

Review Article

Ranching Lake Nasser's Nile Crocodiles

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Abstract

The Nile Crocodile *Crocodylus niloticus* is the most widely distributed crocodile species in Africa, occurring in almost all sub-Saharan countries. It was included in Appendix I in 1975. Egypt submitted a proposal (no. 9) to the IUCN at the Conference of Parties (CoP) no. 15 to transfer the Egyptian population of *C. niloticus* from Appendix I to Appendix II for purposes of ranching. The proposal was not considered in its presented form by the CoP at this meeting. Therefore, the present project considers this problem by reviewing the data presented in previous studies looking for a glimmer of hope to meet the International Union for Conservation of Nature (IUCN) requirements for transfer of species from Appendix I to Appendix II for ranching. The present project aims to determine requirement needed for establishing a farm for ranching Nile crocodile in the region of Lake Nasser; determine potential regions around Lake Nasser for ranching Nile crocodile; and fill gaps in the Egyptian proposal (no. 9) submitted to the CoP 15 in 2010. Records on numbers and sizes of Nile crocodile in 2008, 2009, 2012 and 2013 were collected from previous studies and analysed to determine requirement to establish a Farm for Ranching Nile Crocodile (FRNC). The farm will provide job opportunities for local people; therefore, it may help to resolve conflict between human and crocodile by reaching a win-win situation. It will help in reducing illegal hunting activities by local fishermen, as well as tackling the illegal trade in cross-border imports of crocodile leather from Sudan. On the other hand, exporting the products of the crocodile farm under the Convention on International Trade in Endangered Species (CITES) (e.g. leather, meat, bones, fats, etc.) will increase national income and the hard currencies.

Keywords: *Crocodylus niloticus*; *Crocodylus cataphractus*; Caiman crocodylus; Tamarix

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Introduction

The Nile Crocodile *Crocodylus niloticus* is the most widely distributed crocodile species in Africa, occurring in almost all sub-Saharan countries. It was included in Appendix I in 1975. Egypt submitted a proposal (no. 9) to the IUCN at the Conference of Parties (CoP) no. 15 to transfer the Egyptian population of *C. niloticus* from Appendix I to Appendix II for purposes of ranching. The proposal was not considered in its presented form by the CoP at this meeting. Therefore, the present project considers this problem by reviewing the data presented in previous studies looking for a glimmer of hope to meet the International Union for Conservation of Nature (IUCN) requirements for transfer of species from Appendix I to Appendix II for ranching.

This project is important to fill gaps in the Egyptian proposal (no. 9) submitted to the CoP 15 in 2010. Filling some of these gaps will lead to accomplish of the proposal and it's fully the acceptance and hence, establishment of a Farm for Ranching the Nile Crocodile (FRNC). The farm will provide job opportunities for local people; therefore, it may help to resolve conflict between human and crocodile by reaching a win-win situation. It will help in reducing illegal hunting activities by local fishermen, as well as tackling the illegal trade in cross-border imports of crocodile leather from Sudan. On the other hand, exporting the products of the crocodile farm under the Convention on International Trade in Endangered Species (CITES) (e.g. leather, meat, bones, fats, etc.) will increase national income and the hard currencies.

Several attempts were conducted; nevertheless, none of them was used in advantageous way to accomplish the Egyptian proposal to transfer the Egyptian population of *C. niloticus* from Appendix I to Appendix II for purposes of ranching.

Shirley and Salem [1], submitted a regional report of Egypt on "Lake Nasser Crocodile Program" to the Crocodile Specialist Group of the Species Survival Commission of the IUCN. In this report, they pointed out the important traditional role played by the Nile crocodile (*Crocodylus niloticus*) in Egypt history. They reported two surveys that have been conducted for crocodiles in Lake Nasser. Ibrahim estimated the total population of in Lake Nasser being no more than 1000 crocodiles. Another survey was conducted by Salem and Asran [2], who surveyed about 80% of Lake Nasser (both west and east banks from the High Dam at the North to Korosko at the South) and the population was estimated to be less than 2000 individuals. They stated that a project started in 2008 aimed to train a group of Egyptians to be capable of managing the Lake Nasser crocodile population. At that time, this group has no knowledge regarding specific technique for crocodile or for robust estimates of its population size.

Shirley et al. [3], studied the population ecology of Nile crocodile in Lake Nasser and its distribution and abundance was most readily accounted for by habitat type. They estimated the abundance of the Nile crocodile in Lake Nasser. Their raw encounter rate was 0.355

crocodiles per km. They classified Lake Nasser into three habitat types of relevance to crocodiles: (a) Sandy beaches; (b) Rocky cliffs; and (c) Intermediate. When they accounted for observer effects and habitat, they estimated a surface population abundance of 2,581 (2,239-2,987, 95% credible intervals) crocodiles in Lake Nasser. However, earlier, Baha El Din [4], in his book “A guide to the Reptiles and Amphibians of Egypt”, stated that the number of breeding adults (sexual maturity is reached at about 10 years of age) is probably considerably fewer than 5000 animals.

Salem [5], investigates the crocodile nesting sites on Lake Nasser, observed during the breeding season 2009-2010. He observed a relatively low number of nesting sites was found, explained by the intensity of anthropogenic activity in the area and by the low water levels of Lake Nasser.

A project started in June 2008 aimed to assess crocodile population in Lake Nasser and work with key stakeholders to assess negative impacts of crocodiles and the potential to utilize crocodiles as sustainable resource [1]. Later on, the Nature Conservation Sector of the Egyptian Environmental Affair Agency (EEAA) created a Crocodile Management Unit (CMU), at the Southern Nature Conservation Sector, to oversee *Crocodylus niloticus* management and monitoring. The CMU aimed to train a group of Egyptians to be capable of managing the Lake Nasser crocodile population. The CMU is responsible for outreach activities within local communities and with any parties involved in crocodile use, as well as with local and environmental law enforcement agencies to prevent illegal trade [6]. The CMU has evaluated the number of crocodiles in Lake Nasser using a spot-light survey method at three intervals: a) In July 2008 - June 2009; b) In 2011 - 2012; and c) In 2013. The CMU tracked the movement of 11 crocodiles ranging in size from 1.7 to 3.6 m using specially designed VHF Transmitter devices.

The data were collected from previous studies [3,6], were organised and analysed using graphs and simple statistics to detect relationships, trends and generalization patterns among them. Gaps were identified and needs were addressed to fulfil the IUCN requirements.

State-of-art aspects of the present project are lying in reviewing criticisms rose on the submitted Egyptian proposal and identifying gaps and needs to fulfil the IUCN requirements

The Nile crocodile, *Crocodylus niloticus*, is the fresh water top predator throughout Nasser Lake and in a large part of Africa.

Nile Crocodile

Classification

There are 24 recognised species of extant crocodylians, divided into three Families - Alligatoridae (8 species; alligators and caimans), Crocodylidae (14 species; “true” crocodiles) and Gavialidae (2 species; Gharial and Tomistoma).

Morphology

Nile crocodiles are strict carnivores and relentless predators throughout their lives as they grow from 30 - 33 cm in total length up to 6.20 m and weighing over 750 kg [5].

Habitat

Nile crocodiles are found in a wide variety of habitat types, including large lakes, rivers and freshwater swamps. In some areas they extend into brackish water environments [7,8]. The Nile crocodile prefers permanent, still or slow-moving water with high, sunny, sandy banks above flood levels and enough vegetation to provide shade and shelter. Like all true crocodiles, this is a tropical/sub-tropical species, rarely found where mean water temperatures are below 15 - 20°C (upland areas and the south of the continent), being rare in moist forest and extensive swamps, where it is replaced by *Crocodylus cataphractus* and *Caiman crocodylus*. Its absence from these habitats is strongly linked to those geomorphological characteristics of rivers and lakes which have a directly influence on the nesting behaviour [9].

In sandy areas, vegetation was dominated by a border of *Tamarix* sp, which can be submerged during high water periods or 20 m above the waterline during low water periods. Above the *Tamarix* was generally a band of sandy beach (1-20 m width) suitable for Nile crocodile nesting habitat [3]. Shirley et al. [3], divided Lake Nasser into three habitat types of relevance to crocodiles: (a) Sandy beaches; (b) Rocky cliffs and (c) Intermediate. Sandy beach habitats were those areas characterized by gently sloping shores composed predominantly of sand and loose rocky slate or gravel. Rocky cliff areas were those with sheer rock faces descending into the water with few or no haul-out sites. Intermediate habitats were those sites that have at least 25% beach habitat with the remainder composed of rocky shores ranging from gently sloping gravel banks to sheer rock faces [3].

Conservation status

The Nile crocodile (*Crocodylus niloticus*) had virtually disappeared from Egypt by the 1950s. Nile crocodile is listed as “Lower Risk/Least Concern” on the 2009 IUCN Red List [10]. *Crocodylus niloticus* was included in Appendix I of the CITES Convention, in 1975 [4,11,12], as one of the most endangered animals. Appendix I include all species threatened with extinction which are or may be affected by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances (Article II, paragraph 1 of the Convention).

The CSG believes the transfer to Appendix II at CoP15 is needed to encourage management, with a zero quota, but that Egypt will have to finalise the program before Parties at CoP16 can truly assess it. The transfer to Appendix II would facilitate the utilization, and will lead to limited hunting tourism and its potential benefits.

Lake Nasser

Shoreline habitat

Using data on water level fluctuations during the past few years and by base levelling using a Theodolite, Ali [13], classified the shoreline habitat of Lake Nasser into four moisture gradient zones: 1) Wet zone (frequently inundated and recently exposed zone): The main part of the zone exposed for a short period (1-2 months), too freshly exposed and too wet to support any vegetation (175.9-176.9 m above MSL); 2) Moist Zone (periodically inundated zone): Most of the zone exposed for a longer period (3-4 months) than the wet zone (176.9-180.3 m above MSL); 3) Semi-dry Zone (rarely inundated):

The lower edge of the zone was inundated twice in 1998 and 1999 for short periods, but since then it has been exposed (180.30-184.80 m above MSL); and 4) Dry Zone (never inundated): < 184.80 m above MSL.

The present research project aims to: a) Analyse the obtained from previous studies; b) Determine requirement needed for establishing a farm for ranching Nile crocodile in the region of Lake Nasser; c) Determine potential regions around Lake Nasser for ranching Nile crocodile; and Determine suitability of hatchlings and/or eggs for ranching Nile crocodile.

Materials and Methods

Study area

Lake Nasser is the second largest man-made lakes in the world after Bratsk Reservoir in Russia [13]. The lake is some 479 km long and 16 km across at its widest point, which is near the Tropic of Cancer. It covers a total surface area of 5,250 km² and has a storage capacity of some 132 km³ of water. It has a shore length of 7,844 km at 183 m above mean sea level [14].

Data collection

Records on numbers and sizes of Nile crocodile in 2008, 2009, 2012 and 2013 were collected from previous studies [3,5,6] and analysed to determine requirement to establish a Farm for Ranching Nile Crocodile (FRNC).

Data analysis

Using Excel programme graphics were produced to illustrate variations in numbers of Nile crocodile hatchlings and yearling between Northern sites and southern sites, as well as, between sites at west and east banks.

Results

Shoreline habitats

Figure 1 illustrates the habitat characterising the shoreline of Lake Nasser. West Bank of Nasser Lake characterises by gently slope bays (khors), wide with sandy to sandy-loam beaches. East Bank of Nasser Lake characterises by steep slope, relatively narrow with elevated hills and rocky beaches interspersed with sandy areas surrounded by a belt of *Tamarix* shrubs.



Figure 1: Location map of Lake Nasser.

Nile crocodile

Spatial Variations: Analysing the collected data shows that sites on the west bank of the lake had a higher number of both hatchlings (ranged from 9.0 at El-Ramla to 0.0 at Amada, Sebou, Tomas Wa Afia and Eniba) and yearlings (ranged from 21.0 at Dehmeit to 0.0 at Eniba) than those of the east bank (hatchlings ranged from 1.0 at Kurusku to 0.0 at Dehmeit, Allaqi, Abu Handal, El-Der, Qutta and Genina Wa El-Shebak; and yearlings ranged from 15.0 at Kurusku to 0.0 at Genina Wa El-Shebak). Also, the northern sites are characterising by higher number of both hatchlings (9.0 at El-Ramla) and yearlings (21.0 at Dehmeit) than the southern sites (e.g. Eniba) where neither hatchlings nor yearlings were recorded (Figure 2).

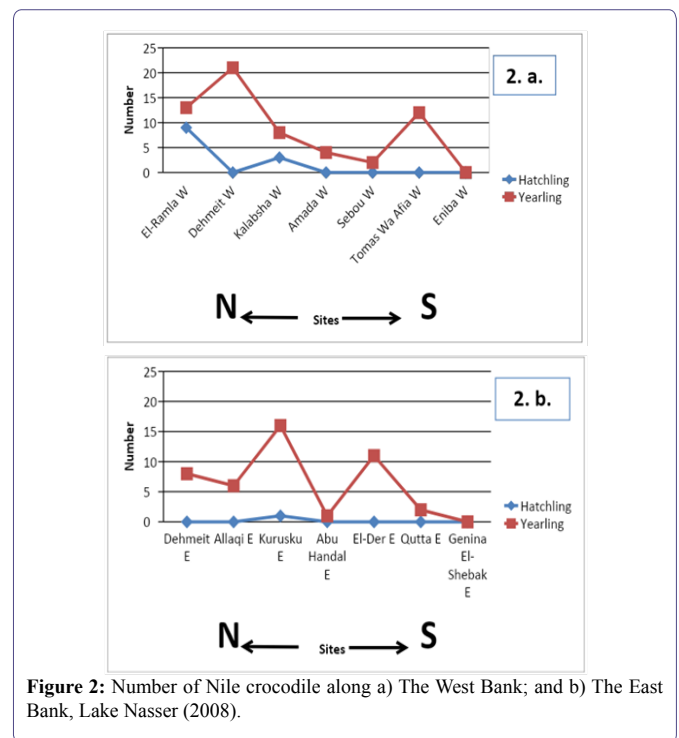


Figure 2: Number of Nile crocodile along a) The West Bank; and b) The East Bank, Lake Nasser (2008).

Temporal variations: The data collected in the years 2008, 2009 and 2012 showed that the number of hatchlings and yearlings had decline from 9.0 and 4.0, respectively, in 2008 to 0.0 and 1.0, respectively, in 2012 (Figure 3).

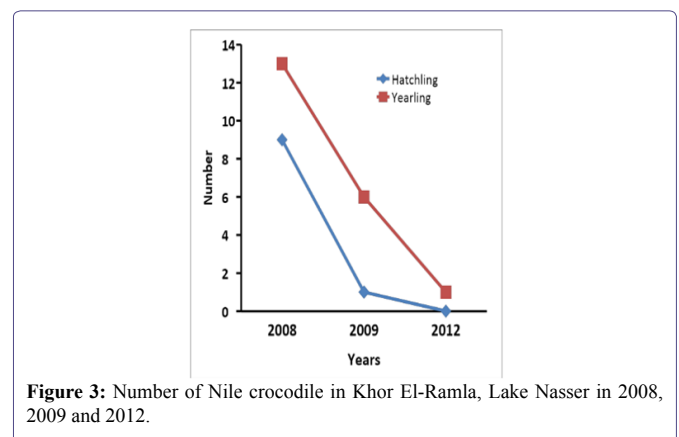


Figure 3: Number of Nile crocodile in Khor El-Ramla, Lake Nasser in 2008, 2009 and 2012.

Discussion

In Egypt, *Crocodylus niloticus* is limited to Lake Nasser in Upper Egypt. Recent reports from as far as Cairo are almost certainly of escapees or releases [15].

The best available estimates of crocodile indicate the population is not small [15]. Baha El Din [4], stated that the number of breeding adults (sexual maturity is reached at about 10 years of age) is probably considerably fewer than 5000 animals. However, a survey in the period 2008-2009 estimated the crocodile population in the lake as between 6000 and 30,000 [3].

The analysis of the data presented in this research indicates that the number of Nile crocodile hatchlings varied spatially. It is declining towards South, and the west bank characterises by higher number of hatchlings than the east bank. However, the habitat quality is good and the entire lake is suitable habitat for crocodile occupancy during one life stage or another, approximately 80% contains suitable nesting habitat [15]. According to Ali's divisions the banks of Lake Nasser in 2003 considering the water levels fluctuation, the most suitable habitats for crocodile are mainly located between the upper part of the moist zone (176.9 - 180.3 m above MSL) which, periodically inundated, but it is exposed for longer period; and the lower edge of the semi-dry zone (180.30 - 184.80 m above MSL), which was inundated short periods, but exposed most of the year. Also, Salem [5] stated that suitable area is with 5-75% crocodile occurrence probability.

The present data indicates that population of *Crocodylus niloticus* in Lake Nasser is declining over the time from 2008 to 2012. Similarly, Salem [5] stated that it a severe reduction in the number of adult individuals was observed. This may be because high sandy banks, essential for crocodile ecology, are also good fishing camps and village sites; therefore fishermen activities had a severe influence on the nesting success of crocodiles and on the crocodiles themselves [5]. In addition to that there the conflict between man and crocodile is increasing in Lake Nasser. It becomes more frequent and severe over recent decade, as a result of human population growth and expansion of agricultural and industrial activities around the lake. This in turn increased negative interaction between local fishermen and crocodiles [15].

A farm for Ranching the Nile Crocodile (FRNC) will provide job opportunities for local people; therefore, it may help to resolve conflict between human and crocodile by reaching a win-win situation. It will help in reducing illegal hunting activities by local fishermen, as well as tackling the illegal trade in cross-border imports of crocodile leather from Sudan. On the other hand, exporting the products of the crocodile farm under the Convention on International Trade in Endangered Species (CITES) (e.g. leather, meat, bones, fats, etc.) will increase national income and the hard currencies.

The Egypt's proposal for ranching will be based on an annual hatchlings harvest, with initial quotas set at around 2500. The proponents believe that this will allow ample time for approved ranching operation to build a stock. However, the presented data is collected discontinuously and irregularly that assemble a relatively small area of the lake. The analysis of the data collected indicates that the initial quota (2500 hatchlings) seems high and is hardly to be harvested from the local environment in Lake Nasser area, under the

prevailed circumstances. Illegal hunting practices lead to huge areas of destroyed natural habitat, seconded by illegal trades of hatchlings and/or skins [5].

Because this proposal to transfer a population from Appendix I to Appendix II is involve ranching, the following observation are recommended to be made: (a) Precise estimates of wild populations; (b) Clarify what should be collected hatchlings and/or eggs.

The findings of the proposed research could be a useful tool, which can help environmental managers and decision makers to choose the most suitable quota of crocodile to ranch and select the proper zone for establishing the Nile crocodile farm. Informed decision-making will reduce the environmental impacts of large lake such as High Dam Lake.

Conclusion

The present study will help in setting a sustainable development plan based on modern scientific basis for the long-term benefit of the Nile crocodile in Lake Nasser.

Recommendation

In order to establish Farm for Ranching the Nile Crocodile (FRNC), the following should be included in the proposal:

1. Precise estimates of wild Nile crocodile populations in Lake Nasser are needed.
2. Detail on how the ranching programme would be carried.
3. Detailed management and monitoring plan, e.g. why hatchlings rather than eggs are to be collected.
4. Include methods for assessing the economic success of ranching.
5. Decreased negative interaction between local fishermen and crocodiles.

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