

Interim Report 1

South African Lion Bone Trade

A Collaborative Lion Bone Research Project



Report for the South African National Biodiversity Institute (SANBI)

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Table of Contents

Table of Contents	2
1 Introduction and Project Aims	3
2 Methodology Overview for Sub-Projects & Activities Initiated in 2017	5
2.1 <i>National captive lion survey</i>	5
2.2 <i>Analysis of data from multiple information sources</i>	5
2.2.1 EXPORTS OF LION BONES: CITES EXPORT PERMITS & AIR WAYBILL DATA	5
2.2.2 QUOTA APPLICATIONS	5
2.2.3 OTHER	5
2.3 <i>Monitoring of muthi markets for lion products</i>	6
3 Captive Lion Survey	6
3.1 <i>Reasons for keeping and/or breeding lions, and the main purpose of the facilities</i>	6
3.2 <i>Estimated value of sales</i>	8
3.3 <i>Ban on the import of captive-produced lion trophies</i>	9
3.3.1 US BAN ON THE IMPORT OF CAPTIVE-PRODUCED LION TROPHIES	9
3.3.2 POTENTIAL OF A UK–EUROPE BAN ON THE IMPORT OF CAPTIVE-PRODUCED LION TROPHIES	10
3.4 <i>Lion bone quota: impact and adaptation</i>	11
3.5 <i>Lion euthanasia</i>	12
3.6 <i>Average age of lions sold for bones</i>	13
3.7 <i>Sale of lion bones</i>	13
3.7.1 FACILITIES SELLING BONES AND PARTS TO VARIOUS BUYERS	14
3.7.2 UTILISATION OF ‘BONE AGENTS’ OR MIDDLEMEN	14
3.7.3 ORIGIN OF SKELETONS	15
3.7.4 YEARS OF BONE EXPORTS	15
3.7.5 PRICE RANGES OF LION AND LIONESS SKELETONS	17
3.7.6 SKELETON EXPORTS	19
3.8 <i>Summary discussion of questionnaire results</i>	20
4 Data from Multiple Information Sources	20
4.1 <i>Exports of lion bones (2008–2016)</i>	20
4.1.1 PUBLISHED CITES EXPORT PERMITS & AIR WAYBILL DATA	20
4.1.2 UNPUBLISHED CITES EXPORT PERMITS & AIR WAYBILL DATA	21
4.2 <i>Lion bone quota applications (2017)</i>	22
5 Muthi Market Monitoring for Lion Products	24
6 Discussion, Conclusions, Recommendations	24
6.1 <i>Current situation</i>	24
6.2 <i>Data limitations and further avenues to explore</i>	25
7 Supplementary Documents	26
8 References	26
9 Appendix 1	27
10 Appendix 2	29
10.1 <i>Abstract from Williams et al. 2017a (‘A roaring trade? The legal trade in Panthera leo bones from Africa to East-Southeast Asia’)</i>	29
10.2 <i>Extracts from the text of Williams et al. (2017a)</i>	29
11 Appendix 3	31
11.1 <i>Abstract from Williams et al. 2017b (‘Questionnaire survey of the pan-African trade in lion body parts’)</i>	31
11.2 <i>Extracts from Williams et al. (2017b)</i>	31

1 Introduction and Project Aims

The African lion is the only big cat listed on CITES Appendix II, and the only one for which international commercial trade is legal under CITES (Williams *et al.* 2017a). Debates on the contentious trade in lion bones and body parts were amplified at the 2016 CITES Conference of the Parties (CoP17) when consensus on a proposal by Chad, Côte d'Ivoire, Gabon, Guinea, Mauritania, Niger, Nigeria and Togo to transfer all African populations of *Panthera leo* (lion) from Appendix II to Appendix I of CITES could not be reached, and many southern African countries in particular opposed the proposal. Instead, through negotiations within a working group, a compromise to keep *P. leo* on Appendix II with a bone trade quota for South Africa, was agreed as follows:

A zero annual export quota is established for specimens of bones, bone pieces, bone products, claws, skeletons, skulls and teeth removed from the wild and traded for commercial purposes. Annual export quotas for trade in bones, bone pieces, bone products, claws, skeletons, skulls and teeth for commercial purposes, derived from captive breeding operations in South Africa, will be established and communicated annually to the CITES Secretariat.

CoP17 underscored a need for further information on lion trade and the consequences for lions across the continent. And, in accordance with the annotation, South Africa was required to establish an export quota for lion bones, and the Scientific Authority was mandated to advise the Department of Environmental Affairs (DEA) on the size of this quota on an annual basis. Following consultation with various relevant government agencies (national and provincial) and other stakeholders (including a public meeting on 18 January 2017), the 2017 export quota was set at 800 skeletons (with or without the skull) in July 2017. No specific export quotas were set for teeth, claws or individual bones; these items are included in the quota as parts of a skeleton. In order to provide sound scientific decision support to the DEA, an interdisciplinary and collaborative research project led by two independent experts, Dr VL Williams (VLW) and Mr M 't Sas-Rolfes (M'TSR), was commenced in March 2017 and will end in March 2020. This interim report is the first in the series of report backs on the research to SANBI.

The core aims of the collaborative research project, as given in the collaboration memorandum, are:

1. To increase understanding of the captive breeding industry and the trade in lions (especially bones, but also other products and live lions) in South Africa;
2. To investigate how the trade in captive-produced lion skeletons and other body parts under a quota system affects wild lion populations;
3. To strengthen the evidence base for the annual review of the lion bone export quota in order to ensure it is sustainable and not detrimental to wild populations.

The lion bone trade also interacts with the recreational hunting industry and may affect other felid species internationally; accordingly, the project also aims:

4. To gain a better understanding of the consequences of the US ban on imports of captive-origin trophies that took effect from the start of 2016;
5. To gain a better understanding of potential linkages between markets for lion body parts and those of other large felids in and beyond Africa.

In respect of the aims, various sub-projects and/or data analysis activities were initiated in 2017, namely:

1. *The National Captive Lion Survey*: an online questionnaire survey distributed to South African facilities that breed, keep, hunt and trade in lions (live and/or products) (commenced August 2017; ongoing, but to be closed in 2018 on a date to be determined; the focus of this report) (various collaborators);
2. *Analysis of data supplied by multiple information sources*: analysis of available data (see Table 1) to inform the evidence base;
3. *Muthi market monitoring*: a project tracking the presence of lion parts (mainly skins) in traditional medicine outlets/markets (commenced January 2017; ongoing) (VLW only; not SANBI funded).

Table 1: Summary of the multiple information sources used, or to be used, to provide data on lion related utilisation and activities over the progression of the 3-year collaborative research project. Progress on accessing and evaluating these data to date are indicated with a ✓ or ✗.

Data type		Evaluated? ✓ or ✗
Quota applications		✓ & ✗ (superficially)
CITES trade records as reported by exporters and importers (data sources include the CITES UNEP-WCMC trade database, and annual reports submitted by South Africa to the CITES Secretariat.		✓ & ✗ (Partial up to 2015; see Williams <i>et al.</i> 2017a,b) (2016/17 reports requested)
TOPS permits issued (hunting, killing, exporting, selling, buying, transporting of lions)		✗ (Data requested)
TOPS registrations for captive breeding operations		✗ (Data requested)
Inspection reports for lion bone consignments inspected	(i) At source (hunting farm/captive breeding operation)	✗ (Data requested)
	(ii) Upon endorsement of the permit	✓ & ✗ (Partial; complete data set not supplied)
Reports from Environmental Management Inspectors concerning	(i) Confiscations of illegal consignments of big cat bones	✗ (Data requested)
	(ii) Illegal ToPS-restricted activities pertaining to lions	✗ (Data requested)
Wild and captive lion poaching statistics		✗ (Data requested)
Monitoring data from <i>muthi</i> markets		✓ (Ongoing project by VLW)
Results of forensic analyses of random DNA samples to verify species identification and sources of bones (captive/wild)		✗ (Data not requested)
Questionnaire of bone agents, hunting farms and captive breeding operations, with a particular focus on economics, and the breeding, maintenance and sourcing of lions		✓ (Ongoing survey; interim results presented in this report)
National trophy hunting statistics, and allied data		✓ & ✗ (Partial; analysis of data to 2010 in Williams <i>et al.</i> 2015) (Statistics requested for 2011 to present) (Allied data requested in part)
Provincial hunting permits		✗ (Data requested)
Provincial legislation relating to lions		✓ & ✗ (Partial; analysis of legislation to 2011 in Williams <i>et al.</i> 2015a) (Requires updates from the Provinces)
Industry trade data, for example:	Air waybill data from freight consolidation company on behalf of the bone traders: actual exports of lion bone quantities from 2014–2016	✓ & ✗ (Mostly; part of analysis in Williams <i>et al.</i> 2017a; partial assessment in this report)
	Price data along the supply chain (live, body parts, bones, etc)	✓ & ✗ (Incomplete; requires further data gathering from a variety of sources)
Audit of captive lion facilities per province / compliance report		✗ (Data requested)
Various documents relating to decisions, policy, legislation, etc		✓ & ✗ (Incomplete; wish list partially compiled)

This 2017 Interim Report 1 on the collaborative lion bone project summarises some of the information collected to date. Further additional research is planned for 2018 and beyond, which is discussed in Section 6 of this report along with some important broader contextual considerations.

2 Methodology Overview for Sub-Projects & Activities Initiated in 2017

2.1 National captive lion survey

In August 2017 we launched the online 'National captive lion survey'. The structured semi-quantitative questionnaire with 61 questions (Supplementary Doc 1) was designed and pre-tested over a four-month period. Input on the wording of selected questions in Sections B,D,E & G (Appendix 1) was sought from C. van der Vyver (former South African Predator Association [SAPA] CEO), and there was also some collaboration with L. Rall (Durrell Institute of Conservation [DICE], University of Kent).

The survey was created and administered using SurveyMonkey, and was translated into English and Afrikaans. The questionnaire was initially distributed via email invitation among potentially suitable research participants identified by SANBI, DEA, and SAPA. A hardcopy is also available to members of SAPA who don't wish to complete the survey online (to date, no hardcopy of the questionnaire has been completed, but SAPA will assist with identifying these members and collecting their responses). The survey will remain open until a suitable closing date is determined in 2018. However, the preliminary survey results presented in this report have identified (i) indicative trends to inform future research, and (ii) that a bigger sample size is needed (which we will pursue in early 2018).

All protocols were carried out in accordance with the ethical guidelines and recommendations of the Human Research Ethics Committee (non-medical) of Wits University (Protocol Number H17/06/55).

The interim results presented in this report are for responses captured up to 10th November 2017.

2.2 Analysis of data from multiple information sources

2.2.1 EXPORTS OF LION BONES: CITES EXPORT PERMITS & AIR WAYBILL DATA

The methods and results for this section are mostly detailed in Williams *et al.* (2017a) (see Supplementary Doc 2; and, Appendix 2), but some additional data not provided in that paper are briefly listed in this report. CITES export permit data indicate the total quantity that specific export permits were issued for; hence, an exported consignment should not exceed the quantity stated on the permit (Williams *et al.* 2017a). Actual quantities of legally exported bones can only be deduced from (1) records of CITES permits that have been inspected and 'endorsed' by a nature conservation inspector at the port of exit (*for which we had access to an incomplete set of records*), and/or (2) from the air waybills (AWB) generated by freight forwarding companies, and/or (3) from records kept by the exporting traders (Williams *et al.* 2017a). Data supplied by a freight forwarding company from the AWBs for 2014–2016 was with the consent of their customers (i.e. six of the main traders of lion bones in South Africa, who buy bones from farms and hunting facilities), and these data contained: (i) combined monthly totals of the sets of bones exported, (ii) the mass of the consignments, and (iii) the destination countries in East-Southeast Asia.

To estimate the maximum allowable levels of legal annual trade in lion bones, all CITES data were rigorously cross-checked against the annual reports submitted by South Africa to the CITES Secretariat (as detailed in Williams *et al.* 2017a). Where anomalies were discovered, appropriate adjustments were made. To date, however, we have not had access to the 2016 CITES reports to the Secretariat.

2.2.2 QUOTA APPLICATIONS

In October, the DEA provided us with some data relating to the quota applications received during 2017. These provided us with useful information on the current sources of bones for export.

2.2.3 OTHER

In May 2017, we met with a representative group (i.e. most) of the lion bone intermediary traders and exporters and gained significant contextual information (i.e. qualitative data) on the history and structure

of the bone export industry (some of which is included in Williams *et al.* 2017a). We have taken this background information into account both in planning our future research and in this interim assessment.

2.3 Monitoring of muthi markets for lion products

The *muthi* market monitoring project was initiated in January 2017 by VLW and is ongoing; the first sampling phase will be completed in February 2018. Lion products (mainly skins) are being monitored in tandem with two other threatened species. Each species has a different set of collaborators from several institutions (however, the project does not currently involve the collaborator M'TSR).

ToPS (Threatened or Protected Species) permits were obtained from the DEA for all collaborators so that samples could be legally acquired from vendors. The samples will probably be sent to the laboratory at the National Zoological Gardens (Pretoria) for DNA testing in 2018. Monitoring is currently occurring in four South African provinces and one neighbouring country. This component of the research is not SANBI funded.

3 Captive Lion Survey

By 10 November 2017, 124 respondents had visited the survey and started to complete it. However, there is a low rate of survey completion and only 34 respondents (27%) have answered ≥ 1 of the six sections. The number of respondents answering sections is: (i) all 6 sections: $n=5$; (ii) 5 sections: $n=9$; (iii) 4 sections: $n=11$; (iv) 3 sections: $n=5$; (v) ≤ 2 sections: $n=4$ (see Appendix 1 for response rates to individual questions). Respondents were mostly members of SAPA and/or PHASA (79%, Table 2). We note that SAPA membership has dropped significantly during the last two-year period and the number of cooperative respondents is thought to represent more than one third of extant members (C van der Vyver, November 2017). However, we need to establish the reasons for the low completion rate and ensure that the future finalised survey results account for a larger proportion of captive lions. At this stage, we must consider the results to be indicative rather than fully representative of industry trends.

Table 2: Number of respondents and the membership of the facilities to various associations.

Organisation	No. of respondents who answered all/some of the questionnaire (n=34)
SAPA ^a only	17
SAPA ^a & PHASA	6
PHASA only	3
SAPA, PHASA, WRSA, WTA	1
Membership not listed	7

^a SAPA has 55 paid members, which is down from 109 after resignations due to financial circumstances

3.1 Reasons for keeping and/or breeding lions, and the main purpose of the facilities

❖ Reasons for breeding (Q9), reasons for keeping (Q10), and the core purpose of the facility (Q11)?

The majority of facilities (56%–65%) breed and keep lions for live sales and hunting, and less than one-third breed and/or keep lions for the bones/products trade (Table 3). Hunting safaris and breeding/rearing were ranked highest as the core purpose of facilities, whereas lion bone sales had the 6th highest overall mean rank (Figure 1).

Table 3: Respondents' reasons for why their facilities breed and/or keep lions. Reasons that include the bone market are in blue. Blank cells indicate options not available in the respective questions

Reasons	Reasons for breeding lions (Q9) (n=34)	Reasons for keeping lions (Q10) (n=34)
Live sales	n=22 (65%)	n=21 (62%)
Hunting	n=21 (62%)	n=19 (56%) ^a
Products/derivatives (incl. bones)	n=10 (29%)	
Products/derivatives (e.g. skins)		n=7 (21%)
Skeletons/bones for Asia		n=9 (26%)
Muti		0
Personal use/pleasure/purposes	n=6 (18%)	n=6 (18%)
Relocation purposes	n=13 (38%)	
Tourism	n=9 (26%)	n=12 (35%)
Other	n=6 (18%) ^b	n=4 (12%) ^c

^a Keeping lions for hunting includes lions purchased from other breeders and kept for selling to hunting outfitters.

^b 'Other' reasons given by the facility for breeding lions are: conservation of wild lions; love of lions and the preservation of the species; "lions are free-roaming and are not a breeding project but an extensive system aimed at lions as a game farm animal (sic)"; education/research; gene preservation program; "breeding takes place per chance, the reserve as extra breeding camps for special game".

^c 'Other' reasons given by the facility for keeping lions are: love of lions; "lions as game farm animals to establish and utilise for hunting and ecotourism"; "we have one captive lioness due to her history as she could not be released back into the wild"; education/research.

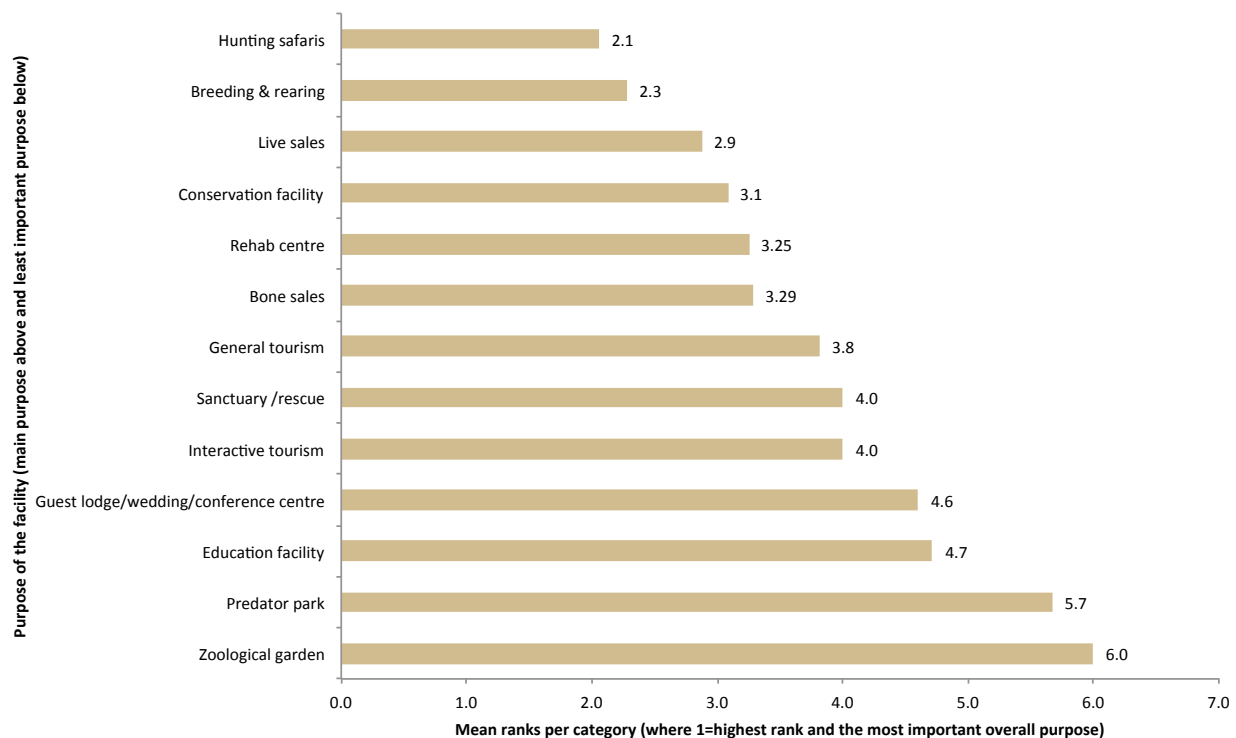


Figure 1: Core purposes of the facilities, expressed as the mean rank per purpose and ordered from top to bottom from the most to least important purposes respectively (Q11). Respondents ranked and selected as many categories as applied to their facility. Lion bone sales were placed sixth overall in the order of core purposes of a facility, but have a mean rank of 3.3.

3.2 Estimated value of sales

❖ Estimated annual value of sales per activity (Q15 & 16)

The original question requested information for eight income streams (viz. live sales for breeding; live sales for trophy hunting; live sales for keeping; trophy hunting on the property (international clients); trophy hunting on the property (SA clients); skin/body parts for 'muti'; display-tourism-educational visits; and, bone/skeleton sales for export market). For this interim report, we show results for bone sales along with those for live sales for trophy hunting and income from foreign trophy hunters, for illustrative comparative purposes.

- 14 facilities responded, with the number of respondents increasing per year from 2012 to 2016 as the number of new facilities entering the market also increased (Figure 2; Table 4). Accordingly, the median value of sales also increased annually (see Table 4 footnotes). However, the facilities deriving revenue from bone sales decreases markedly in 2017.
- The loss of total revenues from bone sales from 2015 to 2017 correlates with declines in the total values of live sales for trophy hunting and income from foreign trophy hunts, following the US trophy import restrictions in early 2016.
- Most surprising was the number of facilities that said the value of lion bone sales was >R1 million in prior years (especially in 2015 and 2016 – see Figure 2).

Table 4: The estimated annual value of sales, and the mean value per respondent, for lion bone sales, live sales for trophy hunting, and trophy hunting on the property for foreign clients.

		2012	2013	2014	2015	2016	mid-2017
Bone sales	Number of respondents	9	10	11	12	13	8
	Total value of annual sales for facilities ^a	R5.4 mill.	R5.2 mill.	R7.2 mill.	R9.7 mill.	R6.6 mill.	R2.7 mill.
	Mean ^b value of sales per facility	R595 000	R519 000	R650 000	R809 000	R505 000	R344 000
Live sales for trophy hunting	Number of respondents	5	8	10	11	13	11
	Total value of annual sales for facilities	R7.4 mill.	R12.0 mill.	R16.1 mill.	R16.1 mill.	R6.6 mill.	R7.7 mill.
	Mean value of sales per facility	R1.47 mill.	R1.5 mill.	R1.61 mill.	R1.47 mill.	R508 000	R695 000
Trophy hunting on property: foreign	Number of respondents	6	12	12	14	13	12
	Total value of annual sales for facilities	R9.9 mill.	R21.3 mill.	R28.3 mill.	R30.3 mill.	R8.5 mill.	R9.6 mill.
	Mean value of sales per facility	R1.6 mill.	R1.8 mill.	R2.4 mill.	R2.2 mill.	R650 000	R802 000

^a Calculated per annum by multiplying the no. of respondents per sales value class (in ZAR) by the median value of the class (e.g. median of R22 500 for the 'R15 000–R30 000' class)

^b Calculated as the mean for the values in the preceding row (e.g. for 2012, R5.35 million / 9, etc.)

The results of these two questions indicate clearly the joint impact of the US trophy import restrictions and export quota on the bone trade. Breeders that previously benefited from joint trophy hunt and bone markets have seen sharply reduced revenues by 2017 and some have not traded at all. We note that 2016 was a somewhat anomalous year, that included potential lag effects from carried-over 2015 hunts and sales, as well as strategic behaviour in response to both the US trophy restrictions and the CITES quota decision (see also Williams *et al.* 2017a; Appendix 2 this report). We should also note that this sample is not necessarily representative of the breeding industry – in Section 4.2 we find that most of the successful 2017 quota applicants had not previously sold bones (that we know of; however, they may have sold bones to traders that consolidated consignments in previous years).

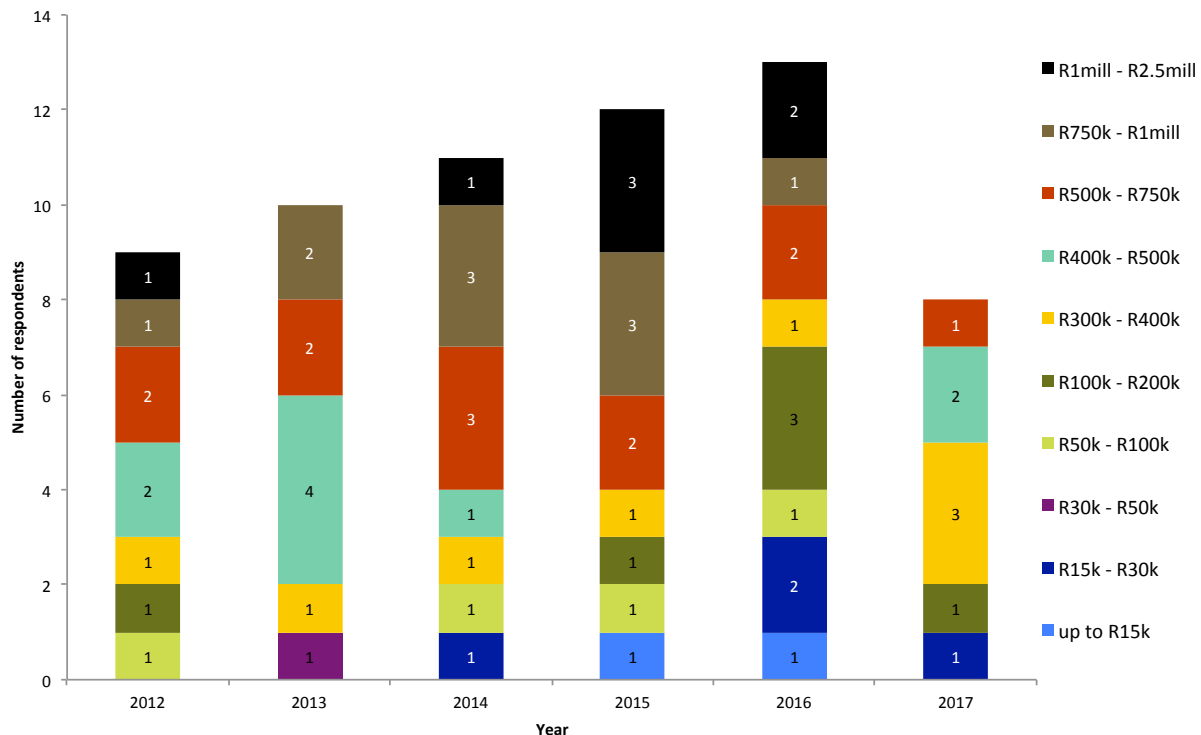


Figure 2: Estimated value of bone/skeleton sales for the export market (2012–2017) reported by the respondents (Q16). Note: number of new respondents entering the bone market increased annually by one, but dropped off in 2017. Corresponding figures for ‘live sales for trophy hunting’ and ‘trophy hunting on the facility for foreign clients’ not given (see the mean values in Table 4).

3.3 Ban on the import of captive-produced lion trophies

In an attempt to further understand the links between the lion trophy export and bone markets in relation to the captive breeding industry, we asked several further questions.

3.3.1 US BAN ON THE IMPORT OF CAPTIVE-PRODUCED LION TROPHIES

❖ *Did the January 2016 US ban on the import of captive produced lion trophies impact business in anyway? (Q17)*

- 34 facilities responded:
 - 27 (79%) indicated that the 2016 US ban had affected business;
 - 5 (15%) indicated the ban had no affect
 - 2 (6%) indicated this was ‘Not Applicable’ to their business

❖ *If the answer was ‘Yes’ to the above question, respondents were asked to indicate how they were adapting to the impact (Q18)*

- 28 facilities responded:
 - 23 (82%): breeding production scaled down
 - 17 (61%): employees/workers let go
 - 13 (46%): live lion stock sold off
 - 8 (29%): euthanized lions
 - 6 (21%): redirected business to focus on the lion bone trade
 - 3 (11%): redirected business to focus on interactive tourism
 - 3 (11%): continued business as usual
 - 6 (21%): selected ‘other’, and listed the following ways in which they were adapting:

- *We will start selling again from this year*
- *Change the business with more focus on buffalo, sable and roan hunts*
- *Extensive system begins with managed wild lions*
- *Must sell lions for MUCH less than they are worth – just to keep going and pay expenses*
- *No interested buyers at the lion sales. Value of animals has come down.*
- *Had to start over marketing in other countries. Many workers lost their jobs.*

Table 5: From the eight selectable adaptation strategies provided in Q18, the number of strategies that facilities indicated they are adopting because of the 2016 US ban is described.

Number of strategies adopted	Number of facilities	Strategy(s) most frequently selected as being adopted
1	8	n=3 listed 'scale down breeding production'
2	5	n=3 listed the pair of scale down breeding & let go of employees
3	3	All 3 included scale down breeding, but the other strategies selected varied
4	9	Tended to select the combination of scale down breeding & let go of employees, with sell off live lion stock. n=4 also listed euthanize lions
5	3	All 3 selected the combination of scale down breeding, <i>focus on lion bone trade</i> , let go of workers, sell live lion stock, & euthanize lions

❖ *If the US ban continues to be implemented with no sign that it will be lifted in the near future, what would respondents do? (Q19)*

- 31 facilities responded:
 - 16 (52%): will focus on the lion bone trade
 - 9 (29%): will euthanize all lion stock
 - 8 (26%): will convert business to another form of wildlife breeding
 - 8 (26%): will close the business
 - 7 (23%): will continue business as usual
 - 4 (13%): will focus on interactive tourism
 - 2 (6%): selected 'other', and listed the following ways in which they were adapting:
 - Marketing of lion hunts to move to other countries
 - Will continue extensively with fewer lions with high worth

Table 6: From the seven selectable potential adaptation strategies provided in Q19, the number of strategies that facilities said they might adopt IF the US ban continues is described.

Number of strategies that might be adopted	Number of respondents	Strategy(s) most frequently selected as likely to be adopted
1	14	n=5 selected only <i>focus on lion bone trade</i> ; n=3 selected continue business as usual. Remainder of the adaptations varied across the strategies
2	10	Strategy pairs varied
3	7	Strategy combinations varied

In other words, facilities mostly said they were adapting to the current ban by scaling down production, letting workers go, and selling off lion stock. However, facilities tended towards entering the bone trade and euthanizing lions IF there was no sign that the US ban would be lifted in the near future.

3.3.2 POTENTIAL OF A UK–EUROPE BAN ON THE IMPORT OF CAPTIVE-PRODUCED LION TROPHIES

❖ *In addition to the US ban, IF the UK and/or Europe also implemented bans on the import of lion hunting trophies, what would the respondents do? (Q19)*

- 32 facilities responded:
 - 12 respondents (38%): will close their business

- 12 (38%): will euthanize all lion stock
- 12 (38%): will focus on the lion bone trade
- 10 (31%): will downscale but continue production expecting that the ban will be lifted
- 7 (22%): will convert business to another form of wildlife breeding
- 6 (19%): will continue business as usual
- 3 (9%): will focus on interactive tourism
- 2 (6%): selected 'other', and listed the following
 - *Because I have access to food for lion farming and capital has been spent on building cages and to create jobs and (the facility) is already established, it would make sense to continue farming and give the market what it needs to protect the wild (lion) population. Because I never did trophy hunting on my premises, it is only a result of the industry that there is still a need for bones. There will always be hunters who are willing to hunt lions and the need for bones will be there, legal or illegal*
 - *In this case, we will be affected because we would lose the interactive lion program.*

In other words, facilities tended towards closing businesses, euthanizing lion stock and entering the bone trade. Alternatively, they would keep the lions and derive income from the trade if the markets were opened up.

Table 7: From the eight selectable potential adaptation strategies provided in Q20, the number of strategies that facilities said they might adopt IF the UK/Europe implemented bans is described.

Number of strategies that might be adopted	Number of respondents	Strategy(s) most frequently selected as likely to be adopted
1	12	n=4 each selected <i>close business</i> , and <i>continue business as usual</i>
2	10	No dominant pairs of strategies, but n=6 pairs include <i>euthanasia</i> , and n=5 pairs include <i>bone trade</i>
3	8	Strategy combinations varied, but n=5 of the combinations included the pair <i>close business</i> & <i>euthanize all stock</i> , while n=3 combinations included the pair <i>bone trade</i> & <i>downscale production expecting ban to be lifted</i> .
4	2	All selected focus on <i>bone trade</i> , <i>focus on tourism</i> , <i>downscale production expecting ban to be lifted</i> , & <i>continue business as usual</i>

These results show that, in the wake of the US trophy import restrictions, a significant proportion of survey respondents are eager to sell lion bones in the near future, either as part of a strategy to continue commercial lion breeding, or to defray the costs of down-scaling and euthanizing animals. This tendency will likely be enhanced if the US does not lift restrictions and/or if other trophy export markets (e.g. Europe) are also closed off.

3.4 Lion bone quota: impact and adaptation

❖ Will the lion bone quota restrict business in anyway? (Q21)

- 34 facilities responded:
 - 17 respondents (50%) said YES (this should be 21 according to the answers to Q 22 below)

❖ If the answer was 'Yes' to the above question, respondents were asked to indicate how businesses would be adapted (Q22)

- 21 facilities responded:
 - 12 (57%): will search for alternative markets for the bones
 - 11 (52%): will continue selling bones, but downscale
 - 4 (19%): will close the business

- 4 (19%): will continue business as usual
- 2 (10%): will stop selling bones
- 2 (10%): selected 'other', and listed the following
 - *By reducing hunting or lion bones (from captive animals?) there will be no reason or purpose for lions and they will die as a result of wild populations being poached for the bone market. Poachers are 'lifted' above the law and smuggling will be like drugs that cannot be stopped. The scarcer the bones become, the more sought after (they are) and the prices will rise as the demand will continue to grow*
 - *The quota is not practical and currently not functional, how will the DEA determine who will get how many exports?*

Table 8: From the seven selectable adaptation strategies provided in Q22, the number of strategies that facilities said they have, or might adopt, in response to the bone quota is described.

Number of strategies adopted	Number of respondents	Strategy(s) most frequently selected as likely to be adopted
1	10	At most, n=3 respondents selected <i>continue selling bones, but downscale</i> ; n=5 selected the combination <i>continue selling bones, but downscale & search for alternative markets for bones</i>
2	8	
3	3	n=2 selected the combination <i>continue selling bones, but downscale & search for alternative markets for bones</i>

In answering these two questions, the respondents implied that a restrictive quota would incentivize people in the lion industry to find alternative channels for bone sales. We note that SAPA requested a considerably higher quota in early 2017 than 800, and that the exporters we spoke to also warned that frustrated aspiring sellers might resort to other (potentially illegal) trade channels. All these factors point to a distinct threat of the potential development of a parallel illegal market.

3.5 Lion euthanasia

❖ *In the past two years, has the number of lions euthanized at the facility increased? (Q23)*

- 34 facilities responded:
 - 7 (21%): answered YES
 - 8 (24%): answered NO
 - 19 (56%): answered NOT APPLICABLE
- Of the seven that answered YES, four elaborated on when they started euthanizing and why:
 - *Began in 2016. Before the US ban we ONLY sold lion bones from hunted lions – in 2016 we had to eliminate lions because the facilities were overcrowded and we needed the cash flow to look after the lions.*
 - *Must get an income from lions because hunting and sales have decreased and, I'm looking more at the breeding of better genes and I will thus reduce any lions with bad genes*
 - *Due to circumstances.*
 - *After the restrictions on the import of lions were introduced, we had to act drastically. At this stage we are still feeding the lions, but we can't carry on. If the hunts don't 'open up', we will have to get rid of all lions.*

The responses to this question re-emphasize our point in 3.4 above, namely that additional carcasses from euthanized lions provide an additional source of bone supply for which at least some breeders are likely to seek markets. The extent to which the size of this supply matches the loss of supply from reduced trophy hunts is unclear, but must be seen in the light of the implied overall shrinkage of the captive breeding industry (and therefore possible lower output rates in future).

3.6 Average age of lions sold for bones

❖ What is the average age that live lions and lionesses are sold for breeding, hunting or bones? (Q39)

- 17 facilities responded:
 - 13 (76%): answered for hunting
 - 17 (100%): answered for breeding
 - 10 (59%): answered for bones

Lions sold to facilities for breeding purposes are up to 5 years old; hunted lions are ≥ 3 years old (especially males, which tend to be >5 years); lion carcasses sold for bones are ≥ 1 years old (but typically 3–5 years) (Figure 3).

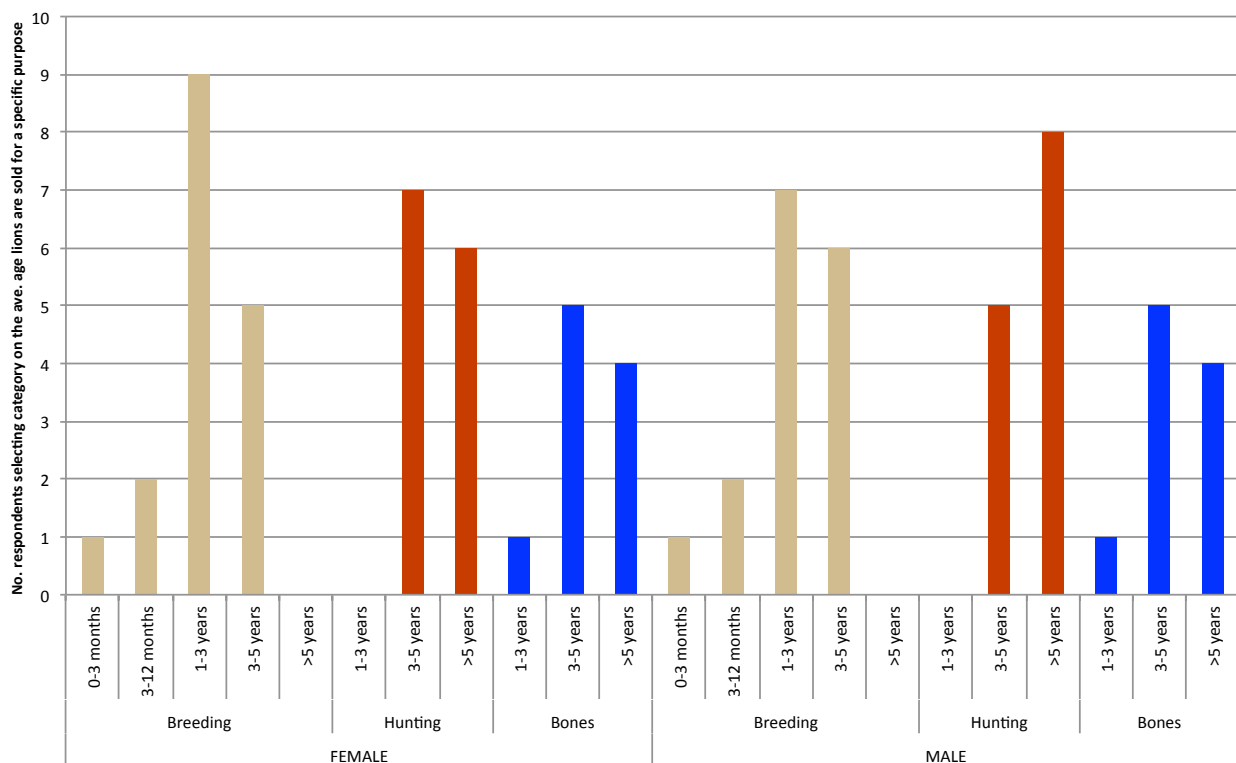


Figure 3: The number of responses for the average age when lions and lionesses are sold for specific purposes. Breeding purposes in beige, hunting purposes in red, and inclusion into the bone trade in blue.

The age distribution evident here (bias toward older males for hunting) suggests that if trophy hunting is further restricted, a greater number of younger males may start coming on stream in the bone market, with possible implications for future bio-economic supply functions.

3.7 Sale of lion bones

The following questions were aimed at finding out more about the specific structure and nature of the skeleton supply market. Industry structure plays a role in price formation and also influences the incentives of individual market participants. These factors are vital to the understanding of existing and potential market dynamics associated with variable quota setting. The role of other body parts apart from bones in the marketplace is also relevant.

❖ Has the facility sold lion products, bones, skeletons, body parts, trophies and/or other derivatives (Q43)

- 32 facilities responded:

- 13 (41%): answered YES

3.7.1 FACILITIES SELLING BONES AND PARTS TO VARIOUS BUYERS

❖ *Select the lion body parts the facility is aware of having sold/supplied to (Q44)*

- 12 facilities responded, and an additional facility declined to elaborate. A summary of the responses is in Table 9.

Table 9: Number of facilities that were aware of having sold/supplied specific lion products to different customers.

Product ^a	To taxidermist	Direct to Asia	To SA trader selling to Asia	Muti traders	Hunter
Full trophy ^b	5	2	5	-	6
Skeletons (full/partial)	5	2	8	-	4
Skin	7	1	2	-	7
Claws	4	1	5	-	7
Skull	4	2	5	-	6
Teeth	5	1	4	-	6
Paws	3	1	5	2	5
Individual bones	2	1	3	2	3
Fat ^c	1	1	2	2	1
Internal organs	1	1	2	2	1

^a One facility mentioned that lion legs are a by-product of hunting safaris, and that they were once thrown away. No facility supplied products to customers in other African countries

^b Includes: skeleton, skull, skin, teeth and claws

^c Fat cut off and given to staff members at a facility for their own use

Table 9 illustrates the complexity of the lion product market. In particular it highlights the existence of both local and overseas markets for lion body parts. It also indicates that breeders are selling both directly to foreign markets and via South African intermediaries. The fact that none of the surveyed breeders claim to be selling body parts to other African countries is also noteworthy.

3.7.2 UTILISATION OF 'BONE AGENTS' OR MIDDLEMEN

❖ *If the facility has used a middleman (SA and/or foreign) to export bones/skeletons to Asia, what % of the total number of skeletons went via a middleman/bone agent/trader (Q45)*

- 12 facilities responded:
 - 2 facilities did not use middlemen to export any bones to Asia (i.e. they have exported 100% of the bones at the facility directly to Asia without the use of a middleman) (consistent with Table 9 in 3.7.1)
 - 1 facility had used a middleman to export 50% of the available bones
 - 2 facilities used middlemen to export 70% of the available bones
 - 7 facilities used middlemen to export 100% of the bones
 - Mean % of bones exported with the assistance of a middleman is 74% (therefore 26% exported directly to Asia without using a middleman)

❖ *If you sell bones through middlemen, have you sold bones using middlemen in countries besides South Africa? If yes, what % of bones are sold through international middlemen (Q46)*

- 12 facilities responded:
 - 6 facilities have not used international middlemen to export any of the bones to Asia (i.e. they have exported 100% of the bones using South African agents)
 - 1 facility has used an international middleman to export 20% of the bones

- 1 facility used an international middleman to export 50% of the bones
- 1 facility used an international middleman to export 70% of the bones
- 3 facilities used international middlemen to export 100% of the bones
- Mean % of bones exported with the assistance of an international (non-South African) middleman is 37% (therefore 63% of bones are exported using South African middlemen)

We include the above results as they provide some evidence of existing industry structure, in which intermediary traders appear to have some market power, but in which some breeders also appear to have direct links to Asian markets. This is relevant insofar that it gives some indication of the potential for parallel illegal markets and/or potential laundering of illegal products. Whereas there seems little reason to suspect significant laundering of illegal products within South Africa at this time, there is some potential for illegal parallel markets to develop, with associated laundering on the Asian side of the supply chain.

3.7.3 ORIGIN OF SKELETONS

❖ *Before January 2016, what % of skeletons originating from hunting trophies and/or natural mortalities and/or euthanized animals went in to the bone market (Q47)*

In hindsight, this is an ambiguous question that respondents treated in 2 different ways:

- 1) As a sum of the parts (i.e. combined % from a facility = 100%) (n=4)
 - a. 94% of skeletons that went into the bone market were from *hunting trophies*
 - b. 5% of skeletons...were from *natural mortalities*
 - c. 5% of skeletons...were from *euthanized* animals
- 2) Each category as potentially 100% (n=6)
 - a. 77% of the skeletons from *hunting trophies* from a facility went to the bone market
 - b. 51% of the skeletons from *natural mortalities* went to the bone market
 - c. 84% of the skeletons from *euthanized animals* went into the bone market

Both of these sets of results are interesting. They show that (as expected) prior to the US trophy import ban, trophy hunts comprised the main source of exported skeletons. However, they also show that (i) not all skeletons from trophy hunted animals are exported (only around three quarters of these respondents did this) and that (ii) respondents are very likely to export skeletons from euthanized animals. They are less likely to do so from naturally deceased animals. This is most likely due to economies of scale (lions are likely euthanized in batches, as opposed to isolate natural mortalities). In future, it would be interesting to establish why some breeders do not sell their skeletons.

3.7.4 YEARS OF BONE EXPORTS

❖ *Indicate the years in which bones/skeletons originating from this facility were exported to Asia (Q48)*

- 12 facilities responded, and the number of facilities selling bones annually increased (Table 10). The pattern of increase is similar to Figure 2, and the trend reflects the increase in exports detailed in Williams *et al.* (2017a).
- Two facilities have been selling bones consistently since 2008.
- In 2017, however, one facility (F9) indicated they would not sell bones – but two new facilities (F11 and F12) indicated they would enter the market in 2017. The responses of F11 and F12 to the questionnaire are summarised as case studies below Table 10 so as to understand why the facilities have decided to enter the bone trade following the announcement of the quota.

Table 10: Number of facilities indicating they sold bones/skeletons to Asia from 2008–2016 and/or predicted they would sell bones in 2017. Facilities F11 and F12 predicted they would sell bones for the first time in 2017 (the year of the quota). ? = facilities F8 and F9 indicated in Q51 (Table 11) that they exported skeletons in 2012/2013, but they did not select these years when answering this question (Q48).

Facility	2008	2009	2010	2011	2012	2013	2014	2015	2016	Predicted to sell in 2017	Total years selling (to the end of 2016)
F1	*	*	*	*	*	*	*	*	*	*	9
F2	*	*	*	*	*	*	*	*	*	*	9
F3			*	*	*	*	*	*	*	*	7
F4			*	*	*	*	*	*	*	*	7
F5				*	*	*	*	*	*	*	6
F6					*	*	*	*	*	*	5
F7					*	*	*	*	*	*	5
F8					?	*	*	*	*	*	4 (5?)
F9					?	?	*	*	*	-	3 (5?)
F10									*	*	1
F11										*	0
F12										*	0
Total/a	2	2	4	5	7(9?)	8(9?)	9	9	10	11	

The following two accounts (case studies) of new market entrants F11 and F12 provide useful indicative information on potential future trends:

Case study 1: Facility F11

- A 2500ha facility in the Eastern Cape that opened in 2009 for the purposes of hunting and live sales;
- Ranked purposes: 1=hunting; 2=breeding/rearing; 3=live sales;
- Average of 50 paying visitors per year; number of visitors is stable;
- No. of lions on property decreased from Jan 2016;
- Facility has never sold lion bones before (explicitly stated that they were not in the bone business)
- Value of sales:
 - In 2014/2015: facility had 5 income streams
 - Live sales for breeding (up to R100,000/a)
 - Live sales for keeping (<R15,000/a)
 - Live sales for trophy hunting (R1 mill to R2.5 mill/a)
 - Trophy hunting on property (international clients): (R1 mill to R2.5 mill/a)
 - Trophy hunting on property (SA clients): (up to R100,000/a)
 - In 2017: facility listed only 2 income streams
 - Trophy hunting on property (international clients): (R1 mill to R2.5 mill/a)
 - Trophy hunting on property (SA clients): (up to R100,000/a).
- January 2016 affected business. Facility is adapting by scaling down business and dismissing workers;
- If the ban continues, and/or the EU/UK decide to implement a ban, they will close down the business and euthanize lion stock;
- Since January 2015: there was a 40% and 50% decline in adult males and females respectively, a 60% decline in cubs, and a 15% increase in sub-adults i.e. a 36% decline overall in the number of lions on the property (in 2015 there were 90 lions on the property, and by January 2017 there were 58)
- Facility indicated that they would potentially sell bones for the first time in 2017, and that they could supply 20 SKE
- Facility estimated that their loss of earnings since January 2016 has been R1.6 million, and they have retrenched 10 workers.

Case Study 2: Facility F12

- A 2000ha facility in the Free State that opened in 1995, and their only purpose is live sales;
- Ranked purposes: 1=educational; 2= breeding/rearing;
- Average of 20-30 paying visitors per year, but this has stopped;
- In 2015, income from live sales was R750,000 to R1 million. No income stream was listed for 2017, and they have never sold bones;

- January 2016 affected business. Facility adapting by scaling down business;
- If the ban continues, and/or the EU/UK decide to implement a ban, they will close down the business;
- Indicated that the bone quota will affect business – and they will adapt by looking for alternative markets for bones;
- In the last 2 years they have euthanized more lions as a result of the circumstances;
- Since January 2015: there was a 33% and 40% decline in adult males and females respectively, a 50% decline in cubs, and a 17% decline in sub-adults, i.e. a 32% decline overall in the number of lions on the property (in 2015 there were 28 lions on the property, and by January 2017 there were 19);
- They did not list how many skeletons they could supply in 2017, and they did not list their loss of earnings.

The above results and two case studies illustrate the growing participation in, and significance of, the bone market, essentially as an alternative source of income for breeders. These results also indicate that supply from this sector would meet the current quota level, if not much more, for at least the next year or two.

3.7.5 PRICE RANGES OF LION AND LIONESS SKELETONS

Market prices provide a valuable indication of market trends – i.e. the extent to which supply is able to meet demand. Rapidly rising prices indicate a widening gap between demand and supply. Price drops suggest that demand is declining relative to supply. Collecting accurate price data is challenging, as market participants are often incentivised to report incorrectly (for various reasons). We attempted to obtain some indicative price data time series for skeletons, by asking the following.

❖ *List the prices (or a range) at which the facility sold lion (Q48) and lioness (Q49) skeletons in the respective years.*

➤ 8 facilities responded

Responses are recorded below by way of illustrative graphs (Figures 4a-c); Figure 4a includes outliers¹, whereas Figures 4b and 4c have been adjusted to remove the outliers. The graphs suggest that prices have been consistently rising over the last five years, at a rate that appears slightly higher than the official rate of inflation. This is indicative of slow but steady growth in consumer demand. The 2017 prices should be viewed as less reliable indicators given the wider variance, incomplete sampling across the year, and constricting effect of the quota.

¹ There were three facilities with outliers. Two of these facilities had never sold bones prior to 2016, but indicated they could possibly supply ≤3 skeletons in 2017. A third facility sold on average 5 skeletons per year (compared to >20 per year by facilities where price data was not anomalous). Hence the anomalous prices quoted by three facilities were not aligned with the prices quoted by the facilities that consistently sold larger quantities from at least 2012.

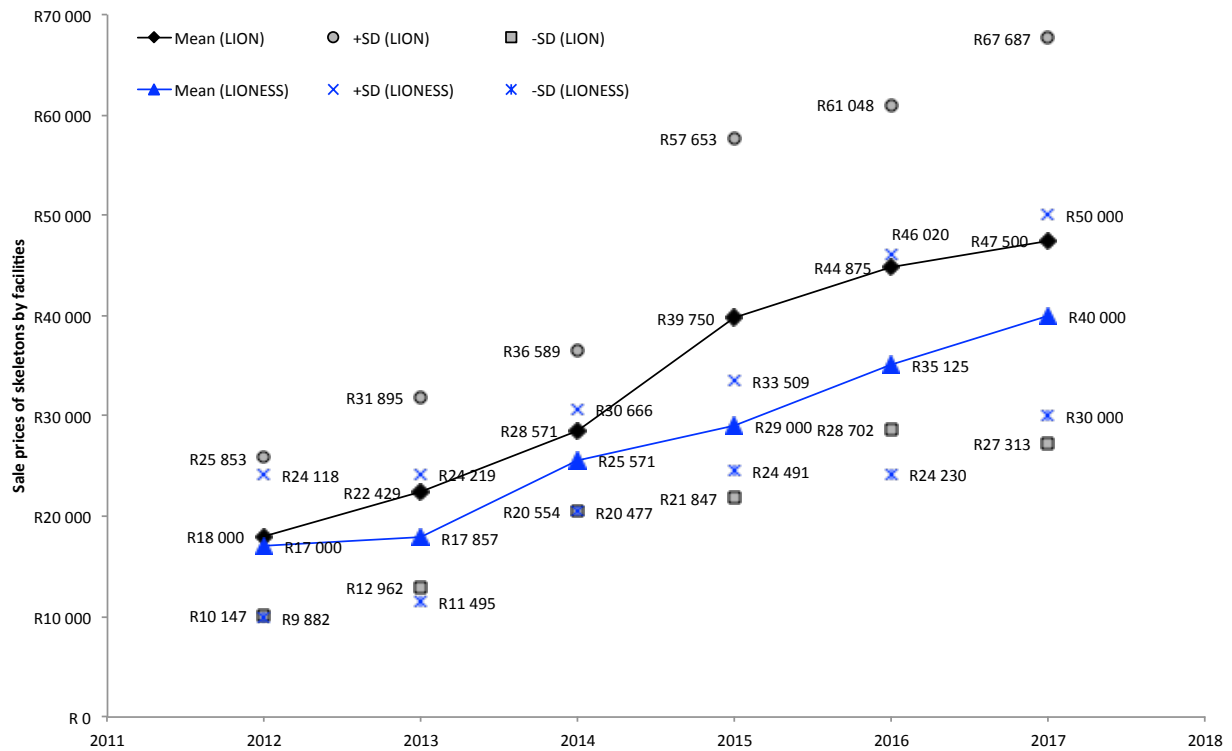


Figure 4a: Prices of lion and lioness skeletons (2012–2017) (mean \pm standard deviation). The means include three anomalous data points. The annual price means for lions and lionesses without the anomalies are in Figures 4b and 4c respectively.

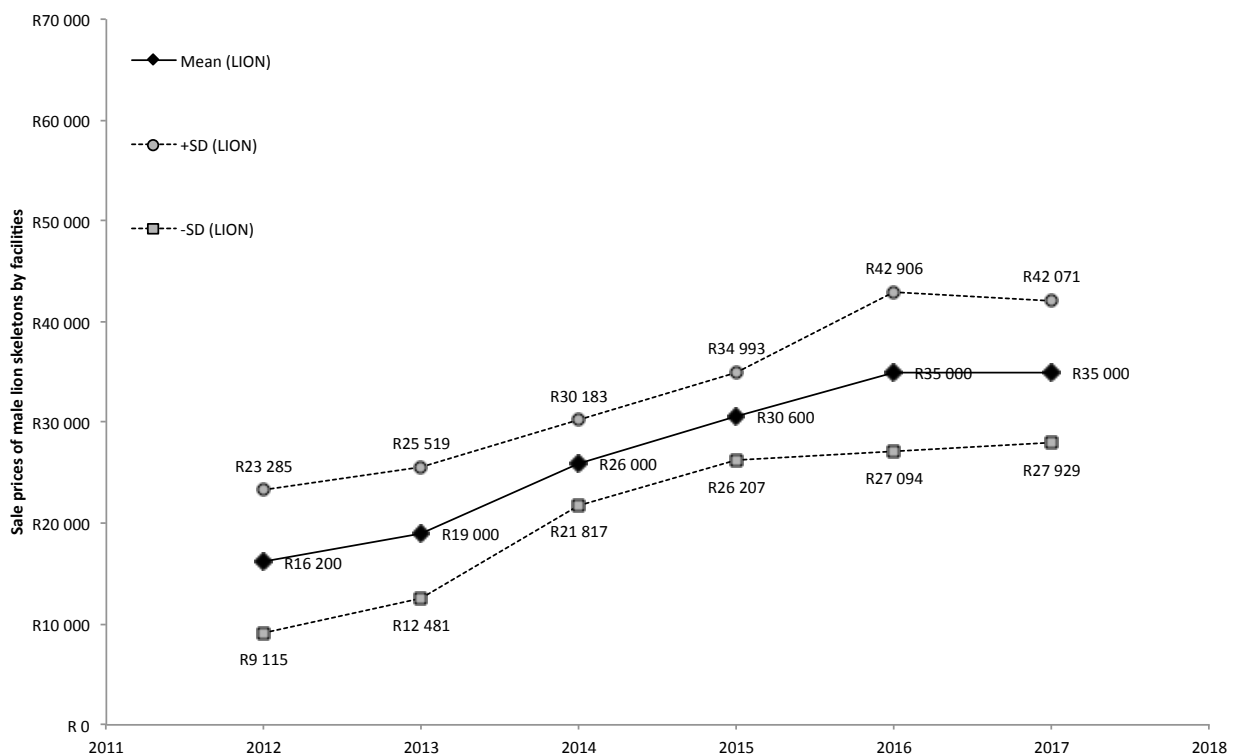


Figure 4b: Prices of male lion skeletons (2012–2017) (mean \pm standard deviation) (excluding three anomalous data points).

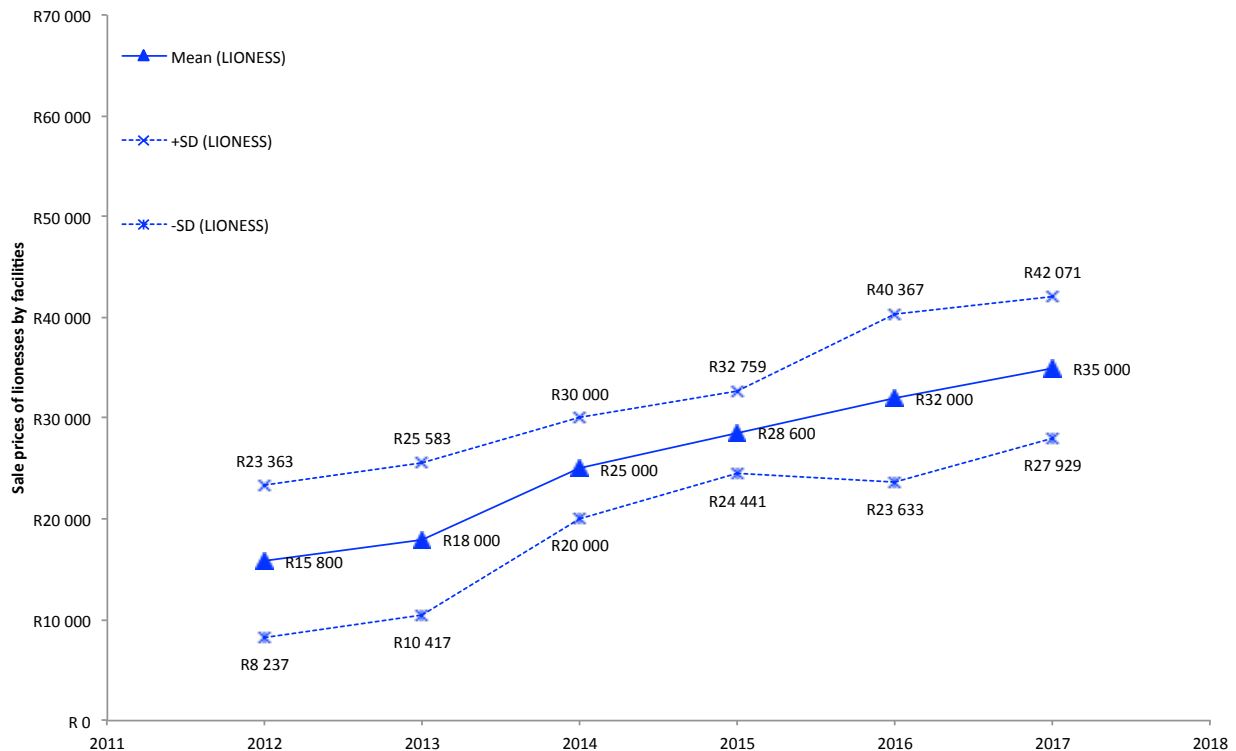


Figure 4c: Prices of lioness skeletons (2012–2017) (mean \pm standard deviation) (excluding three anomalous data points).

3.7.6 SKELETON EXPORTS

- ❖ *Indicate the number of skeletons that made up the bone exports from the facility to Asia each year (2012–2017) (Q51)*
- ❖ *Estimate how many skeletons could currently be exported to Asia in one year if there were no restrictions (Q52)*

- 8 facilities responded (although 10 said in Q48 that bones from their facility had been exported to Asia to the end of 2016, Table 10)

Seven of the eight facilities had exported 10–80 skeletons to Asia per year from 2012 to 2016 (Table 11). Two facilities had sold more than 300 skeletons in total over the five-year period. The number of skeletons that they said they could supply without restriction varied. Six facilities said they could sell more bones than supplied in 2016 (although listed 2016 export quantities were notably down from previous years), and these quantities also tended to be the same as but mostly more than the quantities sold in 2015 or earlier (for example, F2 said they could supply 40–80 skeletons in 2017, but they had sold five in 2016 and >40 in 2015 and earlier; F3 said they could supply 30 skeletons in 2017, but their average annual skeletons sales from 2012–2016 was five).

The sample, which is skewed toward respondents who supply skeletons as a by-product of trophy hunts, indicates that output has dropped in 2016 and 2017. The reasons for this are somewhat complicated and not necessarily reflective of the entire industry (in which other breeders may be euthanizing lions on a larger scale). However, it is worth noting the higher estimates of potential bone supply in the potential absence of restrictions.

Table 11: Numbers of skeletons that responding facilities exported from 2012–2017, and they could export if there was no quota. The facility numbers correspond with those in Table 10.

Facility	Number of skeletons exported (Q51)							Number of skeletons that could be exported without restrictions (Q52)
	2012	2013	2014	2015	2016	2017	Total	
F1	50	50	50	50	50	50	300	Do not know
F2	30	40	60	44	5	0	179	40–80 ^a
F3	4	4	4	6	8	0	26	30 ^b
F4	50	50	60	60	5	5	230	5
F5	40	50	60	60	4	0	214	5–10 ^c
F6	70	65	80	80	14	20	329	70–90 ^d
F7	<i>No figures given, but facility indicated in Q48 (Table 10) that bones were exported from 2012–2016</i>							
F8	40	45	50	55	34	22	246	100 ^e
F9	10	10	20	25	30	0	95	30
F10	0	0	0	0	? ^f	0	0	2–3 ^g
F11	0	0	0	0	0	0	0	20
F12	0	0	0	0	0	0	0	Zero ^h (see Table footnote)
Total	295	315	385	381	151	98	1625	>369

^a Comment from facility: “This is the number of lions we can comfortably hunt every year if there were no restrictions”.

^b Comment from facility: “With the current hunting market decreasing, there has also been a reduction in the sales of breeding animals – i.e. we are now obliged to sell 40-60% of our lion stock in to other markets such as bones. With my current breeding, I have to sell about 30 carcasses”.

^c Comment from facility: “In 2016 we only hunted 5 lions, compared to 50 in 2015. Because the import of lions into the USA is closed, we only hunt between 5–10 lions per year”.

^d Comment from facility: “Average 70–90 based on current bookings from USA clients if the USFWL open hunting and bookings from Middle East clients China and Poland”.

^e Comment from facility: “If the USA market opens up, I will be able to export 100 skeletons with the European market”.

^f No figure given for 2016, but facility indicated in 48 (Table 10) that bones were exported

^g Comment from facility: “Natural mortalities of lions that have killed each other”.

^h Facility answered ‘geen’ (‘none’); however, in Q48 (Table 10), they predicted they would sell bones in 2017

3.8 Summary discussion of questionnaire results

The questionnaire results to date have provided some useful indicative information of some of the trends within the industry. However, we need to be mindful of sample limitations, and note that the respondents likely only account for less than 20% of the total number of lions in the captive breeding industry. The sample most likely suffers from an element of self-selection bias (see comments in the final paragraph of Section 4.1.2 below). Breeders keen to avoid attention or exiting the industry are less likely to have responded. To improve the representative validity of the answers we would ideally identify and target the largest breeders and encourage them to answer the full questionnaire. We hope to accumulate a larger sample of respondents as the study progresses.

4 Data from Multiple Information Sources

4.1 Exports of lion bones (2008–2016)

4.1.1 PUBLISHED CITES EXPORT PERMITS & AIR WAYBILL DATA

Read Williams *et al.* (2017a) for a comprehensive assessment of the trade in lion bones from South Africa for 2008–2016 (extracts provided in Appendix 2). This paper includes an evaluation of the CITES data, air waybill data on actual exports from a company exporting lion bones on behalf of six lion bone traders, and input from one of the South African lion bone traders. Figure 5 (below) is from that paper and shows the number of CITES permits issued to export bones and bodies from South Africa from 2008–2015, and the actual number of skeletons exported from 2014–2016 (derived from the air waybill data).

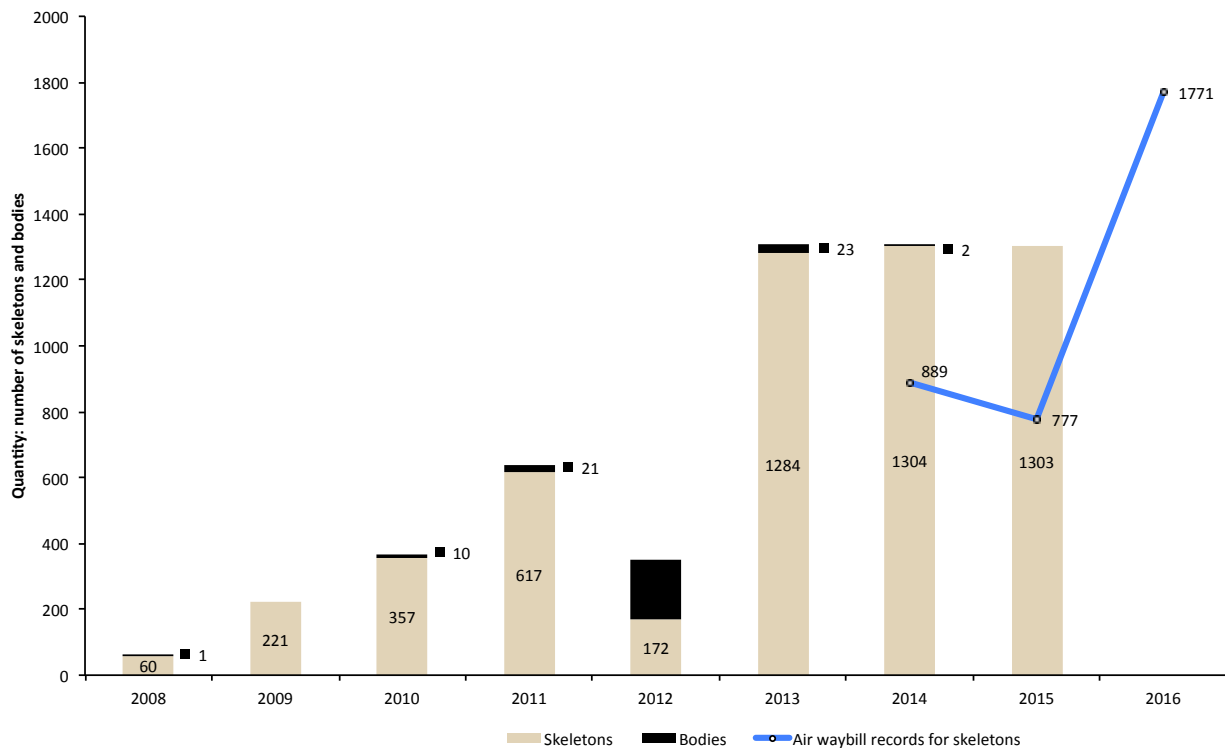


Figure 5: Combined number of lion skeletons and bodies sourced from South Africa and listed on issued CITES permits from 2008–2015 (histogram), compared to air waybill records (blue line) for actual exports of skeletons to East-Southeast Asia from 2014–2016. CITES permit records for skeletons and bones represent the maximum permitted annual quantity and not the actual annual exports. (Source: Williams *et al.* (2017a), but excluding 47 skeletons from Namibia that were issued in 2013–2015). CITES data for 2016 unavailable.

For additional information on lion trade across Africa, see Williams *et al.* (2017b), which is based on a questionnaire survey of the pan-African trade in lion body parts and a literature survey on the consumptive use of lions across the continent. The abstract of this paper is provided in Appendix 3 (the abstract, and extracts from Williams *et al.* (2017a) are provided in Appendix 2)

4.1.2 UNPUBLISHED CITES EXPORT PERMITS & AIR WAYBILL DATA

Absent from Williams *et al.* (2017a) (and hence from Figure 2 in that paper), are the combined weights of the consignments that were exported quarterly. The mass has previously been used by Williams *et al.* (2015b) to assess the mean mass of exported skeletons and detect potentially fraudulent exports (e.g. more skeletons in a consignment than the permits allow). Hence, Figure 6 (below) includes the weight of the consolidated consignments; the bigger the gap between the point on the blue line and the top of the histogram, the heavier the average mass of a skeleton was.

However: as explained in Williams *et al.* (2017a) (based on comments from a bone exporter), prior to 2016 and rumours of the US intending to ban the export of captive-origin trophies, farmers and traders tended to stockpile bones throughout the year and export them in the first quarter of the new year. Hence, bones tended to dry out (and thus weigh less) before export. Recent uncertainties in the market meant that skeletons were exported sooner after the lion was hunted, thus the skeletons were wetter and heavier. Furthermore, countries like Thailand have a preference of bones with more meat on – and those consignments were accordingly heavier. While the abovementioned factors influenced the mass of the consolidated consignments, there was sufficient reason to believe that some consignments had more bones than allowed by the permits (that said, the bag counts matched the permit requirements, according to the freight forwarder, which would have also been checked when the permit was endorsed).

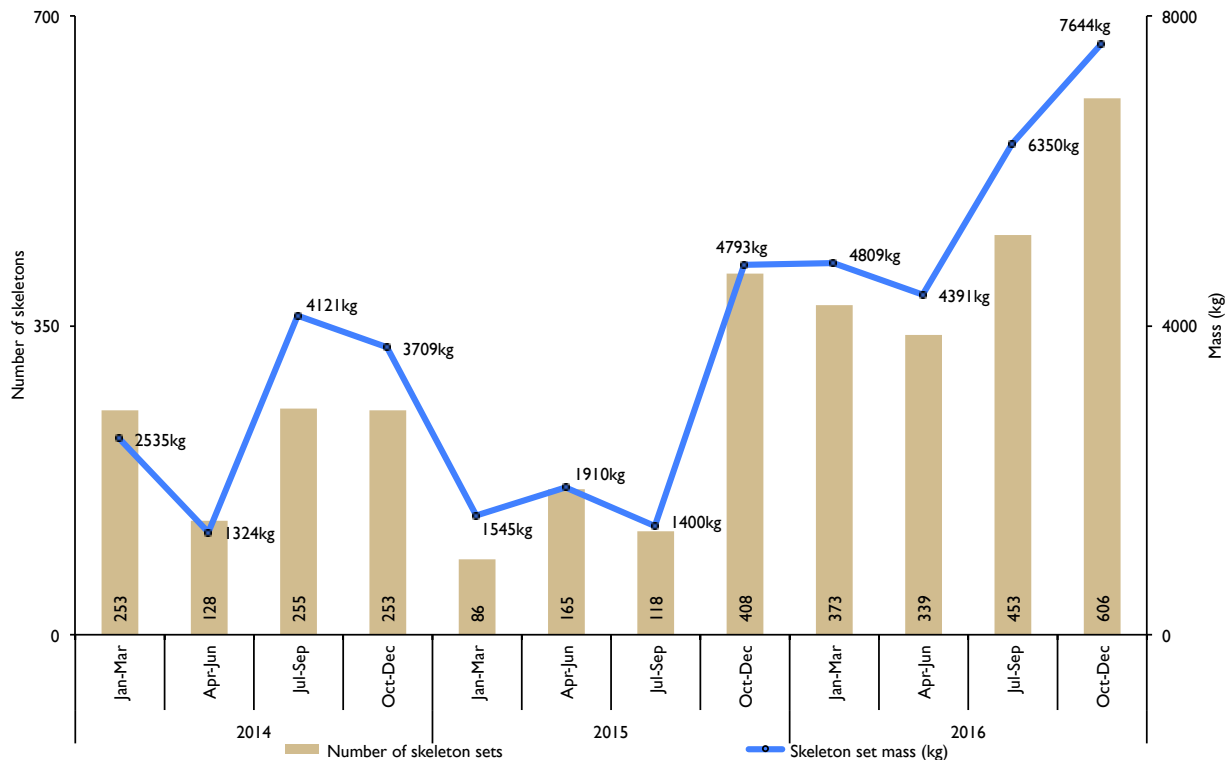


Figure 6: Actual annual quarterly exports of sets of lion skeletons from South Africa to East-Southeast Asia from 2014–2016, obtained from air waybill records provided by a freight forwarding company handling the exports on behalf of six lion bone traders.

The significantly increased volume of bone exports in 2016 suggests that the survey results indicated in Table 11 above are not representative of the industry (i.e. the survey sample respondents had reduced their overall bone sales in 2016). It is unclear to what extent the increased overall industry volumes are made up of trophy skeletons versus euthanized lions, but likely that the latter played a significant role (refer to the 2017 results below in Section 4.2). Observing the overall trend reflected by Williams *et al.* (2017a) (and in Figure 5), we would expect stakeholders in the industry to consider the 2017 quota of 800 skeletons to have been ‘insufficient’ relative to the supply. The rapid uptake of the quota reflected in the following Section (4.2) appears to bear this out.

4.2 Lion bone quota applications (2017)

From data supplied to us, 14 people applied for the lion bone quota, four of whom exported bones to Asia prior to 2017 (Figure 7; applicants A1 & A3–A5). The remaining 10 applicants are not known to have applied for CITES permits in the period 2012–2016. One exporter (A1) from the Free State applied for 52% of the quota. Given our knowledge of where applicants A1 & A3–A5 exported bones to in the past, we know that A1 (52%) will export to Vietnam, A3 (10%) will export to Thailand, A4 (7%) and A5 (3%) will export to Laos. The destinations of the remaining quota applications (28%) will only be known from the CITES permit applications. Once the quota was opened, it took less than two months for it to be used up (Figure 8). Most of the quota was for bones originating in the Free State (63%) and for euthanized lions (74%) (Table 12).

The data from the quota applications are clearly indicative of the disruption to the captive breeding industry and show that euthanized lions are now displacing hunted lions as the primary source of skeletons for export.

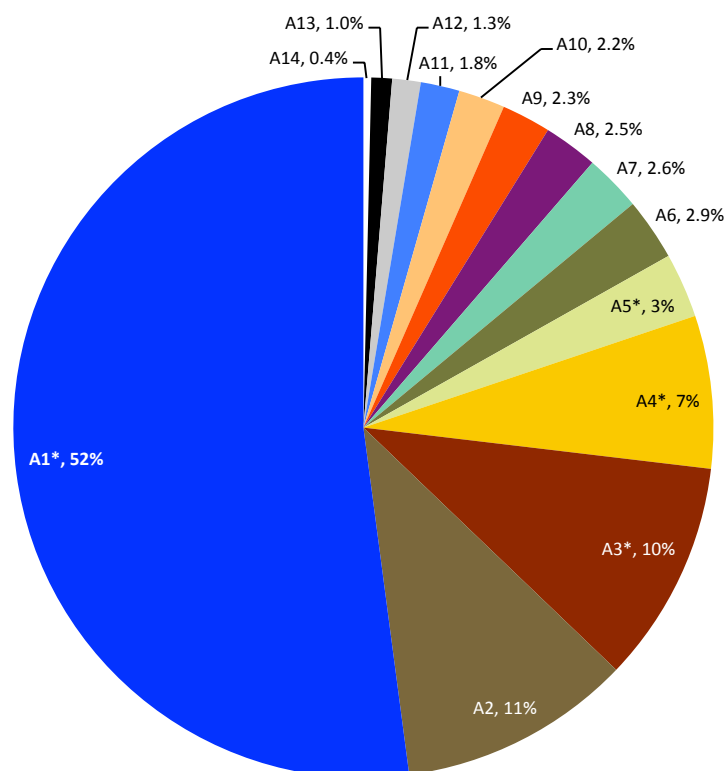


Figure 7: Applications received for the lion bone quota: listed by applicant (A1 – A14) and the percentage of the quota they applied for. Applicants A1* and A3*–A5* exported lion bones prior to 2017; however, all other applicants were newcomers to the market.

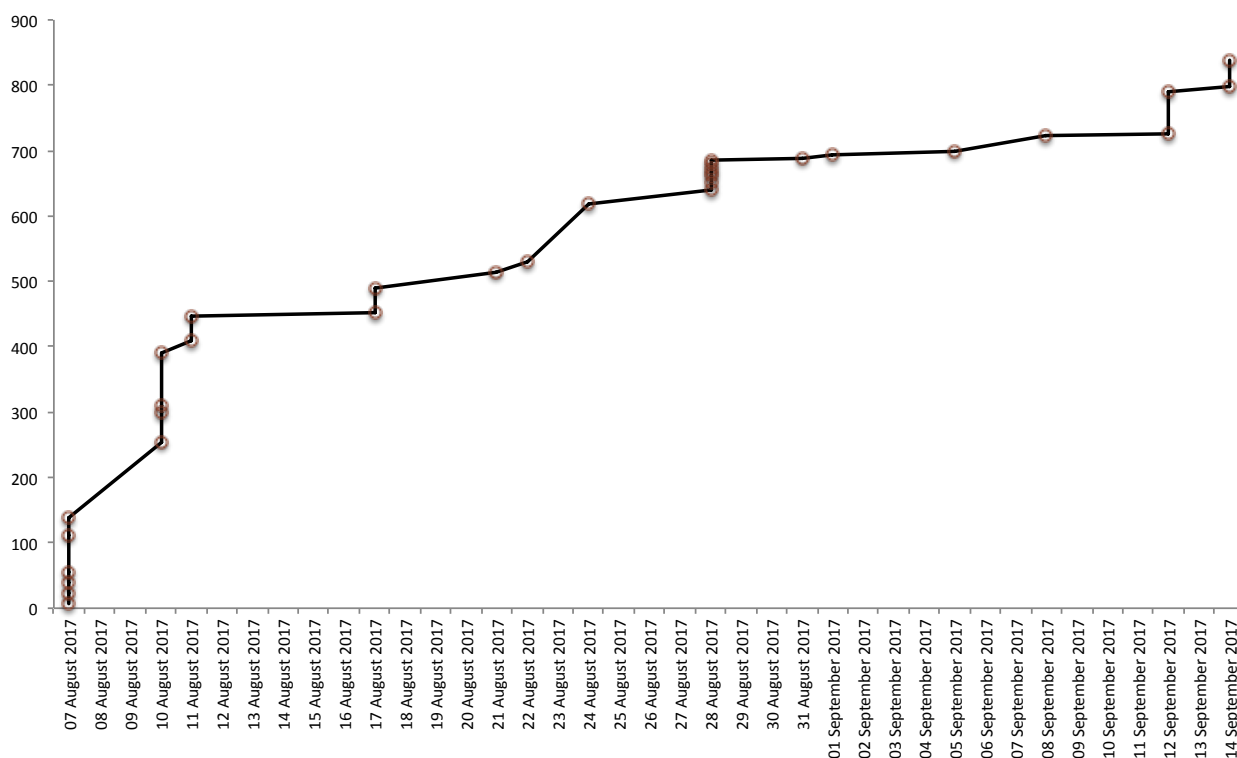


Figure 8: Date and rate of received applications for the 2017 lion bone quota

Table 12: Applications received for the lion bone quota: number of skeletons per province and cause of death.

Cause of death	Euthanasia		Hunting		Natural Causes	DCA ^a
	Free State ^b	Gauteng	North West	Gauteng	North West	North West
Province						
Number	529	90	166	41	3	8
Percentage	63%	11%	20%	5%	0.4%	1%

^a 'Damage Causing Animals'^b Includes 38 applied for after the quota was reached

5 Muthi Market Monitoring for Lion Products

This information on muthi market monitoring is not essential to the collaborative research project on lion bones, and is an ongoing work in progress. The results of this project will eventually give some essential indication of the prevalence of lion skins in provincial muthi markets, the prices of the samples relative other similarly monitored threatened species, the prevalence of fakes (i.e. the species being sold as lion), and appropriate information from DNA testing. Tissues samples acquired for DNA testing during the research include skin, fat, mane hair, a tooth, meat and 'saliva'.

The muthi market survey represents a branch of the illegal trade in lion body parts in South Africa. One assessment that needs to be conducted in due course is an assessment of known incidents of poaching, illegal trade, confiscations, ToPS restricted activities pertaining etc. Some of these data have been requested.

6 Discussion, Conclusions, Recommendations

We conclude this report with the following:

1. An overview of our understanding of the current situation, based on our research to date; and
2. A summary the limitations of the data received to date, highlighting potential avenues for further research.

6.1 Current situation

The captive lion breeding industry is in state of flux (i.e. unstable), having been significantly affected by the recent US trophy import restrictions, as well as the imposition of the skeleton export quota. Lion breeders are adapting in different ways. If there is no reversal in the US policy, or if there are further EU trophy import restrictions, there will (judging from the responses of the respondents) be further 'fallout'. Different breeders will continue to respond in different ways, which are not that easy to predict.

Some breeders are most likely to scale down significantly, if not disinvest from lion breeding altogether. At least some of these will euthanize lions and attempt to recover costs through sale of skeletons. Even if the US does not change its stance on allowing any imports from captive bred lions, some breeders are seeking new trophy markets and this sector may grow slightly again, albeit at lower rates.

The fact that a large proportion of survey respondents have stated that they will seek 'other markets' for lion bones should be of concern. This clearly signals the potential for a parallel illegal market to develop. Should such a market develop closer links with organized criminal enterprises, the effects could be irreversible (as with the rhino horn trade) and result in greater and more widespread threats of focused commercial-scale poaching of wild felids. Well-informed existing legal exporters of lion skeletons share these concerns.

From a wildlife auction in April 2017 that VLW attended, we know that the prices of lion hunts have dropped markedly². In addition, the trajectory of skeleton prices suggests that consumer demand is stable and possibly growing (at a slow rate). We do not know anything about the elasticity of demand (sensitivity to price changes), but price shocks are best avoided. Although there have been some incidents of lion poaching within South Africa in the last year, none of these involved wild lions in formally proclaimed protected areas, nor were they aimed at procuring whole skeletons. We can currently find no substantial evidence that legal exports of skeletons from captive-bred lions have adversely affected wild populations in South Africa to date. What requires urgent investigation is the extent and impact of trade in other African lion range states where vulnerable wild lion populations are likely to be adversely affected (Williams *et al.* 2017a).

6.2 Data limitations and further avenues to explore

Although we are satisfied that we have some useful baseline data to assess the state of the industry, we would ideally prefer to obtain more, both in terms of additional types of data (see Table 1) and survey response rates. The response rate to the national captive lion survey has been disappointing; whereas a large number of respondents initially signed up, a far smaller portion followed through and actually answered the relevant questions. It would be very useful to find out why this was so. As discussed earlier, it is possible that the co-operative questionnaire respondents do not constitute a representative sample of the industry. For this reason, we intend to increase the sample size by increasing sampling effort; ideally, we would like to identify the largest breeders to try and ensure that they all participate to at least some useful extent. Knowing that we have received responses that account for the majority of the captive population would be more reassuring. We propose to pursue more potential respondents through channels such as SAPA, and by re-advertising the questionnaire. Hence, the survey will remain open until an appropriate closing date is determined.

There are three broad research avenues we feel are important to explore in 2018:

- We would like to obtain more accurate information on the current total number of lions in captivity and how this is being affected by the recent policy changes; ideally, we would like to access updated census data relating to the captive population.
- We would like to evaluate/compare South Africa's annual CITES permit reports with data on trophy hunts (e.g. the national trophy hunting statistics) (See Table 1 on what data we do/don't yet have) (this comparison would be similar to the one conducted by Williams *et al.* 2015a); ideally, we would monitor time series data on hunts.
- We also hope that the compliance report will generate more information on the state of captive breeding operations and, it is important that we obtain more comprehensive data on reported incidents of poaching and seizures.

Finally, we note that there is considerable research interest in the general topic. CITES/CMS have requested funds for a large-scale study on lion trade, and there are postgraduate students at various UK universities who are keen to investigate aspects of the lion bone trade, and who intend exploring conservation threats from lion trade and jaguar trade. Some of these students plan to co-ordinate their work with ours. In addition, both WildCRU and ICCS provide technical support of one of us (M'TSR) via the Oxford Martin Programme on Illegal Wildlife Trade, to further explore and understand the systemic links between legal lion trade, illegal trade in other felid species, and associated conservation impacts. This work will engage expert groups using techniques such as participatory modelling and scenario planning to develop a deeper shared understanding of the issues, identify areas of key uncertainty, and appropriate techniques for addressing these.

² Not presented here; details to be included in subsequent reports. A few examples are listed: (i) A trophy package of 1 lion and 1 lioness was sold for R104,000 – in 2016, this would have sold for ±R190,000; (ii) a trophy package for a male lion sold for R30,000 (where the hunting area had to be arranged) – in 2016, it would have sold for R130,000.

7 Supplementary Documents

1. National Captive Lion Survey: English version of the questionnaire
2. Williams VL, Loveridge AJ, Newton DJ & Macdonald DW (2017a) A roaring trade? The legal trade in *Panthera leo* bones from Africa to East-Southeast Asia. *PLoS ONE* 12(10): e0185996. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0185996>
3. Williams VL, Loveridge AJ, Newton DJ & Macdonald DW (2017b) Questionnaire survey of the pan-African trade in African lion body parts. *PLoS ONE* 12(10): e0187060. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0187060>

8 References

- Williams VL, Loveridge AJ, Newton DJ & Macdonald DW (2017a) A roaring trade? The legal trade in *Panthera leo* bones from Africa to East-Southeast Asia. *PLoS ONE* 12(10): e0185996. <https://doi.org/10.1371/journal.pone.0185996>
- Williams VL, Loveridge AJ, Newton DJ & Macdonald DW (2017b) Questionnaire survey of the pan-African trade in African lion body parts. *PLoS ONE* 12(10): e0187060. <https://doi.org/10.1371/journal.pone.0187060>
- Williams VL, Newton DJ, Loveridge AJ & Macdonald DW (2015) *Bones of Contention: an Assessment of the South African Trade in Lion Panthera leo Bones and Other Body Parts*. Cambridge: TRAFFIC and Oxford: WildCRU. A joint report. Available: http://www.traffic.org/species-reports/traffic_species_mammals83.pdf
- Williams VL, Loveridge AJ, Newton DJ & Macdonald DW (2015b) Skullduggery: lions align and their mandibles rock. *PLoS ONE* 10(11): e0135144. <https://doi.org/10.1371/journal.pone.0135144>

9 Appendix 1

Section	Question no.	Question	Answer count
A	Q1	(Preference for anonymity)	124
	Q2	Name	20
	Q3	Province	95
	Q4	Job description	94
B	Q5	Year facility opened	34
	Q6	Membership of organisations	34
	Q7	Facility purpose	34
	Q8	No. of employees	34
	Q9	Reasons for breeding	34
	Q10	Reasons for keeping	34
	Q11	Rank the core purposes of the facility	34
	Q12	No. of paying visitors	33
	Q13	Approximate sizes of various areas (farm, breeding, keeping, camps, etc)	34
	Q14	From January 2016, which ones increased/decreased/stayed the same (refers to no. of lions on the property, total breeding areas, total keeping/growing area, total hunting area)	34
	Q15	Est. annual value of sales 1 (4 income categories)	34
	Q16	Est. annual value of sales 2 (4 income categories)	34
	Q17	Any impact if 2016 US decision?	34
	Q18	If yes to (17), indicate how you are adapting?	31
	Q19	What will happen if US ban continues?	34
	Q20	If UK & Europe ban xxx, what will you do?	34
	Q21	Does the lion bone quota restrict business?	33
	Q22	If yes to (21), how will you adapt?	29
	Q23	Has euthanasia of lions increased in 2 years	34
	Q24	Does trade of captive lions affect wild lion pops (describe)	33
C	Q25	Est. no. lions at 31 January 2017	33
	Q26	Est. no. lions at 31 January 2016	33
	Q27	Est. no. lions at 31 January 2015	33
	Q28	From where has current lion stock been sourced?	33
	Q29	Where was original lion stock sourced from?	33
	Q30	Redirect: is purpose hunting only? (No→ Q31; Yes→ Q43)	33
	Q31	Redirect: does facility breed lions (Yes→ Q32; No→ Q37)	26
D	Q32	No. adults breeding	20
	Q33	% that certain factors result in reduction in lion numbers	20
	Q34	How are lion numbers controlled?	20
	Q35	Wild lions introduced to breeding stock?	20
	Q36	Stud book, identification, DNA?	20
	Q37	Redirect: has facility sold live lions (Yes→ Q38; No→ Q43)	23
E	Q38	Est. no. live lions sold 2014 - present	18
	Q39	Average age when sold	17
	Q40	Average sale price adult lion 2015	18
	Q41	Average sale price adult lion 2016	18
	Q42	Average sale price adult lion 2017	18
	Q43	Redirect: facility sold products, bones, trophies etc (Yes→ Q44; No→ Q53)	28
F	Q44	Have products been sold to named customers	11

	Q45	Has facility used middleman to export bones to Asia	11
	Q46	Has facility sold bones via middlemen in other countries	11
	Q47	Before Jan 2016, what % skeletons from named selected sources entered bone market	11
	Q48	When did bone exports from facility start?	11
	Q49	Prices of male skeletons 2012-2017	11
	Q50	Prices of female skeletons 2012-2017	11
	Q51	Number skeletons exported 2012-2017	11
	Q52	How many skeletons could you export?	11
	Q53	Redirect: hunting allowed at facility? (Yes→ Q54; No→ end of survey)	24
G	Q54	Ave. time lion in hunting area	25
	Q55	Details of hunting area(s) (sizes, number, etc)	25
	Q56	% clients from countries before 2016	25
	Q57	% clients from countries after 2016	25
	Q58	Number lions hunted 2012-2017 so far	25
	Q59	After Jan 2016, what month did income start to decline?	25
	Q60	Since Jan 2017: est. loss of earnings	25
	Q61	Due to ban, have people been retrenched?	25

10 Appendix 2

10.1 Abstract from Williams et al. 2017a ('A roaring trade? The legal trade in *Panthera leo* bones from Africa to East-Southeast Asia')

The African lion is the only big cat listed on CITES Appendix II, and the only one for which international commercial trade is legal under CITES. The trade in lion body parts, and especially the contentious trade in bones from South Africa to Asia, has raised concerns spanning continents and cultures. Debates were amplified at the 2016 CITES Conference of the Parties (CoP17) when a proposal to up-list lions to Appendix I was not supported and a compromise to keep them on Appendix II, with a bone trade quota for South Africa, was reached instead. CoP17 underscored a need for further information on the lion bone trade and the consequences for lions across the continent. Legal international trade in bones to Asia, allegedly to supply the substitute 'tiger bone' market, began in South Africa in February 2008 when the first CITES permits were issued. It was initially unclear the degree to which bones were sourced from captive-origin lions, and whether trade was a threat to wild lion populations. Our original assessment of the legal CITES-permitted lion bone trade from South Africa to East-Southeast Asia was for the period 2008–2011 (published 2015). In this paper, we consolidate new information that has become available for 2012–2016, including CITES reports from other African countries, and data on actual exports for three years to 2016 supplied by a freight forwarding company. Thus, we update the figures on the legal trade in lion bones from Africa to East-Southeast Asia in the period 2008–2016. We also contextualise the basis for global concerns by reviewing the history of the trade and its relation to tigers, poaching and wildlife trafficking. CITES permits issued to export bones escalated from ± 314 skeletons from 2008–2011, to ± 1312 skeletons from 2013–2015. South Africa was the only legal exporter of bones to Asia until 2013 when Namibia issued permits to export skeletons to Vietnam. While CITES permits to export ± 5363 skeletons from Africa to Asia from 2008–2015 were issued (99.1% from South Africa; 0.7% from Namibia) (51% for Laos), actual exports were less than stated on the permits. However, information on actual exports from 2014–2016 indicated that >3400 skeletons were exported in that period. In total, >6000 skeletons weighing no less than 70 tonnes have been shipped to East-Southeast Asia since 2008. Since few wild lions are hunted and poached within South African protected areas, skeletons for the legal trade appear to be derived from captive bred lions. However, confirmation of a 116kg shipment from Uganda to Laos, and reports of lion poaching in neighbouring countries, indicate that urgent proactive monitoring and evaluation of the legal and illegal trade is necessary in African lion range states where vulnerable wild lion populations are likely to be adversely affected.

10.2 Extracts from the text of Williams et al. (2017a)

The following extract from the paper are mostly relate to interviews (i.e. pers. comms.) with lion bone traders on key aspects of the trade and exports.

- **Page 9:** The CITES export data presented...for 2008–2015 are based on the adjusted quantities listed on the export permits issued for skeletons (SKE) and bodies (BOD)...– in other words, quantities traders had usually 'guestimated' they could export when they applied for the permits, and *not* the actual quantities exported. However, most traders say they tend to use the entire permit, so actual exports should be close to the quantities listed on the issued permits [Anonymous, pers. comm., July 2017].
- **Page 10:** From the permit endorsement records it was noted that some exported consignments were smaller than the maximum allowed by the corresponding permit, and some permits were not used in the same year they were issued. Lion bone traders said that this happened quite frequently in the past because hunting establishments had a tendency to stockpile all, or most, of the skeletons resulting from hunts in a year until ca. November, after which they would sell them to "[lion bone traders] to assist with travel expenses during January and February when most of the international [hunting] tradeshow take place" [Anonymous, pers. comm., July 2017]. And, since the traders were unable to complete the applications for permits (including CITES) in time due to the December vacation period in South Africa, the export of those stockpiled bones was typically delayed until January/February of the following year [Anonymous, pers. comm., July 2017]. However, bone traders also said that uncertainty in the industry from January 2016 resulted in this practice (of stockpiling) being abandoned, and most hunting farms sold bones on a monthly basis for the rest of that year [Anonymous, pers. comm., July 2017].
- **Page 10:** Traders say that under the 800 skeleton per year quota, 100% of the permit will be used

because the maximum quantity allowed for 2017 is less than what they can be supplied with [Anonymous, pers. comm., July 2017].

- **Page 14:** The 2016 figures, however, also show a significant increase in actual exported quantities compared to previous years (Figs 2 & 4). Because of prevailing uncertainty in the industry, the surge was partly indicative of the regular availability of skeletons due to farms selling available bones monthly to South African traders rather than stockpiling them to the end of the year (which also means that bones are likely to be wetter, and the average skeleton mass heavier, than estimated by Williams *et al.* (2015b). The most evident increase was in the last quarter of 2016 following the October 2016 outcome of CoP17 that a quota on bone exports was to be implemented in 2017. The surge after CoP17 was mostly indicative of traders buying and exporting as many skeletons as possible in anticipation of a zero quota, or a quota that would be lower than the quantities that they knew could be bought from facilities [Anonymous, pers. comm., July 2017].
- **Page 14:** Actual exports for 2016 are more than double the quantities of previous years, and thus appear to be a reaction to the various trade restrictions that were imposed, proposed and/or anticipated. South African lion bone traders agreed that these are all valid reasons for the 2016 figures [Anonymous, pers. comm., April and July 2017]. It is further noteworthy that, while the international market for South African lion hunts has declined markedly since 2016, the domestic market has allegedly expanded (partially due to hunts being sold at reduced rates); however, South African hunters tend not to take the skulls as trophies, and so complete skeletons from trophy hunted lions are entering the supply chain more frequently [Anonymous, pers. comm., August 2017].

11 Appendix 3

11.1 Abstract from Williams et al. 2017b ('Questionnaire survey of the pan-African trade in lion body parts')

The African lion is in decline across its range, and consumptive utilisation and trade of their body parts and skins has been postulated as a cause for concern. We undertook a pan-African questionnaire and literature survey to document informed opinion and evidence for the occurrence of domestic and international trade and consumption in African lion body parts across current and former range states. Sixty-five people from 18 countries participated in the online questionnaire survey (run from July 2014 to May 2015), with information provided for 28 countries (including 20 out of 24 countries believed to have extant populations). Respondents were experts within their professional spheres, and 77% had ≥6 years relevant experience within lion conservation or allied wildlife matters. Their opinions revealed wide sub-regional differences in consumptive use, drivers of trade, and access to lions that impact wild lion populations in different ways. Traditional medicine practices (African and Asian) were perceived to be the main uses to which lion body parts and bones are put domestically and traded internationally, and there is reason for concern about persistent imports from former lion range states (mainly in West Africa) for parts for this purpose. The domestic, rather than international, trade in lion body parts was perceived to be a bigger threat to wild lion populations. Parts such as skin, claws, teeth and bones are thought to be in most demand across the continent. The impact of international trade on wild populations was acknowledged to be largely unknown, but occasionally was judged to be 'high', and therefore vigilance is needed to monitor emerging detrimental impacts. Seventeen countries were nominated as priorities for immediate monitoring, including: South Africa, Tanzania, Zimbabwe, Mozambique, Zambia, Botswana, Kenya, Nigeria, and Cameroon. Reasons for their selection include: prevalence of trophy hunting, 'hot spots' for poaching, active domestic trade in lion body parts, trade in curios for the tourist market, and histories of legal-illegal wildlife trade. This survey, and increased incident reports since mid-2015 of lion poisoning and poaching in Mozambique, Zimbabwe and South Africa, and sporadic poaching events in Uganda and Tanzania, are signalling an escalating trend in the trade of lion products that is an increasing threat to some national populations. The evidence is sufficient to make more detailed investigation of this trade a conservation priority.

11.2 Extracts from Williams et al. (2017b)

The paper is extensive and covers trade in lions (all body parts) across their African range. The abstract will suffice as an overview of the content.