## AMENDMENTS TO APPENDICES I AND II OF THE CONVENTION

## Proposals Submitted Pursuant to Resolution on Ranching

#### A. <u>PROPOSAL</u>

Maintenance of the Madagascar population of Crocodylus niloticus in Appendix II.

#### B. <u>PROPONENT</u>

The Democratic Republic of Madagascar.

## C. JUSTIFICATION DE LA PROPOSITION

1. <u>Taxonomy</u>

11.	Class:	Reptilia
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- 12. Order: Crocodylia
- 13. Family: Crocodylidae
- 14. Species: <u>Crocodylus niloticus</u> (Laurenti, 1768)

15.	Common Names:	English: French: Spanish:	Nile crocodile crocodile du Nil Cocodrilo del Nilo
		Malgache:	Voay (small specimen) Mamba (large specimen)

16. Code Numbers:

#### 2. Biological data

The Democratic Republic of Madagascar signed the Convention on International Trade In Endangered Species of Wild Fauna and Flora (CITES), ratified by Ordonnance No. 75-014 of 5 August 1975.

21. <u>Distribution</u>: The various surveys carried out on the geographical distribution of the Nile crocodile have shown that it is found everywhere in Madagascar's low-lying areas, particularly along rivers and lake shores.

Surveys were begun in 1987 by Behra, and continued in 1988 by Hutton and Behra as part of CITES' "Nile Crocodile" project. Since 1989, they have been carried out jointly by the FAO and the Malagasy Government within the framework of Project TCP/MAG/8954, "The Development of Crocodile Breeding in Madagascar".

A clearer picture of the crocodile's geographical distribution and the areas favourable to it emerged from the studies, the nocturnal and aerial surveys and the follow-up examinations of the first collection of eggs (see Annexes I and II).

22. Population: In general, favourable crocodile habitats are to be found throughout the country.

Demographic pressure on the east coast, however, has had a negative effect on crocodile populations. In fact, observations have shown that population density is very low on the Pangalanes Canal and the Maningory River.

The most suitable areas for crocodiles are found in the west and northwest of the country (see Annex III). The first counts carried out on the large rivers in the west, however, revealed relatively low populations in general. On the other hand, a few rivers like the Maningoza, the Manambolo and the Mahavavy contained fairly large ones.

On the Mangoky, the population density is around 0.27 crocodile per kilometre. Comparisons of this figure with the counts taken on other rivers such as the Sofia and Bemarivo and with the nocturnal and aerial counts show that the population densities are considerably higher. Based on the various observations, therefore, a minimum population density of 4.2 crocodiles per kilometre and a maximum density of 9.2 can be estimated on the most populated stretch (downstream from the river Sikily).

On the Mahavavy, a rough calculation of 0.5 crocodile per kilometre has been made on the 140-kilometre stretch between Kandreho and Sitampiky.

The highest population densities, however, have been recorded on the 20 kilometres of river bordering the Kasizy special reserve.

On the Manambolo, the average population density varies roughly from 0.11 to 1.75 crocodile per kilometre. It should be pointed out that these figures represent reliable minimum estimates, confirmed by the work conducted during the egg collecting campaign in 1990, which was part of Project TCP/MAG/8954, "The Development of Crocodile Breeding in Madagascar".

However, a few short 15 to 25-kilometre stretches of rivers like the Tsianaloka and the Tsionga have higher population densities.

On the lakes adjacent to this river, high population densities of at least 23 crocodiles per kilometre have been recorded.

On other rivers like the Sambao and the Maningoza, populations vary between 0.29 and 0.52 crocodile per kilometre due to the rivers' sinuous form and the small size of the adjacent lakes.

26 adult crocodiles have been sighted there (24 on the adjacent lakes and 2 on the river) and 78 nests have been located (54 of them on a 6.5-kilometre stretch of the river).

At the end of their comprehensive surveys of the Nile crocodile population in Zimbabwe, Hutton and Wolhouse discovered that the number of animals they had observed at night was somewhere between 30% and 63% of the estimated total number. In short, the different observations carried out in Zimbabwe do not apply to other regions.

As far as reproduction is concerned, observations suggest that crocodiles prefer particular areas for nesting. A large proportion of the nests that were discovered had been destroyed by man, underlining the extreme importance of involving the rural population in a ranching programme for the management and conservation of the crocodile. 30 nests were collected in the region of Besalampy, with was an average of 38 eggs per nest, a minimum of 27 and a maximum of 60.

Comparing the average number of clutches of the Nile crocodile populations with other countries, those registered in Madagascar seem relatively low.

As for the gathering of eggs, almost 2,000 were collected in the region of Besalampy without any prior knowledge of the breeding sites. But taking into account the number of destroyed nests and the time spent looking for them, as many as 6,000 could have been collected.

Taking the whole area of Besalampy (Sambao, Maningoza), Ankasakasa as far as Soalala (Manomba) and Cape Saint-André, there are probably as many as 15,000-20,000 crocodile eggs.

In the region around Antsalova, more than 800 eggs were collected on a short stretch of the Soahany River (approximately 50 kilometres). This area, therefore, has a potential of 5,000 eggs.

In the region between the Mahavavy and Manambolo Rivers, there is a minimum potential of 20,000 to 25,000 eggs.

Surveys still have to be carried out in other regions of the country, particularly in the north where large numbers of crocodiles have already been sighted (on the Mananjeba River and some on the lakes of Vohémar).

It is quite clear, therefore, that there is a definite potential for crocodile ranching in Madagascar. In view of man's large-scale destruction of crocodile nests (more than 60% of those sighted), a ranching programme involving the local people would obviously benefit crocodile conservation.

23. <u>Habitat</u>: As Behra and Hutton have been at pains to point out, the Nile crocodile's habitat in Madagascar suffers considerable damage due to population growth and the thoughtless destruction caused by shifting cultivation, particularly of rice, the country's staple food.

However, if large numbers have been sighted in isolated regions, it is because they are sparsely populated and ideal for crocodiles.

#### 3. Trade Data

### 31. National Utilization:

311. <u>Commercial Hunting:</u> Since the crocodile is classified as a game animal (Order No. 88-243 of 15 June 1988), crocodile hunting is controlled. A commercial hunting permit issued by the Minister in charge of the administration of waters and forests is required for hunting or dealing in crocodiles and their by-products.

Despite the fact that crocodile hunting is legal, and because the Malagasy Government is resolutely committed to ranching, no hunting permits were issued in 1990. This should facilitate the setting up of a rational ranching management programme as well as the designation of protected breeding areas.

So as not to compromise local trade, it would be advisable to reauthorize commercial crocodile hunting. However, strict measures should be enforced to ensure that:

- hunters possess a valid permit, and do not sell skins less that 45 centimetres across the abdomen;
- skins of breeding crocodiles are not sold;
- the by-products are not exported;
- hunting only takes place within areas designated as non-favourable to crocodiles (the densely populated eastern areas).

Manufactured products will be controlled as well.

312. <u>Crocodile Breeding</u>: Two farms were already operational - REPTEL and Mr. Delanessan's - when the development programme of ranching began. Since then, a certain number of new ones have been started and have decided to begin collecting eggs and capturing newborn crocodiles.

Four breeding ranches were authorized in 1990:

- 1. Mr. Jean-Baptiste Donty's farm which captured 400 newborn crocodiles at the beginning of 1990 in the Antsalova and Vohémar regions.
- 2. The REPTEL farm which collected 568 eggs in the north of the country (Vohémar).
- 3. Mr. Charles Delanessan's farm which collected 977 eggs on the Ikopa, a river that was not considered very important.
- 4. The Voay Company which collected 2,887 eggs between the Maningoza, the Sambao and the Soahany rivers.

It should be pointed out that collecting eggs and capturing newborn crocodiles are conditional on:

- the existence of adequate installations approved by the Direction des Eaux et Forêts;
- the designation of areas planned for collecting and capturing;
- obtaining a permit from the Direction des Eaux et Forêts specifying the number of eggs and reptiles;
- respect for the technical and administrative regulations set out in the register.

A draft of the guidelines on the practice of ranching, a copy of which is attached, will be published as soon as possible (Annex V).

32. <u>Legal International Trade</u>: Madagascar has entered no reservation to the Washington Convention and its exportations are made in compliance with the provisions of CITES. These exportations began in 1985; until 1989, they were as follows:

Year 1985	155
Year 1986	668
Year 1987	3,681
Year 1988	3,073
Year 1989	<u>3′930</u>
Total	11'507

Special quotas, annual quotas and products bred in captivity.

33. <u>Illegal Trade</u>: Exports of products derived from crocodile skins, by nationals and in small quantities, can be considered illegal trade at a certain level. According to CITES as well as national legislation (Interministerial Order 760/80). Malagasy nationals can take out personal objects made from crocodile skins provided that they re-import them.

Measures have been taken to inform both nationals and tourists that exporting crocodile skins is forbidden as well as the sale of crocodile products at the international airport, which, at present, has been totally suppressed.

Finally, more effective means of checking the repatriation of products taken out of the country by nationals are currently being studied by different departments (Customs, Waters and Forests, the Gendarmerie, the National Police).

34. <u>Potential Trade Threats</u>: The exploitation of crocodiles bred on ranches cannot be considered as endangering the crocodile populations because the

majority of the eggs collected would have been destroyed by man anyway, and their valorization makes their conservation a matter of interest.

While local trading of crocodile products, after a period of rapid growth brought about by unchecked hunting, has not shown a decline, it has at least stabilized.

There is no doubt that the projected control measures (requiring a permit, etc.) will cause a drop in the number of small traders. The ban on trading of all skins of more than 45 centimetres and on the manufacturing of products from skins of 45 centimetres will help to protect the breeders; finally, the decision to permit hunting only in certain stipulated areas on the east coast should help to protect the large crocodile populations on the west coast.

## 4. Protection Status

41. <u>National Level</u>: According to Madagascar's law on wildlife, the Nile crocodile is classified as "game". (Order no. 88-243, 15 June 1988, see Annex VI). This means that the crocodile can only be hunted, captured or collected by holders of hunting permits issued by the Direction des Eaux et Forêts.

No matter what permit or authorization is issued, it can in no circumstances be used in national parks or protected areas. There are, in fact, two nature reserves and six special reserves which include or border on particularly ideal crocodile habitats.

This is especially interesting in view of the fact that more wildlife officers will be posted to these areas as part of WWF's "Debt to Nature" project. For example, four officers and a chief officer will be posted to the Kasiky special reserve, whose eastern boundary is ideally adapted to populations of Mahavavy crocodiles. Likewise, two other officers will be posted to the Maningoza special reserve, whose entire southern limit borders on the Maningoza River where 17 crocodile nests have been counted.

As for ranching, strict regulations have been established by the Direction des Eaux et Forêts and every operator must sign a register before undertaking any operations involving crocodiles.

Besides strict adherence to technical standards ensuring the viability of the ranches and the conservation of the species, the ranchers are required to report regularly to the Direction des Eaux et Forêts and to make available 5% of the crocodiles hatched from collected eggs or 10% of captured baby crocodiles for release into the wild.

Any infraction of these regulations or of any article of the legislation on crocodiles can lead to the withdrawal of the rancher's permit or even the closure of his establishment.

Instructions on crocodile ranching have been drawn up by the Direction des Eaux et Forêts and are currently being published in the form of a reference manual.

- 42. <u>International</u>: Since it became a Party to CITES, the Democratic Republic of Madagascar has strictly enforced the provisions of CITES. Trade and exportations are submitted to the procedures laid down by CITES; that is to say, skins are tagged and export permits approved by CITES are issued before exportation is authorized.
- 43. <u>Additional Protection Needs</u>: The rational management of the species through ranching, governed by the guidelines published by the Direction des Eaux et Forêts and other legislation, can be considered the best existing method for the conservation of Madagascar's crocodiles, and one which will safeguard the crocodile populations.

The only supplementary measures that need to be taken, therefore, are stepping up surveillance and, more importantly, organizing a permanent observation of the evolution of the crocodile populations.

## 5. Information on Similar Species

This is not applicable as the Nile crocodile is the only existing crocodile species in Madagascar.

## 6. <u>Comments from the Countries of Origin</u>

It should be noted here that Madagascar's African neighbours, the United Republic of Tanzania, Malawi, Zimbabwe, Zambia and Mozambique are also considering similar breeding systems for their Nile crocodile populations.

Therefore, it seems that this species should be permanently listed in Appendix II of CITES.

## 7. Additional Remarks

It was at the end of 1989 that Madagascar, which already had two operational breeding farms approved by CITES, embarked on a ranching programme. With the help of the FAO, and later the UNDP, the pilot programme for crocodile breeding was set up, as well as a training and information programme.

The first year of the pilot programme demonstrated its economic, socioeconomic and ecological viability.

Ideal crocodile habitats were found, ranchers were trained, egg collections were organized in collaboration with the rural people, and an overall management system was effected by the Direction des Eaux et Forêts.

The existence of an operational breeding farm based on this system, and with 2,000 baby crocodiles living in excellent conditions, demonstrates the feasibility of continuing the programme in a satisfactory manner.

# 8. <u>Government Policy on Crocodile Breeding</u>

Since the establishment of the ranching programme in Madagascar, the government has kept a close watch on all activities pertaining to crocodiles in order to evaluate the impact on the country's crocodile population and therefore confirm its profitability.

From the biological point of view, ranching increases the crocodile's chances of survival in the wild. In fact, only a very low percentage (3% to 5%) of newborn crocodiles survives in the wild, while on ranches there is a very high hatching rate (at least 85%) and a high survival rate (at least 80%). Ranching, therefore, guarantees the survival of a large number of newborn crocodiles which would not normally survive in the wild and makes an important contribution to the potential exploitation of the crocodile population.

Moreover, the programme of reintroducing into the wild 5% of the hatched crocodiles or 10% of the one-year-old crocodiles raised from babies captured in the wild is another measure contributing to the stability of the wild populations.

The main aim of the programme is to promote crocodile ranching in Madagascar as well as to guarantee an uninterrupted supply for an enduring resource.

Ranching also creates employment in rural areas bringing about an improvement in living standards for the rural population.

#### 9. <u>The Tagging System</u>

If Madagascar receives the support of the Conference of the Parties for its proposal to keep its crocodile population in Appendix II, it will adhere to the recommendation of Resolution Conf. 3.15 concerning the tagging system for crocodiles from breeding ranches. All exportation of crocodiles and their by-products will be carried out under cover of CITES export permits and the correct tagging.

#### 10. <u>Reasons for the Request</u>

The management of the Nile crocodile (<u>Crocodylus niloticus</u>) population in Madagascar has reached the point where it is in the country's economic interest to insist on appropriate management of the species.

At this critical stage, the CITES Management Authority in Madagascar, the Direction des Eaux et Forêts, needs help and is calling on the Conference of the Parties to support its proposal to keep its crocodile population in Appendix II, so that trade in products from ranched crocodiles bred on ranches will benefit the national economy.

In this way, management of the crocodile population will continue to benefit from both the support of the political authorities and the indispensable support of the public, thus guaranteeing the survival of the species in its natural environment.

Finally, in order to strengthen ties between the operators and the government, and establish a deeper understanding of all parties concerned, the Malagasy

Government is preparing an instruction manual for the management of Madagascar's flora and fauna.

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Olivier BEHRA (Chef du projet crocodiles à Madagascar Labo. des Reptiles et Amphibiens Museum Nat. d'Hist. Nat. 25 rue Cuvier 75005 Paris

Object: reply to comments made by the World Conservation Monitoring Centre on the proposal for ranching of the Nile crocodile in Madagascar.

Dear Sir,

Given the complex socio-political situation in Madagascar and the probability that this has prevented the authorities concerned from replying to your letter of 20 August 1991 to the Directeur des Eaux et Forêts concerning Madagascar's proposal for ranching for the Nile crocodile, may I make a few remarks that I hope will be useful in supporting the Malagasy proposal and in helping the authorities responsible for judging its validity to appreciate its importance.

\* First, I would like to draw your attention to an extract from my report to FAO (written before the latter's approval) on the subject of crocodile populations:

"2.1 POTENTIAL OF CROCODILE POPULATIONS

To highlight the importance of the collected data, it is essential to recall here some of the basic information acquired on the crocodile populations in Madagascar during the censuses that preceded the project for the development of crocodile ranching and during FAO's TCP Project.

It was right at the beginning of the sixties that interest was first shown in Parker and Graham's censuses of the Nile crocodile (*Crocodylus niloticus*) populations in Tanzania.

There are several special techniques for counting crocodiles: either nocturnal counts on lakes and rivers with the aid of spotlights (which reflect in the crocodiles' eyes), or aerial counts carried out from light planes. No animal population census is ever exact, of course; it can only be an estimate. The quality of a population estimate is judged by its accuracy and precision. The degree of accuracy is the relationship between the real size of the population and the estimate. Inaccuracy is caused by the impossibility of seeing all the animals to be counted. A lack of precision results from possible variations in the counts due to chance or other factors.

Be that as it may, if an estimate always reflects the same proportion of the real population, it can be used as an indicator of the size of that population. In fact, any change in the population will be reflected by this indicator. For these indicators to be useful, however, it is imperative to evaluate their accuracy.

The first censuses of crocodile populations in Madagascar were carried out at night by Behra in 1987.

Every census method has its advantages and disadvantages. For different reasons, though, particularly as some groups and areas are inaccessible by either land or boat, aerial censuses have generally proved to be the most reliable for the scientific community. This holds true for Madagascar, especially in view of its traditional

record of pressure from hunting and the subsequent withdrawal of the remainder of the crocodile population into the most remote areas.

This is why the census work continued by Behra and Hutton in June 1988 and by Behra in October 1988 was mainly carried out from the air.

The size of any crocodile population, of course, cannot be determined on the basis of one sole census. This especially applies to a study of crocodile populations in an area as large as Madagascar. During the whole of 1988, in fact, more than 2,500 kilometres of river were studied from low-flying planes, and this only covered the west of the country, an area recognized as the most suitable region for crocodile populations.

As mentioned above, most of the problems connected with crocodile population management can be resolved by using relative density indicators considered in linear relationship with the absolute density. The latter, therefore, is of scarcely any interest by itself.

If census techniques are rigorously standardized, one can, theoretically, follow the evolution of crocodile populations by referring to the relative density.

This was the case in 1988 when the main aim of the census expeditions was to acquire a basis for continuing the study of crocodile populations and to make an analysis of their evolution possible.

Similarly, when keeping track of the populations, interesting data can be collected by studying their birth rate and its evolution by recording the number of clutches. This explains why information on the clutches was collected during the egggathering period in the wild.

With the exception of high-lying areas, virtually the whole of Madagascar offers the crocodile populations a favourable habitat. Due to demographic pressure, however, the eastern part of the country is no longer of much interest. Prior to the crocodile ranching development project, only very small crocodile populations had been observed on the Pangalanes canal and the MANINGORY, a river further to the north. The most favourable areas for crocodiles are situated in the west and north-west of the country.

The first aerial counts carried out on the large rivers in the west, however, in general revealed rather light population densities.

So, well equipped with all the data gathered in 1988 but restricted by the means available, the censuses were directed towards very precise areas, but only after a thorough study had been made.

In general, the crocodile populations observed previously were not only sparse, they were also unevenly distributed. Following a study of the factors that can influence variations in crocodile populations, in particular those connected with their environment (climatology, hydrology, the presence of human populations, etc.), the censuses were directed towards 4 potentially interesting areas:

- The MANGOKY had been studied from the air three times before (by Hutton and Behra in June 1988, and twice by Behra in October 1988). As large crocodile populations had already been sighted there, a fourth aerial survey was carried out. An average population density of only 0.27 crocodiles per kilometre was registered, although the censuses were conducted at a favourable period (dry and cold); but this is not really a representative figure as large differences in population density were observed depending on the section of river. Some of these sections, therefore, would offer an interesting potential for ranching.

The counts carried out in July 1990 showed a very slight variation in population density and the same comments apply.

- An aerial survey of the MAHAVAVY had already been made in June 1988 over a 65-kilometre stretch upriver from Namakia. Considering that the river offered a potentially very interesting biotope, surprisingly low population densities (0.04 crocodiles per kilometre) were observed.

This time, therefore, it was decided to carry out an aerial survey concentrating on an isolated stretch further upriver between Kandreho and Sitampiky (140 kilometres long). Very interesting population densities of crocodiles were observed, in fact, with a rough average of 0.52 crocodiles per kilometre being registered. Taking into account the river's sinuous form, though, it can be estimated that the area under observation represented scarcely more than 50% of the total habitat.

- The MANINGOZA, an average-sized river, had never been the object of a census. Based on the results and analyses of other censuses, as well as the maps of the country, this river too seemed to present extremely interesting possibilities, despite being relatively unimportant. In the region north-east of Marovoaykely, it was observed that there were, strictly speaking, very few crocodiles. On the other hand, crocodiles were sighted during aerial observations of the lakes. There are many of these small lakes and, here and there along a five to sixkilometre stretch of the river, about a dozen crocodiles large enough to reproduce were sighted in them. In this type of habitat, of course, it is quite probable that a census of less than 30% of the favourable biotope was carried out.
- The SAMBAO had never been studied from the air either and, like the Maningoza, is bordered by small lakes. Good-sized crocodiles have been sighted along certain stretches of this river, but very unevenly distributed. Few of the adjacent lakes have been surveyed from the air but, if some large lakes like Lake AMPARIHY have very flat shores and are thus of relatively little interest for crocodiles, a group of 9 breeders was sighted during aerial observations of one little lake less than 200 metres long.

As mentioned before, even if the data collected on Madagascar's crocodile populations are not reliable enough to determine their real status with any scientific exactness, a simple analysis of these figures will still be carried out so as to give an idea of the potential crocodile populations for ranching.

Important rivers such as the MANGOKY (575 kilometres long), the MANANBOLO (258 kilometres long) and the MAHAVAVY (more than 200 kilometres long) are therefore of substantial interest.

For example, while the population densities on the MANGOKY are distributed unevenly, observers still noted a basic average of 0.27 crocodiles per kilometre. By comparing this figure with the counts made on other rivers with relatively similar environments, such as the SOPHIA and the BEMARIVO, where nocturnal and aerial counts have been compared, the population densities on the MANGOKY, adjusted in this way, are considerably higher. In fact, when these comparative counts were made, only 10% of the animals sighted at night were sighted during the day from the air. As a result of Hutton's comprehensive studies on counting the Nile crocodile (Crocodylus niloticus) in Zimbabwe, he and Woolhouse discovered that, during the nocturnal counts, between 10% and 63% of the animals were sighted. Although the observations carried out in Zimbabwe can in no way be applied to other regions and biotopes, one can still safely assume, by following these different observations, a minimum population density of 4.2 crocodiles per kilometre on the part of the MANGOKY that was surveyed (180 kilometres). Over the most interesting stretch the 80 kilometres downstream from the river Siliky - the population density reaches 9.2 crocodiles per kilometre.

While rough calculations of 0.52 crocodiles per kilometre have been made along approximately 140 kilometres of the MAHAVAVY river, between Kandreho and Sitampiky, only 50% of the habitat can be considered as having been surveyed. By following the same principles, therefore, a population density of 16.5 crocodiles per kilometre has been estimated. Here again it should be noted that the largest population densities were sighted over the 20 kilometres of river bordering the special Kasijy reserve.

While the rough average population density observed during the aerial counts along the MANANBOLO was only 0.11 crocodiles per kilometre, higher population densities have been sighted along some smaller 15 to 25-kilometre sections, such as the 15-kilometre stretch between Tsianaloka and Tsionga. Based on the meticulous observations carried out on the lakes adjacent to the river, population densities reaching at least 23 crocodiles per kilometre along the 15-kilometre stretch mentioned above have been estimated. The minimum population density estimate along the whole 165-kilometre stretch under observation, however, remains at only 1.75 crocodiles per kilometre.

It should be pointed out that the estimates given above are minimum estimates (particularly those on the MANANBOLO) and are completely reliable.

The work carried out during the 1990 crocodile egg collecting campaign as part of the UNDP/FAO/MAG/90/011 project has largely confirmed that these figures can be used with total confidence.

Due, in fact, to the sinuous nature of such rivers as the SAMBAO and MANINGOZA and the smallness of the adjacent lakes, aerial observations have estimated rough population densities of only 0.29 crocodiles per kilometre over 75 kilometres of the SAMBAO and 0.52 along 50 kilometres of the MANINGOZA. But many more nests than animals were observed, especially on the MANINGOZA, where only 26 adult crocodiles were sighted (24 on the adjacent lakes and 2 on the river) compared to 78 nests, 54 of them along one 6.5-kilometre stretch of the river.

The first observations suggest that the crocodiles which were sighted had trouble reproducing because the slopes of the lake shores are very gradual and liable to flooding and the animals were therefore regrouping in specific breeding areas.

A large number of the nests had already been destroyed (most of them by man). This underlines the extreme importance of involving the local people in a ranching programme for the management and conservation of the crocodile. Thirty nests were collected in the region of Besalampy, with an average of 38 eggs per nest, margin of error 7.94, the minimum being 27 and the maximum 60.

Compared to the average clutches of Nile crocodile populations already known (Greer A.E. 1975, 60.4 eggs per nest), the Malagasy averages seem rather low. This would suggest a population of relatively young female breeding stock building up again after exports were stopped in 1975 but, at the present stage of research, such an interpretation is far from certain.

Almost 2,000 eggs were collected in three weeks in the region of Besalampy without any prior knowledge of the breeding sites.

Taking into account, therefore, the number of nests destroyed and the time spent looking for the eggs, around 6,000 could have been found in the same area during this collection period.

It is probable that, in the whole region of Besalampy (SAMBAO, MANINGOZA), from Ankasakasa to Soalala (MANOMBA) and Cape St.-André, there is easily a potential of 15,000 to 20,000 eggs.

In the region of Antsalova further to the south, 800 eggs were collected along one small part of the SOAHANY River (approximately 50 kilometres long) by the project's national expert.

It can be estimated that the region of Antsalova (excluding the MANANBOLO) will ultimately yield a potential of 5,000 eggs.

Throughout this western region, therefore, between the MAHAVAVY and MANANBOLO Rivers, there is a minimum potential of 20,000 to 25,000 eggs (with varying degrees of accessibility).

Investigations remain to be carried out in other parts of the country, particularly in the north as interesting population densities of crocodiles have already been sighted along certain rivers (the MANANJEBA) and lakes in the region of Vohémar as well as further north.

Be that as it may, it is now quite clear that there is a definite potential in Madagascar for crocodile ranching. Moreover, considering man's widespread destruction of crocodile nests (more than 60% of those sighted), involving the local people in a ranching programme can only benefit crocodile conservation.

The prevailing socio-political situation in Madagascar in July 1991 (July being the most suitable period for aerial censuses) made it impossible to continue with the censuses and to expand the information on the potential of crocodile populations. Unfortunately, therefore, a map of the potentially interesting areas for crocodile ranching will be based solely on the information gathered before July 1991, and this, we know, is incomplete. The census taking will have to be continued."

It is important to take into account that : a) the collection of enough satisfactory information on crocodile populations to estimate their present size would necessitate, in the case of Madagascar, substantial means and considerable time, and it is conceivable that this is not one of the most important elements in the conservation of the country's crocodiles; b) the information gathered, particularly during egg collecting, has made a certain amount of data available which will help to evaluate

trends among crocodile populations, and it should be possible to gather extra data during each subsequent collection, thereby permitting a follow-up study, at least in the areas recognized as most suitable for crocodiles.

- \* There is no doubt that, at present, local trade is almost unchecked and the degree of law enforcement depends on the government. It should be noted, however, that thanks to WWF's "Debt for Nature Swap" project, the Direction des Eaux et Forêts will henceforth benefit from nine wildlife officers assigned to the town of Antananarivo (where the largest amount of the country's fauna and flora products are sold), and they will be responsible for the monitoring of, among other things, local trade.
- \* Setting up a ranching programme should entail a reinforcement of the existing laws, especially the law stipulating that each local seller of crocodile products must display a sign that it is illegal to export these products. The authorities should certainly be encouraged to take steps in this direction.
- \* All the animals taken to ranches will be identified and registered (there are specific periods for collecting eggs and hatchling crocodiles, which must be strictly adhered to). Each ranch, duly approved by the Direction des Eaux et Forêts, is responsible for keeping an accurate register of animal stocks on the basis of the numbers registered at the end of the collecting season, and for writing monthly reports for the Direction des Eaux et Forêts. In this way, the Management Authority will have up-to-date information on each ranch's stock of live and dead crocodiles and will be in a position to carry out appropriate inspections to make certain that no animal from the wild has been added. Measures will be taken to ensure that officials from the Direction des Eaux et Forêts are advised when crocodiles are to be slaughtered so that they can be present to verify that export tags have been put on the ranched animals.
- \* Two different reasons can be given for man's present destruction of 60% of all the crocodile nests in Madagascar: first, due to difficult living conditions, some groups are starting to eat crocodile eggs; secondly, people living in the vicinity of crocodile populations see no advantage in their conservation, the complete opposite in fact. In their eyes, the crocodile is simply a creature that kills their livestock and poses a physical threat to man. This explains why, even if the law has changed and the crocodile is no longer classified as a pest animal, in practice rural people continue to destroy their nests with the aim, understandable in the circumstances, of fighting to prevent their proliferation. And here we find ourselves face to face with one of the crucial points in a crocodile conservation programme in such a country as Madagascar: that the means at the authorities' disposal coupled with the size of the country make any enforcement of the law totally impossible. Field studies concluded, therefore, that the only way to successfully save the crocodile and its nests in these remote areas was to give it an economic value.

So, with the ranchers buying nests from them, the villagers, who know where to find crocodile nests, have every reason for not destroying them; as they collect the eggs in any case, it is in their interest to be paid for it. This policy, moreover, is aimed at encouraging the local people to regard the crocodiles as a renewable natural resource and at making them allies in the struggle for crocodile conservation on the assumption that they will have to protect the breeding crocodiles if they are to continue selling the nests. One can also hope that, with the revenue generated, the villagers will take measures themselves that will limit the risks connected with

crocodiles (constructing bridges over the rivers, discontinuing the cultivation of certain low-profit crops on the banks of crocodile areas and planting them some distance away, etc.).

To conclude, it is quite apparent that our knowledge of crocodile populations is incomplete and that there is a lot of work to be done to set up both a management programme and the mechanism for the delicate and important task of controlling local trade, and that the local authorities should do something about all this very quickly. Be that as it may, the development programme for ranches has worked satisfactorily on an experimental basis at all levels adhering to criteria recognized internationally, and it seems quite clear that its broad application is the best solution for working towards crocodile conservation in Madagascar.



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