DEPARTMENT OF FISHERIES AND FAUNA
WESTERN AUSTRALIA

REPORT VI

REPORT ON THE CURRENT STATUS OF CROCODILES IN WESTERN AUSTRALIA

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THE CURRENT STATUS OF CROCODILES IN WESTERN AUSTRALIA WITH RECOMMENDATIONS FOR CONSERVATION AND MANAGED EXPLOITATION.

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APPENDICES

Skinned carcases of 10 freshwater crocodiles found at the Theda-Kalumburu boundary fence, about 10 miles from Theda Station. Some of these were first sighted on 22nd August. The photograph was taken by me on 8th October, 1969.

I OBJECT OF THE VISIT

AIM

The aim of the survey was fivefold,

(1) to determine the present abundance and composition of saltwater crocodile populations in Western Australia,

(2) to comment on the status of the freshwater crocodile in Western Australia following 7 years of total protection,

(3) to locate study area(s) for detailed work on crocodile biology,

(4) to investigate the feelings of people on the spot (especially shooters or ex-shooters) towards crocodile conservation, and

(5) to investigate law enforcement problems relating to crocodiles.

ITINERARY

I arrived in Perth on 17th September, 1969 where I was subsequently joined by my assistant (Mr. J. Bredl). We arrived in the Kimberleys on 22nd September and left Western Australia on 13th October, 1969. Our three weeks in the Kimberleys was almost entirely spent on field work. We surveyed the Cambridge Gulf and associated rivers by boat ("Lollipop", skippered by Joe Weir) leaving Wyndham on 24th September and returning on the 28th. We travelled by road from Wyndham to Kalumburu via Fitzroy Crossing, arranging our itinerary so that we could work on the freshwater crocodile at night (29th September to 4th October). From Kalumburu we surveyed Napier Broome Bay by boat and investigated river systems in the area (4th October to 9th October) and on 10th and 11th October we surveyed freshwater crocodile areas accessible from Wyndham.

TYPES OF INFORMATION OBTAINED

Information was obtained on all aspects of the work outlined under 'Aims'. Field observations, made by spotlight at night under ideal conditions (see pages 7-16), produced data on the present abundance and composition of populations of both crocodile species in a number of locations.

Discussions with shooters and persons interested in conservation in the Kimberleys provided information which helped to frame recommendations which would provide for effective conservation.

Possible study areas for detailed work on the freshwater crocodile were located in several areas.

ACKNOWLEDGEMENTS

I am indebted to very many people for help and discussion during our visit to Western Australia but particularly to Mr. H.B. Shugg, Chief Warden of Fauna who dealt with enquiries over a period of years in addition to arranging our itinerary; to Mr. B.K. Bowen, Director, Department of Fisheries & Fauna for inviting me to undertake this work; to Mr. G. Hanley, Warden at Wyndham, who accompanied us on much of the survey work, drove us some 2,000 miles in the Kimberleys, and provided a great deal of help often under difficult conditions; and to Rev. Father S. Sands, Father Superior, and members of the Bene tine Community at Kalumburu. Father Sands (an Honorary Fauna Warden) as well as being a valuable source of biological information, provided much material assistance to the survey.

II. SUMMARY REPORT AND RECOMMENDATIONS.

There are two species of crocodile in Western Australia both of which are restricted to the north of the State. The salt-water crocodile (Crocodylus porosus) occurs from King Sound to the Northern Territory border. Although it typically inhabits estuaries individuals may be found in fresh water at considerable distances from the sea. Its skin is particularly prized, being valued at present at over $3.00 per belly inch. No size limits or close season apply at present although a licence is required to sell the skin.

The second species, the freshwater crocodile (Crocodylus johnsoni), is an inhabitant of freshwater river systems and billabongs in the Kimberleys. This small and inoffensive species does not possess a good skin and is one of the more interesting members of the local fauna. It has been totally protected since 5th October, 1962.

The freshwater crocodile appears to have held its own until recently due largely to the very low price received for its skin. However, rising skin prices have led to very extensive poaching. Individuals of breeding size are now rare in most areas and most of the crocodiles seen were either in their first or second year of life (see pages 13-17 and Appendix A).

The billabong habitat inhabited by the freshwater crocodile during the dry allows easy capture (by netting) and even large pools with a length of about 6 miles have been completely fished out. Urgent steps are necessary if this species is to receive effective protection under the 1962 legislation.

An even more acute problem centres around the continued

survival of the saltwater crocodile as a member of the Western Australian fauna. This species has been hunted to the verge of extinction and most of the remaining stocks could readily be wiped out since, unfortunately, they are not at all wary of humans at night (see pages 7-9). In the estuarine areas which they favour they are in no way in conflict with man. In these shark-infested murky waters they cannot even be said to deter swimmers!

Recommendations :

(1) The saltwater crocodile fishery should be totally closed for a period of 10 years to allow the species some measure of recovery.

(2) At the end of this period the situation should be resurveyed and if a reasonable measure of recovery has occurred, permits should be issued to take some specimens as the nucleus of crocodile farms. Indiscriminate shooting, as has happened until the present, is so wasteful that it should never be permitted again.

(3) The setting up of a Fauna Reserve with resident ranger specifically for saltwater crocodiles. This would prove a very great tourist attraction for the Kimberleys as well as ensuring the future survival of the species (see pages 21-23 and page 28).

(4) Total closure of the freshwater crocodile should be continued. Closure must be made more effective (see Appendices D and E).

(5) It is essential that realistic fines be imposed on poachers.

A minimum fine of $2,000 on conviction, as is the case for crayfish, is recommended. Fines above the minimum are considered in Appendix B. The stiff minimum fine will deter poaching and raise morale of Fauna Wardens who at present face magistrates who impose only token fines (see Appendix B).

(6) These recommendations should be implemented without delay (especially (1) and (5)) and the new legislation should be given the widest publicity inter-state as well as in Western Australia (most poachers appear to originate from Queensland).

III REVIEW OF THE CURRENT SITUATION

THE CROCODILE SKIN TRADE

There is almost complete agreement that the crocodile skin trade is finished in Western Australia (that is, the legal trade in saltwater crocodile skins). There is only one professional shooter now making his livelihood from saltwater crocodile skins in the State. For instance, in 1966, according to returns from licensed shooters, 97 skins were taken; the following year the figure was 157.

The catastrophic decline has taken place within this decade in many areas. For instance, in 1961 a group of four shooters returned to Broome after four months in the Collier Bay area north of Derby with 582 skins all of the saltwater crocodile. The party worked inlets, using a dinghy and outboard motor, with a lugger as their base and probably only shot large crocodiles. An advertisement in

the "Sunday Times" for November 4th, 1962, for individuals to join a crocodile shooting safari said "Hunters earning £8/9000 per season".

A crocodile shooter writing to the Chief Warden of Fauna from Yampi Sound, in July 1968 stated,

"Five years ago I did a six week shooting trip and took 50 (saltwater) crocodiles over 7'6". Five years previous I took twice that number in as many days. Nowadays I'd be lucky to even see one."

After the last war saltwater crocodiles were still very numerous in all suitable habitat in northern Australia. Once shooting got underway all populations that were shot were rapidly decimated. Shooters first shot the more accessible areas. Father Sands at Kalumburu describes the shooting of 35 crocodiles in four days *in daytime* in Admiralty Gulf, six or seven of which exceeded 14' in length. He informed me that shooting only started in the area 5-6 years ago and that in two years over 3,000 were shot between Scots Strait (Bigge Island) and Cape Londonderry. Most, however, came from Admiralty Gulf.

There has been no legal trade in freshwater crocodile skins following total closure in 1962.

THE STATUS OF THE CROCODILES

(a) Saltwater

The above section indicates that saltwater crocodiles are now scarce. However, one of the main aims of the survey was to investigate the population remnants. This work is described below and a complete list of all crocodiles seen together with their sizes is given in Appendix A. Unless otherwise stated all crocodile spotting

work was carried out after dark using sealed beam spotlights. Two spotting dinghies operated independently each night in order to double the area investigated. The following diary extracts are samples selected to illustrate the situation.

24th September. Anchored up Lyne River (west Cambridge Gulf). After 1 hour's search, group 1 saw a saltwater just over 4' (all lengths are total length, i.e. head, body and tail). It was not at all shy and could have been easily hand-caught. When it submerged it immediately surfaced again nearby. Soon afterwards we reached the rocks near the top of the river estuary where we saw the eyes of a large crocodile. Despite trouble in getting the dinghy across the rocks it was still there in the shallows with all the body at the water's surface. It, likewise, was not at all shy and remained there while we approached to within 4-6 feet of its head. It measured about 9'. We watched it for some time and then had to get out to lift the dinghy over the rocks as the tide was falling fast. When we re-entered the dinghy the crocodile was still in the position where we had first sighted it.

This situation - of even large crocodiles allowing very close approach - makes the remaining stocks of the saltwater crocodile in Western Australia particularly vulnerable. As will be seen below it was repeated with most crocodiles encountered. By very close approach I mean that the crocodile could have been either hand-caught (if small enough) or harpooned by hand prior to shooting.

Lack of shyness must reflect the pattern of shooting in the Kimberleys. Crocodiles soon learn to associate a spot-light and

the sound of an outboard motor with danger. Bustard (1968)* demonstrated learning after a single exposure to light and the sound of an outboard motor in the saltwater crocodile in Papua-New Guinea. This means that where intensive shooting is taking place the crocodiles (except for recent hatchlings) submerge whenever a spotlight shines in their eyes and while the dinghy is still a quarter to half a mile away. It seems likely that in the Kimberleys, where most areas are not close to habitation, a shooting party has tended to work one area intensively and remove virtually all the crocodiles. This area is then neglected for some years and the remnants, if any, are therefore unaccustomed to spotlighting. It is noteworthy that the exceptions to this occurred where there was either regular hunting or where hunting had occurred recently.

On the same evening, September 24th, group 2 saw only one juvenile which was caught, measured and released. It measured 17".

The following evening we worked Hemby River upstream until it became unnavigable. On the way up we worked all the left hand tributaries. We saw no crocodiles. However, near where "Lollipop" was anchored we had seen a crocodile 'slide' the previous morning. We examined this at the end of the night's work, and from measurements of the hind foot pug mark estimated the crocodile to be about 9'. It should be explained that this track, fresh when first sighted some twelve hours earlier, was still in excellent condition despite the fact that it had been covered by the tide

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* BUSTARD, H.R. (1968). Rapid learning in wild crocodiles (Crocodylus porosus). Herpetologica 24: 173-175.

for most of the day. Indeed it was possible to discern other nearby tracks representing activity over perhaps the whole of the preceding week. The mud characteristics, whereby tracks remain clear even after a tide has covered them, make slide searches a valuable method of cross-checking for the presence of medium or large crocodiles.

On 26th September "Lollipop" anchored in the estuary of the Ord River near Mount Connection. Group 1 worked a circular tributary near Mt. Connection and group 2 worked the main river. Results were as follows :

Group 1 saw 4 crocodiles in five hours' searching time. We went up river at high tide when the water was over the bank in the mangroves and returned at low tide when the water was all in the creek-bed. At this time the banks were checked for slides for at least 2 hours with negative results. The two crocodiles seen on the way up were both sighted again on the way down, when two additional crocodiles were seen. It appears likely that these were in the mangroves when we went upstream. At low water there is nowhere for the crocodiles to hide and their eyes were seen reflecting at distances of approximately half a mile although they only measured 4'. All four crocodiles allowed extremely close approach.

Group 2 set out at 4 p.m. to reach Turkey Island with the flowing tide. They travelled about 25-30 miles each way. On the way up river they checked for slides until nightfall - a distance of about 10 miles - and saw no slides whatsoever. One small (4') crocodile was seen basking. On the return trip they spotlighted

and saw 7 crocodiles comprising 5 of this year's young, one about 3'6" and one of 6'. With the exception of the six-footer, which only allowed approach to about ten feet, all allowed very close approach without diving.

The poor state of the population in this ideal habitat based on 13 hours' search after dark was indicated by the following :

(1) absence of sightings of any breeding stock;

(2) the absence of these confirmed by absence of any 'slide' sightings;

(3) by the paucity of the hatchling year class, a further confirmation that little breeding was occurring. (All five hatchlings could have come from one nest.)

(4) scarcity of immature recruits to the population (the five crocodiles measuring 3½'-4' could all be one year class, and the 2 remaining (independently estimated at 5½' and 6') the sole survivors of an older year class.

The really significant problem from the conservation viewpoint is that all of these few remaining individuals could have been taken by an average shooter in two nights.

On the 27th September, "Lollipop" anchored at the mouth of the Forrest River. Group 1 went up river with the tide as far as the Mission, a distance of about 35 miles and group 2 worked the mouth of the river. Group 1 sighted 4 crocodiles in 6 hours' searching. Three measured about 4' and one about 9'. The nine-footer could have been shot quite readily and one of the smaller ones was hand touched. However, the other two were very shy - one dived when we were 200 yds. off and did not surface again in the

succeeding five minutes, and the other one dived as soon as the spotlight beam struck it and also remained submerged. This pattern was anticipated as Forrest River had been carefully worked over by professional shooters some months previously. Indeed we were surprised that the large crocodile was not more wary.

Group 2 sighced no crocodiles that night.

On 4th October work commenced at Napier Broome Bay. The King Edward River was worked from the landing stage for one mile up river and downstream to the mouth. No crocodiles were seen. In Monger Creek a crocodile was seen near the mouth in mid-stream. It dived when the dinghy was about 500 yards away and didn't reappear. It is difficult to be certain of its size which was estimated at 6-8'. In a rocky pool near the top of Monger Creek two crocodiles were sighted. One dived at a distance of 3-400 yards and could have been of similar size to the preceding one. The other was approached to within 5 yards and measured about 6'. The shyness of these crocodiles is explained by a barge which brings stores to Kalumburu three or four times a year. The two barge operators shoot crocodiles while the barge is at Kalumburu.

On the night of 5th October, group 1 searched mangrove inlets in Napier Broome Bay and group 2 worked Woppinbie River. Despite excellent hunting conditions - tide just right and no moon - ten and a half hours' searching disclosed no crocodiles.

The following night group 1 searched Dominic Creek but saw no crocodiles.

An attempt to reach the Drysdale River was thwarted by rough seas. This, therefore, concludes this phase of the survey work on the saltwater crocodile.

In selecting to investigate the status of saltwater crocodiles initially in the Cambridge Gulf and Napier Broome Bay we were following the advice of a long-time resident of the area who advised us that Cambridge Gulf was less shot by professionals than Vansittart or Napier Broome Bays. Hence it was thought the two areas would give us a good indication of the range of conditions occurring throughout the State. The above results confirm this statement.

(b) Freshwater

The status of the freshwater crocodile was investigated at a number of localities throughout its range as follows and a complete list of all crocodiles seen together with their sizes is given in Appendix A.

September 30th. Geikie Gorge, near Fitzroy Crossing. (Recommendations for this area, which is a National Park, are set out in Appendix C). We travelled the length of the Gorge in the late afternoon (the most favourable time to see basking freshwater crocodiles at that time of year). Although no crocodiles were seen, slides were in evidence in a number of places. After dark we searched the lower half of the Gorge by spotlight, and saw 75 crocodiles. However, none of these were of breeding age (size) - all were in their first or second year except for a very few in their third year. Clearly the area has been subject to very heavy poaching in the

past. Investigations confirmed that this had taken place two or three years ago. Most of the crocodiles were very shy and dived while we were still several hundred yards distant.

Just south of Mt. House we searched two creeks on 1st October. The first was investigated by day and appeared ideal with pools up to ten feet deep. No slides were seen. The second creek, which was either Edkin's or Adcock Creek, was still flowing and two slides of crocodiles of about 4' and 2½' respectively were seen. Only two first year crocodiles were sighted; however, conditions were difficult for night spotting.

On October 2nd about three miles of the Drysdale River was searched for slides by day. The area contained very deep pools and abundant sandbank areas for basking. Varanus mertensi (water goanna) tracks were exceptionally numerous but there were no indications of any crocodiles inhabiting this ideal stretch of river.

The Morgan River was examined near Theda Station on the afternoon and evening of October 3rd. In the afternoon one slide (3' crocodile) was seen and also a basking crocodile of the same size. By night seven crocodiles were seen within half a mile of the homestead. The largest was about 4' and the remainder between 18" and 3'. The paucity of crocodiles in such good habitat strongly suggested extensive recent poaching.

On the 6th October while based at Kalumburu one dinghy worked two large water holes. One hole was situated at the junction of the Carson and King Edward Rivers and the other, known as Ular waterhole, was a further 22 miles distant. Father Sands, an

Honorary Warden of Fauna, had reported crocodile poachers the previous week and thought they had been in the area for some time. It seemed to be useful to gauge the extent of their activities by night-spotting likely operational areas. Ular waterhole stretched for 3 miles and the other for about a mile. In the smaller waterhole we saw 31 crocodiles, of which the largest was 5'. There were quite a number of 3-3½' and the rest babies. All were very shy. However, in Ular waterhole, which should have supported several hundred, only 16 of a similar size distribution to the first hole were seen. Once again the crocodiles were very shy.

On the night of 8th October, one dinghy searched an ideal pool with a length of somewhat in excess of one mile called either Milyangy or Moorella. On Saturday, 27th September, 1969 two aborigines had seen signs of a fresh camp fire at Milyangy, together with turkey feathers, Land Rover tracks and the trail of a dinghy entering the water. The same aboriginals had been there two days previously (Thursday, 25th September) and the fire etc. were not there. The aboriginals, who are not allowed to light fires themselves, also saw a camp fire burning several miles away and about 4 miles distant from the junction of the Carson and King Edward Rivers. Further details of recent poaching activities appear in Appendix D. A careful search of this pool by spotlight found only four crocodiles although the pool was still over one mile long towards the end of the dry! With the exception of one individual they were not at all shy and I was able to nudge the largest, which measured between 4' and 4½', by hand before it submerged. The virtual total extirpation

of the population in this pool suggests netting operations and indicates the effectiveness of netting against the freshwater crocodile.

On 10th October we spotlighted the King River pumping station pool (Wyndham's water reservoir) which measured one and a half to two miles long by about two hundred yards wide and is very deep. Forty-four crocodiles were sighted in a two and a half hour search and the population included 16 in excess of four to 4½' long. This was the best population we had seen and included the largest crocodiles we had seen - up to 6'. The close proximity to Wyndham and the presence of a Pumping Station Attendant gives this population a fair degree of protection. The previous attendant, who was there until about a year ago, was an Honorary Warden.

On 11th October we surveyed a four to five mile section of the Ord River, from Carlton Crossing upstream, for freshwater crocodiles. Actual searching time was approximately one hour. Most of the time was spent moving the dinghy from one pool to another. Fifty-three crocodiles were sighted and although most measured between 15" and 3'6", two were about 6' long and six between 4' and 5'. The presence of numerous rocks and sand-bars would make netting extremely difficult. Furthermore, Carlton Hill Station is on one side of the river and Ivanhoe on the other. The managers of both stations are Honorary Wardens.

In concluding the account of the freshwater, it must be stated that although very young crocodiles (in the first, second or third year) were fairly abundant in many of the localities

surveyed, breeding stock, even those only just reaching probable first breeding size, were extremely rare. The largest individuals seen by the survey measured 6'.

Former Fauna Warden Trevor Nelson told us that when he came to the Kimberleys in 1942, one commonly saw freshwater crocodiles measuring between 8 and 12'. Not only are these a thing of the past, but in my opinion, the freshwater crocodile is definitely not holding its own in the Kimberleys at present despite full legal protection. The removal of most of the breeding stock with the result that poachers are now taking even young in their first year, will lead to an accelerated decline in numbers as a result of little further breeding taking place. Ways in which this situation can be reversed are considered in Section IV of this report.

CROCODILE BIOLOGY

Very little is known about the biology of most crocodilians. Only one species has been studied in any detail, namely the Nile crocodile (Crocodylus niloticus) in East and Central Africa by Dr. Cott (1961)*.

Size at sexual maturity

Crocodile species, which reach a large adult size like the Australian saltwater crocodile, do not commence breeding until they are fairly large. The smallest breeding female saltwater

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* COTT, H.B. (1961). Scientific results of an enquiry into the ecology and economic status of the Nile crocodile (Crocodylus niloticus) in Uganda and Northern Rhodesia. Trans. Zoo. Soc. London. 29 (4): 211-365.

crocodile known to me measured 7'6". Most females do not commence breeding until they attain a size of between 8 and 9'.

The Australian freshwater crocodile being a much smaller species will commence breeding at a correspondingly smaller size. The exact size is not known but I would anticipate that this is approximately 5'.

Clutch size

Cott has shown a marked increase in clutch size in the Nile crocodile with increase in female size. A similar relationship holds in most reptiles. Female Nile crocodiles of just over 9' lay about 35 eggs and the clutch has increased to about 85 eggs at a length of 11'6".

This means that females breeding for the first few times are not nearly so productive as slightly larger females. Conservation (or farming) must, therefore, aim to keep a reasonable proportion of the larger females. Incidentally, female saltwater crocodiles do not grow nearly so large as males. Females over 14' were rare even when large crocodiles were numerous and few females appear to exceed about 12' in length.

Limited data on the Australian saltwater crocodile indicates that a similar relationship exists between length and clutch size to that recorded by Cott. Clutch size is similar to that quoted for the Nile crocodile, that is, from 40 to 85 eggs or more in a clutch depending on size of the female. Australian freshwater crocodiles lay much smaller clutches comprising about 10 to 25 eggs.

Growth

Limited data on captives have shown that the Australian saltwater crocodile can maintain an annual growth rate of one foot per year at least until it attains a size of 6-8'. There are indications that under extremely favourable conditions this growth rate may even be exceeded.

I am not aware of any information on the growth rate of the Australian freshwater crocodile. I would expect it to be considerably slower than for the saltwater. At Fitzroy Crossing three juvenile year classes appeared to be present. The young of the year measured about 14", what may represent second year animals averaged about 19", and what certainly represents a distinct year-class, tentatively assigned to the third year, averaged 2'4".

Feeding

Very small crocodiles feed mainly on aquatic insects, frogs and small fish. As they grow fish become more important, and in Australia fish probably remain important for the saltwater crocodile throughout life. (In Africa the rich large mammal fauna provides much of the food of large crocodiles). The Australian freshwater crocodile feeds predominantly on fish.

The freshwater crocodile is quite harmless to man and is a shy creature which will always move away when approached (except when dazzled by a spotlight at night). There is little danger to humans even from large saltwater crocodiles. The few instances of attack have received wide publicity. It is well established that the saltwater crocodile usually shuns man.

Crocodiles and fisheries

It is pertinent to quote from Dr. Cott's findings on this subject :

"In most of the localities with which this investigation is concerned, comparatively worthless, or second-class fish (compared with the commercially desirable Tilapia, Serranochromis and Sargachromis) predominate among prey eaten.... Several of the above-mentioned genera together with other fishes less often included in the diet (list provided) are themselves at some stage predatory on fish, fry or fish-eggs. Thus it appears that the destruction of crocodiles would be unlikely to benefit fishery interests, and might well be harmful."

IV PLANS FOR THE FUTURE

CONSERVATION

Crocodiles present a special conservation problem in that there is a very large financial incentive to poach them. Furthermore, crocodile shooting, as well as attracting some fine people, seems to attract a lot of undesirables. Naturally poachers largely fall into the latter category. It is important, therefore, to appreciate at the outset that these individuals have utterly no respect for the law.

It will be impossible to wipe out poaching. However, it is certainly possible to greatly reduce it from the present level where a number of individuals are openly "poaching this season" - information which is freely available both in Western Australia and

inter-state. It is to be hoped that poaching can be reduced to a level which the populations can withstand.

The two species are considered separately below.

(a) Saltwater

This poses a difficult conservation problem in that its numbers have sunk to such a low level that even a low sustained level of poaching might result in the loss of the species in Western Australia. Continued poaching on any scale will certainly prevent the species from making even a limited "come-back".

I unhesitatingly recommend total closure of the saltwater crocodile for a period of 10 years.

The problem is further aggravated by the fact that most of the remaining individuals are not wary and present sitting targets at night (pages 8-10).

Furthermore, there are strong and legitimate pressures from business people for the licensing of crocodile farms (I have had five Australian proposals referred to me so far this year). These individuals strongly resent the fact that the stocks have been allowed to dwindle to such low levels that they cannot obtain the nucleus with which to start a farm. Even if poaching can be virtually exterminated, it is going to be a number of years before these people can obtain stocks (see Recommendations 1 and 2, page 5). They are going to be extremely vocal unless they feel every effort is being made to adequately protect the stocks to enable recovery to occur.

Since it may otherwise be impossible to ensure this species' survival, and since all the tourists to the "Top End" want to see a live crocodile, and preferably a large one, I

consider that a Fauna Reserve should be established with the utmost urgency for this species. An ideal area for this in that it encompasses (a) excellent saltwater crocodile habitat, (b) still holds a number of crocodiles which could repopulate the area if rigidly protected, (c) would be easy to patrol, and (d) is readily accessible to Wyndham for tourists, is available on the Ord River between about Mount Connection and Turkey Island, a stretch of about twenty to twenty-five miles of river. It is envisaged that this proposed Fauna Reserve would have a permanent ranger.

The area could rapidly be developed into a prime tourist attraction as well as conserving a small part of the saltwater crocodile's range in the State so that people can see this, the largest of living reptiles, in its natural environment. There are a number of people interested in privately doing something like this in the Kimberleys as a commercial venture. However, in my opinion, this section of the Ord is an area where the Government should take the initiative in view of their obligation to do everything possible to ensure the crocodile's survival. Following recovery, if recovery has not taken place elsewhere, the reserve could provide the nucleus for an experimental crocodile farm.

At the end of 10 years I recommend that the situation be reappraised following a survey and that if a reasonable measure of recovery has occurred, permits be issued to approved organisations to take a number of specimens, of predetermined sizes, to form the nucleus of crocodile farms. Licensing of farms will be

subject to annual returns, right of inspection, submission of detailed plans and an approved method of identifying skins from the farm so that these do not provide an outlet for poached skins.

If the proposed closure is to meet with any success it must be accompanied by realistic fines which will deter most poachers. Only by gazetting these will closure have the full backing of wardens (both honorary and full-time), and those shooters and other individuals interested in the future of the saltwater crocodile in Western Australia. This topic is dealt with in detail in Appendix B.

(b) Freshwater

I recommend that this inoffensive little animal remain on the fully protected list and that every effort be made to make closure more effective. At present a small number of individuals are making large sums of money by illegal exploitation of the species.

The problem concerning the freshwater crocodile is less difficult than in the case of the saltwater crocodile. Firstly it cannot be considered as threatened at present although the stocks have recently been seriously depleted.

The main worry centres round the *rate* at which they are being poached. However, if effective action can be taken now the species will be in no danger.

If the saltwater crocodile is closed the job of enforcement of legislation protecting the freshwater species automatically becomes much easier. At present individuals equipped for crocodile shooting can claim they have come to Western Australia purely to

take saltwater crocodiles. Unless they are actually found with freshwater skins in their possession there is no case against them. However, if closure is applied to the saltwater, then anyone in possession of crocodile hunting equipment will arouse suspicion since any use of the gear in the State must be illegal.

Although the Kimberley Division covers a large area, the scarcity of roads make apprehension of poachers very much easier than it appears from a cursory glance at the map. Station owners usually dislike crocodile shooters since they tend to leave carcases in an around water holes. The cattle will then not drink at the fouled hole. Furthermore, poachers are not averse to taking cattle from time to time for food. The thought that poachers might dynamite pools to get the crocodiles (and thereby completely foul the pool by killing all the fish) is also at the back of many station managers' minds. Furthermore, the annual wet and dry restrict the poaching season to approximately May to September inclusive. However, the warden needs to be just as professional as the poacher. Further comments on this topic appear in Appendix E.

The comment on fines under the heading "saltwater crocodile" is equally pertinent here. The minimum fine should be the same for both species. The key change recommended is for legislation imposing a statutory minimum fine on conviction (see Appendix B and Recommendation 5, page 4) to be gazetted.

EXPLOITATION

The skin of the saltwater crocodile is particularly prized for leather, currently being valued at slightly over $3.00 per belly inch (width) for a grade 1 skin. The best way of producing this commodity, unless very strict controls are applied to exploiting natural populations, is by crocodile farming. When a number of viable farms are in production it is hoped that this will reduce the pressure on wild populations and in turn encourage further large-scale farming operations so that most or all of the commercial skin requirement can be provided from captive-bred animals. For this reason The Survival Services Commission of the International Union for the Conservation of Nature and Natural Resources will give full support to farming, in which the crocodiles which will in due course be killed for their skins have been *bred* in the farm. (The Union has recently established a Crocodile Group within the Survival Services Commission.) Other so-called farms, which either rob natural nests of their eggs, or catch the newly hatched crocodiles and merely raise them to a commercial size in confinement will be opposed since they are merely imposing yet another strain on wild populations.

In advocating farming of the saltwater crocodile, I recommend that the first farm be of an experimental nature, rather than a direct financial venture, and that after several years' operation the information gained be made available to approved commercial farming ventures. This is because there are a number of aspects which require careful study. Until these have been appraised it seems wrong to solicit funds from investors.

Establishment of full commercial farms *before* procedures have been fully worked out is likely to work to the detriment of the species. The argument that "we have invested X thousand dollars, therefore we have the right to do such and such" is well known. The first obligation of the Department of Fisheries and Fauna must be to conserve the resource. When officers of the Department are convinced that a farming proposal *will succeed as programmed*, then and only then should farming go ahead.

In writing the above, I would like to make it clear that I am a strong advocate of farming - where the selected species is suitable and the animal is readily available. Where these conditions cannot be met, as in Western Australia at the present time, extreme caution must be exercised.

A detailed discussion of the biological and commercial aspects of farming crocodiles lies outside the scope of this report. However, in my opinion the Australian saltwater crocodile is a species well suited to farming and should provide an excellent financial return once an initial supply is available. Crocodiles breed fairly readily in close confinement in the tropics. I have seen an individual captured at about 2' and raised in captivity, which has laid eggs in three succeeding years in an enclosure measuring only 20' x 12'.

I cannot recommend farming of the Australian freshwater crocodile. The skin is greatly inferior to that of the saltwater crocodile, in part due to the presence of osteoderms, and is not much in demand on the world markets. At the present time skin prices

for this species are very inflated (up to $1.60 per belly inch). However, this reflects the acute shortage of saltwater skins and successful farming of the saltwater crocodile in Australia or Papua-New Guinea or of any suitable overseas species will overcome this. One would anticipate a crash in the price for freshwater skins and for the price to settle around a level where farming would not be economic. (In 1966 a large consignment handled by the Department of Fisheries and Fauna were worth only approximately 40c/inch.)

Furthermore, every effort is being made at present to have Queensland close the freshwater crocodile which would then be the first species of crocodile anywhere to be protected throughout its range. Since Customs would then declare its skin a prohibited export and no market would exist with in Australia, poaching would no longer present serious enforcement problems. (At present skins taken illegally in Western Australia or the Northern Territory are legally sold in Cairns.)

Farming effort should, therefore, be concentrated on the highly sought after saltwater crocodile skin, which alone can be expected to provide a viable operation. It should be noted, however, that since these are unavailable to potential farm operators at the present time they will argue in favour of farming the freshwater species. These arguments must be resisted since by restricting farming to the saltwater species Australian farms can provide a skin at least the equal of any other in the world.

In advocating crocodile farms my first interest is to

ensure the future of the species. However, I am confident that farms based on the saltwater crocodile can be financially sound. I am prepared to participate, in a purely advisory role, of course, in any experimental farming venture which may be approved.

TOURISM

"All tourists visiting northern Australia want to see crocodiles and preferably large ones." At present this desire usually has to be satisfied in so-called zoos which usually keep the animals under extremely poor conditions.

Under the heading "Conservation" I strongly recommended the creation of a Fauna Reserve specifically for the saltwater crocodile and pointed out that an ideal area existed on the Ord River and that this was readily accessible to tourists from Wyndham. In the absence of other large game in Australia this reserve could become a major attraction.

It should be pointed out that the interests of the Department in conserving the saltwater crocodile within the reserve need not conflict with legitimate tourist activities. The only time when tourism would be detrimental is when the females are nesting. Nesting in the saltwater crocodile coincides with the wet when there are no tourists anyway.

Crocodiles, like many animals, soon become quite used to humans when not hunted and the sight of numbers of these huge reptiles basking on mudbanks would be a great draw.

RESEARCH

As mentioned under Section III, very little is known about the biology of either Australian crocodile. I hope to commence a study on the freshwater crocodile in Western Australia in 1970. This work has been projected for several years but worries about poaching of the study population (amply justified by the present survey) and difficulties in finding relatively unexploited populations have caused delays. Work is at present in progress on ageing techniques and if these are successful, a number of detailed population analyses can be made during 1970.

APPENDIX A

SIZE DISTRIBUTION OF CROCODILES

(a) Saltwater : Total seen 21.

Size	Number
18"	6
3'6"	1
4'	7
5-6'	3
6-8'	2
9'	2

(b) Freshwater : Total seen 206.

Size	Number
14-15"	about 36
18-19"	about 100
18-42"	43 (of which 8 were between 27 & 30")
4'-5'	24*
6'	3*

* Note : All three six-footers and 21 of the 24 measuring 4-5' were seen at the King River Pumping Station pool or on the Ord River upstream from Carlton Crossing. Apart from these 2 localities, freshwater crocodiles of breeding size were extremely rare.

APPENDIX B

PENALTIES FOR POACHING

The present system in Western Australia, in which maximum penalties exist but no minimum fines, is unsatisfactory both for conservation and for the Fauna Wardens. Many magistrates let crocodile poachers off with only token fines. Very few poachers are caught at present and those few who are apprehended and then successfully convicted must consider it very amusing if only a nominal fine is imposed.

The maximum penalty for illegal possession of freshwater crocodile skins in Western Australia - $200 per skin - is rightly very severe. However, this would not be sufficient to deter poachers of saltwater crocodiles. Furthermore, the practice of charging a poacher with an offence against the act in respect of each skin in his possession was unknown to the present warden at Wyndham.

I will give only two examples of what I consider totally inadequate law enforcement in respect of the totally protected freshwater crocodile. One individual caught in possession of 14 skins was fined $100. Another individual who held a licence to take saltwater crocodiles was caught two years ago with freshwater skins and *didn't even lose his licence!*

Ways in which the offensive against the poacher can be made more effective - one is inclined to say more professional - are discussed in Appendix E. The present section is concerned with the imposition of a stiff fine on conviction as a deterrent to poaching. Poachers are able to calculate the chance of being

apprehended and are at work for large financial gain. Nominal fines of even a few hundred dollars are merely added to operating costs. In this connection it may be useful to quote the sort of skin values which individuals or two man partnerships have brought out of Western Australia this year. These figures are based on discussion with crocodile skin buyers who know the individuals concerned, and who are offered the skins. Two poachers, poaching in Western Australia at the time of our survey, were probably working on their third haul for the season. The first haul was brought out shortly after the wet and valued at between $15,000 and $20,000. I am told that this figure, on present prices for freshwater skins, represents about the maximum number which they can move out of the State by road at one time. If it is assumed that only two hauls are taken per year the poachers probably clear between $20,000 and $30,000. It seems rather improbable that they pay tax on this, making them about the wealthiest members of Australian income-earning society!

I have quoted these figures because there is almost complete ignorance of the profitability of operations among the enforcement people in the State. It seems rather unlikely that a magistrate in possession of this information would consider the poacher guilty of only a petty offence.

In view of this I feel that *minimum fines must be imposed.* The minimum suggested is $2,000 as currently applied in the crayfish industry. However, many people will feel this is still too low. Minimum fines should apply when a person is convicted of

possession of *any skins*. There should be statutory fines, thereafter, of no less than ten times the value of the skin in excess of the first skin, as well as confiscation of skins and all gear. A statutory fine of $200 per freshwater skin on top of the minimum is adequate at present but for the saltwater the fine should be no less than $1,000 per skin. These fines may appear severe but then the profits to be made from crocodile shooting are enormous. Potential poachers weigh the potential gain against the chance of being caught and the likely fine if they are caught and convicted. So long as a single week-end's operation will cover the fine, even although they may lose some skins, the odds are heavily stacked in their favour and poaching will continue.

A crocodile shooter, who strongly advocated a Fauna Reserve for crocodiles in the "Top End" appealed to me to tell the Government to impose fines ten times greater than normal for any poaching within the Reserve. These men know the profits being made by poachers and consider present fines laughable*. Furthermore, they are sour with the Government because it greatly annoys them, as West Australians living in the Kimberleys and obeying the legislation, to see poachers, almost all of whom come from interstate, coming to Western Australia and "getting away with it". New Australians seem to predominate among the poachers.

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* Incidentally, fines of up to $10,000 are currently being imposed in Florida in an attempt to wipe out alligator poaching in the Everglades National Park.

APPENDIX C

GEIKIE GORGE NATIONAL PARK

This is an exceptionally attractive area with a rich fauna. With proper management it is likely to remain so. Perhaps there is an urgent need for better liason between National Parks and the Department of Fisheries and Fauna in Western Australia. In situations like Geikie Gorge their aims should be similar. There is no need to keep tourists out but there is need to control tourist activities. This is in the interests of future tourists as much as the faunal components.

When travelling up the gorge by boat on 29th September I was surprised when an aeroplane flew over us at less than 50 feet. It skimmed the trees and was below the cliffs forming the top of the gorge. This sort of behaviour, apart from endangering the tourists in the 'plane, scares off all the birds in the gorge, sends all the fruit bats into the air, and any basking crocodiles into the water.

Furthermore, cattle are causing serious bank erosion, general habitat destruction and must be seriously impairing incubation success in the favoured crocodile nesting sites.

Ideally the area should become a Fauna Reserve with tourist access. However, failing this, National Parks might be encouraged to fence the area and prohibit low flying in the Gorge.

APPENDIX D

DIRECT EVIDENCE OF POACHING

During our survey we investigated recent poaching activities in the Kalumburu area. The Father Superior of the Benedictine Community at Kalumburu, Rev. Father S. Sands, an Honorary Fauna Warden, provided me with general information as well as details of the present poaching activities which had led him to contact the Wyndham police.

Poachers who visit the Community come under false pretences, such as looking for shells. Whereas all visitors to the area come to the Community many poachers avoid it; however, the evidence they leave - in the form of heaps of carcases and trails along the Carson and King Edward Rivers - speaks for itself. They have visited the area every year in the last three years. Two years ago the pool at Kalumburu which provides the Community's water supply, and which is less than one mile from the main buildings, was cleaned out by netting.

Access to Kalumburu is now exclusively through Theda Station on a new road put in this year. (However, those who know of the existence of the old road and wish to avoid detection, could still use it and thus avoid Theda).

On 22nd August an aboriginal garage mechanic saw 4 freshly skinned freshwater crocodile carcases at the boundary fence.

On 27th September, 1969 a group of aboriginals saw signs of a fresh camp fire at Milyangy pool on the Carson, turkey

feathers, and tracks of a Land Rover and dinghy tracks entering the water. These signs were not there two days previously. The men also saw a camp fire burning several miles distant and about 4 miles from the junction of the Carson and King Edward Rivers.

On 7th October I visited these areas with Father Sands. The Land Rover had not used the road, the tracks went off into the bush and towards a gap on the other side of the river from the Theda-Kalumburu road. The paucity of crocodiles in Milyangy pool which I subsequently searched by spotlight at night was reported on page 14.

Warden Hanley visited Mario pool 5 miles up the King Edward from the junction with an aboriginal from the Community who showed him the remains of a large fire used to burn crocodile carcases. A burned freshwater crocodile skull was found among the remains of this fire (Plate 1). The burnt remains of a freshwater crocodile foot was found at the water's edge (Plate 2). This suggests that the carcases are first burnt and then tossed into the water to destroy overt evidence of poaching activities.

I visited the area beside the Theda-Kalumburu boundary fence (about 10 miles from Theda homestead) where 4 fresh freshwater crocodile carcases had been sighted on 22nd August. These and additional carcases located nearby are shown in the frontispiece to this report.

I was able to obtain the names of the two shooters involved from three separate sources in the Kimberleys and I

PLATE 1

Burnt skull of freshwater crocodile collected from fire beside Mario pool, King Edward River.

PLATE 2

Burnt remains of freshwater crocodile leg found at water's edge Mario pool, King Edward River.

independently checked this with skin dealers interstate. All named the same men.

These abundant indications of recent poaching activity in close proximity to habitation where both men (Father Sands and Gilbert Dayes, Manager of Theda Station) are Honorary Wardens do not leave much hope for less well protected areas.

Father Sands pointed out to me that since protection poachers visit the Kimberleys more often than before. They had no need to come before as freshwater crocodiles were abundant elsewhere (Queensland and the Northern Territory). Now the Queensland shooters operate illegally in the Kimberleys and the Northern Territory. This can only be because they can no longer obtain any quantity of freshwater crocodiles in Queensland since the species is still totally unprotected in the State of Queensland. Their activity in the Kimberleys, therefore, provides Western Australia and conservationists with the best argument with which to refute Queensland's statement that the freshwater crocodiles do not require protection in Queensland and can sustain the present rate of exploitation.

APPENDIX E

THE ROLE OF THE FAUNA WARDEN

Western Australia has an excellent system of Honorary Wardens. If full use of this system was made in the Kimberleys then the problem of apprehending crocodile poachers would be greatly reduced. In my view a professional Fauna Warden must form an intelligence system. Honorary Wardens should be the backbone of this. If they advise the Fauna Warden of the presence of poachers as soon as they are detected, he has every chance of a conviction, since poachers remain in one area for weeks at a time.

Both the present warden and his predecessor complained bitterly to me that their information comes in late and that Honorary Wardens often tell the poachers to clear off, they are going to report them, and hence prevent the professional warden charging them with illegal possession of skins.

I have made some investigations into this situation and have come to the conclusion that the blame lies fairly and squarely on the professional wardens. Were I an Honorary Warden in the Kimberley Division I would be strongly inclined to tell poachers to clear off since this would be the best way to get rid of them. The full-time wardens have simply not been looking after their interests or that of the Honorary Wardens. I will give one example in some detail. During the last 3-4 years one Honorary Warden sent in several reports of poachers and nothing happened. He subsequently sent a member of his staff to the Department of Fisheries and Fauna in Perth to see the Chief Warden of Fauna (at that time Mr. Fraser).

Mr. Fraser was otherwise engaged but the visitor was told that a warden would come and see them but again nothing happened. This Honorary Warden is in a key area for enforcement and is an ardent naturalist. Until I arrived with Warden Hanley he had never seen a warden! Yet he is extremely accessible. One can drive there from Wyndham or catch a 'plane. There are frequent air charters and a 'back-charter' (which I myself used) costs only $15.

I consider it a basic requirement that the warden at Wyndham should make every effort to visit his Honorary Wardens once a year to talk over their problems and to give them a feeling that they are serving a useful purpose. Without this how can one possibly expect them to put themselves out to report presence of poachers? Inevitably their contact with the local warden is used to judge the interest or otherwise of the Government and the Department of Fisheries and Fauna in conservation. In my view, it is because of this lack of attention that the Honorary Wardens are taking matters into their own hands and trying to get rid of crocodile poachers by threatening to report them.

In order to fully integrate the Kimberley Division into the conservation network in Western Australia - which in my view is already the best in Australia - an experienced and senior warden should be stationed in the Kimberleys for several years. It would be a great advantage if he could be provided with an assistant.

I am not in favour of the Wardens trying to apprehend crocodile poachers by themselves. I think they should always be accompanied by a police officer who should be armed.

If a lone warden finds poachers at present he has to search their vehicle for skins. (Without examination he cannot be sure if the skins belong to the protected freshwater crocodile or the saltwater species). If the poacher refuses there is nothing he can do except charge them with obstruction for which I believe the maximum fine is about $100. It is hard to imagine a poacher with a valuable load of skins allowing a single unarmed warden to search his vehicle!!

At present the dice are heavily loaded against the enforcement officer both in apprehending poachers and in obtaining a satisfactory fine.

Detailed examination of the files on crocodiles held by the Department of Fisheries and Fauna in Perth leaves no doubt in the reader's mind that the Department methodically hunts down all breaches in the legislation protecting the freshwater crocodile that come to its notice. The present rather unfortunate crocodile conservation picture in the Kimberleys is presumably due to distance from Perth resulting in lack of adequate supervision from Head Office. Appointment of a senior warden to the Division should greatly reduce this problem.