

ECONOMICS, ECOLOGY AND THE ENVIRONMENT

Working Paper No. 130

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**A REPORT ON THE MANAGEMENT OF SALTWATER CROCODILES
(*CROCODYLUS POROSUS*) IN THE NORTHERN TERRITORY: RESULTS OF A
SURVEY OF PASTORALISTS**

REPORT SUMMARY

The management of saltwater crocodiles (*Crocodylus porosus*) in the Northern Territory is an important component of the State's wildlife management policy. It encompasses saltwater crocodile control (the removal of problem crocodiles dangerous to humans and livestock), and the regulation of harvesting, farming and ranching of saltwater crocodiles for the production of commercial products. The distribution of saltwater crocodiles and their habitats often extend onto private and communal lands along the coastal belt of the Northern Territory, and therefore are a concern of landholders both Aboriginal and pastoral. This report presents the findings of a study of managers of Northern Territory cattle properties (pastoralists). Their attitudes are surveyed towards saltwater crocodiles on their properties and their views of the Northern Territory Parks and Wildlife Commission's saltwater crocodile management plan are outlined.

This report addresses social, economic and environmental aspects of the issue: pastoralists' attitudes towards saltwater crocodiles in general, the impact saltwater crocodiles have on their cattle-raising business, their opinions of the Northern Territory Government's saltwater crocodile plan and its operation, and their views of saltwater crocodile harvesting, its potential as an income earner and its contribution to the conservation of the saltwater crocodile. Opinions of pastoralists about new management schemes such as trophy hunting of saltwater crocodiles are also analysed. A concluding statement ties up the findings of the study and provides a snapshot of the current views of pastoral landholders of saltwater crocodiles and their management in the Northern Territory.

1. INTRODUCTION

This report is the culmination of a survey conducted in 2005 of a group of pastoralists in the Northern Territory (NT). The survey was about their management of saltwater crocodiles (*Crocodylus porosus*) on their cattle properties. Its aim was to obtain views of NT pastoralists about the saltwater crocodile, their opinions about the NT government's management plan for saltwater crocodiles, their interest in the commercial use of the saltwater crocodiles and whether they have made any changes in the way they manage and develop their properties as a result of having rights to the harvesting of crocodiles (either crocodile eggs, hatchlings, juveniles or adults).

Writings on the management and sustainable use of saltwater crocodiles in Australia usually involve surveys of the crocodile farming industry, studies of the research and development in crocodile farming methods, or overviews of the management plans of the various state governments. This study fills a gap in the literature by surveying the management of saltwater crocodiles at the grassroots level, i.e., the private landholders in NT holding rights over saltwater crocodile resources found on their land and who thus form the resource-base of the saltwater crocodile farming industry. This study of landholder attitudes and their management of saltwater crocodile resources is important because the long-term conservation of these resources depend on their wise use and stewardship. This is particularly so because the main economic concern of pastoralists is cattle raising and sales, and the presence of saltwater crocodiles on their properties often conflicts with this primary interest because saltwater crocodiles are known to harm cattle. At the same time, however, saltwater crocodiles are increasingly seen by pastoralists to possess economic value of interest to them.

As a result of this survey, it was hoped that a better understanding would be obtained of pastoralists' attitudes towards saltwater crocodiles and their management, and of their motivations for conserving saltwater crocodiles on their properties.

2. PROCEDURES

The survey was conducted by the use of questionnaires and by interviews. Two pastoralists were interviewed during a field trip to the NT, and following this, forty questionnaires were prepared for other pastoralists in the NT. This was done after prior discussions with two cattlemen in the NT and after some advice from the Cattlemen's Association of the NT. The questionnaires were mailed to the Cattlemen's Association of the NT in April 1 2005, and it then helped in distributing these questionnaires to pastoralists across the NT. The questionnaires were delivered to pastoralists as part of a kit that contained an endorsement letter from the Cattlemen's Association's Director, a letter from the researchers explaining what the survey is about, and postage-paid envelopes for ease of return. Out of the forty questionnaires prepared, six were returned. Out of these six pastoralists who completed the questionnaires, one stated that he did not have saltwater crocodiles on his property. Together with the interviewed pastoralists, our sample consists of nine pastoralists. However, the effective number of responding pastoralists was eight because the pastoralist who stated that he has no crocodiles on his property did not answer the questions because he felt they were not applicable to him.

The results are tabulated and explained in the various sections, each addressing different issues of saltwater crocodile management from the viewpoint of pastoralists.

3. GENERAL ATTRIBUTES OF CATTLE PROPERTIES COVERED IN THIS SURVEY

The pastoral properties surveyed ranged in size from 200 square kilometres to 4,500 square kilometres and stocked from 2,500 head of cattle to 30,000 (or more) (see Table 1). Together, they accounted for more than 16,720 square kilometers of land and over 112,500 head of cattle (Table 1).

Table 1. Size of sampled properties in km² and number of cattle stocked, arranged by increasing number of cattle

Individual properties	Property size (square kilometres)	Head of cattle
Pastoralist 1	320	2,500
Pastoralist 2	200	4,000
Pastoralist 3*	300	5,000
Pastoralist 4	400	11,000
Pastoralist 5	3,800	15,000
Pastoralist 6	4,200	18,000
Pastoralist 7 [†]	3,000	27,000
Pastoralist 8	4,500	30,000
Pastoralist 9*	-	-
<i>Totals</i>	<i>16,720+</i>	<i>112,500+</i>

* These pastoralists were not surveyed using questionnaires but were interviewed during a field trip to the Northern Territory

[†] The pastoralist who stated that he has no saltwater crocodiles on his property

Figure 1 provides a map of the Northern Territory showing the general locations of the pastoral properties surveyed in this study.

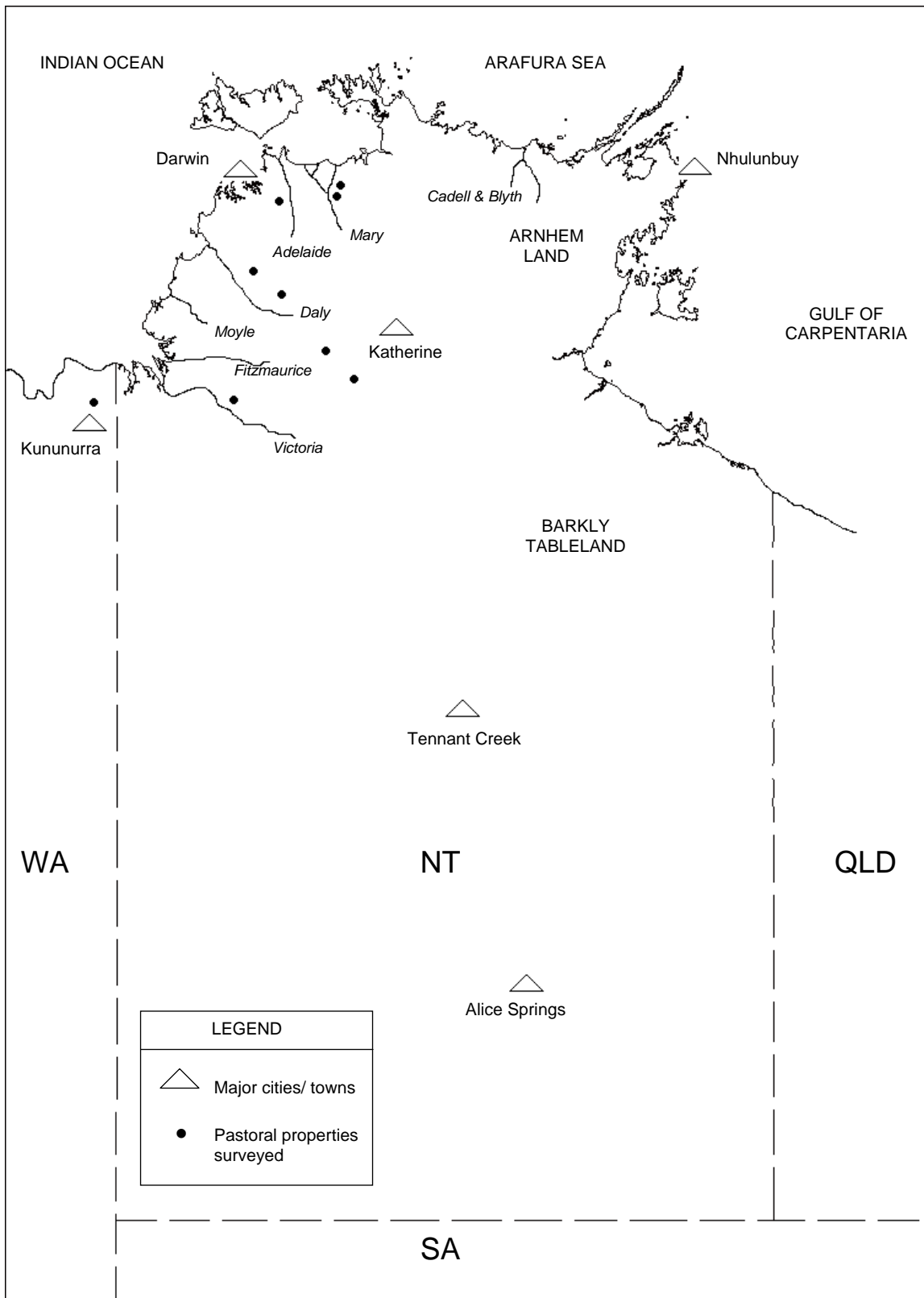


Figure 1. The distribution of the pastoral properties surveyed in this study. Note that Property 5 is affiliated with the Cattlemen’s Association of the NT although it is located in Western Australia

4. CHARACTERISTICS OF CROCODILE POPULATIONS ON THE PASTORAL PROPERTIES IN THIS SURVEY, PASTORALISTS' ATTITUDES TO THE HARVESTING OF CROCODILES, AND STOCK LOSSES CAUSED BY CROCODILES

More than three-quarters (or seven) of the pastoralists surveyed said that they have saltwater crocodiles on their properties (Table 2). Of those who said that they have saltwater crocodiles on their property, a third said that they have saltwater crocodile nests on their property (Table 3).

Table 2. Whether or not crocodiles are present on the property surveyed: frequency of responses

Responses	No. of pastoralists	%
Saltwater crocodiles on property	7	77.8%
No saltwater crocodiles on property	1	11.1%
Unsure	1	11.1%

Table 3. Whether or not there are crocodiles nest on the surveyed properties (for pastoralists who stated that they have saltwater crocodiles on their properties): frequencies

Responses	No. of pastoralists	%
Yes	3	33.3%
No	0	0.0%
Don't know	2	22.2%
N/r	2	22.2%

Of those who said that they have saltwater crocodile nests on their property, one said less than 10% of this property contains crocodile nests, another said that figure is at 10% to 25%, and the third pastoralist put the figure at more than 50%.

More than a third of the pastoralists who said that they have saltwater crocodiles on their property stated that crocodiles are present on more than a half of the area of their properties (Table 4).

Table 4. Extent of crocodile presence on the properties surveyed (for pastoralists who stated that they have saltwater crocodiles on their properties): frequencies

Percentage of property that is crocodile territory	No. of pastoralists	%
< 10%	0	0.0%
10% - 25%	2	25.0%
25% - 50%	0	0.0%
> 50%	3	37.5%
N/r	2	25.0%

All of the pastoralists responding to the question of whether crocodiles are pests, an asset or both stated that saltwater crocodiles are both pests and assets (Table 5).

Table 5. Whether crocodiles are considered to be a pest or an asset or both on the surveyed properties: frequencies

Responses	No. of pastoralists	%
A pest	0	0.0%
An asset	0	0.0%
Pest and asset	6	75.0%
N/r	2	25.0%

The pastoralists provided the following comments about the pest-and-asset nature of saltwater crocodiles:

- Approximately Aus\$35,000 worth of eggs were harvested in the wet season of 2004 and problem crocs ate Aus\$30,000 worth of cattle
- [The saltwater crocodiles are] too large in number, invading smaller billabongs and dams; would be asset if they could be harvested
- [Saltwater crocodiles are] necessary for the environment, yet too many cattle are taken [by the crocodiles]

Most of the pastoralists believe that the number of crocodiles on their properties has increased over the last decade (Table 6), and most of them would like to see this number of crocodiles decrease (Table 7). They argue that (i) as crocodiles get older, they become ‘cattle killers’ and that many older crocodiles means many cattle are killed; and (ii) that crocodiles not only contribute to cattle losses but are also a hazard to workers. Another pastoralists said that there are “far too many juveniles, i.e., male crocodiles up to 3 metres” long.

Table 6. Pastoralists perceptions of trends in crocodile numbers on their properties: frequencies

Responses	No. of pastoralists	%
Increased	7	87.5%
Decreased	0	0.0%
Remained the same	0	0.0%
Unsure	0	0.0%
N/r	1	12.5%

Table 7. Changes desired by pastoralists about the number of crocodiles on their property: frequencies

Responses	No. of pastoralists	%
Increase	0	0.0%
Decrease	5	62.5%
Remain the same	2	25.0%
N/r	1	12.5%

Most of the pastoralists complained of the presence of problem crocodiles on their property (Table 8). Of the six who have or had problem crocodiles on their property, four said that the number of problem crocodiles has increased, one said the number of problem crocodiles remains the same while one of them gave no response.

Table 8. Frequency of response to the question: “Do you have or have you had problem crocodiles on your property?”

Responses	No. of pastoralists	%
Yes	6	75.0%
No	2	25.0%

Overall, none of the pastoralists would like to see an increase in the number of saltwater crocodiles in the NT; almost all of them stated that they would like to see the number of crocodiles decrease in the Territory (Table 9).

Table 9. Variations desired by pastoralists in number of crocodiles in the Northern Territory: frequencies

Responses	No. of pastoralists	%
Decrease	6	75.0%
Increase	0	0.0%
Remain the same as now	0	0.0%
N/r	2	25.0%

They gave the following reasons for wanting to see saltwater crocodile numbers reduced in the NT:

- Numbers in the Territory have exploded to dangerous saturation levels - crocodiles now inhabit all freshwater in the Top End to the furthest reaches of catchments, e.g. human and stock fatalities must increase.
- Overpopulation in rivers is causing crocodiles to move further out in search of habitat
- The number of crocodiles has increased and provides a real threat to tourists, employees and animals
- They seem to be going further up most water systems
- Loss of stock; personal safety; no safe swimming areas
- I would like to see the number of juveniles decrease. But leave the dominant large crocodiles in place. I believe if the large animals are shot the numbers will increase.

It is thus not surprising that none of the pastoralists favour a ban on saltwater crocodile harvesting (Table 10).

Table 10. Whether surveyed pastoralists would like to have saltwater crocodile harvesting banned in the Northern Territory again: frequencies

Responses	No. of pastoralists	%
No	6	75.0%
Yes	0	0.0%
N/r	2	25.0%

The following are their reasons for wanting the continued harvesting of saltwater crocodiles:

- It will only be harvesting that controls the future populations, e.g., helicopter egg harvests is not enough to control levels, and egg harvests do not control the big beef-eaters
- Controlled harvesting would be healthy however just eradicating the larger animals is not the answer
- If this happens [i.e., a ban], it will eventually affect tourism and pastoral operations dramatically
- It will help control numbers

- Put value on some things, conservation [of saltwater crocodiles] will be enhanced
- Some control [on saltwater crocodiles] is necessary

Almost all the pastoralists would like the present quota for the number of saltwater crocodiles harvested to be increased (Table 11). None wanted it left unchanged or reduced.

Table 11. Preference of pastoralists surveyed for alteration in the size of the Northern Territory quota for harvesting of crocodiles: frequencies

Preference	No. of pastoralists	%
Reduce the quota	0	0.0%
Leave it unchanged	0	0.0%
Increase it a little	4	50.0%
Increase it considerably	2	25.0%
Increase	1	12.5%
N/r	1	12.5%

The pastoralists who want the quota to be increased considerably gave the following comments:

- Increase [quota] in short term, and every water system should be monitored for population, and larger crocodiles should be removed as population density is an influence on predation targets
- At present, our property is allowed (permitted) to take 10 per year, this is not many considering the area has approximately 70,000 crocodiles

The pastoralists who want the quota to be increased slightly gave the following comments:

- I believe the numbers have increased dramatically in the last 10 years
- Managed control [required]

Pastoralists were asked if they favoured the harvesting of saltwater crocodiles at different stages of the crocodile's life-cycle. Out of six responding pastoralists, all favoured the harvesting of saltwater crocodile eggs (Table 12). This may be because of the potential earnings that they could receive from crocodile egg harvesting. The majority of responding pastoralists wanted to see juveniles harvested and half favoured the harvesting

of adult crocodiles. Slightly more pastoralists favoured the harvesting of juveniles compared to adults. This may be because pastoralists see the large number of juvenile crocodiles as potential threats to cattle.

Table 12. Number of pastoralists expressing support for harvesting of crocodiles in different stages of their life-cycle

Stage in life-cycle	No. of responses	As a % of pastoralists who answered the question (<i>n</i> = 6)
Crocodile eggs	6	100.0%
Hatchlings	1	16.7%
Juveniles	4	66.7%
Adults	3	50.0%
Do not support harvesting	0	0.0%

The pastoralists, as a whole, reported that they lose about Aus\$326,000 worth of cattle annually due to crocodile attacks (Table 13). Some pastoralists estimate that they lost annually up to 300 head of cattle due to crocodile predation. From the figures provided by pastoralists, we were able to estimate the percentage of stocks of cattle lost by individual pastoralists annually as a result of crocodile predation (Table 13, column 5). These ranged from 0.2% to 3%. Only one pastoralist seems to have received returns from crocodile harvesting significant enough to cover a substantial portion of this pastoralist's cattle loss (Table 13, column 6).

Table 13. Pastoralists' estimated annual loss of stock to crocodiles and the extent to which losses are covered by income from crocodile harvesting

Individual pastoralists	Head of stock lost by pastoralists	Other stock lost	Estimate of total value of stock lost each year due to crocodile attacks (Aus\$)	Percentage of cattle lost in relation to total stock of cattle on property (%)	Percentage of income received from crocodile harvesting that covers cattle stock losses (%)
Pastoralist 1	300	Horses	180,000	1.0	0
Pastoralist 2	150	N/r	75,000	3.0	N/r
Pastoralist 3	50	20 buffaloes	33,000	1.3	2
Pastoralist 4	25	N/r	30,000	0.2	90
Pastoralist 5	12 to 20	N/r	N/r	-	N/r
Pastoralist 6	10	-	8,000	0.4	6
Pastoralist 7	0	N/r	N/r	-	N/r
Pastoralist 8	0	-	0	-	0
Pastoralist 9*	N/a	N/a	N/a	-	N/a

*This pastoralist stated that he does not have saltwater crocodiles on his property and so the questions addressed in this table were not applicable to him.

5. PASTORALISTS' KNOWLEDGE OF THE NT CROCODILE MANAGEMENT PLAN AND THEIR VIEWS ABOUT ITS OPERATION

Most of the pastoralists surveyed are aware of the NT Government's Crocodile Management Plan (Table 14). More than half of those who are aware of the plan said that they know the plan well (Table 15). The pastoralists also gave comments about the good and bad points of the plans. While they recognise that crocodile management by the Parks and Wildlife Commission of the NT is important to them, they also stated that management needs to be more vigorous and believe that harvesting quotas are still very conservative relative to the proliferation of saltwater crocodiles (Box 1).

Table 14. Pastoralists' awareness of the NT Parks and Wildlife Commission's Crocodile Management Plan: frequencies

Response	No. of pastoralists	%
Aware of plan	7	87.5%
Not aware of plan	1	12.5%

Table 15. Knowledge level of those who are 'aware of the crocodile management plan': frequencies

Response	No. of pastoralists	%
Excellent	1	14.3%
Moderately good	3	42.9%
Poor	2	28.6%
N/r	1	14.3%

Box 1. Good and bad points of the management plan according to the surveyed pastoralists

Good points

1. Most [crocodiles] have come upstream in the wet season and get caught in large water holes. Parks and Wildlife keep a close eye on them and take appropriate action
2. At least they are trying to manage the crocodile

Bad points

1. 10 nests that have 45 eggs if hatched in one river system can saturate that system 10 years later with hungry crocs
2. From top of my head, the flaw in this plan is that there is only provision to harvest 500 odd live crocodiles. This is far too small a number given there are on average 45-odd eggs to a nest
3. The management seems to be concentrated around populated areas
4. They are not listening to people on the ground
5. Pastoralists are almost ignored, we seem to be insignificant!
6. Requires more activity

6. INFORMATION FROM PASTORALISTS HOLDING PERMITS FOR CROCODILE HARVESTING – ATTITUDES TOWARDS CROCODILE HARVESTING, WHETHER CONTINUING WITH PERMITS, IMPACT ON CROCODILE CONSERVATION, SIGNIFICANCE AS AN INCOME SOURCE, FAIRNESS AND ADEQUACY OF THE NT CONSERVATION MANAGEMENT PLAN

More than half of the pastoralists surveyed believe that they should receive payments from crocodiles harvested on their property (Table 16). Some of the reasons provided by them for stating this are that it is a source of income and that it could help cover losses resulting from crocodile predation of cattle. They also commented that by paying landholders for the crocodiles harvested, the value of the crocodile in the eyes of the landholders will be enhanced (see comments in Box 2).

Table 16. Frequency of responses to the question: “Do you believe that harvesters (mostly crocodile farmers) should pay landholders to take saltwater crocodile eggs and crocodiles on their property?”

Response	No. of pastoralists	%
Yes	5	62.5%
No	1	12.5%
Unsure	0	0.0%
N/r	2	25.0%

Box 2. Reasons given by pastoralists for why they believed that harvesters should pay them for harvesting crocodiles from their properties

- | |
|--|
| <ol style="list-style-type: none"> 1. This turns the crocodile into an asset to property 2. Country will more likely to be managed to conserve habitat and presence 3. To cover the cost of lost stock 4. This would provide the landowner with extra income 5. Helps compensate for losses 6. Because it is a resource of the property 7. So pastoralists have control of culling and harvesting |
|--|

Some pastoralists said that there is competition between crocodile farms/harvesters to collect eggs from their property while others said there is no such competition (Table 17). Pastoralists were asked what factors they take into account when deciding between potential crocodile harvesters to harvest crocodiles on their property. Three of them stated that they will consider who can pay them the most. Other comments made are that they

prefer someone who has a reputable harvesting background, and who has a serious approach to harvesting efficiently (e.g., before the floods in the wet season).

Table 17. Frequency of responses to the question: “Is there competition between businesses (harvesters) to collect crocodile eggs on your property?”

Response	No. of pastoralists	%
Yes	2	25.0%
No	3	37.5%
No & Unsure	1	12.5%
N/r	2	25.0%

The pastoralists were asked to rank reasons why they should be paid for harvests of crocodiles on their property. Six pastoralists responded to his question. They agreed to all the reasons listed in the survey, but with varying intensity (see Table 18). Average ranks for each listed reason are given in Table 18. They most strongly agreed with the proposition that payment would encourage landholders to conserve crocodiles on their property.

Table 18. Pastoralists’ average ranking of reasons for why landholders should be paid for harvests of crocodiles on their property.

Reasons	Average ranking (1 = 'strongly disagree', 2 = 'disagree'; 3 = 'neutral', 4 = 'agree'; 5 = 'strongly agree')
"It will encourage landholders to conserve crocodiles"	4.67
"It provides some compensation for stock losses caused by crocodiles"	4.5
"The landholder's property is supporting the crocodiles, so it is correct that the owner gets some return for that"	4.5
"It helps compensate for the trouble and risk of letting outsiders work on the property"	4

More than half of the surveyed pastoralists (about 5 of them) have applied for and obtained permits for allowing the harvesting of saltwater crocodiles on their properties (Tables 19a and 19b). Reasons given by these pastoralists for applying for permits are mainly to reduce crocodile numbers on their property and to obtain some income as well (Table 19c). Other reasons given are to recoup some on the losses from crocodile predation of cattle, and to support local businesses that conduct crocodile harvesting.

Table 19a. Frequency of responses to the question: “Have you ever applied for a permit allowing the harvesting of saltwater crocodiles (eggs, hatchlings, juveniles, adults) on your property?”

Response	No. of pastoralists	%
Yes	5	62.5%
No	3	37.5%

Table 19b. Frequency of responses to the question: “Have you ever obtained or do you have a permit to harvest saltwater crocodiles on your property?”

Response	No. of pastoralists	%
Yes	5	62.5%
No	3	37.5%

Table 19c. Reasons provided by pastoralists who have applied for permits for doing so:

Reasons	No. of pastoralists	%
"To get extra income" & "To reduce crocodile numbers on my property"	2	40.0%
"To reduce crocodile numbers on my property" & "Others"	1	20.0%
No reasons given (interviewed pastoralists)	2	40.0%

Pastoralists were also asked how many crocodile eggs/hatchlings/juveniles/adults were collected from their properties in the last harvesting season. Only two out of the five pastoralists who stated that they had obtained harvesting permits responded to this question. One said that 2,000 crocodile eggs were collected, and another pastoralist said that 500 crocodile eggs were collected and 10 adult crocodiles were harvested. Out of these five pastoralists, three said that they are continuing to allow the harvesting of crocodiles on their property, while the remaining two (interviewed) pastoralists did not specifically state that they are continuing crocodile harvesting activities on their properties but it is likely that they are doing so (Table 20). The following reasons were given by some of the pastoralists for continuing with allowing the harvests of saltwater crocodiles:

- For management (“if you don’t, in 5 years plus you will be overrun by cow killers”)
- To reduce crocodile numbers
- For income

Table 20. Frequency of responses to the question: “Are you continuing with allowing harvesting of saltwater crocodiles or their eggs on your property?” [Responses of pastoralists who said that they have applied permits to harvest saltwater crocodiles, $n = 5$]

Response	No. of pastoralists	%
Yes	3	60.0%
No	0	0.0%
N/r	2	40.0%

However, with the exception of one, most pastoralists believe that income from allowing saltwater crocodile harvesting did not alter their land-use practices or farm management (Table 21) nor did most pastoralist conserve any habitat suitable for saltwater crocodiles as a result of income from saltwater crocodile harvesting (Table 22). One of the interviewed pastoralists stressed that the main business of pastoralists is cattle raising. The only pastoralist who said that she altered land-use practice as a result of receiving income from crocodile harvesting explained that she (i) cleared infestations of an introduced weed, mimosa (*Mimosa pigra*), off the river banks that are potential crocodile nesting areas to increase their available nest areas, and (ii) aerial-sprayed mimosa weeds to maintain older crocodile nesting sites. She also said that if crocodiles nest where you know, then it does not cost you helicopter time to search for them (for egg harvesting, for example). One of the interviewed pastoralist said that he would like crocodiles to nest on his property so he can sell crocodile eggs. Presently he has crocodiles but they do not nest on his property.

Table 21. Frequency of responses to the question: “Has your income from allowing saltwater crocodile harvesting altered your land-use practices or farm management in any way?”

Response	No. of pastoralists	%
Yes	1	12.5%
No	4	50.0%
N/r	3	37.5%

Table 22. Frequency of responses to the question: “In particular, have you conserved (not altered) any habitat or area that suits saltwater crocodiles because you have obtained income from the harvesting of saltwater crocodile eggs or saltwater crocodiles on your property?”

Response	No. of pastoralists	%
Yes	1	12.5%
No	4	50.0%
N/r	2	25.0%
May do so	1	12.5%

Only one pastoralist reported that income earned from crocodile harvesting on their property as significant (Table 23). This is the same pastoralist who said that income from crocodile harvesting has altered her land-use practices on her property. Pastoralists were then asked what percentage of the income from their property had been obtained in recent years as a result of them having permits for saltwater crocodile harvesting. Three pastoralists responded, stating that the percentages were less than 0.01, 0.2 and 5 percent. According to one of these pastoralists, the amount received is not worth worrying about, another pastoralist stated that income from crocodile harvesting was “peanuts”, whereas another argued that the returns could be sustainably increased if harvesting of larger crocodiles was permitted.

Table 23. The number of pastoralists who regard the income they earned from saltwater crocodile harvesting on their property as significant or otherwise

Response	No. of pastoralists	%
Significant to them	1	12.5%
Insignificant to them	4	50.0%
N/r	3	37.5%

The pastoralists were also asked whether the levy charged by the NT Parks and Wildlife Commission on each viable crocodile egg harvested is fair. None agreed that it was, and half of the pastoralists stated that it was not fair or reasonable (Table 24). Comments by pastoralists were ‘why should they pay such a levy since it is just another form of taxation’, and ‘levy payments usually go towards funding populated area management (rather than less densely populated areas such as where the pastoralists are located)’. One pastoralist questioned the entitlement of the Parks and Wildlife Commission to collect such a levy when it is not the territory managed by the Commission.

Table 24. Frequency of responses to the question: “Do you regard the levy/royalty of Aus\$1.25 per viable crocodile egg charged by the NT Government for crocodile eggs as fair and reasonable?”

Response	No. of pastoralists	%
Yes	0	0.0%
No	4	50.0%
Unsure	1	12.5%
N/r	3	37.5%

None of the surveyed pastoralists said that the present crocodile management system (whereby landholders receive income from the harvesting of saltwater crocodiles) would not help conserve crocodiles, and in fact all that answered the question said it would (Table 25). Some pastoralists commented that giving value to the saltwater crocodile increases its protection. One pastoralist suggested that crocodile management levy of Aus\$0.20 be charged as part of every Northern Territorian’s property rates if the NT Government is serious about improving crocodile management.

Table 25. Frequency of responses to the question: “Do you think that present crocodile management whereby landholders can get payment for collection of saltwater crocodile eggs, hatchlings, juveniles and adults on their land helps conserve saltwater crocodiles?”

Response	No. of pastoralists	%
Yes	4	50.0%
No	0	0.0%
N/r	4	50.0%

Some pastoralists were satisfied with the current permit system and the allocation of permits for harvesting crocodiles, while some were not (Table 26). Some comments were given by the pastoralists. These are provided in Box 3.

Table 26. Frequency of responses to the question: “Are you satisfied with the current permit system and the process of allocating permits for harvesting crocodiles?”

Response	No. of pastoralists	%
Yes	2	25.0%
No	3	37.5%
N/r	3	37.5%

Box 3. Comments of pastoralists about their satisfaction or dissatisfaction with the permit system for saltwater crocodile harvesting and the allocation of these permits.

<p><i>Those who said that they were satisfied with the permit and quota allocation systems</i></p> <ul style="list-style-type: none"> - Has to be efficient, e.g., quick as climatic conditions, e.g., going into wet season, are short time frames for harvest windows - Unsure of alternatives possible
<p><i>Those who said that they are not satisfied with the permit and quota allocation systems</i></p> <ul style="list-style-type: none"> - Allocated harvest numbers are too low - Needs less regulation

A small portion of the pastoralists suggest that changes be made to the current permit system and the process of allocating permits for harvesting crocodiles (Table 27). Some suggestions made are that explanations be provided on how permit allocation numbers are allocated by the Parks and Wildlife Commission of NT, that permits be given for harvesting sustainably, and changes be made to the number of crocodiles harvested for “safety purposes”.

Table 27. Frequency of responses to the question: “Do you suggest any changes in the current permit system and the process of allocating permits for harvesting crocodiles?”

Response	No. of pastoralists	%
Yes	2	25.0%
No	1	12.5%
N/r	5	62.5%

7. GENERAL VIEWS OF PASTORALISTS ABOUT WILDLIFE HARVESTING, INCLUDING TROPHY HUNTING OF CROCODILES

Three-quarters of the pastoralists are in favour of trophy hunting of saltwater crocodiles (Table 28). The responding pastoralists also provided some comments about their responses and these are as follows:

- The real big crocodiles are not the problem
- Yes [I am in favour of trophy hunting], but under strictly regulated system giving pastoralist equal opportunity
- [In favour of trophy hunting], but not of large established animals

It appears that large crocodiles are not the only type of crocodiles pastoralists would like to see hunted, and some presumably would like to see juvenile crocodiles hunted too.

Table 28. Frequency of responses to the question: “Are you in favour of the trophy hunting of saltwater crocodiles?”

Response	No. of pastoralists	%
Yes	6	75.0%
No	2	25.0%

Pastoralists also were asked if they are in favour of commercial harvesting of wildlife in general in the NT if it is sustainable. Three-quarters said that they were in favour, and none opposed the proposition (Table 29). Some provided following comments:

- Commercialising protects wildlife, negates illegal trading
- All pastoralist know the crocodile and wildlife are important to the Territory and its economy and will manage them in a sustainable manner just as they do with the land
- Adds commercial value to crocodiles, which will enhance their protection

Table 29. Frequency of responses to the question: “Are you generally in favour of commercial harvesting (use) of wildlife in the NT if it is sustainable?”

Response	No. of pastoralists	%
Yes	6	75.0%
No	0	0.0%
N/r	2	25.0%

They were also asked whether they are in favour of the sustainable commercial harvesting of crocodiles in the NT specifically, and almost all of them responded positively (Table 30). One pastoralist commented that, again, the younger crocodiles (such as the juveniles) should also be targeted for harvesting.

Table 30. Frequency of responses to the question: “Do you favour the sustainable commercial harvesting of crocodiles in NT?”

Response	No. of pastoralists	%
Yes	7	87.5%
No	0	0.0%
N/r	1	12.5%

Finally, some pastoralists stated some additional general points about the management of saltwater crocodiles in the NT. One pastoralist stated that his property borders the Mary River system in the NT (which, according to him, is believed to have one of the largest populations of saltwater crocodiles) and yet he is only allowed to harvest 10 crocodiles per year. Another commented that the majority of the older animals have learnt to live with humans and that people must be educated not to feed them.

8. CONCLUDING OBSERVATIONS

On the whole, the pastoralists surveyed in this study are supportive of the NT Saltwater Crocodile Management Plan and the harvesting of saltwater crocodiles on their pastoral properties and in the NT in general.

Pastoralists are in favour of the management plan because it is believed that it reduces cattle losses on their property from crocodile predation, and also provides them with some income from allowing crocodiles and their eggs to be harvested from their property. While some pastoralists say that the income from this activity helps compensate for cattle losses, the payments they receive from crocodile harvesting has to be much larger if it is to significantly cover the cost of cattle losses from crocodile predation suffered by most pastoralists.

Nevertheless, it appears that pastoralists welcome crocodile harvesting mainly as a way to control the proliferation of saltwater crocodiles on their property. Only one pastoralist stated that she actively pursued activities to alter land use on her property to provide for the saltwater crocodile nesting. All other pastoralists stated that they did not alter land use practices to accommodate saltwater crocodiles as a result of income they received or might receive from harvesting saltwater crocodiles on their landholdings.

Most pastoralists surveyed would like change in the crocodile management plan of the Parks and Wildlife Commission of the Northern Territory. In particular, they would like harvest quotas for saltwater crocodiles increased given their claim that saltwater crocodile numbers have increased greatly and that current harvesting levels are inadequate to keep the saltwater crocodile numbers in check. Furthermore, most pastoralists indicate that they would like to see more juvenile saltwater crocodiles harvested.

Pastoralists in general are supportive of saltwater crocodile harvesting for sustainable use and for trophy hunting. They are of the opinion that giving commercial value to wildlife, such as the saltwater crocodile, will enhance efforts to conserve them. Also giving value

to the harvesting of crocodiles provides an economic incentive for harvesting them which in turn helps to limit crocodile predation on cattle on pastoral properties.

ACKNOWLEDGEMENTS

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APPENDIX

Sample Survey Questionnaires Distributed to NT Pastoralists



**MANAGEMENT OF SALTWATER CROCODILES IN THE NORTHERN TERRITORY:
SURVEY FOR NORTHERN TERRITORY PASTORALISTS**

This survey is being conducted by staff at The University of Queensland and Queensland University of Technology as part of their independent research into the commercial use of Australian tropical wildlife. This study is for scientific purposes only and is partly supported financially by the Australian Research Council. Its objective is to obtain views of NT pastoralists about the saltwater crocodile, their opinions about the government’s management of the crocodiles in NT, their interest in the commercial use of the saltwater crocodiles and whether they have made any changes in the way they manage and develop their properties where they have rights to the harvesting of crocodiles (eggs, hatchlings, juveniles, adults). **Please assist this research by completing this survey form and returning it in the postage paid envelope enclosed.** Your identity and answers will be kept **confidential**. Your answers will only be used for research purposes. If you require any further information, please contact Tony Searle (Cattlemen’s Association Rep.), or Professor Clem Tisdell (contact details below). Respondents will be given a summary of the results.

Thank you. Clem Tisdell.

Contact details: Clem Tisdell, School of Economics, The University of Queensland, Brisbane, QLD 4072
Tel: (07) 3365 6570 Fax: (07) 3365 7299 Email: c.tisdell@economics.uq.edu.au

A. BACKGROUND INFORMATION

1. Date survey form completed:.....
 2. Your given name: Family name:
 3. Your position (e.g., owner/manager; manager):
.....
 4. Name of pastoral property:.....
 5. Location (address) of pastoral property (please include postal area code):
.....
.....
- Approximate distance from Darwin by road:km
6. Your telephone no.: Fax no. (if available):
- E-mail address (if available):.....



7. Size of pastoral property in square kilometres:
8. Approximate number of head of stock usually carried:
9. Main source of income from property (e.g., 'cattle sales' etc.):



B. CROCODILES ON THIS PROPERTY

10. Do you have saltwater crocodiles on this property? Yes No Don't know
 If 'yes', roughly how much of your property is considered to be crocodile territory?
 Less than 10% 10% to 25% 25% to 50% More than half

11. Do you have saltwater crocodiles nesting on your property? Yes No Don't know
 If 'yes':
 Roughly how much of your property contains crocodile nests?
 Less than 10% 10% to 25% 25% to 50% More than half
 Circle whichever applies regarding density of nests:
 'There are many/moderate amounts/few/very few crocodile nests on my property'.

12. Do you consider saltwater crocodiles on your property to be
 A pest An asset Both a pest and an asset Other ?

[Tick whichever applies]

Why?

.....

13. During the last 10 years, do you think the number of crocodiles on your property has:
 Increased Decreased Remained about the same as now Unsure?

Would you like to see saltwater crocodile numbers on your property

- Increase Decrease Remain about the same as now?



Why?

.....
.....

14. Have the number of 'problem crocodiles' (crocodiles that threaten livestock on your property or endanger people) been increasing over the last 10 years? Yes No Unsure

15. Would you like to see saltwater crocodile numbers in the Northern Territory

Increase Decrease Remain about the same as now?

Why?

.....
.....

16. Would you like to see crocodile harvesting banned in the NT again? Yes No

Why?

.....
.....

17. Which of the following do you favour as far as the size of the quota for harvesting crocodiles in the NT is concerned? Reduce the quota Leave it unchanged Increase it a little Increase it considerably

Why?

.....
.....

18. How many head of stock do you estimate you lose each year due to crocodiles?

(a) Number of cattle lost:

(b) Number of other stock lost and type:

(c) What is your estimate of the total value of stock lost each year due to crocodile attacks (in dollars)?

.....

(d) Any comments about the nature of the stock lost?

.....



19. What percentage (on average) of the dollar amount of your stock losses is covered by the property's income from permitting collection of crocodile eggs, hatchlings, juveniles and adults on your property?
.....%



C. CROCODILE MANAGEMENT

20. Do you support the harvesting of the following for economic gain [tick whichever applies]:
 Crocodile eggs Crocodile hatchlings Juvenile crocodiles Adult crocodiles
 Do not support crocodile harvesting

Any comments:

.....
.....

21. Are you aware of the crocodile management plan of the NT Government Parks and Wildlife Service (“Biodiversity and Conservation”)? Yes No
If ‘yes’, do you consider your knowledge of it to be: Poor Moderately good Excellent?

22. If ‘yes’ to Q. 21, what in your view are its good and bad points?

Good points:

1.....
2.....
3.....

Bad points:

1.....
2.....
3.....

23. Do you believe that harvesters (mostly crocodile farmers) should have to pay landholders to take crocodile eggs and crocodiles on their property? Yes No Unsure
Why?



1.....
 2.....

24. Is there competition between businesses (harvesters) to collect crocodile eggs on your property?
 Yes No Unsure

If 'yes', is this competition strong? Yes No

What are the main factors you take into account in deciding between potential harvesters on your property?

1.....
 2.....
 3.....

25. On a ranking of 1 to 5 where (1) represents 'strongly disagree'; (2) 'disagree'; (3) 'neutral'; (4) 'agree'; and (5) 'strongly agree', indicate your reaction to the following:

Landholders should be paid for harvests of crocodiles on their property because

Your response

(insert number)

- It provides some compensation for stock losses caused by crocodiles
- It helps compensate for the trouble and risk of letting outsiders work on the property
- The landholder's property is supporting the crocodiles, so it is correct that the owner gets some return for that
- It will encourage landholders to conserve crocodiles

26. Have you ever applied for a permit to allow the harvesting of saltwater crocodiles (eggs, hatchlings, juveniles, adults) on your property? Yes No

If 'yes', why did you apply? [you can tick more than one box]

to get some extra income to reduce crocodile numbers on my property Others (please specify):

.....



27. Have you ever obtained or do you have a permit to harvest saltwater crocodile (eggs, hatchlings, juveniles, adults) on your property? Yes No

If 'yes', for which of the following did you obtain a permit? Eggs Hatchlings Juveniles Adults

If 'no', skip Section D and go to Section E

28. What is the last harvesting season for which you had a permit and how many crocodiles were collected?

.....
Season Eggs Hatchlings Juveniles Adults



D. PERMIT HOLDERS AND CROCODILE MANAGEMENT

29. Are you continuing with allowing harvesting of crocodiles or their eggs on your property? Yes No
Why?

.....
.....

30. Has your income from allowing crocodile harvesting altered your land-use practices or farm management in any way? Yes No

If 'yes', how?

.....
.....

31. In particular, have you conserved (that is, not altered) any habitat or area that suits crocodiles because you have obtained income from the harvesting of crocodile eggs or crocodiles on your property? Yes No

Why?

.....



32. Do you regard the income you have earned from crocodile harvesting on your property as:

- Significant for you
- Insignificant?

About what percentage of your net income from this property have you obtained in recent years as a result of your having permits for crocodile harvesting (eggs, hatchlings, juveniles, adults)?%

Any comment:

.....

.....

33. Do you regard the levy/royalty of \$1.25 per viable egg charged by the NT Government for crocodile eggs as fair and reasonable? Yes No Unsure

Please comment:

.....

.....

34. Do you think that the present crocodile management plan whereby landholders can get some payment for collection of crocodile eggs, hatchlings, juveniles or adults on their land helps conserve crocodiles?

- Yes
- No

If 'yes', how? If 'no', why?

.....

.....

35. Are you satisfied with the current permit system and the process of allocating permits for harvesting crocodiles? Yes No

Please elaborate:

.....

.....

36. Do you suggest any changes in the current permit system and the process of allocating permits for harvesting crocodiles? Yes No

If 'yes', what changes do you suggest?

1.....

2.....





E. GENERAL MATTERS

37. Are you in favour of the trophy hunting of saltwater crocodiles? Yes No

Any comments:

.....
.....

38. Are you generally in favour of the commercial harvesting (use) of wildlife in the NT if it is sustainable? Yes No

Any comments:

.....
.....

39. Do you favour the sustainable commercial harvesting of crocodiles in NT? Yes No

Any comments:

.....
.....

40. Please add any general points about the management of saltwater crocodiles in the NT which you have not been able to state elsewhere in this survey.

.....
.....

THANK YOU FOR HELP. PLEASE DO NOT FORGET TO POST YOUR COMPLETED FORM IN THE POSTAGE PAID (PRE-ADDRESSED) ENVELOPE PROVIDED.



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