

RESEARCH AND DEVELOPMENT DIVISION



LOCAL ENTERPRISE AUTHORITY

ASSESSMENT OF EXOTIC SKINS AVAILABILITY IN BOTSWANA

RESEARCH AND DEVELOPMENT DIVISION

DATE: JULY 2018

	<p style="text-align: center;">Assessment of Exotic Skins Availability in Botswana</p>	DOC	RDD.RD.PA02/F03
		EFF	31 ST NOV 2014
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Executive summary

Background

The Research and Development Division conducted a study to assess the Availability of Exotic Skins in Botswana for the Local Enterprise Authority (LEA) to support the Leather Park Project. The primary objective of this survey was to assess the availability of exotic skins in the country with main focus on the crocodiles as the leather park project has a dedicated tannery line for exotic skins. The focus on the crocodile skins at the exclusion of the other game skins is that they can be processed in the same line with bovine hides and small stock skins except ostrich. The data for the study was collected through face-to-face interviews from targeted respondents who were mainly crocodile farmers. Secondary data was also collected from the Department of Wildlife and National Parks.

Overall objective

The primary objective of this survey was to assess the availability and potential of exotic skins in Botswana that may support the exotic skins tannery at the Leather Park.

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Summary of Findings

A. Current population of crocodiles in the licenced farms

- i. In Botswana, there are four licensed crocodile farmers to date with the oldest crocodile farm started operating in 1986 and all the farms are mainly distributed in the Northern parts of the country.
- ii. Current population stand at 19 449 live animals from all the four farms, and this include the breeding stock, hatchlings and growers. All the 4 farms are keeping only one species of the crocodile; the Nile crocodile.
- iii. Table 1 depicts the current population of live crocodiles in the four farms. The largest farm, by number of crocodiles kept has a total of about 10887 animals (breeders, hatchlings and growers) while the smallest farm has got a total of 1507 animals.
- iv. The farms have a total of 579 breeders combined (70 males and 509 females) and 10869 hatchings and 8001growers.
- v. It is worth noting that, amongst the four respondents, Farm number 3 is not actively involved in skin production at the moment but concentrating on tourism and educational uses only.
- vi. The reasons advanced by this farmer is that it is expensive to rear crocodiles for skins and she is not keeping up with the costs.



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Table 1: Current population of crocodiles in the farms

Farm no.	Breeding stock		Hatchlings	Growers	Total
	Males	Females			
1	30	294	7996	2567	10887
2	16	104	1356	3549	5025
3	9	56	897	1068	2030
4	15	55	620	817	1507
Total	70	509	10869	8001	19449

B. Production


- i. The main objectives of the four farmers to venture into crocodile farming at start up were mainly for tourism and meat production. However, at present the primary focus is on the skin production while tourism, meat and educational are secondary objectives.
- ii. Tourism and educational research purposes are reported to be playing a major role in keeping the projects running during the time when there is no or little sales from the skins.
- iii. Farmers were assisted to kick-start operations through the harvesting of eggs and live animals for breeding from the wild (Okavango and Thamalakane rivers) under a quota system from Department of Wildlife and National Parks and all the four farms are located in the Northern parts of the country. Animals are kept in large farms with an average of 5 hectares each.

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- iv. Respondents reported that, from a period of hatching up to four years, 100 crocodiles can be housed in a one hundred square meters space while the hatchlings occupy a very small space (can be kept in holding tanks as shown in Images 1 & 2 below) of depending on the number. The adults need much bigger space of about thirty to forty meters square per 10-15 adults due to their frequent fights.

- v. Respondents reported that crocodiles are considered ready for the skin market when they are 3-4 years old or when measuring 25 - 29 cm wide on the belly skin and 1.20 - 1.40-meter-long and by this time they would be weighing about 30-40 kilograms.

- vi. For the female crocodiles, respondents reported that they start laying eggs when they are 8 to 12 years old with the smaller ones laying 20-60 with an average of 40 eggs per animal within one clutch (once a year). The older females lay 60-100 eggs with an average of 80 eggs per animal while production of eggs depend largely on the management practices and feeding pattern of the animals.

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C. Processing

a. Slaughtering

- i. All the 3 respondents reported that slaughtering of the animals is done onsite within the farms using the electro-stunning method to immobilize the animals before slaughtering.
- ii. The slaughtering facilities mainly consists of concrete and metals tables placed in shaded areas or in the open.
- iii. Then a spinal cord severance is achieved instantly with a sharp metal chisel positioned between the skull and the first cervical vertebra, just behind the cranial platform or by using a sharp knife. Immediately following severance of the spine the brain can be destroyed by pithing (insertion of a stainless steel (or metal) rod into the brain).

b. Skinning

- i. The three farmers reported importing the skinning personnel from South Africa during the time of slaughtering as the skill is not available locally. They cited that crocodile skins do not easily separate from the underlying flesh and tissue and therefore need to be carefully cut by trained and experienced personnel with the right equipment; being a small blade, knife or air-knife.
- ii. The correct opening lines is made on the animal so that the final shape of the skin complies with accepted market standards, which may vary from buyer to buyer.

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- iii. Respondents reported that skimmers charge around P150-P200 per animal after skinning as the prices also depends on the damages caused during skinning.


c. Preservation and Storage

- i. Immediately after slaughtering, skins are salted and stored in a cool place or refrigerator. However, only one farm has the refrigerated room where the skins are kept awaiting transportation while others keep them under a shaded place but ensure they do not take long before they can be transported.
- ii. There is a particular way in which the skin must be rolled so that it does not compromise its quality. To maintain quality of the skin during preservation, skins are rolled without folding, starting from the tip of the head skin and finishing with the tail tip.

d. Tanning

There is no tannery in the country to process crocodile skins and get value addition. The absence of a tannery in the country affect the improvement of the crocodile industry at large starting from the production methods to increasing numbers kept in the farms with an assurance of the skin market locally.

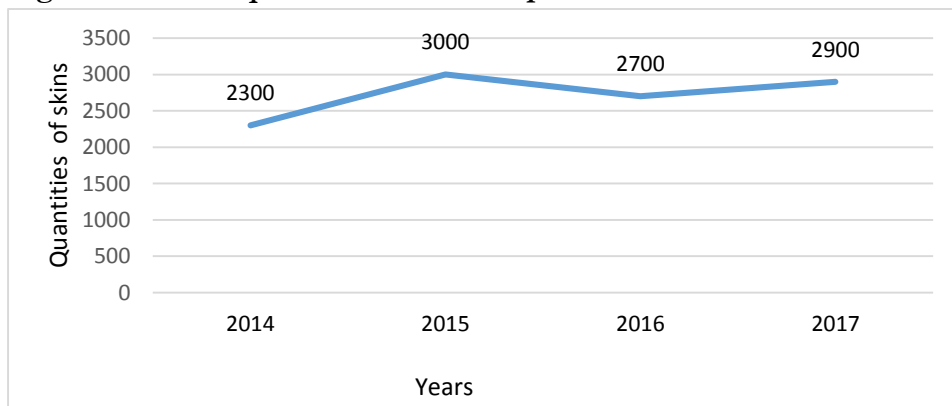
Respondents reported that, after skinning, all raw skins are exported to South Africa. However, in many countries where crocodile farming is at advanced stages, tanneries are built on farms as an integral investment in value-adding.

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e. Skin and Meat Market

- i. It is reported that the main markets for high quality grade skins is Italy and other European countries while China and other Asian countries absorb the low grades that could not be absorbed by the European countries due to high standards requirements.
- ii. Currently all Botswana skins are exported to South Africa with reported re exports to Italy high quality and low quality to China but the quantities for each market cannot be established.
- iii. Figure 1 below shows annual quantities of crocodile skins exported between 2014 and 2017 as reported by respondents with the highest exported quantities of 3000 crocodile skins in 2015 which equals the quota the country can export annually as per CITES regulations.

Figure 1: Annual quantities of skins exported between 2014 and 2017




- iv. Currently there is limited market for crocodile meat in the country. One farmer reported selling small portions of meat (mainly tail and legs) to few hotels and lodges, individuals and some is given to farm workers for free while excess meat is fed to other adult crocodiles.

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D. CITES Role in Crocodylian Skins Trade

- i. CITES stands for Convention on International Trade in Endangered Species of Wild Fauna and Flora. Since 1975 all species of living crocodylians have been listed on either Appendix I or Appendix II of CITES (CSG 2015; CITES 2015) and international trade in them are regulated and monitored accordingly as per convention requirements.
- ii. The Convention establishes a legal framework for either preventing or regulating trade in species that are considered endangered or likely to become so without regulation. It gives both producer and consumer countries responsibilities for different aspects of trade, and fosters international cooperation to achieve trade that is legal, sustainable and verifiable.
 - Appendix I lists those taxa which are threatened with extinction which are, or may be, affected by trade. Virtually all international trade in these species is prohibited unless the exporting Party grants an export permit. This may only be done if the trade is not detrimental to the survival of the wild population and if a permit has been issued by the importing Party stating that the animals or products are not to be used for primarily commercial purposes. There are few exceptions to this, the major one being if the animals traded derive from populations bred in captivity in accordance with the conditions described below. Such animals are treated as being in Appendix II.
 - Appendix II lists those taxa in which trade must be subject to strict regulation in order to prevent them, or similar species in the list, becoming threatened with extinction in the future. Trade is therefore permitted only when the exporting country issues an export permit indicating that the trade is not detrimental to the survival

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of the wild population. Countries which are party to the Convention must treat non-party states more or less as if they were also Parties. In other words, if a trader in a party.

- iii. In Africa, where the Nile Crocodile (*crocodylus niloticus*) is the only species found, two countries; Mali and Senegal are listed in Appendix I where trade in crocodile skins is restricted to captive breeding operations.
- iv. The trade for the other 13 countries (Botswana, Egypt, Kenya, Ethiopia, Madagascar, Malawi, Mozambique, Namibia, South Africa Uganda and Tanzania) is subjected to Appendix II of CITES.
- v. Botswana crocodiles having been placed in placed in Appendix II is allowed to trade in crocodile skins from ranched animals within an allocated quota based on the total population.
- vi. The current Botswana quota related to exports of crocodile skins is 3000 pieces annually which should be tagged and issued with an export certificate by the National Management Authority which also doubles as an Enforcement Authority being the Department of Wildlife and National Parks.
- vii. As per the CITES regulations; a country that wishes to revise its allocated quota should do so through the conduct of a non-detrimental study overseen by a recognized CITES Scientific Authority; in the case of Botswana, the Department of Wildlife and National Parks.

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E. International Market For Skins

- i. The trade in crocodilian products is in the leather and fashion industry, meat, live animals for breeding purposes and zoos. Most of the trade is in leather which is a high value product in the fashion industry with most of the commercial crocodile farming purpose being for leather production.
- ii. According to the CITES notification of the Parties No. 27 /006 of January 2017, signatories are required to submit annual reports detailing number of permits and certifications issued; thereby ensuring that the trade in endangered species is closely monitored.
- iii. According to the Statistics, a total of 5.2 million skins were traded globally over a 3-year period between 2013 and 2015. The main importers (market) for the skins are mainly EU countries (Italy, France) who absorb almost all the high value grades while Asia (Japan, Singapore, China, Korea) absorbs mostly lower quality grades of global output of crocodilian skins.
- iv. The United States of America is a major player as both a producer and importer for exotic skins.
- v. As for the species, the most traded species globally, is the *Alligator mississippiensis* at 59% of the 2015 global trade followed by the *Crocodylus Niloticus* (Nile crocodile) at 34%. No trade was recorded for the *Crocodylus johnstoni*
- vi. The total African export figures from the continent stands at 251596. As at 2015 the main exporters are Zimbabwe at 115 499 pieces per annum,

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followed by South Africa at 59 638 pieces and Mozambique at 11 161 pieces.

- vii. Table 4 shows exported figures for rest of the continent. It is noted from the table that the Botswana figures reported in the table are over estimated and disputed by the local CITES office at the Department of Wildlife and National Parks and also does not tally with the figures reported by the crocodile farmers who are the only known exporters in the country. It is not possible for Botswana to have legally exported above its quota of 3000 skins per annum.

Table 4: African Exports of Crocodile Skins (2006 – 2015)


Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Botswana	0	*320	*374	*1,626	*1,500	1 800	1 000	4 000	4 500	*4,400
Ethiopia	727	*594	492	0	4	*77	*400	0	0	6
Kenya	8 710	6 354	4 504	4 283	4 309	4 180	6 903	6 332	5 300	6 504
Madagascar	6 660	5 500	2 640	2 450	0	0	0	0	*3	154
Malawi	698	*1,350	3 370	2 603	399	1 508	6 063	5 373	2 784	6 246
Mali	0	0	107	0	0	15	0	0	0	0
Mauritius	83	180	189	100	0	338	150	102	100	
Mozambique	2 021	179	566	0	2 449	788	7 234	22 700	10 781	11 161
Namibia	305	0	0	600	2	200	800	1 103	1 458	*2,127
Senegal	2	0	1	0	0	0	0	0	0	7
South Africa	23 542	30 514	37 627	25 050	53 329	298	77 473	73 032	121 057	59 638
Sudan	0	0	2	0	20	0	0	0	0	7
Tanzania	*1,100	*1,556	*1,784	1 365	601	*475	**1,209	**1,379	**1,287	**1,294
Uganda	*300	0	*290	0	500	0	405	400	515	600
Zambia	*40,457	37 305	28 197	43 655	23 717	37	15 331	*45,368	44 233	*43,926
Zimbabwe	71 616	64 490	81 554	67 350	80 995	90	88 421	115 499	90 828	115 499
Total	156 221	342	698	084	825	796	205 489	275 288	282 846	251 596

Adapted from Caldwell (2017)NOTES

*Figures provided by Importers

Ethiopia Data supplied from EWCO (the Ethiopian Wildlife Conservation Organisation)


Zimbabwe Data supplied by CFAZ (the Crocodile Farmers Association of Zimbabwe).

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- viii. Table 5 shows the destination of the Nile crocodile skins produced in Africa. According to the table, the main markets are mainly in Europe and Asia.
- ix. The three countries that have significant production being Zimbabwe, Zambia and South Africa all sell in the Far East and Europe.
- x. The continental imports are limited with the main importer being South Africa which imports from Botswana and Mozambique while Zimbabwe imports negligible amounts from Mauritius.

Table 5: Sources and destinations of Nile Crocodile Skins

<i>Exporting Country</i>	<i>Market</i>
Botswana	South Africa
Kenya	Italy, Korea, Singapore
Ethiopia	Japan, Korea
Madagascar	Not stated
Malawi	Australia
Mali	United States of America, France
Mauritius	Zimbabwe
Mozambique	Japan, Singapore, South Africa
Namibia	Italy, Korea
Senegal	Ukraine, France, Spain
South Africa	Europe, Japan, Asia
Uganda	Korea
Zambia	France, Singapore
Zimbabwe	Italy, France, Japan, Singapore, USA

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F. Current Production and Projections

- i. Table 6 shows summary of current production status of the three farms currently on skin production.
- ii. A comparison of the current and expected hatchlings shows that the current productivity of females across the 3 farms engaged in skin trade stands at an average of 37%.
- iii. Two of the farms are using incubators for egg hatching while the other relies on the natural environment.
- iv. Farm 3 is not engaged in skin trade and breeding under natural conditions.

Table 6: Current production capacity at the four farms based on the hatchlings from 2017

Farm no.	Expected no. of hatchlings	Current no. of hatchlings	Shortfall	% of current production
1	17640	7996	9644	45
2	6240	1356	4884	22
4	3300	620	2680	19
Totals	27180	9972	17208	37

- v. Table 7 shows the expected number of hatchlings for the three farms using the current production percentage capacity derived from Table 6.
- vi. Using the current production and assuming a total of 27180 eggs (with an average of 60 per clutch) gives 9972 hatchlings.
- vii. Thus the current hatchlings based on the mortality rate of 15% per annum and market readiness of 4 years will be 8477 crocodiles in 2022. This number will be produced annually for the next 8 years when the current juvenile females can start reproduction.



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Table 7: The expected number of hatchlings based on the % of current production

Farm no.	Females	Exp. no of eggs in 2017 at an average of 60 per animal	Current no of hatchings 2018 (45, 22, 19%)	Exp. no of juveniles in 2022 with rate of mortality at 15%	Exp. no of juveniles in 2023 with rate of mortality at 15%	Exp. no of juveniles in 2024 with rate of mortality at 15%
1	294	17640	7996	6797	6797	6797
2	104	6240	1356	1153	1153	1153
4	55	3300	620	527	527	527
Total	453	27180	9972	8477	8477	8477


G. Challenges

- i. There is an evidence of lack of proper formal training and skills development in the country in relation to crocodile farming.
- ii. Skinners are imported from South Africa as there are none within the farms who has knowledge on skinning.
- iii. Two of the three farmers cited the national quota (of 3000 pieces) as a stumbling block in their business as they are limited to the number of skins they can export annually.
- iv. High costs related to start up procedures such as Environmental Impact Assessments (EIAs) was cited as a stumbling block to the new entrants in to the crocodile farming.
- v. Lack of established feeds manufacturing in the country for crocodile feeds was cited as a major challenge in crocodile farming.
- vi. Most farmers feed their animals poultry and some collect is as far as more than 400km from their farms as feeds import costs are prohibitive.

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H. SWOT analysis for the exotic skins industry in Botswana

<p>STRENGTHS</p> <ul style="list-style-type: none"> • The existence of operational crocodile’s ranches/farms 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Low number of entrepreneurs in the crocodile production. • Non-commercial operation of current establishments. • Low animal productivity in the current operations • High feeding costs in operations. • Poor infrastructure and equipment within the farms.
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • Existence of current farmers to support new entrants. • Willingness of some of the current farmers to expand their operations. • Existing farmers commercialization • Current crocodile farmers are aware of the crocodile skins market requirements. • Existence of local CITES designated office. • Revision of the quota • Importation of skins from neighbouring countries (Zimbabwe and South Africa) 	<p>THREATS</p> <ul style="list-style-type: none"> • CITES Listing of Crocodiles in Appendix II requires stringent compliance issues to be met with in order to trade. • Low production skills within the local population • Low trade quota. • NO existence of skills in the extension services of the crocodile industry. • Current local producers already have established markets. • High capital costs required for entry into crocodile production.

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I. Current population of game Animals in ranches

- i. Table 8 shows a total number of 151090 of game animals in ranches kept across 95 ranches in Botswana.
- ii. It is to be noted that, the only other animal that is a source of exotic skins is the ostrich and there are only 2272 birds with no deliberate breeding initiatives of this species.
- iii. The slaughter figures for ostriches are as low as 10 per annum in 2017 and there are no indications that the skin is currently being traded by Botswana.
- iv. There is a total of 1164 animals reported to have been slaughtered in 2017 and mostly were Impala an indication of 1164 skins produced.

Table 8: Number of game kept in the farms

Animal	Number	No slaughtered
Impala	44533	352
Wildebeest	26130	140
Kudu	19792	228
Eland	13907	52
Gemsbok	12259	62
Zebra	5762	22
Hartebeest	5260	20
Springbok	4714	11
Warthog	4418	107
Waterbuck	3195	45
Baboon	2376	0
Steenbok	2301	35
Ostrich	2272	10
Bushbuck	1569	52
Duicker	1274	23
Giraffe	828	1
Tsessebe	255	4
Sable	193	0
Rhino	47	0
Mountain Reedbuck	5	0
Total	151090	1164

Source: DWNP data - 2017


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J. CONCLUSIONS AND RECOMMENDATIONS

a. Conclusion

Crocodile farming in Botswana is still at static stage as indicated by the establishments of only four farms regardless of the industry having started as early as 1986. Farms currently have a total of 19449 and a CITES allocated annual trade quota of 3000. Farmers are still not producing at fully commercial capacity due to challenges the industry is faced with ranging from compromised production methods, poor facilities high standards required in the market. Based on projections with production at full commercial capacity, farmers will be able to produce enough numbers in the next three years' time onwards and will be able to supply consistently the required quantities to the tannery. The country's quota of 3000 pieces annually as provided by CITES need to be taken into consideration and addressed before the tannery can be established.

A review of the international market dynamics on crocodile skins, there are indications that Botswana will struggle to access 7000 pieces of raw skins for its exotic skins leather tannery within the continent and globally. The high value nature of the product under review and the current markets is highly competitive and a new entrant may struggle to access this high number of skins of the highest quality. The CITES listing of crocodiles in Appendices I and II which imposes regulation and monitoring of the industry also limits the immediate response to additional demand. With the foregoing, Botswana is unlikely to access a considerable proportion of current output of raw exotic skins in the international market. The current significant producers have established internal value chains for exotic skins and the value proposition for exporting to Botswana, a new entrant in the niche industry may be limited to low quality grades of skins not absorbed by premier markets.

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b. Recommendations

1. The Local Enterprise Authority should engage the Ministry of Environment, Wildlife and Natural Resources as a desk office for the CITES with a view to facilitating increase in local production, throughput and revision of the county quota to support the local exotic skins tannery.
2. The LEA needs to conduct a full risk assessment and mitigation measures specific to the Exotic skins tannery component of the project.
3. The LEA should consider compiling a business case/ plan to confirm financial viability of the exotic skins tannery at the planned processing capacity.



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List of Acronyms used

LEA	-	Local Enterprise Authority
CITES	-	Convention on International Trade in Endangered Species
WCU–SSC	-	World Conservation Union–Species Survival Commission
GDP	-	Gross Domestic Product
IACTS	-	International Alligator and Crocodile Trade Study
DWNP	-	Department of Wildlife and National Parks
MoA	-	Ministry of Agriculture

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Definition of terms

Hatchling : a young bird, reptile, or fish recently emerged from an egg

Clutch : number of eggs produced by birds or reptiles often at a single time and those laid in a nests.

Exotic leather/skin: made from relatively rare animal species or from skin parts of animals that are rarely processed into leather (e.g. crocodiles, lizards, snakes, stingrays, ostriches, elephants and various others)


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1. INTRODUCTION

1.1 Background

The mandate of the Local Enterprise Authority (LEA) is to promote entrepreneurship and enterprise development in Botswana. This is achieved through empowering entrepreneurs to start and grow their businesses. LEA has since helped establish various enterprises in all sectors of the economy since 2007 to date. The LEA has been delegated by the Government to implement the leather park project at Lobatse and the designs include a line for exotic skins (crocodiles and ostriches) tanning. The current study seeks to assess the availability of exotic skins in the country and populate the numbers of the current stock and throughput to estimate the quantities of raw material (skin) available for processing.

For over a century, the skins of exotic animals have been used for manufacturing of exotic leather products. According to Joanen et al. (1997), early in the 1800s, the first large-scale commercial use of exotic skins resulted in the widespread hunting of exotic animals. This led to drastic population declines of exotic species particularly the crocodilian (crocodile family) across the world and resulted in enactment of variety of national and international restrictions on hunting and trade (ibid). However, at the beginning of the 1960s, the scarcity of skins also had significant effects on the reptile leather business and many tanneries closed, purchased illegal crocodilian skins, or switched to the hides of other reptiles, including sea turtles, lizards, and snakes (King 1978). With the adoption of the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) in 1975, the first steps were taken to regulate wildlife trade at an international level. Nonetheless,


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because of the high demand for skins, considerable illegal trade continued (Inskipp & Wells 1979).

Many African nations had argued that their populations of Nile crocodiles had never been endangered and should not have been listed on CITES (Hutton 1992). The desire of the African nations to commercially manage Nile crocodiles added to a dialogue within CITES over the value of commercial trade to promote “value added” conservation. For crocodiles, what resulted was a series of CITES resolutions that loosened the requirements for legal trade, either by promoting crocodile ranching programs or by establishing temporary CITES-approved annual export quotas of skins from cropping programs. Ranching was seen as a robust management approach that had few biological risks for wild populations, and the harvest quotas were designed as an interim measure to provide nations with the financial resources to implement management programs based on ranching.

The CITES Secretariat, working with crocodylian biologists Crocodile Specialist Group of the World Conservation Union–Species Survival Commission (WCU–SSC), played an important role in providing funds and technical assistance that allowed African nations to develop proposals for managed use under the CITES guidelines (Thorbjarnarson, 1999). By the 1990s, Cameroon, Congo, Ethiopia, Somalia, Sudan, South Africa, Botswana, Kenya, Madagascar, Malawi, Mozambique, Tanzania, Zambia, and Uganda had taken advantage of these resolutions to export crocodile skins (ibid).

Dzoma et al (2007) reported that in Botswana crocodile farming started in the 1980 and the oldest farm was established in 1986. Afterwards, an average of three farms have been in operation since then, all of which obtained their stock from the Okavango and Thamalakane rivers with the stock of about 5419. The farms are


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mainly distributed in the Northern parts of the country. The original objectives for the farms ranged from breeding to meat production and tourism and this started mainly by the capture of wild crocodiles (ibid). From 1997 to 2002, Botswana contributed a paltry 0.0006% to the trade of the Nile crocodile (IACTS 2004).

The main product from the crocodile is the skin, while meat, live animals and teeth are important by-products (Brazaitis 1987; Van Jaarsveldt 1987; IACTS 2004). World trade numbered 80,000 skins annually in 1993 with the majority coming from Zimbabwe (54%) and South Africa (15%) from ranching and captive breeding (farming) (Collins & Luxmoore, 1996). By 1996, the value of the industry in Zimbabwe was in excess of US\$ 5 million from the sale of hides and meat (Anon 1997). Studies have indicated that Botswana can increase the commercial production of the crocodile, while reducing the threat of over-exploitation, with the promotion of ranching or farming systems (Barnes 1992).

1.2 Rationale for the Survey

The original original objectives for farming crocodiles ranged from breeding to meat production and tourism. However, with crocodile skin market presenting lucrative business across the world, the study therefore sought to establish the current objectives of the farmers for farming crocodile and assessed whether there has been a change in considering skin as a key product from the crocodile. Therefore, with the Leather Park project having a dedicated line for exotic skins processing and the need to sustainably supply the tannery with raw material (skin), it was imperative to know the possible local supply based on the current throughput and an estimation of the supply required to keep the exotic skins tannery running.


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1.3 Research Objectives

The primary objective of this survey was to assess the availability and potential of exotic skins in Botswana that may support the exotic skins tannery at the Leather Park.

1.3.1 Specific Objectives

1. Determine the number of crocodiles kept by the licensed farmers.
2. Profile the slaughter facilities for the different exotic skin.
3. Determine the number of other exotic species kept in ranches.
4. Determine the current production methods in the crocodile farms.
5. Establish the current market for the farmed crocodile skins.
6. Ascertain the challenges farmers encountered in farming of crocodiles.
7. Ascertain the legislation policy relating to farming and exportation of the exotic skins.
8. Establish the annual throughput from the ranched game animals.

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2 METHODOLOGY

2.1 Scope and units of research

The survey targeted all the four licensed crocodile farmers in Botswana as well as collecting statistics of other live exotic species kept in ranches

2.2 Data collection


Primary data was collected from crocodile farmers using a questionnaire while secondary data about statistics of other exotic animals was sourced from Department of Wildlife and National Parks (DWNP) and Ministry of Agriculture. An interview guide was used for key informants from Department of Wildlife and National Parks (DWNP) on exotic skins production.

2.3 Data Management and Analysis

Primary data was processed and analyzed using the Micro soft Excel while Rapid analysis was used to analyze qualitative data from key informants.

2.4 Limitations of the research methods

All research methods have limitations and it is important that such be acknowledged so that the results are understood in the context of those limitations. Below are some the limitations associated with the research method used in this study.


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2.4.1 Face-to-face interviews may introduce interviewer bias/effects where the interviewer may direct the respondent in a certain direction or line of answering the questions posed.

2.5 Challenges encountered during the survey

There were only few challenges encountered during data collection.

- Respondents were hesitant to provide market prices of the raw skins.
- Limited records keeping by some the respondents leading to estimates of their stock.

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3 FINDINGS

3.1 Current population of crocodiles and game animals in licenced farms

3.1.1 Current population of crocodiles in the licenced farms

In Botswana, there are four licensed crocodile farmers to date with the oldest crocodile farm started operating in 1986 and all the farms are mainly distributed in the Northern parts of the country. Current population stand at 19 449 live animals from all the four farms, and this include the breeding stock, hatchlings and growers. All the 4 farms are keeping only one species of the crocodile; the Nile crocodile. Table 1 depicts the current population of live crocodiles in the four visited farms. The largest farm, by number of crocodiles kept has a total of about 10887 animals (breeders, hatchlings and growers) while the smallest farm has got a total of 1507 animals. The farms have a total of 579 breeders combined (70 males and 509 females) and 10869 hatchings and 8001 growers. It is noted that the current 8001 growers are aged between 2 and 4 years, translating to 2667 juveniles per age. This therefore means that the number of market ready crocodiles (4 years old) is only a third of the current juveniles (2667). It is worth noting that, amongst the four respondents, Farm number 3 is not actively involved in skin production at the moment but concentrating on tourism and educational uses only. The farmer has indicated that it is too costly for her to keep crocodiles for skins and she cannot keep up with the associated costs.


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Table 1: Current population of crocodiles in the farms


Farm no.	Breeding stock		Hatchlings	Growers	Total
	Males	Females			
1	30	294	7996	2567	10887
2	16	104	1356	3549	5025
3	9	56	897	1068	2030
4	15	55	620	817	1507
Total	70	509	10869	8001	19449

3.2 Production Methods

3.2.1 Production

The main objectives of the four farmers to venture into crocodile farming at start up were mainly for tourism and meat production. However, at present the primary focus is on the skin production while tourism, meat and educational are secondary objectives. Tourism and educational research purposes are reported to be playing a major role in keeping the projects running during the time when there is no or little sales from the skins. Farmers were assisted to kick-start operations through the harvesting of eggs and live animals for breeding from the wild (Okavango and Thamalakane rivers) under a quota system from Department of Wildlife and National Parks. All the four farms are located in the Northern parts of the country because this region contains high populations of the wild crocodile (Pooley 1982), some of which ended up as breeder stock on the farms after being captured as problem animals.

All the four farms are large with an average of 5 hectares. However, space occupied by the animals is an average of 2.5ha indicating 50% utilization of the

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current land occupied. One farm has developed and reserved about 0.5 ha for educational research. Respondents reported that, from a period of hatching up to four years, 100 crocodiles can be housed in a one hundred square meters space while the hatchlings occupy a very small space (can be kept in holding tanks as shown in Image 1 & 2 below) depending on the number. The adults need much bigger space of about thirty to forty meters square per 10-15 adults due to their frequent fights (see Image 3).




Image 1 and 2: Hatchlings in the holding tanks few days after hatching



Image 3: Adults crocodile basking in the sun

Respondents reported that crocodiles are considered ready for the skin market when they are 3-4 years old or when measuring 25 - 29 cm wide on the belly skin and 1.20 - 1.40 meter long and by this time they would be weighing about 30-40 kilograms (as

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shown in Image 4). For the female crocodiles, respondents reported that they start laying eggs when they are 8 to 12 years old with the smaller ones laying 20-60 with an average of 40 eggs per animal within one clutch (once a year). The older females lay 60-100 eggs with an average of 80 eggs per animal. However, the production of eggs depend largely on the management practices and feeding pattern of the animals. However, compared with best practice as described by Manolis and Webb (2016) that if well managed, a young crocodile can lay up to 60 eggs in a single clutch and up to 80 eggs for an adult female, however, this may also depend of the type of feeds.



Image 4: crocodiles (3-4 year olds) ready for the skin market

3.2.2 Methods of Production

There are only two production methods currently practiced by the respondents, natural and incubation hatching. In the natural method, crocodiles lay and nests eggs then hatchlings are collected and kept in the holding rooms to be taken care of. Respondents reported that under this production method, the number and survival rate of the hatchlings can be very low of about 40% as opposed to incubation due to unfertilized eggs or that predators may feed on the hatchlings before the farmer notices and collects them. In the incubation production method, eggs are collected and incubated where temperatures are regulated and this give hatchling rate of up to 80-95% (see Image 5). However, to ensure high hatching rate in incubation, more

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care is required during egg collection. Collectors should ensure that they record temperature around the eggs as this can provide valuable information of the conditions experienced by the eggs prior to collection which can sometimes be used to explain embryo mortality and abnormalities due to high temperatures. Temperature are measured using electronic sensors and the readings are then adjusted to standard ones in the incubator if necessary (24-32 degrees Celsius).



Image 5: Eggs Incubator where temperatures are maintained at 24-32 degrees Celsius

3.2.2.1 Collection of the eggs

Respondents reported that as eggs are collected, they are marked on the uppermost surface using a pencil as the eggs sit in the nest before being removed and should not be rotated, but rather maintained with the marked surface uppermost. They are laid in a horizontal position in the collection crate/box with the marked surface uppermost (see Image 6). Where eggs are being collected from several nets, clutches should be separated or marked so they can be identified before processing and should not be exposed to conditions that will lead to egg temperatures higher than 33 degrees Celsius. Trainings has been done by farm managers to the staff (egg collectors) as reported by the two farmers who incubates.



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Image 6: Eggs being marked as they are collected from the nest

3.2.2.2 Hatchlings

Respondents reported that, to increase the rate of hatchlings, they ensure that the following are done; the first hatchlings from a clutch are checked to determine whether the residual yolk has been withdrawn completely into the body cavity. If not, the remaining eggs are left undisturbed until yolk internalization is complete. This is very important and need to be observed all the time as in some cases the first hatchlings to emerge may cause the hatching of others where the yolk is not fully internalized to start hatching as well. In such situations, respondents shared that the latter is left in the incubation container to allow complete internalization. If the yolk is internalized normally, and incubation conditions have been identical for all eggs, the remainder of the clutch is at the same stage of development and should be opened by hand as some hatchlings have difficulty piping or emerging from the egg. Immediately after hatching, hatchlings can be washed with clean water or with disinfected with chlorine or iodine solution for those the yolk was not internalized naturally. However, respondents reported that, weak or deformed hatchlings generally have a low chance of survival and are euthanized.

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3.2.2.3 Management

Respondents reported that to keep up with high quality standards required in the market, production of healthy skins is crucial. Ponds are cleaned more frequently, that is everyday for the hatchlings and every third day for the juveniles. A report on management of crocodile reported similar approach in relation to production of quality skins that, for skin production, good water quality is considered beneficial to combat some pathogens that can damage the skin hence frequent cleanup of the ponds is very essential (Pfitzer *et al.*, 2014). All the farm reported losing animals on rare occasions as crocodiles are not susceptible to diseases, hence no veterinary programs is conducted on the animals.

Respondents reported that culling often occurs to the slow growing animals or if they are suspected to be carrying some diseases as there are no sick bays reserved for sick animals. The two farmers who incubate, only one famer reported regulating the temperatures of water for the small ones both winter and summer to 24-32 degree Celsius so that it does not affect their growth rate. As supported by experts in crocodile farming, water temperature should be sufficient to promote good health, and may include artificial heating during cooler periods in different climates (Manolis & Webb (2016).

Table 2 Summarizes overall cost for water and electricity across the four farms. On average, one farm spends on average P29500 in electricity and P750 in water bills (portable water used for other activities in the farm)while the least farm spend on average P400 and P25 on electricity and water bills per month respectively. The variation in expenses is dependent on the number of animals per farm as well as the production method used by the farmer. As indicated in Table 2, the farmer who keep more animals and also incubates has more expenses as opposed to the one with less animals and does not incubate.



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Table 2: Estimated Monthly expenses on water and electricity (Pula)

Farm no.	No. of crocodile	Average water expenses	Average electricity expense	Preservation method
1	10887	750	29500	Cold-room
2	5025	250	2250	Shaded place
3	2030	75	750	-
4	1507	25	400	Shaded place

3.2.2.4 Foods and Feeding

All the four respondents reported feeding their animals mainly chickens. But sometimes blood mixed with maize is provided to the animals particularly the juveniles. Respondents cited that though chickens are their main source of feeds, they are not readily available in the locality of production and has to source them as afar as 500km away. Another farmer reported having tried to source pelletized food from outside the country (South Africa and Zimbabwe) where they are commonly used in the farms but failed due to high transportation costs. Farmers reported that, though these are difficult to find, the advantages are that dry feed can be stored for longer periods without refrigeration and also comes with the proper nutrient supplement thus saving on electricity for storage, fuel for transportation. In relation to the best practice as described by Manolis and Webb (2016) that crocodile diets vary greatly across different farms and different species, and the hatchlings of some species appear more diverse in their food preferences than others. Minced or finely diced red meat, abattoir offal, discarded carcasses from intensive animal farming (pigs, chickens) are commonly used by farmers (ibid).

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Hatchlings are fed daily post-hatching period and this continue until they are a year old and then reduced to 4-5 days per week. Older animals are fed less frequently which can be 1-2 per week or once during winter. On average, one farm reported to be spending P7500 on feeds in a single month with the least spending on average P1100 (Table 3 refers).


Table 3: Estimated monthly expenses on crocodile feeds (Pula)

Farm no.	No. of crocodile in the farm	Average expenses
1	10887	7500
2	5025	3000
3	2030	2000
4	1507	1100

3.3 Marketing

It is also worth noting that the majority of crocodile skins in international trade are the belly skins with relatively few hornbacks (mostly at the back of the crocodile). This part of the skin is very soft and can be easily tanned as oppose to the upper one with more hornbacks (Manolis & Webb, 2016). The back part of the skin is often used to manufacture ornaments including belts, wallets and others. Some of these products (see Image 10) are imported from South Africa and sold in the farms' curio shop. Crocodile skins are graded according to quality of the skin classified as grades¹.

¹ **Grade I:** no defects on the belly, though there may be one defects on the tail and neck. **Grade II:** a small defect on the belly big defect on the tail or neck. **Grade III:** one excessive defect on the belly and more than three defects on the tail and neck and **Grade IV:** a lot of defects across the whole skin

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Currently there is no proper and reliable market for both the skin and the meat for crocodile in the country and this present as a challenge for the crocodile farmers.




Image 10: Belts and other products made from crocodile skin

Three farmers reported having other farms in South Africa where they take the skins after slaughtering for sale.

3.3.1 Processing

3.3.1.1 Slaughtering

All the 3 respondents reported that slaughtering of the animals is done onsite within the farms. The electro-stunning method is used by all farmers to immobilize the animals before slaughtering. One farmer also reported using the captive-bolt pistol depending on the numbers of animals to be slaughtered. However, with captive – bolt pistol, it is assigned one individual has been well trained to use it to ensure a direct hit on the brain and ensure total immobilization of the animal. Similarly, with the best practice, the use of the two devices are recommended and widely used across the world including South Africa and Zimbabwe (Pfitzer *et al.* 2014; SABS 2014). Then a spinal cord severance is achieved instantly with a sharp metal chisel positioned between the skull and the first cervical vertebra, just behind the cranial platform or by using a sharp knife. Immediately following severance of the spine the

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brain can be destroyed by pithing (insertion of a stainless steel (or metal) rod into the brain). The animal is taken for skinning under a cool place either on the table or on a built concrete stand (see Image 7).



Image 7: Skinning place for the crocodiles

3.3.1.2 Skinning

The three farmers reported importing the skinning personnel from South Africa during the time of slaughtering as the skill is not available locally. They cited that crocodile skins do not easily separate from the underlying flesh and tissue and therefore need to be carefully cut by trained and experienced personnel with the right equipment; being a small blade, knife or air-knife. The correct opening lines is made on the animal so that the final shape of the skin complies with accepted market standards, which may vary from buyer to buyer. The farmers reported that, they prefer to use experienced skimmers who know the preferred cuts by the main skin markets. Farmers reported that the skimmers always bring along their equipment for contract skinning though all equipment needed reported to be available in the local stores (bladed, air knives, duct tape, electric stunner) It was reported that, skimmers

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charge around P150-P200 per animal after skinning as the prices also depends on the damages caused during skinning.

- ***Flensing (fleshing)***


Respondents reported that, more often they inspect the skin after skinning to ensure that skimmers have removed all flesh, fat and blood on the underside of the skin. Flesh and fat is removed using a blunt knife, scrapers with rounded corners. If not removed properly, these layers of tissue may interfere with the penetration of salt during the curing process.

3.3.1.3 Preservation and Storage

Immediately after slaughtering, skins are salted and stored in a cool place or refrigerator. However, only one farm has the refrigerated room where the skins are kept awaiting transportation (Image 8). One farmer reported keeping the skins in the cold-rooms while others keep them under a shaded place but ensure they do not take long before they can be transported which may result in a huge loss.




Image 8: Cold-room storage for the skins

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There is a particular way in which the skin must be rolled so that it does not compromise its quality. Skins can be rolled without folding, starting from the tip of the head skin and finishing with the tail tip (see Image 9). If rolled like this and maintained in a cool, climate controlled facility, the possibility of fold marks damaging the skin, and reducing its value, can be avoided. This preservation method is in line with the recommended one for best practice by Manolis & Webb (2016). Moreover, David (1987) recommended further use of mixture of water (97.6%), bleach (2.0%) and “Tide and Borax” laundry detergent (0.4%) as addition of this chemicals to the salt may counter the effects of salt-resistant bacteria which may end up affecting the quality of the skin. However, the respondents never mentioned use of any other chemicals on the skins besides salt.

3.3.1.4 Tanning

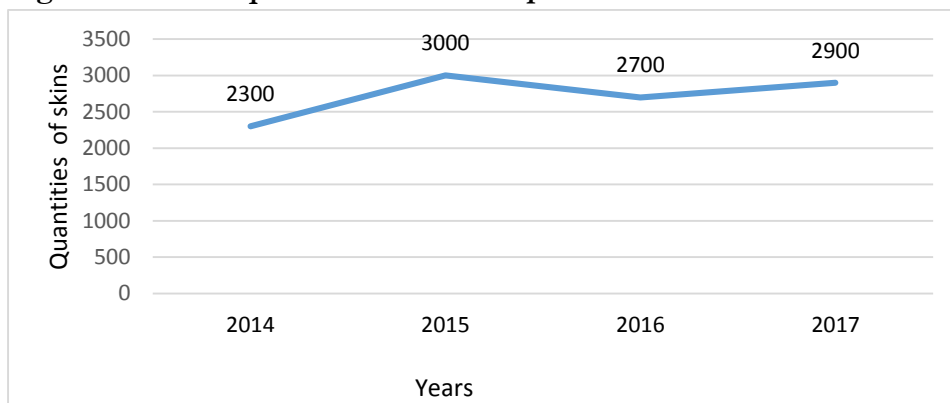
There is no tannery in the country to process crocodile skins and get value addition. Respondents reported that, after skinning, all raw skins are exported to South Africa. The absence of a tannery in the country affect the improvement of the crocodile industry at large starting from the production methods to increasing numbers kept in the farms with an assurance of the skin market locally. However, in many countries where crocodile farming is at advanced stages (Colombia, Madagascar, Mexico, South Africa, Thailand, USA, Vietnam, Zimbabwe (Manolis & Webb (2016)), tanneries are built on farms as an integral investment in value-adding. In some cases local tanning is mandatory and prescribed in national legislation. For example, Indonesia and Colombia do not allow the export of raw crocodilian skins, they must be processed to at least a “wet blue” stage (Fuchs, 2006).

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3.3.1.5 Skin and Meat Market

After primary tanning in South Africa, depending on the quality of the skin, they will be sold to Italy or China. It is reported that the main market for the skins is China while the Italian market is very thin due to high standards required and mainly buy skins of grade I while grade II and III is sold to China. However, when the supply is very low across the continent, grade II is sometimes considered. Grade IV is usually used by the South African tanners to produce other cheap products. However, farmers reported that, very few skins penetrate the Italian market as opposed to the Chinese where quantities are considered to produce substandard products (see image 10). Figure 1 below shows annual quantities of crocodile skins exported between 2014 and 2017 as reported by respondents with the highest exported quantities of 3000 crocodile skins in 2015 which equals the quota the country can export annually as per CITES regulations.

Figure 1: Annual quantities of skins exported between 2014 and 2017



Currently there is limited market for crocodile meat in the country. One farmer reported selling small portions of meat mainly tail and legs (see Image 11) to few hotels, individuals and some is given to farm workers for free while excess meat is fed to other adult crocodiles as the species is naturally cannibalistic.


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Image 11: Crocodile meat (tails)

3.4 CITES Role in Crocodylian Skins Trade

CITES stands for Convention on International Trade in Endangered Species of Wild Fauna and Flora. Since 1975 all species of living crocodylians have been listed on either Appendix I or Appendix II of CITES (CSG 2015; CITES 2015) and international trade in them are regulated accordingly. The Convention establishes a legal framework for either preventing or regulating trade in species that are considered endangered or likely to become so without regulation. It gives both producer and consumer countries responsibilities for different aspects of trade, and fosters international cooperation to achieve trade that is legal, sustainable and verifiable.


- *Appendix I lists those taxa which are threatened with extinction which are, or may be, affected by trade. Virtually all international trade in these species is prohibited unless the exporting Party grants an export permit. This may only be done if the trade is not detrimental to the survival of the wild population and if a permit has been issued by the importing Party stating that the animals or products are not to be used for primarily commercial purposes. There are few exceptions to this, the major one being if the animals traded derive from populations bred in captivity in accordance with the conditions described below. Such animals are treated as being in Appendix II.*

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- Appendix II *lists those taxa in which trade must be subject to strict regulation in order to prevent them, or similar species in the list, becoming threatened with extinction in the future. Trade is therefore permitted only when the exporting country issues an export permit indicating that the trade is not detrimental to the survival of the wild population. Countries which are party to the Convention must treat non-party states more or less as if they were also Parties. In other words, if a trader in a party.*

In Africa, where the Nile Crocodile (*crocodylus niloticus*) is the only species found, two countries; Mali and Senegal are listed in Appendix I where trade in crocodile skins is restricted to captive breeding operations. The trade for the other 13 countries (Botswana, Egypt, Kenya, Ethiopia, Madagascar, Malawi, Mozambique, Namibia, South Africa Uganda and Tanzania) is subjected to Appendix II of CITES. Botswana crocodiles having been placed in placed in Appendix II is allowed to trade in crocodile skins from ranched animals within an allocated quota based on the total population.


The current Botswana quota related to exports of crocodile skins is 3000 pieces annually which should be tagged and issued with an export certificate by the National Management Authority being the Department of Wildlife and National Parks. As per the CITES regulations; a country that wishes to revise its allocated quota should do so through the conduct of a non-detrimental study overseen by a recognized CITES Scientific Authority. According to officials at the Department of Wildlife and National Parks; the study should be attached to the application which is to be submitted through National Authority. This therefore implies that Botswana cannot trade with the skins beyond this quota until a study on non-detrimental has been submitted to influence revision of the quota.

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3.5 International Market For Skins

The crocodylian global trade is monitored by Convention on International Trade in Endangered Species (CITES) and all species are listed in Appendix I and II. The CITES monitoring requires international trade in the species to be documented for monitoring of compliance with the CITES requirements. The trade in crocodylian products is in the leather and fashion industry, meat, live animals for breeding purposes and zoos. Most of the trade is in leather which is a high value product in the fashion industry with most of the commercial crocodile farming purpose being for leather production. According to the CITES notification of the Parties No. 27 /006 of January 2017, signatories are required to submit annual reports detailing number of permits and certifications issued; thereby ensuring that the trade in endangered species is closely monitored. The Caldwell (2017) report of World Trade in Crocodylian skins prepared under the auspices of the UN Environment World Conservation Monitoring Centre (UNEP-WCMC) has compiled the most recent data from 2013 to 2015 trade, the report also has historical data dating as far back as 2006. This report will be extensively used in the analysis of the international markets for crocodylian skins.

According to the Statistics, a total of 5.2 million skins were traded globally over a 3-year period between 2013 to 2015 (ibid). The main importers (market) for the skins are mainly EU countries (Italy, France) who absorb almost all the high value grades while Asia (Japan, Singapore, China, Korea) absorbs mostly lower quality grades of global output of crocodylian skins. The United States of America is a major player as both a producer and importer for exotic skins. As for the species, the most traded species globally, is the *Alligator mississippiensis* at 59% of the 2015 global trade followed by the *Crocodylus Niloticus* (Nile crocodile) at 34%. No trade was recorded for the *Crocodylus johnstoni* (Annex 1 refers)

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The total African export figures from the continent stands at 251596. As at 2015 (ibid), the main exporters are Zimbabwe at 115 499 pieces per annum, followed by South Africa at 59 638 pieces and Mozambique at 11 161 pieces. The rest of the continent exported negligible figures as shown in the Table 4. It is noted from the table that the Botswana figures reported in the table are over estimated and disputed by the local CITES office at the Ministry of Environment, Wildlife and Natural Resources as it is not possible for Botswana to have exported above its quota of 3000 skins per annum. The figures are also different from the figures provided by the primary sources (crocodile farmers) who are the only exporters of skins.

Table 4: African Exports of Crocodile Skins (2006 – 2015)

Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Botswana	0	*320	*374	*1,626	*1,500	1 800	1 000	*4 000	*4 500	*4,400
Ethiopia	727	*594	492	0	4	*77	*400	0	0	6
Kenya	8 710	6 354	4 504	4 283	4 309	4 180	6 903	6 332	5 300	6 504
Madagascar	6 660	5 500	2 640	2 450	0	0	0	0	*3	154
Malawi	698	*1,350	3 370	2 603	399	1 508	6 063	5 373	2 784	6 246
Mali	0	0	107	0	0	15	0	0	0	0
Mauritius	83	180	189	100	0	338	150	102	100	
Mozambique	2 021	179	566	0	2 449	788	7 234	22 700	10 781	11 161
Namibia	305	0	0	600	2	200	800	1 103	1 458	*2,127
Senegal	2	0	1	0	0	0	0	0	0	7
South Africa	23 542	30 514	37 627	25 050	53 329	298	77 473	73 032	121 057	59 638
Sudan	0	0	2	0	20	0	0	0	0	7
Tanzania	*1,100	*1,556	*1,784	1 365	601	*475	**1,209	**1,379	**1,287	**1,294
Uganda	*300	0	*290	0	500	0	405	400	515	600
Zambia	*40,457	37 305	28 197	43 655	23 717	37	584	15 331	*45,368	44 233
Zimbabwe	71 616	64 490	81 554	67 350	80 995	90	533	88 421	115 499	90 828
Total	156 221	148 342	161 698	149 084	167 825	212 796	205 489	275 288	282 846	252 596

Adapted from Caldwell (2017)

NOTES

*Figures provided by Importers

Ethiopia Data supplied from EWCO (the Ethiopian Wildlife Conservation Organisation)

Zimbabwe Data supplied by CFAZ (the Crocodile Farmers Association of Zimbabwe).



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Table 5 shows the destination of the Nile crocodile skins produced in Africa. According to the table, the main markets are mainly in Europe and Asia. The three countries that have significant production being Zimbabwe, Zambia and South Africa all sell in the Far East and Europe. The continental imports are limited with the main importer being South Africa which imports from Botswana and Mozambique while Zimbabwe imports negligible amounts from Mauritius.

Based on the output quantities of skins in the African continent; the two countries in the region that could be considered to be possible sources for the Botswana crocodile skins exotic tannery are South Africa and Zimbabwe. It is however noted that the crocodile industries of the two countries have fully developed value chains from producers, slaughter facilities, tanneries, manufacturers and retailers. In South Africa; the Exotic Leather South Africa (ELSA) cluster has the full support of the government through the Department of Trade and Industry under the Competitive Improvement Programme. The country even has an Exotic Leather Research Institute which provides the needed requisite skills to the industry. This has led to South Africa, being recognised as having the ability to produce quality tanned leather and leather goods (ELSA, 2016).

In Zimbabwe, the Crocodile Farmers Association of Zimbabwe (CFAZ) is a producer representative body that regulates the industry through the definition of minimum standards and application of code of ethics. In addition, the CFAZ ensures that Zimbabwe meets its obligations to CITES and gives confidence to the countries purchasing crocodile products that they come from officially sanctioned farms and have been produced on a sustainable basis. The diversity of the Zimbabwean markets of exotic skins also shows that they are sought the world over. In order, to demonstrate the high value of Exotic skins, In Zimbabwe for the period 2006- 2010, the skins constituted 12% of the export volume but 84% of the export value of all


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hides and skins exported (ITC, 2012). The high value skins are mostly absorbed by the European markets for big brands products while China and other far east countries absorb most of the low quality skins for the production of various unbranded crocodile skin goods.

Table 5: Sources and destinations of Nile Crocodile Skins

<i>Exporting Country</i>	<i>Market</i>
Botswana	South Africa
Kenya	Italy, Korea, Singapore
Ethiopia	Japan, Korea
Madagascar	Not stated
Malawi	Australia
Mali	United States of America, France
Mauritius	Zimbabwe
Mozambique	Japan, Singapore, South Africa
Namibia	Italy, Korea
Senegal	Ukraine, France, Spain
South Africa	Italy, France, Japan, Asia
Uganda	Korea
Zambia	France, Singapore
Zimbabwe	Italy, France, Japan, Singapore, USA

Outside the continent, other countries have also come up with initiatives that ensures that where possible, the value addition of exotic skins is done internally and where exported, should meet the standards of high end markets in Europe with Asian markets being fall-backs for quality compromised skins. For example, in countries such as a Columbia and Indonesia; the value addition is mandatory and tanneries are prescribed in legislation as the export of raw crocodilian skins is not allowed, they must be processed to at least a “wet blue” stage (Fuchs 2006). As the global economy grows and more join upper middle classes, the demand for luxury

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products will likely increase. According to Paul-Iwuoha (2015), Africa has a unique advantage in the skins business because the Nile Crocodile species survives well in captivity and its skins are highly sought after in the luxury leather market. With the foregoing, the response to global demand for more skins would come from captivity produced crocodile skins within the ambit and regulations of CITES. The incentive to meet the stringent CITES regulations is driven by the high value of skins that the market is ready to pay for the skins. Therefore, luring any of the current significant exporters from the current markets to local markets within the continent does not have a business case as it will require that new markets to be able to pay competitive prices than the current market. Presented with this scenario, any country that needs to increase its output of crocodile skins and products has to do that from within by expanding the output of captive crocodile produced skins. Botswana with a CITES quota of 3000, would therefore need to work around meeting the requirements for upward revision of the quota and also expand the current output of its crocodile skins to support its local leather industry projects.

3.6 Current Production and Projections

Table 6 shows summary of current production status of the three farms currently on skin production. It is worth noting that 1 farmer is currently not in skin production but in tourism and other educational activities and is therefore excluded in making future projections for skins. Based on the number of female crocodiles across the farms (Table 1) and the best practice reproduction rates, the expected number of eggs were 27180, but achieved a total of 9972 hatchlings with shortfall of 17208, indicating 37% of production capacity. The largest farm achieved 45% of the production with the lowest farm achieving 19% hatchlings.


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Table 6: Current production capacity at the three farms based on the hatchlings from 2017


Farm no.	Expected no. of hatchlings	Current no. of hatchlings	Shortfall	% of current production
1	17640	7996	9644	45
2	6240	1356	4884	22
4	3300	620	2680	19
Total	27180	9972	17208	37

Notes: The Expected number of hatchlings takes into account clutches per crocodile and hatching rate.

Table 7 shows the expected number of hatchlings for the three farms using the current production percentage capacity derived from Table 6. Assuming that the total number of eggs (with an average of 60 per clutch) was 27180, then using current production percentage gives 9972 hatchlings. As discussed by Isberg et al. (2004) that in commercial captive raising facilities, average survival rates between hatching and one year of age are generally reported to be 80-90%. Thus the current hatchlings based on the mortality rate of 15% per annum and market readiness of 4 years will be 8477 crocodiles in 2022.

Table 7: The expected number of hatchlings based on the % of current production

Farm no.	Females	Exp. no of eggs in 2017 at an average of 60 per animal	Current no of hatchings 2018 (45, 22, 19%)	Exp. no of juveniles in 2022 with rate of mortality at 15%	Exp. no of juveniles in 2023 with rate of mortality at 15%	Exp. no of juveniles in 2024 with rate of mortality at 15%
1	294	17640	7996	6797	6797	6797
2	104	6240	1356	1153	1153	1153
4	55	3300	620	527	527	527
Total	453	27180	9972	8477	8477	8477

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3.6.1 Projections on assumptions

Assumption 1: If all the three farmers incubate with the same number of breeding stock from December 2018 for the next 3 years.


As reported by the farmers who incubates and using the number of females in the three farms, the expected number of eggs in 2018 will be 27180 with an average of 60 eggs per animal (annex 2 refers). This will produce 21744 number of hatchlings in 2019 (after 3 months incubation period) on success rate of 80%. This will also lead to 18482 juveniles with 15% mortality rate in 2022 (after 4 year period when the animals will be considered ready for the skin market). The same number of 18482 juveniles will be expected to be produced in 2023 and 2024 as indicated in *Annex 4*.

3.7 Challenges

Challenges in the crocodile industry ranges from production, market, skills, policies and regulations and feeds. Below is a summary of the reported challenges by the four farmers;

3.7.1 Skills

There is an evidence of lack of proper formal training in the country in relation to crocodile farming. The presence of only four crocodile farms to date shows that most Batswana do not have much knowledge and skills in the crocodile industry as opposed to other industries including cattle farming and poultry production. As reported by the four respondents, apart from the owners who have proper qualification in animal science, most of the staff who deal with crocodiles (feeding, cleaning, handling) had only informal training acquired on-site while the new employees learn from the experienced employees. Skinners are always imported whenever there is slaughtering of the animals as there are none within the farms who

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has knowledge on it as it was reported to take more time and trainings for one to acquire the relevant skills.

3.7.2 Policy and regulations

- ***Quota and Skin tags***


Respondents complained about the delays in receiving the tags from DWNP during the time when they want to slaughter and tag the skins. One farmer reported having to wait for the tags for a period of 5 months before they can be availed. Two farmers also cited the quota (3000 pieces) as a stumbling block in their business as they are limited to the number of skins they can export annually.

- ***Environmental Impact assessment (EIA)***

Environmental Impact assessment was cited as a stumbling block to the new entrants in to the crocodile farming. Two farmers reported having offered internship programs to young Batswana who wanted to venture into crocodile farming but later abandoned the idea due to the high amounts of money required to conduct the EIA as part of their proposal.


3.7.3 High prices for feeds

Lack of established feeds manufacturing in the country for crocodile feeds was cited as a major challenge in crocodile farming. Most farmers feed their animals poultry and some collect is as far as more than 400km from their farms as cannot afford to import. Depending only on poultry product to feed the animals was cited as a major challenge to all the farmers.

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3.8 SWOT analysis for the exotic skins industry in Botswana

<p>STRENGTHS</p> <ul style="list-style-type: none"> • The existence of operational crocodiles ranches/farms 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Low number of entrepreneurs in the crocodile production. • Non-commercial operation of current establishments. • Low animal productivity in the current operations • High feeding costs in operations. • Poor infrastructure and equipment within the farms.
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • Existence of current farmers to support new entrants. • Willingness of some of the current farmers to expand their operations. • Existing farmers commercialization • Current crocodile farmers are aware of the crocodile skins market requirements. • Existence of local CITES designated office. • Revision of the quota • Importation of skins from neighbouring countries (Zimbabwe and South Africa) 	<p>THREATS</p> <ul style="list-style-type: none"> • CITES Listing of Crocodiles in Appendix II requires stringent compliance issues to be met with in order to trade. • Low production skills within the local population industry • Low trade quota. • NO existence of skills in the extension services of the crocodile industry. • Current local producers already have established markets. • High capital costs required for entry into crocodile production.

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3.9 Current population of game Animals in ranches

Table 8 shows that a total number of 151090 of game animals in ranches kept across 95 ranches in Botswana. According to the statistics; the highest number of game are Impala (29.5%) followed by Wildebeest (17.3%) and Kudu (13.1%). The least numbers are for duickers, giraffes and tsessebe who form less than 1% each for ranches. It is to be noted that the Ostrich, which is also a source of exotic skins population in ranches stands at only 2272 birds and only 10 of them were slaughtered in 2017. There is a total of 1164 animals reported to have been slaughtered in 2017 and mostly were Impala (352) followed by Kudu (228), Wildebeest (140) and Warthog (107). This is an indication that there were 1164 skins produced from these animals. Other animals sold were less than hundred (Table 8 refers).

Table 8: Number of game kept in the farms

Animal	Number	No slaughtered
Impala	44533	352
Wildebeest	26130	140
Kudu	19792	228
Eland	13907	52
Gemsbok	12259	62
Zebra	5762	22
Hartebeest	5260	20
Springbok	4714	11
Warthog	4418	107
Waterbuck	3195	45
Baboon	2376	0
Steenbok	2301	35
Ostrich	2272	10
Bushbuck	1569	52
Duicker	1274	23
Giraffe	828	1
Tsessebe	255	4
Sable	193	0
Rhino	47	0
Mountain Reedbuck	5	0
Total	151090	1164

Source: DWNP data - 2017


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4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusion

Crocodile farming in Botswana is still at static stage as indicated by the establishments of only four farms regardless of the industry having started as early as 1986. Farms currently have a total of 19449 and a CITES allocated annual trade quota of 3000. However, farmers are still not producing at fully commercial capacity due to challenges the industry is faced with ranging from compromised production methods, poor facilities high standards required in the market. However, based on projections with production at full commercial capacity, farmers will be able to produce enough numbers in the next three years' time onwards and will be able to supply consistently the required quantities to the tannery. However, the country's quota of 3000 pieces annually as provided by CITES need to be taken into consideration and addressed before the tannery can be established.

A review of the international market dynamics on crocodile skins, there are indications that Botswana will struggle to access 7000 pieces of raw skins for its exotic skins leather tannery within the continent. The high value nature of the product under review and the current markets is highly competitive and a new entrant may struggle to access this high number of skins. The CITES listing of crocodiles in Appendices I and II which imposes regulation and monitoring of the industry also limits the immediate response to additional demand. Any increase in production has to be preceded by a validation through non detrimental utilization studies supporting the review of the quota for any country wishing to increase its trade in exotic skins. This is a cumbersome process which Botswana as a country may not be able to support for access to external exotic skins. With the foregoing, Botswana is unlikely to access a considerable proportion of current output of raw exotic skins in the international market. The current significant producers in the

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continent have established internal value chains for exotic skins and the incentive for exporting to Botswana, a new entrant in the niche industry is limited. The number of ostriches as an additional source for exotic skins is very low and the current slaughter figures is negligible.

4.2 Recommendations

1. The Local Enterprise Authority should engage the Ministry of Environment, Wildlife and Natural Resources as a desk office for the CITES with a view to facilitating increase in local production, throughput and revision of the county quota to support the local exotic skins tannery.


2. The LEA needs to conduct a full risk assessment and mitigation measures specific to the Exotic skins tannery component of the Leather Park project.

3. The LEA should consider compiling a business case/ plan to confirm financial viability of the exotic skins tannery at the planned processing capacity.

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References

1. Anon (1997) - Australian standard for hygienic production of crocodile meat for human consumption. Standing Committee on Agriculture and Resource management (in preparation).
2. Barnes, J.I. (1992). Economic aspects of tourism in national parks and game reserves: the case of Botswana. CSERGE Working Paper No. GEC 92-21, Centre for Social and Economic Research on the Global Environment (CSERGE), London
3. Brazaitis, P., (1987). Identification of Crocodilian Skins and Products. In: G. Webb, C. Manolis and P. Whitehead (eds.). Wildlife Management: Crocodiles and Alligators. Surrey Beatty & Sons, Chipping Norton, NSW, Australia
4. Collins, L., and Luxmoore, R. (1996). World trade in crocodilian skins, 1992–1993. World Conservation Monitoring Centre, Cambridge, United Kingdom.
5. David, D. (1987). Effects of alligator skin storage techniques on “red heat”. Pp. 393-395 *in* Wildlife Management: Crocodiles and Alligators, ed. by G.J.W. Webb, S.C. Manolis and P.J. Whitehead. Surrey Beatty & Sons: Chipping Norton, Australia.
6. Dzoma, B. M. & Sejoie, S. & Segwagwe, B.V.E. (2007). Commercial crocodile farming in Botswana
7. ELSA (2016) Exotic Leather South Africa is a sub national cluster responsible for setting on industry standards and benchmarks.
www.elsa.org.za
8. Huchzermeyer, F.W. (2003). Crocodiles. Biology, Husbandry and Diseases. CABI Publishing: Cambridge
9. Hutton, J. M. (1992). Report of the coordinator of the CITES Nile crocodile project to the CITES Secretariat as presented to the Parties at the seventh meeting of the Conference of the Parties, Lausanne, Switzerland, 1989.


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Pages 169–214 in J. M. Hutton and I. Games, editors. Committee on International Trade in Endangered Species, Gland, Switzerland.

10. Hutton, J.M. and van Jaarsveldt, K.R. (1987). Crocodile farming and ranching in Zimbabwe. pp. 323–327. In: G. Webb, C. Manolis and P. Whitehead (eds.). Wildlife Management: Crocodiles and Alligators. Surrey Beatty & Sons, Chipping Norton, NSW, Australia
11. IACTS- International Alligator and Crocodile Trade Study, 2004
[https://scholar.google.com/scholar?q=IACTS-
%20International%20Alligator%20and%20Crocodile%20Trade%20Study%2C%202004](https://scholar.google.com/scholar?q=IACTS-%20International%20Alligator%20and%20Crocodile%20Trade%20Study%2C%202004)
12. Inskipp & Wells (1979). International Institute for Environment and Development
13. Isberg, S., Shilton, C., and Thomson, P. (2004). Improving Australia’s crocodile industry productivity: understanding runtism and survival. Rural Industries Research and Development Corporation, Canberra. Publication No. 9/135: 4-147
14. ITC (2012) *Zimbabwe leather Sector Strategy: 2012- 2017*. International Trade Centre
15. Iwuoha, John-Paul (2015) *Crocodile Farming in Africa, an interesting Niche Business many people don’t know about and A success story from Kenya*. Agribusiness and Food Business Ideas. <http://www.smallstarter.com/get-inspired/crocodile-farming-business-in-africa-and-a-success-story-from-kenya/>
16. Joanen T, McNease L (1997) Ecology and physiology of nesting and early development of the American alligator. *Am Zool* 29: 987–998
17. NRC (National Resource Council), (1983). Crocodiles as a Resource for the Tropics. National Academy Press, Washington, D.C

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18. Manolis, S.C. and Webb, G.J.W. (2016). Best Management Practices for Crocodilian
19. Farming. Version 1. IUCN-SSC Crocodile Specialist Group: Darwin, Australia.
20. Pfitzer, S., Ganswindt, A., Fosgate, G.T., Botha, P.J. and Myburgh, J.G. (2014). Comparison of electrical immobilization with manual capture in farmed Nile crocodiles (*Crocodylus niloticus*) by monitoring stress-related physiological parameters. Pp. 279-287 in Crocodiles. Proceedings of the 23rd Working Meeting of the IUCN-SSC Crocodile Specialist Group. IUCN: Gland, Switzerland.
21. Pooley, A. C. (1982). The status of African crocodiles in 1980. In: Crocodiles. IUCN Publication, Gland, Switzerland
22. Thorbjarnarson, J. (1999). Crocodile Tears and Skins: International Trade, Economic Constraints, and Limits to the Sustainable Use of Crocodilians Conservation Biology Volume 13, No. 3.
23. John Caldwell (2017). World trade in crocodilian skins 2013-2015. UNEP-WCMC, Cambridge.
24. King, F. W. (1978). The wildlife trade. Pages 253–271 in H. P. Brokaw, editor. Wildlife and America. Council on Environmental Quality, Washington, D.C.
25. Van Jaarsveldt, K.R., 1987. Flaying, Curing and Measuring Crocodile Skins. In G. Webb, J.W. Grahame, S. Charlie Manolis and P.J. Whitehead (eds.). Wildlife Management: Crocodiles and Alligators. Surrey Beatty & Sons Pty Limited

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Annexes

Annex 1: Most traded species of crocodylians globally


Taxon	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
<i>Alligator mississippiensis</i>	422,931	262,127	230,464	297,187	369,731	312,542	326,538	481,341	485,916	428,557
<i>Crocodylus acutus</i>	120	404	1,371	1,460	200	1,392	1,968	1,905	2,262	3,403
<i>Crocodylus johnstoni</i>	0	0	0	0	0	0	0	0	0	0
<i>Crocodylus moreletii</i>	158	11	724	485	0	184	679	1,300	2,031	1,291
<i>Crocodylus niloticus</i>	156,221	148,342	161,698	149,084	167,825	212,796	205,489	275,288	282,846	251,596
<i>Crocodylus novaeguineae</i>	38,645	28,663	25,638	26,212	24,480	16,632	23,461	26,046	24,982	38,946
Total	618,075	439,547	419,895	474,428	562,236	543,546	558,135	785,880	798,037	723,793

Annex 2: Expected number of juveniles in 2022 assuming 80% success rate of the hatchlings with 15% mortality for the **three** farmers

Farm	Females	Expected no of eggs in 2018 at an average of 60 per animal	Expected no of hatchings 2019 with 80% success rate	Expected no of juveniles in 2022 with rate of mortality at 15%
1	294	17640	14112	11995
2	104	6240	4992	4243
4	55	3300	2640	2244
Total	453	27180	21744	18482

Annex 3: Expected number of juveniles in 2022 assuming 80% success rate of the hatchlings with 15% mortality for all the **four** farmers

Farm	Females	Expected no of eggs in 2018 at an average of 60 per animal	Expected no of hatchings 2019 with 80% success rate	Expected no of juveniles in 2022 with rate of mortality at 15%
1	294	17640	14112	11995
2	104	6240	4992	4243
3	56	3360	2688	2285
4	55	3300	2640	2244
Total	509	30540	24432	20767

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Annex 4: Expected number of hatchlings based on the number of juveniles achieved in 2022 for the next 3 years using same number of breeding stock for the **three** farms

Farm	Females	Expected Hatchlings in 2022	Expected Hatchlings in 2023	Expected Hatchlings in 2024
1	294	11995	11995	11995
2	104	4243	4243	4243
4	56	2244	2244	2244
Total	453	18482	18482	18482

Annex 5: Expected number of hatchlings based on the number of juveniles achieved in 2022 for the next 3 years using same number of breeding stock for the **four** farms

Farm	Females	Expected Hatchlings in 2022	Expected Hatchlings in 2023	Expected Hatchlings in 2024
1	294	11995	11995	11995
2	104	4243	4243	4243
3	56	2285	2285	2285
4	55	2244	2244	2244
Total	509	20767	20767	20767

Annex 6: Current production for all the four farms

Farm no.	Expected no. of hatchlings	Current no. of hatchlings	Shortfall	% of current production
1	17640	7996	9644	45
2	6240	1356	4884	22
3	3360	897	2463	27
4	3300	620	2680	19
Total	30540	10869	19671	36

Annex 7: Projections for all the four farmers

Farm	Females	Exp. no of eggs in 2017 at an average of 60 per animal	Exp. no of hatchings 2018	Exp. no of juveniles in 2022 with rate of mortality at 15%	Exp. no of juveniles in 2023 with rate of mortality at 15%	Exp. no of juveniles in 2024 with rate of mortality at 15%
1	294	17640	7996	6797	6797	6797
2	104	6240	1356	1153	1153	1153
3	56	3360	897	762	762	762
4	55	3300	620	527	527	527
Total	509	30540	10869	9239	9239	9239