Crocodile Conservation Action

A Special Publication of the Crocodile Specialist Group of the Species Survival Commission of the IUCN- The World Conservation Union.

1992

Compiled by James Perran Ross, Executive Officer, CSG
Florida Museum of Natural History
Gainesville, FL 32611, USA.

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Rue Mauverney 28
CH-1196 Gland
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FOREWORD

In March 1992 the Crocodile Specialist Group published its ACTION PLAN for the Conservation of Crocodiles, culminating several years work gathering and collating information on the status and conservation needs of crocodilian species worldwide. The ACTION PLAN, as well the process of preparing it, focussed the activities of the CSG on several crocodilian species that were judged to be the highest priority for conservation action and stimulated a flurry of activity on these species. As a result a number of field inspections, surveys and assessments were conducted during 1991 and 1992 that have resulted in immediate advances in the conservation of crocodilians.

These activities were conducted by CSG members under the auspices of the CSG, in many cases in close collaboration with the Secretariat of CITES, and supported by a variety of governmental and private donors. Each of these field activities was followed within days by the production of a report making recommendations on which further conservation could be based. The very rapid production of the results of these surveys has greatly facilitated the prompt reaction of the CSG and other conservation bodies to immediate conservation issues. Each of these reports has been previously distributed to cooperating agencies, sponsors and the governments of countries involved and circulated within and outside the CSG. Nevertheless, it was thought advisable to give these reports a wider circulation in order that the important results and recommendations that they contain can receive the widest possible distribution and effectiveness. A generous donation from Mr. Utai Youngprapakorn, of Sumatprakan, Thailand, has made possible the production and distribution of this volume. The reports for CSG field activities in Cuba, Honduras, Thailand, Indonesia, China, Philippines, Vanuatu and Paraguay are reprinted here without amendment.

The CROCODILE ACTION PLAN provided a background and focus for conservation of crocodiles, but conservation in the modern world is a rapidly advancing and constantly variable field. Our ACTION PLAN is a dynamic working document that will be constantly updated. These reports constitute the immediate implementation of CSG ACTION PLAN recommendations. The ability to identify, assess and respond to problems in a prompt manner is of inestimable value in winning the race for the conservation of species and habitats. This collection of reports demonstrates the success that can be achieved by the effective coordination of government agencies, NGO's, donors, Specialist Group experts and Management Authorities to respond rapidly and effectively to conservation needs.

Professor Emeritus H. Messel, Chairman CSG, Sydney, November 1992.

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CROCODILIAN MANAGEMENT IN THE PEOPLE'S REPUBLIC OF CHINA - A REVIEW WITH RECOMMENDATIONS

by

Grahame J.W. Webb

Vice-Chairman IUCN Crocodile Specialist Group
(Eastern Asia, Oceania, Australasia)
G. Webb Pty. Limited
P.O. Box 38151
Winnellie, N.T. 0821
Australia

and

Brian Vernon

Deputy Vice-Chairman IUCN Crocodile Specialist Group
(Eastern Asia, Oceania, Australasia)
Mainland Holdings Pty. Limited
P.O. Box 196
Lae, Papua New Guinea

20th February, 1992

Contents

1. Introduction

The Chinese Alligator, Alligator sinensis, is restricted to mainland China and is generally considered one of the world's most endangered crocodilians (Groombridge 1982, 1987). Alligator sinensis is on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and is classified as "endangered" by the International Union for the Conservation of Nature and Natural Resources (IUCN) (Groombridge 1982). It appears that the status of the species has declined steadily since the 1800's, as more and more wetlands were converted from their natural state to meet the needs of agricultural food production (Huang et al. 1986; Chen 1990a). The rate of conversion increased greatly in the 1960's and 1970's, when the human population of China increased dramatically (Chen 1990a).

In the late 1970's, the Chinese Government started a program aimed at reversing the species' declining status. This involved the establishment of a captive breeding research centre [Anhui Research Center of Chinese Alligator Reproduction (ARCCAR)], the protection of the species by law, the initiation of a variety of research programs (e.g. Chen et al. 1985), the declaration of a Chinese Alligator Reserve, and the implementation of a program of surveying remnant wild populations within the Reserve (Huang et al. 1986; Chen 1990a; Anon 1991).

Captive breeding within ARCCAR has purportedly been highly successful (Anon 1991) and China is now seeking registration of ARCCAR as a commercial captive breeding operation for A. sinensis. Their proposal to the 8th Conference of Parties to CITES (Kyoto, Japan; March 1992) was given to the IUCN Crocodile Specialist Group (CSG) for appraisal, and it was discussed at length at a CSG Steering Committee meeting in Santa Marta, Colombia (9-11 November 1991).

The CSG resolved to approach the People's Republic of China with regard to a fact-finding mission by the Vice-Chairman (GW) and Deputy Vice-Chairman (BV) responsible for Eastern Asia. This was subsequently co-ordinated through, and arranged by, Professor Wang Sung, Executive Vice-Chairman of the Endangered Species Scientific Commission (Chinese Academy of Sciences), and Dr. Qing Jian Hua, Deputy Director of both the Conservation Department and the Endangered Species of Wild Fauna and Flora Import/Export Administration Office (Ministry of Forestry).

Dr. Dietrich Jelden (CSG) secured funding for GW through the Internationaler Reptilleder Verband of Germany, and funding for BV was provided by Mainland Holdings Pty. Limited of Papua New Guinea. The mission was undertaken 5-19 January 1992 (Itinerary, Appendix 1).

2. Background

2.1. Historical Resume

In addition to A. sinensis, it appears that the Saltwater or Estuarine Crocodile, Crocodylus porosus, once inhabited the extreme south-eastern corner of China. The extent to which C. porosus actually bred in the region, or were represented by dispersing individuals from Vietnam and/or Cambodia is unknown. They are extinct in China today and may have been for many years (Pope 1935).

Information on the distribution and abundance of A. sinensis in China comes from four primary sources: the fossil record (Xu and Huang 1984; Chen 1990a); ancient Chinese manuscripts (Huang et al. 1986; Chen 1990a); early naturalist reports (Cope 1935); and, recent studies and surveys (Huang et al. 1986; Chen et al. 1985; Chen 1990a; Watanabe 1981, 1982, 1986). Much of the information contained in today's general literature (Neil 1971; Guggisberg 1972; Groombridge 1982, 1987; Webb and Manolis 1989; Ross et al. 1990; Grenard 1991) represents extractions from one or more of those sources.

For the purposes of this report, the fossil evidence and ancient Chinese writings are of little significance, although they do indicate that A. sinensis was once far more widespread in China than was apparently the case by the 19th and 20th centuries (Huang et al. 1986; Chen 1990a). The steady shrinking of their range could well reflect climate changes in addition to the obvious impacts associated with habitat loss to agriculture (Chen 1990a).

It appears that in the 19th century A. sinensis was restricted to the lower reaches of the Yangtze River (= Changjiang River), within the Provinces of Hubei, Anhui, Jianxi, Zhejiang and Jiangso (Fig. 1). Surveys in the 1950's indicated that the range had shrunk to the area of junction of Jiangxi, Anhui and Zhejiang Provinces (Fig. 1). This was mainly due to the impact of humans (Huang 1982; Huang et al. 1986; Chen 1990a), as A. sinensis inhabit wetlands within one of China's most fertile areas for agricultural production. Surveys in the 1970's and early 1980's documented an even greater shrinking of the range within the three Provinces (Huang 1982; Huang et al. 1986; Chen 1990a). Watanabe (1986) and Huang et al. (1986) point out that although A. sinensis once occupied lakes, rivers and swamps within its range, the surviving populations were now largely restricted to small irrigation ponds and reservoirs on tree farms, which tended to be in higher altitude country. Such areas may well have been marginal habitat historically.

The conservation program initiated by the Chinese Government in 1979 concentrated on the population in Anhui Province, as this was clearly the largest one remaining in China (Huang et al. 1986; Chen 1990a); it remains so today.

2.2. Biological Resume

Taxonomy. Alligator sinensis is one of two extant species of the genus Alligator, within the subfamily Alligatorinae. The other surving species is A. mississippiensis, the Amercian Alligator, which is found throughout south-eastern USA. With the exception of A. sinensis, all other members of the the subfamily Alligatorinae (i.e. the caimans) are found in Central and South America. Details of the skull structure and scutellation of A. sinensis can be found in Mook (1921) and Pope (1935) respectively.

Size and Appearence. Alligator sinensis is one of the world's smallest crocodilians, with males reaching a maximum of around 2.1 m and females rarely reaching 2 m. The skin contains 28 or less transverse rows of relatively even-sized belly scales between the collar and cloaca (Brazaitis 1987), and in adults these are heavily ossified with a single large osteoderm

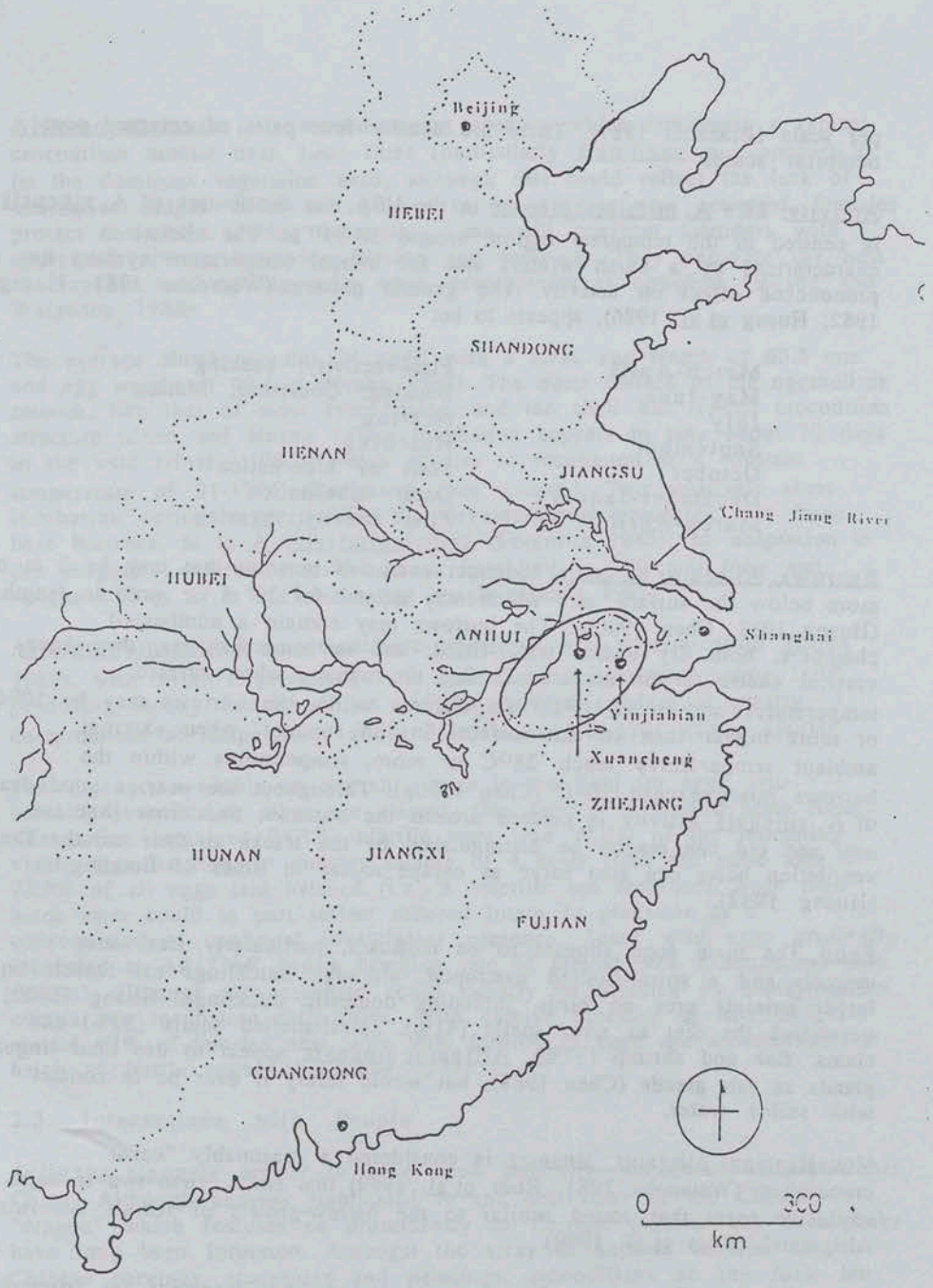


Figure 1. The range of A. sinensis is within the circle. ARCCAR is at Xuancheng.

per scale (Brazaitis 1987). There are usually four pairs of enlarged post-occipital scutes.

Activity. Like A. mississippiensis in the USA, the distribution of A. sinensis is centred in the temperate region, around 30-31° N. The climate is characterised by a harsh winter, and the annual temperature cycling has a pronounced effect on activity. The general pattern (Watanabe 1981; Huang 1982; Huang et al. 1986), appears to be:

March-April	First activity; basking
May-June	Basking; Courtship; Mating
July	Nesting
September	Hatching
October	Start of hibernation
December-January	Deep hibernation
March-April	First activity; basking

Burrows. Alligator sinensis construct extensive burrows that may be 2 m or more below the surface, and which may extend for 20 m or more in length (Huang 1982; Chen 1990b). The burrows may contain a number of chambers, both dry and/or water-filled, and in some habitats, they have vertical shafts to the surface. During the winter, when surface temperatures may reach 0°C, temperatures within the burrows may be 10°C or more higher than on the surface. In the summer, when external ambient temperatures reach 28°C or more, temperatures within the burrows rarely exceed 20°C (Chen 1990b). Throughout the year, a good deal of A. sinensis activity is centred around the burrows, and those that are new and old can readily be distinguished by the tracks at their mouth. The ventilation holes can also serve as escape routes in times of flooding (Huang 1982).

Food. The main food appears to be molluscs, particularly freshwater mussels and a spiral-shelled gastropod, although hatchlings eat insects and larger animals prey on birds, including domestic ducklings. Huang (1982) quantified the diet as river snails (41%), spiral-shelled snails (22%) and clams, fish and shrimp (37%). Alligator sinensis appear to use their lingual glands as salt glands (Chen 1988), but would rarely if ever be in contact with saline water.

Vocalisation. Alligator sinensis is considered a reasonably "vocal" crocodilian (Watanabe 1981; Ross et al. 1989) that emits "from two to eight explosive roars that sound similar to the bellow-growls of female American Alligators" (Ross et al. 1989).

Reproduction. The winter dormancy appears to be important for triggering reproductive activity, and captive A. sinsensis maintained at the New York Zoo for many years without breeding did so once a "winter" was simulated (Behler 1986, 1990). Coutship and mating behaviours appear similar to those described for other crocodilians (Huang 1982; Watanabe 1981, 1986), and the population appears to nest in a short pulse (3 weeks) as does A. mississippiensis. This may well be the only three weeks in a year in which embryo survival is possible. If so, climate change over the last few thousand years could well be pushing A. sinensis towards extinction (Chen 1990b), regardless of the impacts caused by people.

Alligator sinensis is a mound-nesting species, which constructs a typical crocodilian mound nest. Leaf litter (particularly Bambusa sp.), appears to be the dominant vegetation used, although this could reflect the lack of alternative sedges, herbs and grasses in the habitats now occupied. Females protect their nest during incubation, and will confront intruders with aggressive actions involving hissing and jumping. They excavate the nest in response to hatchling calls when development is complete (Huang and Watanabe 1986).

The average clutch contains 24 eggs, with a mean egg length of 60.5 mm and egg weight of 44.6 g (Huang 1982). The outer surface of the eggshell is smooth, like that of most crocodilians, and the shell has typical crocodilian structure (Zhao and Huang 1986). Incubation appears to take about 70 days in the wild (Huang 1982), which equates to incubation at a constant temperature of 31-32°C (Zangdong, pers. comm.). This relatively short incubation period suggests that the developmental processes may have been hastened, as in A. mississippiensis (Ferguson 1985); an adaptation to the temperate environment. The mean hatchling is 200 mm long and weighs 30.2 g; 67.7 % of mean egg weight (Huang 1982).

Alligator sinensis has temperature-dependent sex determination (Chen 1989), with 33-35°C producing 91% males, and temperatures below 28°C producing mostly females (Chen 1990d). Embryo survival is greatly compromised at temperatures above 36°C and below 27°C (Chen 1990d).

Few data are available on mortality rates in the field for eggs, post-hatching juveniles or other age classes. One sample of 5 wild nests from Zhang Cun contained 24.3% infertile eggs, and 72.0% of the remaining viable eggs hatched. In another sample of 4 nests from the same area, 75.9% of all eggs laid hatched (i.e. % infertile not recorded). Such high hatch rates could in part reflect reduced losses to predators as a consequence of continual investigator presence. Some wild eggs artifically incubated at ARCCAR had a hatching rate of around 30% (Zhengdong, pers. comm.), although this estimate could equally be affected by transportation effects and incubation difficulties. With captive breeding at ARCCAR, around 67% of females nest, with 90% fertility of eggs and around 95% hatch of fertile eggs (Zhengdong 1989).

2.3. Interactions with People

Alligator sinensis appear to have been generally considered vermin within China. Although perhaps implicated in the derivation of the Chinese "dragon" which features so prominently in Chinese culture, any such links have long been forgotten. Amongst the array of animals featured in Chinese carvings, sculptures and paintings, crocodilians of any form are almost totally absent. Although A. sinensis prey on domestic poultry (particularly ducklings), it is their burrowing habits (Chen 1990a) which cause most concern. Burrows can and do lead to the draining of fields that are flood irrigated, and are implicated in the breakdown of levy banks constructed to control flood waters. In 1870, A. sinensis were specifically blamed for the breakdown of flood mitigation banks in the Nanking area, which resulted in large loss of human life. This in turn stimulated attempts to eradicate A. sinensis in the region (none exist there today). It appears that A. sinensis was rarely used for food, but was used (minced) to feed ducks (Anon 1991) and was cooked for pigs (Lu Chang Liu, pers. comm.).

2.4. Enforcement

Within China, A. sinensis has been included in Category 1 of the Protected Wildlife Species since 1972 (Anon 1991) and is protected by the "Order Strictly Protecting Certain Wild Animals, 1983" (Klemm and Navid 1989). They are currently protected under China's CITES enabling legislation, the Wild Animal Protection Law of the People's Republic of China, enacted on 1st March 1989.

Enforcement of wildlife legislation within China is complex. At one extreme, the death penalty exists and has been applied to offenders, whereas at the other, many species of wildlife are used for food in rural areas despite protective legislation. With A. sinensis, the populations within protected areas appear to be receiving effective protection where conservation projects are being actively pursued. It may be many years before this public support is widespread throughout the range of A. sinensis.

3. CITES

The People's Republic of China acceded to CITES on 8 January 1981, and passed their enabling legislation on 1 March 1989. Alligator sinensis was on Appendix I of CITES at the time China acceded, and is now on Schedule I of the Wild Animal Protection Law of the People's Republic of China. This prohibits the killing, possession of, or trade in A. sinensis or products derived from them, without a permit issued by the Department of Conservation, Ministry of Forestry.

The current proposal to the 8th Conference of Parties at Kyoto, Japan, seeking registration of the first commercial captive-breeding operation for an Appendix I species, follows the format outlined in Conf. Resol 7.10, paragraph (g). The proposal involves compliance with an array of Articles and Conf. Resolutions, the most significant of which are listed below:

> Article II.
>
> 1. Appendix I shall 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 authorised in exceptional circumstances.
>
> Article VII.
>
> 4. Specimens of an animal species included in Appendix I bred in captivity for commercial purposes ... shall be deemed to be specimens of species included in Appendix II.
>
> Conf. Resol. 2.12
>
> b) that the term "bred in captivity" be interpreted to refer only to offspring, including eggs, born or otherwise produced in a controlled environment ... of parents that mated or otherwise transferred

gametes in a controlled environment ... The parental breeding stock must be to the satisfaction of the competent government authorities of the relevant country:

i) established in a manner not detrimental to the survival of the species in the wild;

ii) maintained without augmentation from the wild, except for the occasional addition of animals ... to prevent deleterious inbreeding... ;
iii) managed in a manner designed to maintain the breeding stock indefinitely.

...A parental breeding stock shall be considered to be "managed in a manner designed to maintain the breeding stock indefinitely" only if it is managed in a manner which has been demonstrated to be capable of reliably producing second-generation offspring in a controlled environment;

d) that the competent government authorities of countries exporting live animals, parts and derivatives of specimens bred in captivity of species listed in Appendix I endeavour, where possible, to ensure that these can be made identifiable by means other than documentation alone.

Conf. Resol. 4.15

a) that Parties provide the Secretariat with any appropriate information on operations occurring in their territories which regularly breed in captivity, for commercial purposes, specimens of species included in Appendix I to which Article VII, paragraph 4, of the Convention applies ... .

c) that Parties reject any document granted under Article VII, paragraph 4, of the Convention, if the specimens concerned do not originate from an operation duly registered by the Secretariat;

... the Secretariat to compile and update a register of the operations which breed specimens of species included in Appendix I in captivity for commercial purposes ....

Conf. Resol. 6.21

b) ... the first commercial captive breeding operation for an Appendix I species be included in the Secretariat's Register only by approval of two-thirds majority vote of the Parties...

Conf. Resol. 7.10.

a)
ii) for species that are so critically endangered that their survival does depend on a captive-breeding programme, then commercial captive-breeding operations should not normally be considered, unless they make use of specimens that are surplus to those needed for the preservation of the species...

b) ... the proposal document that the species has been bred reliably to at least the second generation (F2) in captivity;

c) ... the operator describe the measures that will be taken to recognize and avoid deleterious inbreeding;

d) that 1) captive-bred specimens, and 2) gametes or embryos collected without detriment to the wild population may be authorised by the Management Authority for addition to the breeding operation at any time;

4. Current Management

That the status (distribution and abundance) of A. sinensis in China was declining was apparent in the 1930's (Cope 1935) and in the 1950's when a number of surveys were conducted (Huang et al. 1986; Chen 1990a). However, it was not until surveys in the 1970's and early 1980's (Huang 1982; Huang et al. 1986) that the full consequences of the decline - the likely extinction of A. sinensis in the wild - was recognised.

The recovery program was planned in the late 1970's and implemented in the early 1980's (Watanabe 1981, 1982, 1986). The overall strategy was to concentrate the rescue operation in the area where A. sinensis was most abundant - south-eastern Anhui Province - rather than spread resources thinly over the complete range (which included north-eastern Jiangxi Province and north-western Zhejiang Province)(Fig. 1).

4.1. Anhui Province

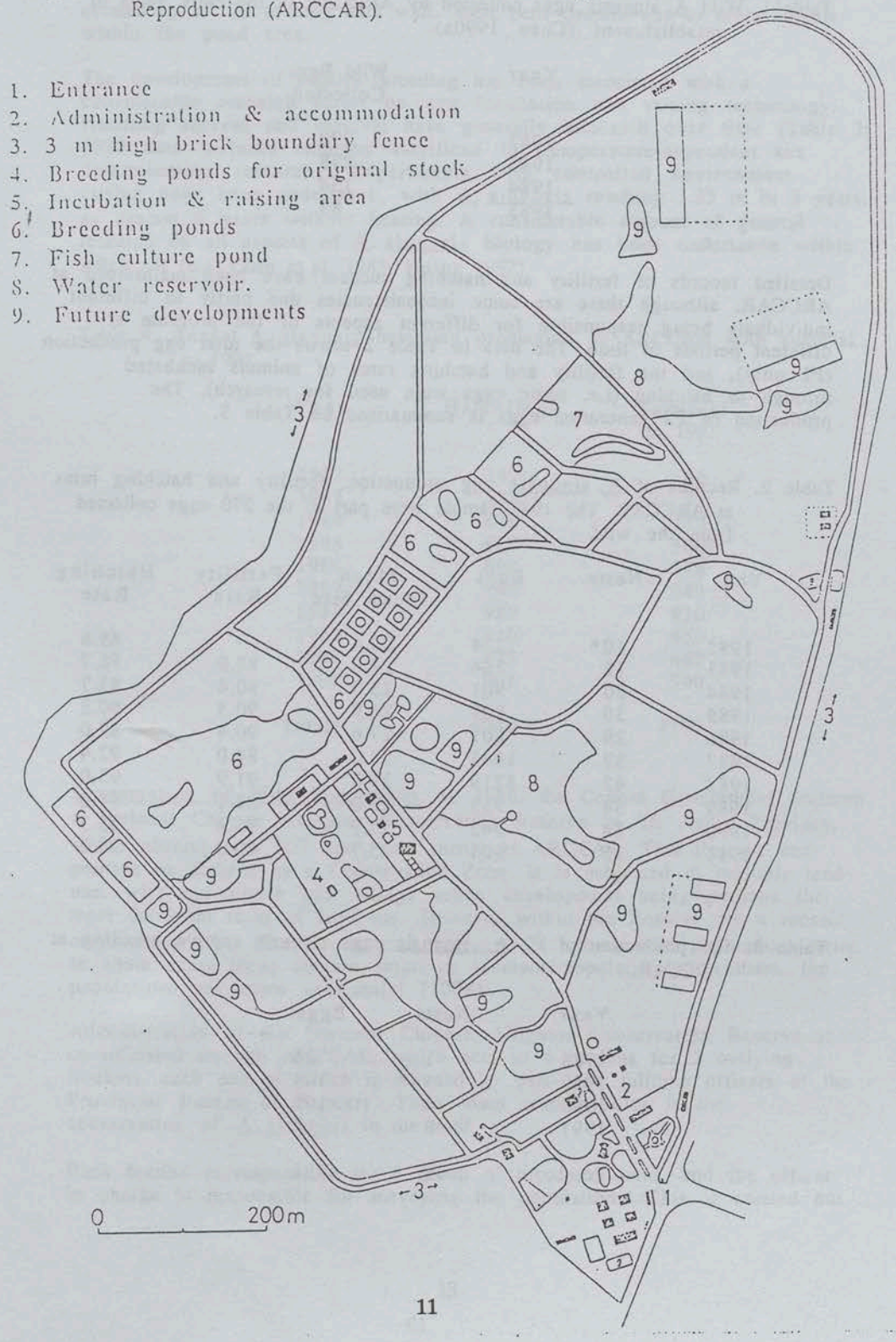
Within Anhui Province, the conservation-management program for A. sinensis involves two separate programs (captive breeding and conservation of wild populations), with various degrees of overlap.

The Anhui Research Center of Chinese Alligator Reproduction. ARCCAR was established in 1979, specifically to prevent A. sinensis becoming extinct. It was a joint project between the Central Ministry of Forestry and the Anhui Provincial Government, and it is managed by the Anhui Provincial Bureau of Forestry.

ARCCAR (Fig. 2) is located 5 km S of Xuanzhou, which is itself about 35 km SW of Wuhu, on the Yangtze River. ARCCAR encompasses almost 1 km^2 of land enclosed within a 3 m high brick fence. ARCCAR contains an impressive array of buildings (museum, conference room, laboratory, visitor accommodation, permanent staff accommodation, incubation and raising building) and ponds, for present and future breeding and raising. There is a permanent staff of around 40 people which includes 5 research staff. Capital works represent an investment of some $US 2 million, and annual running expenses are about $US 60,000.

Foundation stock for ARCCAR came from the wild. In 1981-82 some 212 animals were captured and/or purchased from villagers. These were subsequently housed in a circular pond, then moved to a natural pond complex, where the survivors (160-170) remain today. The ponds are large and well vegetated and captive breeding has occurred annually since 1983. The animals are fed fish, ducklings and rabbit with extra snails and red

Figure 2. The Anhui Research Center of Chinese Alligator Reproduction (ARCCAR).



meat in May-June. In addition to this initial stock, some wild nests were collected annually in the early years (Table 1)(Chen 1990a):

Table 1. Wild A. sinensis eggs collected by ARCCAR in the early years of establishment (Chen 1990a).

Year	Wild Eggs Collected
1982	270
1983	278
1984	154
1985	85

Detailed records of fertility and hatching success have been maintained at ARCCAR, although there are some inconsistencies due partly to different individuals being responsible for different aspects of the program at different periods of time. The data in Table 2 shows the total egg production (F1 only), and the fertility and hatching rates of animals incubated through to hatching (i.e. some eggs were used for research). The production of F2 generation eggs is summarised on Table 3.

Table 2. Records of A. sinensis egg production, fertility and hatching rates at ARCCAR. The 1982 sample were part of the 270 eggs collected from the wild.

Year	Nests	Eggs	Mean Clutch Size	Fertility Rate	Hatching Rate
1982	10*	224	22.4	-	65.6
1983	12	264	22.0	88.9	58.7
1984	20	501	25.0	90.4	83.7
1985	30	809	26.9	90.5	90.3
1986	29	801	27.6	90.4	82.0
1987	37	1045	28.0	84.0	92.4
1988	42	1219	29.0	91.9	95.0
1989	34	955	28.0	92.1	94.0
1990	34	942	27.7	95.4	85.3
1991	35	901	25.7	80.0	90.2

Table 3. The production of F2 A. sinensis eggs through captive breeding at ARCCAR.

Year	Nests	Eggs
1988	1	25
1989	5	143
1990	4	109
1991	9	217
Total	19	484

Total hatchling production and survivorship until 1992 is summarised on Table 4. All progeny have been retained in ARCCAR, with new ponds being built for each successive year class. These range in size from 0.20 to 2.7 ha in size, and have different shapes and configurations. The largest pen is created by a 170 m long dam wall. Most pens contain one or more islands within the pond area.

The development of captive breeding has been associated with a considerable research effort on egg incubation and raising technology. Hatching success and survival have generally increased over time [Table 2; 1990 data includes embryos sacrificed for temperature-dependent sex determination research]. Experiments with controlled environment raising have been undertaken, with A. sinensis reaching 1.35 m in 3 years, as against 5 years without heating. A considerable amount of general research on all aspects of A. sinensis biology has been undertaken within ARCCAR (e.g. Chen et al. 1985; Huang 1982).

Table 4. Annual A. sinensis hatchling production at ARCCAR with survival to 1992.

Year	Hatchlings	Survival to 1992
1982	147	66
1983	237	77
1984	476	117
1985	667	300
1986	694	576
1987	744	649
1988	989	910
1989	510	450
1990	675	462
1991	901	590
Totals	6040	4197

Conservation of Wild Populations. In 1986, the Central Government declared a National Chinese Alligator Conservation Reserve in SE Anhui Province, which encompasses 907 km^2, and surrounds ARCCAR. This Reserve can perhaps be defined as a Conservation Zone. It is subjected to multiple land-use, with agriculture and village urban development being perhaps the most dominant form of land use. However within the Reserve are a mosaic of protected areas (N= 26), up to 3 km^2, where known wild populations exist. In some cases these contain small or remnant populations, in others, the populations are more substantial (100+).

Administration of the National Chinese Alligator Conservation Reserve is co-ordinated through ARCCAR, which acts as a nucleus for 5 outlying Stations, each one of which is manned by part- and fulltime officers of the Provincial Bureau of Forestry. Their main responsibility is the conservation of A. sinensis in the wild.

Each Station is responsible for a group of protected areas, and the officer in charge is responsible for surveying the populations. This is carried out

using 3 main sources of information, which may be integrated to give a final estimate for a particular region: spotlight counts; active burrow counts; and, reported sightings from villagers. The officers at different stations appear to devote different levels of diligence and technology to the surveys. Thus, although some results are at best a guide, others are repeat spotlight counts carried out annually over many years. These data are forwarded to ARCCAR, where they are compiled manually and stored.

Establishment of the protected areas has in some cases involved the resumption of agricultural land, which may involve compensation payments to the families affected. The current ARCCAR program (1992-95) is directed at extending protected areas and rehabilitating natural habitats within them.

ARCCAR estimates that the total wild population within the Reserve is about 800 animals, and that this would be no more than 900 if various survey biases were taken into account. They estimate that within Anhui Province up to 100 individuals could exist in small isolated patches of habitat outside the Reserve, such that the total wild population in Anhui Province is about 1000 individuals.

Detailed survey results were available for Jianxian county, over the period 1982 to 1990 (Fig. 3)(1991 was a year of intense flooding in which few surveys were undertaken anywhere). The results indicate an exponential rate of increase of 0.14 (P= 0.004), which is a mean annual increase of approximately 15% per year over the period 1982 to 1990. These results also indicated a dichotomy in the recovery pattern. Pools which had 7 or less animals when surveyed during 1982 have remained stable or decreased, whereas those which originally contained greater than 7 individuals have increased. This appears to reflect a disparity between what are essentially breeding congregations (major ponds and streams) and water bodies between which are used as transit areas during the active season. The survey data available does not allow quantification of the size and/or age structure of the population.

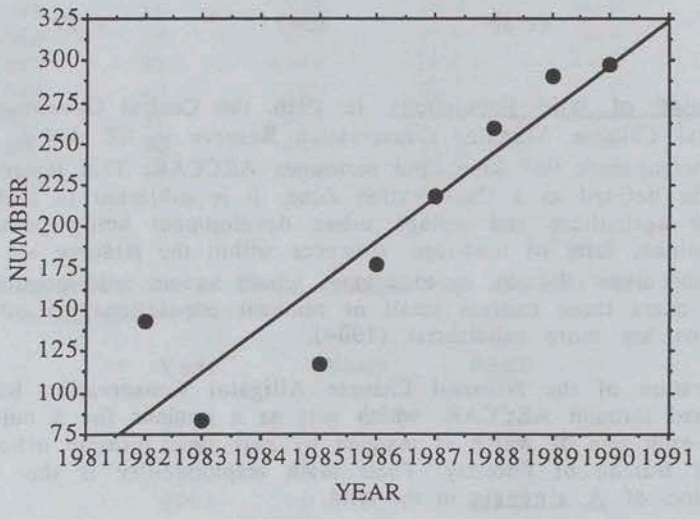


Figure 3. The relationship between numbers of A. sinensis counted in the wild in Jingxian county (Anhui Province) and time.

The extent of nesting that takes place in the wild is unclear, and there are no data allowing the percentage of wild adult females that nest annually to be estimated. At one site visited (Zhang Cun), the standing population is around 55 animals, yet only one nest per year is made. At another site, Shuang Keng, the standing population is around 32 animals in dams next to rice fields, plus 50 in surrounding areas. No nests have been found, but newly hatched animals indicate that nesting does occur. At Yangtan, where the standing population is over 100 animals, only 2 nests per year have been located. Others are suspected to be made within bamboo thickets, but there has been no intensive nest surveys to date.

4.2. Zhejiang Province

Relative to the program in Anhui Province, efforts within Zhejiang Province have been hampered by a lack of resources (i.e. the major emphasis within China has been to protect and re-establish the population in Anhui Province).

Yinjiabian Village Farm. The Yinjiabian Chinese Alligator Protection Area was established by villagers at Yinjiabian Village, 22 km west of Changxing Township, in the NW corner of Zhejiang Province. It comprises 122 hectares, mainly of farmland, and a brick-fenced breeding farm of 0.67 hectares.

Historically, A. sinensis occurred in the wild in and around Yinjiabian Village, but they were basically extirpated by increasing utilisation of land and water for agriculture. The manager of the Protection Area (Mr. Lu Chang Liu) reported that in the 1950's he could remember people killing A. sinensis and feeding them to pigs.

The local villagers started the farm by catching 4 wild adults, when the Government promoted the need to rescue rare kinds of fauna that were facing extinction. It has been operated largely by the villagers (Huang 1988), with some assistance from the Zhejiang Provincial Bureau of Forestry. To our knowledge, there has been no funding from Central Government for the project. Funding is limited, and is partly dependent on donations from visitors. Even small groups of school children save and donate small amounts of money to assist the project, which is widely seen as rescuing the Chinese Alligator in Zhejiang Province.

The farm area has essentially one office and accommodation building, 2 breeding ponds and a series of raising ponds. The original stock (4 animals) appear to have been the last animals in the wild from this region. There have been no further additions from the wild, and the farm's current stocks (N= 118) represent the progeny from cative breeding. One of the original adults died, and the breeding population now consists of 2 females and one male. The first F1 stock are nearing maturity now, and are expected to breed soon.

To date, the only sales of stock from this farm were 10 individuals supplied to the national Forest Park of Giandaohu (Thousand-Island Lake).

Table 4. Alligator sinensis captive breeding results from the breeding farm at Yinjiabian Village. Development time indicates days of first and last hatching within natural nests.

Year	Nests	Eggs	Hatchlings	Development Time Min.	Max.
1984	1	22	10	68	69
1985	1	24	18	52	54
1986	1	25	22	61	62
1987	1	25	14	63	64
1988	1	18	15	60	61
1989	1	21	3	80	83
1990	1	26	26	56	57
1991	2	47	39	58	61
Totals	9	208	147	52	83

Conservation of Wild Populations. Our time in Zhejiang Province was limited to Chanxing County and we were not able to examine any areas where wild A. sinensis may still exist. Huang et al. (1986) presents survey data (collected 1982) for the Anji County within Zhejiang Province, however we could obtain no confirmation that these wild populations are still in existence. On the basis of surveys undertaken in the 1970's and early 1980's, the wild population is still estimated at about 70 individuals (Anon 1991), but there appear to be no recent data. Clearly, the status of wild populations within Zhejiang Province is in need of quantification.

4.3. Jiangxi Province

Surveys in the 1970's and early 1980's revealed a small remnant population in the northermost part of Jiangxi Province, which abutts the Yangtse River (Huang et al. 1986). We did not visit the Province and it appears the status of this population is unknown. Given the increased pressures on land over the last 10 years, it is possible that the remnant population is now extinct.

5. Asessment of CITES Proposal

5.1. General

The proposal to the Conference of Parties seeks registration of ARCCAR as the first commercial captive breeding operation for A. sinensis. This is required under Conf. Res. 6.21, and the suggested format in Conf. Res. 7.10 has been followed. This format does not require details of how the commercial use will be effected.

We can confirm that at this stage no final plan for utilisation has been formulated within China. Various options have been considered generally, but there is virtually no experience with international trade in crocodilians or products derived from them. If the proposal is successful, a plan for commercial utilisation will be derived, and assistance from the IUCN Crocodile Specialist Group has been offered in this endeavour. Clearly, any such trade must conform with the articles and resolutions of

CITES which govern the mechanics of trading, tagging, identification, reporting, etc.

The current proposal should be assessed on the basis of whether ARCCAR meets the articles and resolutions of CITES with regard to the establishment of a commercial captive breeding operation (rather than those to do with the commercial operation itself).

Alligator sinensis is on Appendix I of CITES and throughout much of its former range it is extinct or critically endangered. This situation reflects primarily a land-use conflict. The human population of China is 1.16 billion, increasing at 17 million (1.5%) per year, and the natural range of A. sinensis not only lies within the main area for producing human food, but it depends on a resource (water) that is critical to agriculture.

Recognising this situation, and prior to acceding to CITES, China embarked on a rescue operation concentrated in the remaining stronghold of the species. That this program has been successful is indicated by the grave situation which appears to exist in Zhejiang and Jiangxi Provinces relative to Anhui Province. At least some sections of the wild population in Anhui Province are increasing under the protection strategy, and the total population (wild plus captive bred) is now over 5000 individuals.

The central dilemma facing this program is that the cost of running ARCCAR is becoming prohibitively high. Each year's progeny are maintained until sexual maturity is reached, and with F2 breeding confirmed, the population within ARCCAR is set to increase exponentially in the future. Wild populations within protected areas are themselves increasing, and there are not sufficient protected areas to absorb any major restocking effort. Furthermore, any such effort must be undertaken gradually, and with a high degree of public education and awareness, as A. sinensis is generally regarded as a pest. There is limited utility in restocking for cosmetic purposes.

The 1992-95 program is aimed at further improving the situation in the wild (habitat rehabilitation, etc.), however the captive breeding program will utilise most of the available financial resources. Clearly, a ceiling must be placed on ARCCAR's population growth rate. There would appear to be three options:

a) Greatly increase the budget for A. sinensis conservation in China. This is unlikely, as a high budget is allocated to A. sinensis now, and any increase would be at the direct expense of other conservation projects.

b) maintain the current budget but destroy eggs/hatchlings and reduce the standing population to levels that are feasible to maintain (say 2000 animals), thereby releasing more funds for the acquisition and improvement of wild habitats; or,

c) maintain a standing population of say 4000 animals at ARCCAR, and use all production above that 4000 for commercial trade to generate funds for the A. sinensis project in its entirety.

Option c) is essentially the one chosen by China, and the first step in achieving it is the Registration of ARCCAR with the CITES Secretariat as a commercial captive breeding operation.

5.2. Specific

With regard to specific Articles and Resolutions:

Article II. The situation with A. sinensis would seem to be an exceptional one, in that China has financed and constructed what is clearly one of the world's largest research centres for crocodilians. They have invested heavily in research and now have a production system capable of providing numbers of A. sinensis well in excess of the capacity of the wild to maintain at this stage.

Article VII. For the purposes of international trade, captive bred A. sinensis can be treated as Appendix II animals.

Conf. Resol. 2.12. The captive breeding at ARCCAR meets the definition of "bred in captivity", in that the full reproductive cycle is taking place within a controlled environment. F2 generation breeding is established and the operation is designed such that it can maintain the stock indefinitely, without augmentation from the wild. The establishment stock came from the wild, and some wild caught nests are collected annually to boost the survival of hatchlings. In the short-term this program may have been to the detriment of some local wild populations. By way of contrast, the program has increased the total population of A. sinensis significantly.

Conf. Resol. 4.15. The proposal provides information to the Secretariat on the operation, and seeks registration.

Conf. Resol. 6.21. The proposal provides the information required to the Conference of Parties.

Conf. Resol. 7.10. The proposal seeks support for registration as a commercial captive breeding operation so that a standing population can be maintained indefinitely for conservation purposes; only animals excess to those required will be sold. F2 breeding is confirmed. The populations were founded on what amounts to one-quarter of the existing wild population. They are maintained in large ponds which enhance random breeding between the foundation stock. The Management Authority has authorised the annual collection of some wild eggs to add to the captive population.

6. Future Management - Recommendations

The conservation program for A. sinensis in the People's Republic of China has reached a crossroad. There is now a first-class establishment capable of producing thousands of A. sinensis each year, and there are protected areas in the wild within Anhui Province where the declining status in the wild has been halted. These achievements represent the results of a large and dedicated effort by many people, not to mention the significant budget allocated to the project by Central Government. The central questions now facing the Government are: 1. Where do we go from here; and, 2. How can it be financed?.

6.1. Public Perceptions

That farmers "dislike" A. sinensis is understandable - per capita income is low and A. sinensis represents a financial liability, (although perhaps a small one). This will be a major impediment to any program aimed at increasing the distribution and abundance of A. sinensis in the wild in China, and perhaps there is little that can be done about it.

One approach would be to evict farmers from land (all land belongs to Government) so that it can be converted to additional protected areas for A. sinensis. This has in fact been done to some degree now, but compensation is involved. Such an approach is unlikely to work on any large scale, and without compensation it would drive public opinion against wild A. sinensis even further.

It is difficult to avoid the conclusion that any long-term strategy aimed at improving the status (distribution and abundance) of A. sinensis in the wild must head in the direction of A. sinensis gradually becoming (and being perceived as such), an asset: that is,

1. If A. sinensis is a commercial asset to "someone", not necessarily "everyone" in a community, they will gradually be accepted as an asset rather than a liability to the community (this has occurred in and around ARCCAR and the Zhejiang Farm).

2. If A. sinensis is a commercial asset to China as a whole, and can be used for example to promote tourism, they will gradually be accepted as a national commercial asset rather than a heritage asset and a commercial liability.

Suggested options that may have some potential are:

1. Promote the conservation program nationally and internationally. It can rightly be considered a very significant achievement in the field of international conservation, and there should be more widespread recognition of what has been achieved.

2. Promote A. sinensis within Anhui Province. Can it become an emblem? Teach children about their conservation, biology, utilisation etc.

3. Investigate whether any village level captive breeding or raising is feasible.

4. Promote international documentaries and magazine articles on A. sinensis, and encourage overseas researchers and conservation professionals to participate in joint projects.

5. Create employment opportunities on A. sinensis projects for local villagers.

6. Examine all cases where commercial losses are purportedly due to A. sinensis. Build up definitive data on what A. sinensis does eat in the wild.

6.2. Restocking

Public opinion and attitudes to A. sinensis will determine the success of any restocking program from a "human" viewpoint, but not from a biological viewpoint. It would be cosmetic to simply release animals into an area and "hope for the best". It is suggested that trial releases be undertaken within protected areas with known populations, and that the success or failure of the program be monitored over 2-3 years.

6.3. Collection and Collation of Data

At ARCCAR, a number of different scientists, researchers and managers have been responsible for different aspects of the program during its development. An unfortunate result is that there is no single report available (to our knowledge) that details all the statistics related to both stocking, captive breeding, incubation success, mortality, experiments, etc. As a result, it is difficult to track down exactly what has happened over the years.

Given that the project is now established and may well continue indefinitely, the collection and collation of all past data should be seen as a priority. From that point on, an annual report should update each table, each year.

6.4. The Wild Population

The points raised above, apply specifically to the information available on the wild populations. Series of surveys have been undertaken since the 1950's, and we are unsure whether these data have all been collected and collated in the one repository, such that they can form a standard reference for the future.

Similarly, the general survey program that exists at present is largely the domain of different officers located in the different areas. Although survey records are submitted to ARCCAR, there are questions about methodology and repeatability that should now be clarified. In the first instance, surveys were instigated to locate existing populations and provide some information on their size. This objective has now been superceded by a need to monitor populations tightly, which requires rigid standardisation.

6.5. General Research

The research capacity of ARCCAR, in particular, is impressive. It would be enhanced further by the acquisition of more basic equipment (fax, photocopier, computers). ARCCAR serves now as a major national Centre of crocodilian research, but there is considerable scope for expansion, perhaps through collaborative research with a variety of international researchers and students.

Some of the topics, with management significance, that seem appropriate are:

Food Consumption. Techniques are now available for removing stomach contents and quantifying food types and feeding rates, without injuring

the animals. Such quantification would provide definitive information on the ecology of A. sinensis, but would also allow questions about the impact of A. sinensis on local agricultural communities to be quantified objectively.

Sex Determination. Notwithstanding the results achieved at ARCCAR to date (Chen 1989), there would be utility in quantifying the precise relationship between incubation temperature, sex and post-hatching growth and survival rates.

Minimum Requirements for Breeding. Within ARCCAR and the Zhejiang Farm, breeding ponds are large semi-natural enclosures. Such facilities would be difficult to duplicate at the village level. Yet based on research in Thailand and Australia, single pairs may breed more often and with greater fertility rates, if housed in small pens suited to village construction.

Movement and Dispersal. There appear to be very few data on the movement patterns of adult and subadult A. sinensis in the wild (Chen 1990c) Some of these problems could be resolved by radio-tracking, and if funds are not available internally, it could perhaps be undertaken as a joint research project with someone overseas (who has the equipment!).

Population Dynamics. In order to model the population, data are needed on reproductive rates, mortality rates, immigration rates, emigration rates and sex ratio. Although some of these estimates are available for the wild, others are not and thus the overall dynamics cannot be quantified.

Monitoring Program. Surveys have been conducted by many different people over a long period of time. There is utility in collecting and collating all past survey data, and entering it into a long-term record keeping system to which all future survey results can be added. Support for international trade will depend on the wild population continuing to recover, which in turn will depend on ongoing monitoring.

Controlled-Environment Raising. Current studies should be continued, especially where commercial raising is involved.

Restocking. There is a need to quantify the results of restocking with different aged/sized animals.

Production Model. Model the production aspects of A. sinensis such that the advantages and disadvantages of different management options can be tested objectively.

Over and above research undertaken with A. sinensis, the ARCCAR facilities are such that consideration could be given to expanding the scope to include one or more additional species of endangered animals.

6.6. Commercial Utilisation at ARCCAR

Given CITES approval for registration of ARCCAR as a commercial captive breeding operation, the next step will be to organise the commercial utilisation. In this regard, marketing will be all-important. In our opinion, ARCCAR should aim at maintaining a standing population of say 4000 A. sinensis, and use production over and above this for restocking and

commercial purposes. Maximising the commercial return will involve a well researched marketting plan, and possibly the involvement of international agents. Clearly, a mechanism needs to be found through which the money's generated from A. sinensis are used for the conservation of A. sinensis and the wetland habitats they occupy. The more direct the link between the two, the greater will be the conservation benefits.

We suggest that the following strategies be investigated:

Skins. Market research is required, as the skins of large A. sinensis are strongly ossified, reducing their value. It would seem prudent to get some skins to international tanners, such that their value relative to other crocodilian species can be ascertained. Given the unique nature of the A. sinensis program, consideration should be given to the marketing of a specific conservation product: i.e., the skin may not be as good as another species, but the conservation value of purchasing products made from these skins could be high.

Meat. Market research is required on the value of A. sinensis meat. Given that only small amounts will be available, we suspect that an arrangement could be made with a single international hotel in Beijing, to absorb all A. sinensis meat produced in China. It should be labelled distinctively ("dragon" meat), and the conservation message should accompany it.

Zoos. Alligator sinensis is a crocodilian which tolerates cold conditions well, and thus could be displayed in many temperate areas. In promoting the sale of captive raised A. sinensis to zoos, an effort should be made to ensure promotion of the conservation program for A. sinensis in the wild.

Pet Trade. Market research is required on the extent of the pet trade demand for A. sinensis. To safeguard against escapes in overseas countries, temperature-dependent sex determination could be used to ensure animals exported for the pet trade are of a single sex.

Village Level Production. Every effort should be made to involve villagers in programs aimed at commercial use and production of A. sinensis.

6.7. Zhejiang Province

The situation with wild A. sinensis in Zhejiang Province is in need of clarification. There appear to be few if any reserves of natural habitat retained for A. sinensis in the Province, and the status of the wild population may well be declining. The small farm at YinJianbian may contain important genetic material, and would make an excellent nucleus for an expanded program on the conservation of A. sinensis. Clearly, A. sinensis captive breeding and conservation should be co-ordinated such that the Provinces work together, with an open exchange of information.

6.8. Staff Training

Notwithstanding the achievements of researchers and managers within China, there is a considerable delay between technological developments with crocodile research, farming and management outside China, and their eventual implementation within China. This problem could be partly

overcome if staff and students were able to work at other crocodilian research/management centres. For example, if one or more students working on A. sinensis in China, could do so from Universities in Zimbabwe, Southern USA or Australia, they would be able to transfer the technology almost immediately. This is particularly so with survey technology and wild crocodile conservation strategies.

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APPENDIX I

Itinerary

5/6 January. Arrive Beijing. Meet with interpreter Mr. Jinzhong Fu; general discussions with Professor Wang Sung of Endangered Species Scientific Commission (Chinese Academy of Sciences).

7 January. Fly to Hefei, Anhui Province. Meet Forestry Department staff led by Mr. Wang Baozhou, Director of Provincial Office for Nature Protection and Management.

8 January. Drive from Hefei south-east to ARCCAR ; around 7 hours, and cross Yangtse River. ARCCAR is situated 5 km from the town of Xuancheng.

9 January. Meeting with senior staff of ARCCAR discussing the history, management and research. Walked around the facility and examined breeder pens, juvenile pens, ponds, fish ponds, hatchery, incubation room, administration buildings.

10 January. Visit Yantan Protection Station, 5 km from Jing Xian. Examined field site with nests and burrows. Later visited office to examine records, then travelled to a second protection site at Shuang Keng, approximately 30 minutes drive from Jing Xian. This site is composed of a small creek and dams surrounded by agriculture. Overnight at ARCCAR.

11 January. Drive 1.5 h to Protection site at Zhang Cun in Xuan Zhou County. An island in a lake. Obtain survey and breeding results. Meeting at ARCCAR reviewing data and discussion on incubation methods and principles of ranching. Overnight at ARCCAR.

12 January. Drive for 3 hours to Zhejiang Province, arriving at the town of Zhicheng, in county of Chang Xiang. Visit small breeding farm at Yinjian Bian, which had been visited by Behler, in 1988. Overnight at Zhicheng.

13 January. Meet with officials of Zhejiang Province Forestry Bureau plus local Government. Discussed progress with the Yinjiabian farm, and the possibility of expanding it. Drive for 2.5 h to Provincial capital of Hangzhou, where overnight.

14. January. Catch train for Beijing at 8 am. Goes via Shanghai and Nanking. 30 h trip.

15 January. Arrive Beijing 11.30 am. Work on report. Meet with Professor Wand Sung in the evening.

16 January. Visit Endangered Species Scientific Commission and Department of Zoology, both within the Chine Academy of Sciences. Meet officials of the Endangered Species Import and Export Administrative Office.

17 January. Sightseeing and report writing.

18 January. Depart for Hong Kong

APPENDIX II

Administration

Within China, the CITES Management Authority is the Ministry of Forestry, whereas the Scientific Authority is vested within the Chinese Academy of Sciences.

The Ministry of Forestry is subdivided into a number of Bureaus, which includes the Conservation Bureau. This in turn is subdivided into a section dealing with Nature Reserves, one dealing with wild species and the Management Authority ("Wildlife Endangered Species Export and Import Administrative Office - "Permit Office"). The Vice-Minister of Forestry is the head of the Management Authority. The Vice-head of the Management Authority is also head of the Conservation Bureau.

The Chinese Academy of Sciences is itself divided into some 26 separate institutions, employing some 80,000 staff. Its role as Scientific Authority to CITES is co-ordinated through the ESSC (Endangered Species Scientific Committee), which is under the direction of Professor Wang Sung.

CITES Mission to Cuba, June 9 - June 16 1991

Report of the Technical advisors.

Part 2. Crocodilians

20 September 1991

Jose A. Ottenwalder
Department of Wildlife
School of Forest Resources and Conservation
University of Florida
Gainesville, FL 32611, USA

James Perran Ross Phd
Assistant Scientist
Florida Museum of Natural History
Gainesville, FL 32611, USA

Participation of the authors was supported by a donation from the Center for Marine Conservation, Washington, DC, USA.

CROCODILES IN CUBA

Executive summary:

The results of a brief field inspection, discussions with Cuban authorities and a summary of available information on crocodiles in Cuba are presented. Three species of crocodilian occur in Cuba, the endemic Cuban crocodile (*Crocodylus rhombifer*), the American crocodile (*C. acutus*) and the introduced common caiman (*Caiman crocodilus fuscus*). The Cuban crocodile has a very restricted distribution. Its exact status in the wild is unknown but it is greatly depleted and highly endangered. The American crocodile is more abundant and widespread but numbers are reduced and no adequate survey data or management plan exists. The introduced Caiman is highly successful on Isla de Juventud and may be partly responsible for the apparent disappearance of the Cuban crocodile there. Detailed information on wild crocodilian populations in Cuba are inadequate to develop management and conservation plans or to evaluate the effects of exploitation and international trade. Crocodiles in Cuba are treated as an economic resource but development of the resource has concentrated on establishing farms and breeding captive crocodiles and little work has been done on wild populations. Extensive discussions on the need for improving management of crocodilians in Cuba were held and plans developed to prepare proposals to initiate the necessary work.

Five general recommendations are offered:

- Surveys of wild crocodilian populations in Cuba are needed immediately. Proposals to develop such surveys should be prepared.
- A management plan integrating conservation of the wild resource with commercial use and international trade should be developed.
- The activities of existing crocodile farms should be modified to be compatible with conservation activities and further development of farms should be deferred until technical and trade issues are resolved.
- The introduced Caiman population on Isla de Juventud should be surveyed and then exploited by harvesting to reduce numbers and yield economic benefits. The feasibility of ranching caiman should be examined.
- The existing stocks of crocodilian skins and products should be identified, inspected by CITES observers and permanently marked. Their disposal within CITES regulations should be negotiated.

Introduction and Background:

Cuba is a uniquely important center of biodiversity in the Caribbean region. The island combines large size and a diverse topography with a strategic location between the Greater Antilles and the continental land masses of Central and North America. The Cuban fauna and flora contains numerous endemic species and species of unique interest for conservation. Some of these species such as the Hawksbill sea turtle, Cuban crocodile and Cuban parrot are rare, threatened or endangered. Cuba has been largely isolated from external view since the 1960's and the situation regarding conservation is poorly known outside the country. At the same time Cuba is following a carefully planned course of economic development including the sustainable use of natural resources, some of which are valuable export commodities. Integration of Cuban activities in international commerce in endangered species, with international initiatives and treaties regulating such trade is a priority.

Cuba was the 107th party to join CITES, acceding to the convention effective 19 July 1990 and taking reservations on the Hawksbill and Green turtles. Cuba is developing its management structure to implement the convention. To assist this process the Secretariat of CITES conducted a mission to Cuba in June of 1991 followed by a Seminar on CITES implementation. The authors of this report accompanied the mission in the capacity of technical advisors to inspect and discuss

policies, activities and facilities pertaining to endangered species trade, and to assist the mission by making recommendations for further action. The terms of reference of the technical advisor team were to:

- Evaluate the Hawksbill sea turtle (*Eretmochelys imbricata*) fishery program, including the turtle farm in Isla de Juventud;
- Evaluate the crocodile farm and evaluate the possibility to develop a CITES project to assess the current status of the Cuban crocodile (*Crocodylus rhombifer*) and American crocodile (*Crocodylus acutus*) in Cuba;
- To advise the Cuban authorities on what to do with the population of *Caiman crocodilus* that has been introduced into the country;
- To evaluate the management programs, and other relevant CITES matters concerning conservation and trade in the Flamingo (*Phoenicopterus ruber ruber*), Cuban parrot (*Amazona leucocephala*) and bottlenosed dolphin (*Tursiops truncatus*).

An additional technical team consisting of Mr. Jose Vincente Rodriguez and Dr. Miguel Rodriguez, of Colombia were to provide a technical evaluation of the crocodile farm and they are submitting a separate report.

The technical advisors visited Cuba, with the other members of the mission, between 9 and 16 June 1991 to fulfill these activities and this report details our findings and recommendations on crocodilians. A separate report discusses Hawksbill turtles.

Chronological account:

Sunday 9 June 1991

Arrival in La Habana, introduction to COMARNA personnel.

Monday 10 June, Havana

Meeting and introductory discussion with President of Cuban Academy of Sciences and staff.

Meeting with representatives of management authorities, definition of CITES issues.

Meeting with Ministry of Fisheries (MIP) personnel and first exchange of views and information

Tuesday 11 June

Field Trip - Zapata Swamp area.

Introduction to regional management plan.

Inspection of crocodile farm.

Discussion of issues with MIP staff.

Wednesday 12 June

Field trip to Isla de Juventud.

Introduction to local environmental planning and management staff.

Introduction to local issues.

Discussion sea turtle and crocodile issues (MIP).

Thursday 13 June, Isla de Juventud

Inspection of sea turtle farm facility.

Introduction and discussion turtle farm research.

Inspection sea turtle nesting beach and hatchery.

Inspection crocodile farm at Lanier Swamp.

Friday 14 June, Havana

Presentation sea turtle fishery management data and discussion (MIP).

Presentation and discussion draft recommendations (MIP).

Saturday 15 June, Havana

Discussion and debriefing Mission members.
Sunday 16 June , depart Havana.
See appendix 1 for list of persons and institutions contacted.

Results and Findings: Crocodilians.

Three species of crocodilian are currently found in Cuba. *Crocodylus rhombifer*, the Cuban crocodile, is endemic to Cuba and is found in a very restricted number of fresh water habitats; *Crocodylus acutus*, the American crocodile, is found widely distributed in coastal areas, mangroves and offshore cays around the island; and *Caiman crocodilus fuscus*, the spectacled caiman, has been introduced to fresh water habitats on the Isla de Juventud (Varona 1966, 1976, 1986a, 1986b, 1987). Detailed information on the status and distribution of these crocodilians in Cuba is lacking. Two of these, *C. rhombifer* and *C. acutus* are being raised in captivity in Cuba for commercial use and export. The following species accounts are extracted from - Crocodile Specialist Group/SSC-IUCN/Thorbjarnasson, draft Crocodile Action Plan 1991.:

" The Cuban crocodile has smallest known natural distribution of any crocodilian. Its present distribution is restricted to the Zapata Swamp in southwestern Cuba and a small remnant population may still be found in the Lanier swamp on the Isle of Pines (Isla de Juventud). However in the recent past this species was more widely distributed on the main island of Cuba (Varona 1966). Skeletal material also shows that this species was found on the Cayman Islands as well (G. Morgan, pers. comm.). ...

The Cuban crocodile is without doubt the most threatened species of New World crocodilian. Wild populations have been greatly reduced and little or no work has been done on surveys of wild populations, or this species behavior and ecology. ...

Nearly all the remaining wild animals were collected and placed in pens during the 1950's and 60's. The largest farm at Laguna del Tessoro has about 800 adults. Some of the animals are harvested for meat (sold locally) or skins (exported). When the crocodiles were first placed in pens in 1959, *C. rhombifer* were mixed with *C. acutus*. This resulted in hybridization between the two species and presented a grave threat to the genetic integrity of the *C. rhombifer* population. ... *C. rhombifer* is on CITES Appendix I."

"The American crocodile (*Crocodylus acutus*) is one of the most widely distributed of the New World crocodiles, with a distribution including the southern tip of Florida, both the Atlantic and Pacific coasts of southern Mexico, Central America, and northern South America, as well as the Caribbean islands of Cuba, Jamaica, and Hispaniola. The habitat of the American crocodile consists largely of freshwater or brackish water coastal habitats such as the estuarine sections of rivers, coastal lagoons, and mangrove swamps. However, populations are known from freshwater areas located well inland, including a number of reservoirs. ... *C. acutus* is on CITES Appendix I "

"The spectacled or common caiman (*Caiman crocodilus*) is the most widely distributed of the New World crocodilians, ranging from southern Mexico to central Brazil and northern Bolivia. It is also the most geographically variable species with four subspecies generally being recognized (*C.c. apaporiensis*, *C.c. crocodilus*, *C.c. chiapasius*, and *C.c. fuscus*). ... *C.c. fuscus* is on CITES Appendix II"

Crocodilians in Cuba are viewed as a resource with the potential for valuable export earnings. The farm at Laguna de Tesoro has been raising captive born crocodiles for meat and skins and the intention is to produce skins for the international market. As Cuba has now acceded to CITES this exploitation and trade needs to be examined and placed on a legal basis within CITES regulations. To achieve this result several important questions must be addressed:

- Does the status of the wild populations justify continued exploitation and international trade? The status of *C. rhombifer* is of particular interest in this regard.
- What measures are in place, and what measures are needed to ensure the continued survival of the native species in the wild?
- What measures are needed to ensure proper compliance with CITES for international trade in the future?

To address these questions discussions were held with Cuban personnel involved in crocodile management and facilities where crocodiles are held were inspected.

Wild crocodile populations.

Knowledgeable informants with first hand recent experience assured us that *C. rhombifer* continues to exist in the wild in restricted portions of the Zapata Swamp. An area in the central western portion of the swamp was cited as the location of recent sightings. Access to this area is extremely difficult. The terrain is largely flooded scrubby wetland with thick growths of mangrove fringing the coastal regions. Barbour and Ramsden 1919 describe the area as follows..." The inner marshes of the Cienaga (Zapata) in general consist of an enormous deposit of silt, partially held in suspension in water and resting on a firm limestone substratum. In some localities one meets with muddy lakes or the clogged up course of some muddy stream like the lower Rio Hanabana but generally the ooze is sufficiently compacted to support a sort of half floating vegetation of rushes, reeds ... and lily pads." Access is by foot, horse or small boat and is greatly impeded by fallen timber. No systematic surveys have been conducted but our informants estimated that they have occasionally seen as many as 25 or 30 wild crocodiles of various sizes in a 4-5 km stretch of creek running through this area. Evidence of nesting has also been seen. While it is not possible to provide even the most general estimate of numbers of *C. rhombifer* in the wild, the available information suggests a viable population remains. It is noteworthy that large areas of the Zapata swamp in the north western and eastern portions are said to no longer support significant numbers of crocodiles.

Development plan for Zapata area

During our inspection of the Zapata area we were introduced to the coordinators of the regional management plan. The whole of the Zapata peninsular, an area of over 1000 square kilometers, is subject to the "Plan Victoria de Giron" which is an integrated development plan for the region. Multiple land uses are envisaged under the plan with extensive areas of agricultural development on the dryer upland areas of the peninsular, several small scale industrial and residential centers and multiple low impact uses of the woodland and swampy sections. Planned activities include cattle and pig farming, marine fisheries (particularly for lobsters), aquaculture, extraction of timber for charcoal, and honey production. The Zapata Swamp National Park occupies about 8% of the area and development of tourist facilities is envisaged. The crocodile farm is one small

aspect of the overall development plan.

The major area where crocodiles are said to remain is well outside the present National Park. The presence of the crocodiles is acknowledged in the plan but it was not clear what protection and management was to be applied. The integration of crocodile conservation with the regional management plan is necessary.

On Isla de Juventud we were informed by scientists involved in field surveys for environmental management that no wild *C. rhombifer* have ever been encountered during their work over the last several years. Isla de Juventud has an extensive series of fresh water lakes and impoundments in its northern half where *Caiman crocodilus* are now common. The terrain of the Lanier swamp is, if anything, more daunting than Zapata swamp. The area is composed of flooded thickets of impenetrable vegetation over sharp limestone rock. Maps indicate some areas of open marsh in the interior of the swamp. Our informants expressed the opinion that *C. rhombifer* is no longer found on Isla de Juventud and they questioned whether its presence there could be verified by specimens or direct accounts of observers (see discussion).

Crocodylus acutus is reported to be widely distributed in the coastal areas around Cuba although populations are greatly reduced from their former abundance (Varona 1987). Particular localities where our observers had first hand experience were the salt water mangrove margins of the Zapata swamp and Ensenada de la Broa, coast of Isla de Juventud and the Cays of the Canarreos Archipelago. No formal surveys have been conducted but informants were confident that the population in these areas numbered between "hundreds" and "thousands" of crocodiles. Additional locations where *C. acutus* is said to be present are the Birama Swamp in Granma Province, Jobabo and Cheve lagoon, Archipielago Jardines de la Reina and the Archipielago de Camaguey. Estimates of numbers. trends or breeding success in these locations is not available.

Caiman, *Caiman crocodilus fuscus*, were first introduced to Isla de Juventud in 1959 and were well established by 1976 (Varona 1976). Currently caiman are said to inhabit every water body on the Isla de Juventud and to be breeding successfully in numerous locations there including the sewage treatment pond at Nueva Gerona. Varona (1976) was the first to express concern that the habitat overlap between Caiman and *C. rhombifer* might lead to competition and exclusion of the endemic crocodilian. Caiman are now thought to number several thousands on the island and *rhombifer* has not been reported there for many years.

There has been an almost complete absence of studies or surveys on wild crocodilians in Cuba. The information available is anecdotal and non quantitative with no indication of its precision or reliability. No studies have been completed on ecology or behavior of wild crocodilians and even the basic distribution remains poorly understood or reported. MIP staff from the crocodile farm make occasional forays into the wild habitat but we were unable to determine how frequent such field trips were or whether data are collected. The very difficult terrain and lack of equipment and fuel have inhibited field studies. Surveys to establish the distribution and relative abundance of crocodilians in Cuba are the highest priority.

Crocodile farms.

Management authority for crocodilians has been allocated to the Departamento de Cria Experimental of MIP and focussed almost exclusively on the development of crocodile farms, initially at Laguna de Tesoro in the center of the

Zapata swamp, and subsequently on Isla de Juventud. Detailed technical analysis of the farms is the subject of a separate report by our colleagues Dr. Miguel Rodriguez and Dr. Vincente Rodriguez. Here we comment on some biological aspects of the farms operation as they pertain to conservation and CITES trade.

The main crocodile farm at Laguna de Tesoro holds about 800 adult *C. rhombifer* as a breeding stock and a smaller number (perhaps 200?) of *C. acutus*. production of eggs and hatchlings from the breeding of this stock results in approximately 1000 - 1200 hatchlings a year which are raised for 3-4 years and then butchered for meat and skin. For many years the two species were not separated and hybrids resulted, however, we were informed that for the last several years the adult *C. acutus* and *C. rhombifer* have been kept separate and that the hybrids (termed 'mixturados') have been eliminated from the stock. The layout of the farm enclosures makes the management of these large and aggressive crocodiles difficult. The adults are kept in a series of fenced seminatural ponds of approximately 1 to 5 ha area. The margins of the ponds provide nesting habitat and materials and the eggs are harvested and removed to a separate incubation area.

The incubation process is very simple; eggs removed from the nests are laid on the ground and covered with a mound of soil and marked with a stick. Successive clutches are placed in long rows so that the incubation area resembles a field of potatoes ! While this process is said to be reasonably effective we raised questions about the degree of control of temperature and the possible effects of flooding and bacterial contamination that we do not feel were adequately answered. It would be desirable from both conservation and commercial perspectives to have some control over incubation conditions.

Several problems result from these management procedures. Crocodiles are trapped or noosed from the enclosures for handling but the exact number and composition of each enclosure is only approximately known. The adults are unmarked and so exact breeding histories of individuals are not available. It remains possible that some of the adults in the breeding assemblage are *C. acutus* or mixturados that remain uncaught or do not show obviously non *rhombifer* phenotype. A small sub group of breeding adults are said to be the most certain "pure" rhombifer in the collection and are kept separate. Hybridization between these species is of no special biological significance, nearly all species of *Crocodylus* can form fertile hybrids. However the great danger is that extensive hybridization and introgression of the *acutus* genes will eventually eliminate the *rhombifer* geneome. The significance of this in the farm is minimal, except as it may affect CITES trade regulations, however both *acutus* and *rhombifer* are presently Appendix I species and Conf 2.13 would apply, that is: " b. Hybrids are subject to the provisions of the Convention even though not specifically included in the appendices if one or both of their parents are taxa included in the appendices; "

and " c. ... if the parents of a hybrid specimen are included in different appendices, the provisions of the more restrictive appendix shall apply;".

The only interpretation is that hybrids of C. acutus **and** C. rhombifer **must be treated as appendix I species.**

If, however, it becomes necessary to release animals from the farm to the wild to maintain the wild population then issue of hybrids will be critical. Hybrid *acutus* x *rhombifer* are said to grow faster than the pure species and so there is a conflict between the demands for commercial production and the desire to maintain the rhombifer stock. To resolve this issue several actions are necessary:

- The stocks of *acutus* and *rhombifer* should remain separated to eliminate accidental hybridization. Deliberate hybridization for the purposes of commercial production is feasible. No additional problems for CITES

trade would result as the hybrids must be treated as Appendix I.

- The genetic make up of the apparent *rhombifer* stock should be examined using modern genetic techniques such as Mitochondrial DNA analysis and a stock of "pure" *rhombifer* identified and maintained.
- Individuals of the pure rhombifer breeding stock should be individually marked and records kept to allow the maintenance of studbook records to ensure the maximum genetic diversity in this captive stock.
- Removal of wild *rhombifer* from the Zapata swamp to the farm should be minimized, however some introduction of known pure *rhombifer* genetic stock may be advisable to maintain genetic diversity. Such wild stock must be kept separate from any contamination with *acutus* genes.
- Any re-introduction to the wild must only be done with known pure *rhombifer* stock.
- Eggs destined for grow out for commercial use can be incubated in the present low tech method but eggs designed for the production of pure rhombifer for conservation, particularly for restocking, must have incubation conditions controlled to ensure balanced sex ratios and unbiased survival.

The farm at Cayo Potrero on the Isla de Juventud is operated by the Empresa Nacional para la Proteccion de la Flora y la Fauna as part of national program for protection and rational use of crocodilians. The farm was established in 1986 with *rhombifer* stock brought from the Laguna de Tesoro facility. A stock of approximately 40 breeding adults was established and produces 200 -600 hatchlings each year. Release of *rhombifer* back into Lanier swamp to re-establish the population there is envisaged. This farm has serious problems. Breeding pens have been constructed by fencing sections of the swamp and an old peat pit. Security is poor and animal management difficult in these large semi natural enclosures. It is evident that the husbandry practices on the Lanier farm are inferior to the Zapata operation. The most disturbing problem we saw was the very poor security of fencing that allows the captives to escape with ease. In the course of a brief 1 hour visit we saw no less than three crocodiles wandering outside the enclosures. One was a mature adult *C. rhombifer* that was lying by a nest outside the enclosure. Statements from the farm staff that this animal leaves the enclosure to nest and then returns were unconvincing. We also saw a large adult that appeared to be *C. acutus* and a smaller unidentified crocodile. This facility may be repeating the problems of hybridization that have been so difficult to correct at Laguna del Tesoro with added complication that crocodiles, including mixturados, can easily escape into the adjacent Lanier swamp.

Additional farms have been established for *C. acutus* at Sabanalamar, Jobabito and Birama but information on their degree of development or success was not available. It seems ill advised to establish additional farms when the existing farms continue to have unresolved technical problems. Given the uncertain status of future commercial use and international trade from these farms it would be advisable to postpone development until the trade and technical issues are resolved.

Stocks of skins. Some question has arisen about the quantity and fate of crocodile skins produced in Cuba in recent years. It is evident from our inspection of the farms that annual production of eggs is between 1000 and 2000. About 500 to 600 two meter long crocodiles a year are slaughtered to make room for the upcoming generations of offspring produced by captive breeding. The meat is apparently consumed internally but the fate of the skins was not clearly described to us. Some were said to be used internally in leather manufacture of artisanal items

for the tourist trade. Export of manufactured items, parts and derivatives of appendix I species is a violation of CITES. Some hides were said to be "stockpiled". It is unclear to us whether or not crocodile skins have been exported in the past, and what, if anything is proposed for the skins alleged to be stockpiled prior to Cuba's accession to CITES. The identification of outstanding skin stocks, inspection by CITES personnel and irreversible marking of these skins is highly recommended.

Discussion.

The distribution of *C. rhombifer* has been widely reported as " Zapata swamp and Lanier swamp (Isla de Juventud)" (e.g. Barbour and Ramsden 1919, Mertens 1943, Schwartz and Thomas 1975,) however we are unable to locate either specimens or first hand accounts by reliable observers to verify that *C. rhombifer* occurred on Isla de Juventud. Most accounts rely on Varona 1966 and 1986, however Varona quotes "cascadors" (hunters) and the older accounts of Sagra 1843 and Gundlach 1880 as his source and apparently did not locate specimens from the Isla de Juventud. The original recognition of the Cuban crocodile dates back to Dampier 1699 but the Spanish translation of his report in Sagra 1843 (pg 37) is ambiguous, referring to "Pinos de Cuba" not Isla de Pinos de Cuba. Several modern specimens attributed to *C. rhombifer* from Isle of Pines are either not *C. rhombifer* (e.g. specimen # 17718 in the Museum of Comparative Zoology which is *C. acutus*) or cannot be definitely attributed to the Isle of Pines (e.g. specimen MCZ 17728) (1). A specimen collected by Schwarz in 1958 (AMNH 82943) is ascribed to *C. acutus* with a locality of Cayo Cantiles but has a color pattern similar to hybrids between *C. acutus* and *C. rhombifer* (F.D. Ross pers comm.). A contemporary observer recalls the specimen was actually acquired on Isle of Pines and was extremely aggressive (G. Zug pers. comm.). Again both the locality and species is ambiguous. Varona 1966 points out the difficulty of differentiating large specimens of *C. rhombifer* and *C. acutus* from skull characteristics. The most authoritative source seems to be Varona's cascadors but there is strong tendency to identify these animals by locality rather than any objective means. Museums outside Cuba tend to enhance the diversity of their collections by ascribing any large crocodile from Cuba to *rhombifer* and the cascadors call any crocodile caught in fresh water 'cocodrilo' or 'criollo', the colloquial terms for *rhombifer*. It therefore remains unresolved as to whether *C. rhombifer* was ever found on the Isla de Juventud. It is certainly reported to be absent now.

The anecdotal evidence available suggests that *C. acutus* is much more abundant and widespread in Cuba than *C. rhombifer*. This requires verification by objective, quantitative survey. However, if correct it suggests that sustainable use management, coupled to management of a wild population, could be more easily achieved with *C. acutus*.

The status of *C. rhombifer* in the wild is clearly very precarious. It seems highly likely that the population in Zapata swamp is restricted to a small portion of its former range and there is not a second viable population in Lanier swamp. It would be completely unacceptable to allow the wild population of *C. rhombifer* to become extinct even if the captive farm population prospers. Conservation, management and future international trade must be based upon a secure wild population. While the proposed exploitation of *rhombifer* in Cuba is presently restricted to farm bred stock, the opportunity exists to re-invest small portion of the commercial gain in ensuring the viability of the wild population and retaining this unique Cuban endemic form. A program of habitat preservation, monitoring and, possibly, restocking should be developed.

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1. I am indebted to Mr. Franklin D. Ross of the Museum of Comparative Zoology, Harvard University, for examining specimens and researching their origins on my behalf. JPR.

Caiman crocodilus is apparently highly successful on Isla de Juventud. This introduced population of an exotic species that is on appendix II of CITES provides the most immediate prospect for commercial exploitation. It would also be desirable to eliminate, or at least reduce, this population. Following the necessary survey to determine numbers and distribution, a program of cropping adult animals for meat and skin would be advisable. The possibility of raising Caiman in farms should also be examined. Recent advances in husbandry demonstrated in Colombia and Brazil indicate that ranched caiman can be an economically feasible project.

It is probable that complete elimination of Caiman from Isla de Juventud is logistically impossible. It is therefore crucially necessary to conduct research on the interaction of *C. crocodilus* with *C. acutus* and particularly *C. rhombifer*. Several authors have speculated that caiman compete with *C. rhombifer* and are responsible for their elimination from Lanier swamp (Varona 1976, CSG 1991) but data are completely lacking. If this is true then any plans for re-introducing *rhombifer* to Isla de Juventud must be critically re-examined as it would be an expensive waste of time to introduce *rhombifer* only to have them eliminated by caiman again.

The critical issue for the resolution of CITES trade issues in the future for Cuban crocodiles is to establish the status of the wild stocks. Sustainable use of crocodilians has been endorsed by IUCN and the Crocodile Specialist Group as a valuable conservation incentive in some circumstances, but the maintenance of a viable wild population is a necessary precondition for applying this technique. The development of commercial use of crocodilian resources in Cuba is well underway, although as noted above several severe technical problems remain to be resolved. The development of crocodile farms has proceeded with almost total disregard for the wild populations or their habitats and this imbalance must be urgently addressed if the commercial exploitation is to succeed. The most immediate priority is to survey the major habitats for all three species using repeatable quantitative techniques to assess the populations density and distribution. The results of these surveys will provide a basis to direct future research and management to ensure that commercial use and trade of these species is not detrimental to wild populations, a necessary condition for CITES approval.

Following adequate surveys it will be possible to develop management schemes incorporating farming for local and international trade, habitat protection for wild populations, and continued monitoring of the wild populations. It may be necessary to apply a period of complete protection and allow recovery of wild populations before any additional animals are removed from the wild. Restocking from captive bred stock may also be advisable.

The crocodilians of Cuba are resource with great potential for economic development. However it must be understood that the wild populations are a reservoir that supports the commercial development. The wild population serves as a reserve stock to protect the farm in the case of disastrous failure in the farms from disease, hurricane, accident or other unforeseeable events. The wild population is a stable reserve of genetic diversity that the farms will call upon from time to time to improve the genetic viability of the farm stock.

To initiate international trade of either *C. acutus* or *C. rhombifer* it is necessary to submit a proposal to CITES justifying the trade on the basis of production from captive breeding, non detriment to wild populations and a functioning management scheme. A proposal to initiate studies of the wild populations, beginning with population surveys is being developed with the Cuban management authorities.

Recommendations.

1) Surveys to determine the distribution and status of wild crocodilian populations in Cuba are the highest priority and should be conducted

as soon as possible. The development of management plans and international trade arrangements cannot proceed without survey results. Proposals to seek funding for the necessary surveys should be developed before December 1991 and, ideally surveys could be initiated in 1992. The surveys must be based on accepted, quantitative techniques and conducted by experienced personnel. Given the lack of Cuban personnel with the necessary expert experience these surveys should be conducted by expatriate experts. The surveys can function as training for Cuban personnel to enable them to carry on survey functions to monitor wild populations in the future.

2) Development of management plans integrating conservation of the crocodilian resources with farming and international trade should be based upon the results of the survey. Such a plan would include elements of Habitat protection, Population monitoring, Research, Captive breeding and restocking. The plan would be integrated with existing Cuban management plans in regions where crocodilians occur, such as the "Plan de Victoria Giron" in the Zapata peninsular. The combined results of a crocodile survey and a management plan could form the basis for a submission to CITES parties to allow international trade of crocodile products from Cuba.

3) The introduced population of Caiman on Isla de Juventud requires special treatment. Again the first necessary step is a survey to determine the actual status of the population. Following the survey a program of cropping and utilization should be developed with dual goals of controlling the Caiman population and providing immediate economic benefits from crocodilian management. The feasibility of ranching caiman by removing wild eggs and hatchlings to farms should be investigated.

4) The existing crocodile farms should develop enhanced husbandry techniques to make their activities compatible with present and proposed conservation activities. At the well established farm at Laguna del Tesoro these techniques would include improved management of different species, individually marking breeding animals and recording breeding history, genetic analysis of the breeding stock and, improved control of incubation conditions. At the other newer farms the emphasis must first be on eliminating current unacceptable husbandry practices , particularly security of the enclosures and potential hybridization problems. Deferment of development of additional farms until the technical and trade issues are resolved is highly recommended.

5) Existing stocks of crocodile skins, manufactured products, parts, and derivatives must be identified, declared, and inspected by an impartial observer designated by CITES. All existing and preconvention stocks should be permanently marked and negotiations entered into to allow their orderly disposal within CITES regulations.

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Appendix 1.

Persons contacted for discussion.

Prof. Dra. Rosa Elena Simeon Negrin, President, Academy of Sciences of Cuba. *

Lic. Jacinto A. Fierro Barefoot, Viceminister, Ministerio de la Industria Pesquera (MIP) , La Habana..

Lic Elvira Castillo C., Director, Regulacions Pesqueras, MIP. La Habana *

Lic Pedro Rosabal G., Comision Nacional para la Proteccion del Medio Ambiente y Conservacion de los Recursos Naturales (COMARNA), La Habana

Lic. Silvio Elizade R., Departamento Cria Experimental, MIP. La Habana

Lic. Roberto (Toby) Ramos Targarona. MIP Crocodile Farm. Laguna de Tesoro

Director and Staff of the Crocodile farm, Laguna de Tesoro, Zapata Swamp.

Director and Staff of the Crocodile Farm, Cayo Potrero, Lanier Swamp.

Ronald Goteia Gonzalez, Academy of Sciences Cuba (I. de Juventud) *

Personnel of Empresa Nacional para la Proteccion de la Flora y la Fauna. Isla de Juventud

* With additional aides and staff

Crocodilian Management in Honduras

Report of a fact finding mission to Honduras, 20-25 September 1992.

James Perran Ross

Crocodile Specialist Group, Executive Officer

Florida Museum of Natural History

Gainesville, FL 32611
USA

This fact finding mission was conducted under the auspices of the CSG and CITES Secretariat with support by a donation from Cocodrilos Clal Continental, San Pedro Sula, Honduras.

Executive summary

A fact finding mission to investigate management of the crocodilian harvest in Honduras was undertaken between 20 and 25 September 1992. During 5 days in Honduras, 21 individuals representing the CITES Management Authority, government and private sources were interviewed. From these sources information on caiman quotas, illegal killing of crocodiles, domestic use of crocodile skins and the development of infrastructure of the Management Authority were obtained.

Six requests for harvest and export quotas for a total of over 30,000 caiman were received but only 3 permits, each for 2,000 skins were officially issued in 1992. Illegal killing of crocodiles is alleged to be widespread and the Managment Authority is not adequately fulfilling the functions of monitoring, inspection of exports and management of the resource.

Recommendations to rectify this situation were made, including a simple outline of a permiting process based on issuing tags for caiman skins that would bring Honduras into compliance with CITES. It is also recommended that the Management Authority convene a workshop to coordinate government, NGO and commercial interests and form a Scientific Authority for CITES. The proposal to register crocodile farms as captive breeding facilities should be resubmitted to CITES, a nuisance crocodile program be established and copies of all permits should be forwarded to the CITES secretariat. If the Management Authority can develop its function and undertake managment and regulatory functions then the crocodilian resources of Honduras could be managed in a sustainable manner and become a valuable economic benefit.

Introduction and Background.

Management and conservation of crocodilians in Honduras is based upon the recommendations of a CITES Survey conducted in 1988 (King, Cerrato and Espinal 1990). The survey reported that populations of both *Caiman crocodilus* and *Crocodylus acutus* appeared to be depleted and at relatively low density at most sites surveyed. Based on this information a cautious development of sustainable use was recommended with restricted quotas of caiman and complete protection of crocodiles pending the development of crocodile farms and ranches. Detailed recommendations for the formation of a functional management plan and

Management Authority were given with the caveat that if these recommendations were not followed then caiman exports should be restricted to no more than 5,000 animals a year.

In 1991 a proposal for CITES to certify farms in Honduras as the first captive breeding facilities for *Crocodylus acutus* was withdrawn on the advice of the Crocodile Specialist Group (CSG) after questions were raised about the effectiveness of the Management Authority and the degree of detriment to wild populations that stocking farms had caused. During the spring of 1992 a series of reports were received from diverse sources both within and outside Honduras which alleged that the Management Authority was not functioning, the agreed quota for caimans was being exceeded, and that there was widespread and uncontrolled killing of *Crocodylus acutus* during the *Caiman* hunt. Development of controlled sustainable use that would enhance the conservation of both species of crocodilian in Honduras was being impeded by the alleged inability of the Management Authority to control crocodilian exploitation.

These allegations received intense discussion at the CSG meeting in Zimbabwe in August 1992 but in the absence of objective information it was thought premature to take action. A letter requesting information was directed from the Chairman of the CSG to the Minister of Natural Resources, Honduras and it was recommended that an expert visit Honduras as quickly as possible to ascertain the situation and recommend action. With financial assistance and logistic support to the CSG from Clal Crocodile Farms and with the official support of the CITES Secretariat, the Executive Officer of the CSG, Dr. James Perran Ross, undertook a fact finding mission to Honduras between 20 and 25 September 1992 and this report summarizes his findings.

Terms of Reference.
Four main topics of interest were specified in the letter from the Chairman of CSG to the Minister of Natural Resources and the supporting letter from CITES Secretariat:

1) Investigation of the actual 1992 *Caiman crocodilus* export quota.
2) Determination of the magnitude and impact of capture of *Crocodylus acutus.*
3) Evaluation of the amount of internal domestic use of *C. acutus*.
4) Determination of the progress made, and remaining actions needed, to establish an effective management structure for crocodilians in Honduras.

Results.
I spent five days in Honduras and interviewed 21 individuals representing the Ministry of Natural Resources, the Department of Fisheries (Dpta, de Pesca y Aquacultura, the designated Management Authority), university academics and conservationists, the crocodile farmers, and other parties interested in crocodilian conservation including the Chief of Wildlife for CODEFOR, the new Commission on Environment and Development (CONAMA), The El Cajon Reservoir Management Group, US AID, and Honduran NGO's. A list of individuals and addresses is attached. From the information received, answers to the four topics of interest indicated by CITES and CSG were obtained. It was not possible to arrange visits to tanneries and manufacturing outlets to examine skins and directly assess crocodilian use.

1.) 1992 *Caiman crocodilus* export quota.
The Vice Minister of Agriculture reported to me that following internal recognition

of problems in issuance of quota permits to hunt and export caiman, the Minister had recently ordered a complete freeze on permits pending an investigation of the problem. Mr. Ruperto Osorio was designated as a special assistant to the Minister to investigate this issue and assist me. Mr. Osorio is a forester by training with wide previous experience in resource management issues in Honduras, but no direct experience of crocodilians or of the crocodilian program.

The designated head of the Management Authority, the Director of Fisheries and Aquaculture, had recently been replaced and the new incumbent was just now taking on his responsibilities and had no prior experience or knowledge of the situation. This is the fourth director in one year. The new director, advised by the legal affairs person in the Dept. Pesca, informed me that no permits to hunt or export were issued for 1990 or 1991. Applications had been received from six individuals and groups to hunt and export caiman in 1992 as detailed in Table 1.

Table 1. Applications to hunt and export caiman in Honduras 1992.

Company or individual	application	permit approved
G.A.M.	requested 8,000	two permits 2,000 each (4,000 total)
K. Preiss	requested 10,000	one permit for 2,000
Clal Continental	requested 3,000	withdrawn
Ester Borjas*	requested 6,000	none
Miguel Angel Mencia*	requested 6,000	none
Fernando Molina*	requested 6,000	none

* It is normal practice for the applications to be submitted by lawyers on behalf of the actual beneficiaries, these names are therefore of doubtful significance in identifying permits or applications.

Total requests exceeded 30,000 caiman but the Dept. Pesca said they only issued permits for 6,000 total, 3 separate permits of 2,000 each. This is somewhat in conflict with the Vice Minister's statement that all permits have been frozen and I was unable to establish whether all the permits said to be issued are still valid and whether or not they have been used. In a conversation with Mr. Kurt Preiss, one of the recipients of a permit, he informed me that his understanding from his Honduran agent was that his permit for 2,000 skins for export was still valid as of 6 Oct. 1992. All valid permits are supposed to be signed by the Minister, Mr. Mario Nufio.

For the purposes of international trade it would be prudent to verify the status of any permits that do not have the Ministers signature or are for quantities in excess of 2,000 skins, or have issuance dates other than 1992. I recommended that in future a copy of all permits issued be faxed to CITES.

In terms of actual capture of caiman in Honduras no direct information could be

obtained. However, conversations reported to me suggest that artisanal manufacturers have recently had difficulty obtaining raw materials of either caiman or crocodile. Mr. Preiss informed me that his tannery was holding a small number of skins but that the main hunting season was yet to commence (Dry season November - May)

The Management Authority stated that no permits for capture or export of *Crocodylus acutus* have been issued this year. However, it should be noted that both active crocodile farms have in the past collected crocodiles with valid permits from the Management Authority.

The Management Authority appears to have only paper authority and lacks the most rudimentary facilities to function in the manner envisaged by CITES. The staff (total about 10) have responsibility for managing the very extensive fisheries for shrimp and lobster in Honduras as well as the quite large shrimp mariculture business. At the present only a single junior biologist has any experience in crocodiles and I was told that he was recently transferred to another department. There is therefore no provision for status surveys, inspections, enforcement or any other aspect of management other than issuing permits. A proposal to address this lack was presented and is discussed in detail under point 4 below.

2.) Capture of *Crocodylus acutus*

Nearly all informants agreed that the illegal killing of *Crocodylus acutus* is widespread. It was not possible to independently verify any of the reports received but the following anecdotal reports are typical and widely repeated and believed.

- Rural people (campesinos) routinely kill crocodiles because they fear them and dislike crocodile depredations on their smaller stock (goats, pigs, dogs). Human attacks are very rare and only two documented fatalities are said to be reported in the last ten years.

- The military are said to shoot crocodiles for target practice.

- The influx of refugees from Nicaragua during the war there introduced rural dwellers in the Mosquitia (north-eastern Atlantic Zone) to the practice of eating crocodile meat. (This seems implausible to me as eating crocodile is a habit of great antiquity, certainly pre-Colombian, throughout Mosquitia). It is plausible that the refugees constituted an expanded poor rural population who ate more crocodiles. Most refugees have now returned to Nicaragua.

- Gold miners operating on the Rio Patuca and other east flowing rivers shoot crocodiles in the dry season when the crocodiles are vulnerable in dried out pools.

- There exists a relatively small group of families and individuals who have specialized in crocodile hunting for many years. Many of these operate at least part of the time capturing crocodiles for the crocodile farms. When they are unable to sell the crocodiles alive they kill them and try to sell the skins. This activity provides a dilemma for the crocodile farmers. People bring them crocodiles hoping to sell them. This is illegal under Honduran law, although as recounted here, this law is widely ignored and never enforced. If the farms purchase the animals for breeding stock they encourage the continued capture of crocodiles (illegally) for this purpose, but if they refuse to buy them the crocodiles will be killed and their skins enter the illegal trade either domestically or internationally. A simple solution to this problem, of allowing regulated purchase of genuine nuisance crocodiles, is proposed

below.

- The contention that rural hunters do not differentiate between caiman and crocodiles and take both for skins was repeated to me (and seems quite likely). However, several knowledgeable informants suggested that in general crocodiles and caiman occupy separate habitats so that largescale taking of crocodiles requires special dedication in particular areas where they are more common.

Because the Management Authority lacks the staff, structure and knowledge to adequately monitor trade, it was not possible to arrange inspection of stocks of caiman skins to look for crocodiles mixed in. These reports therefore remain unconfirmed.

The impact of these factors on the wild populations of *C. acutus* cannot be accurately assessed without additional surveys, which the Management Authority lacks the infrastructure to conduct. However, the low density of both caiman and crocodiles revealed in the 1988 survey on easily accessible rivers is probably a result of these forces. There is every reason to believe, lacking evidence to the contrary, that crocodile populations continue to decline in Honduras wherever they are accessible to people. Some contention about the interpretation of the 1988 survey remains. Several informants associated with the crocodile farms continue to insist that higher densities of crocodiles can be found in the more inaccessible locations, particularly on the middle portion of the Patuca river. I explained at length that such contentions will remain speculative until additional surveys are done and that certainly no allowance for capture of crocodiles for any purpose could be permitted on such a speculative basis. Objectively, however, it should be acknowleged that the surveys of the Patuca to date consist of two very short sections totalling less than 50 km of a river estimated to exceed 700 km length. One of these surveys was conducted on one night on 30 km near the mouth where all observers agree there are few, if any crocodiles and not surprisingly none were found (King et al. 1990). Detailed intensive surveys of the Patuca river and other potential crocodile refugia are a high priority and must <u>preceed</u> any additional removal of animals from the wild for stocking farms. In this context it should be noted that there is a proposal to extend the existing protected area of the Rio Platano Biosphere reserve southward to the Nicaraguan border and this area would form an extensive refuge for crocodilians and other wildlife, presuming of course that some actual enforcement of the reserve could be implemented.

<u>3.) Internal use of *C. acutus*</u>

I casually inspected 3 fashion shops in San Pedro Sula and one in Tegucigalpa. Some crocodilian products were present in each shop (100% of sample) but the number of items was small, one or two examples in 3 of 4 shops. The fourth shop had more items, mostly small handbags made primarily of cow leather with small inserts of caiman flank, hornback and crocodile skin. This shop also had a locally tanned crocodile belly skin about 1.5 m length on display. This shop also displayed several stamped cowhide "fake" crocodile bags mixed in with, and priced similarly to the real thing. I was also informed that at least two tanneries in the San Pedro Sula area and another in the south that are said to routinely tan crocodile leather for local use and a local boot factory will handmake a pair of croc skin boots on request. Mr. Eric Fernandez made enquiries to the factories in San Pedro Sula and was informed that they had little stock on hand and were currently experiencing difficulty obtaining supplies of raw skins. Several informants said that the lower quality novelty items occasionally seen for sale (stuffed heads, stuffed juvenile caiman and crocodiles in peculiar postures) were imported from Nicaragua where

they are made.

I spoke at length with Mr. Danilo Martinez who owns a manufacturing facility and seven retail outlets for leather products in San Pedro Sula. He occasionally uses both caiman and crocodile, mostly for inserts in bags (his shop is the one noted above with the fake bags). He expressed great interest in obtaining buyers in the US for both manufactured products and tanned skins of crocodile and was disappointed that I was not a buyer for this material. He expressed no difficulty obtaining and exporting as many as several hundred crocodile skins if he could find a buyer. He was apparently unaware of, and not very interested in, the restrictions on obtaining and exporting crocodile skins and products. Mr. Martinez suggested that he was one of six or eight manufacturers in the country with similar production capacity.

I was informed by one knowledgeable informant of the names, locations and routes of transport for illegal export of crocodile skins via Ceiba to the Bay Islands and on to Grand Cayman in one case and via El Salvador to either Nicaragua or elsewhere in the other. Details of these illegal traders have been provided to TRAFFIC and to the CITES Secretariat.

In summary it appears that local use of crocodilian skins for locally manufactured products is routine and widespread. Crocodile is used whenever it is available and a fully functional commercial infrastructure exists for obtaining, tanning, manufacturing and illegally exporting crocodile skins and products. There is evidently no enforcement whatever of local or international regulations regarding this activity. Quantification of the magnitude of this drain on crocodile populations would require an extensive focussed study.

A plan for sustainable use of crocodiles in the El Cajon reservoir has been proposed in association with a plan for fisheries managment of the reservior, but this plan is currently suspended. Dr. Ernesto Vargas had developed a plan to integrate the expanding rural population around the reservoir into fisheries cooperatives to give them an alternative to destructive agriculture in the watershed. One component of the plan was a proposal for sustainable harvest of crocodile eggs and hatchlings for sale to ranches. The ranches in turn proposed to release crocodiles back into the reservoir to build populations there. It was hoped that this scheme would both provide economic benefits locally and mitigate the conflicts between fishermen and crocodiles. This admirable plan is unfortunately no longer being actively pursued but it indicates one potential structure for controlled and sustainable crocodile use in the future.

4.) Enhancing management structure in Honduras.

Given the rather pessimistic appraisal of the preceding sections, enhancement of the management structure in Honduras is the most immediate and valuable priority for crocodilian conservation in the country. The reasons for the inadequacy of the present system, that results in the essentially uncontrolled exploitation of crocodilians confirmed above, lies deeply rooted in the cultural, social, political and economic realities of the country. Analysis of these factors is beyond the scope of this report and would serve little purpose. The CSG, or CITES, is not going to fundamentally alter the functioning of the Honduran system. The challenge is to offer a management system that could function under the restraints of Honduran reality. It is not sufficient to merely offer recommendations for Honduras to create a good crocodile management system, then walk away and expect them to succeed. The recommendations of the previous survey are correct and laudable but both

CITES and CSG must accept the responsibility of failing to provide adequate follow up to ensure that some progress was made in developing a management program, and a functioning CITES Management Authority.

Beginning a process to make up this lack became the primary focus of this short mission and the important recommendations (below) are focussed on the followup necessary to implement CITES in Honduras.

Several factors are favourable to attempting remedial action at this time. There is a rapidly growing environmental awareness spreading through Honduras and manifesting itself in both official government actions and the rapid expansion of an effective NGO community. There is a growing number of young Hondurans with training and attitudes that enhance the capacity for successful resource management. On the negative side, the usual grim pantheon of anti-sustainable development factors is present. Rapid population growth, the spread of rural poverty and unsustainable agriculture and the greed of some elements in the commercial sector all make action on the issue urgent.

To concretely address these issues for the Management Authority and crocodilian management a very simple outline of a possible crocodilian management program was presented and explained to Mr. Pino, the new head of the Management Authority. This plan was based on four main precepts:
1) Recognition of the present logistic and financial limitations of the management authority.
2) The deadline of June 1983 for imposition of the Universal tag requirement for all crocodilian skins in trade (CITES Conf. Res 8.14) and the opportunities this offered for revising management structure.
3) The deadline for submissions of proposals to CITES for the 9th meeting of the parties, by which time a functional management system must be in place.
4) The integration of private sector and NGO elements into the management systems as supporting elements to the Management Authority. In particular these elements could participate in the Scientific Authority, which is presently completely lacking.

The proposal (given as Table 2 below) is an outline sketch of how the more detailed recommendations of the CITES survey might be implemented, taking into account new factors that have arisen. This plan was discussed and many facets appeared to be of interest to the Management Authority, who agreed to "take it under advisement". In discussing this plan several aspects were recognized by the Dept. Pesca staff and Director as necessary and valuable. Among these were:

- The importance of CITES and the Management Authority controlling tag distribution.
- The necessity of inspecting export shipments of skins, even if only a sample of skins were checked and measured.
- The potential value of delegating some aspects of the survey program to other entities while retaining the ability to verify surveys by random check, repeat survey etc.
- The concept of regionalizing harvest of both caiman and crocodiles to allow differential harvest regimes, protection, etc., in different areas, watersheds.
- Copying export permits to CITES to allow verification.

Table 2. An outline for implementing crocodilian management in Honduras, presented and discussed with the Management Authority, 23 September 1992.

ORGANIZATION

Administrative	Scientific
1) Determine quota	a) Coordinate surveys- NGOs, Private sector, University
2) Obtain tags from CITES	b) Verify surveys (sample)
3) Distribute tags* with hunting permits	c) Conduct research (size at maturity?)
4) Inspect and verify export shipments	d) Technical assistance to ranches
5) Issue export permits after verification	
6) Copy permits to CITES secretariat	
7) Inspect farms/ranches- records, inventory	
8) Develop regulations	
9) Prepare annual report summarizing above	

* Cost of tags recovered from exporters.

APPLICATION

Caiman (wild harvest)	Crocodiles (farms and ranches)
- Survey results	- Nest surveys (private sector)
- Regionalize hunting	- Egg and hatchling collection (40% of nests reported)
- Size limit (1.6 m/85cm) mostly males	- Adult breeding stock collection (limited)
- Wild Harvest quota by river	- Nuisance animal program
	- Restocking (to sanctuaries)
	- Inspection, inventory control.
- Inspect and verify exports	- Inspect and verify exports

A new element in the management structure for Honduras is the proposal to establish a Scientific Authority that would have responsibility for research and survey components of management and make recommendations on quotas and size limits. Many informants from different positions recommended that such an Scientific Authority could best be established as a multidisciplinary consortium of interested parties including government, academic and NGO elements. The details will have to be worked out with extensive consultation and government approval but obvious potential contributors are:

Government-

A representative of the Minister for Natural Resources
The Management authority
Dept. Vida Silvestre CODEFOR, which has authority for most wildlife and conservation.
CONAMA, which is becoming the coordinating body for environmental issues.

Academics-

NGO's-

The advantage of a multidisciplinary Scientific Authority would be to take advantage of the wide distribution of skills and experience already available, to defuse some issues of competitiveness on resource management and to eliminate the possibility of special interest influence by any one sector. This concept was repeatedly recommended by informants and should be viewed as a possible Honduran response to Honduran issues that CITES and CSG would do well to consider.

Recommendations.

From the discussion above the following recommendations are made that should facilitate the continuation of improvement in CITES Management Authority.

1) Copies of valid export permits should be copied to the CITES Secretariat.

2) The new Director of the Management Authority should convene a meeting with representatives of the commercial crocodile farms, caiman exporters, academics and NGO's to discuss issues and policies for crocodilian conservation and management.

3) The proposal to register crocodile farms as captive breeding facilities for *Crocodilus acutus* should be revised, with consultation from the farms, and resubmitted to CITES for consideration. It is recognized that the success of this proposal, and the future of crocodilian management in general in Honduras, will be strongly influenced by the success of the Management Authority in improving its function.

4) The Management Authority should quickly pass revised regulations allowing the purchase of nuisance crocodiles by farms for breeding stock. This program should be restricted to a country wide total of no more than 50 animals each year, nuisance animals should be 2m or longer and should be tagged and permanently marked upon acquisition by a farm. Smaller crocodiles offered to farms could be confiscated bythe farms and released back into the wild. Farms should be required to report back to the Management Authority on the numbers sizes, tag numbers applied and names of suppliers of nuisance crocodiles.

5) The Management Authority should begin the consideration of a revised management plan for crocodilians. To accomplish this the Management Authority should request CITES to assist with suitable advisors.
6) A program of tagging all crocodilian skins in trade should be implemented to meet the requirements of CITES Conf. Res. 8.14 and the recommendations of the CITES Animals Committee and the CSG on this issue.

7) To facilitate development of a management plan and a functioning Management Authority a workshop should be convened to bring together government personnel, academics and NGO's to discuss the formation of a Scientific Authority for CITES in Honduras.

Itinerary.

Sunday, 20 September- Flew Gainesville- San Pedro Sula, discussion in evening with E. Fernandez.

Monday, 21 September- am. Inspection Clal Continental Crocodile Farm, pm. phone contacts for meetings, discussion Mr. Jorge Herrero (by phone), Mr. Danielo Martinez leather manufacturer.

Tuesday 22 September- Drive San Pedro Sula to Tegucigalpa,. Lunch and discussion with University Group, Carlos Cerrato, Efrain Villeda, Mario Espinal. Pm. met with Vice Minister of Agriculture and Mr. R. Osorio, Assistant to Minister of Natural Resources. Received assurances of full cooperation. Evening dinner and discussion Gustavo Cruz, Ernesto Vargas, Sergio Midence, Ericka Villagran.

Wednesday, 23 September- Meeting with Management Authority staff; Mr. Mauro Pino the new Director of Pesca y Aquacultura, Legal affairs advisor, Mr. Noel Mendoza and Mr. Osorio. Discussed in detail situation of caiman quotas and recommendations for management structure. Lunch meeting and discussions with Simon Romero, Jefe Vida Silvestre CODEFOR. Pm, meetings with representatives of NGO's Jorge Varela, Rene Gamaro, with Dr. Becky Mytlin of CONAMA, and with Dr. Harritt of US AID. Evening discussed formation of Asociacion de Criaderos with E. Fernandez and E. Villagran.

Thursday, 24 September- Drive Tegucigalpa - San Pedro Sula, brief inspection of tannery of Mr. Kurt Preiss. Further discussions in detail of situation on Patuka River with E. Fernandez and M. Espinal. Discussion of integration with Nicaraguan crocodilian management. Pm. briefed Dr. Jaime Rosenthal, Presidential candidate, on needs for improved management of crocodiles and prospects for sustainable use and international trade.

Friday, 25 September- Departure, fly San Pedro Sula - Gainesville

Individuals contacted.

Dr. Francisco Matamoros F. Vice Minister of Agriculture and Livestock
Secretaria de Recursos Naturales
Boulevard Miraflores
Tegucigalpa,F.M.
tel: 504 32 8817, fax: 504 32 5375

Ing. Ruperto Osorio, Asistente del Ministro Recursos Naturales
Boulevard Miraflores
Tegucigalpa,F.M.
tel: 504 32 8817, fax: 504 32 5375

Mr. Mauro Pino Merren, Director of Fisheries and Aquaculture
Secretaria de Recursos Naturales
Boulevard Miraflores
Tegucigalpa,F.M.
tel: 504 32 8817, fax: 504 32 5375

Mr. Noel Mendoza, Legal Affaires, Dept. Pesca.
Secretaria de Recursos Naturales
Boulevard Miraflores
Tegucigalpa,F.M.
tel: 504 32 8817, fax: 504 32 5375

Dr. Gustavo Cruz,
Depto. de Biologia
Universidad Nacional Autonoma de Honduras
Tegucigalpa

Lic. Carlos Cerrato
Depto. de Biologia
Universidad Nacional Autonoma de Honduras
Tegucigalpa
tel: 504 32 2110 ex 170

Biologo Efrain Villeda Rivera
Manejo de Recursos Naturales y Areas Silvestres
Depto. de Biologia
Universidad Nacional Autonoma de Honduras
Tegucigalpa
tel: 504 32 2208 ex 250

Mr. Mario Espinal, Biologist
Residential Cerro Grande
Bloque 48, Casa No 2409, Zona 2
Comayaguela
tel: 505 38 0530

Dr. Ernesto Vargas
Unidad de Limnologia
Central Hidro Electrica El Cajon
Santa Cruz de Yojoa, Cortes
tel: 505 57 2986, fax: 504 57 4331

Mr. Sergio Midence
Wildlife Conservation International
Honduras

Biol. Simon Pedro Romero
Jefe de Vida Silvestre
CODEFOR
Ba. Carizal, AP 1378
Camayaguela.

Lic. Jorge Varela M.
Presidente, Federation Ambiente y Dir. Ej. COODEFFAGOLF
Apdo. Postal No. 3663
Tegucigalpa
tel: 504 37 2655

Mr. Andres Leake
MOPAWI
Apdo. Postal 2175
Tegucigalpa
tel: 504 37 7210 fax; 504 31 2222

Mr. Rene Gamaro
Director Technico, Fundacion VIDA
Apdo. Postal 4252
Tegucigalpa
tel: 504 39 1646 fax: 504 39 1645

Dr. Becky Mytlin
Comision Nacional del Medio Ambiente y Desarollo (CONAMA)
5 Piso, Edificio Palmira
Col. Palmira
Tegucigalpa
tel y fax: 504 32 7718

Dr. Margaret M. Harritt
Environmental Advisor, US AID
Apdo. Postal No. 3453
Tegucigalpa
tel: 504 32 3120 ex 2657 fax: 504 31 2776

Lic. Eric Fernandez
Cocodrilos Clal Continental,
Aptdo Postal No. 390
San Pedro Sula
tel: 504 53 13 10 fax; 504 52 27 50

Ms. Erica Villangran
Grupo Ganadero Industria
Apdo. Postal 354
Tegucigalpa
tel: 504 32 2918 fax:504 32 5281

Mr. Jorge Herrero
Fundacion Cuero Salado
Aptdo. Post. 122, La Ceiba
tel: 504 430 329 fax: 504 431 391

Mr. Danilo Martinez
Leather manufacturer
San Pedro Sula

Ing. Jaime Rosenthal
C/O, Grupo Continental
Apdo. Postal no. 390
San Pedro Sula
tel: 504 53 1310, fax: 504 52 2750

Summary Report of the Crocodile Specialist Group Review Committee on Crocodile Management In Indonesia

H. Messel, D. Jelden and G. Hemley

(5-12 November 1992)

The IUCN Crocodile Specialist Group (CSG) review committee visited Indonesia to assess the current management of crocodilians, provide advice on further conservation strategies to achieve sustainable use of its crocodile resources, and discuss the forthcoming proposal to indefinitely maintain its Saltwater Crocodile (Crocodylus porosus) population in Appendix II of CITES, at the 9th meeting of the Conference of the Parties of CITES. Members of the review committee were Professor Harry Messel (CSG Chairman), Ms Ginette Hemley (CSG Vice-Chairman for Trade Monitoring) and Dr. Dietrich Jelden (CSG Vice-Chairman for Europe). They were accompanied by observers Dr. Grahame Webb (CSG Vice-Chairman for Eastern Asia, Oceania and Australasia) and Jaques Berney (Deputy Secretary General of the CITES Secretariat). Ginette Hemley had to depart for a meeting in London on the afternoon of Monday 9 November 1992, and thus missed discussions concerning the latter part of the review.

INTRODUCTION

At the request of the Indonesian Ministry of Forestry, Dr. Grahame Webb and Mr. Robert Jenkins (from Australia) undertook a review of crocodile conservation and management within the Republic of Indonesia (17 February to 2 March 1991). Central aims were to evaluate the program from the viewpoint of wise and sustainable use, and advise the Government of Indonesia on their forthcoming proposal to the 8th meeting of the Conference of Parties to CITES (March 1992) to list their population of C. porosus on Appendix II of CITES under the Ranching Criteria (Res. Conf. 3.15).

The ranching proposal was reviewed by a number of Parties to CITES and non-government conservation organisations (NGO's), and came before the CSG Steering Committee for review at the Santa Marta (Colombia) meeting on 9-11 November, 1991. The meeting was attended by three delegates from Indonesia (Dr. Yono Raharjo, Mr. Tazir Saleh and Mr. Atmosudirjo Sumaryoto) and from the Project Manager of the Indonesia FAO Crocodile Project (Mr. Jack Cox). While recognising advances had been made in crocodile management within Indonesia, there was considerable opposition to the proposal in its entirety, by the majority of CSG Steering Committee members. The following detailed resolution was approved:

Resolution on the Indonesian Proposal

11th November 1991

REAFFIRMING that the prime objective of the Crocodile Specialist Group is the conservation of wild crocodiles and that the exploitation of crocodiles in Indonesia is only acceptable if it is sustainable and if it contributed to the conservation of wild crocodiles and their habitats in Indonesia; and

RECOGNISING that the Government of Indonesia was given CITES quotas for 6 years as an interim management tool to allow the development of a management program to ensure sustainable utilisation; and

RECOGNISING further that such a management program has been designed but must be implemented prior to the 8th Conference of the Parties of CITES in Kyoto, Japan in March 1992.

Having ASSESSED the review of crocodile conservation and management in Indonesia conducted by Dr. G. Webb and H. Jenkins and taken note of the recommendations made therein; and

Having NOTED the findings of the FAO/PHPA crocodile project in Indonesia.

BEING AWARE that Indonesia is comprised of many diverse islands with complex geographic and cultural characteristics that impose unique complexity on crocodile management..

THE CROCODILE SPECIALIST GROUP OF IUCN/SSC

1) CONGRATULATES the Government of Indonesia on the initiatives already taken, particularly the new legislation, the review of crocodile management undertaken, the increased enforcement of regulations, and the Governments stated commitment to establishing a Crocodile Management Task Force; and

CONGRATULATES the Crocodile Farmers Association for their commitment to improve management and for their financial support of the review undertaken; and

ACCEPTS that the management program proposed to CITES may be sustainable but its potential for being so cannot be assessed until the administrative and reporting procedures recommended in the Webb and Jenkins report have been implemented; and

2) URGES that the steps already taken by the Government of Indonesia to curtail illegal trade be continued.

3) Urges the Government of Indonesia to immediately establish the proposed Task Force and implement the other appropriate recommendations of the Webb and Jenkins report.

4) Calls UPON the Government of Indonesia to ENSURE that prior to the 8th Conference of Parties in Kyoto, Japan, in March 1992, that the following actions are completed and can be documented:

4.1. A complete inventory of all live crocodiles, skins and tags on farms and in tanneries is conducted.

4.2. Procedures are in place for the regular reporting of all internal transactions in crocodiles and crocodile skins.

4.3. Procedures are in place for the regular reporting of all import and export trade in crocodiles and crocodile skins.

4.4. Reports to CITES for 1989 and 1990 required under Conf. 7.14 are completed and submitted.

4.5. A schedule is determined for the implementation of the Indonesian crocodile management program following the Kyoto meeting.

5) CONFIRMS that the CSG could only support the acceptance of the Indonesian crocodile management program proposed IF the recommendations 2,3, and 4.1-4.5, above are implemented, and encourages Indonesia to adopt similar programs for other wildlife that is subject to exploitation.

The CSG Steering Committee met in Kyoto (Japan) on 29 February 1992, just prior to the CITES meeting. Mr. Widodo Ramono, Sub Director Species Conservation within the Directorate General of Forest Protection and Nature Conservation (PHPA) presented the Indonesian response to the criteria defined in the resolution above. Significant progress was reported with each of them, and after considerable debate the CSG Steering Committee resolved:

That in view of the substantial progress achieved on the action items of the November 11 resolution, the CSG is prepared to support Indonesia's proposal for Appendix II listing with certain conditions. Should the proposal not be accepted, the CSG would support the extension of Appendix II status with a quota, feeling that at this time transfer of the Indonesian population of C. porosus to Appendix I would not be beneficial to conservation of crocodiles in Indonesia or the development of sustainable management plans.

The CSG further resolved that it will, with the co-operation of the Indonesian authorities and the farmer's association, convene an annual, on site review committee of 3 CSG members chosen by the CSG Chairman and with costs covered by the Indonesians, to monitor continued progress in crocodile management and the suppression of illegal trade of crocodilians from Indonesia.

These conditions were accepted by the Indonesian delegation. On the floor of the CITES Conference there was much debate about the Indonesian proposal with considerable support for an Appendix I listing. A temporary Appendix II listing with an annual export quota was finally approved.

The present review represents the first of three reviews to be undertaken before the 9th meeting of the Conference of Parties in late 1994.

RESULTS, DISCUSSION AND RECOMMENDATIONS

1. Species

Species	CITES	NOTES
Crocodylus n. novaeguineae	APPENDIX II	Confined to Province of Irian Jaya and associated islands. There are distinct morphological differences between northern and southern populations.
Tomistoma schlegelii	APPENDIX I	Appears to be confined to Sumatera and Kalimantan, but perhaps remnant populations occur on Java.
Crocodylus porosus	APPENDIX II (Quota)	Throughout Indonesian Archipelago but at highly variable densities.
Crocodylus siamensis	APPENDIX I	Appears restricted to eastern Kalimantan, but remnant populations may exist on Java.

There are a number of taxonomic problems associated with Indonesian crocodiles:

1.1. The northern and southern populations of C. n. novaeguineae are morphologically different, but whether there is any fundamental taxonomic significance of the variation is unclear.

1.2. There are reports of C. n. novaeguineae in Sulawesi, but it is unclear whether this is C. n. novaeguineae, C. n. mindorensis (known only from the Philippines, and particularly the southern island of Mindanao), a new subspecies or species, perhaps the one recently described as C. raninus from old museum specimens, the existence of which is yet to be confirmed.

1.3. The diagnosis of the Kalimantan crocodile as C. siamensis needs to be confirmed, as does the integrity of C. siamensis in Thailand and Cambodia.

1.4. There appears to be considerable morphological variation in C. porosus from the eastern to the western extent of Indonesia.

A visit to a crocodile farm in Sulawesi, by Webb and Jenkins, revealed a mixture of C. porosus and various forms of C. n. novaeguineae which appeared remarkably variable in external morphology relative to those seen on any other farm.

The principal commercial use of crocodiles in Indonesia occurs with C. n. novaeguineae and C. porosus in the Province of Irian Jaya, where both are subject to ranching and wild harvesting with size limits. The Government of Indonesia recognises this use as an important activity representing a significant contribution to the local economies of villages, and to the overall economic development of the Province of Irian Jaya. Internationally, attention has focused mainly on the status, use and trade of C. porosus within Irian Jaya, the status of C. porosus outside Irian Jaya, and Indonesia's compliance with CITES trade control requirements with respect to C. porosus.

The Review Committee felt that resolution of the unsolved taxonomic problems with crocodiles within the Indonesian archipelago was a significant problem affecting both conservation and management. PHPA and LIPI are encouraged to seek funding and if necessary outside advice, to address the problem, using biochemical and morphological criteria.

2. Administrative Structure

The national administrative body responsible for wildlife protection, conservation and utilisation in Indonesia is the Directorate General of Forest Protection and Nature Conservation (PHPA), within the Ministry of Forestry. In addition to a central office in Jakarta, PHPA maintains eight regional offices which oversee a number of subregional provincial offices. Subregional provincial offices, in turn, oversee sectional offices in the provinces. PHPA has been designated, by Presidential Decree, as the CITES Management Authority for Indonesia, and thus has both international and domestic responsibilities. PHPA oversees the development of national regulations, including permitting and licensing for wildlife utilisation and trade.

Regional and subregional provincial PHPA offices are located within the Department of Forestry Regional Offices, and are responsible for day-to-day

wildlife management and utilisation activities, including enforcement. Enforcement often involves extensive cooperation and coordination with local police, customs officials, military forces, special forest police and the public prosecutor, as well as with the Director of Forest Protection in Jakarta. PHPA has established an elaborate permitting system for wildlife utilisation and trade which requires extensive coordination and communication among the various PHPA offices. Three different permits are required for the capture, sale, and possession of wildlife: capture permits, transport permits and export permits. All three are issued by the regional provincial offices of the Department of Forestry. Applications are first reviewed at the regional and subregional provincial offices of PHPA, and are then copied to the central PHPA office in Jakarta. Export permits, including CITES permits, are issued by the Director General of PHPA, after applications have been scrutinised and approved by the relevant regional and subregional PHPA offices.

Within the Ministry of Forestry, PHPA employs about 3000 staff: 530 in Jakarta and Bogor, some 1200 in National Parks and the remainder in the regional and subregional provincial offices. PHPA's Region VIII, which includes the Province of Irian Jaya, has a total staff of about 200. No staff are devoted exclusively to crocodile management matters.

The Indonesian Institute of Science (LIPI) is an independent statutory authority, designated by Presidential Decree as the Scientific Authority for CITES. The staff of LIPI now advise PHPA on scientific issues associated with CITES, including annual capture quotas for species that are utilised, the issue of CITES permits, and the formulation of non-detriment findings. To date LIPI has not been provided with the resources needed to carry out field status assessments for most species in trade. Capture quotas are aimed at setting general harvest levels, within which unsustainable harvesting can be detected from the export data in combination with information on market demands and other factors.

The majority of crocodile farmers belong to the Indonesian Crocodile Farmers Association (ICFA), which is one of seven compartments within the Indonesian Fauna and Flora Traders Association (IFFTA). Both organisations were established in order that Government had a formal channel for dealing with crocodile and wildlife industries respectively.

Under the auspices of PHPA, an Indonesian Crocodile Conservation Task Force (ICCTF) was recently established, with representation from both PHPA and various members of ICFA, specifically to pursue crocodile management issues (see below).

The Review Committee felt that:

- the ability of LIPI to meet its obligations as the Indonesian Scientific Authority for CITES would be severely constrained unless increased resources (additional staff, funding, training and equipment) were made available to it.

- the aims, objectives and methods of establishing general harvest levels (quotas) and the analysis of harvest data with respect to those levels, should be reviewed and rationalised so that there is no confusion nationally or internationally about the scientific basis of them.

4. Task Force

As the result of a recommendation made in the Webb and Jenkins report, and subsequently reinforced by the CSG Steering Committee, the Indonesian Government established, by decree of the Director General of PHPA, an Indonesian Crocodile Conservation Task Force [ICCTF] in December 1991. The objective of ICCTF was to facilitate crocodile management by serving as a central planning body, a data monitoring and reporting nucleus, and an information exchange centre, for all aspects of crocodile management.

The ICCTF became active in December 1991. Its membership, from Government and industry, is subdivided into a Steering Committee (4 members), a Planning and Organisation Committee (12 members representing different provinces and areas of expertise) and an initial staff of one member of the Planning and Organisation Committee, one full-time assistant and 2 part-time assistants.

The ICCTF adopted as its primary activities those recommended by the CSG Steering Committee (see page 1-3), and concentrated initially on implementing an inventory of live animals and skins held on farms, in tanneries and in export company stores. These inventories, which are required under the Decree establishing the ICCTF are complete for some operations but not for others. The activities of the ICCTF have been severely constrained by: 1) lack of funding; 2) inadequate flow of information between ICCTF, government (PHPA) and industry (ICFA); and 3) confusion among some crocodile farmers about the aims and objectives of the ICCTF. As a consequence, the results obtained to date remain unsatisfactory.

The task force concept was based on the assumption that the extremely complex crocodile conservation and management situation that PHPA was faced with in Indonesia, would be better handled by a small group of expert staff within PHPA, or contracted to PHPA, which could work exclusively on the development of a crocodile management program and the implementation of the monitoring systems required to ensure sustainable use of the wild resource. Industry involvement in some aspects of the task force's operations was considered critical to the achievement of pragmatic programs that industry could achieve.

The Review Committee felt that:

- the ICCTF should be integrated more closely with PHPA in Jakarta, such that the collection and flow of information is enhanced.

- the ICCTF should fundamentally be a unit of PHPA in which industry representation assists in the decision-making processes to ensure management decisions are practical to implement. No information should be released from ICCTF without clearance from PHPA.

- that although safeguards were necessary to ensure commercially confidential information was not released via the ICCTF, the crocodile farmers should equally be aware that trade in crocodile products will be seriously jeopardised if basic farm monitoring data are withheld from ICCTF.

- PHPA needs to rationalise the role the ICCTF can play in reducing PHPA's allocation of resources to crocodile management, and avoid duplication of effort.

5. Management Program

The Webb and Jenkins report, the CSG resolution, and Indonesia's proposal to the 8th meeting of the Conference of the Parties to CITES all refer to specific management actions that should be combined within a single management program. This, in turn, should direct crocodile management in a uniform manner for a set period of time - say five years. Most importantly, if Act No. 5 of 1990 was amended in order to allow the management of a species to be subject to an approved management program, the complete management protocol for crocodilians, including reporting procedures, would be mandatory and legally enforceable.

No such management program has been formally designed, and although many of the recommendations have been adopted by individual farms, tanneries, skin buyers, and exporters, through the ICCTF, others know little of the recommendations. None are under a legal obligation to comply, although PHPA can refuse export permits if they so desire. The lack of a management program, especially one that is legally enforceable, is the single most important constraint on improved control, regulation and reporting. It makes the projected operations of the ICCTF very difficult to achieve. We recommend that Act No. 5 of 1990 be amended to allow legal recognition of all actions embodied within a management program for a particular species.

The Review Committee felt that:

- the failure to develop a management program was a major constraint on all aspects of crocodile conservation, management and sustainable use.

- the development and implementation of a management program should be given the highest priority and must be undertaken prior to the next proposal to CITES.

- immediate steps should be taken to amend Act No. 5 of 1990 such that it allows the management of specific wildlife species to be controlled through an approved management program.

6. Monitoring and Reporting

Several schemes are presently in operation within Indonesia to monitor the populations of crocodiles in the wild, the number of live animals held on farms, and the volumes of skins traded internally and externally. By official letter of the Director General of PHPA, licensed farms, tanneries and exporters are required to supply monthly inventories of live animals and skins held in their operations and recently acquired. These data are maintained by PHPA and used in reviewing applications for export permits. There are no legal obligations for complying with the reporting requirements, although export permits can be withheld. We recommend that the reporting requirements be made mandatory. The ICCTF is currently serving to facilitate compilation of data from the monthly reports.

6.1. Monitoring of Wild Populations

Although PHPA and some ICFA members have scattered data on Tomistoma schlegelii and C. siamensis in the wild and in captivity, no formal survey programs aimed at quantifying and monitoring status (density and distribution) have been undertaken in Indonesia. A monitoring program for C.

porosus and C. n. novaeguineae in Irian Jaya has been operating continuously since 1987, with surveys conducted regularly until 1992. The data collected are available through PHPA, and would benefit from more detailed analysis and evaluation. Monitoring data for C. porosus are particularly important to Indonesia's goal of maintaining C. porosus on Appendix II indefinitely. Although C. porosus nesting areas within Irian Jaya are known, none have so far been identified that would be suitable for monitoring the wild population, as occurs in PNG; nests are beneath a canopy and cannot be seen from the air.

6.2. Wild Harvest

Data on the volume and size of skins collected from the wild have been readily available through PHPA transaction reports for several years, although these reports have never been comprehensively analysed. Transaction reports should be submitted by traders on a monthly basis and reports examined from some companies (Bintang Mas, Sentani Valley, Inhutani II) were current. The data from these companies serve a much broader purpose than helping to control trade. They provide definitive accounts of every skin and live crocodile collected, including their size, species and area of collection. Such data are fundamental to the evaluation of harvest sustainability for each population.

6.3. Farm Stocks

Monitoring and reporting of farm stocks is still incomplete. Data from fewer than 50% of the government-licensed farms have flowed through to the ICCTF. Some farms in Sumatera and Kalimantan are still acquiring Tomistoma schlegelii and C. siamensis, a point of concern to the international community given the lack of status data. Accurate reporting of stocks obtained from the wild may be crucial to the successful maintenance of C. porosus on Appendix II at the next meeting of the Conference of Parties to CITES.

The review committee felt that additional staff, possibly from outside the country, may be needed to stimulate reporting and analysis of the monitoring data, while training local staff and ICFA members in these skills. Although the number of reports required may not be able to be reduced, the Review Committee felt that the frequency of reporting could be reduced (quarterly or each 6 months), the number of copies of each report submitted could be reduced and the procedures of reporting could be streamlined. Standardised reporting stationary would greatly assist data compilation and assessment.

6.4. Skins

Movement of skins within Indonesia is regulated through a transport permit system administered by PHPA. Some farmers have their own tannery and are licensed to purchase wild harvested skins in addition to those produced on the farm through ranching and captive breeding. PHPA staff supervise the culling and tagging of farm stocks, and have encouraged the farms to implement an internal tagging system that allows the origin (wild or farm) of skins in tanneries to be identified. This is an important distinction to make, because the quota established at the 8th meeting of the Conference of the Parties to CITES, was essentially two quotas, one for skins originating from the wild, and the other for skins produced on farms. The two subquotas must be accurately adhered to. The Review Committee felt quite strongly that if the culling and skinning of a crocodile were not witnessed by PHPA staff or their delegates, then the skin should be considered as having been obtained from the wild.

The ICCTF is making a strong effort to monitor the transaction form system, but is having difficulty because of lack of understanding of the reporting system on the part of many farmers and traders.

The situation with oversized skins remains complex, in that large animals are inadvertenly killed during normal capture efforts. They cannot be disposed of legally, and so there is no monitoring of the extent of their harvest. Furthermore, such skins encourage illegal trade, and have led to wild speculation about the extent of illegal trade. As an interim measure, the Review Committee feels that the current program of using such skins to finance monitoring activities should be retained, while the extent of the problem is quantified.

6.5. Exports

Export of skins is monitored mainly by PHPA who transfer records to the ICCTF on an irregular basis. Skin export records examined by the review committee at the ICCTF office included those to mid-1992.

CITES reports have been compiled by PHPA and sent to the Secretariat regularly. The most recent report available is for 1990 exports. The fact that the 1991 report has not yet been submitted to the Secretariat, although the reporting deadline has passed, was not considered a major problem by the Review Committee - the export data are readily available from the ICCTF. Copies of CITES export documents should be sent to the CITES Secretariat regularly, preferably on a monthly basis.

In considering the complete monitoring situation, the Review Committee felt:

- immediate steps should be taken to collect, collate, standardise and store in a readily retrievable system, all monitoring data on wild and captive stocks so far collected within Indonesia.

- all monitoring programs be reviewed with a view to identifying the information need that the monitoring programs are designed to answer, and ensuring appropriate analysis and reporting of results.

7. Training

As a consequence of the FAO program, some PHPA staff have received training in survey techniques. However, there is a general need to improve skills in: the principles of surveying and monitoring; the methodology for rigid scientifically-repeatable surveys; the analysis of survey data; and, the means through which survey and monitoring results can be reported in a clear, unambiguous manner. Generally, there is a need to direct monitoring activities at specific management questions/needs.

8. CITES Listing

For Indonesia to pursue the sustainable use of wild crocodile resources, and continue exporting C. porosus products derived from wild harvesting (in any form), the Indonesia population of C. porosus will need to be maintained on Appendix II indefinitely. Current trade is undertaken under a temporary Appendix II listing (Res. Conf. 7.14), and C. porosus will revert back to Appendix I at the next meeting of the Conference of Parties to CITES, unless a proposal to maintain them on Appendix II is prepared, submitted and accepted by the Parties at their next meeting in 1994.

Because of Indonesia's unique management needs, the flexibility of management required for the conservation and sustainable use of wild C. porosus populations within Indonesia does not fall readily into the current CITES criteria defining how a species can be transferred from Appendix I to Appendix II, or maintained in Appendix II without restrictions. Trade in products derived from the captive breeding of C. porosus could be conducted under an Appendix I listing, if the operation of captive breeding farms complies with CITES regulations, and the farms are included in the CITES Secretariat's register of commercial captive breeding institutions for Appendix I species.

Taking into account the variable status of C. porosus in different parts of Indonesia, and the provisions of both CITES and the Resolutions of the Conferences of Parties regarding amendments to the Appendices of CITES, the Indonesian proposal for indefinite maintenance of its C. porosus population on Appendix II should be subdivided into three sections:

8.1. General;

The general section should provide the basic biological and current trade data required for any CITES proposal, and should include full details of the operating management program. Under the heading "Similar Species" in the proposal, information on the protection afforded to Indonesia's Appendix I species (C. siamensis and T. schlegelii) should be provided.

8.2. Indonesian Range Outside of Irian Jaya

For the Indonesian population of C. porosus which exists outside of Irian Jaya, the proposal should satisfy the criteria laid down in Res. Conf. 3.15 for ranching. The management program should be restricted to the ranching of eggs and/or juveniles less than 80 cm total length. The program should specifically exclude any harvesting/cropping of wild specimens for the skin trade, and have legal provisions in place to rescind licences of any farms or tanneries that acquire wild harvested skins, or live animals larger than the maximum permissible size.

As captive breeding also occurs within many ranches, the regulations concerning production via this route need to be included in the proposal. If necessary, combined quotas for ranched and captive-bred specimens may be determined within the proposal.

8.3. Irian Jaya

For Irian Jaya, specimens taken from the wild are either live specimens for ranching, or dead specimens for their meat (for subsistence utilisation) and/or skins (for trade). As Indonesia is unlikely to have the resources needed to fulfil the extensive requirements of Res. Conf. 1.2 (the Berne Criteria), the acceptance of the proposal under Special Criteria, should be sought at the meeting of the Conference of Parties. Specific conditions of notable significance in Irian Jaya, which must be addressed in the proposal, are:

1. The nature of the crocodile habitat with regard to monitoring difficulties;
2. The sympatric relationship with C. n. novaeguineae, which is on Appendix II, and is itself subject to utilisation;
3. The inability of harvesting techniques to distinguish between species;

4. The historical and present use of crocodiles by indigenous hunter-gathers for meat and other products;
5. The need for consistency of management with the successful Papua New Guinea harvesting regimes, which operate in a near identical environment, with the same species, and same type of village-level use.

The proposal should, therefore, demonstrate that sustainable use of the wild population is possible, and that based on the Papua New Guinea experience, it provides conservation benefits to the species, to other sympatric species and to the ecosystem in which they live, in addition to providing significant assistance (income) to the development of local people (Res. Conf. 8.3). This should be supported by a statement from the CSG.

Finally, the proposal should provide safeguards to prevent overexploitation, such as:

1. Size limits,
2. Capture and export quotas, subject or not to the approval of the Conference of Parties,
3. The details of monitoring programs,
4. Reporting procedures,
5. Procedures for the issuance of documentation
6. Details of the tagging system in operation.

Considering the ranching component of the proposal, it must be submitted 330 days before the 9th meeting of the Conference of Parties required by Res. Conf. 3.15; i.e. most probably by early November 1993.

9. Tagging

The distribution of CITES tags needs to be closely controlled and monitored by PHPA and all authorities dealing with the export of crocodile products. Tags not used in a particular year should be returned to PHPA and destroyed at the end of each year.

10. Tomistoma schlegelii and Crocodylus siamensis

Tomistoma schlegelii is believed to be one of the world's most endangered crocodilians, which may well be extinct in Thailand and the Malaysian Peninsula. There are few data available on the species' biology and status within Indonesia. The species is represented on crocodile farms in Malaysia, Singapore, Sumatera, Java and Kalimantan, although typically in small numbers. PHPA has allowed some farms in Sumatera and Kalimantan to acquire T. schlegelii from the wild, as establishment stock for captive breeding. Some hundreds are in captivity, mostly small juveniles. Unfortunately, captive breeding with this species appears to be notoriously difficult, with relatively few clutches of fertile eggs ever having been reported. Added to this, the skin of T. schlegelii appears to have little commercial value, even if large captive-bred stocks were eventually available, which appears unlikely. In the view of the Review Committee, the continued collection of this species from the wild, in the absence of data on its status, cannot be justified. Permission to collect this species should be revoked immediately, and the Government of Indonesia and ICFA should be encouraged to initiate a joint research program aimed at determining its status and co-ordinating research with the stocks currently held in captivity.

The situation with C. siamensis in Indonesia is more complicated, in that there remains a possibility that the population is taxonomically distinct from the mainland population of South-East Asia. This species occurs in Thailand (where the species is virtually extinct in the wild) and Cambodia, where the status of the wild population is unknown. The Kalimantan population is nominally on Appendix I. If it proves to be a new subspecies, it would automatically remain on Appendix I, but if a distinct new species, it would automatically be on Appendix II. [Given its restricted distribution and apparent rarity in Kalimantan, its transfer to Appendix I is likely to be justifiable]. The discovery of this species in Indonesia was a direct result of C. porosus ranching in Eastern Kalimantan. Juveniles were brought to two farms with batches of C. porosus obtained from remote upstream areas. The farms have co-operated fully with PHPA and FAO in providing all information on the species. Larger individuals at one farm are now breeding quite successfully in captivity, which should be encouraged. Increased harvesting from the wild should be banned until the taxonomic status of the species is resolved, and more important, its distribution and status quantified. The farms should be encouraged to maintain their captive stocks in the best possible conditions and to maintain their co-operation with PHPA in researching this species. Unlike T. schlegelii, this species is commercially valuable and is relatively easy to breed in captivity. Once large captive-bred stocks are available, registration with CITES as a commercial captive breeding operation for Appendix I species should not be difficult.

The Review Committee noted that these two species were a high conservation priority within the IUCN-SSC Action Plan for Crocodilians and offer their assistance to implement actions designed to quantify and enhance their status in the wild. Specific recommendations are:

- PHPA and LIPI, with the assistance of ICFA and ICCTF, should collect, collate and report on all available information on T. schlegelii and C. siamensis within Indonesia.

- Depending on the results above, broad-scale investigations should be undertaken (perhaps through questionnaires) to identify areas where either species existed historically and exist now.

- On the basis of these investigations, preliminary field surveys should be undertaken to confirm or reject prospective sites where either species exists.

- With the assistance of the CSG, appropriate research/monitoring programs should be designed to ensure the status of both species does not decline further.

- PHPA should ensure that no opportunities are available for C. siamensis to interbreed with either C. porosus or C. n. novaeguineae in captivity, as hybridisation is claimed to be possible and maintaining pure stocks of these rare species may be critical to later restocking efforts.

- PHPA should not issue transport documentation if one of the consequences of the proposed shipment could be hybridisation.

11. Enforcement

In Irian Jaya, active enforcement of national laws concerning trade in crocodile skins has resulted in at least nine (9) cases during the period 1989-92, with seven (7) successfully prosecuted with up to 1.5 years gaol and fines up to Rp 1.5 million ($US714): two (2) cases are pending. The new Act No. 5 increases significantly the penalties for illegal activities with all wildlife, including

crocodiles and is reported by PHPA officials as being a successful deterrent. The management recommendations made by Webb-Jenkins and supported by the CSG were intended to provide enforcement staff with additional powers of detection, and the failure to incorporate them within a legal instrument may be constraining enforcement efforts.

The Review Committee recommends:

- PHPA liaise more closely with the CITES Secretariat about cases where illegal activities involving illegal international trade in wildlife are suspected or known.

- Where problems arise with enforcement issues, PHPA should seek advice and assistance from the CITES Secretariat.

12. Crocodile Reserves

PHPA, LIPI, ICFA and ICCTF should investigate which areas both within and outside Irian Jaya could serve as protected areas, containing representative habitats, for all of Indonesia's crocodile species. Within Irian Jaya, some areas which may be considered are: Kimaam Game Reserve, the proposed Lorentz National Park and Wasur National Park.

13. Returning Stock Back to the Wild

The provision for PHPA to collect 10% of ranched stock for restocking wild populations is a condition of licences to farm crocodiles in Indonesia. The Review Committee considers such a return-back-to-the-wild should normally only be undertaken where local extinction, rather than low densities per se, is considered a high possibility.

14. Future Reviews

The next CSG reviews are planned (8-16 October 1992) to be carried out immediately following the second review in Thailand. It is suggested that this review examine habitats and farms containing T. schlegelii in Sumatera and Kalimantan.

15. Indonesian FAO Crocodile Project

The Review Committee was under the impression that the Indonesian FAO Crocodile Project had terminated and/or had little chance of further funding. Members were deeply concerned that the survey data collected during the life of this project were not deposited in their entirety with either PHPA or LIPI, as such results have long-term value for conservation and required significant resources to obtain.

At the end of the visit of the Review Committee, the Chairman inadvertently learnt that continuation of the Indonesian FAO crocodile project was the subject of a current aid proposal between the Government of Indonesia and FAO. The proposal itself was examined by the Review Committee, who felt that although support for crocodilian management and sustainable use in Indonesia was urgently required, this proposal was seriously flawed in some areas, and a duplication of the CSG Review Committee's mission in others. If activated in its present form, it may prove futile for the CSG to assist Indonesia through the review program. The proposal should be thoroughly reviewed by the CSG before being proceeded with. It would need to be integrated with the recommendations of the present Review Committee's report.

ACKNOWLEDGMENTS

The Review Committee would particularly like to thank members of PHPA, LIPI, IFFTA, ICFA and ICCTF for their kind hospitality and enthusiastic support for all aspects of the review. Special thanks goes to Dr. Grahame Webb and Mr. Jaques Berney for technical assistance and advice. Thanks to Steven Nash (TRAFFIC Southeast Asia) for his contribution to the final workshop. We would particularly like to thank J. Walker for assistance and encouragement in the field. Complete financial support for the visit of the review team was provided by PHPA and IFFTA, with contributions from each IFFTA compartment: Arwana, birds, corals (shells and tropical fish), crocodiles, reptiles (non-crocodile) plants and primates.

APPENDIX I

Itinerary

5th November 1992

Arrival Jakarta. Working dinner with PHPA, IFFTA, ICFA, LIPI and ICCTF.

6th November 1992

Meeting with Director-General of PHPA (Sutisna Wartaputra) and then discussions about crocodile management within Indonesia. Discussed administrative structure through which different government departments are involved in the regulation of crocodile management. Drove to Bogor in the afternoon and examined the ICCTF office and checked reports on crocodile farm stocks and exports. Meeting with PHPA, LIPI and ICCTF to discuss problems in the collection and reporting of data by the ICCTF. Discussed difficulties with regard to crocodiles being separated from other wildlife under the ICCTF structure, particularly with IFFTA. Evening flight to Jayapura (depart 2100 arrive 0700).

7th November 1992

Arrival in Jayapura (0700). Morning spent on report. Lunch and then visit to provincial office of Forestry, which contains the PHPA office. Meeting with Provincial Forestry staff, PHPA staff, Police, Customs, Sucofindo, LIPI. Discussed the monitoring program for wild crocodile populations in Irian Jaya and examined summary reports showing consecutive spotlight and nest data over a series of years, including 1992 data. Also examined skin and live crocodile transaction records from Bintang Mas, Indonesia's largest crocodile farm. These records contain the sizes and locations of all animals purchased and are thus a fine monitoring tool. Dinner then worked on report.

8th November 1992

Light aircraft flight (2.5 hours) from Jayapura to Panga, in the upper reaches of the Mamberamo River, and then downstream to Dabra, then back to Jayapura. The Mamberarmo River is one of the sites where C. porosus skins and juveniles are collected, and it is the major collection site for C. n. novaeguineae skins and juveniles. There is virtually nothing, in the way of development in the area, with both forest and wetlands being essentially pristine. Lunch at Sentani Valley crocodile farm. Examined Sentani Valley farm and Inhutani II farm, including stock and transaction records. Examined the Sentani Valley tannery, which processes skins to the wet-blue stage. The tannery is not operating and 100-200 skins with internal company tags were in stock. Visited Bintang Mas farm, which contains current stocks of 30,000 live crocodiles and stocks of 29,927 skins. Most of the skins come from small animals, less than 10" belly width, which represents the peak mortality in the ranching program. These skins cannot be exported unless made into products because they are below the minimum size imposed by the Government of Indonesia. The tannery is active and processes all skins through to the wet-blue stage and some skins through to the finished stage. The farm now has a factory for manufacturing finished products in Jakarta, largely for the domestic market. Report writing, dinner and then - report writing.

9th November 1992.

Flight to Jakarta (arrive 1400 hrs). Drive to Cisarua Lodge, Bogor. Dinner with IFFTA and ICFA officials followed by report writing.

10th November 1992

Discussion with representatives from PHPA and LIPI about the draft report followed by report writing. Steven Nash (TRAFFIC Southeast Asia) arrived in the afternoon. Dinner hosted by IFFTA followed by report writing.

11th November 1992.

Report writing. Attendance at IFFTA workshop on sustainable use of wildlife. Review Committee's report summarised by Professor Messel and various presentations by Dr. Jelden, Mr. Berney, Dr. Webb and Mr. Nash. Final dinner hosted by IFFTA. Report writing

12th November 1992

Finalisation of report. Depart Jakarta.

Summary Report of the Crocodile Specialist Group Review Committee on Crocodile Management In Thailand

D. Jelden and H. Messel

(2-4 November 1992)

The IUCN Crocodile Specialist Group (CSG) review committee visited Thailand in order to assess the progress made to date with crocodile management and conservation. Members of the review committee were Professor Harry Messel (CSG Chairman) and Dr. Dietrich Jelden (CSG Vice-Chairman for Europe). They were accompanied by observers Dr. Grahame Webb (CSG Vice-Chairman for Eastern Asia, Oceania and Australasia) and Jaques Berney (Deputy Secretary General of the CITES Secretariat).

INTRODUCTION

At the 8th Conference of the Parties of CITES, in Kyoto, Japan (March 1992), there was much discussion about the existing wildlife trade ban that had been imposed on Thailand by the CITES Standing Committee (in January 1991). The ban was imposed because Thailand had not implemented legislation that allowed it to enforce CITES within the country, and as a consequence, significant illegal wildlife trade had developed. Crocodilians were one of the important species groups involved in this trade.

In mid-1991, the CSG was invited by wildlife traders in Thailand, Japan and Singapore, to advise on wildlife management issues in general and specifically on those relating to crocodilians.

In June 1991, the Crocodile Management Association of Thailand (CMAT) invited Dr. Grahame Webb and Mr. Robert Jenkins from Australia to visit Thailand, and review crocodile management within the country. CMAT had been formed before the trade ban on Thailand, and was thus in a position to co-ordinate activities aimed at rectifying potential problems.

In August 1991 the Webb-Jenkins Report ("Management of Crocodiles in Thailand - A Review with Recommendations") was completed and circulated. The recommendations it contained were reviewed by the CSG and became the basis for action aimed at assisting Thailand to upgrade its crocodile management program. The CSG Chairman made it known to representatives of CMAT that their implementation of the Webb-Jenkins recommendations would help secure the support of the CSG for lifting the trade ban, which also applied to products derived from captive bred crocodiles.

By the CITES meeting in Kyoto (March 1992), Thailand had advanced significantly with the drafting of their enacting legislation for CITES. They had also exerted more rigorous controls on wildlife trade generally, and had started to implement the Webb-Jenkins recommendations. The Steering Committee of the CSG was not prepared to support an unconditional recommendation to the Standing Committee of CITES to life the trade ban, and resolved as follows:

i. Fully supports the applications of 5 Thai crocodile farms for registration in the CITES Secretariat's Register of captive breeding operations for Appendix I species.

ii. Would recommend to the Standing Committee of CITES that they consider a partial lifting of the recommended trade ban to allow the resumption of trade in

legal crocodile products including those derived from captive breeding operations.

iii. Will, with the co-operation of the Thai Management Authority and CMAT, undertake an on-site annual review using a CSG review committee of up to three members chosen by the Chairman, at Thailand's expense.

At the CSG Steering Committee meeting in Kyoto, representatives from Thailand agreed to the above procedures. The present review thus represents the first of the three reviews, using a CSG review committee of two persons.

The review committee decided to use the recommendations made by Webb and Jenkins (1991) as a standard set of criteria for assessing progress with management. However it was clearly understood that these recommendations were often framed as management options, rather than requiring definitive adoption. The itinerary is in Appendix I

RESULTS

1. Specific Recommendations

R.5.1.1. Expedite new legislation

The Government of Thailand has introduced new wildlife legislation, and is currently finalising regulations. They are expected to be in place in about 3 months. The regulations have been approved, but are with the legal Department.

R5.1.2. Crocodile conservation and management should be subject to an approved management program renewable each 5 years.

A conservation and management program, particularly for captive stocks, has been partially prepared by CMAT.

R5.1.3. Encourage Cambodia, Myanmar and Laos to join CITES

The Government of Thailand and CMAT, through its Chairman, Dr. Parntep Ratanakorn, have had several contacts and at least one visit to Cambodia.

R5.1.4. Initiate survey program to quantify status of wild stocks

A questionnaire survey (1000 questionnaires) was carried out in addition to collecting information from various sources. This revealed a small number of locations were C. siamensis may still exist, but one of them, within Pang Seda National Park (Chonburi Province) appeared definite. A ground survey was undertaken during the wet season (September 1992) to try and confirm sightings prior to the CSG review committee visit. None was sighted, but local information indicates that some animals do indeed remain there. It appears that this site may be one well suited for reintroductions. Additional surveys are planned and funds are being sought for them.

R.5.1.5. Establish a working group for reintroductions

CMAT initiated this task 6 months ago and there has been continual discussion with Government about it.

R5.1.6. Consideration may be given to marking released animals with radio transmitters.

CMAT has considered it, but no definitive plan for restocking has yet been arrived at.

R5.1.7. Consideration of Bung-borpet as a restocking site.

CMAT has been unable to confirm that any C. siamensis remain and it remains unclear whether this would be a suitable site for restocking due to its current use for fishing.

R5.1.8. People involved commercially with crocodiles should be encouraged to become members of CMAT.

This has been done and continues to be a priority. The majority of the commercial sector are members of CMAT, which is currently comprised of 160 members (organisations, individuals, researchers, etc.). CMAT circulates a crocodile newsletter amongst its members, and has completed a farming manual in the Thai language.

R5.1.9. CMAT should adopt a Constitution.

Has been done.

R5.1.10. The Royal Forestry Department (RFD) and CMAT should ensure avenues are open for international assistance with illegal trade detection.

Verbally agreed, however CMAT has been liaising with TRAFFIC Southeast Asia.

R5.1.11. Tanneries should be inventoried

RFD has informed most tanneries that when the enabling regulations are finalised (approximately 3 months), this will be done.

R5.2.1-4. A series of recommendations were made concerning the new legislation and its operational aspects.

The new legislation has been passed and with the Regulations, now awaiting finalisation, will allow imports and exports of all species to be regulated according to CITES. It involves a system of licensing and permits for regulation of the taking, keeping, killing, possessing, processing and sale of wildlife.

R5.2.5. Trust fund establishment for industry to contribute to conservation and management.

Not yet done; it may not be feasible under Government policy.

R5.2.6. Consider amalgamation of the three new sets of Wildlife Legislation.

Was not amalgamated.

R5.3 Involves a series of recommendations involved with the nature of management programs and actions.

As the regulations and management programs are incomplete, these have not been implemented fully, yet some aspects of them have been considered.

R5.3.1-11. Recommendations dealing with the impact of management on wild populations.

These cannot be considered seriously before the status of the wild population is quantified.

R5.3.12-15. Recommendations ensuring that management achieves CITES goals.

Regulations are still being finalised. The skins that have been exported came exclusively from CITES registered captive breeding operations and were tagged and accompanied by CITES export permits.

R5.3.16-17. Provision of crocodiles to Government for restocking and formulation of a restocking program.

CMAT farms have offered stock for restocking and discussions about a program are underway between CMAT and RFD.

R5.3.18. CITES reporting procedure

A current reporting procedure exists but has not yet been subject to review.

R5.4. Registration of CITES Captive Breeding Establishments

Five new farms have been registered (CITES Notification to Parties No. 700 of 24 August, 1992).

2., General Issues

2.1. Alleged Crocodile Trade with Cambodia.

On the basis of a CMAT visit to Cambodia, it was estimated that 3000 to 4000 hatchling C. siamensis, produced through captive breeding operations within Kampuchea, may be finding there way into Thailand each year. These appear to be moving into village level farms, and policing will be difficult. There is no evidence that they are moving onto registered breeding farms, who are well aware that their registration would be seriously jeopardised if this were the case. The RFD closely monitors egg production and hatchability on the captive breeding farms now.

2.2. Alleged Crocodile Trade with Andaman Islands

At the 11th meeting of the CSG (Zimbabwe, 1992) an unconfirmed allegation was made that juvenile C. porosus were being collected by Thai fishermen and exported to illegally Thailand. The RFD has not received any reports indicating such a trade exists, but cannot exclude it as a possibility.

2.3. Caiman issue.

Thailand was involved historically in the importation of Caiman skins without appropriate documentation. The RFD has agreed that such skins can be made into products for domestic sale only, but will not issue CITES documentation for their re-export as skins or products. The number of these skins in existence within Thailand is unknown, however once the Regulations are in place, the RFD will insist that they be declared. If not declared, and found by the RFD, they will be confiscated and destroyed. The one tannery visited (see Appendix I) was largely non-operational and contained no crocodilian skins on site.

Information gained indicated that at least two tanners/manufacturers had around 1000 skins each (see Appendix I)

DISCUSSION

In a series of meetings and discussions, the following items were resolved:

1. The Review Committee was pleased with the excellent progress made with crocodile conservation and management in Thailand to date. The Chairman congratulated the group and encouraged everyone to continue with the good work.

2. The next review committee meeting would be 3-8 October, 1993.

3. The CSG would give every encouragement to continued survey programs, and urges some attention be paid to Tomistoma during the same program.

4. The CSG reaffirmed that every effort should be made to curtail illegal trade with crocodiles across the border with Kampuchea.

5. The CSG reaffirmed that every effort should be made to trace, inventory and monitor the stocks of Caiman skins within Thailand.

6. The CSG encourages Thailand to form a marketing group in order that Thailand sales and exports of skins are tightly controlled.

7. The CSG encourages Thailand to pursue the reintroduction program.

8. The CSG was gratified to learn that the concerns expressed by the US Fish and Wildlife Service would be addressed within the new regulations.

9. The CSG pointed out that the lifting of a ban in the US would not mean that C. siamensis (including hybrids), would be accepted as a legal import into the US as a separate petition from Thailand to the US would be needed to have the status of C. siamenis under the US Endangered Species Act changed, and this could take a number of years.

10. The CSG gratefully acknowledges the donation of $US10,000 from Mr. Utai Youngprapakorn, for research and educational activities of the CSG. Mr. Youngprapakorn's long-standing concern for the conservation of world crocodiles has been an inspiration for many people, in many parts of the world, and this gesture is but another example of his commitment.

11. The review committee and observers gratefully acknowledge the friendliness and outstanding hospitality extended to them by the crocodile farmers and researchers of Thailand.

APPENDIX I

Itinerary

1st November 1992
Arrival Bangkok

2nd November 1992

Visit "Samphran Elephant Ground and Zoo". Discussions with Preecha Ratanaporn (Royal Forestry Department) and the owner, Pichai Chaimongkoltraukul, and owner's son, Kriengkrai ("Ken") Chaimongkoltraukul, about management and general aspects of Government control of farms. The farm is particularly well run and clean. The owner, when questioned, was not in a position to provide latest data on current stocks. Last inventory data for the four species was 1991 - they are obliged to report to the Royal Forestry Department annually. Further discussion revealed that standardised reporting to CMAT and RFD would be advantageous. Data presented on breeding success indicated low hatchling production per adult held in captivity. In 1992, only 444 hatchlings were produced from 2517 eggs, which was attributed to young breeding animals, although the pen designs, which are well suited to public exhibition, are probably constraining breeding. Drove to Sriracha, then to Pattaya.

3rd November 1992

Visit "Pattaya Crocodile Farm" and held discussions with the owner, Suan Panomwatanakul, about management of the operation, which is still under construction. The official opening for this remarkable high quality facility, is expected in two months time, and it is expected to prove a good tourist attraction. The entire enterprise, as with Samphran, is oriented mainly at tourism. operation. Also discussed Caiman skins associated with a small tanning operation that Suan is involved in. He estimates around 1000 Caiman skins would be involved.

Drove to "Srirachafarm Co. Limited" and inspected breeding pens, raising pens and incubators with owner Maitree Temsiriphong. Discussed general management of the operation purely as a production farm. Also discussed marketing and examined finished products made locally from skins retrieved from dead animals. Construction had been greatly extended since the Webb-Jenkins visit (1991) and now includes some 500 unitised (one male:one female) pens. The review committee was also able to inspect the excellent incubation facilities and the controlling system for temperature and humidity. This farm produced some 2000 hatchlings last season. The hatchlings are raised in a large, two tiered, controlled-environment shed.

Drove to "Samutprakarn Crocodile Farm and Zoo", which has been significantly upgraded in many aspects since the Webb-Jenkins visit (1991). We were shown around the farm by Charoon, Uthen, Nitaya and Panya Youngprapakorn and Suwanna Junprasert. The response to falling skin prices has been to hold stocks, and to this end, batteries of new pens have been constructed. During 1992, total exports of skins were estimated as 100 (to Japan). The raising pens appear crowded, however, the animals themselves are in excellent condition - this would be confirmed by the estimated mortality rate of around 1% per year in animals over 1 year of age. The carrying capacity of the farm appears to have been reached unless more pens are constructed. Inspected a captive group of 66 large adult Tomistoma, which generally appeared to be in excellent condition. Captive breeding has still not been achieved successfully,

although a nest of infertile eggs was reported from the previous year. Overnight in Bangkok, where Jacques Berney had arrived.

4th November 1992

Dr. Jelden visited the "UK International Co., Ltd." tannery (Nikom Industrial Estate Authority SOI 1, 567 SOI 2, Sukhumvit Rd., Tambon Bangpooomai, Ampher Muang, Samutprakarn 10270) with Uthen Youngprapakorn. The tannery is a joint venture between Utai Youngprapakorn and Inoue Co. from Japan. The manager of the tannery was Itaru Yoshino. No crocodilian skins were in stock within the tannery, which appeared to be largely dormant. The recent tanning within the tanning was restricted to python, shark, stingray and sea-snake skins. At Samutprakarn, met with Utai Youngprakakorn and was shown stockpiles of about 1000 Caiman crocodilus skins (mainly from the subspecies fuscus), with 15-16 C. c. yacare and 21 C. c. crocodilus. The C. c. yacare had what appeared to be spear marks behind the nuchal crest (skins 16-20" belly width).

Meeting with RFD representative and CMAT members started at 10.00 hours. It was completed at 1530 hours.

5th November 1992
Departure for Jakarta.

CONSERVATION AND SUSTAINABLE USE OF

CAIMAN YACARE IN PARAGUAY

A Report to the CITES Secretariat and to the Japanese Leather Industry Association (JLIA)

by

EMERITUS PROFESSOR HARRY MESSEL
University of Sydney
Sydney 2006, Australia
and
Chancellor of Bond University
Gold Coast, Queensland 4229, Australia

Chairman of the IUCN/SSC Crocodile Specialist Group
and
Senior Vice Chairman of the IUCN Species Survival Commission

and

PROFESSOR F. WAYNE KING
Florida Museum of Natural History
Gainesville, FL 32611, USA

Deputy Chairman of the IUCN/SSC Crocodile Specialist Group

21 OCTOBER 1992

Preface by Prof. Harry Messel. In March 1992, while attending the 8th Conference of the Parties to CITES in Kyoto, Japan, in my capacity as Chairman of the Crocodile Specialist Group of SSC/IUCN, I was first approached by a representative of the Japanese Leather Industry Association (JLIA) and then by staff from both the international CITES Secretariat and CITES Paraguay (followed by an official invitation from the Government of Paraguay) in relation to the possibility of a sustainable use caiman program being implemented in Paraguay in the near future. I was invited to visit Paraguay in order to have discussions with the groups involved and to carry out a short (4-day) preliminary survey in a number of waterways in Alto Paraguay (northeastern Paraguay). It was hoped that I could provide further guidance on the next steps which should be taken. I then invited Professor Wayne King, Deputy Chairman of the CSG, who I considered to be the most knowledgeable scientist on the crocodilians of Central and South America, to accompany me. Professor King has been actively involved with the crocodilians of South America since the early 1970's when he collaborated with Professor Federico Medem.

At that time, I also contacted Dr. Norman Scott, a CSG member, to brief him on what was developing, since Dr. Scott had conducted the systematics survey of the crocodilians of Paraguay in the 1980's and was involved with a projected long-term caiman monitoring project there. Some of the results of the systematics and taxonomy survey have been published by Scott *et al* (1990)

Introduction. The Crocodile Specialist Group (CSG) of the Species Survival Commission (SSC) of the World Conservation Union (IUCN) is charged with the responsibility of conserving crocodilians throughout the world. At present, there are

essentially two basic types of crocodilian conservation programs in effect worldwide: recovery programs designed to reduce the threat of extinction to endangered species (such as those for the Orinoco and Philippine crocodiles), and sustainable use programs that capitalize on the economic value of certain of the crocodilian populations as a means of promoting their conservation (such as those for the common caiman, the Nile and saltwater crocodiles, and the American alligator).

Conservation through sustainable use -- or value driven conservation -- has proven to be very successful for a number of crocodilian species, when carried out under carefully planned and rigorously controlled management programs. That kind of successful program is functioning at the present time in a number of countries: in Venezuela for common caiman; in the USA for the American alligator; in Zimbabwe and a number of other African nations for the Nile crocodile; and in Papua New Guinea and Australia for the saltwater crocodile. Similar sustainable use programs for crocodilians are in the process of being established in a host of other countries worldwide.

The impetus for such projects is the established record that legal, carefully managed and controlled sustainable use of a number of crocodilian species has proven to be of conservation benefit to the species, to the conservation of biodiversity, to the protection of wetlands that are not only the habitat of crocodilians but also of many other wetland dependent species, and at the same time provides considerable economic benefit to peoples of the country concerned. It is also proving to be an important and potent force against illegal trade in crocodilian skins and products.

During the past 15 years the illegal trade in crocodilians has been vast, running into many millions of skins and hundreds of millions of dollars (US$). Not only have some crocodilian populations been decimated but the people of the countries concerned have

usually derived little economic benefit in the process. This is now changing very rapidly and one of the main reasons for this is the availability of legal crocodilian skins derived from sustainable use programs.

In March 1992, the CSG/SSC/IUCN ACTION PLAN FOR THE CONSERVATION OF CROCODILES was published. This official publication highlights the importance of sustainable use for the conservation of crocodilians and the reader is referred to this publication for a detailed discussion of the matter.

Sustainable use projects for crocodilians vary greatly and usually from country to country. However, they can be classified into two principal types: cropping and ranching. Cropping is the harvest of commercial-sized animals directly from the wild, and ranching is a modified cropping program involving the captive rearing of crocodilians collected from the wild as eggs or hatchlings. In captivity, the crocodilians are harvested after being reared to commercial size. Because eggs and hatchlings have a very high mortality rate in the wild, removing them from the wild has far less impact on the population than does the removal of breeding-sized adults. It is for this reason that, when economically feasible, ranching is by far the most preferred method for the sustainable use of the resource. This is certainly the case for the Nile and saltwater crocodiles. In the case of the common caiman a number of important economic and biological factors come into play which may dictate a different strategy. The value of caiman skins, both flanks and belly skins, has traditionally been considerably below that derived from the 'classic' belly skins of the American alligator or the saltwater crocodile. Thus, while ranching of the latter species can be profitable, that is not necessarily the case for the common caiman. In addition, caiman usually occur in far greater numbers than other crocodilians and their populations appear to be fairly resilient to hunting pressure and, if their numbers are down, are able to

recover relatively quickly provided the hunting stops. This suggests a strategy for the sustainable use of caiman based upon cropping of large mature males and/or ranching.

Whatever strategy is used, it must be based upon a scientifically sound caiman management plan with a strong monitoring and control component capable of responding immediately to any perceived negative impact of sustainable use. This is absolutely fundamental and is the major price which sustainable use projects must pay and continue to pay. Too often, in recent times, once a sustainable use project is underway, there is a tendency to neglect the monitoring aspect. When this occurs, the project should be terminated immediately.

Surprisingly, very little systematically collected scientific data is available on the status of the caiman populations of Paraguay, even though numerous scientists have worked on crocodilians there. Unfortunately, such information as has been available appears to be largely anecdotal. Medem (1983) and Scott *et al* (1990) indicate that both *Caiman yacare* and *Caiman latirostris* were present in substantial numbers during the 1960's and 1970's (how many -- even approximately -- we will never know). However, because the skin of *Caiman latirostris* is more valuable than that of *Caiman yacare*, its numbers were drastically reduced through over hunting and now it is listed on Appendix I of CITES. Until sound systematic data are gathered on its status in Paraguay, it will not be possible to determine whether the numbers of *Caiman latirostris* remaining are sufficient to eventually support a ranching project for this species.

According to Scott *et al* (1990), *Caiman yacare* persists in good numbers in many parts of Paraguay. Apparently, this is in spite of the heavy illegal hunting of the species for over a decade and a half. Under Decreto No. 18.796 of 1975, all commercial hunting and trade in wildlife is banned in Paraguay. Nevertheless, very heavy illegal trade in

Caiman yacare has persisted there for years -- the persistence may be, in part, a result of the ban. Large quantities of illegal skins -- numbered in the tens of thousands -- are still being confiscated, when apprehended.

For many years, illegal caiman skins exported from Paraguay have sustained the international illegal trade in crocodilian skins. Some of these were derived from Paraguay caimans and apparently a number of the more accessible caiman populations in the country have been severely depleted. Many illegal skins from Bolivia and Brazil were 'laundered' by being given false export papers from other countries and shipped through Paraguay. This illegal trade out of Paraguay has been the source of great consternation internationally, has provoked a number of international complaints, and has thwarted efforts to promote legal trade in crocodilian skins. However, during the past few years, a number of loopholes in international trade have been closed which will make continued illegal trade much more difficult and far less profitable. Japan's strict implementation of CITES regulations since the late 1980's and the removal of the CITES reservation on caiman by Singapore in 1992 closed off two of the major routes by which illegal caiman skins entered international trade. The recent CITES bans on wildlife trade with Thailand and Italy will also impact heavily on the illegal trade in caiman skins. Finally, in June 1993, the CITES requirement for the universal tagging of all crocodilian skins entering into trade should have a dramatic affect. Slowly but surely, the illegal traders will learn that it is far more profitable to trade in legal skins than in illegal ones. In addition, most of the world's major traders and buyers of crocodilian skins have joined forces with CITES and the CSG to help ensure that the trade becomes legal and has conservation merit.

Professors Messel and King, and Mr. Yoichi Takehara from JLIA of Tokyo, Japan, arrived in Asunción, Paraguay, on 11 October 1992 where they were joined by Dr. Obdulio Menghi, Scientific Coordinator in the international CITES Secretariat, and Mr.

Juan Villalba-Macias of TRAFFIC South America. Mr. Yasushi Kobuchi, of Estancia (Ranch) General Diaz and CRIAPAR Asunción, joined the above group and acted as coordinator for the many meetings held with various officials in the ensuing three days. Included was a meeting with the President of the Republic of Paraguay and also a meeting with the Minister of Agriculture and Livestock in conjunction with Aida Luz Aquino-Shuster of the CITES Paraguay office. During these discussions, the concept of conservation of caiman through their sustainable use was discussed at length and strongly encouraged by us.

On 15 October 1992, Professors Messel and King, accompanied by Messrs. Takehara and Kobuchi and Carl Shuster of the CITES Paraguay office, departed by small plane for the planned brief, preliminary survey in northeastern Paraguay (Fig. 1). Professor Messel stressed forcibly that though this quick dash into the field would be conducted according to the rigorous crocodile survey methods he had developed and carried out in many areas of the world, it could not in any way be construed as anything but a preliminary look at the resource. The itinerary followed by the group is shown in Appendix 1.

Methods. The survey methods for systematic and repeatable night spotlight censusing of crocodile populations are given in Messel *et al* 1981, Monograph 1 of SURVEY OF TIDAL RIVER SYSTEMS IN THE NORTHERN TERRITORY OF AUSTRALIA AND THEIR CROCODILE POPULATIONS. This publication is one of 20 monographs on crocodile surveys by Professor Messel and co-workers and was published by Pergamon Press. The reader is referred to this publication for details of the survey methods used for a wide variety of waterways.

It was unfortunate that our short survey took place during 1992 which was one of the wettest years on record. The Río (River) Paraguay was in flood, from 2 m to 6 m above its normal level, and its waters were spread for miles on either side of the mainstream. Vast areas appeared like a shallow inland sea and surveying for crocodilians it this area was out of the question. The areas we originally planned to survey had to be changed at the last moment as we flew over the areas in a chartered Cessna 206 Centurion II plane. Alternative waterways were found on which the flood waters had fallen sufficiently that a survey could be carried out. However, this meant that a survey boat (with local driver) had to be rented and batteries and food obtained at short notice -- not exactly a simple matter in remote Alto Paraguay. Fortunately, because of the excellent organizing ability and local knowledge of Yasushi Kobuchi, unbelievably, we were able to make such arrangements.

Normally, October is the prime month for surveys in the Alto Paraguay region but during 1992 the wet season persisted much longer than normal. Thus as mentioned above, only few areas were suitable for survey -- and even these did not enjoy optimum conditions for crocodilian surveying. Large areas of wetlands usually were present on either side of the main waterways. During normal dry seasons, many of these would be dry and the caiman concentrated into them. During our short survey period we lost a day and a half due to rain and thus ended up with only 3 good working days.

Results and Discussion. It is not unusual to have difficulty obtaining good maps on a scale of 1/50,000 to 1/100,000 for many remote areas of the world. Alto Paraguay was no exception. For surveying the Río Apa we had to use a 1/1,000,000 map. Elsewhere, maps of 1/250,000 were available. Fortunately, the use of our Magellan GPS NAV 1000 PRO allowed us to accurately determine start and end points for the surveys we were able to carry out. Our findings are presented and discussed separately for each of the areas.

1. Río Apa.

We used the 1/1,000,000 scale map sheet of Paraguay issued under 'Direccion del Servicio Geografico Militar, 5th Edition, 1988.'

During the day and night of 15 October 1992, we were able to carry out a systematic survey of 55 km of this waterway.

	Start		Finish	
	Latitude	Longitude	Latitude	Longitude
Río Apa	22°06'17"S	57°40'24"W	22°07'28"S	57°55'35"W

This excellent freshwater waterway joins the Río Paraguay just north of Valle Mi. Flood levels had receded on it and it was flowing within its banks, though there were a number of major oxbows and lagoons off from the waterway where there could have been substantial numbers of caiman. The Río Apa, like all waterways in the area, meanders through the flood plain and is fringed with various freshwater vegetation and provides good nesting habitat. The stream is fast flowing, shallow and has numerous sandbars, though sections of it have sharp high cut away banks.

We sighted 158 caiman as follows: 15(2-3'), 33(3-4'), 44(4-5'), 36(5-6'), 12(6-7') and 5(7-8') and 13(E0 = 'eyes only').

These 158 caiman were not distributed evenly throughout the waterway. The density of animals sighted was as high as 24/km on the extreme surveyed upstream section

of the waterway, and then dwindled as we proceeded downstream. Considering the fact that this open waterway has relatively high river traffic, we felt the results were surprisingly good.

2. Laguna General Diaz.

The same map sheet used for the Río Apa was used for Laguna Gral. (General) Diaz, though a 1/250,000 scale sheet is issued by the same authority for this area. In addition, the owner of the 2,000 hectare Estancia (Ranch) Gral. Diaz, Mr. Yasushi Kobuchi, had a 1/2,500 scale map of Laguna Gral. Diaz, apparently prepared as part of a boundary survey of this property.

	Start		Survey Length (km)	
	Latitude	Longitude	Lagoon Perimeter	Stream
Laguna Gral. Diaz	21°08'01"S	58°33'10"W	13.0	2.2

We surveyed Laguna Gral. Diaz and the Arroyo Syry during the day and night of 16 October 1992 and only sighted 103 caiman as follows: 1(2-3'), 16(3-4'), 19(4-5'), 22(5-6'), 26(6-7') and 19(7-8'). Many of the animals were exceedingly wary and would submerge shortly after being hit by the beam of the spotlight.

Laguna Gral. Diaz is well described in a detailed report prepared by a number of consultants for its owner. It is a shallow freshwater lake with the small Syry stream (no name is shown on the map) draining into its western end. Normally the maximum lake depth is some 2 m, but during our survey the lake, and surrounding area, was flooded and the lake level was 80 cm above normal. The stream and lake are bordered by lush aquatic

vegetation and contain large areas of water hyacinth (*Eichhornia*) and rushes (*Typha*). Fishes and birds, particularly herons, egrets, cormorants and ducks, were abundant. It would be difficult to locate wetland habitat better than this. It constitutes prime habitat for caiman and the many other wetland species present. At considerable expense in cash and labor, the owner has established a large caiman ranching project on the western shore of the lake. However, during the heavy floods in 1992 an unspecified number of the caiman, both adults and juveniles, escaped from the pens. At the site of the ranch, drainage is a major problem which will make it difficult to maintain proper sanitation. An adequate source of feed is another problem.

The small number and wary nature of the caiman sighted was surprising, considering the excellence of the habitat. During a survey by Aida Luz Aquino in the period 16-20 October 1987, she sighted 3,002 caiman on the lagoon and stream (personal communication from Aquino and also the Kobuchi report). We are unable to explain the drastic decrease in the number of caiman sighted, although dispersal of caiman during periods of flood is well documented in other areas.

3. Lagunas Inmakata, Riari and Morocha.

While at Estancia Gral. Diaz, we took the opportunity to carry out an aerial survey of Arroyo Syry and Lagunas Inmakata (misspelled 'Inmakaia' on some maps), Riari and Morocha on 18 October with the intention of carrying out a spotlight survey of Laguna Inmakata. However, flood and weather conditions precluded this.

The Syry stream flowing in at the southwestern end of Laguna Gral. Diaz provides excellent habitat for caiman and other wetland species. However, it was not navigable by boat beyond km 2.2 because passage was blocked by mats of water hyacinth. During the

aerial survey, we followed its course over 20 km and were struck by the amount of bird life and lush vegetation along its banks.

Lagunas Inmakata, Riari and Morocha are each smaller than Laguna Gral. Diaz. There is an estancia on the shore of Laguna Inmakata with its own airstrip (rain sodden at the time of our aerial survey), thus aerial access is available. This lake, the closest to Laguna Gral. Diaz, appeared to provide caiman habitat similar to, but not as good as, Laguna Gral. Diaz. Laguna Morocha is the largest of the three and both it and the smaller Laguna Riari provide good caiman habitat. Substantial areas surrounding the lakes were inundated. We were told that during very dry seasons, Laguna Gral. Diaz is the only one which does not dry out.

The general area around the four lagoons is sparsely inhabited and we were struck strongly by the potential for it to be declared as a conservation and ecotourism zone -- benefiting the local people.

4. Aerial survey from Fuerte Olimpo to Puerto Bahia Negra, Río Negra past Cerrito Jara to the Pantanal.

On 19 October 1992, we were able to carry out an aerial survey of the areas along the Río Paraguay from Fuerte Olimpo to Puerto Bahia Negra, then along the Río Negra on the Paraguay-Bolivian border -- physiographically part of the pantanal -- and from there westward to a series of small lakes, which surprisingly were already nearly dry. The flood level at Puerto Bahia Negra was only 2 m above normal level. Even though the areas bordering the main waterways were partially flooded, we were struck by the extensive nature of the excellent caiman habitat. It was far greater than we had expected.

Undoubtedly there is great potential for legal sustainable use of caiman in the area which could become a major source of income for the peoples of the region.

Because of the collapse of crocodile and caiman skin prices, there exists, at the present, a real window of opportunity for the Government of Paraguay to achieve control of the caiman trade in and from Paraguay. The demand for legal skins has declined drastically and for illegal skins even more so. Illegal hunting of caiman has fallen off and the income gained by local people from this source is disappearing. This is hurting many local people. The next 2 years, after which world skin prices are expected to increase, will provide the opportunity to institute a carefully managed program of conservation through sustainable utilization which will protect the resource and provide real economic benefit to the local people.

The Crocodile Specialist Group is prepared to use its considerable expertise to help the Government of Paraguay to implement the recommendations that follow.

Recommendations.

1. That Paraguay continue taking the steps necessary for the implementation of a *Caiman yacare* conservation program based upon the sustainable use of the jacare. One of the major necessary implementing steps has already been taken and that is the establishment and staffing of CITES Paraguay offices.

2. That Paraguay's CITES Scientific and Management Authorities be separate and distinct.

3. That a rigorous repeatable systematic censusing of the caiman populations of Paraguay be carried out as soon as possible.

4. That the first rigorous general survey should be headed by a scientist experienced in crocodilian survey techniques so that the validity of the results obtained is beyond question. Such a survey should not take more than a total of 2 months surveying time and would yield a minimum number of caiman present. There is no great need for an exact estimate of the caiman population.

5. That, during the general caiman status survey, scientists from Paraguay be trained in the methods of systematic crocodile surveying techniques.

6. That the results of the caiman population status survey be used to determine a small number of survey sites for the future monitoring of the *Caiman latirostris* and *Caiman yacare* populations, by scientists from Paraguay. Such monitoring would provide the crucial information as to whether the population is increasing, decreasing, or remaining stable.

7. That based upon the results of the general caiman population survey, a comprehensive caiman management plan be prepared -- based upon conservation through sustainable use of caiman. Such a plan will only succeed, if local inhabitants of the sustainable use areas are the major beneficiaries. Stringent control and monitoring mechanisms must be instituted from the beginning of the plan. Every effort should be made to treat this matter regionally; to coordinate management efforts with neighboring countries.

8. That in order for the CITES Scientific and Management Authorities to gain experience in handling legal quotas of harvested and/or ranched caiman, a very small and safe experimental quota, of perhaps 5,000 *Caiman yacare*, be granted initially. Adequate precautions will have to be taken to see that the large number of illegal skins already in stock in various places are not laundered by means of this experimental program. The CITES requirement for the universal tagging of crocodilian skins comes into force on 1 June 1993. The recommended small experimental quota should provide a steep learning curve for the CITES Paraguay Scientific and Management Authorities to move from planning into effective implementation.

9. That following the general caiman survey and preparation of the management plan, new sustainable quotas be determined.

10. That steps be taken immediately to establish a small number of protected areas in which *Caiman latirostris* and *Caiman yacare* will be protected in fact as well as in name. Such areas would ensure conservation of biodiversity and caiman, based upon sustainable use and ecotourism. It should involve the local people and provide them with a source of income.

11. That the Lagunas Gral. Diaz, Inmakata, Riari, and Morocha be considered for one of the first such protected areas.

Acknowledgements. Our thanks go to the Minister of Agriculture and Livestock, Mr. Raul Torres, as well as to Aida Luz Aquino of the Paraguay CITES Scientific Authority office for their kind invitation to visit Paraguay. We greatly appreciated the support of their staff and especially of Carl Shuster, who accompanied us on our short field survey. The presence of Mr. Obdulio Menghi, Scientific Coordinator for the CITES Secretariat,

during the early part of our visit was most important and we applaud his great efforts on behalf of legal trade in wildlife species. His wide experience on conservation issues faced by Latin America is unsurpassed.

We also wish to thank the Japan Leather Industry Association (JLIA) and especially Mr. Akira Saikyo and Mr. Yoichi Takehara of that organization for making our visit to Paraguay possible. JLIA is playing an ever increasing and important role in conservation through legal sustainable use. Mr. Yasushi Kobuchi did much of our organizing in Paraguay and did a marvelous job. We greatly appreciate his efforts and hospitality.

References.

Medem, F. 1983. Los Crocodylia de Sur America. Vol. II. Instit. Ciencias Nat. Mus. Hist. Nat. Univ. Nac. Colombia, Bogotá. 270 p.

Scott, Norman J., Aida Luz Aquino and Lee Fitzgerald. 1990. Distribution, habitats, and conservation of the caimans (Alligatoridae) of Paraguay. Vida Silvestre Neotropical 2(2):43-51.

Appendix 1. Itinerary of the Preliminary Survey Trip.

11 October, Sunday:

11:00 -- Arrival of Profs. Messel and King and Mr. Takehara in Asunción, Paraguay.

12:00 -- Check into the Hotel Chaco, Asunción.

16:00 -- Review of schedule at hotel.

12 October, Monday -- 14 October, Wednesday:

Official meetings with the President of the Republic, the Ministry of Agriculture and Livestock, CITES Paraguay, Vida Silvestre, the legislature's National Committee for the Defense of Natural Resources, and the press.

15 October, Thursday:

09:00 -- Depart from Asunción by airplane.

10:30 -- Arrive in Puerto Valle Mi airport.

12:00 -- Lunch.

15:00 -- Reconnoiter Río Apa upstream by boat to km 66; wait for nightfall; survey downstream; when survey is complete (±01:00), overnight in El Meson Hotel, Valle Mi.

16 October, Friday:

07:00 -- Breakfast at El Meson.

08:00 -- Depart Valle Mi by airplane; overfly the portion of the Río Apa surveyed last night.

10:30 -- Arrive at Estancia General Diaz caiman farm.

12:00 -- Lunch; write up results of Río Apa survey.

14:00 -- Daytime reconnaissance of Laguna General Diaz and Arroyo Syry that flows into the lake.

20:00 -- Dinner.

20:30 -- Nighttime spotlight survey Laguna General Diaz and Arroyo Syry; afterward overnight at Estancia General Diaz.

17 October, Saturday:

08:00 -- Breakfast; torrential rains during the night made the airstrip too muddy for use so the morning was spent in camp.

12:00 -- Lunch.

14:00 -- Inspection of Laguna General Diaz caiman farm operations.

20:00 -- Dinner; overnight at Estancia General Diaz.

18 October, Sunday:

07:00 -- Breakfast.

11:00 -- Aerial reconnaissance and habitat survey of lagoons General Diaz, Morocha, Riari, and Inmakata.

12:00 -- Lunch.

13:30 -- Depart Estancia General Diaz by airplane for Fuerte Olimpo.

13:50 -- Arrive Fuerte Olimpo.

14:00 -- Depart Fuerte Olimpo by boat for Hotel Americana 30 minutes by boat upstream on the Río Paraguay.

20:00 -- Dinner.

19 October, Monday:

06:00 -- Breakfast.

07:00 -- Depart Americana Hotel by boat for Fuerte Olimpo.

07:30 -- Meet with Alto Paraguay Regional Governor to discuss caiman conservation.

09:00 -- Depart Fuerte Olimpo by airplane for aerial reconnaissance and habitat survey north along Río Paraguay to the border with Bolivia and the Brazilian pantanal, then west along Rio Negra to Estancia Cerrito Jara, then west to a series of small lakes. Fly inland to Puerto Bahia Negra.

12:00 -- Arrive at Puerto Bahia Negra; meet with regional Military Commander; lunch.

14:00 -- Depart Bahia Negra for Fuerte Olimpo by airplane.

14:30 -- Arrive Fuerte Olimpo.

16:00 -- Depart Fuerte Olimpo by airplane for return to Asunción.

18:00 -- Arrive in Asunción; check into Hotel Guarani.

19:30 -- Dinner.

20 October, Tuesday:

Writing preliminary report.

21 October, Wednesday:

Edit, revise and printout preliminary report. Meet with CITES Paraguay Scientific Authority.

22 October, Thursday:

Fax preliminary report to Dr. Obdulio Menghi, CITES Secretariat.

23 October, Friday:

Depart Asunción for return to the U.S.A. and Australia.

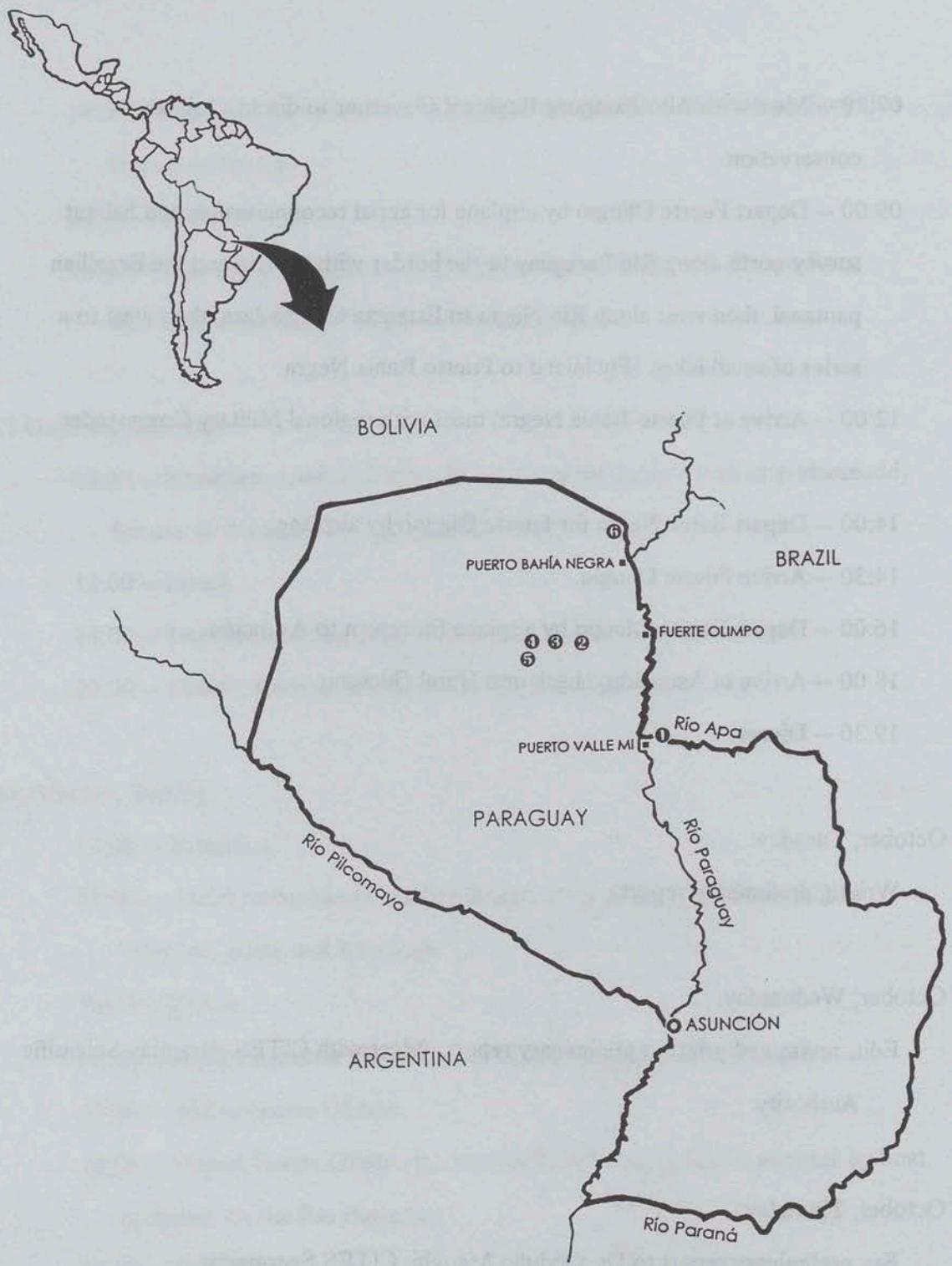

Figure 1. Sites of brief preliminary nighttime spotlight and daytime aerial surveys in northeastern Paraguay: 1) Río Apa, 2) Laguna General Diaz, 3) Laguna Inmakata, 4) Laguna Riari, 5) Laguna Morocha, 6) Estancia Cerrito Jara.

SUMMARY REPORT ON THE

WORKSHOP ON THE PROSPECTS AND FUTURE STRATEGY OF CROCODILE CONSERVATION OF THE TWO SPECIES (*CROCODYLUS MINDORENSIS, CROCODYLUS POROSUS*) OCCURRING IN THE PHILIPPINES

Subtitle: The Present Status of the Two Species in the Philippines and Analysis of the Activities of the Crocodile Farming Institute (CFI), and the Future Strategy of Species Conservation.

24-25 February 1992

Crocodile Farming Institute, Puerto Princesa City
Palawan, Philippines

Prof. Harry Messel, Prof. F. Wayne King, Dr. Grahame J.W. Webb, and Mr. Charles A. Ross

Support and cooperation of Japan International Cooperation Agency (JICA); Japan Wildlife Research Center (JWRC); Japan Leather Goods Industries Association (JLIA), CITES Promotion Committee; Mr. Akiro Saikyo; Mr. Yoichi Takehara; The Nagao Foundation (Japan); Department of Environment and Natural Resources (DENR-Philippines): Protected Areas; Wildlife Bureau (PAWB-Philippines) and the staff of RP-Japan Crocodile Farming Institute is gratefully acknowledged.

25 February 1992

Introduction. The following item appears in the minutes of the Crocodile Specialist Group meeting held in Santa Marta, Colombia, 9-11 November 1991, which was reported in the December 1991 CSG NEWSLETTER, vol. 10, no. 4, pp. 12:

> Philippine Crocodile Farming Institute. A letter was received by the Chairman from Charles A. Ross concerning the activities of the Philippine Crocodile Farming Institute (CFI) in Palawan, Philippines. It was alleged that the farm was contributing to the decline of *C. mindorensis* by collecting stock and had made little progress in captive breeding. This concern was made known to the sponsors of CFI in the Japanese Leather Association (JLIA) and their representative visited the Philippines to review the situation. The report of Dr. Ross was thought to be due to an unfortunate breakdown in communications with CFI staff. In view of the highly endangered status of the Philippine crocodile it was thought appropriate that the CSG intervene as a disinterested party in this matter. The Chairman proposed that a small workshop to be convened of CSG personnel, CFI staff and Mr. Ross to meet in the Philippines and make productive recommendations to CFI. This workshop schedules for February 1992.

The RP-Japan Crocodile Farming Institute is a foreign-assisted special project based at Puerto Princesa City, Palawan, Philippines. It is a joint project of Japan and the Philippines through the Department of Environment and Natural Resources (DENR) and the Japan International Cooperation Agency (JICA). Both of these bodies in addition to JLIA responded immediately to the CSG proposal and the workshop was held during the last week in February 1992. The agenda for the meeting and a list of participants is given in Appendix 1.

Also circulated at the meeting was a special report 'Tentative Future Plan, Crocodile Farming Institute, February 1992' (Appendix 2) and a report by Grahame Webb and Brian Vernon 'Crocodilian Management in the People's Republic of China – A Review with Recommendations.' This latter report, which had just been completed a few days previously, was circulated because of the similarity of a number of issues being faced for both the Chinese alligator, *Alligator sinensis*, and the Philippine crocodile, *Crocodylus mindorensis*. It is not included here.

Former uncontrolled hunting of both *C. porosus* and *C. mindorensis* and the continued destruction of their habitat for agriculture and aquaculture has brought both species of crocodile in the Philippines to the verge of extinction. At the present the human population on the 7,000 islands (300,000 km¨) comprising the Philippines is near 62 million, and is increasing at the very high rate of 2.3% annually. Barring a catastrophe, the population will have reached some 120 million within 30 years. Extraordinary measures will be needed to save the crocodiles, samples of the wetland habitats they occupied naturally, and many other species of highly endangered fauna and flora in the Philippines.

Crocodylus mindorensis, found only in the Philippines, is the most highly endangered crocodilian in the world today. This is despite the fact that most of the world's crocodilians (22 species) occur in developing nations within the equatorial regions of the world. There remain only minor pockets of habitat in which *C. mindorensis* exists today, and none appears to be protected. Informed estimates yield a maximum of 500 animals held in captivity and in the wild. The wild animals are scattered on Mindanao and a few other island in the southern Philippines. The species is listed in Appendix I of CITES and is considered 'endangered' by the IUCN-The World Conservation Union.

C. porosus are found in small numbers in some wetland habitats on a number of Philippine islands – specially Mindanao and Palawan. Their number is exceedingly low and likely to be in hundreds rather than thousands. It is doubtful that any wild populations exist that are large enough to sustain ranching or any other form of sustainable use.

Perhaps most important, both species are widely regarded as vermin in the Philippines and the probability of their surviving in the wild is low.

To prevent the further decline of the crocodile populations, the RP-Japan Crocodile Farming Institute (CFI) was created on 20 August 1987. A 1.76 billion Yen aid grant from Japan was made and it is implemented through the Department of Environment and Natural Resources (DENR) in cooperation with the Japan International Cooperation Agency (JICA). It operates on 10 hectares of

land in Barangay Irawan, City of Puerto Princesa, Province of Palawan. The CFI has two main objectives:

to conserve the two endangered species of crocodiles in the Philippines; and

to promote the socioeconomic well-being of local communities through the development and introduction of a suitable crocodile farming technology.

On Sunday, 23 February 1992, after inspecting the CFI we had little doubt that it is one of the best crocodile research facilities in the world. It was impressive in its equipment, facilities and scope, and the JICA must be congratulated for its forward vision in providing the original funds for its establishment. Inspection of the captive animals and those already bred on the farm strengthened our view that the project to save *C. porosus* and especially *C. mindorensis* in the Philippines simply must not be allowed to fail. So much has already been impressively accomplished but yet so much remains to be done.

It quickly became obvious that one of the major shortcomings of the crocodile project was the lack of exposure and interaction of the Japanese and Philippine scientific staff with the international community of crocodile experts. This has resulted in CFI painfully researching answers to questions on crocodile husbandry, breeding, development biology, nutrition, growth and pathology that have already been answered by crocodile biologists elsewhere. Though many answers were rediscovered, it has resulted in unnecessary expenditure of time, effort and funds.

On Monday, 24 February, CFI staff made a number of presentations on their work and results. Considering that the project only started on 20 August 1987 and did not really get underway until 1989, there have been some excellent achievements. Both *C. porosus* and *C. mindorensis* have been bred successfully at CFI, resulting in 137 hatchling *mindorensis* and 186 *porosus* during the 1991 breeding season alone. CFI currently holds 265 *mindorensis* and 437 *porosus* in all size classes. Thus an excellent stock of crocodiles is at hand to continue the crocodile recovery program. The original CFI crocodile stock was obtained from both the wild and from other small captive projects. The acquired crocodiles are shown in Table 1.

Table 1. Classification of Acquired Crocodiles at CFI

Classification	*C. porosus*		*C. mindorensis*	
	Wild	Captive	Wild	Captive
Hatchling	34	54	6	24
Juvenile	34	22	1	50
Subadult	38	21	1	28
Breeder	54	7	2	29
Total	160	104	10	131

Under normal circumstances the removal of breeding adults from depleted wild populations to stock a farm is to be discouraged, because it depresses the reproductive rate of the wild population and slows its recovery. However, it is wrong to leave the small nucleus of breeding adults in areas where they are being killed by local people and where their habitat is being alienated to create rice terraces. It would be foolish not to place them in a captive breeding program where their survival is guaranteed and where they can contribute to a conservation program. Such is the situation in the Philippines.

Abandoning *C. mindorensis* in the wild, before real protection can be accorded to them in reserves or sanctuaries, would probably have resulted in the final extinction of the species in the Philippines. To save *C. mindorensis*, they had to be taken from the wild and placed in conditions where they can breed successfully and where the young can survive and flourish until restocking is possible. The same situation applies to *C. porosus*, but, given its wider distribution outside the Philippines, perhaps with less force.

After long and thorough discussion with CFI staff (and others) we make the following recommendations:

1) That at least two CFI scientists (separately or together) each spend one to two months studying and working intensively at an overseas crocodile breeding facility for the purpose of

technology transfer to CFI on matters relating to crocodile breeding and rearing.

2) That a CSG expert on crocodile farming be invited immediately to spend two weeks at CFI in order to advise on the priorities that should be allocated to the many projects contemplated and needed.

3) That one or two CFI scientists attend each CSG meeting and present summary papers on the research program and results of the Institute to date, and then at two year intervals. This would call the work to the attention of the international community, would assist other faced with similar problems elsewhere, and provide important interactions between CFI and other CSG experts. The next meeting of CSG will be convened 2-9 August 1992 in Zimbabwe.

4) That a review committee be established with three CSG experts, to carry out an annual on-site review of the progress and achievements of CFI.

5) That at the next meeting of the review committee, a thorough review be made of the staffing structure of CFI with the view to making it more effective.*

6) That renewed efforts be made to establish an innovative crocodile sanctuary for *C. mindorensis* (perhaps on a small offshore island) and one for *C. porosus*. This may need to be done in cooperation with the IPAS program, and may need to emphasize wetlands fauna in general rather than crocodiles alone. It would result in 'safe' populations of these crocodiles in the wild and could in the long-term form a base for their ranching by local people. This matter is most urgent because of rapid human population growth and destruction of wetland habitats needed for crocodiles and other wetland fauna.

7) That the acquisition of additional *C. mindorensis* be continued until such time as a safe sanctuary is established for them in the wild.

8) That renewed efforts be made to carry out a systematic crocodile survey of areas with high potential on Palawan first, and eventually on Mindanao (in particular the Agusan marsh) with the hope of finding a viable *C. porosus* population. Any such population might form the basis of a small ranching project that would economically benefit the local people. However, we have grave doubts about the possibility of finding even small viable populations. It is more likely that the only remaining crocodiles are single individuals scattered along the coast.

9) That efforts to educate Philippine citizens, particularly those living near crocodile habitat and potential sanctuary areas, be increased. Local citizens must not be given hopes of income from sustained use of crocodiles which cannot be fulfilled.

10) That a second small crocodile breeding center be established near Manila which would act as a crocodile education center for the public and tourists. It would act as a back-up for CFI in case of an epidemic among CFI's crocodiles. Furthermore, it could provide income from public and tourist admission and sales. The breeding facility could be part of a larger facility devoted to endangered wildlife and the concept of sustainable use of wildlife in the Philippines.

11) That JICA and the Philippine Government accept the general overall strategy for the future activities of CFI as laid out in the planning document given in Appendix 2. However, various details of this overall plan require amendment. Every detail of the document should be assessed in terms of the extent to which it contributes to the CFI aim.

12) That renewed and concentrated effort be made to save *C. mindorensis* and *C. porosus* in the Philippines. If this is accomplished it will bring great credit to both the Philippines and to Japan. Failure is unthinkable.

In the longer term, the CFI should aim to maintain a standing population of 2,000+ *Crocodylus mindorensis* and 2,000+ *Crocodylus porosus*, such that production over and above this can be used for conservation and eventually commercial purposes.

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* Note: Implementation of recommendations 1 to 5 could lead to considerable overall cost savings to the operation of CFI.

FINAL DRAFT

SURVEY AND PLAN FOR RECOVERY OF THE CROCODILE POPULATION OF THE REPUBLIC OF VANUATU, SOUTHWESTERN PACIFIC OCEAN

AND

A PROJECT FOR THE SUSTAINABLE USE OF WILDLIFE RESOURCES BASED AT PORT PATTESON ON VANUA LAVA, BANKS ISLANDS, IN THE BANKS-TORRES CONSERVATION REGION.

A REPORT
TO THE GOVERNMENT
OF THE REPUBLIC OF VANUATU, PORT VILA, VANUATU

by

EMERITUS PROFESSOR HARRY MESSEL
University of Sydney
Sydney 2006, Australia
and
Chancellor of Bond University
Gold Coast, Queensland 4229, Australia

Chairman of the IUCN/SSC Crocodile Specialist Group
and
Senior Vice Chairman of the IUCN Species Survival Commission

and

PROFESSOR F. WAYNE KING
Florida Museum of Natural History
Gainesville, FL 32611, USA

Deputy Chairman of the IUCN/SSC Crocodile Specialist Group

SEPTEMBER 1992

INTRODUCTION

The New Hebrides in the Pacific Ocean (Fig. 1) were ruled by a condominium – a joint government operated by Britain and France until 30 July 1980. On this date the islands were granted independence and renamed as the Republic of Vanuatu. The present population is some 160,000 and consists predominantly of Melanesians (some 94 percent). There is a smattering (approximately 1%) of indigenous Polynesians and other Pacific Ocean Islanders. The majority of the Caucasian population is of English and French descent. Australians and New Zealanders are rapidly becoming more involved with Vanuatu and the French and British involvement is waning.

The first European to reach Vanuatu was the Portuguese Pedro Fernandez de Quiros who led an expedition of three small ships from Peru in 1605, in the service of the Spanish Crown. In 1766 the French nobleman Louis Antoine de Bougainville led an expedition of two ships and visited a number of the larger islands of Vanuatu. It was Captain James Cook, on his second Pacific expedition, in 1774, who named the New Hebrides – a name which lasted over 200 years. It is thus not surprising that many of the islands have had a variety of names of Spanish, French and British origin. Confusion over names still exists today.

The 74 populated and some 270 other small and tiny islands and rocky outcrops of Vanuatu have a total area of only 12,336 sq km (Fig. 1). The ni-Vanuatu, as the people of Vanuatu are called, rely mainly on subsistence agriculture – as do the peoples of most of the Pacific Islands. And as in most of the Pacific Islands, one is witnessing the depletion of the marine resources at a frightening and unsustainable rate, encouraged by the rapacious appetite of tourists and the developed countries' resource croppers.

With the world-wide publicity being given to the World Conservation Union's (IUCN) "Caring for the Earth: a strategy for sustainable living", the signing of the Biodiversity Convention at the June 1992 Earth Summit in Rio de Janeiro by some 153 nations – including Vanuatu – and the hundreds of millions of dollars being spent world-wide on producing elaborate documents, such as national conservation strategies, for governments on sustainable development, it is sad to see the increasingly rapid depletion of the marine and forest resources in the Pacific Islands – including Vanuatu. ("Naika", March 1991 issue).

National Conservation Strategies have little effect unless implemented. Often, it appears that their acceptance in too many developed and developing nations of the world is used as a cover for unsustainable development – for the destruction of habitat and the severe depletion of a nation's wildlife resources. And usually this is done to meet the wants of the developed nations or is a consequence of rapid population growth.

Increasing global tourism can be of considerable value for sustainable development but too often it also impacts negatively upon a nation's wildlife resources. And yet, it is these resources, used sustainably, which could ensure the livelihood of millions of people in developing nations.

One can appreciate readily the acceptance of quick rewards by peoples whose livelihood is based upon subsistence agriculture and subsistence use of marine resources. But the rewards are usually short term and illusory. One has only to witness the impact of the severe depletion of these resources in such nations as the Solomon Islands. Unhappily it appears that Vanuatu is allowing the same thing to happen. However, it is not yet too late to arrest the unsustainable use of this new island nation's wildlife resources.

In 1981, Dr. Brian Groombridge of the Species Conservation Monitoring Unit in Cambridge England forwarded to Professor Wayne King, then Chairman of the IUCN/SSC Crocodile Specialist Group (CSG), a report in "Naika", Journal of the Vanuatu Natural Science Society, on the *Crocodylus porosus* population, on Vanua Lava in the remote Banks Islands of Vanuatu (Fig. 1). The journal had been forwarded by David Dickinson, Chairman of the Society to Dr. Groombridge, with the request for advice on what, if anything, should be done about the population. Professor King promptly forwarded the documents to Professor H. Messel in Australia in January 1982. On 4 February 1982, Professor Messel phoned his longtime friend Mr. Hermon Slade, Chairman of the Hermon Slade Foundation, resident in Port Vila, Vanuatu. Hermon Slade knew David Dickinson as they had founded the Vanuatu Natural Science Society. Professor Messel encouraged Hermon Slade to do everything possible to have this small but important population of *C. porosus* surveyed and fully protected. This led to the Hermon Slade Foundation funding a survey of the *C. porosus* population by David Luders, a former research officer of the Australian Antarctic Research Group, then working on the possible aquaculture of prawns in Vanuatu. The survey was carried out during two weeks, from 21 April 1983. The report to the Foundation, on the survey, was forwarded to Professor Messel on 14 October 1983 and was also summarized in the September 1983 issue of "Naika". David Luders did not see any crocodiles during the day or night but gathered important local information on the crocodile in Vanua Lava.

In his report Luders stated:

> "Prior to 1972, Mr. Jimmy Jones occupied the plantation on the Sulphur river. Daily sightings were common. Crocodiles frequently basked on the sandbanks near the mouth of the river and they were known to go some distance inland to

take pigs or even cattle. Crocodiles of all sizes were seen. The largest quoted was one shot by Mr. Jones which measured 5.5 metres (and was losing its teeth).

"The 1972 cyclone destroyed the English school at Port Patteson, but prior to that it was common for the students to see numbers of crocodiles 'floating' in the sea in the northern anchorage of Port Patteson, near 'Red Water'. Tracks across the sandbar to 'Red Water' were seen daily. Former students of the school describe a battle between a crocodile and a bullock (from which the bullock escaped) witnessed by a number of them. Another account of a crocodile in this stream suggests a length of around 4m.

"Description of the population on the 'Alligator' river suggests that it was at least equivalent to that on 'Red Water". Other sightings have been occasional, and of single crocodiles. Locations include the mouth of the Tes, a river in the north-west of the island, and one on the south-west where a crocodile was speared and eaten.

"Nests were occasionally found in the Sulphur river area, and the population included all sizes. There is little doubt that it was a breeding population, and total numbers may have ranged up to 200.

"THE EFFECT OF THE 1972 CYCLONE

"The cyclone was a severe one. The wind from east to north drove huge seas across the peninsula joining Nousa point to the main island. The force of this destroyed the school totally. With flooding from rain, the combined effect was a

vast body of water which could well have washed the crocodile population out to sea."

In his commentary and conclusion Luders stated:

"It seems certain that the 1972 cyclone reduced the crocodile population of Vanua Lava almost to nil. The actual cause of this decline is a matter for conjecture, but two things seem likely:

– that the bulk of the population was simply washed out to sea and suffered an unknown fate;

– the habitat of the main centre of population (Sulphur river) was altered unfavourably.

"It seems reasonable to suppose that the first is the primary cause. Otherwise, there would now be significant populations of all sizes in the other two streams.

"There seems to be no worthwhile basis for research into the crocodiles on Vanua Lava unless it be long-term monitoring of a return to former levels. That would presumably require only the recording of sightings for quite some years until numbers began to be significant. Any research contemplated would be better done on Vanikolo in the Solomon Islands where there is still a substantial population.

"The crocodiles of Vanua Lava ought not to be disturbed, by researchers or others. Formal steps to protect them are hardly necessary, since there is no likelihood of disturbance as things stand. The best course is probably the easiest – that of laissez-faire."

It is difficult to accept that the crocodiles of Vanua Lava were reduced to almost nil by the 1972 cyclone. *C. porosus* is known to be a very strong swimmer and may stay submerged for periods in excess of an hour. Furthermore they are known to have a homing instinct. Problem crocodiles have been known to return to Darwin Harbor in northern Australia after having been translocated to rivers in excess of 100 km away. One may conjecture a more sinister end – as Australian crocodile hunters, who were busily endeavoring to extirpate the *C. porosus* population of the Solomon Islands during the 1970's, with the help of the Solomon Islanders (Messel and King, 1990) were known to have come to hunt *C. porosus* on Vanua Lava.

Little more was heard of the crocodiles in Vanuatu until the report "The Status of the Estuarine Crocodile (Crocodylus Porosus Schneider 1801) in Vanuatu" by M.R. Chambers and D. Esrom of the Environment Unit, Ministry of Lands, Port Vila, Vanuatu was produced in 1989 and summarized in the March 1991 issue of "Naika". Their executive summary states:

> "This project was carried out to assess the current status of the estuarine crocodile in Vanua Lava, the only island in Vanuatu known to have a breeding population . The study was carried out by a combination of a site visit coupled with interviews with villagers and the local distribution of a questionnaire."
>
> "The findings show conclusively that there are very few crocodiles remaining on the island, perhaps only two or three. No young ones have been seen for several years. It thus appears that breeding has ceased and if this is the case then the crocodile will become extinct in Vanuatu. Previously high numbers of crocodiles appear to have been decimated by a severe cyclone in 1972. Some survivors of this event were subsequently shot, and coupled with natural mortality perhaps

increased by later cyclones, this sequence of events appears to have brought the crocodiles down to a non-viable population size. The available habitat for the crocodiles appears to be extensive and in good condition."

"There is a strong belief in Vanua Lava that crocodiles were accidentally introduced to the island in the mid-19th century. There is no independent corroboration for this. However they came to be there, they are not popular. They undoubtedly eat domestic animals and have recently begun to attack people. In view of the expense and difficulty of attempting to build up the crocodile population, and that it would be unpopular amongst the islanders, it is recommended that nothing be done to attempt to save the crocodiles from probable extinction. If they were to become extinct this would mean a shrinkage of the crocodile's extensive range, as Vanuatu is the easternmost limit of this range."

It is this latter recommendation which is unacceptable to the conservation world. It goes completely against the accepted principles of conservation and of the necessity for the preservation of biodiversity. No crocodiles were sighted by Chambers and Esrom.

The Crocodile Specialist Group of IUCN is unable to sit idly by and watch the crocodiles in the Pacific extirpated in one island nation after the other with a consequent drastic decrease in the historical range of *C. porosus*. The Vanua Lava population of *C. porosus* constituted the easternmost limit of this range. The next easternmost population is some 250 km northwest, on Vanikolo Island in the Solomon Islands. The survey of the crocodile populations of the Solomon Islands by Messel and King in 1989 has shown that crocodiles there are highly endangered and the same applied to Palau, surveyed by Messel and King in 1991. The crocodiles in the Philippines are even more endangered and thus

the easternmost population of *C. porosus* which is not highly endangered is in Papua New Guinea.

We must also comment on the tale that the crocodiles in Vanua Lava were introduced by Bishop Patteson in the mid 1860's. Six biographies of Bishop Patteson were studied by Chambers and Esrom and there was no mention of crocodiles. Yet the Bishop was known to have been a meticulous and accurate recorder of what he saw and did. The crocodile populations, though small, on Nendo and Vanikolo Islands in the Solomon Islands are only some 250 to 300 km to the northwest of Vanua Lava – a mere stone's throw away for the strong and long distance swimming *C. porosus.* A lone *C. porosus* has been sighted as far away as the northern islands of New Zealand and the Cocos Keeling Islands in the Indian Ocean! Thus we must disagree with the Bishop Patteson tale. We strongly suggest that the crocodile population on Vanua Lava was a natural extension of the populations of the Solomon Islands.

The sporadic sighting of *C. porosus* in the waterways of Espiritu Santo (Fig. 1) are also easily accounted for, as animals probably originating from Vanua Lava or even the Solomon Islands.

Following the Chambers-Esrom report, a systematic survey of *C. porosus* in Vanuatu was given a high priority by CSG. Funding for the survey was quickly pledged by the Hermon Slade Foundation, Conservation International of Washington, DC, and the Nagao Foundation of Japan. Mr. Ernest Bani, Principal Environment Officer of the Environment Unit of the Government of Vanuatu held discussions with Professor Messel during the CITES Kyoto conference in March 1992 and offered the support of the Unit. In the meantime Mr. Hermon Slade arranged for the participation of his colleague Mr. Aaron Hanghangkon, a very knowledgeable and respected citizen of Vanuatu. On 16 August

1992, Professor Messel and Mr. Paul Slade, a Patron of the CSG, proceeded to Port Vila, Vanuatu, where a series of meetings were held with various government departments. Ernest Bani then accompanied them to remote Port Patteson (the primary area for *C. porosus*) on Vanua Lava (Fig. 2) in order to help with logistical arrangements and to carry out a preliminary survey. Such preliminary work and planning for surveys in remote areas is vitally important, if much time and large sums of money are not be wasted. This has occurred far too often for crocodile surveys carried out in various countries in the past.

Goodwill Training Centre, an Anglican school for ni-Vanuatu teenagers is situated at Port Patteson, a 2½ hour beach walk from Sola airstrip on Vanua Lava. There are no roads. It is an idyllic spot and no wonder that *C. porosus* migrated to it! The Director of the Training Centre is Father Luke Titinsom Dini, Senior Priest, Banks and Torres Region. A cabinet minister in the pre-independence government of Vanuatu, he gave up politics in order to lead his people – those of the Banks and Torres Region. He became a priest and returned to his native Banks Island – landing at Port Patteson at the spot where the Training Centre is presently situated. There he built, with the aid of his followers and his own hands, using bush materials, an educational training centre for teenage boys and girls. Training is given on soap making, subsistence agriculture, carpentry, home duties, health, general cleanliness and all the other aspects of leading a happy, healthy life in this remote area of the world. It is hoped that the students will choose to remain on their traditional lands in the Banks and Torres Islands and not migrate to urban centers where they often are relegated to being second class citizens. The Centre's total budget for salaries, food, equipment and maintenance is some US$500 per month!

At the time of Father Luke's arrival at Port Patteson in 1986, the reefs in the area were teeming with marine life, a wide variety of reef fish, giant clams, trochus shells, green

snails, lobsters (crayfish and rock lobsters), and on the land, coconut crabs. By just walking onto the reef at low tide one could fill a large sack with lobsters in half an hour. Large numbers of green, hawksbill and lesser numbers of loggerhead turtles nested on the beaches, especially on nearby Ravenga Island. There was no shortage of food for the people. This has changed drastically over the past six years and the reefs in the area have been harvested to almost total depletion in order to meet the requirements of the ever increasing number of tourists coming to Vanuatu as well as the export trade. The harvesting and depletion of the marine resources has occurred at a frightening rate. It was done on a totally unsustainable basis. We were shocked by what we found but quickly realized that the Port Patteson area provided an excellent opportunity for the conservation of wildlife species there through sustainable use and development. It had all the ingredients which we felt were necessary: education, religion, remoteness of a small subsistence population and the determination of Father Luke to protect, conserve and utilize sustainably the wildlife resources for his people, with emphasis on ecotourism.

The funding requirements for an important conservation project at Port Patteson, through sustainable use and development, which could provide hope and an example for other Banks and Torres Islands and South Pacific Ocean islanders to follow, would not be astronomical. Professor Messel immediately undertook to raise the necessary funds including his own personal contribution. He provided the necessary cash funds on the spot for the immediate construction of a cottage, on Port Patteson, to be used as the conservation project's headquarters and which he will donate to the Training Centre for their use. The Slade family has since provided the funds for the construction of a second conservation cottage and the Professor Wayne King family the third one.

Father Luke immediately undertook to call a meeting of the six village chiefs and traditional land owners to obtain their agreement to petition the government of Vanuatu to

declare the Port Patteson area a Conservation Region. They would protect it, for they now had experienced the sad consequences of the unsustainable use of their wildlife resources.

In the meantime two preliminary daytime surveys were carried out by us of the waterways in the area. While bailing out a canoe, a young lady had been attacked by a large crocodile some two months previously - so the story went. The villagers had speared it, but the spear didn't hold. They then tried to shoot it. Was it all true? Were there any crocodiles left on Vanua Lava or were they now extinct in Vanuatu? None had been seen during the Luders survey or the Chambers-Esrom survey.

Fortunately in mid-afternoon of 19 August and at low tide we spotted a 14-16 foot male *C. porosus* on a mud bank. It slid slowly into the water leaving a giant belly slide, which we photographed. We had been so surprised on spotting the large animal that we pointed the tape recorder rather than the camera at it. No photograph. *C. porosus* was not extinct in Vanuatu! No signs were seen of other crocodiles during the daytime preliminary survey. The planned systematic spotlight survey by us, commencing 5 September 1992 would provide us with the required information on the population size and structure.

In the meantime, we were obtaining the agreement of the villagers that the crocodiles must be conserved along with the other wildlife resources. We pointed out that the crocodiles were an important component of the ecosystem. The villagers could learn to live with and utilize crocodiles sustainably as do many other peoples in Papua New Guinea, Australia, Indonesia, Africa, America and so forth.

It has always been somewhat of a mystery to us why the people of the Pacific Islands, including Palau, Solomon Islands and Vanuatu fear and dislike crocodiles so strongly.

This is just a recent phenomena for in former times there appeared to have been a truce between the crocodiles and the islanders (see Messel and King 1990, 1991). The appearance of the white hunter seems to have ended the truce and helped fire the fear and consequent dislike by the islanders of the crocodiles of the Pacific. Yet nearby in Papua New Guinea and Australia the truce still holds - and as strongly as ever in PNG.

On 2 September 1992, Professors Messel and King, and Mr. Paul Slade flew to Port Vila in Vanuatu, where they joined Ernest Bani and Aaron Hanghangkon. The group flew to Espiritu Santo and on to Sola airstrip on Vanua Lava on 5 September. Mr. Kaltau Ayong, Deputy Director of Radio Vanuatu also accompanied the group. It was fortunate that the Rotary Club of New Zealand had gifted a 12 ft dinghy with a 25 hp outboard motor to the training centre at Port Patteson. Thus on this occasion we were able to transport the survey gear by boat rather than on our backs. A 20-foot wood hulled Fisheries vessel was used for carrying personnel and also for crocodile surveys.

METHODS

The survey methods for repeatable night spotlight censusing of crocodile populations are given in detail in Messel *et al* 1981, Monograph 1 of 'Survey of Tidal River Systems in the Northern Territory of Australia and Their Crocodile Populations'. This publication is one of 20 monographs on crocodile surveys by Professor Harry Messel and co-workers and published by Pergamon Press. Since the Vanua Lava Island crocodile survey is only concerned with their number, size class and distribution, it was not essential to measure and record a number of parameters usually recorded in a survey. State of the tide, amount of bank exposed, water salinity and temperature were monitored. Salinity measurements indicate whether the aquatic habitat is a freshwater system or not. This is of importance as

salinity generally determines the suitability of the particular waterway as a potential breeding area - see Monograph 1, page 100.

Normally, on long hazard-free tidal waterways, with a team of three (i.e., spotter, recorder-navigator and driver), surveys are made at a speed of 20 to 30 km per hour and cover from 40 to 100 km per night before the tide rises and the amount of exposed bank decreases to less than 60 cm making it harder to see the crocodiles.

On Vanua Lava, which is only 331 sq km in size, matters were different. The ni-Vanuatu on the small island were well acquainted with the area which the former *C. porosus* inhabited. It was centered on Port Patteson and the ni-Vanuatu lived right there. Crocodiles had been known to inhabit only three of the waterways in the area. These waterways were well known and often frequented by the islanders during their daily living. Thus our survey task was greatly simplified. But knowing that a very large crocodile lived in those narrow shallow streams alerted us to use extreme caution while surveying. Instead of using the 12 ft aluminum dinghy with its 25 hp outboard motor which we used during the 19 August daytime survey, we used a 20 ft wood hulled Fisheries boat with high sides and 8 and 25 hp Yamaha outboard motors.

The waterways are tidal, short, narrow and shallow. Each waterway was surveyed from the zero point at its mouth to the upstream terminal point that was determined by shallow water that prevented navigation further upstream.

The tidal variation between high and low water was only 0.7 to 0.8 meter during 6-9 September 1992 but this still required careful planning both for daytime reconnaissance of the survey routes and for the nighttime surveys. Surveys should be done on a +1/4 to 1/2 tide.

We were fortunate to be able to engage the services of Messrs. Kalep Wilkins, Harrison Ford, Norman and Jimmy Wona and Edwin Tagar of the Port Patteson area. Their intimate knowledge of the area and its waterways made it possible for us to work safely and efficiently. Their knowledge of where the remaining crocodiles of Vanua Lava were most likely to be found proved accurate and saved us valuable time. They said we would see one, or at most two, and they were right.

Optimum months for surveying are during the dry season months, May to October. However, 30 to 40 knot southeasterlies blow during much of September and October with only little respite. These give rise to fine sunny days and cool nights. While Port Vila is beginning to warm during these months, Port Patteson experiences its coolest period. Throughout Vanuatu, January to March are the wet months and Vanua Lava experiences some 3000 mm of rainfall per year. This is also the cyclone period and Vanua Lava is in the most cyclone prone area.

Quick response probes for temperature measurement, a temperature compensated refractometer for rapid salinity measurements, a Magellan GPS NAV 1000 PRO for fast and accurate determination of latitude and longitude, and 5-cell Magnalites for spotlighting, were used. In addition, survey sheets and books, large scale maps, cameras, photographic film of various speeds, cassette tape recorder, and a laptop computer and portable printer were used. These are requisites for systematic and repeatable day and nighttime surveys and rapid data analysis.

RESULTS

Our findings are presented and discussed separately for each of the areas surveyed. Only one map sheet is required: Carte de la Melanesie a 1/100,000, Vanuatu, Feuille No. 2. Iles Banks-Nord.

1. Alligator River (local name).

During the day and night of 6 September 1992 this short waterway, not shown on the map sheet and barely distinguishable on the relevant aerial photograph, was surveyed systematically. The mouth of the river is distinct on the aerial photograph.

	Longitude	Latitude	Survey length (km)
Alligator River	167°32'52"E	13°49'06"S	1.25

The waterway is heavily vegetated with mangroves and had to be cleared of overhanging limbs prior to the daytime survey on 6 September. Because of the dense tree canopy overhead, a GPS latitude and longitude reading could not be obtained at the natural survey terminal point. The distance surveyable by boat is approximately 1.25 km, but during our daytime survey we were able to follow the Alligator River for a further 500 m or so on foot, wading along and through the narrow stream, about 1 m wide and from a few cm to 0.5 m deep. The stream drains a forested swamp of several square km.

Two and a half hours after low water, the salinity at the mouth of the waterway was 33 o/oo and at the survey upstream terminal point it was 12 o/oo. Thus, the Alligator River is a small but good TYPE 1 breeding system, draining swampland.

During the day we saw what the guides claimed were faint belly marks and indistinct tracks of a crocodile. We remain unconvinced. If the tracks were those of a crocodile, it was certainly much smaller than the animal we saw on the Selva River on 19 August.

The nighttime survey was carried out under ideal conditions of exposed bank but no crocodiles were sighted.

2. Selva--Pagpaglog (Tahiti, local name) Rivers, Walter Creek.

During the day and night of 7 September 1992 this system of waterways was surveyed systematically. We also carried out a resurvey of these waterways on the night of 9 September. The map shows separate mouths for the Selva and the Tahiti (Pagpaglog) Rivers, however, now only the south mouth remains open and the Tahiti River may be treated as a tributary of the Selva River. There is also a short navigable side creek of the Selva at km 0.8 just to the north of the Tahiti River (Fig. 2), known locally as Walter Creek.

	Longitude	Latitude	Survey length (km)
Selva River	167°32'27"E	13°50'47"S	1.6
Tahiti River	167°32'27"E	13°50'47"S	1.8
Walter Creek	167°32'24"E	13°50'20"S	0.8

Gaining entrance to the Selva River at 1/2 tide requires manhandling the boat in, over the shallow bar. This would be of little consequence were it not for the fact that we sighted the 14-16 ft (4.5-5 m) crocodile only 200 m upstream from this point. It is also at this point that the ni-Vanuatu wade across the Selva River on foot when visiting Sola airstrip and villages on the south of the island.

The Selva River had a measured salinity of 3 o/oo both at its mouth and at the upstream terminal survey point at km 1.6. The river shallows rapidly and navigation upstream of km 1.6 is not possible. Upstream of this point there are many dead trees, shoals, and other obstacles. There are numerous basking areas along the river; the banks are heavily vegetated. The river appears totally devoid of aquatic life beyond km 0.8, apparently the result of highly acidic waters, containing sulfur and other minerals from active fumaroles and hot springs on the side of the still thermally active volcano at the headwaters, being poured into and flushed through the river. On 7 September sufficient acidic water flushed through the river to discolor much of the bay outside the river's mouth with a milky yellow precipitate. Two days later both the river and bay were clear. Were it not for these periodic acidic flushings, the waterway would provide excellent habitat for *C. porosus*.

Walter Creek is a narrow, 5 to 6 m wide freshwater system. The banks are heavily vegetated with vines drooping into the water along much of its 0.8 km surveyed length, thus making it difficult to obtain more than 0 cm exposed bank for surveying. Salinity was 2 o/oo at its mouth and 0.5 o/oo at the upstream terminal survey point at km 1.6. We saw many mullet in the stream and it would provide good nesting habitat for *C. porosus*.

Similar remarks apply to the Tahiti River which is an excellent TYPE 1 breeding system for *C. porosus*. The salinity at the upstream terminal point was 0 o/oo and the water was sweet for drinking. The stream was teaming with fish, large and small.

During our daytime survey, we saw two large belly slides, some days old, probably those of the large crocodile we had viewed on 19 August. They were between 200 m and 300 m upstream of the mouth of the Selva River.

The nighttime surveys of the three waterways were carried out under ideal spotting conditions, but no crocodiles were sighted.

DISCUSSION

The crocodiles of Vanua Lava are on the verge of extinction. There is one large male *C. porosus* remaining for certain and there might be a second animal, smaller in size. Since no juvenile crocodiles were sighted, if there is a second animal then it is a second male or an immature female. There is no longer a breeding population remaining; though breeding used to occur in the past. Confirmation of this is available from many inhabitants at Port Patteson. Mr. Frank Hosea Wokeke, Treasurer of the Banks-Torres Local Government Council, regularly saw crocodiles of all size classes when he was a student at the Port Patteson school. On 10 September 1992 on Kwakea Island, we also had a very interesting discussion with Jimmy Jones, a well known local personality. He lived on the Selva River for many years in the area now occupied by the Custom landholder, Norman Wona. Mr. Jones saw many crocodiles of all sizes during the 1960's and 1970's and shot some; the last one in 1978 was 5.5 m in length, and we saw a photograph of it. He is brimming with information and has become an ardent conservationist in recent years. He is most anxious to include Kwakea Island, and the beautiful waters surrounding it, in the Banks-Torres Conservation Region. He holds a 30 year renewable lease on the island.

It is unlikely the *C. porosus* population at Port Patteson can recover on its own. Only a restocking program will save *C. porosus* there. And the ni-Vanuatu at Port Patteson are now prepared to support restocking as part of a program proposed by us for conservation of their wildlife resources through sustainable use and development, based on ecotourism in the first instance.

The Custom landholders and the chiefs of Eastern Vanua Lava have already signed documents agreeing to set the area aside as a region for the conservation and sustainable use of the species listed in Appendix 1.

RECOMMENDATIONS

1. That the Government of Vanuatu set aside the area of Eastern Vanua Lava shown in Fig. 2, with the possible immediate extension to include Kwakea Island, as a conservation region for the following species:

Trochus shell (*Trochus niloticus*)

Lobsters (*Panulirus* spp., both crayfish and rock lobster)

Green snails (*Lunatica marmoratus*)

Giant clams (*Tridacna* sp.)

Coconut crabs (*Birgus latro*)

Saltwater crocodiles (*Crocodylus porosus*)

Marine turtles (*Chelonia mydas, Eretmochelys imbricata,* and *Caretta caretta*)

It is reported that the Government will be passing a National Parks and Conservation Law during the forthcoming session of Parliament. The above recommendation could be covered by this new law or by existing legislation.

2. That commercial trade in any of the above species, taken from the conservation region, be totally prohibited and to take effect immediately after the declaration of the conservation region -- Eastern Vanua Lava.

3. That the conservation region -- Eastern Vanua Lava -- be restocked in accordance with the recommendations made by Father Luke Dini, as set forth in Appendix 1. In addition, the area be restocked with giant clams and saltwater crocodiles.

4. That the restocking of the area be carried out sequentially starting with coconut crabs and proceeding to lobsters, green snails, trochus shells, giant clams, and crocodiles. The source stock for all of these can probably be obtained in Vanuatu, with the exception of the crocodiles. Both the giant clams and the saltwater crocodile would require CITES export and import permits if obtained from other countries. The cost of restocking to be met by outside donors, arranged by Professor Messel.

5. That harvesting of the named species in the conservation region -- Eastern Vanua Lava -- be totally prohibited for a period of 3 years to give the populations a chance to establish and grow. After this initial period, the prohibition will be re-evaluated. Harvest quotas will be established for those species whose populations have recovered sufficiently to be able to withstand a sustainable harvest.

6. That the quotas be decided by a conservation committee in consultation with the Ministries of Environment and Fisheries. Committee members will be dawn from the inhabitants of the conservation region -- Eastern Vanua Lava -- and the donors of the project.

7. That the Conservation Region - Eastern Vanua Lava -- serve as a pilot project for conservation of the wildlife resources through sustainable use and development, based in the first instance upon ecotourism. Success in this project could serve as a model for the Banks-Torres Region and all of Vanuatu.

8. That the inhabitants of the Conservation Region -- Eastern Vanua Lava -- be its major beneficiaries, acting as guides, boat drivers, hostel operators, and the like. Once the area is restocked, the area will only require careful vigilance and protection against poaching.

9. That the Anglican Diocese of the Banks and Torres Region and the Goodwill Training Centre become the focus for conservation through sustainable use education in the area.

10. That the peoples of the region be made aware that their livelihood and that of their children depends critically upon sustainable use of their wildlife resources, which at the present time are being rapidly depleted through unsustainable over exploitation.

11. That five conservation cottages be constructed for use by the conservation project, the Goodwill Training Centre and for use by ecotourists. Three of these cottages are pledged and one is under construction already. Professor Messel will endeavor to arrange immediate funding for the other two so that earnings may quickly start flowing to the local inhabitants.

12. That an easily replaceable timber foot bridge be constructed over the Selva River and also one over the Alligator River so that inhabitants traveling between Sola, Goodwill Training Centre and villages to the north do not have to wade these two streams. This will remove much of the risk from any crocodiles in the area.

13. That two boats be obtained for use by the sustainable development project. The boats presently used by Fisheries are the ideal type and could be used for protecting the wildlife resources in the conservation region and for ecotourism.

ACKNOWLEDGMENTS

Without the quick funding support from the Hermon Slade Foundation, Australia; Conservation International, Washington DC; and the Nagao Foundation, Japan; the present survey of the crocodile population at Port Patteson on Vanua Lava could not have taken place. Importantly, the pilot project for conservation of wildlife resources through sustainable use and ecotourism in the Banks and Torres Conservation Region -- Eastern Vanua Lava area may not have been forthcoming. Within four days of the preliminary survey came the pledges to help finance the restocking of the wildlife species given in the report. Here was real conservation action at the grass roots level by the local inhabitants and the donors.

The Hermon Slade Foundation, Mr. Ishii and friends of Prof. Messel from Japan and Conservation International quickly joined Prof. Messel in the funding, and hopefully others also will join.

Father Luke Dini met with the Customs landholders and chiefs of the proposed conservation region and won their enthusiastic support, which they recorded in a written contract. The signed contract was delivered to Professor Messel and the Government of Vanuatu within 10 days -- an incredible achievement.

Discussions with government officials and Ministries took place concurrently. Unlike other countries in which we have carried out surveys and made recommendations, the Government and people of Vanuatu -- especially those in the proposed conservation region -- acted immediately.

The success of the project depends upon many people: Ernest Bani of the Vanuatu Government Environment Office; Aaron Hanghangkon of the ADAB office of the Australian High Commissioner David Ambrose (who was most supportive); and Hermon and Paul Slade were actively involved from the planning stage. The moral and financial support of Conservation International with its President, Dr. Russell Mittermeier and Tim Werner was critical; as was the Nagao Foundation with Professor Satoo and Dr. Yoshio Kaneko; and Messrs. Hamano and Ishii of Japan, who agreed to help fund the project the moment they heard of its importance.

Then there are the local chiefs and Custom landholders, without whose support and active assistance as guides and boat operators the survey would have been difficult if not impossible. More importantly, the future success of the project depends on their continued support and involvement.

Special thanks must go to Father Luke Dini and his friendly and helpful staff, headed by Kalep Wilkins, and the students of the Goodwill Training Centre. They climbed many a coconut tree to keep us supplied with drink, and made our evening hours pleasant with communal singing. Our thanks go to them with the wish that each of them becomes an ardent conservationist.

We have not mentioned the food prepared by Kalep Wilkins and his charming wife Lilian and their helpers. Here are cordon-bleu chefs on bush-tucker. One could easily write a paper on their preparation of natural and unadulterated foods of the area; in an earthen oven! And so the list goes on -- everyone helped. Never have we met such friendly and enthusiastic people. The future of the project augurs well.

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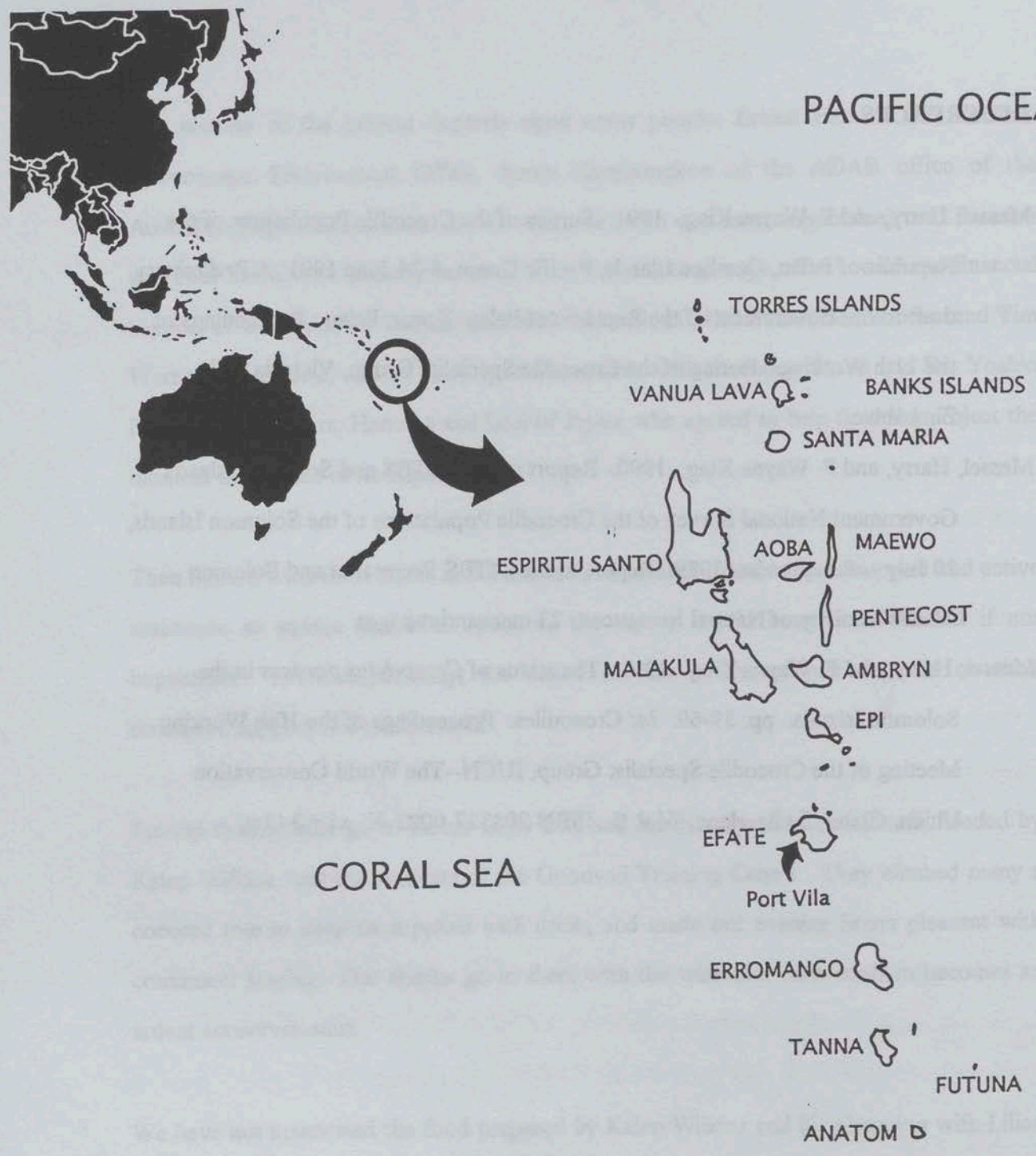

Figure 1. Republic of Vanuatu.

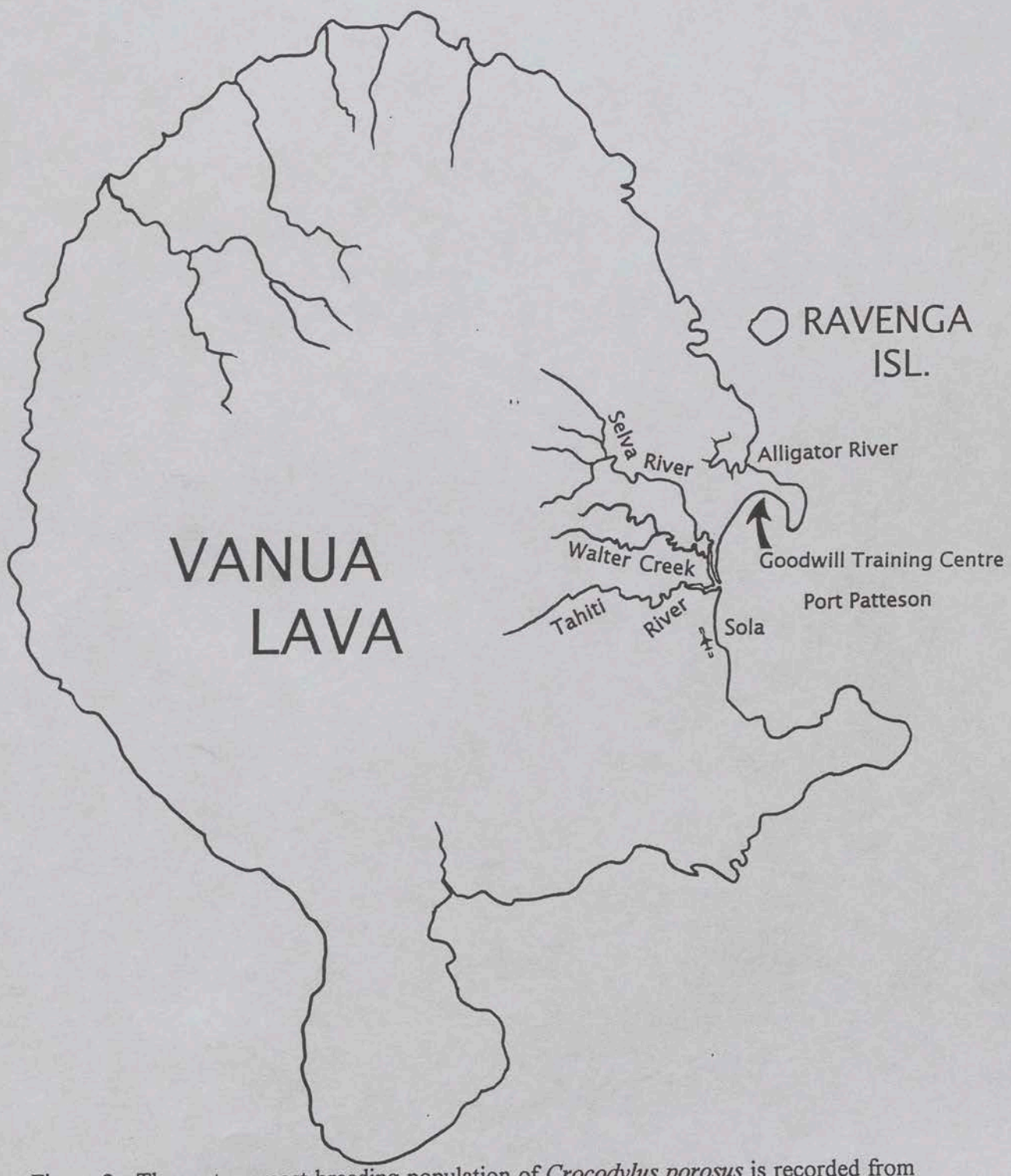

Figure 2. The eastern-most breeding population of *Crocodylus porosus* is recorded from the Selva River, Tahiti River, Walter Creek and Alligator River of Vanua Lava Island, Banks Islands, northern Vanuatu.