 2003). Cubs which exhibit interaction activities and enter into a lifetime of captivity, such as a zoo, may benefit from having been habituated (AZA, 2012), in comparison to a less

habituated individual which would be of a more nervous disposition. When removed too early from their mothers, cubs will lack the essential colostrum and mother's milk necessary for healthy development, compounded when poor nutritional milk replacers are used. While predators receive some antibacterial agents via the placenta, this largely comes from colostrum, which contains high concentrations of immunoglobulins, leukocytes and white blood cells (Cundiff, 1972; Chastant-Maillard *et al.,* 2017). Age of weaning of lion cubs, that are already separated from their mothers, from milk replacers varies across facilities, starting as early as eight weeks of age. In comparison, mother-raised cubs are only weaned at 7 - 12 months (AZA, 2012).

Tourists at lion cub interaction facilities often ask the whereabouts of the cub's mother, who is usually said to have abandoned her cubs (Hargreaves, 2010). Such statements have not been confirmed but the Lion Care Manual (AZA, 2012) does caution that females should be left totally alone for 24 hours, as disturbances in these early stages of rearing may cause the female to neglect or become aggressive towards the cubs. There is also a welfare concern for the mother. Little attention has been paid to the psychological consequences and long-term impacts of breaking the mother–young bond in non-human mammals (Newberry and Swanson, 2008). The stakeholders questioned the effect of constantly removing cubs from the mother and what would be the most appropriate manner and age to do so. In a zoo situation, "A management strategy that focuses on both maternal care and socialization with human caretakers can provide the best of both worlds. However, this should only be done after careful consideration is given to the temperament of the mother, the experience of the staff, and clear guidelines have been developed for the entire process." (AZA, 2012). The same could be said to apply to facilities breeding / sourcing cubs for tourist interaction purposes.

Interaction time management, Choice in environment, Species-specific needs, Sleep needs, Social needs and Behavioural knowledge:

These were all raised as independent welfare concerns but are discussed together as they all impact upon the behaviour of the lion cubs used in the interaction activities. Interaction time was believed to be highly variable, depending on the many factors that influence visitor numbers and management of the cubs, including day of the week and time of year. Some interaction facilities operate from 0800-2000h and the cubs are exposed to a constant flow of interaction participants during this time, with as many as 500 interactions taking place in this period (Hargreaves, 2010). Other facilities may have peak periods with variable numbers or only operate at set times of the day. Lions are known to sleep and rest for a great deal of the day (Estes, 2012), and lion cubs naturally spend a very large proportion of the day sleeping, but inactive cubs are less interesting to visitors, which may result in visitors provoking or interacting with the animal on their own terms (Fernandez *et al*., 2009). Facilities manage the extent of contact with the cubs as they see fit, with some allowing the cub to be carried around whilst others have a more controlled approach, restricting the interaction to a stroke on the back. In the wild, lion cubs naturally engage in extensive play behaviour and visual exploration of their environment (Ncube and Ndagurwa, 2010), but less when their mothers have left to go to hunt (Schenkel, 1966). Similarly, cubs are regularly groomed by their mother under natural conditions (Estes, 2012). As well as the usual motor play of running, rolling, climbing and turning, cubs will engage in stalking, ambushing and grappling, all motor patterns that they would normally use as adults to capture prey (Bertram, 1978; Estes, 2012). The extent of these behaviours will depend on the complexity of their environment and the cognitive stimulation of the cubs. To what extent visitor presence affects these natural behaviours is not yet known.

Waiblinger *et al.* (2006) explain how interactions are perceived not only by the human but by the animal being interacted with too. These animals are not just affected by the current interaction taking place but also have residual effects from past interactions. The way in which an animal perceives these interactions can affect its future

human-animal-relationships (Hosey, 2008), potentially resulting in profound consequences on that animal's life. Negative interaction experiences such as being prodded and pulled will have an immediate negative behavioural response but also affect the way cubs will respond to a future interaction attempt. This implies that what lion cub interaction facilities allow to be done to the cub, within the interaction experience, can have a lasting welfare impact on the cub's life, either by how they respond to future interactions or even resulting in long-term behavioural problems.

The inability of the cubs to retreat from a forced human interaction and seek refuge was seen as a welfare issue by the stakeholders, but any retreat impacts negatively on the visitors' experience and desire to interact with the animal they have come to see (Fernandez *et al.*, 2009). This may lead to fewer visitors and less financial gain. Noisy, active crowds are the biggest source of stress (Fernandez *et al.*, 2009). The benefits of providing a retreat space for animals in petting interactions at a zoo are mainly in allowing for rest and reduction of undesirable behaviour (Anderson *et al.*, 2002). The Lion Care Manual (AZA, 2012) supports this, suggesting that more space and choices about where lions can spend their time may prevent social and behavioural problems.

The African lion's complex social structure makes them unique among wild cats. The Lion Care Manual (AZA, 2012) requires them to be housed in numbers of sufficient size so as to meet their social and behavioural needs. Often cub siblings are removed together and housed in interaction facilities together. The welfare plight of a solitary housed cub is therefore assumed to be worse, given it will have no interaction with any other member of its kind. Appropriate social groupings are important to provide examples of species-typical behaviours (Price and Stoinski, 2007). This links the species-specific needs of the cubs to social needs, also identified as a welfare issue. Suboptimal group sizes are associated with increased abnormal behaviours in a range of captive mammals (Price and Stoinski, 2007). The Lion Care Manual (AZA, 2010) explains how the cub's exposure to adult lions is, a critical component of a cub's social development, so all options (even males) should be considered. It emphasizes that this is especially important

for singletons. This social and species-specific requirement cannot be met when cubs are housed separately from adults for interaction purposes.

Stakeholders felt that the behavioural knowledge held by cub handlers and keepers was linked with their training and disciplining of the cubs to ensure that they were safe to have around the interacting public. Zoos have some influence on keeper skills and behaviour (Hemsworth, 2003), and only positive reinforcement training should be used (Savastano, Hanson and McCann, 2003). The Lion Care Manual (AZA, 2010) encourages a relationship between keepers and lions that is built on trust and positive interactions, resulting in lions that are comfortable and cooperative with people. However, it has been suggested (AZA, 2010) that interactions with cubs in zoos should cease around three months of age, as it is at this time that the cubs become dangerous. Many cub interaction facilities in South Africa use cubs for interactions up until six months of age, or for as long as the temperament of the cub allows. The training required to achieve this state needs to be fully understood and scrutinized from a welfare perspective.

Hygiene:

Hygiene was perceived as a welfare issue for two reasons. First, the popularity of open farms and petting zoos has increased over the years and the open access policy of these establishments allows visitors to be in direct contact with animals, which may lead to the transmission of pathogens from animals to humans (Stirling *et al.,* 2008) and potentially from household pets to the cubs through the human interactors and care-takers as the vector. African lions are susceptible to the same diseases of domestic carnivores (Martella *et al.,* 2007). Options to control the transmission of diseases are hand washing and sanitizers before and/or after each interaction and vaccinating cubs prior to the initiation of interactions with the public. In the latter case, facilities can only allow interactions to begin when the cubs are eight weeks of age, as this is the earliest at which the vaccines can be administered. Lion cubs should be vaccinated against feline rhinotracheitis (FRV), feline calicivirus (FCV), feline panleukopenia virus (FPLV) and

rabies. Parasite control is usually also applied to cubs in facilities which choose to vaccinate. The Lion Care Manual (AZA, 2010) mandates the vaccination of cubs in their facilities, and vaccinations of bred wild carnivores is encouraged by the South Africa Veterinary Association (2016).

Entry and Exit strategies:

The entry and exit strategies for lion cubs used in interaction activities were both considered welfare concerns, despite the fact that these are events which take place prior to and after the period of activity being evaluated in this study. Reports by animal welfare groups (NSPCA, 2013) and animal rights advocacy groups (BLOOD LIONS™, 2015) indicate that many cubs in South Africa are bred in poor conditions for hunting, and that facilities may use cub interactions as an opportunity to generate additional income from the use of the cub. It could be argued that wherever the cub goes, its life and use should be humane to justify its use in the interaction facility. Current known options available to cubs include sale to a zoo, use in a lion-walking safari up until approximately two years of age, entering into a breeding programme, being hunted and or entering the lion bone trade. There is little evidence of the fate of most cubs.

Affective states:

Finally, the affective state of the cubs was identified as a welfare concern. The stakeholders initially stated well-being as the welfare concern and upon being asked to clarify, indicated the affective states of the cubs. This demonstrates the confusion in terminology that exists in some sectors of the industry. For some well-being is a synonym for welfare, used more in the USA to avoid confusion with the welfare state (Phillips, 2008). For others (Appleby and Sandøe 2002), it is the presence of pleasant mental states and the absence of unpleasant ones, i.e. a hedonism that may be difficult to achieve for lion cubs used in an interaction activity.

5.2 Conjoint analysis

Limited literature exists on the welfare of lion cubs used in wildlife tourism interactions and as such this method allowed a wide range of stakeholders with opinions and expertise in their fields to rank identified welfare attributes arising from current management practices as scenarios, by using a trade-off methodology. While the software was able to rank these attributes based on their relative mean weightings in percentages, the high variance attained for most attributes and attribute levels, reveals that there is very little agreement on their prioritisation across the demographic groups.

The NMDS ordination (Figure 3) depicts the associations of the affiliated responses in terms of their mean weightings. The single wildlife rehabilitator was excluded from analysis, as the opinion of only one cannot be representative of an affiliation. The animal rights advocacy representatives are outliers in the ordination. This reflects their absolutist approach to moral decision-making (Galvin and Herzog, 1992). The ethologist and lion research academics are associated outliers in another direction but have some association with each other. The applied natural sciences emanating from species-specific behaviours may assist in explaining the association.

The remaining affiliates, namely nature conservators, wildlife veterinarians, government organisations, lion breeders and or owners, lion cub handlers and animal welfare group representatives, appear to be associated by their broad fields of involvement which currently (specifically in SA) require them to work closely with each other when it comes to lion cub interactions. The captive lion industry currently employs and/or works with each of these affiliates. Welfare attributes associated to these affiliates include disease transfer, caretakers, breeding, vaccinations and parasite control, social groupings of cubs and their ability to choose their environment as well as enrichment.

The value model produced by the responses of the 60 participants is a potential tool to be used by an institution or organization to evaluate the welfare of cubs used in wildlife tourism activities. This tool can also be used to determine where welfare shortfalls exist and allows welfare weights for attributes to be improved, thereby improving the overall welfare of the cubs. The welfare model is limited to the attributes included in the conjoint analysis survey, which have support in literature. The attribute weightings (%) require validation through scientific evidence, however the model has strength because it was generated from participation from a wide range of stakeholders.

When the value model is practically applied, all the lowest level attributes could be seen as representing a welfare deficient situation for the lion cubs. The 12 lowest level attributes can be seen as unacceptable practices from a welfare perspective. Some of these lower level attributes need to be redefined if deemed unacceptable in order to avoid confusion with middle levels. The 12 attributes modified to be mutually exclusive are:

1. No forced interactions should be allowed, and cubs should be allowed retreat from an interaction
2. No untrained staff may be allowed to handle cubs and multiple inexperienced volunteers and visitors may not be responsible for bottle feeding
3. Cubs should not be purposefully inbred to retain traits
4. Cubs should not be removed from the mother before 2 days of age
5. Weaning from milk replacers as young as 2 months and a diet restricted to chicken only is unacceptable
6. Interactions must not exceed 200 per day
7. Training should be restricted to handlers only and not exceed a tap on the nose
8. Cubs should not be raised in isolation
9. Cubs should not be carried and handled by interactors

10. Parasite control should be mandatory
11. All interactors should wash their hands prior to interacting
12. Climbing structures should be provided for the cubs

The lowest level of welfare (0% in the model) is as follows: being purposefully inbred to retain genetic traits, removed from its mother at birth and raised in isolation by multiple inexperienced volunteers and bottle fed by visitors; interacted with over 200 times a day, prevented retreat from an interaction and regularly carried and handled, unwanted cub behaviour is discouraged by handlers and interactors, no toys or climbing structures are provided; replacer milk is only provided until two months of age; diet comprises of chicken only; no vaccinations nor parasite control is provided and interactors use no footbaths nor hand disinfectants.

Conversely, the best welfare possible (100% in the model) is as follows: cub is bred making use of a studbook, it remains with its mother up until two weeks of age and is always kept together with its siblings; only trained full time handlers are responsible for raising the cubs; no training takes place; cub is interacted with less than 100 times a day, is not interacted with when sleeping and may retreat from an interaction; toys or climbing structures are provided for the cub; replacer milk is provided up until 6 months of age while introducing scientifically suitable feline pellets then chicken and meat including carcasses; vaccinations and parasite control is provided and interactors make use of footbaths and hand disinfectants. This best welfare practice just described must be contextualized to the existing lion cub interaction industry. The attainment of a 100% welfare score only implies that the welfare level is as good as it can be within such an industry. It does not mean that welfare cannot be further improved upon, such as not being included in such an industry in the first place.

A tool allowing one to assess welfare in a lion cub interaction facility should determine a quantifiable level, below which it can be considered unacceptable. A 0% welfare score is not necessarily this limit. These next lowest values above 0% may represent the minimum welfare weightings for the attributes used. The sum of these second level attributes produces a score of 57%. The value welfare model can therefore be used as a tool to measure and assess the welfare of African lion cubs used in interaction facilities.

5.3 Cub ethology

No literature on wild lion cub activity budgets could be sourced, with wild behavioural studies focusing almost solely on the adult lions within a pride. However, recognising that many behaviours are stimulus driven (Stolba and Wood-Gush, 1984), it is clear that wild lion cubs raised within a pride will experience vastly different internal and external stimuli to those raised in captivity, devoid of adult lion presence and frequent human interaction. Consequently, resulting activity budgets from two such vastly different stimuli bases would reflect equally different behavioural repertoires and frequencies. To compare activity budgets in this situation might therefore not serve to determine their state of welfare. The non-performance of a behaviour seen in the wild does not necessarily imply that welfare is compromised in the captive individual (Veasey *et al*., 1996) and conversely, new behaviours never observed in wild conspecifics may also not imply welfare compromise. Veasey *et al.* (1996), therefore cautions that other techniques should be used in conjunction with wild behaviour comparisons in assessing welfare.

Current scientific literature provides little information on Inactive behaviour of lion cubs and there does not even appear to be any consensus on the activity budgets of wild adult lion which have been the subject of extensive research. Wild lion are easily identified from their distinguishing characteristics such as markings that come with age, but cubs are more difficult to identify in the wild at an individual level (Bertram, 1975), making behavioural sampling difficult for cubs, in the absence of invasive marking techniques.

Hanby, Bygott and Packer (1995) reported that lion in Tanzania spent up to 80% of their time inactive, sleeping, lying down and sitting, mostly during the daytime. Hayward and Hayward (2007) however, found that lion in Addo National Park, South Africa, were active for 41% of the time throughout the day with one lioness being active for as much as 54% of the day. They suggest that it is a popular misconception that lions sleep for 22 hours per day. A study in Zimbabwe of self-sufficient (able to hunt for themselves) captive born adults with their wild born sub-adult offspring, which were being prepared for release into the wild from a 403-acre camp, found that their resting behaviour accounted for 61% of their time, range 52-69%. However, the activity budgets of these lion were probably influenced by research activities, such as playing of territorial vocalisation calls made by other lion (Dunston *et al*., 2016). A zoo with a small enclosure determined that adult and sub-adult lion slept for 38% of their day, but when moved to a larger more enriching environment, they increased their sleeping to 51% (Clarey and Farnsworth, 1983).

Only a single study on lion cubs was found for comparison. Captive lion cubs in Zimbabwe (Ncube and Ndagurwa, 2010), that were mother raised within a sanctuary in the absence of environmental enrichment, spent 68% of their time resting. Within the same study, two separate orphaned lion cub groups not exposed to human interactions were provided extensive environmental enrichment, which resulted in resting percentages of 37% and 40% respectively. Pre-enrichment activity budgets were unfortunately not recorded, nor a definition of what would constitute resting. When comparing the inactive behaviour of the lion cubs in this study with other available literature, we note how even this relatively well understood and common behavioural category within ethological studies is unable to be contextualized due to an absence of relevant literature and or an inconsistency in the use of behavioural descriptors. As such, the activity budget of the lion cubs used in this study contributes new information about their behaviour under such environmental conditions.

Inactivity was the dominant behaviour expressed by all the lion cubs. The cubs at Facility pair AB decreased sleep as human interaction frequency increased, correlating with their resting behaviour frequency increase. Wechsler's (1995) explanation that "an animals behavioural repertoire is to achieve goals which correlate to behavioural functions; coping behaviours represent a means to still attain those goals; successful attainment through coping results in adaptation behaviour", suggests that even though Facility pair AB cubs were able to maintaining a level of inactivity it cannot be seen as coping, given that sleep and rest serve different biological functions. At Facility C, there was an overwhelming dominance of Inactivity. A wide range of behaviours is required in order to alleviate suffering with behavioural deprivation being classified as a central problem in animal welfare (Dawkins, 1988) with inappropriate husbandry causing animals to be unable to perform behaviours more typical of their species. Given that this frequency of Inactivity at Facility C is the highest recorded level of inactivity for any lion within scientific literature, it can be considered an abnormal behaviour. Excessive sleep is identified as an avoidance strategy within the Stress Response Scale (Weiss, Horowitz and Wilner, 1984) for humans, to avoid a stressful situation and its implications. Bixler *et al.* (2005) determined that depression was the most significant risk factor associated with excessive sleep in people and that the association was stronger in the young. The Wistar-Kyoto (WKY) rat is a genetic model in which excessive sleep and even narcolepsy have been associated with depression (Allard *et al*., 2004). In animals, problem behaviours such as excessive sleep, are reflective of poor mental states and poor welfare (Gonyou, 1994). Increased inactivity can also be a biological indicator of boredom in animals (Burn, 2017) which implies an awareness of self as the animal misses an opportunity to perform alternate behaviours (Wemelsfelder, 1985). The corresponding negative emotion therefore associated with this behavioural problem is depression and should it continue will result in suffering (Dawkins, 1988). To determine this, it would need to be ascertained whether the behavioural deprivation effect expressed by the cubs is reversed once interactions are ceased or whether a long-lasting effect is attained. Should it continue, then the malfunction-induced behaviour (Mason, 2006) could morph into a stereotypical behaviour with sleep acting as the continuous repetitive behaviour.

Play behaviour, as with exploratory behaviour, occurs once all primary needs have been met, indicating a positive internal state (Held and Špinka, 2011). It encourages learning through behaviours adapted from usual contexts (Smith, 1982), it strengthens social attachments (Bekoff, 1977) and in correct contexts and quantities, reflects a positive emotional state (Barnett, 1958). Play is a plausible indicator of welfare at a population level rather than at an individual level (Richter *et al.*, 2016) as it has been known to increase when conditions are stressful such as in the absence of parental care or after a period of deprivation (Held and Špinka, 2011). Play therefore needs to be recorded in its various forms, such as social play versus solitary play, as well as frequencies of play and duration, if it is to distinguish between different welfare states (Ahloy-Dallaire, Espinosa and Mason, 2018). Self-play and conspecific play dominated the play behaviours expressed by the cubs, with relatively less play with humans. Facility pair AB cubs decreased their conspecific play frequency as human interaction numbers increased. This could mean that human interactions prevented opportunities for conspecific play as increased human play was not correspondingly increased. Self-play at Facility pair AB was not influenced by human interaction increase, suggesting that human interaction numbers typically experienced at Facility pair AB did not prevent learning within a solitary context, nor did they increase as is often done during stressful situations. Facility C cubs exhibited play behaviour at a frequency of less than one third of those at Facility pair AB. While their self and conspecific play were not affected by human interaction increase, their play with humans increased. It is possible that the increase of play with humans at Facility C is therefore indicative of a stressful situation (Held and Špinka, 2011), which would support the high levels of Inactivity being a problem behaviour.

The behaviours within the Attentive behaviour category are biologically different but were grouped together based on their necessitated focused state. Alert behaviour was the most common form of attentive behaviour expressed by the cubs. According to Wemelsfelder (1991), an animal should be able to be attentive when required to react to unexpected events and even concentrate on goal-oriented tasks. An inability to respond

appropriately to environmental stimuli has been linked with a poor variability of behaviours, with animals in impoverished environments becoming habitually inattentive. Wemelsfelder (1989) suggests that this inattentiveness leads to an inability to adapt to an environment and can be a precursor to stereotypic behaviours (Wiepkema and Van Adrichem, 1987). Facility C's cubs displayed alert behaviour at less than half the frequency of Facility pair AB's cubs. Ascertaining whether this is an effect of poor behaviour variability or simply a result of less frequency time remaining after a large proportion has been assigned to inactive behaviour, will need to be determined if lack of alert behaviour is to be associated with poor welfare. The Investigatory behaviour shown by the cubs occurred very infrequently and with high variability. Its presence in an activity budget suggests positive welfare, given that the benefits of such behaviour outweigh any costs and risks to the individual and as such must hold inherent value for animals (Renner, 1990). The lack of such behaviour might constitute a lack of behavioural diversity. Excitement behaviour is a positive anticipatory and reward-seeking behaviour - a response to a physiological need associated with high-arousal positive states (Mendl, Burman and Paul, 2010). When there is a high expectation of positive events, emotions akin to optimism are experienced (Mendl, Burman and Paul, 2010). The presence of excitement behaviour within the lion cub activity budgets is reflective of positive emotional states, albeit infrequent and highly variable.

Grooming behaviour was not significantly different across the three facilities and yielded similar frequencies and variability. Lion groom by licking and in affiliative behaviours, also head rubbing (Matoba, Kutsukake and Hasegawa, 2013). Licking assists in enforcing social bonds and has hygienic benefits (Schaller, 1972) with head rubbing providing a tactile opportunity to communicate affection and to also communicate through scents (Bradshaw and Cameron-Beaumont, 2000). Both forms of grooming between conspecific adults and subadults in captivity have been found to maintain and strengthen social bonds (Matoba, Kutsukake and Hasegawa, 2013) but no information is available on these activities in cubs. A reasonable assumption is that the benefits of these behaviours exist for cubs too. The performance of conspecific grooming, also termed

allogrooming, reflects a positive behaviour from a welfare perspective, and it was observed in the cubs. Self-grooming, also known as autogrooming, was the most dominant form of grooming by the cubs. Self-grooming maintains health by keeping the individual clean but also serves to thermoregulate, stimulate pheromones and decrease irritation, and as such are vital for adaption and survival (Feusner, Hembacher and Phillips, 2009). As with conspecific grooming, some self-grooming appears to reflect a positive emotional and behavioural state, but excessive self-grooming is indicative of a negative one. Human grooming, an obvious unnatural behaviour when compared to wild lion, is however reflective of a bond existing between cub and keeper. Such reciprocal relationships have been known to exist between humans and farm animals and result in improved quality of life for both (Hemsworth, 2003). There are reports of wild felids in captivity who rub and lick their human keepers, including those who, unlike lion, are solitary in behaviour (Cameron-Beaumont, Lowe and Bradshaw, 2002). This behaviour is strongly associated with human-reared felids (Mellen, 1988). The reason as to why an animal should groom an unfamiliar human, has not been determined. Perhaps it is a reciprocal behavioural reaction on the part of the animal who perceives the petting action as grooming or the animal soliciting favour, if it deems the human as a dominant. Human associated grooming increased with human interaction frequency, which simply reflects more opportunity. Human interaction frequency did not have any effect on self- or conspecific grooming.

Aggression was the least frequent behaviour category expressed by the cubs, with conspecific aggression occurring just a little more than human directed aggression. McGlone (1986) suggests that aggression can be termed an abnormal behaviour when the form of aggression is not witnessed in the wild. But Dantzer and Mormede (1983) state that aggressive behaviour can be considered abnormal when it results from a lack of control over the environment. Broom (1991) explains how fear is difficult to cope with and aggression may be an animals' response. Aggression may also be displayed as a result of frustration when another behaviour is unable to be performed (Roper, 1984). As such, a clear understanding of an aggressive response from a cub is required when

evaluating its emotional state, be it towards conspecifics or humans. Cubs at Facility pair AB exhibited increased flight behaviour as human interaction increased. Flight was also associated with human directed aggression, thus linking the fight and flight responses. Both are viewed as responses to a state of fear (Boissy, 1995). Animals need to have control over their environments through choice or manipulation, as it provides them with opportunities to avoid a negative stimulus. A lack of control results in fear, eliciting a flight, fight or undesirable behavioural response (McBride, 1984). None of the lion cubs had access to a retreat space where they could retain control over their environments.

Non-nutritive suckling was the predominant form of abnormal behaviour at Facility A and B. A behaviour typically observed in intensely farmed animals such as bovine calves, non-nutritive suckling is reduced when previous nutritive suckling bouts are for a sufficient time and that the non-nutritive suckling was not as a result of low feed levels, however did present itself when a meal was skipped (Rushen and de Passillé, 1995). It was also determined that milk source (cows' milk or artificial milk) did not have an influence on the time spent on non-nutritive suckling (de Passillé, Rushen. and Janzen, 1997). The desire to non-nutritive suckle was strongest in a 10-minute interval after having ingested milk. The satiating effect of the non-nutritive suckling was related to metabolic hormones which continued to increase (de Passillé and Rushen, 1997). It was concluded that deprivation of suckling behaviour could influence digestive physiological processes. The survival of young depends on their successful suckling and de Passillé (2001) draws the link between this strong motivation and frustration if suckling is deprived, resulting in negative impacts on welfare. Given that the act of suckling is an appetitive behaviour, it should be provided for in captivity in order to alleviate stress (Carlstead and Shepherdson, 2000). The performance of non-nutritive suckling in the lion cubs, indicates a desire to perform the behaviour.

Stereotypy, in the form of pacing, was the dominant form of abnormal behaviour expressed by the lion cubs and was extremely variable, mostly abundant at Facility C. It is well known that environments which induce stereotypy reduce animal welfare. Mason

(2006) suggests that stereotypy behaviour be classified as either 1) a frustration-induced behaviour which is maladaptive, in that it is performed by a normal animal responding to an abnormal environment and can be reversed and 2) malfunction-induced behaviours which are associated with mental pathologies and impaired central nervous system functioning. Pacing, as a very common form of abnormal repetitive behaviour, was most presented at Facility C, evident when the cub cohort were split into adjoining enclosures, and as such can be classified as a frustration-induced response to separation from conspecifics. An incident at Facility B which resulted in pacing, when a fire break was being burned outside of the enclosure, can also be classified as a frustration-induced response. Clubb and Vickery (2006) describe how carnivore stereotypies are typically actioned along the border of an enclosure and represent frustrated escape attempts such as to reach a mate. These lion cub stereotypies are undesirable and represent a frustration to being confined in an environment it wishes to escape from.

Shaking and trembling as observed by a cub at Facility B, represents a state of freeze, a defensive response not characterised by flight nor fight, as each are mutually exclusive (Eilam, 2005). The freeze state reflects hypervigilance, associated with fear whilst a decision to then either flee or fight is being weighted up (Bracha, 2004).

The fence biting behaviour expressed by a cub at Facility C is an abnormal behaviour. Not all abnormal behaviours are harmful to the animal but do reveal a problem (Cooper and Mason, 1998). This behaviour had presented itself very infrequently and should it have then developed further into a repetitive abnormal behaviour, would have been reflective of a state of on-going frustration (Mason et al., 2007).

5.4 Interactor questionnaire

In order for controversies over wildlife interactions to be abated, it is clear that there should be benefits for the animals as much as there are benefits for the interactors. Ballantyne, Packer and Falk (2011, p2) have summed up the positives for the wildlife tourist as being "heightened awareness, appreciation of and reconnection with nature, personal rejuvenation and a realisation of personal responsibility for the state of the environment" while those for the wildlife may include "providing income for the ongoing protection and sustainable management of wildlife and wildlife habitats encouraging visitors to make financial and non-financial contributions to environmental causes; providing socio-economic incentives for the conservation of natural resources and influencing tourists' behaviour during their visit". It should however be noted that these benefits are more for the species and their wild counterparts as opposed to the individual animal ambassadors themselves. Baird (2018) suggests that this is because best practice guidelines are generally designed for zoos and sanctuaries and do not take into account the varied husbandry and interaction conditions such ambassador individuals are exposed to. While 38% of the interactors were aware of controversies around interacting with wildlife and specifically lion cubs, this is not a reflection of public awareness in general. It is a limitation of the study that the respondents interviewed did not represent those who are aware of such controversies and as a result, choose not to interact. Selfish motives or self-interest often result in people applying their judgement to maximize their own personal objectives (DeScioli *et al*., 2014) as was the case with tourists initiating contact with rehabilitating Orangutans in Malaysia (Markwell, 2001). While this might be a plausible reason in the case of lion cub interactions; for those who mentioned the desire to interact despite having knowledge of such controversy; it cannot be assumed that the controversy is always negative and valid. The respondents who indicated their intention to verify the facility for themselves, thus wanting to make up their own opinions about such controversies, suggests that there will always be a market for such activities, and if the controversies are to be abated, then a decision will need be made between banning or regulating the industry– a long standing animal rights debate (Francione and Garner, 2010).

It is evident from the responses that the interactors did not have much in the way of expectations when it came to interacting with the lion cubs, as 65% simply expected to interact. This basic need is perhaps a result of our dissociation with animals (Curtin, 2009), and that the act of interacting is seen as a way of getting in touch with nature (Carr and Broom, 2018). Marketing and media influence tourist motivations and expectations around animal interactions (Newsome, Dowling and Moore, 2005). But understandably, these cubs are very unlikely to be the same individuals and seldom similar ages to the ones depicted and this may result in expectations not being met. There is therefore a repercussion to digital and social media, in that a tourist desires the interaction depicted (Carr and Broom, 2018). Prior knowledge and attitudes can impact the extent of the introspection and reflection within an animal exhibit (Ballantyne, Packer and Falk, 2011). In our study, the expectations held by respondents prior to interacting with the cubs were significantly associated with the impact they would experience. This implies that a change in media and advertising could effect a change in expectations, thus having a more positive pro-conservation impact on the interactors. When interactors had no expectations or were faced with situations opposite to what they wanted, such as older cubs when presented with young ones, they experienced no impact at all. But when expectations were met through the experience, opportunities for self-reflection, empathy for the cubs and a pro-conservation attitude was achieved. Some respondents felt that their expectations were exceeded as they had had an opportunity to reflect on the actual cubs they had interacted with. This ability to think deeply about an experience or about individuals, viz the cubs, allows the respondent to gain a philosophical account of their experience, supports free will and lays the foundations for moral based values (Velleman, 1989). Such responses suggest an understanding of the cubs on a personal and individual level, referring to their states of minds and personalities and not simply objectifying them as objects of entertainment.

The impact of an experience is determined by an affective involvement and when associated with an animal experience can result in an environmental social identity, reflecting connectedness, caring and empathy for both animals and nature (Luebke and Matiasek, 2013). But, when examining the affective experience responses of respondents, not all reflected a connectedness with the cubs, with several reflecting only on their own affective states. Some respondents expressed empathy towards the individual cubs as opposed to the species, but it is not known whether this would be enough to impart a sense of environmental identity. Conservation awareness was achieved in some respondents, ranging from a sense of heightened awareness of the plight of wild lions to even changing perceptions around their possible persecution. This awareness is a characteristic of apex predator tourism, but requires support both publicly and politically, through management, monitoring and regulation, if it is to be effective (Macdonald et al, 2017). Overall, 22% of the respondents were able to use the impactful experience for positive introspection and reflection, which may have led to them being active conservation advocates (Luebke and Matiasek, 2013).

While lion cubs meet the criteria for being favourites amongst visitors, they did not overwhelmingly maintain this position post interaction once other animals had also been interacted with. Marginally leading as the favourite interaction experience at Facility A and C, cubs did so on account of their trait for being “a baby / cuter / playful & active”, a characteristic known to attract favouritism (Small, 2012). The baby schema concept explains how traits associated with young animals have a high appeal for humans (Borgi *et al*., 2014). This trait therefore appeared to have a greater relationship to the age of the cub rather than the fact that it was a lion. Cheetah were identified as the favourite animal interaction experience at Facility B for traits which were dissociable with those of the lion cubs, such as being an “adult” animal and being “calmer/ quieter” and for “interacted back with me / more natural and less commercial”. Giraffe at Facility C shared this latter trait with the cheetah, as they chose to interact with the public by approaching the fence of their enclosure for feed. Here the idea that an animal chooses to interact with the public is seen as an attractive trait (Bitgood, Patterson and Benefield, 1988) and was the leading

reason why an animal was identified as being the favourite interaction of the day. The psychosocial and psychophysiological effects of human-animal interactions are well described and explain why animal assisted therapy is so successful (Beetz *et al*., 2012.). But it should be noted that a prerequisite for such positive interaction effects, such as those felt through reciprocal interactions, is that the animal is perceived as a social partner thus allowing for an emotionally relevant relationship, (Julius *et al*., 2012).

Half of the respondents had been accompanied by children, supporting the idea that lion interaction facilities, as with zoos, are considered destinations for family outings and activities. Wineman, Piper and Maple (1996) classified contact with animals at zoos as high-impact experiences, citing it as an opportunity to overcome fears and cultivate curiosity in children, with similar effects for adults. The majority of these respondents had brought the children to interact for an experience associated with proximity and touch. The lack of barriers was mentioned by respondents and clearly differentiated from the experience one could get by just visiting the zoo. There was also a desire amongst respondents to share such experiences across various social platforms. Dinhopl and Gretzel (2016) explain how the modern tourist uses ‘selfies’ to transform a destination into an extraordinary experience around themselves. Despite education being a reason provided by nine percent of respondents who brought children to interact, it does not imply that only nine percent of children would be educated through the experience. Wells and Lekies (2006) suggest that childhood involvement with both wild and domesticated nature can do more than just educate, it can effect change in environmental behaviours. However, Wilson (1995) considers that one of the best ways to teach children about caring for the environment is to practice it, and so respondents which were motivated to educate their children around environmental issues were likely to be themselves already enlightened and likely to pass on this knowledge to their child, not needing the lion cub experience to do so. The rationale to bring children to interaction activities so that they might learn or develop a passion for animals is supported by Eagles and Muffitt (1990), who determine that opinion-forming behaviour in children is imperative for the appreciation of wild animals as adults. Whatever the motivation to bring a child to interact,

what is perhaps more important is how the experience is perceived by the child. A fearful experience could negate the opportunity for positive change in environmental behaviours, as with the children which experienced the interaction negatively due to being nervous, scared and/or uncertain. Responses relayed by the respondents on how the child expressed this negative experience appear to all be routed in not being suitably prepared for the experience of interacting with the lion cub, incorrectly expecting it to be domesticated or tame. This at times also appeared to be perpetuated by comments on how the child should behave in order to not get injured by the cubs. A state of anxiety causes a child to be unavailable to process cognitive information efficiently (Perry, 1999), thus rending the experience a lost educational opportunity.

There is a need for both in situ and ex situ conservation efforts to meet real conservation outcomes (Buckley *et al*., 2020) and link their existence to environmental problem solving (Fa *et al*., 2014). Lion numbers have decreased by 43% in the last two decades, with estimates of only 20,000 remaining in the wild (Panthera, 2019). Ambassador individuals can facilitate this awareness through close interactions which have been shown to increase knowledge, have a behavioural effect and create awareness for the animal, its species and nature (Povey and Rios, 2002). Understanding this capacity for education, the fact that only just over half of the respondents had felt that they had learnt something is not positive for conservation. A deeper inspection of what had been learnt reveals that the majority of the respondents had simply inferred knowledge through their own experiences such as the feel of the cubs' coat. We can deduce that what the respondent thought they had learnt had in fact only been their perception of an experience. General facts relayed by the guides, including how to conduct themselves around the cubs, does not contribute towards sense of environmental identity. Only one percent of the total adult respondents had learnt about the plight of lions and were as a result equipped to effect a behavioural change.

Fraser (1995) explains how different people consider what is good and/or bad for an animal based on their own judgement about what they consider important for that animal. The lack of significance towards welfare within the demographics of the respondents is supported by Herzog and Burghardt (1988), who state that attitudes towards animals are highly personal. What was evident from our results is that there are clear overall positive and negative welfare states associated with lion cubs used in the interaction activities. Freedom from discomfort was the leading positive welfare state indicated by respondents. Responses on why this was identified, appear to be driven by respondent feelings, and not a knowledge of welfare as suggested by Melfi, McCormick & Gibbs (2004). The example provided by one respondent that these lion cubs had better lives and shelter than most people, reflects this. Freedom from hunger and thirst was the second positive welfare state indicated by respondents. This is supported by a common notion that, in captivity, animals do not need to seek nor fight for their food and avoid hardships associated with scarcity. A lack of freedom to express normal behaviour was the leading poor welfare indicator, with respondents identifying the lack of other lions present and especially the absence of the cubs' mother. The second leading poor welfare state contradicts the identified leading welfare state, namely the lack of freedom from discomfort. The reasons given by the respondents were also driven by personal feelings and reflected that the cubs could be leading a better life if they were not used for such interactions. One Health thinking ties together the need for a healthy and willing animal which is mentally stable to be used in human animal interactions if there is to be an emotionally relevant relationship from which a positive effect can be gleaned (Julius et al, 2012). This one health concept seeks interdisciplinary collaboration between human, animal and environmental health care, understanding their interconnectedness with each other (Gibbs, 2014). Without optimum welfare, such ambassador lion cubs are unlikely to make the necessary impact on interactors, required for the formation of an environmental identity, required in order to support the survival of their wild conspecifics.

5.5 A utilitarian review

Fennel (2012b) states that utilitarianism holds value as an ethical decision-making tool in tourism where the interests that animals may have in not suffering is weighed up against human benefits. Fennel further emphasises that this would require an assessment of costs and benefits to a broad community from tourists through to operators and importantly, the animals whose interest must be presented. The utilitarian ethical review example was able to execute this brief, reaching a diverse range of stakeholders.

Position one and position four are two opposite extremes of the interaction industry yet their harms-benefit analysis frequency results are remarkably similar. They are both lacking in true benefits with none being identified in position four and only one, the associated industries being identified in position one. The difference therefore lies in which combination of stakeholders are harmed and the reasons why. Position one reflects exploitation of the non-human stakeholders including the lion cubs, their mothers, the wild lion populations and the environment. In part this has been caused by the intense farming of lions, and typical of intensified animal production systems, associated welfare compromise akin to suffering. When tourists view animals in helpless states with poor welfare, they may be overcome by a sense of helplessness (Keulartz, 2015). This helplessness may translate into a negative experience with negative emotions and hamper environmental consciousness (Powell and Bullock, 2014), as opposed to positive emotional experiences which have the capacity to connect more with the earth and be more environmentally responsible (Carter, 2011). While position one is lacking in pure benefits the human stakeholders who generate a living and income from the captive lions and their breeding do experience mixed situations with regards their benefits and harms. The opportunity to generate an income and support one's family has far reaching consequences, and this is certainly true for South Africa where unemployment levels are at 32.6% (Statistics South Africa, 2021). However, stressful and psychologically taxing jobs threaten the affective wellbeing of the employee (Rothmann, 2008). This has been reported in intensive animal production systems where suffering spreads from animals to

humans, causing the employee physical, psychological and moral suffering and this is exaggerated by the need to conceal this (Porcher, 2011).

Position 4 may be thought of as an ideal position, given that no captive animals and no interactions with tourists must mean no animal suffering and exploitation. Despite this, according to the utilitarian ethic review, this position rates the poorest as it provides the least benefit to the least number. There is a distinct lack of benefits to the human stakeholders who are unemployed as a result. Once cannot conserve nature and biodiversity when communities are poor, in fact many communities have remained poor as a result of such high ethical values (Gupta, 1990). South Africa has many game reserves and national parks and it is argued that education around conservation issues are better suited to such settings, negating the need for captive wildlife and or wildlife interactions. South Africa's national parks attract millions of tourists annually, contributing significantly to the tourism economy (Butler and Richardson, 2015). However, figures from South Africa's Department of Tourism show that Black South Africans make up only a very small proportion of these tourists (NDT, 2012) with a lack of financial capacity being the leading cause (Butler and Richardson, 2015).

Virtue ethics referees between the extremes of relativism and absolutism (Hinman and Park, n.d.). with a virtuous person being able to do the right thing for the right reason (Annas, 2006). A virtuous assessment of the four interaction positions would therefore indicate positions two and three as being most virtuous given their middle ground reasoning. The utilitarian ethics review has however taken this virtue ethics a step further by clearly identifying position three as being the most ethical, based on the frequencies of benefits, harms and mixed analyses. The most notable difference between position two and three is the absence of the need for breeding lion mothers and their cubs to exist. This negated need to have breeding mothers who must suffer in order to have their cubs removed for interaction purposes decreases the harms, which despite the best welfare standards as identified by this study, remained a concern. Common sense ethics, also

known as pre-theoretical moral judgement, may have foretold this position, however some may require these facts to explain and justify the result (Brown, 1998).

Position three with its utilitarian ethical consideration, reflects many of the current sentiments circulating in animal-based tourism industries. Karwacki and Boyd (1995) refer to ethical ecotourism which is aware of its impacts both on the supply side and on the demand side of the experience and which ensures sustainable conservation of protected areas. Understanding the demand side of animal-based tourism can inform ethical consumerism in the tourism industry, as it seeks to minimize negative impacts on the society and the environment (IGD, 2007). An environmental ethic making use of environmentally justified virtues calls for a wonder of nature, compassion towards animals, and a sustainable use of natural resources (Sandler, 2013). Finally, the concept of one-welfare emphasises the interconnectedness of animal welfare, human wellbeing and environmental health and specifically understanding how animal welfare adds value to society (Pinillos *et al*., 2016).

5.6 Summary

The lack of governance and regulation is not a direct welfare concern, but it does indicate that in the absence of such governance and regulation, many welfare contraventions are experienced. The use of stud books and DNA profiling should be used to prevent inbreeding. The removal of the cub so early from the mother means that its nutritional and psychological needs are compromised. Interaction times need to be monitored so that cubs are still able to meet their sleep, social and behavioural needs and are also granted the choice to retreat from such interactions should they wish. Understanding species-specific needs and the cubs' behaviour is an integral part of this. Hygiene is essential for a healthy cub and healthy environment. The affective state of the cubs is linked to the provisioning of other welfare needs. Finally, the entry and exit strategies for the cubs introduces not only welfare but also ethical concerns and raises welfare concerns after interactions have concluded. The 12 unacceptable practices

proposed by the study through the conjoint analysis survey, reveal what might possibly be seen as first minimum requirements for such a regulated industry.

The study contributes substantially to the knowledge of cub behaviour within such facilities and it is evident that the management strategies of the interaction facility is a strong influencer of this behaviour. Human interaction frequency can affect both the diversity of behaviours and their frequencies. At low interaction frequencies, cubs can still express a diversity of behaviours though there may be a change in their frequency. At high interaction numbers behavioural deprivation is evident with a potential for developing a malfunction induced behaviour.

Despite the controversy surrounding lion cub interactions, there is still a desire from tourists to do so. Not all reasons for doing so are negative and many do originate from good intentions. Children are strong influencers in this activity with many parents considering it an opportunity for them to experience the activity. There are opportunities for educating the tourist about lions and the environment, yet facilities are not providing this. With regards the cubs' welfare, tourists were conflicted on the freedom of discomfort with many feeling that captivity alleviates discomfort typically experienced in the wild, whilst other felt that the cubs were in discomfort as a result of the captivity and activities they were being used in. The welfare of the animal is linked to its ability to cause environmental consciousness through an interaction. Only an animal in a positive welfare state, able to connect with the tourist on its terms, can do so.

When wildlife interaction offerings are assessed, they need to be accountable to all stakeholders and the animals used should be equal participants. Virtue ethics and utilitarianism have indicated that the most benefits can be afforded to the greatest number when an alternate species more suited to such activities is used.

CHAPTER 6: CONCLUSION

The chapter begins by concluding (section 6.1) on the study and then moves on to describe the limitations (section 6.2) ending with recommendations for further research (section 6.3).

6.1 Conclusion

The workshop, with its truly diverse range of stakeholders, resulted in a complete understanding of welfare issues faced by lion cubs within the tourism interaction industry. The workshop provided the first unbiased, consensus-based description of a tourism-based industry's impacts on the welfare of a specific animal group, supported by the fact that there was no significant relationship between welfare issues raised and stakeholder affiliations. Experience with either captive or wild lion was the defining factor regarding an association with the identified welfare issues. Having such a representative overview facilitated acceptance. The welfare concerns identified by the stakeholders, a lack of governance and regulation and the problems of inbreeding, call for a stricter, more regulated and accountable industry. The welfare concerns that were next identified were considered for recommendation of regulatory control but are to some extent inherent to the practice: nutrition of the cubs, impact of removal of the cubs from the mother and the age of such removals. These issues are the major concerns of many of the industry's critics, are exceedingly difficult to address (in that they are required for the industry to exist) and as such would need to warrant existence on approved governance and regulatory grounds through demonstrated education and confirmed conservation benefits. If this could be guaranteed, then interaction time management, environmental choice, species-specific needs, social needs, behavioural knowledge and hygiene all need to be considered and included in the governance and regulations proposed. The entry (captive lion breeding practices) and exit (post interaction life of the lions) strategies of lion cubs to and from the industry needs far greater attention, and the interaction industry should not be excused from welfare issues these may generate. Non-negotiable

practices identified unanimously by the group lend themselves to being the first minimum regulatory practices for such an industry.

The value model produced through the conjoint analysis survey of welfare issues can be used to guide cub management on what is unacceptable through to what is optimal and ought to be strived for, within industry practices. The minimum welfare levels identified within each issue should be considered unacceptable, as a result of their lack of welfare weighting, and should supplement the non-negotiable variables identified through the stakeholder workshop. At an individual level, facilities would be encouraged to make use of the value model to identify areas where they might improve welfare for the lion cubs in their keep.

Facilities which host lion cub interactions clearly have the capacity through their management actions to influence and affect the behaviour of the lion cubs within their programmes. Their ethological profiles can be used as welfare indicators based on the diversity and durations of the behaviours expressed, with human interaction frequency affecting both. Facilities which host less than 100 interactions per day do not appear to influence behavioural diversity but do have an impact on the sleeping behaviour, conspecific and human directed play behaviour, alert behaviour, human directed grooming, human directed aggression and associated flight response frequencies. The listed human directed behaviours are clearly associated with human interactions and as such can be readily altered through allowing cubs retreat opportunities from humans, as identified through the stakeholder workshop and welfare value model. When interaction numbers exceeded 100 and approached 300 per day, the cubs appeared to no longer have the capacity to cope, resulting in a lack of behavioural diversity being expressed, with sleep becoming the dominant malfunction-induced pathological behaviour exhibited.

Non-nutritive suckling, typical of intensely farmed animals, was evident but also as with intensely farmed animals, dissipated with age, linked to the age when suckling would naturally cease. Stereotypy in the form of pacing along perimeter borders was exhibited and was clearly associated with frustration induced responses, reflecting a strong desire to escape the confinement of the enclosure in which the cub was held.

Despite controversies existing within social media over lion cub tourism interactions, tourists remained keen to experience the activity for themselves and had a desire to draw their own conclusions around such controversies. Poorly defined interaction expectations mostly resulted in poor impacts on the tourist. Such poor impacts do not lead to philosophical reflection and thus minimize the learning potential of the experience. Children are clear influencers and the cause for participating in the interaction activity when present. The clear identification of a lack of freedom to express normal behaviour, by interactors when asked about the cubs' welfare, appears to indicate a realization that the behaviour of the cubs indicates a welfare concern. Conversely, the identification of freedom from discomfort reflects a desire to believe that facilities hosting cub interactions have the capacity to positively enhance the lives of those they are custodians of.

A utilitarian ethical review coupled with a harms-benefit analysis further interrogated the ethics of the practice of lion cub interactions and considered the effect that welfare standards, identified through the study may have on such practices. While welfare improved the ethical outcome, it was determined that a more suited species, provided with highest welfare standards would be required in order to attain a better ethical outcome for all stakeholders.

The stakeholder workshop provided the study with an in-depth review of welfare issues faced by lion cubs within the wildlife tourism interaction industry. These welfare issues were ranked for importance, making use of the conjoint analysis and provided the

industry with a tool to improve the welfare of the cubs. The cub ethological study was able to confirm these issues from the cubs' perspective and reflected the effects of interaction frequency on their behaviour and welfare. The desire for and the outcomes of such interactions needed to be understood in order for the welfare compromise to be contextualized and this was achieved through the interactor questionnaires. A harms-benefit analysis was now possible and resulted in a utilitarian guided ethical solution.

6.2 Limitation of the study

The coefficient of concordance in the conjoint analysis survey could have been improved had less participants opted out of the survey, potentially decreasing the wide standard errors for each of the rankings.

Only three lion cub interaction facilities allowed the researcher to make use of their facilities and as such the data only represents findings from these three facilities. While they may represent what typically happens at lion cub interaction facilities, there is a chance that different results may have been gleaned from a wider data base. Adding to this, the facilities were aware of the presence of the researcher and the objectives of the study and this may have had implications for how the cubs were managed.

Motivations and perceptions of interactors was determined through interviews, however interviews with those opposed to interacting may have allowed for more in depth analyses regarding those both for and against such activities.

A theoretical harms-benefit analysis would be strengthened by interviews with various stakeholders, so as to validate the harms, benefits and mixed effects.

6.3 Recommendations

Lion cub interactions occur globally but within different societal and cultural contexts. Welfare issues faced by the lion cubs will however remain valid for all cubs. As such, a harms-benefit analysis, specific to such society and culture, may assist in deciding which interaction position is deemed acceptable as a tourism activity. Should lion-cub interactions be deemed permissible within that society and culture, then it should be in accordance with the best welfare practice model produced from this study.

In terms of future recommended research, it would be beneficial to start reviewing the welfare of many different species used in wildlife interaction tourism, making use of similar interdisciplinary theories. Such interdisciplinary studies should then seek to inform policy, encouraging wildlife interaction tourism to meet targeted welfare and ethical standards.

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APPENDICES

Appendix A: Stakeholder workshop program

UNISA university of south africa

Programme:

The identification and ranking of key welfare issues within the African lion cub petting industry

Glenburn Lodge

31 May 2016

Time	Activity
08:30 – 09:00	Morning tea
09:00 – 09:30	Welcome, Introductions, Expectations and Objectives Ground Rules
09:30 – 09:40	Scope and Context of the Research Project
09:40 – 10:00	Welfare and its Importance
10:00 – 10:30	Theme Identification
10.30 – 10:45	Theme Prioritisation
10:45 – 11:00	Tea
11:00 – 12:30	Identification of Areas per Theme
12:30 – 13:00	Prioritisation of Areas per Theme
13:00 – 14:00	Lunch
14:00 – 14:45	Feedback on prioritisation
14:45 – 15:30	Identification of "non-negotiables"
15:30 – 15:45	Tea
15:45 – 16:30	Closure and Way Forward

Appendix B: Interactor questionnaire

Part 1:

1. Please indicate your age group:

   ☐ 18 to 30 years ☐ 31 to 50 years ☐ 51 and over

2. Please indicate your continental association:

   ☐ Africa ☐ Australasia ☐ Europe ☐ North America ☐ South America ☐ Asia

3. Please indicate your gender:

   ☐ Male ☐ Female

4. Where do you live:

   ☐ In a city (built up environment with no garden) ☐ Suburbia (housing community with gardens and/or green spaces) ☐ In a rural environment (such as on a farm or game reserve)

Part 2:

5. Are you aware of, or have you heard of any controversy around lion cub interactions?

   ☐ Yes (please answer question 6) ☐ No (please move on to question 7)

6. Despite knowing of the controversy, what made you still come interact today?

Part 3:

7. Would you participate in a cub interaction experience again if you could (assuming you were not affected by distance and/or cost)?

   ☐ No, I have now done it and know what it is about ☐ Yes, but not in the too near future (next 2 years) ☐ Yes, and soon (within the next 2 years)

8. Did you interact with any other animals today?

   ☐ Yes (please answer question 9) ☐ No (please move on to question 10)

9. Which other animals did you interact with and which animal interaction was the most enjoyable for you and why?

Part 4:

10. Had the actual cub interaction activity, not been a part of today's experiences, would you still have visited this facility? And why?
11. Did the actual physical interaction with the lion cub live up to your expectations, please elaborate.
12. What impact if any, did the cub interaction experience have on you?

Part 5:

13. Do you have children under 17 with you here today?

    ☐ Yes (if yes, then please answer questions 14 & 15) ☐ No (if no, then please move on to question 16)

14. Did the fact that you had children with you here today, in any way affect your decision to come and pet cubs, and why?
15. How was the interaction experience received by the children? Please elaborate:

Part 6:

16. Was the actual interaction an educational experience for you?

    ☐ Yes (please answer question 17) ☐ No (if no, then please move on to question 18)

17. Please share what you learnt through the actual cub interaction you experienced.

Part 7:

18. What did you think of the welfare of the cubs you interacted with and please elaborate?

Appendix C: Participants of the stakeholder workshop who requested recognition for their input and participation and those of the organisations they represented.

K.A. Ramsay, a then recently retired governmental organization stakeholder whose views were expressed in his personal capacity.

K.M. Hatley, a lion owner and breeder whose views were expressed in her personal capacity.

K. Koeppel, a practicing wildlife veterinarian and academic, whose views were expressed in her personal capacity.

B.K. Reilly, an academic in the Nature Conservation industry, whose views were expressed in his personal capacity.

S. McKay an animal ethologist, whose views were expressed in her personal capacity.

A. Abrahamson, an animal rights advocacy representative who represented the views of Captured in Africa Foundation.

K.A. Marnewick, a representative of the Nature Conservation industry whose views were expressed in her personal capacity.

D. Morgan, an animal welfare organisation stakeholder who represented the views of Wild Welfare.

N. Wright, a wildlife rehabilitator specialist, whose views were expressed in her personal capacity.

W. Jacobs as a lion owner and breeder, who expressed the views of Ukutula.

I. Wentzel, an animal welfare organisation stakeholder who represented the views of the National SPCA.

T. Mashua, a governmental organization stakeholder whose views were expressed in her personal capacity.

Appendix D: Mean and standard deviation percentage utility scores achieved for each attribute according to the affiliation of the participants

Attributes	Cub handler	Owner / breeder	Nature conservator	Government official	Ethologist	Rehabilitator	Veterinarian	Academic	Animal rights advocacy rep.	Animal welfare organisation rep
Breeding										
Ad hoc breeding	6.9 (2.1)	7.05 (4.64)	4.5 (4.5)	7.8 (3.8)	5.2 (3.5)	1.9 (0)	4.8 (3.4)	5.8 (5.0)	3.3 (2.5)	4.6 (3.1)
Use of a husbandry studbook	9.9 (3.6)	11.31 (3.82)	9.4 (6.6)	11.3 (4.8)	9.4 (3.6)	3.7 (0)	9.2 (5.2)	11.0 (5.8)	5.6 (3.3)	9.3 (3.7)
Care takers										
Multiple semi-trained volunteers	9.6 (1.7)	7.79 (5.78)	5.5 (3.3)	5.0 (2.3)	3.5 (3.1)	3.7 (0)	4.4 (2.9)	6.1 (3.5)	3.1 (3.6)	5.5 (2.7)
Trained full time handlers only	13.6 (6.3)	10.94 (5.60)	10.6 (5.0)	10.0 (4.7)	5.3 (3.8)	5.6 (0)	8.1 (2.7)	11.1 (4.7)	6.2 (4.3)	10.6 (4.6)
Nutrition linked to removal from mother										
Removal after 2 days	2.5 (2.4)	3.28 (2.24)	3.3 (2.7)	4.4 (4.7)	4.1 (2.2)	3.7 (0)	3.7 (1.9)	5.2 (4.0)	6.0 (3.2)	5.2 (5.1)
Removal after 2 weeks	6.2 (2.9)	6.29 (4.59)	6.5 (4.1)	9.5 (7.4)	10.9 (5.8)	7.4 (0)	6.7 (2.1)	10.7 (7.7)	9.8 (5.1)	11.0 (10.1)
Nutrition up until 6 months of age										
Replacer milk until 4 months while introducing chicken pieces then chicken and meat carcasses	2.9 (3.4)	4.1 (4.3)	3.2 (2.3)	4.3 (3.0)	3.0 (3.3)	3.7 (0)	3.9 (2.7)	4.0 (2.9)	1.9 (1.5)	4.5 (2.8)
Replacer milk until 6 months while introducing feline pellets then chicken pieces then chicken and meat carcasse	4.9 (5.0)	5.9 (5.3)	5.0 (3.8)	6.1 (3.2)	4.8 (5.0)	9.3 (0)	6.3 (5.1)	5.3 (2.7)	5.6 (4.7)	9.3 (5.2)
Number of interactions per day										
100 - 200 interactions per day	6.4 (2.9)	2.8 (2.0)	3.2 (2.1)	3.5 (2.0)	3.5 (3.8)	1.9 (0)	2.8 (3.0)	4.5 (2.4)	2.7 (1.2)	3.1 (3.1)
< 100 interactions per day	8.7 (5.2)	6.0 (3.8)	9.5 (5.3)	7.1 (2.9)	7.4 (5.5)	3.7 (0)	6.9 (3.3)	7.3 (2.5)	5.4 (2.3)	8.2 (9.0)
Cubs' ability to choose their environment										
Sleeping cub interacted with but allowed to retreat from an interaction	6.4 (0.5)	6.3 (4.6)	5.8 (4.0)	6.4 (4.1)	8.6 (4.9)	3.7 (0)	6.7 (3.1)	5.5 (2.0)	5.6 (6.3)	7.0 (4.6)
Sleeping cubs not disturbed and allowed to retreat from an interaction	7.9 (0.7)	8.9 (3.7)	9.9 (4.6)	10.0 (6.8)	11.3 (5.3)	7.4 (0)	11.1 (6.3)	9.3 (2.6)	9.9 (3.1)	11.4 (5.3)
Training										
Tap on nose for inappropriate behaviour, applied by handler only	2.0 (2.6)	5.2 (1.8)	3.7 (3.4)	4.3 (1.3)	3.4 (2.8)	9.3 (0)	3.3 (2.1)	5.2 (3.1)	4.1 (2.8)	5.3 (3.5)
No training & no repercussion for inappropriate behaviour	2.2 (2.6)	9.1 (5.2)	6.5 (4.4)	6.7 (3.5)	5.9 (3.5)	13.0 (0)	5.3 (4.9)	6.6 (3.8)	5.7 (2.9)	10.7 (6.7)
Social grouping										
Cubs grouped but split during interaction hours	7.9 (0.8)	4.4 (1.0)	7.4 (4.3)	5.7 (3.7)	14.7 (3.1)	3.7 (0)	9.1 (6.8)	7.6 (6.8)	5.6 (6.4)	8.1 (5.3)
Cubs always together	8.7 (0.7)	10.1 (4.9)	10.3 (5.6)	8.9 (3.6)	19.5 (4.8)	7.4 (0)	12.7 (6.7)	11.8 (5.7)	12.9 (11.9)	10.9 (5.6)
Extent of interaction										
Entire body stroked	6.9 (2.1)	5.3 (4.8)	2.4 (1.4)	3.3 (2.5)	4.1 (2.6)	7.4 (0)	2.4 (2.4)	3.7 (4.9)	2.2 (2.3)	3.4 (2.2)
Backs & abdomen only	14.2 (2.8)	7.3 (4.4)	5.6 (2.4)	5.8 (3.7)	6.9 (4.8)	20.4 (0)	3.8 (2.7)	5.3 (5.4)	7.2 (5.6)	4.9 (1.6)
Vaccinations & parasite control										
Parasite control only	2.9 (0.7)	3.1 (1.9)	5.4 (4.5)	3.6 (2.4)	4.8 (1.8)	1.9 (0)	9.1 (5.3)	3.6 (1.9)	9.2 (2.0)	2.3 (0.9)
Vaccinations & parasite control provided	7.3 (4.9)	7.0 (4.2)	11.5 (7.2)	9.5 (4.1)	7.8 (4.1)	3.7 (0)	13.8 (5.0)	7.6 (2.9)	13.0 (2.7)	4.1 (1.4)
Disease transfer										
Hand soap wash only	2.5 (1.9)	4.6 (4.3)	3.6 (3.3)	3.6 (2.5)	1.0(0.9)	5.6 (0)	4.3 (3.5)	2.3 (1.7)	5.7 (3.0)	1.7 (1.6)
Foot baths and hand disinfectants used	6.3 (0.4)	8.8 (8.1)	6.2 (4.5)	6.9 (3.5)	3.0 (3.3)	13.0 (0)	7.4 (5.8)	5.0 (4.2)	8.4 (42.5)	3.3 (2.1)
Enrichment										
Climbing structures only	9.5 (4.1)	6.0 (2.5)	5.8 (5.2)	4.8 (2.7)	4.0 (3.0)	3.7 (0)	5.1 (3.6)	7.4 (3.1)	5.5 (50.7)	3.4 (2.2)
Toys and climbing structures provided	10.0 (3.8)	8.8 (3.1)	9.1 (4.7)	8.2 (3.5)	7.7 (6.2)	5.6 (0)	8.5 (3.5)	9.0 (3.3)	10.3 (4.4)	6.3 (4.3)

Appendix E: Mean and standard deviation percentage utility scores achieved for each attribute according to the experience of the participants

Attributes	<1 year	1-5 years	6-10 years	11-15 years	16-20 years	>20 years
Breeding						
Ad hoc breeding	4.9 (4.2)	5.4 (2.8)	4.7 (4.8)	7.6 (5.2)	6.2 (3.7)	4.4 (3.7)
Use of a husbandry studbook	6.9 (2.9)	8.3 (4.1)	10.5 (5.5)	10.7 (5.8)	11.3 (4.8)	8.8 (5.4)
Care takers						
Multiple semi-trained volunteers	3.3 (2.8)	5.8 (3.1)	4.8 (3.1)	7.8 (5.3)	5.2 (3.0)	4.4 (1.8)
Trained full time handlers only	5.1 (4.4)	10.1 (4.2)	8.9 (3.9)	13.1 (8.5)	9.6 (2.7)	9.3 (4.2)
Nutrition linked to removal from mother						
Removal after 2 days	7.4 (7.9)	4.0 (2.2)	2.5 (1.7)	3.7 (3.4)	4.0 (3.2)	5.0 (4.1)
Removal after 2 weeks	13.5 (10.5)	7.4 (2.4)	5.8 (3.2)	7.7 (6.2)	7.7 (5.7)	11.4 (8.2)
Nutrition up until 6 months of age						
Replacer milk until 4 months while introducing chicken pieces then chicken and meat carcasses	4.3 (1.8)	3.0 (1.8)	3.4 (2.7)	2.4 (2.4)	3.6 (2.6)	5.7 (3.2)
Replacer milk until 6 months while introducing feline pellets then chicken pieces then chicken and meat carcasses	5.6 (2.1)	5.9 (4.3)	4.6 (2.9)	3.5 (3.8)	6.0 (4.3)	9.6 (3.5)
Number of interactions per day						
100 - 200 interactions per day	4.7 (1.6)	4.6 (2.7)	2.6 (1.5)	4.0 (3.8)	2.7 (2.2)	3.2 (2.2)
< 100 interactions per day	7.4 (3.4)	8.4 (3.9)	7.8 (4.9)	9.2 (9.4)	7.0 (4.1)	6.7 (3.4)
Cubs' ability to choose their environment						
Sleeping cub interacted with but allowed to retreat from an interaction	8.3 (5.9)	6.6 (3.1)	4.4 (3.0)	7.6 (4.7)	6.3 (3.7)	6.1 (4.2)
Sleeping cubs not disturbed and allowed to retreat from an interaction	12.6 (9.9)	10.3 (3.7)	8.6 (3.1)	10.1 (3.9)	10.5 (6.2)	9.6 (4.8)
Training						
Tap on nose for inappropriate behaviour, applied by handler only	3.2 (1.2)	4.8 (3.9)	4.4 (3.0)	3.9 (2.0)	3.8 (2.4)	4.4 (3.1)
No training & no repercussion for inappropriate behaviour	5.5 (3.5)	8.4 (6.7)	7.4 (4.0)	5.6 (2.3)	6.2 (3.9)	6.7 (4.9)
Social grouping						
Cubs grouped but split during interaction hours	13.1 (8.9)	6.8 (4.2)	7.3 (4.2)	9.3 (5.5)	8.2 (5.8)	5.4 (3.8)
Cubs always together	16.6 (7.6)	9.2 (4.2)	12.2 (5.8)	13.9 (7.5)	11.1 (5.9)	9.4 (5.3)
Extent of interaction						
Entire body stroked	2.5 (2.2)	3.5 (2.3)	3.8 (4.2)	4.5 (4.1)	2.8 (2.5)	3.3 (1.8)
Backs & abdomen only	3.2 (2.1)	6.6 (4.5)	6.8 (5.3)	6.8 (4.0)	5.9 (3.6)	6.2 (4.6)
Vaccinations & parasite control						
Parasite control only	6.0 (1.2)	5.0 (3.8)	5.3 (3.3)	3.9 (2.0)	4.9 (4.7)	4.2 (4.5)
Vaccinations & parasite control provided	9.0 (2.8)	9.6 (5.8)	9.5 (3.4)	8.3 (3.7)	10.4 (7.4)	8.5 (6.0)
Disease transfer						
Hand soap wash only	1.8 (1.8)	3.5 (2.7)	5.0 (3.4)	1.8 (2.1)	2.9 (2.7)	3.5 (3.1)
Foot baths and hand disinfectants used	2.5 (2.5)	6.9 (3.4)	7.8 (4.8)	3.2 (2.4)	6.2 (4.5)	7.0 (5.4)
Enrichment						
Climbing structures only	7.7 (1.8)	6.4 (3.6)	7.7 (5.2)	5.1 (3.4)	4.0 (2.8)	3.9 (2.0)
Toys and climbing structures provided	12.1 (3.5)	8.8)4.0)	9.8 (4.6)	7.9 (3.6)	8.1 (4.7)	7.0 (2.4)

Appendix F: Mean and standard deviation percentage utility scores achieved for each attribute according to the gender of the participants

Attributes	Males	Females
Breeding		
Ad hoc breeding	5.4 (4.1)	5.6 (3.9)
Use of a husbandry studbook	10.0 (4.2)	9.6 (5.5)
Care takers		
Multiple semi-trained volunteers	4.5 (3.0)	5.8 (3.3)
Trained full time handlers only	8.3 (4.8)	10.6 (4.5)
Nutrition linked to removal from mother		
Removal after 2 days	5.3 (4.0)	3.5 (2.9)
Removal after 2 weeks	10.1 (7.5)	7.7 (5.0)
Nutrition up until 6 months of age		
Replacer milk until 4 months while introducing chicken pieces then chicken and meat carcasses	3.3 (3.1)	4.0 (2.4)
Replacer milk until 6 months while introducing feline pellets then chicken pieces then chicken and meat carcasses	5.8 (5.0)	6.1 (3.5)
Number of interactions per day		
100 - 200 interactions per day	3.3 (2.6)	3.5 (2.3)
< 100 interactions per day	7.7 (6.1)	7.7 (3.8)
Cubs' ability to choose their environment		
Sleeping cub interacted with but allowed to retreat from an interaction	7.4 (4.2)	5.7 (3.4)
Sleeping cubs not disturbed and allowed to retreat from an interaction	11.3 (5.7)	9.4 (4.1)
Training		
Tap on nose for inappropriate behaviour, applied by handler only	3.9 (2.9)	4.5 (2.7)
No training & no repercussion for inappropriate behaviour	6.9 (5.2)	7.0 (4.2)
Social grouping		
Cubs grouped but split during interaction hours	7.2 (5.0)	7.7 (5.1)
Cubs always together	11.3 (7.0)	11.1 (5.1)
Extent of interaction		
Entire body stroked	3.1 (2.8)	3.5 (2.8)
Backs & abdomen only	5.6 (3.6)	6.5 (4.5)
Vaccinations & parasite control		
Parasite control only	5.6 (4.1)	4.3 (3.4)
Vaccinations & parasite control provided	9.6 (7.0)	9.1 (4.3)
Disease transfer		
Hand soap wash only	3.2 (3.1)	3.4 (2.7)
Foot baths and hand disinfectants used	5.0 (4.5)	6.7 (4.3)
Enrichment		
Climbing structures only	5.4 (3.9)	5.4 (3.5)
Toys and climbing structures provided	8.4 (4.4)	8.5 (3.7)

Appendix G: Mean and standard deviation percentage utility scores achieved for each attribute according to the residency of the participants

Residents	Non- SA	SA
Breeding		
Ad hoc breeding	6.0 (2.6)	5.4 (4.3)
Use of a husbandry studbook	11.1 (3.4)	9.5 (5.3)
Care takers		
Multiple semi-trained volunteers	5.2 (2.9)	5.4 (3.3)
Trained full time handlers only	8.6 (3.9)	10.0 (4.8)
Nutrition linked to removal from mother		
Removal after 2 days	4.6 (3.4)	4.0 (3.5)
Removal after 2 weeks	9.6 (5.4)	8.3 (6.3)
Nutrition up until 6 months of age		
Replacer milk until 4 months while introducing chicken pieces then chicken and meat carcasses	3.4 (1.5)	3.8 (2.9)
Replacer milk until 6 months while introducing feline pellets then chicken pieces then chicken and meat carcasses	6.1 (3.8)	6.0 (4.2)
Number of interactions per day		
100 - 200 interactions per day	3.9 (2.8)	3.3 (2.3)
< 100 interactions per day	8.6 (6.9)	7.5 (4.2)
Cubs' ability to choose their environment		
Sleeping cub interacted with but allowed to retreat from an interaction	4.5 (1.7)	6.7 (4.0)
Sleeping cubs not disturbed and allowed to retreat from an interaction	9.0 (3.2)	10.3 (5.1)
Training		
Tap on nose for inappropriate behaviour, applied by handler only	5.5 (2.7)	4.0 (2.7)
No training & no repercussion for inappropriate behaviour	9.5 (5.4)	6.4 (4.2)
Social grouping		
Cubs grouped but split during interaction hours	9.7 (6.1)	7.0 (4.7)
Cubs always together	12.9 (6.1)	10.8 (5.8)
Extent of interaction		
Entire body stroked	4.3 (4.2)	3.2 (2.4)
Backs & abdomen only	6.8 (5.1)	6.0 (4.0)
Vaccinations & parasite control		
Parasite control only	3.2 (2.2)	5.1 (3.9)
Vaccinations & parasite control provided	6.4 (3.2)	9.9 (5.6)
Disease transfer		
Hand soap wash only	2.1 (1.8)	3.6 (3.0)
Foot baths and hand disinfectants used	3.8 (2.7)	6.6 (4.6)
Enrichment		
Climbing structures only	5.6 (4.1)	5.4 (3.6)
Toys and climbing structures provided	7.6 (4.8)	8.6 (3.8)

Appendix H: Describes the pacing behaviour observed by the cubs at the three facilities (data represented by an '*' are sourced from the scan sampling data and frequency of occurrence represented by the symbol '*f*'.

Facility, Cub, Sex, Age in days	Description of pacing behaviour	Observed possible cause for behaviour
A, Kroontjie, ♀, 83	Paced purposefully up and down (*f*1), swinging around to change direction, along the perimeter border of the enclosure for 53 seconds.	Cub heard her keeper who had raised her, speaking outside of the enclosure for some time, becoming anxious waiting for him to enter.
* B, Shera, ♀, 42	Paced along enclosure perimeter.	Paced after she was denied lactational suckling on the other cubs, by the volunteers.
* B, Shera, ♀, 42	Paced short distances against the perimeter of the small travelling crate whilst vocalizing.	Placed into one small travel crate alone during the volunteers' lunch break during which time no-one would be present nor allowed to interact with the cubs.
B, Manny, ♂, 52	Paced short distances (*f*1), almost a weave due to constricted size, against the door opening of a small travelling crate for 31 seconds.	The three male cubs were placed into one small travel crate during the volunteers' lunch break during which time no-one would be present nor allowed to interact with the cubs and the male appeared frustrated by the close confines.
B, Shera, ♀, 91	Paced along enclosure perimeter and then in the night enclosure room where she fled (*f*4).	A fire break was made around the enclosure and this was accompanied by smoke and loud noises. The other 3 male cubs congregated in the night

		enclosure room together during this time, but Shera did not congregate with them.
C, Gareth, ♀, 85	Paced for 37 seconds (*f*1) along the perimeter enclosure	Appeared to be in response to load noises made by vehicles and labourers outside of the enclosure.
C, Brett, ♂, 95	Paced for 75 seconds (*f*1) along enclosure perimeter.	Appeared to be in response to being woken by load noises outside of the enclosure.
*C, Reinhardt, ♂, 108	Paced along enclosure perimeter.	Appeared to be upset when the group of 5 cubs were spilt from each other to accommodate separate interaction sessions.
C, Gareth, ♀, 110	Paced a total of 180 seconds (*f*2) along the shared perimeter fence of the adjacent enclosure and vocalized occasionally.	Appeared to be upset when the group of 5 cubs were spilt from each other to accommodate separate interaction sessions.
*C, Amy, ♀, 110	Paced along enclosure perimeter.	Appeared to be upset when the group of 5 cubs were spilt from each other to accommodate separate interaction sessions.
C, Brett, ♂, 112	Paced for 30 seconds (*f*1) along enclosure perimeter.	Appeared bored, not alert and no apparent reason.
C, Demi, ♀, 131	Paced rapidly for 85 seconds (*f*1) along at the entrance to the enclosure, with head lowered down to the ground.	Appeared to want to exit the enclosure.
C, Demi, ♀, 146	Paced a total of 1316 seconds (*f*7) along the shared perimeter fence of the adjacent enclosure and vocalized occasionally.	Appeared to be upset when the group of 5 cubs were spilt from each other to accommodate separate interaction sessions.

C, Amy, ♀, 162	Paced for 354 seconds (*f*4) along enclosure perimeter.	Appeared to be upset when the group of 5 cubs were spilt from each other to accommodate separate interaction sessions.
C, Brett, ♂, 163	Paced for 189 seconds (*f*1) along enclosure perimeter.	Appeared to be upset when the group of 5 cubs were spilt from each other to accommodate separate interaction sessions.
C, Demi, ♀, 181	Paced for 50 seconds (*f*1) along enclosure perimeter.	Cub heard her keeper which had raised her speaking outside of the enclosure.
C, Demi, ♀, 217	Paced for 123 seconds (*f*1) along enclosure fence perimeter, partly covered with netting and housing a cheetah on the other side.	Cub appeared anxious and unsettled, with the cheetah presence and cubs had been moved to this new enclosure.
C, Demi, ♀, 253	Paced for 119 seconds (*f*1) along enclosure perimeter.	Appeared bored, not alert and no apparent reason.

Appendix I: Thesis Turnitin Report

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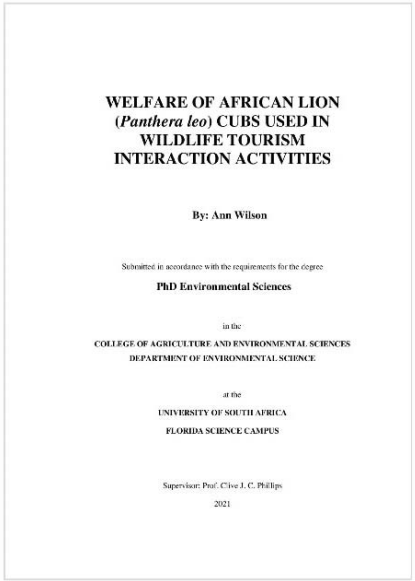

WELFARE OF AFRICAN LION (*Panthera leo*) CUBS USED IN WILDLIFE TOURISM INTERACTION ACTIVITIES

By: Ann Wilson

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in the

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DEPARTMENT OF ENVIRONMENTAL SCIENCE

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