Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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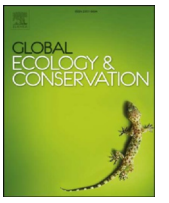

Assessing the economic impact of COVID-19 on the private wildlife industry of South Africa

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ABSTRACT

The world of travel and tourism have perhaps changed forever as a result of COVID-19; considered the worst global pandemic to affect the world, post World War II. The spread of the Coronavirus diseases was considerably attributed to the travel and tourism industry, and with the attempt to curb the spread of the virus, the industry experienced calamitous effects and suffered staggering financial losses. The same accounts for wildlife tourism (Southern Africa's largest product) – bringing the hunting and ecotourism sector of South Africa to a complete standstill. The pandemic accompanied concerning and devastating effects, not only from a financial point of view, but also in terms of the conservation of these sectors within the industry. This paper presents a comprehensive analysis using the data obtained from the members of Wildlife Ranching South Africa (WRSA) to quantify the actual and potential financial losses in the private wildlife industry due to cancellations of hunters and eco-tourists, live game sales and finally, game meat sales in the industry. From the results, the estimated financial impact of COVID-19 on the private wildlife industry is R6.694 billion (ZAR). The study made the following three contributions: Firstly, it determined the economic impact of COVID-19 on the private wildlife industry. Secondly, it provides the industry with a tangible document that can be used in securing funding and assistance from government and other non-profit organisations. Thirdly, it shows the importance of this industry to the South African economy and employment, although only applicable to private-owned reserves

1. Introduction

The Coronavirus disease of 2019 (COVID-19) is an ongoing global pandemic that has come to be considered as the worst post World War II pandemic to affect the world, surpassing the outbreaks of severe acute respiratory syndrome (SARS) in 2003 and the Middle East respiratory syndrome (MERS) in 2012 (Baldwin and Di Mauro, 2020; Huynh, 2020; Ruiz-Estrada et al., 2020). The travel and tourism industry, much like in the case of the SARS outbreak, is widely considered to have been the vector for the spread of COVID-19 and has virtually ground to a halt. As a result of the discussed, there has been monumental financial losses in the industry due to country lockdowns and stringent travel restrictions implemented to curtail the spread of COVID-19 (Novellia et al., 2018; Arezki and Nguyen, 2020; Stezhko et al., 2020). The aforementioned is iterated by Oğuz et al. (2020) who state that the impact of COVID-19 has been particularly catastrophic for the travel and tourism sector. The statistics on

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international air travel show the industry came to an abrupt halt, with knock-on effects to all parts of the industry, including the wildlife tourism industry of Africa.

Wildlife is the leading source of tourist revenue in Africa (also for South Africa) through photographic safaris and hunting (Van der Merwe et al., 2007; Tairo, 2020). Snyman et al. (2021) state that wildlife is an essential drawcard for tourists who visit protected and conserved areas. Tairo (2020) and Snyman et al. (2021) states that wildlife conservation experts in Africa are worried about the impact of the COVID-19 pandemic on wildlife tourism products. Research conducted by WRSA (Wildlife Ranching South Africa) in April 2020 indicates that hunting and ecotourism on game farms in South Africa came to a complete standstill (WRSA, 2020). The knock-on effects of this decrease in economic activity can have devastating effects on the South African economy. Marras (2020) acknowledges that the world and the tourism industry have changed, perhaps forever. The COVID-19 pandemic has turned the wildlife tourism industry upside down and brought immense concern and considerable uncertainty to product owners.

Therefore, this research aims to assess the impact of COVID-19 on the South African private wildlife industry and the South African economy. In order to quantify the losses due to COVID-19, a comprehensive analysis of the actual and potential financial losses in the private wildlife industry due to cancellations of hunters and ecotourists, live game sales and game meat sales in the industry are firstly determined by using an online survey. The current and potential losses in employment opportunities in the industry are also assessed. And, finally, how these losses influence production and employment in the rest of the economy through multiplier analysis.

2. Literature background

2.1. Wildlife tourism

Higginbottom (2004:2) states that; wildlife tourism is tourism based on encounters with non-domesticated (non-human) animals such as springbok, elephants and lions. The occurrence can take place either in the animals' natural environment such as reserves, game farms and national parks, or when in captivity, such as zoos. These activities can be classified into two main groups, namely non-consumptive (photographic safaris) or consumptive (hunting and fishing). Wildlife tourism includes attraction to a fixed site, tours and experiences in association with tourist accommodation or unguided encounters by independent travelers (Higginbottom, 2004:3).

Van Hoven (2005) specified that the more significant portion of wildlife tourism in South Africa takes place on private game reserves or farms (therefore the reason to select the private wildlife industry), which form 17.9% of the total land suitable for agriculture in the country. This translates to 14.7 million ha (6 330 exempted game farms) compared to three percent (3%) of the land (3.7 million ha) officially protected under SANParks management. In 2013 at the Biodiversity Indaba held at the Ranch, Polokwane, CEO of WRSA (Wildlife Ranching South Africa), Adri Kithoff, indicated that the private wildlife industry consists of 10 000 game farms/wildlife reserves covering 20.5 million ha of land compared to the 7.5 million ha state-owned conservation areas (national parks, provincial parks, etc.) (Kitshoff, 2013). This shows the expansion and growth this industry experience in this period. The private wildlife industry is based on four pillars, namely the live game trade, hunting (trophy and biltong), ecotourism, and processed game products (Fig. 1) (Van der Merwe, 2004). As indicated, this research will determine the impact of COVID-19 on all the identified pillars.

2.2. Economics of hunting in South Africa

Hunting in South Africa is divided into two groups of hunters: trophy hunters and biltong hunters. Van der Merwe and Du Plessis (2014) define biltong hunting as a cultural activity, during which wildlife is hunted with a rifle, bow or similar weapon to produce a variety of meat (venison) products, such as biltong, droëwors (dry sausages) and salami, to name a few. Biltong is a type of cured meat, the concept of which originated in South Africa. It is made from various types of meat, such as beef and game (biltong is similar to jerky, produced in the USA). Trophy hunting is an activity whereby wildlife is hunted with a rifle, a bow or a similar weapon, primarily for horns (measured according to Rowland Ward and Safari Club International) and skins, which are subsequently displayed as trophies (Saayman et al., 2009:vii).

Research conducted by TREES (TREES Tourism Research in Economics, Environs and Society (2017); Wildlife Ranching South Africa, 2020) indicates that the average spending of trophy hunters, including game hunted and general spending, in South

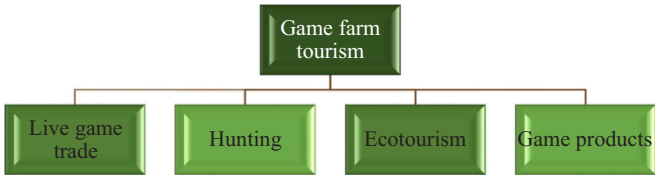

Fig. 1. Four pillars of game farm tourism.
Source: Retrieved from Van der Merwe (2004)

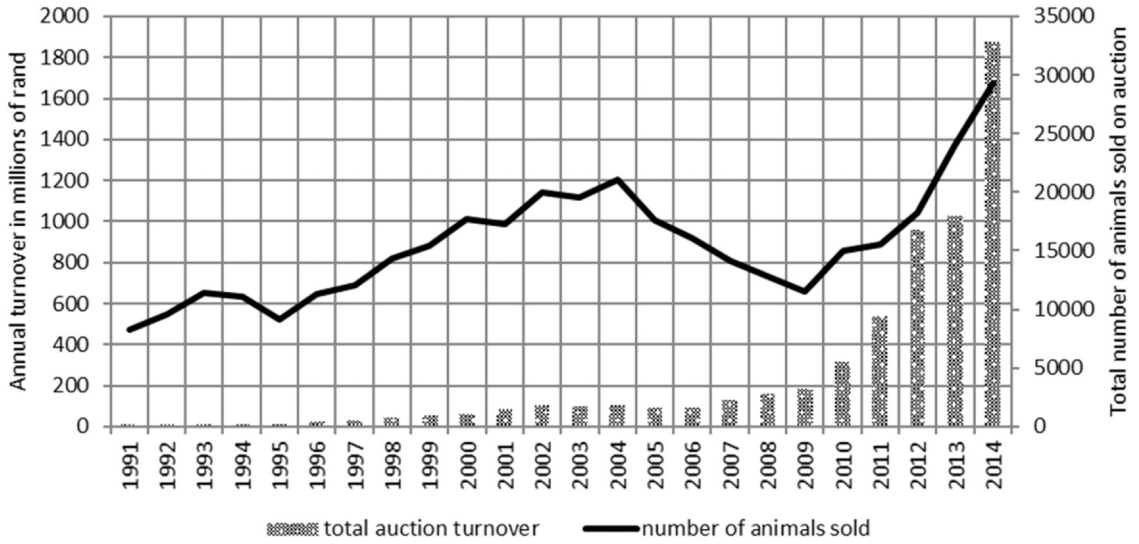

Fig. 2. Annual turnover (ZAR million) and the total number of wild animals sold on wildlife auctions in South Africa (1991–2014). (Source: Cloete et al., 2015)

Africa amounts to a total of USD20 135 (ZAR261 761), which excludes travel costs to SA. If this is multiplied by the number of hunters visiting South Africa in 2016, the economic contribution of trophy hunting to the South African economy therefore is USD153 million (ZAR1.989 billion). The spending can be sectioned into game hunted and general spending (accommodation, travel, food, souvenirs, etcetera) which results in USD76.923 million (ZAR1 billion) on game hunted and USD76.077 million (ZAR989 million) on general goods and services. In a broader Southern Africa perspective, research by SCI (Safari Club International) estimated the economic benefits of trophy hunting in eight African countries – Botswana, Ethiopia, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe. They claim that the overall economic benefit from their estimated 18 815 trophy hunter visits is USD426 million to the studied eight (8) countries, and that trophy hunting, directly and indirectly, supports 53 000 jobs (Murray, 2017).

In 2017 it was estimated that biltong hunters in South Africa spent on average USD4 162 (ZAR58 275) per hunter per season on hunting. When sectioned into game hunted and general spending it divides into USD2 147 (ZAR30 064) on game hunted and USD2 015 (ZAR28 212) general spending, per hunter per season. When multiplied with the number of frequent biltong hunters in South Africa (200 000), it totals USD832.4 million (ZAR11.655 billion) for the season, with USD429.5 million (ZAR6.013 billion) for game hunted and USD402.8 million (ZAR5.640 billion) general items. Therefore, if biltong and trophy hunters spending are added up, the estimated spending by hunters (local and international) in South Africa are USD985.4 million (ZAR13.644 billion) (Van der Merwe and Saayman, 2016).

2.3. Economics of the live game trade

During the 1990s up to the middle 2000s, only a small percentage of game animals found their way onto the live market and, as a result, the economic contribution of live game trade was relatively small compared to hunting and wildlife-based ecotourism. Information in terms of the economic value of breeding and live sales is, however, limited to the statistics from formal live game auctions. Fig. 2 provides an overview of the trends in terms of the turnover and number of animals sold on formal live game auctions since 1991. Since 2009, the number of animals that were sold on formal game auctions increased with an average of 16.7% per annum, while turnover increased on average with 35.8% per annum. The total turnover on wildlife auctions reached a historic high of just over USD128.571 million (ZAR1.8 billion) in 2014 (Cloete et al., 2015).

According to Cloete (2020), the game trade market decreased tremendously in the last couple of years (2018–2020), due to the fact that trading had reached saturation point. The statistics of 2019 showed that the turnover for game sales were USD40.2 million (ZAR563 million), considerably lower than in 2014.

2.4. Economics of ecotourism in South Africa

The World Travel and Tourism Council (2019) indicated that the direct contribution of wildlife tourism to the world Gross Domestic Product (GDP) was USD120.1 billion in 2018, or 4.4% of the estimated direct global travel and tourism GDP of USD2.751 billion. Once additional multiplier effects across the global economy are allowed, the total economic contribution of wildlife tourism comes to USD343.6 billion – approximately equivalent to the entire GDP of South Africa. The report further showed that wildlife tourism sustained 21.8 million jobs, equal to 6.8% of total jobs sustained by global travel and tourism in

2018. Across Africa, wildlife tourism represents over one-third of travel and tourism revenue (World Travel and Tourism Council, 2019).

An article by Joubert and Poole (2018) as in Snyman et al. (2021), tourism related to biodiversity generated direct spending of ZAR31 billion (USD2.4 billion) in the South African economy in 2015, with domestic tourism accounting for 52% of this demand (ZAR16 billion or USD1.3 billion) and foreign or inbound tourism for 48% (ZAR15 billion or USD1.2 billion). The direct contribution to GDP in 2015 was ZAR14.8 billion (USD1.2 billion) (0.4% of GDP). Tourism-related to biodiversity also accounted for more than 88 000 direct jobs (12% of direct tourism jobs) in 2015 and accounted for more than ZAR1 billion (USD78 million) of taxes on products (Joubert & Poole, 2018). Kakar (2018) states that ecotourism helps the economy grow by generating jobs and involving local people in the maintenance of the industry. Ecotourism also benefits other industries such as airlines, hotels and public infrastructure.

2.5. Economics of game products

Game products involve different forms of products from wildlife, such as meat, skin, bones, horns and other body parts of wild animals (Department of Arts and Culture, 1998:8; Festa-Bianchet, 2012:12). Research determining the economic impact or contribution of this pillar of the private wildlife industry is limited. With the literature review, we were able to obtain information from game meat products, but searches regarding other game products delivered no results (Cloete et al., 2015). Work regarding the economic impact or contribution of this pillar was only found for game meat sales. A report conducted by Slabbert and Saayman (2018) on game meat use, estimated the economic impact of game meat to be between USS171.4million (ZAR2.4 billion) to USD514.3 million (ZAR7.3 billion) annually. Research conducted by Wildlife Ranching South Africa (WRSA, 2020) estimates the overall economic contribution of game products to be USD321.4 million (R4.5 billion), which lies within the range estimated in 2018.

3. Method of research

3.1. Sampling method and sample size

A quantitative research approach was followed by means of a web-based survey. The advantages of web-based surveys are that they allow the researcher access to a unique population, while saving time and money (Wright, 2005). The target populations for the study were Wildlife Ranching South Africa (WRSA) members (1 754 members), although other agricultural and wildlife platforms, such as Agri SA, HAWASA (Hunting & Wildlife Associations of South Africa) and Wildswinkel were also used to distribute the questionnaire.

The questionnaire was made available to the entire population of WRSA members via its website. In this case, the sample population is 1 754 and 601 completed questionnaires were obtained. Of these, the majority (67%) were from WRSA members, representing approximately 25% of the 1 754 commercial wildlife rancher members registered with WRSA, while 23% of the respondents were wildlife ranchers who obtained the survey through other means. With a sample size of 600, given the population of WRSA members, the margin of error is three percent (3%) on a 95% confidence level. Even 400 responses deliver a margin of error of four percent (4%), indicating that with 95% certainty, the average maybe 3–4% higher or lower than indicated by the respondents.

3.2. The measuring instrument

The questionnaire was developed by WRSA, in consultation with experts at North-West University, research unit TREES (TREES Tourism Research in Economics, Environs and Society, 2017; Wildlife Ranching South Africa, 2020) and was accompanied by a consent letter explaining the purpose of the study (see Appendix A). The questionnaire (see Appendix A) was administered online. The questionnaire consisted of the following sections:

- Question 1–4 measured the demographic information of respondents.
- Question 5–23 determined the impact of COVID-19 on the different pillars of the private wildlife industry.
- Questions 24–31 determined the impact of COVID-19 on employment in the industry.
- Questions 32–33 determined the impact on the environment of COVID-19.

3.3. Data collection

An online survey was conducted on the WRSA website. Data were generated using a fixed questionnaire. Data were collected online, utilizing a Google Drive survey administration application, called Google Forms. Google Drive is a software program by Google that offers users a diverse selection of web-based business and office tools. Within this program is Google Forms, which facilitates the creation and administering of online surveys, as well as the automatic collection and collation of survey responses. Survey information and the link was posted on the WRSA website and other agricultural platforms (explained above), where respondents had voluntarily opted to participate in the survey. Respondents were provided with information about the study, the survey and the consent letter, and was provided with a link to the online survey questionnaire.

To avoid that respondents accidentally skip a question, the online survey required participants to answer every question before the form could be submitted or allowed them to go to the next page. Respondents were reassured that no attempt was made to capture information that they do not voluntarily provide.

3.4. Economic modelling approach

The modelling approach that will be used to quantify the losses and effects on the economy is the multiplier analysis. Multipliers were derived from the 2012 South African Social Accounting Matrix (SAM), compiled by Van Seventer et al. (2016) to capture the secondary economic effects (indirect and induced) of any change in activity. The SAM framework allows one to study these impacts at a disaggregated level; by sectors and by socio-economic groups.

The model applied in this study is based on a two-model approach; the first of which is presented by the standard input-output Leontief model and for which input coefficients and Leontief multipliers (M^L) were calculated (Hajnovicova and Lapisakova, 2002):

$$M^L = (E - A)^{-1}$$

where A is a matrix of input (technical) coefficients.

The second extends the linear Leontief model to a SAM framework by partitioning the accounts into endogenous and exogenous accounts and assuming that the column coefficients of the endogenous accounts are all constant. To determine the set of endogenous accounts, it is important to know whether changes in the level of expenditures directly follow any change in incomes (Pyatt and Round, 1985).

Multipliers calculated from the SAM are calculated from the matrix of expenditure shares after excluding the exogenous accounts. The computed multipliers will be sensitive to the choice of exogenous accounts and express the sensitivity of the endogenous accounts to changes in demand for exogenous accounts. SAM multipliers (M^S) are calculated as (Hajnovicova and Lapisakova, 2002):

$$M^S = (E - A)^{-1}$$

where M is a matrix of expenditure shares of endogenous accounts.

The decomposition of multipliers proposed by Pyatt and Round (1985) will be used. The matrix M^S which is reduced to the Leontief multiplier matrix M^L corresponds only to the production accounts. To perform the impact analysis, the M^S matrix is truncated to conform to the dimension of the matrix M^L. Matrix M^S can therefore be decomposed into three components (Hajnovicova and Lapisakova, 2002):

$(M^S - M^L)$which measures induced effects,

$(E + A)$which measures direct effects,

$(M^L - E - A)$which measures indirect effects,

where,

$$M^S = (M^S - M^L) + (E + A) + (M^L - E - A)\cdot$$

4. Results

The provincial distribution of the respondents is firstly reviewed to determine the representativeness of the sample, before the losses incurred by private game farms and the subsequent economic impact thereof are assessed.

4.1. Provincial distribution

From the obtained responses, the results indicated (see Fig. 3) that the majority (51%) of the respondents own game farm(s) that are located in the Limpopo province. Fourteen percent (14%) of the respondents indicated that their game farm(s) are located in the Eastern Cape province, followed by ten percent (10%) in the North-West province. An additional nine percent (9%) of the respondents' farms are located in the Northern Cape and eight percent (8%) in the Free State. The Western Cape is home to three percent (3%) of the game-farm owners of South Africa, and two percent (2%) of the respondents, respectively, own game farms in the province of Mpumalanga and KwaZulu-Natal. Finally, only a mere one percent (1%) of the game farm owners reside in Gauteng. This correlates well with work conducted by Von Solms (2019) who also determined the distribution of game farms amongst the different provinces of South Africa and give us confidence in the representativeness of our sample.

4.2. Actual losses due to COVID-19

In this section, the actual losses between March and May 2020 reported by the respondents are stated. The respondents were classified into the province of the private game operation, and the average of each province's responses are reported in the

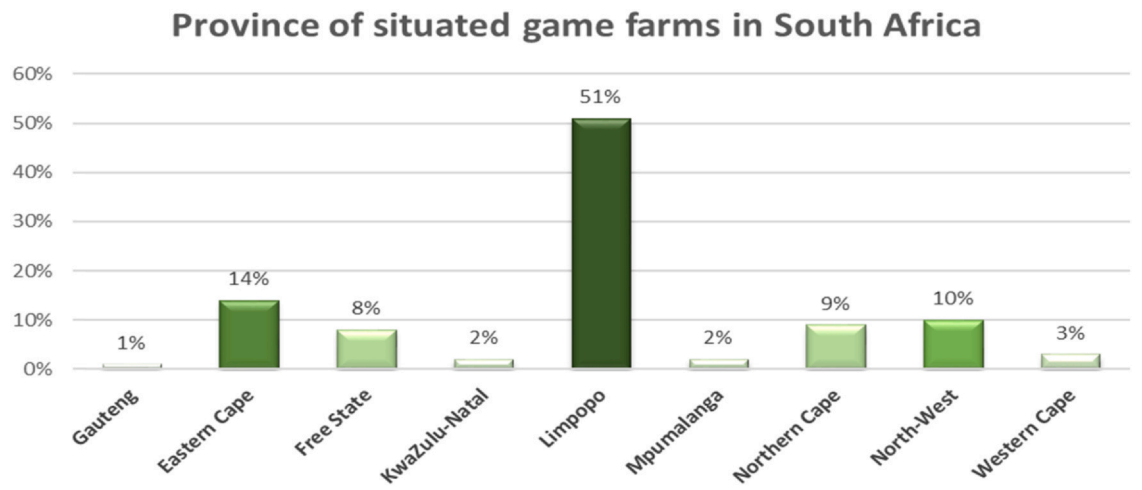

Fig. 3. Game farm distribution.

tables. To derive the total losses, the WRSA membership numbers according to the province were used. Although not all private game farms are registered with WRSA, it is the largest organization that is recognized by the South African government and other stakeholders to represent the wildlife and ranching industry in South Africa. To quantify the losses, we therefore use only the WRSA member numbers, since other estimates of the number of private game operations may be inaccurate and this may overinflate the numbers. Our estimates below can therefore be viewed as conservative.

Table 1 reports the losses due to cancellations of tourists and hunters to the private game farms according to the specific province as well as the average financial loss that the average establishment had to face due to these cancellations. It is evident that more than 77% of bookings were cancelled, with KwaZulu-Natal, Eastern Cape and the Free State experiencing cancellations above 80%. The average game farm recorded a financial loss of ZAR1.873 million (USD122 100) due to these cancellations, with establishments in Limpopo and KwaZulu-Natal experiencing an average loss greater than ZAR3 million (USD0.195 million) and in the case of Limpopo, almost ZAR4 million (USD0.261 million).

In total 1 754 establishments were registered with WRSA during 2020, with the most game farms (44%) found in Limpopo province, followed by the North-West (10.2%) and Eastern Cape (10%) provinces. Using the WRSA numbers and distribution, the total loss (average loss multiplied by the number of game farms) are shown in the last column of Table 1. Accordingly, the financial losses due to cancellations between March and May 2020, is determined to be R4.611 billion (USD300 million).

Table 2 shows the average losses reported by game farms during March-May 2020 due to cancellations of live game sales as well as losses in game meat sales. In terms of live game sales, game breeders in Mpumalanga reported the greatest average losses, while the Northern Cape province experienced the greatest losses due to game meat sales. Again, using the WRSA registered numbers, the total loss in live game sales and game meat sales over the lockdown period is calculated in the last column of Table 2. The loss is estimated to be approximately ZAR1.225 billion (USD80 million).

In Table 3, the impact of the national lockdown due to COVID-19 from March-May 2020 on employees in the game industry is shown. The average game farm employs approximately 16 employees, with game farms in KwaZulu-Natal employing an average of 31 employees compared to those in the Western Cape that only employs an average of 9 employees. The subsequent columns in Table 3 show the percentage of workers affected by COVID-19 during the lockdown months. For the country in total, 32.55% of employees received reduced wages, 21.37% had to take unpaid leave, and 18.51% were laid off. The last column

Table 1
Financial losses due to tourist or hunter cancellations[a].

Province	Percentage cancellations	Average financial loss (ZAR)	Number of game farms	Total losses (ZAR million)
Eastern Cape	83.31%	R1 643 452	175	R287.6
Gauteng	68.57%	R950 000	159	R151.1
Western Cape	72.19%	R517 273	88	R45.5
Northern Cape	78.88%	R1 887 407	90	R169.9
Free State	83.00%	R764 031	137	R104.7
KwaZulu-Natal	85.36%	R3 022 222	84	R253.9
Mpumalanga	76.50%	R1 589 286	71	R112.8
North-West	75.09%	R2 556 545	179	R457.6
Limpopo	73.85%	R3 926 847	771	R3 027.6
Average/Total	77.42%	R1 873 007	1754	R4 610.6

[a] The average exchange rate for the first three months of 2020 was USD1 =ZAR15.34. The ZAR remained volatile during 2020 and an average exchange rate of USD1 =ZAR16.45 was recorded during 2020

Table 2
Financial losses due to live game and game meat sales.

Province	Live game sales losses (ZAR)	Game meat sales losses (ZAR)	Number of game farms	Total losses (ZAR million)
Eastern Cape	R409 903	R93 976	175	R88.2
Gauteng	R370 000	R66 666	159	R69.4
Western Cape	R358 758	R48 750	88	R35.9
Northern Cape	R90906	R898 333	90	R162.7
Free State	R655 300	R110 107	137	R104.9
KwaZulu-Natal	R584 000	R111 666	84	R58.4
Mpumalanga	R1 282 000	R27 500	71	R92.9
North-West	R716 157	R147 412	179	R154.6
Limpopo	R459 789	R133 899	771	R457.7
Average/Total	R638 368	R182 034	1754	R1 224.8

Table 3
Employment losses.

	Average number of employees	Percentage on reduced wages	Percentage on unpaid leave	Percentage made redundant	Total number of employees affected
Eastern Cape	20.43	34.45%	16.55%	13.76%	2 315
Gauteng	14.71	25.00%	14.29%	17.86%	1 337
Western Cape	9.06	5.00%	11.25%	3.00%	153
Northern Cape	13.09	27.29%	16.40%	23.15%	788
Free State	10.85	33.55%	22.98%	22.08%	1 168
KwaZulu-Natal	30.81	64.00%	44.07%	31.62%	3 615
Mpumalanga	13.70	41.60%	31.11%	24.44%	945
North-West	17.12	33.44%	19.18%	16.60%	2 121
Limpopo	12.99	28.63%	16.50%	14.08%	5 928
Average/Total	15.86	32.55%	21.37%	18.51%	18371

explains what this means for employment under WRSA members, with more than 18000 workers affected negatively by the lockdown.

The provinces that were hardest hit by the lockdown during March-May 2020 were Limpopo province, KwaZulu-Natal and the Eastern Cape. More than 10 000 workers in these provinces were affected, and lay-offs were more prevalent in KwaZulu-Natal than in any other province.

4.3. Potential losses due to COVID-19

Besides assessing the losses that the private wildlife industry experienced during the initial lockdown in South Africa, the questionnaire also assessed the expected potential losses if COVID-19 continues to disrupt this industry until December 2020, as the case was. To a large extent this has realized, and for this reason the industry's expected losses are also explored.

Table 4 shows the decline in bookings that the respondents experienced, and it is evident that compared to 2019, bookings for the remainder of 2020 were 77.26%. The estimated financial loss of this decline in bookings on average of ZAR1.9 million (USD124 500) per establishment. Given the number of WRSA members in each province, the total loss due to the decline in bookings combined with the cancellations already reported in Table 1, amounts to ZAR8.192 billion (USD534 million). The province most affected is Limpopo province with more than 50% of the total loss in the country-wide activities in this industry recorded in this province. This is not that surprising, given that most of the game farms are situated in the Limpopo province.

Table 4
Potential financial losses due to less tourist or hunter bookings until December 2020.

Province	Percentage decline in bookings	Estimated loss (ZAR)	Number of game farms	Total loss (cancellations and decline in bookings) (ZAR million)
Eastern Cape	81.30%	R3 115 669	175	R832.8
Gauteng	84.17%	R591 667	159	R245.1
Western Cape	76.00%	R857 275	88	R121.0
Northern Cape	66.71%	R1 423 066	90	R297.9
Free State	72.98%	R1 271 538	137	R278.9
KwaZulu-Natal	97.69%	R3 303 338	84	R531.3
Mpumalanga	80.00%	R1 721 010	71	R235.0
North-West	64.93%	R2 720 308	179	R944.5
Limpopo	71.58%	R2 176 138	771	R4 705.4
Average/Total	77.26%	R1 908 890	1 754	R8 192.0

Table 5
Potential financial losses due to live game and game meat sales.

Province	Live game sales losses (ZAR)	Game meat sales losses (ZAR)	Number of game farms	Total losses (ZAR million)
Eastern Cape	R1 328 339	R261 072	175	R278.1
Gauteng	R1 750 000	R246 666	159	R317.5
Western Cape	R1 173 335	R50 000	88	R107.7
Northern Cape	R2 567 180	R743 552	90	R298.0
Free State	R1 476 318	R495 833	137	R270.
KwaZulu-Natal	R2 905 000	R662 857	84	R299.7
Mpumalanga	R2 014 286	R155 000	71	R154.0
North-West	R2 685 920	R581 489	179	R584.9
Limpopo	R5 161 062	R525 229	771	R4 384.1
Average/Total	R2 340 160	R413 522	1754	R6 694.1

Table 6
Potential employment losses.

Province	Staff numbers (February 2020)	Percentage employees affected	Number of employees affected
Eastern Cape	3 575	53.61%	1 916
Gauteng	2 340	72.86%	1 705
Western Cape	797	46.20%	368
Northern Cape	1 178	49.00%	577
Free State	1 486	57.73%	858
KwaZulu-Natal	2 588	75.44%	1 953
Mpumalanga	973	59.20%	576
North-West	3 064	51.38%	1 574
Limpopo	10 013	51.76%	5 183
Total	26 014	57.46%	14 710

Table 5 reports the potential losses that the industry might lead due to the coronavirus during all of 2020 because of losses in live game sales as well as game meat sales. It is especially the live game sales that was expected to be negatively influenced by the pandemic with expected losses ranging from R1.2 million per game farm in the Western Cape, to R5.2 million per game farm in Limpopo. In aggregate, the total loss that the industry expected to incur due to COVID-19 for the year 2020 amounted to ZAR6.694 billion (USD436.4 million).

Table 6 shows the corresponding expected number of employees that will be affected by a prolonged COVID-19 crisis in the private wildlife industry in South Africa. Based on the average number of employees on game farms in each province and the total number of WRSA members, the total number of people employed by WRSA members is approximately 26 000. The respondents indicated that 57.46% of employees would experience reduced wages, be forced to take unpaid leave or be made redundant if the coronavirus crisis persists during 2020. This translates into almost 15 000 employees being negatively affected by a prolonged pandemic. Although this number is less than those affected by the total lockdown in March-May, it is expected that a higher percentage of these job losses may be permanent compared to the temporary crisis.

4.4. Economic impact of COVID-19 losses

To determine the effect of the losses in the private wildlife industry (as proxied by the WRSA members) on the economy, multiplier analysis was used, with multipliers derived from the 2012 South African social accounting matrix. The actual losses reported by the industry from March to May 2020 were used as a negative spending shock to the model and the subsequent effect of this shock, as it ripples through the economy, measured using multipliers. The multipliers convert the expenditure shock into the associated declines in production, income and employment. The tables below report the decline in production, income and employment due to the actual losses incurred by the industry.

Table 7 shows the impact of this negative shock on production in the country. The direct effect indicates the direct losses in production due to the decline in spending on tourist and hunting activities on private game farms and the decline in live game sales and game meat sales (i.e. ZAR4 million). The indirect effect measures the decline in production of suppliers to the direct producers, while the induced effect measures the decline in production due to the decline in incomes caused by the negative shock. The sum of the direct, indirect and induced effects is the total economic impact that the change in spending has on the economy. One should keep in mind that this decline is not instantaneous, but takes time as the effects of this shock ripples through the economy.

The direct effect on production of this decline in spending is ZAR4.338 billion (USD282.8 million) (Table 7), with the agricultural industry experiencing the greatest decline (42.6%). The indirect and induced effect contributes 65% to the total decline in production. In total, the decline in production due to the losses that private wildlife industry incurred due to the COVID-19 lockdown is estimated to be ZAR12.437 billion (USD810.7 million). The sectors most affected are the agricultural sector (42.6% decline), followed by the manufacturing sector (17.2%) and the government sector (11.8%). If the decline in

Table 7
Impact through production multipliers (ZAR million).

Sector	Direct	Indirect	Induced	Total	Percentage
Agriculture	R1 866.0	R1 228.5	R2 202.4	R5 297.0	42.6%
Mining	R110.5	R58.0	R126.6	R295.1	2.4%
Manufacturing	R703.5	R585.8	R848.5	R2 137.8	17.2%
Electricity & water	R82.7	R46.2	R92.0	R220.9	1.8%
Construction	R36.3	R29.4	R46.8	R112.6	0.9%
Trade, accommodation, catering	R312.9	R222.0	R379.3	R914.1	7.4%
Transport & communication	R246.9	R141.9	R276.0	R664.9	5.3%
Financial & business services	R346.0	R244.8	R41911	R1 009.8	8.1%
Government	R514.8	R345.9	R601.5	R1 462.2	11.8%
Personal and social services	R118.7	R58.0	R145.5	R322.3	2.6%
Total (ZAR million)	R4 338.4	R2 960.5	R5 137.7	R12 436.6	100.0%

Table 8
Impact through household income multipliers (ZAR million).

Sector	Total production	Low income	Middle income	Total income	Percentage
Agriculture	R5 296.9	R445.0	R1 823.7	R4 530.7	40.6%
Mining	R295.1	R22.1	R114.9	R285.2	2.6%
Manufacturing	R2 137.8	R163.1	R755.3	R1 822.1	16.3%
Electricity & water	R220. 9	R14.0	R82.3	R211.0	1.9%
Construction	R112.6	R9.4	R41.0	R98.9	0.9%
Trade, accommodation, catering	R914.1	R71.6	R345.6	R840.5	7.5%
Transport & communication	R664.9	R46.8	R236.0	R586.2	5.3%
Financial & business services	R1 009.8	R73.5	R443.6	R1 084.6	9.7%
Government	R1 462.2	R98.5	R562.5	R1 386.9	12.4%
Personal and social services	R322.3	R40.8	R131.2	R319.4	2.9%
Total (ZAR million)	R12 436.6	R984.8	R4 536.2	R11 165.5	100%

bookings is also taken into consideration, the potential decline in production caused by the coronavirus in the private wildlife industry is ZAR36.1 billion (USD2 billion) (see Table A1 in the Appendix).

Additionally, it is also possible to determine the effect of the losses in the game farm industry due to the lockdown on family incomes in South Africa. Table 8 shows that the total loss in income due to the losses in the industry amounts to ZAR11.166 billion (USD728 million). It is evident that low-income groups are also negatively impacted by the lockdown, with a total loss in income of almost ZAR100 million (USD64 million). Similar to the production results, it is households in agriculture that are most affected with an estimated loss in income of ZAR4.5 billion (USD295 million). The manufacturing sector (ZAR1.8 billion; USD119 million), the government sector (R1.4 billion; USD90 million) and financial and business services (ZAR1.1 billion; USD71 million) also show considerable losses in income. If the potential financial losses up to December 2020 are taken into consideration, the loss of income due to the negative effects on the private wildlife industry can be as much as ZAR24.3 billion (USD1.8 billion) (see Table A2 in the Appendix for the complete results).

The decline in production also implies a loss in job opportunities, as the survey showed. Given that the decline in the private game farm industry have spill-over effects to other sectors of the economy and also within the agricultural sector, implies a loss in employment in more than simply the industry where the initial loss was experienced. Table 9 shows the decline in job opportunities in all sectors of the economy.

Table 9
Impact through employment multipliers.

Sector	Total production (ZAR million)	Multiplier	Total labor	Percentage
Agriculture	R5 296.9	4.16	22 045	47.5%
Mining	R295.1	0.45	134	0.3%
Manufacturing	R2 137.8	1.00	232	4.6%
Electricity & water	R220.9	0.63	140	0.3%
Construction	R112.6	5.54	624	1.3%
Trade, accommodation, catering	R914.1	8.62	7 883	17.0%
Transport & communication	R664.9	1.82	1 210	2.6%
Financial & business services	R1 009.8	2.29	2 313	5.0%
Government	R1 462.2	6.14	8 983	19.4%
Personal and social services	R322.3	2.80	904	1.9%
Total	R12 436.6		46 367	100%

The total number of job opportunities that are at stake due to the losses the private wildlife industry experienced during the lockdown (March to May 2020), is more than 46 000. Most job losses can be expected in the agricultural sector (47.5%), and the job losses which exceed that only apply to the game farm industry (see Tables 3 and 6). Both the government and the trade, catering and accommodation sectors also experienced significant job losses due to linkages with the private wildlife industry. Given the projected losses of a prolonged crisis, the job losses due to a decline in economic activity in this industry could be as much as 112 000 (see Table A3 in the Appendix).

5. Discussion and conclusion

The results of this study, without a doubt, indicate the enormous negative impact COVID-19 had on the private wildlife industry of South Africa during the initial onset of the pandemic in 2020. Given the prolonged nature of the pandemic, these negative effects may persist, negatively affecting the industry for the next 2–3 years. Although this study did not measure the impact of COVID-19 on state-owned protected areas (national parks and provincial parks) in South Africa, the national lockdown and closure of borders had a similarly severe impact on these operations. For South Africa, this is a tremendous blow as wildlife tourism is one of the key tourist attractions (local and international market). This may also result in that owners of private wildlife conservation areas will alter land-use to other sources of income such as cattle and crop farming. This will definitely impact on conservation and the biodiversity of South Africa as the private wildlife industry is accountable for a large percentage of wildlife based tourism in South Africa (See introduction section).

The results of the research further show that the sector of the economy most affected by COVID-19 is the agricultural sector since the private wildlife industry is classified as an agricultural activity. Besides the subsequent loss in both output and income in the private wildlife industry, it also had a significant impact on employment in the agricultural industry and will continue to do so for the next couple of years until the negative effects of the pandemic dissipate. What makes this even worse is the fact that the majority of these farms are located in the rural areas of South Africa, where poverty is a reality and employment much needed. Game farms or private game reserves make an enormous contribution to the economic wellbeing of these provinces (Chardonnet, 2009; Van der Merwe et al., 2014). As indicated, the most affected provinces are the Limpopo, Northern Cape, North-West and Eastern Cape provinces.

Sustained losses due to the COVID-19 pandemic could result in product owners having to close their doors, which will affect the conservation of wildlife and the biodiversity in South Africa, including the protection of rhinos and other endangered and protected wildlife. This may also result in that owners of private wildlife conservation areas will alter land-use to other sources of income such as cattle and crop farming. This will definitely impact on conservation and the biodiversity of South Africa as the private wildlife industry is accountable for a large percentage of wildlife based tourism in South Africa as it covers approximately 20.5 million (10 000 exempted game farms), compared to 7.5 million ha officially protected by South African National Parks (Kitshoff, 2013). Private game reserves depend on hunter or tourist spending to sustain their efforts to protect these animals. Hunters or tourists further play an important role in the fight against poaching as they provide extra feet and eyes on the ground in protected areas. Therefore, the prolonged negative impact of COVID-19 could also spell dire consequences for conservation, as most of South Africa's wildlife is owned by the private sector. The loss in employment and income can lead to an increase in poaching and illegal trade in wildlife products in these rural areas due to the need of residents for survival. According to Maron (2020) this is a likewise threat for game reserves in Kenya.

Besides the direct impact COVID-19 are having, the indirect and induced impacts will be severe on service providers and supporting industries, such as the translocation of game, hunting equipment, game feeding products, travel industry and suppliers. To conclude, if the South Africa government takes tourism (specifically wildlife tourism), agriculture and conservation seriously, they will have to assist in mitigating the impacts of COVID-19 on the private wildlife industry. Typical policy measures that can be used include tax breaks, subsidies or legislation aimed at stimulating the industry. Some examples of this can be in the form of relaxing some permit requirements, for example fire-arm importation, hunting permits for certain protected animals, and ease of visas to overseas hunters. It is important to mention that wildlife tourism products were some of the first tourism products that reopened after total lockdown, as wildlife areas are seen to be low-risk areas due to their wide open spaces, allowing social distancing to be easier implemented.

The study made the following three contributions to the field of research. Firstly, it determined the economic impact of COVID-19 on the private wildlife industry. Secondly, it provides the industry with a tangible document that can be used in securing funding and assistance from government and other non-profit organisations. Thirdly, it shows the importance of this industry to the South African economy and employment, although only applicable to private-owned reserves.

A shortcoming of this research is that it lacks data of the public protected areas, such as national parks in South Africa, as this will give the readers a more comprehensive view of the real impact of COVID-19 on the wildlife tourism industry of South Africa. Future research could therefore aim to include the impact that COVID-19 had on national and provincial parks in South Africa. Secondly, to quantify the losses, the current research only uses WRSA registered members, and although this is the main recognized body for private game farms, not all establishments are members of WRSA. The losses may therefore be even higher than estimated in this paper.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: P van der Merwe reports administrative support was provided by North West University and the NRF (National Research Foundation).

Appendix A

See Appendix Tables A1–A3.

Table A1
Potential total impact through production multipliers (ZAR million).

Sector	Direct	Indirect	Induced	Total	Percentage
Agriculture	R5 283.1	R3 478.7	R6 235.8	R14 997.7	47.5%
Mining	R296.4	R155.8	R339.6	R791.8	2.5%
Manufacturing	R1 838.7	R1 535.8	R2 215.3	R5 589.8	17.7%
Electricity & water	R214.8	R119.9	R238.6	R573.3	1.8%
Construction	R82.5	R66.7	R106.1	R255.3	0.8%
Trade, accommodation, catering	R568.4	R402.0	R689.1	R1 659.5	5.3%
Transport & communication	R640.0	R365.2	R714.8	R1 720.0	5.4%
Financial & business services	R828.7	R586.7	R1 007.9	R2 423.2	7.7%
Government	R967.3	R649.7	R1 130.4	R2 747.4	8.7%
Personal and social services	R309.3	R148.2	R379.7	R837.2	2.6%
Total (ZAR million)	**R11 029.2**	**R7 508.8**	**R13 057.2**	**R31 595.1**	**100.0%**

Table A2
Potential total impact through household income multipliers (ZAR million).

Sector	Total production	Low income	Middle income	Total income	Percentage
Agriculture	R14 997.7	R1 260.0	R5 163.3	R12 827.7	45.4%
Mining	R791.8	R59.3	R308.3	R765.1	2.7%
Manufacturing	R5 589.8	R426.1	R1 973.2	R4 759.7	16.9%
Electricity & water	R573.3	R36.4	R213.8	R547.6	1.9%
Construction	R255.3	R21.4	R93.0	R224.4	0.8%
Trade, accommodation, catering	R1 659.5	R130.2	R628.5	R1 528.2	5.4%
Transport & communication	R1 720.0	R122.0	R612.1	R1 520.5	5.4%
Financial & business services	R2 423.1	R176.8	R1 075.3	R2 627.9	9.3%
Government	R2 747.4	R185.1	R1 057.1	R2 606.3	9.2%
Personal and social services	R837.2	R107.4	R342.1	R832.8	2.9%
Total (ZAR million)	**R31 595.1**	**R2 524.7**	**R11 467.0**	**R28 240.2**	**100%**

Table A3
Potential total impact through employment multipliers (ZAR million).

Sector	Total production (ZAR million)	Multiplier	Total labor	Percentage
Agriculture	R14 997.7	4.16	62,430	55.8%
Mining	R791.8	0.45	354	0.3%
Manufacturing	R5 589.8	0.99	5557	5.0%
Electricity & water	R573.3	0.63	363	0.3%
Construction	R255.3	5.54	1414	1.3%
Trade, accommodation, catering	R1 659.5	8.57	14 15	12.7%
Transport & communication	R1 720.0	1.86	3207	2.9%
Financial & business services	R2 423.1	2.16	5225	4.7%
Government	R2 747.4	6.14	16,881	15.1%
Personal and social services	R837.2	2.74	2298	2.1%
Total	**R31 595.1**		**111,944**	**100%**

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