



Northern
Territory
Government

DEPARTMENT OF
NATURAL RESOURCES, ENVIRONMENT, THE ARTS AND SPORT



DRAFT

Management Program for the Freshwater Crocodile (*Crocodylus johnstoni*)

in the Northern Territory of Australia, 2010–2014



fresh ideas | real results

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Territory

A Territory Government initiative

Submissions

You are invited to comment on the draft Management Program for the Freshwater Crocodile in the Northern Territory of Australia.

The draft Program is open for public comment until **Friday 12 February 2010**.

Written submissions can be sent to:

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Management program for the Freshwater Crocodile (*Crocodylus johnstoni*) in the Northern Territory of Australia, 2010–2014

Parks and Wildlife Service of the Northern Territory

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A management program prepared under the *Territory Parks and Wildlife Conservation Act*.

Executive Summary

The freshwater crocodile *Crocodylus johnstoni* is found only in Northern Australia, where it commonly lives in rivers, lagoons and billabongs, largely upstream of tidal influences. Freshwater crocodiles have a high cultural value with residents and visitors alike and there is currently a small commercial harvest and trade of freshwater crocodiles.

The aim of this management program is:

To ensure the long-term conservation of the freshwater crocodile and its habitats in the Northern Territory.

The four principal objectives of the Management Program are to:

1. Facilitate the conservation and sustainable use of freshwater crocodiles;
2. Promote community awareness and public safety;
3. Ensure humane treatment of freshwater crocodiles; and
4. Monitor and report on the impact of the harvest of freshwater crocodiles.

The freshwater crocodile is protected under the *Territory Parks and Wildlife Conservation Act*, the Australian *Environment Protection and Biodiversity Conservation Act* and is listed internationally under Appendix II of the Convention for International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Existing land use patterns in the Territory are generally consistent with retaining the habitat required by freshwater crocodiles. The current major threats are poisoning by cane toads, other predation such as by saltwater crocodiles or of eggs by goannas, and the effects of drought and climate change. The latter may become an increasingly important threat to crocodile habitat through changes in sea levels, hydrology and saltwater intrusion.

Performance indicators, key actions, and timelines for each objective are given in 'lift-out' tables for managers and staff. Priority actions include reviewing and analysing available long-term population data; implementing monitoring programs for the wild population; investigating the genetic versus environmentally-induced status of "pygmy" crocodiles; and investigating the relationship between freshwater crocodile population dynamics and cane toads.

Details are also given on management practices, including commercial harvest and use, legal compliance, problem crocodile removal, animal welfare issues and community awareness and participation.

Auditing and monitoring freshwater crocodiles, as outlined in the program, will ensure that the *C. johnstoni* will remain conserved into the future.

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Definitions and Acronyms

Adults

Animals greater than 1.5 metres (approx. 5 feet) total length are classed as adults. This is a defined size class for the purpose of this Management Program and may not always equate to sexual maturity.

CITES

Convention on International Trade in Endangered Species of Wild Fauna and Flora

Crocodile Products and By-products

Includes all parts from a crocodile except for skins as defined below.

Crocodile Skins

Includes raw or tanned belly skins (cut along the back), hornbacks (cut along the belly) and whole skins.

DEWHA

Australian Government Department of the Environment, Water, Heritage and the Arts

Egg Harvest

The physical removal of an egg from its natural location in the wild and transportation to another location.

Eggs

Unless otherwise stipulated includes all eggs regardless of whether it is fertile or infertile, with a live or dead embryo.

Eggs - viable

Eggs that produce a normal hatchling surviving at least one day outside the egg.

EPBC Act

Environment Protection and Biodiversity Conservation Act. Australian Government legislation.

Harvest Ceiling

The Northern Territory's annual maximum allowable number of individuals that can be harvested in each of the defined life stages.

Hatchling

Animals classed as hatchlings are less than one year old and typically less than 0.6 metres (approx. 2 feet) total length.

Juvenile

Animals classed as juveniles are approximately between 0.6 and 1.5 metres (approx 2–5 feet) total length.

Landholder The owner or occupier of specified lands.

NRETAS

Northern Territory Government Department of Natural Resources, Environment, The Arts and Sport.

Ranching

As used in the context of CITES, it is the rearing in a [controlled environment](#) of [specimens](#) taken from the wild.

RDPIFR

Northern Territory Government Department of Regional Development, Primary Industry, Fisheries and Resources.

Total Length

Animal length measured from the tip of the snout to the end of the tail.

TPWC Act

Territory Parks and Wildlife Conservation Act. Northern Territory legislation.

1. Introduction

This Management Program deals with the conservation and sustainable use of the freshwater crocodile and focuses on population dynamics, harvest limits and monitoring the impact of the harvest on population trends. The program does not deal with commercial aspects of the industry such as promotion or marketing, or mechanisms to increase industry growth and Indigenous participation.

The management of freshwater crocodiles in the Northern Territory has been regulated to date by the “Management program for *Crocodylus porosus* and *Crocodylus johnstoni* in the Northern Territory of Australia” (PWCNT 1998). This current program updates, revises and replaces that previous program.

1.1 Aim and objectives

The aim of this management program is:

“To ensure the long-term conservation of the freshwater crocodile and its habitats in the Northern Territory”.

The program incorporates the subsistence and commercial use of freshwater crocodile populations. The program aims to encourage management practices that favour the freshwater crocodile, and protect wetland habitats beyond the boundaries of Parks and Reserves.

The program has four principal objectives to:

1. Facilitate the conservation and sustainable use of freshwater crocodiles.
2. Promote community awareness and public safety.
3. Ensure humane treatment of freshwater crocodiles.
4. Monitor and report on the impact of the harvest of freshwater crocodiles.

1.2 Species

The freshwater crocodile (*Crocodylus johnstoni* Krefft 1873) is one of two species of crocodile found in Australia; the other being the larger saltwater crocodile (*C. porosus*). Subspecies or races have not been formally described but there has been some speculation that a ‘pygmy’ form may warrant investigation. Further details on the status and ecology of the freshwater crocodile are provided in Appendix 1.

1.3 Responsible authority

The Northern Territory Department of Natural Resources, Environment, The Arts and Sport (NRETAS) is obliged under the *Territory Parks and Wildlife Conservation (TPWC) Act* to manage wildlife in the Northern Territory. The control of all aspects of the harvest from the wild in the Northern Territory is administered under this legislation. Once animals are

contained in a farm, the Department of Regional Development, Primary Industry, Fisheries and Resources (RDPIFR) has the administrative role for crocodile farming. These responsibilities are outlined in Appendix 2.

1.4 Legislative, national and international obligations

1.4.1 Northern Territory

Territory Parks and Wildlife Conservation (TPWC) Act

The *TPWC Act* contains provisions for the management and conservation of native animals including freshwater crocodiles. The freshwater crocodile is classified as protected wildlife throughout the Northern Territory under Section 43 of the *TPWC Act*. Section 66 of the Act prohibits the taking or interfering with protected wildlife without a permit issued by the Director of the Parks and Wildlife Commission or their delegate. It is also an offence under Section 66 of the Act to possess or trade in live or dead crocodiles, crocodile eggs or parts of crocodiles without a permit. The freshwater crocodile is not classified as threatened in the Northern Territory. It has recovered from the very low population numbers in the 1960's to now being considered a widespread and abundant species and not of any conservation concern.

It is an offence to possess live freshwater crocodiles or their eggs except in accordance with a permit issued under Section 43 of the *TPWC Act* by the Director of the Parks and Wildlife Commission or their delegate (Section 66(2)).

Permits to possess and/or trade in crocodiles may be issued by the Director of the Parks and Wildlife Commission or a delegate in accordance with Sections 55, 56 and 57 of the *TPWC Act*. The Director may under Section 57 of the Act apply terms, conditions or limitations to the permit to regulate the harvesting and farming of crocodiles.

The taking of wildlife by Aboriginal people for traditional purposes, including food, is provided for under Section 122 of the *TPWC Act*. Aboriginal people are not bound by hunting regulations or seasons when taking animals for food or other traditional purposes.

Animal Welfare Act

The *Animal Welfare Act* ensures that animals are treated humanely; cruelty to animals is prevented and community awareness about the welfare of animals is promoted. Crocodiles held in captivity under permit are classified as stock animals under the *Animal Welfare Act* and persons must not neglect, or commit an act of cruelty that causes an animal unnecessary suffering.

Code of Practice on the Humane Treatment of Captive and Wild Australian Crocodiles

Animal welfare standards for crocodiles are detailed in this Code. All crocodiles must be managed in accordance with this Code.

<http://www.environment.gov.au/biodiversity/trade-use/publications/crocodile-code-of-practice.html>

Environmental Assessment Act

New developments for the farming, processing and display of crocodiles will need to meet the requirements of this Act.

Meat Industries Act

Farmed crocodiles may be slaughtered in abattoirs licensed for the slaughter of crocodiles. Unlike the saltwater crocodile, the freshwater crocodile has not been declared as a game animal under the *Meat Industries Act*. This precludes the use of freshwater crocodiles killed in the wild for human consumption.

Food Act

Crocodile meat is sold for human consumption and this Act provides for the safety and suitability of food for human consumption.

Livestock Act

Farmed crocodiles are treated as livestock under this Act which provides for disease surveillance, disease control, identifying and tracing animals and regulating movement of animals and animal products for the purpose of disease control.

Integrated Natural Resource Management Plan for the Northern Territory: sustaining our resources – people, country and enterprises.

This Northern Territory Government endorsed plan (LCNT 2005) provides the broad framework and a series of actions directly contributing to the conservation of freshwater crocodile habitat and for the sustainable use of wildlife such as freshwater crocodiles.

A Strategy for Conservation through the Sustainable Use of Wildlife in the Northern Territory of Australia.

This Northern Territory Government endorsed strategy provides the policy framework for the sustainable use of wildlife such as freshwater crocodiles.

1.4.2 Other States and Territories

The freshwater crocodile is protected in all Australian States and Territories.

Western Australia

Whilst *C. johnstoni* is listed as common in Western Australia, it is listed as “otherwise specially protected” under the *Wildlife Conservation Act* in recognition of the potential impact that unauthorised taking can have on wild populations (CALM 2003).

Queensland

Crocodiles and all native fauna in Queensland are protected under the *Nature Conservation Act*. There is currently no management program for *C. johnstoni* in Queensland.

1.4.3 Commonwealth Government

Environment Protection and Biodiversity Conservation (EPBC) Act

The *EPBC Act* regulates imports and exports to and from Australia of all Australian native animals or their parts. The freshwater crocodile is a listed marine species under the *EPBC Act*. This protects the species and limits the circumstances under which they may be taken. Part 13A of the *EPBC Act* regulates imports and exports of crocodiles and crocodile products. It also fulfils Australia’s legislative requirements as a signatory party to CITES (see 1.4.4). Section 303CH lists specific conditions that must be met for the export or import of CITES

specimens. For CITES Appendix II exports the specimen must be sourced from an appropriate captive breeding or artificial propagation program, an approved wildlife trade operation, or an approved wildlife trade management plan.

This Northern Territory Management Program meets the requirements of the *EPBC Act* for both international and national activities with freshwater crocodiles. This management program therefore complies with an approved Commonwealth wildlife trade management plan pursuant to Section 303FO of the *EPBC Act*. Commercial export permits for crocodiles are issued under Section 303CG.

A State/Territory management program for wild populations is not required if a State/Territory elects to limit use to captive breeding. However, even crocodile farms based solely on captive breeding in Australia have to be registered under the *EPBC Act* before permission to export products is granted.

Aboriginal Land Rights (Northern Territory) Act

This Act establishes the Land Councils. A function of the Land Councils is that they confirm the correct landholders (traditional owners) have given their permission for any commercial wildlife harvest before *TPWC Act* permits can be issued. This Act also provides for Section 19 Land Use Agreements which should be in place for commercial crocodile harvesting. These agreements can provide the conditions of access to land for the purpose of harvesting and there should be consistency between *ALR Act* Land Use Agreements and *TPWC Act* permits.

1.4.4 International

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

All Crocodylians (including alligators, caimans and true crocodiles) are listed on the Appendices of CITES to which Australia is signatory. Those species most threatened in the wild by trade are listed on Appendix I and all remaining species are listed on Appendix II. *C. johnstoni* is listed on Appendix II which allows international trade subject to the provisions of CITES. The Appendix II listing places controls on international trade in crocodiles and crocodile products through export permits. A CITES export permit is required for all commercial exports and can only be issued if it has been determined that the export will not be detrimental to the survival of the species and that the specimen was legally obtained.

Convention on Wetlands of International Importance (Ramsar Convention)

Australia is a signatory to the Ramsar Convention. There are plans of management for two of the three Ramsar-listed areas of the Northern Territory (Stages one and two of Kakadu National Park) which protect wetlands and their dependent fauna, including freshwater crocodiles. NRETAS is currently developing a plan of management for Cobourg Peninsula (Garig Gunak Barlu National Park).

2. Management Context

2.1 Socio-economic values

2.1.1 Cultural values

In the Northern Territory, crocodiles are iconic animals that attract considerable publicity and a wide range of community views and opinions regarding their abundance, distribution and cultural and economic importance. Community views towards crocodiles range from them being regarded as totems of spiritual significance among some Aboriginal communities to being automatically seen as dangerous pests (mostly *C. porosus*) among some other sectors of the community.

2.1.2 Harvesting & farming

The harvesting of saltwater crocodiles primarily for their skins but also for their flesh and body parts supports a significant industry in the Northern Territory. There is also a very small demand for *C. johnstoni*. The skins of *C. johnstoni* are less valued than those of *C. porosus*, as they have a larger scale size, and osteoderms (bone deposits) in the scales make them more difficult to process (Peucker 1997).

2.1.3 Tourism

Crocodiles contribute significantly to visitor knowledge of the Top End and viewing crocodiles is an important expectation or even a “must” for most Top End visitors. In visitor surveys, Tremblay (2003) reported that crocodile viewing dominates the best experiences in wildlife-viewing. While tourists generally prefer to see the larger saltwater crocodile, attractions featuring freshwater crocodiles are also rated highly and are popular.

2.2 Population estimates and trends

There are no reliable estimates of the population size of *C. johnstoni* in the whole Northern Territory, however, it is regarded as being common and locally abundant and is not listed as threatened under Northern Territory or Commonwealth legislation. Details of the distribution and density of freshwater crocodiles have been gathered in conjunction with the saltwater crocodile monitoring program (Leach *et al.* 2009). Additional data have been collected in other parts of their distribution as part of specific projects. A 1993 population estimate for freshwater crocodiles (Webb and Manolis 1993) suggested that there were approximately 40 000 to 60 000 individuals in the Northern Territory. There are no more recent estimates.

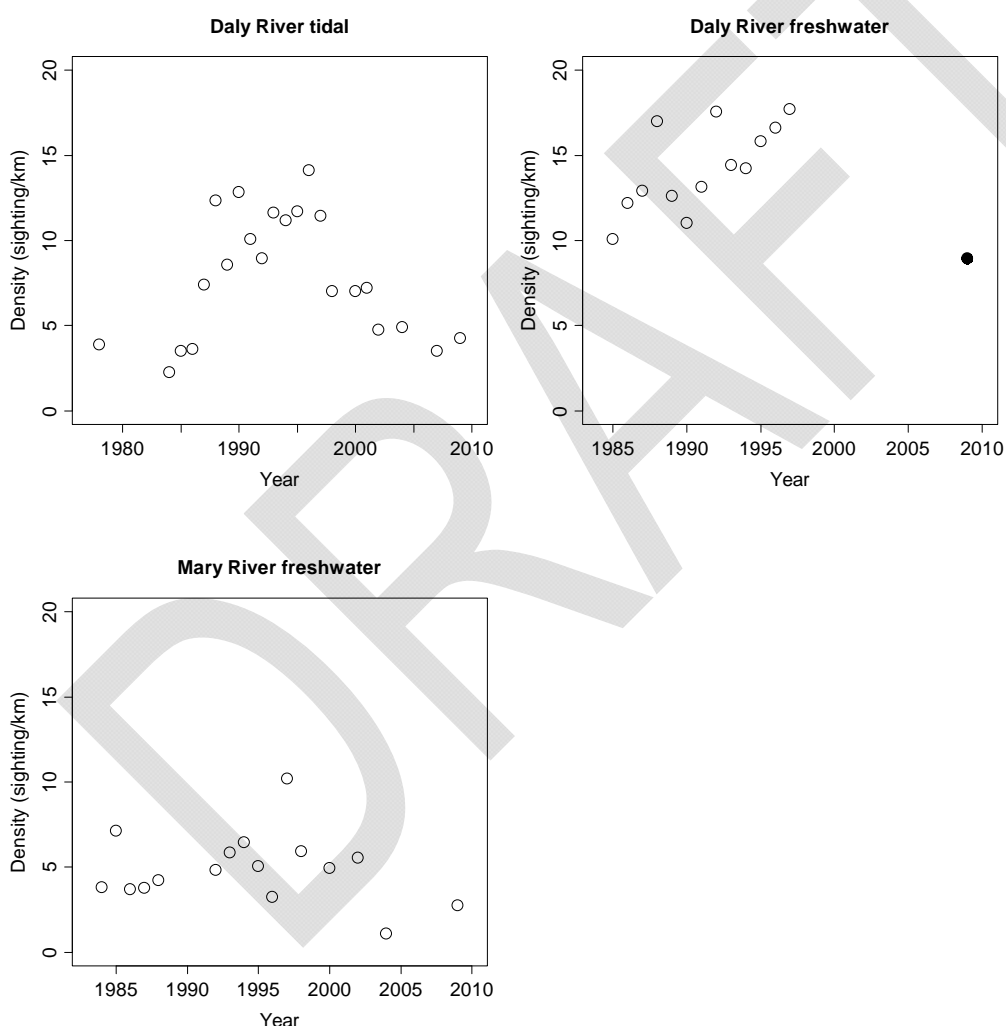
Densities of *C. johnstoni* vary between habitats. The tidal section (approximately 35 km) and the freshwater section (approximately 165 km) of the Daly River, and the freshwater section (approximately 70 km) of the Mary River have been surveyed as part of the monitoring of freshwater crocodile populations in the Northern Territory (Figure 1). The density of *C. johnstoni* reported from these surveys ranges between 3 to 15 *C. johnstoni* per kilometre in the tidal section of the Daly River and 10 to 17 per kilometre in the freshwater section; and between 2 to 10 *C. johnstoni* per kilometre in the freshwater section of the Mary River.

The density of *C. johnstoni* in both the tidal and freshwater sections of the Daly River appears to have increased until the late 1990s. Data from the tidal section suggest that

numbers of freshwater crocodiles have rapidly decreased since the late 1990's. In the Mary River, the population appears to have been relatively stable with a possible decrease in recent years. Further surveys are required before this potential decrease can be confirmed.

The timing of these possible decreases roughly coincides with the expansion of saltwater crocodiles into areas formerly used by freshwater crocodiles, and the later advent of cane toads in the area. Finer details of the population trend in freshwater crocodiles since the arrival of cane toads is unknown but is under detailed investigation in the McKinlay River in the upper Mary River catchment (Wildlife Management International), and in the Daly and Victoria River catchments (M. Letnic, University of Sydney).

Figure 1: Density of *C. johnstoni* (non-hatchlings) sighted in spotlight surveys of the downstream (tidal) and upstream (freshwater) sections of the Daly River and the freshwater sections of the Mary River. The 2009 survey in the freshwater section of the Daly River (filled circle) was shorter than other years by 40 km and must be treated with caution.



2.3 Habitat

Freshwater crocodiles inhabit inland wetlands, rivers, creeks and billabongs across the Top End of the Northern Territory. They occur in the upper tidal reaches of some rivers, but are primarily upstream of tidal influences. These upstream rivers, creeks and wetlands contain non-tidal freshwater that may or may-not flow during the dry season. Substrate tends toward either sand or, where river channels transect escarpments and plateaus, rocky, and in freshwater wetlands sands,

loams and other friable substrate. This reflects the nesting requirements of the Freshwater crocodile for friable substrates in which they can dig a 'nest-hole'.

2.3.1 Protected areas

Parks, Reserves and Sanctuaries in the Northern Territory provide a mosaic of secure areas in which freshwater crocodiles and their riparian and wetland habitats are protected (Table 1). They also provide areas where the public can view and learn about crocodiles and their conservation. The commercial harvest of *C. johnstoni* is not currently permitted within these protected areas.

Table 1: Protected areas in the NT where *C. johnstoni* is known to be abundant.

| Name | Area (km ²) |
|--|-------------------------|
| Kakadu National Park | 19 068 |
| Gregory National Park | 12 887 |
| Limmen National Park | 12 300 |
| Nitmiluk (Katherine Gorge) National Park | 2 935 |
| Garig Gunak Barlu National Park | 2 063 |
| Litchfield National Park | 1 459 |
| Mary River National Park | 1 217 |
| Keep River National Park | 314 |
| Elsey National Park | 138 |
| Flora River Nature Park | 77 |
| Douglas River / Daly River Esplanade Conservation Area | 43 |
| Tjuwaliyn (Douglas) Hot Springs Nature Park | 31 |
| Daly River (Mt Nancar) Conservation Area | 21 |

2.3.2 Significant wetlands outside reserves

A major part of the range of *C. johnstoni* in the Northern Territory lies within either Aboriginal Lands or pastoral lands. Pastoralists, local communities and/or their legal representatives support the maintenance of freshwater crocodile habitat by controlling activities likely to be detrimental to the long-term conservation of freshwater crocodiles. These protocols and restrictions offer significant protection of freshwater crocodile habitat by assisting with control of fires and invasive species, protecting riparian habitat and controlling access.

2.4 Problem freshwater crocodiles

Crocodile management in the Northern Territory allows problem crocodiles (mostly saltwater crocodiles *C. porosus*) to be removed from areas where they may cause harm to people and their property.

Problem crocodiles are defined broadly as those individuals where one or more of the following applies:

- The crocodile has attacked or is about to attack a person or persons;
- The crocodile is behaving aggressively towards a person or persons;
- The location of the crocodile makes it a threat or potential threat to human safety or wellbeing; or

- The activity of the crocodile is affecting the productivity of industry or commercial enterprises.

In the case of freshwater crocodiles, animals may be of concern on occasions where they venture into areas where *C. porosus* are considered a problem. It can be difficult to identify species and the presence of any crocodile in some areas can constitute a problem (Webb *et al.* 1987). Although generally harmless to humans freshwater crocodiles can be of slight concern to the public, particularly if they are provoked or interfered with. Freshwater crocodiles do not generally attack stock or larger prey.

In some areas, such as the “no tolerance” management area of Darwin Harbour and designated swimming areas in National Parks (e.g. Wangi Falls in Litchfield National Park), any saltwater crocodile found there is removed and in certain circumstances freshwater crocodiles may also be removed (e.g. large aggressive animals).

2.5 Indigenous harvest and use

Crocodile meat and eggs are thought to have been used as a food source by Aboriginal people for up to 40,000 years (McBryde 1979, Flood 1983). The value of eggs to Indigenous communities lay in the protein they provided to people.

The importance of crocodiles of both species in Aboriginal culture is reflected in a complex system of totems and ceremonies which is still evident in Northern Australia today (Lanhupuy 1987).

Section 122 of the *TPWC Act* maintains the right for traditional harvest (other than for the purpose of sale) of crocodiles and their eggs for food gathering, ceremonial and religious purposes by Aboriginal people. The extent of traditional harvests of crocodiles is thought to be small but it is difficult to quantify and varies greatly from area to area and year to year. Recent evidence suggests that the contemporary subsistence use of crocodiles in areas where they are relatively abundant is negligible (A Griffiths (NRETAS) and J Altman (ANU), *pers. comm.*). No dedicated monitoring is required for the subsistence use of freshwater crocodiles.

2.6 Commercial harvesting and use

Freshwater crocodiles were commercially hunted in the Northern Territory before they were given protection in 1964. *C. johnstoni* was only hunted intensively for the last five years from 1959 to 1964 (Webb *et al.* 1987, Davis 1994). Before this they were largely ignored because their skin was inferior to that of *C. porosus*. With increased demand and advances in technology, a market for *C. johnstoni* skins was established in 1959 (Webb *et al.* 1987). Although the total number of animals taken is not available, it has been estimated that 60 000 to 80 000 *C. johnstoni* skins were traded (legally and illegally) between 1959 and 1964 (CCNT 1986, Webb *et al.* 1987). The recovery of *C. johnstoni* populations in the Northern Territory since 1964 has largely gone unnoticed by the general public as its preferred habitat is generally away from populated areas (Webb *et al.* 1987) and it does not have the same high predator profile as that of *C. porosus*.

Initial management programs for crocodiles (*C. porosus* and *C. johnstoni*) in the Northern Territory included the provision for wild harvest of eggs, hatchlings, sub-adults and adults for rearing in captivity for production purposes. The 1998 management program (PWCNT 1998) also allowed non-hatchlings to enter trade directly after harvesting, without the need to spend time in a farm. The first crocodile farm in the Northern Territory was established in 1980.

There are currently six operating crocodile farms in the Northern Territory, which collectively hold 252 *C. johnstoni* as at 31 December 2008 (cf. 86,000 for *C. porosus*).

There is a small demand to harvest freshwater crocodiles for their skins, flesh and body parts. While extensive harvests of *C. johnstoni* were carried out in the 1980s, very little harvest from the wild has occurred since the mid-1990s. The value of skins from this species is low and the current export market demand for skins or parts of *C. johnstoni* is correspondingly low.

The Daly River was one of the main rivers from which *C. johnstoni* hatchlings were harvested in the 1980s. A total of 15,655 hatchlings (1983 to 1991), 866 eggs (1983 to 1984) and 27 juveniles/adults were harvested from the Daly River. Figure 1 demonstrates that for the Daly River this level of harvest of *C. johnstoni* hatchlings from 1983 to 1996 had no adverse detectable effect on populations during that time.

The commercial harvest of freshwater crocodiles in the Northern Territory was mainly of eggs and hatchlings prior to the mid-1990s (PWCNT 1998). The total harvest since 2000 is 485 animals, most of which were harvested as hatchlings (Table 2). During the period of the previous management program (PWCNT 1998), the annual harvest limits in place for freshwater crocodiles were:

| | |
|-------------|-------|
| Viable eggs | 4,000 |
| Hatchlings | 6,000 |
| Juveniles | 1,000 |
| Adults | 200 |

Table 2. Number of freshwater crocodiles of different age classes harvested since 2000.

| Year | Eggs | Hatchling | Adult | Total Returns |
|--------------|-----------|------------|------------|---------------|
| 2000 | 12 | 75 | 0 | 87 |
| 2001 | 0 | 0 | 91 | 91 |
| 2002 | 0 | 80 | 0 | 80 |
| 2003 | 0 | 25 | 25 | 50 |
| 2004 | 0 | 2 | 0 | 2 |
| 2005 | 0 | 0 | 27 | 27 |
| 2006 | 0 | 54 | 0 | 54 |
| 2007 | 0 | 60 | 30 | 90 |
| 2008 | 0 | 0 | 4 | 4 |
| Total | 12 | 296 | 177 | 485 |

3. Threats and Impacts

Existing patterns of land use (chiefly pastoral, reserves and Indigenous lands) in the range of the freshwater crocodile are generally consistent with retaining large wetland areas and their dependent crocodile populations. Groombridge (1987) and Jenkins (1987) have detailed potential threats or impacts to crocodile populations worldwide. As with all crocodilian species, most threats (direct and indirect) impacting *C. johnstoni* are anthropogenic in origin. Within the life of this program there are no perceived or likely threats to alter the current conservation status of *C. johnstoni* in the Northern Territory and all predictions indicate that the species will continue to be abundant.

The public expectations of more intensive management of saltwater crocodiles in areas close to human habitation will result in the localised removal of increased numbers of freshwater crocodiles. However, real or perceived changes to public attitudes and any subsequent reduced tolerance of crocodiles will not impact on the broad-scale maintenance of a viable Northern Territory-wide population of freshwater crocodiles.

3.1 Cane toad poisoning

The cane toad *Rhinella marina* (formerly known as *Bufo marinus*) contains high concentrations of a toxin which is poisonous to many Australian vertebrates. Since its introduction to Queensland in 1935, the cane toad has invaded much of Northern Australia and its range is still expanding. It is listed as a key threatening process under the *EPBC Act*. The freshwater crocodile has been identified as a species that is potentially at risk of being poisoned by cane toads (van Dam *et al.* 2002). Letnic and Ward (2005) have reported on predatory interactions between *C. johnstoni* and cane toads in the Roper and Daly Rivers of the Northern Territory, confirming previous reports (e.g. Covacevich and Archer 1975; van Dam *et al.* 2002), that cane toads are a prey item for and may be ingested by *C. johnstoni*. Freshwater crocodiles are susceptible to poisoning by cane toads (Letnic and Ward 2005) and there is evidence that cane toads have adversely impacted *C. johnstoni* populations in the Northern Territory (Letnic *et al.* 2008) at least in the short-term.

Anecdotal evidence suggests that the impact of cane toads will be greatest in low productivity habitats such as the semi-arid zone and sandstone plateau areas where food resources are limited and encounter rates with cane toads are likely to be higher. Conversely crocodiles should be least impacted in the lowland wetlands and rivers which are highly productive and toads are less likely to be encountered compared with other prey. Concern has been raised that the smaller “pygmy” crocodiles in the upland plateaus will be most affected.

3.2 Other natural predators

The only significant predator of crocodiles apart from humans is other crocodiles, with larger saltwater crocodiles eating small crocodiles of both species. The current encroachment of *C. porosus* into *C. johnstoni* habitat may be causing localised declines or shifts in the structure in *C. johnstoni* populations (see Figure 1).

Monitor lizards, and to a lesser degree feral pigs, are predators of the eggs of *C. johnstoni*. The current adverse impact of cane toads on goanna populations (Doody *et al.* 2006) may be lowering the predation pressure and increasing the survivorship of crocodile eggs. This is a complex interrelationship which requires detailed study to unravel.

3.3 Rainfall variability and climate change

Between years, the rate of increase of *C. johnstoni* populations is strongly linked to rainfall and its subsequent influence on habitat, nesting sites and food availability. The timing of onset and duration of the wet season, the total amount of rain, and the intensity of rainfall events, all influence breeding success.

The impact of climate change through changes in sea levels, temperature, rainfall patterns and probable vegetation changes is an unquantified and largely unknown impact on the freshwater crocodile and its habitats and is operating over a longer time period than this Management Program. One of the major effects of climate change is an anticipated rise in sea level with conservative estimates (Hennessy *et al.* 2004) anticipating an increase in sea level of 50 centimetres by 2100 and a corresponding loss of wetland habitat. These calculations do not take into account other anticipated and compounding changes such as further saltwater intrusion or changes in hydrology and in weed and feral animal distributions. The predictions of more frequent and intense dry season wildfires and severe storm events may have negative impacts on nesting vegetation, food sources and survivorship rates. Changes in mean nest temperatures may result in shifts in population sex ratios arising from temperature dependant sex-determination during the incubation period for freshwater crocodile eggs. However, changes may also create opportunities for crocodiles to expand their distribution. The possible impacts of climate change remain in the realm of prediction and modeling and over a time frame much longer than the life of this Management Program. As such they cannot be mitigated within this program but monitoring should be capable of detecting significant population changes through whatever cause.

3.4 Habitat loss and modification

The habitats of *C. johnstoni* are, in general, not threatened by development although current and proposed clearing in the Daly and Katherine regions may have indirect long-term impacts. Freshwater crocodiles do not appear to be affected by the invasion of freshwater wetlands by introduced plants such as *Mimosa pigra*. Since the 1970s, the disturbance of floodplain habitats by feral buffalo and cattle has been greatly reduced following eradication campaigns, although the buffalo and pig numbers are again increasing in some areas.

3.5 Harvesting

Over the several decades of harvesting in the Northern Territory, harvest has been managed to deliver the primary objectives of sustainable, viable crocodile populations.

The harvest of crocodiles and crocodile eggs is widely dispersed. The harvest has not been a threat to the species and it is unlikely to have an impact on the genetic integrity of the population.

The very small numbers of eggs and non-hatchling crocodiles taken mean that these harvesting operations do not significantly adversely impact the habitat.

There is no evidence or expectation that the commercial harvest is likely to have any impacts on threatened species or ecological communities of conservation significance or that it will cause disturbance or displacement to native fauna. Similarly there is no evidence as yet that commercial harvest helps introduce or disperse invasive weeds although there is a possibility that boats could be a vector for aquatic weeds such as *Salvinia* or *Eichhornia*.

4. Management Practices and Performance Measures

To achieve the aims and objectives of this management program, NRETAS in conjunction with the Department of Regional Development, Primary Industry, Fisheries and Resources (RDPIFR) implements a range of procedures that ensure the conservation of freshwater crocodiles and provides control of their harvest, farming and trade in accord with the *TPWC Act* and the *EPBC Act*.

Performance indicators are provided for each management practice. The milestones and performance measures for the life of the program are summarised in Appendix 3.

Objective 1 - To facilitate the sustainable use of freshwater crocodiles

4.1 Commercial harvest and use

Commercial use will be regulated by issuing individual permits. It is anticipated that commercial demands will be met primarily by farming freshwater crocodiles under permit.

Any commercial operations established will be individually licensed and will be regulated under Section 55 of the *TPWC Act* and such operations are subject to review under the *Environmental Assessment Act*.

4.1.1 Restrictions on harvesting

Harvesting will be prohibited or restricted in some areas or circumstances if necessary to ensure the sustainability and conservation of the species. In particular harvesting will not normally be permitted:

1. In waterways where a watercourse forms the boundary between two or more properties.
2. In the upstream sections of the catchments where rivers are seasonally restricted to billabongs and waterholes until research clarifies the extent of impact of cane toads on these populations.
3. On populations of the stunted form of the freshwater crocodile ("pygmy" freshwater crocodile) until analysis determines the level of genetic distinctiveness of the stunted form (as found in the upper catchments in the Arnhem plateau and the Pinkerton Range). Further specific management objectives may be determined for such forms should they be demonstrated to be significantly distinct.
4. From sites where crocodiles are particularly significant to local Indigenous people.
5. In catchments that are heavily used by the tourist industry except on a case by case basis. In those cases where low level harvest is permitted it will be strongly regulated to ensure that the tourist and crocodile industries remain complementary.
6. Of particularly large crocodiles (greater than 2.5m) except on a case by case basis. This will be regulated closely to ensure the presence of large iconic animals which are culturally important.

Performance Indicator

Ensure all harvest has no significant impact on tourism, social or cultural interests.

4.1.2 Harvest ceiling

The total number of *C. johnstoni* that can be taken for commercial harvest within the Northern Territory in a calendar year is the annual commercial freshwater crocodile ceiling (Table 3). The Director of the Parks and Wildlife Commission may vary the ceilings, provided that, in the case of an increase, the Australian Government has provided written approval of the change. Prior to making a decision to revise the ceiling, the Director of the Parks and Wildlife Commission must consider the following:

- current known trends in population size and structure;
- climatic or environmental effects on the population;
- management objectives for specific areas;
- proportion of total habitat subject to harvesting;
- any non-commercial mortality events within populations;
- review of previous harvests;
- review of past and current research results; and
- any other information considered relevant by the Director of the Parks and Wildlife Commission.

Within specific areas of land subject to harvesting, local sustainable harvest levels will be determined after similar considerations.

The natural mortality of *C. johnstoni* eggs and hatchlings is known to be high (e.g. Webb et al. 1987 estimate that <5% of eggs survive to become 1 year old hatchlings). With high natural mortality amongst the early age classes of *C. johnstoni*, the removal of a small number of hatchlings has limited impact on the overall population. Adult survivorship is considerably higher allowing for a limited harvest to be taken without adversely affecting the stability of *C. johnstoni* populations or its capacity to increase.

The harvest levels set out in Table 3 represent substantial reductions in the harvest ceilings from the previously approved freshwater crocodile management program and are considered to be conservative and well within sustainable limits. These reductions from the previous program are in response to the reduced demand for freshwater crocodiles over the past two decades (Section 2.6) rather than a management response to any population decline. Populations harvested at these levels are expected to fluctuate primarily in response to environmental conditions such as rainfall and the availability and quality of breeding habitat.

Table 3: Annual harvest ceilings for *C. johnstoni* from the wild. The size of each category of crocodile is indicated in total length (TL), measured in metres from the tip of the snout to the end of the tail.

| Stock | Size | Ceiling |
|-------------------------|-----------|---------|
| Eggs | | 300 |
| Hatchlings (0 – 1 year) | <0.6 m | 1 000 |
| Juveniles | 0.6–1.5 m | 300 |
| Adults | >1.5 m | 200 |

Performance Indicators

Investigate and take appropriate action on all suspected local impacts on the population.

Instigate adaptive management actions should there be any increase in threats to the freshwater crocodile and their habitat.

Develop and implement a GIS database to assist with monitoring harvest effort and compliance.

Adjust harvest appropriately based on monitoring results and in accordance with the provisions of this Management Program.

4.2 Permits and compliance

Commercial use will be regulated by issuing individual permits under Section 55 of the *TPWC Act*. The NRETAS web site provides details of the types and conditions of permits relating to wildlife (<http://www.nt.gov.au/nreta/wildlife/permits/index.html>). Commercial operations are subject to review under the *Environmental Assessment Act* when established. The commercial processing of farmed crocodile meat from the live animal up to leaving an abattoir is covered under the *Meat Industries Act*. Food products after leaving the abattoir are regulated by the *Food Act*. Packaging is labelled to identify the contents as coming from an approved wildlife trade management program.

4.2.1 Permits to take

C. johnstoni is protected in the Northern Territory. The removal of any crocodiles from the wild (animals or eggs; live or dead) requires a Permit to Take from the Northern Territory Government, or on Commonwealth land such as Kakadu National Park, a permit from the Australian Government. Permits to Take must be linked to a Permit to Keep if the specimens are retained. Permit applications must include details on the method, extent and location of the proposed harvest. All permits for harvesting will require the written consent of the landholder. Permits are normally for one year but egg harvesting permits may on request be issued for up to three years. New multiple year egg harvest permits will be issued on the basis of an annual allocation. The allocations for years two and three will be assessed and adjusted each year as part of a rolling program. The closing date for egg permit applications for each season will be 30 April.

The permit holder must provide the Northern Territory Government with a written report on activities conducted under the permit. This report should include details on the number of animals (including eggs) taken, skin tag numbers if relevant, the size and sex of each crocodile that was taken, and a GPS location of the harvest. In the case of egg collections, returns must be lodged by 31 July and the report should provide detail of all eggs including the number of live eggs harvested at each collection site with GPS location and the number of viable eggs produced. Annual reports/returns need to be submitted each year for a multi-year permit. Failure to lodge a return or the inclusion of insufficient or incorrect information in the permit return may result in issuing a warning letter, caution notices, an infringement notice, the refusal of future permit applications, revocation of permits and/or prosecution.

The Northern Territory Government may cancel a permit at any time if information becomes available that indicates that conservation management measures may be required to protect a *C. johnstoni* population. Compliance with the Code of Practice (see Section 1.4.1) will be a condition of all permits issued for harvesting crocodiles.

4.2.2 Permits to keep

A Permit to Keep from the Northern Territory Government is required to keep and/or trade *C. johnstoni* and/or its parts. A Permit to Keep *C. johnstoni* in captivity is subject to annual renewal and compliance with the provisions of the *TPWC Act* and the *Animal Welfare Act*. Compliance with the Code of Practice (see Section 1.4.1) will be a condition of all permits issued to keep crocodiles. Crocodiles kept as pets also require a Permit to Keep with a particular set of permit conditions. These conditions can be found at the following link <http://www.nt.gov.au/nreta/wildlife/permits/croc.html>

Farm records are administered by RDPIFR and the responsibility for farm records rests with RDPIFR. The holder of the Permit to Keep is required to provide monthly farm records to RDPIFR detailing stock gains/losses, transfers, sales, mortality, and skin and meat processing figures. Crocodile farms are also required to submit the details of all animals held on the annual permit return to NRETAS. This information is used to compare farm holdings with wild harvest permit returns and ensure compliance with wild harvest permits. In the case of wild caught animals annual returns are to be provided to NRETAS.

Individuals or companies that trade products derived from freshwater crocodiles taken under this Management Program are required to maintain detailed records, and to mark such products (excluding skins) with a product label in accordance with the NRETAS product label guidelines. NRETAS issues product labels for finished products on a cost recovery basis or producers can print the required information on their own labelling and packaging. The minimum requirement for an approved product label is that the label:

- states that this is a crocodile product produced in accordance with an approved management program;
- shows the permit number of the Permit to Keep that the product was produced under; and
- shows the date that the product label was affixed to the product.

These labels identify these products as originating from a legitimate source.

Failure to lodge a return or the inclusion of insufficient or incorrect information in the permit return may result in issuing a warning letter, caution notices, an infringement notice, the refusal of future permit applications, revocation of permits and/or prosecution.

4.2.3 Permits to export and import

A permit issued under the *TPWC Act* is required to export (including re-export) wild caught, commercially farmed and captive-bred *C. johnstoni*, or its parts, from the Northern Territory to other Australian States and Territories. Permits for the export of live animals or parts derived from wild caught animals are obtained from NRETAS. Permits for export of parts derived from ranched or captive-bred animals are obtained from RDPIFR.

The overseas export of shipments of live crocodiles and commercial shipments of crocodilian skins, products or by-products from Australia requires an additional CITES permit from the Australian Government (DEWHA). RDPIFR provides skin tags and permits on behalf of the Australian Government for commercial shipments of skins from crocodile farms. Other international exports will require an export permit from NRETAS prior to DEWHA issuing a CITES permit.

Under CITES provisions for personal effects, crocodilian products can leave Australia within a passenger's personal luggage without a CITES permit if they are personally owned, non-commercial, legally acquired, and no more than four items are carried per person. If sourced in the Northern Territory, these items should have a product label attached stating that the crocodilian product is derived from an approved management program (see section 4.2.2).

An import permit issued by the Australian Government (DEWHA) is required for the commercial shipment of crocodilian products or their parts entering the Northern Territory from overseas. A Northern Territory import (including re-import) permit, issued under the *TPWC Act* is required for all shipments of crocodiles or their parts entering the Northern Territory from within Australia. Imports from other Australian jurisdictions should also be accompanied by an export permit from that jurisdiction. Import permits for live animals are issued by NRETAS and are valid for one month. Import permits for crocodile products are issued by RDPIFR.

4.2.4 Permits and returns

Each farm's Permit to Keep requires that the farm submit monthly farm records (see section 4.2.2). Data from the monthly returns from crocodile farms is collated and submitted to RDPIFR, published in annual reports by NRETAS and submitted to the Australian Government in compliance with the *EPBC Act*. Submitting production data to RDPIFR is a requirement of the Permit to Keep. RDPIFR conduct annual hatchling audits on all farms to validate monthly returns.

Shipment inspections

An AQIS health declaration and certification of any skins and hides is required for international shipment and is supplied by RDPIFR. All international shipments of crocodile products are inspected by a RDPIFR officer. Shipments are inspected to ensure that they comply with the

conditions and details on the export permit. Once a shipment is inspected and sealed by a RDPIFR officer it can be exported.

Skins

Each whole skin, whole belly skin and, whole hornback skin and trophy skin entering trade or being exported will be marked with a non-reusable orange plastic skin tag issued by the Australian Government in compliance with the provisions of CITES Resolution Conf. 11.12. <http://www.cites.org/eng/res/11/11-12.shtml> . Excised backstraps are packaged into a carton and the skin tag is attached to the carton. The permit issued for backstraps states that the tag is attached to the box and records the total number of backstraps in the carton.

Each farm completes a Specimen Export Record (SER) which states the skin tags have been attached to either whole skins or cartons of backstraps and returns it to DEWHA. Each skin tag is uniquely numbered and the number serves as an identification number for all subsequent record keeping related to the skin of that particular animal. RDPIFR is responsible for issuing skin tags on a cost-recovery basis. Skin tags are issued annually.

Flesh

Flesh is packed in cartons that are marked to show that the enclosed product is a farmed product. Producers can use pre-labelled cartons which state that the contents are perishable and needs to be kept frozen or kept cold. Alternatively flesh can be sealed in standard cartons using specially marked green tape printed with "contents are perishable and needs to be kept frozen or kept cold". This labelling requirement applies to both domestic and international shipments. The labelled tape is available from RDPIFR.

By-products

Large parts (e.g. skulls), minor parts and derivatives of animals exported under the program are labelled with a product label in accordance with the NRETAS product label guidelines NRETAS (see section 4.2.2).

Manufactured items (excluding tanned whole skins)

Manufactured items are identified with a product label in accordance with the NRETAS product label guidelines (see section 4.2.2).

4.2.5 Compliance

The Northern Territory government implements the following actions as minimum measures to enforce compliance:

- random checks may be conducted on permit holders to ensure compliance with permit conditions and reporting;
- data collected will be linked and compared to ensure the smooth transition between different NT Departmental auditing systems;
- the Northern Territory Government will work collaboratively with other jurisdictions (i.e. Queensland, Western Australia and Australian Governments) and industry to eliminate the possibility of illegal trade of eggs, animals or products interstate; and
- the Northern Territory Government will investigate any reported potentially illegal incident and take legal action where sufficient evidence is obtained.

The Northern Territory Government has the capacity to develop and introduce permit conditions should any new additional compliance measures be needed.

Performance Indicators

Ensure that the annual commercial harvest of freshwater crocodiles does not exceed the approved ceiling for each category.

Assess applications and issue permits under the TPWC Act.

Monitor and audit harvest applications, approvals and returns and investigate and resolve any discrepancies.

Ensure all permit applications have correct landholder approval.

Ensure returns comply with permit conditions and are reported to NRETAS as per permit conditions.

Ensure compliance with the issue of skin tags and permits.

Conduct random checks on farm stock numbers as required.

Review permit conditions annually and amend where necessary.

Ensure compliance with permit conditions is at or near 100% and that the addressing of permit breaches through warning letters, caution notices, infringement notices or prosecution is at or near 100%.

4.3 Management-focused research

Management decisions will be enhanced by some focussed research and analysis at the population level. Firstly, there are several populations of so called “pygmy” freshwater crocodiles which occur in low productivity areas on sandstone plateaus – namely the Arnhem plateau and Pinkerton Range. Within the life of this management program, NRETAS will encourage research to assess the genetic distinctiveness of these two forms. The results of this research will determine the appropriate management strategies to be implemented with respect to these populations in the Northern Territory. Preliminary genetic analysis of a population in the upper Liverpool River on the Arnhem Plateau suggests that the differences do not warrant sub-specific status (Nancy Fitzsimmons University of Canberra, *pers. comm* 2007).

Secondly, updated knowledge of current population dynamics and age/sex structure is strongly needed, particularly with the advent of cane toads across the Territory and the likely future impacts of climate change. This is best initially achieved by a detailed analysis, including population modelling, of existing survey data from all rivers. Comparisons with the long-term detailed capture data from the McKinlay River area (collected by Wildlife Management International) would be invaluable. Research into the impact of cane toads on *C. johnstoni* populations and population dynamics particularly in the drier, upstream areas of catchments is important and under investigation in the McKinlay River (Wildlife Management International) and in the Daly and Victoria Rivers (M. Letnic, University of Sydney).

NRETAS will assess and issue permits for research on crocodiles. Crocodiles or any crocodile products taken under a research permit will not be considered as part of this management program unless they are likely to enter into commercial trade. Any live eggs

that arise from permitted research activities that enter the commercial farming system will be included within the ceiling and the reporting to the Australian Government. Non-viable eggs collected for permitted research activities will be excluded from the egg ceiling. Additional viable eggs can be obtained for legitimate research provided they do not enter the commercial industry. These eggs would be subject to the normal conditions and processes covered under any research proposals that use wildlife.

Performance Indicators

Review and analyse available data to describe changes to freshwater crocodile populations and their distribution and publish the outcomes as appropriate.

Objective 2 - To promote community awareness and public safety.

4.4 Removal of problem crocodiles

The program allows for problem freshwater crocodiles to be relocated, killed and used directly for skin and meat production, or captured and used as stock in crocodile farms.

NRETAS has specialist staff-members who remove problem crocodiles. In remote areas where NRETAS staff-members are unable to attend, crocodiles may be removed following the issue of a Permit to Take by NRETAS. Crocodiles taken in these circumstances will contribute to the ceiling for wild harvested crocodiles. Problem crocodiles removed by NRETAS staff do not contribute to the ceilings for wild harvested crocodiles.

Given that it can be difficult to distinguish between species of crocodile, public awareness campaigns will also be conducted on an as-needs basis to minimise harmful interactions between people and crocodiles, including *C. johnstoni*.

The capture and handling of problem crocodiles must comply with the *Animal Welfare Act* and the Code of Practice.

Performance Indicators

Issue permits to remove problem crocodiles as necessary and appropriate.

Maintain the program to remove all crocodiles in designated swimming and 'no tolerance' management areas.

NRETAS responds to reports of problem crocodiles and implements appropriate management measures.

4.5 Community awareness

The public profile of crocodiles and crocodile management in the Northern Territory is high, particularly for the saltwater crocodile *C. porosus*. Maintaining effective communication links between NRETAS and the community is considered an important component to the success of this program. Effective communication structures are also essential for adaptive management and incorporation of feedback from industry and community groups into future management policies and practices for crocodiles in the Northern Territory.

NRETAS promotes crocodile awareness among Northern Territory residents and visitors to the Territory by disseminating educational information. NRETAS will also aim to promote relevant legislation, policy and guidelines to the commercial crocodile industry and wider community via promotion of this management program and through the NRETAS permit system.

Performance Indicators

Continue to conduct public awareness, safety and educational message campaigns through the media and on the NTG website.

Objective 3 - To ensure humane treatment of freshwater crocodiles.

4.6 Animal welfare

Harvesting and farming of *C. johnstoni* must be in accordance with the provisions of the *Animal Welfare Act* and with the *Code of Practice on the Humane Treatment of Captive and Wild Australian Crocodiles*.

Compliance with the Code of Practice will be a condition of all permits issued to take and/or keep crocodiles and hence enforcement is achieved through the *TPWC Act*. Compliance with the Code of Practice for harvests will be enforced by NRETAS and in the case of farms by RDPIFR staff. An indication of a decrease in animal welfare standards or a suspected breach of the *Animal Welfare Act* will result in an inspection. Non-compliance with the *Animal Welfare Act* or the Code of Practice may result in an infringement notice, the permit being revoked and/or prosecution under either the *Animal Welfare Act* or the *TPWC Act*.

Performance Indicators

Ensure the requirements of the Code of Practice are a condition on all permits and that a copy of the Code is distributed to all new permit holders.

Ensure all successful permit applicants are competent to comply with animal welfare standards including the Animal Welfare Act and the Code of Practice.

Inspect farms regularly to ensure animal welfare standards are met.

Investigate and take appropriate action on any suspected breaches of the Animal Welfare Act or the Code of Practice.

Objective 4 - To monitor and report on the impact of the harvest of freshwater crocodiles.

4.7 Monitoring

4.7.1 Population estimates

Spotlight surveys over selected river systems within the Northern Territory provide indices of the size and age structure of crocodile populations and are the standard method of monitoring for both *C. porosus* and *C. johnstoni* (Messel *et al.* 1981; Stirrat *et al.* 2001). The surveys include counts of the 0–2 foot (0–0.6m) size class which is accepted as equating to

hatchlings (less than one year old) and so provides a measure of recruitment from the last nesting season.

The key rivers monitored by this program are the rivers where most crocodile harvesting occurs; that have been surveyed using the spotlight technique in the past; and for which long-term data sets are available. The results of the spotlight monitoring surveys are used to inform harvest quotas.

The spotlight monitoring program for freshwater crocodiles developed for this program focuses on the following rivers:

- Daly River – the floodplains are currently the site of the only commercial harvest (juveniles and adults) of *C. johnstoni* and there is an increasing interest in harvesting adults from the area. Surveys will include both the downstream estuarine, also monitored for saltwater crocodiles, (Leach *et al.* 2009) and upstream freshwater sections of the Daly River.
- Mary River – this river has a particularly high density of large crocodiles of both species, and is also monitored for saltwater crocodiles, (Leach *et al.* 2009). Additionally, the upper McKinlay River has been monitored for many years by Wildlife Management International.
- Katherine River including Katherine Gorge – the current *C. porosus* surveys will be upgraded to allow monitoring of the freshwater crocodile populations.

Additional rivers may be included if regular harvesting starts to occur or is anticipated in those areas. Under the current harvest regime, the likelihood of populations declining dramatically due to harvesting is very low. Due to the substantial overlap with the established monitoring program for saltwater crocodiles, these surveys will be synchronised and combined wherever possible.

4.7.2 Analysis of survey data

In addition to data collected from these rivers by NRETAS under dedicated monitoring surveys, data from Keep and Gregory National Parks, collected by Parks staff may provide additional data on the status of populations. Data from Kakadu National Park collected by Parks Australia North will also be used as a control as no harvest is occurring in this area. Analysis of the various long-term spotlighting datasets held by NRETAS and the long-term capture data from the McKinlay River (as collected and held by Wildlife Management International) may help to interpret whether any perceived major reduction is due to harvesting or some other independent factor (e.g. climate change or cane toads).

NRETAS will maintain a broad overview of the current extent and quality of freshwater crocodile habitat on all tenures of land.

4.7.3 Commercial harvest estimates

Information on the crocodile harvest (size and sex of non-hatchling crocodiles, numbers of total, live and viable eggs) is obtained through harvest returns submitted by permit holders. Harvest figures will also be considered in combination with numbers removed through other means (e.g. non-commercial destruction), and with environmental conditions that may impact on population size and structure (e.g. poisoning by cane toads). Information on the

demographics of the crocodile harvest (e.g. size and sex of non-hatchling crocodiles) is obtained through harvest returns submitted by permit holders.

Performance Indicators

Continue the population monitoring program as stipulated in this management program.

Investigate any large scale declines in populations as appropriate.

Analyse and assess the results of the monitoring program(s) and implement any resulting management recommendations.

4.8 Reporting

4.8.1 Crocodile farms

All crocodile farms are visited by RDPIFR staff on a regular basis for the purposes of inspection and certification of crocodiles and crocodile products for trade and disease investigations. During these visits RDPIFR staff monitor for compliance with animal welfare standards. Designated Northern Territory Government Animal Welfare officers may conduct an animal welfare investigation at any time in response to a complaint. See Sections 4.2 and 4.6 for performance indicators.

4.8.2 Auditing and reporting

The Management Program will be audited internally by the Northern Territory Government (NRETAS and RDPIFR) on an annual basis. The performance indicators listed in this report will be audited and assessed annually by program management staff. The Northern Territory Government will provide bi-annual reports to the Australian Government. The annual report will include:

- Progress against performance indicators;
- Harvest statistics including:
 - Number of crocodile eggs taken;
 - Number of crocodile hatchlings taken;
 - Number of crocodile juveniles taken;
 - Number of crocodile adults taken;
 - Sex ratio of harvest (adults only); and
 - Average body size of harvested animals for each sex.
- Number of permits issued for problem crocodile removal and details of the fate of each crocodile covered under those permits;
- Number and location of problem crocodiles removed by NRETAS and the fate of each crocodile; and
- Industry compliance statistics including:
 - Number of premises inspected;
 - Number of caution notices issued and reason for issue;
 - Number of alleged offences investigated and outcomes;
 - Any joint surveillance/enforcement activities completed with other agencies; and
 - Any unusual situations that arose (e.g. drought or flood conditions, market influences).

Performance Indicators

Annually audit the progress of the Management Program against each of the performance indicators and adjust management practices as necessary.

Submit bi-annual progress reports to the Australian Government and provide a summary on the Departmental website.

4.8.3 Review of program

The 2010–2014 program will be fully reviewed at the end of five years from the date of approval of the program as required under section 32(2) of the *TPWC Act*. The detail included in this management program in relation to management actions, legislation and administrative arrangements is current as at October 2009.

It is not proposed that the management program will be rewritten should there be changes to management actions, legislation and administrative arrangements during the life of the program unless any such changes are so significant and that the Northern Territory Government and Australian Government agree that a new program is required. The Australian Government will be advised of any changes to this program.

Performance Indicator

Review and update the Management Program by 2014.

5. References¹

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Appendix 1: Freshwater crocodile background information

Crocodylus johnstoni Krefft

A1.1 Conservation status

Northern Territory (*Territory Parks and Wildlife Conservation Act*): Protected species, but not listed as threatened.

Australia (*Environment Protection and Biodiversity Conservation (EPBC) Act*): Marine protected species, but not listed as threatened.

International (Convention on the International Trade in Endangered Species (CITES)): Appendix II (unqualified). Australia is a party to CITES, and with the *EPBC Act* ensuring that its obligations are discharged.

A1.2 Distribution

Crocodylus johnstoni is endemic to Northern Australia where it is generally confined to permanent freshwater rivers, lagoons and billabongs (Figure 2). In the Northern Territory, *C. johnstoni* inhabits wetlands and river channels largely upstream of the tidal reaches of coastal rivers. In the dry season, freshwater crocodiles tend to congregate in isolated permanent and semi-permanent billabongs along secondary creek lines in both rocky escarpments and floodplains (Webb *et al.* 1987).

Geographic variation in morphology has been shown in *C. johnstoni* however, the extent of geographic variation across its entire range is yet to be determined (Webb and Manolis 1993, Edwards *et al. in prep.*) Some populations of freshwater crocodile are strikingly stunted with mature males reaching only 1.2 metres in total length and weighing 7 kilograms (Webb and Manolis 1989).

Figure 2: The distribution of the freshwater crocodile *Crocodylus johnstoni* in Australia (Source: Cogger 2000).



A1.3 Ecology

Cogger (2000) provides a general description of Crocodylia. Grigg and Gans (1993), Cooper-Preston and Jenkins (1993) and Molnar (1993) discuss morphology, physiology, natural history, biogeography and phylogeny. Detailed discussion of many topics concerning crocodile biology may be found in Webb *et al.* (1987).

Considerable research has been conducted into the biology and status of *C. johnstoni* in northern Australia. Its biology, population dynamics, recovery since protection and management have been the subject of intensive research efforts (Table 4), the details of which are contained in a variety of publications (e.g. Burbidge 1987, CCNT 1986, Compton 1981, Smith and Webb 1985, Taplin 1987, Tucker *et al.* 1993, Webb and Gans 1982, Webb *et al.* 1982, Webb *et al.* 1983a-f; Webb *et al.* 1987, Webb *et al.* 1994, Webb and Manolis 1983, 1989, 1993; and Webb and Smith 1984 and 1987).

Crocodylus johnstoni is morphologically distinct from other freshwater species found in the Asian region (e.g. *C. porosus*, *C. mindorensis*, *C. novaeguineae*) because of its unusually narrow snout (Tucker 1998).

Table 4. Basic ecological data for the freshwater crocodile *C. johnstoni* (Source: Webb and Manolis 1993 and citations therein).

| Characteristic | Freshwater crocodile <i>C. johnstoni</i> |
|---|--|
| Biology | |
| Size and age at sexual maturity (males) | 1.7 m; 17 yrs |
| Size and age at sexual maturity (females) | 1.5 m; 12 yrs |
| Normal length (males) | 2.0 m |
| Normal length (females) | 1.8 m |
| Normal maximum length (males) | 3 m |
| Normal maximum body weight | 70–80 kg |
| Nesting Season; months | Dry Season; Aug.– Sept. |
| Duration of egg laying | 4 weeks |
| Mean clutch size; (range) | 13.2 (1–21) |
| Mean egg weight; (range) | 68.2 g (47–89) |
| Mean hatchling weight | 44.7 g |
| Nest defence | rare |

A1.4 Nesting ecology

Female *C. johnstoni* lay eggs into holes which they dig in exposed sand bars and sandbanks during the dry season. Mating occurs about six weeks prior to nesting and all females nest in a short period of time (Webb *et al.* 1987). There are some slight geographic variations in the timing of nesting. For example, nesting in the McKinlay River area is from August – September, while nesting occurs slightly later in the Victoria and Roper River regions where

females and clutch sizes also appear to be smaller (Webb *et al.* 1987). On average 13 eggs are laid and incubation normally lasts 75–85 days (Webb *et al.* 1983c). Females do not attend or defend their nests during the incubation period. Around October females show renewed interest by excavating their nests in response to the calls of hatchlings. Females often remain with hatchlings which congregate in crèches among fallen trees or semi-emergent vegetation (Webb *et al.* 1987).

As with *C. porosus*, the sex of *C. johnstoni* hatchlings is determined by the incubation environment of the egg. Data from the McKinlay River and 13 other rivers in the Northern Territory indicates a significant female bias in hatchlings (Webb *et al.* 1987). Further information on *C. johnstoni* reproduction can be found in Compton (1981), Smith and Webb (1985), Webb and Smith (1984), Webb *et al.* (1983b) and Webb *et al.* (1987).

A1.5 Survivorship and population dynamics

The population dynamics of *C. johnstoni* are generally characterised by low egg and hatchling survivorship, but reasonably high survivorship among sub-adults (Webb *et al.* 1987). Eggs fail to hatch for a number of reasons including predation by monitor lizards and pigs, nest inundation, overheating, infertility, trampling by livestock, and excavation of nests by other females. Predation by monitor lizards (*Varanus sp.*) poses the largest threat to incubating eggs. Most losses of hatchlings up to one year old occur in the first six months after hatching. The survivorship between ten years of age and reproductive senescence is unknown, but has been estimated to be greater than 85% per year (Webb *et al.* 1987).

In the absence of human predation or hunting, *C. johnstoni* populations fluctuate primarily in response to seasonal conditions such as rainfall and temperature (Webb and Smith 1984; Webb *et al.* 1987). While there is recent evidence of rapid changes in population numbers and age structure in local areas when cane toads arrive (Letnic and Ward 2005); there is still an abundant population of Freshwater Crocodiles in Queensland where cane toads have been present for much longer than in the Northern Territory.

A1.6 Diet

Despite the narrow snout, the diet of *C. johnstoni* is quite varied and includes a wide variety of invertebrates and small vertebrates. The most important prey items are aquatic and terrestrial insects, fish and crustaceans (Webb *et al.* 1982). Freshwater crocodiles appear to feed opportunistically at the water's edge, and more prey is taken during the warmer Wet season than during the cooler Dry season (Webb *et al.* 1982), when growth in *C. johnstoni* is negligible (Webb *et al.* 1983a).

Appendix 2. Farm Management

Farm biosecurity

Farms are advised to follow the Biosecurity plan available from RDPIFR. Any signs of illness, disease outbreak or unusual deaths should be reported as soon as possible to RDPIFR. The crocodile industry will be alerted to any possible disease problems and a disease investigation will be undertaken if needed. In the event of an emergency crocodile disease outbreak, the Biosecurity plan would be mandated under the *Livestock Act* for the period of the emergency animal disease response.

Farm security

Farms are required to have secure fencing, capable of containing crocodiles, as a condition on the permit to keep and trade. Fences and enclosures must be maintained to ensure animals cannot escape. NRETAS will check farm security annually as part of the process for renewing permits.

Farm data and audit Validation

Each month farms will submit stock data to RDPIFR to validate and collate before it is submitted to NRETAS each year. Individual farm performance data will be compared with Northern Territory industry averages and provided to individual farms.

RDPIFR will validate monthly returns using annual physical audits for hatchlings and will also conduct random spot audits for all other class of animal on the farm. Hatchlings will be audited each year by hand counting all animals gained for that current year on the farm when they are transferred to raising/yearling class pens.

Farm visitation

Farms will be visited by RDPIFR under the powers of the *Livestock Act* to ensure animal welfare, farm biosecurity, inspection of shipments, animal audits, disease investigation and any other related matter. Farms will be visited by NRETAS to ensure that farms meet the conditions stated on the Permit to Keep, investigate any wildlife breaches and other related matters.

Animal welfare

Animal welfare on all crocodile farms will continue to comply with the *Animal Welfare Act* and follow the Code of Practice on the Humane Treatment of Captive and Wild Australian Crocodiles as stated in this Management Program. Animal welfare on farms will be enforced by RDPIFR as animal welfare inspectors under the *Animal Welfare Act*.

Farm workers OH&S

Workers on all crocodile farms that have duties involving handling crocodiles or being in close contact with crocodiles must meet the relevant Northern Territory OH&S legislation.

Farmer responsibilities

The responsibilities of farms are detailed in Table 5.

Table 5: Stakeholder Responsibilities in the freshwater crocodile Management Program 2010–2014

| Stakeholder | Responsibilities |
|--|---|
| Department of Natural Resources, Environment, The Arts and Sport | <ul style="list-style-type: none"> • Assess applications and issue permits as appropriate. • Ensure compliance with permit conditions. • Issue permits for domestic shipments of live crocodiles from farms within ten working days. • Remove and dispose of problem crocodiles from agreed intensively managed areas. • Collate annual report to the Australian Government. • Compare wild egg collection data with farm hatchling data each year. • Review the Management program for the freshwater crocodile (<i>C. johnstoni</i>) in the Northern Territory of Australia. |
| Department of Regional Development, Primary Industries Fisheries and Resources | <ul style="list-style-type: none"> • Ensure monthly returns from crocodile farms are submitted and collated. • Process applications for permits to import/export crocodile skins and products both overseas and domestic within two business days of application. • Inspect crocodile skins and products for export and process appropriate paperwork. • Annually audit the hatchlings on each farm to validate data in the monthly returns. • Visit farms to ensure animal welfare standards are being met. • Ensure production data from monthly returns is collated, validated and passed on to NRETAS annually. • Ensure each crocodile farm is given confidential feedback every six months on their farm production performance compared with the Northern Territory industry average. • Ensure the supply, payment and issue of skin tags for crocodile skins for trade. • Investigate breaches in trade conditions or illegal trade of crocodilian skins or products. • Implement the Biosecurity plan in the event of an emergency crocodile disease outbreak |
| Northern Territory Crocodile Farming Industry | <ul style="list-style-type: none"> • Comply with all permit conditions. • Submit production returns to RDPIFR each month. • Ensure animal welfare standards are being met in accordance with the <i>Animal Welfare Act</i> and the Code of Practice. • During an emergency disease outbreak comply with the Biosecurity plan. • Ensure worker safety is not comprised by adhering to appropriate Workplace Health and Safety requirements. • Assist RDPIFR and/or NRETAS to annually audit hatchlings. • Submit applications for permits to import/export crocodile shipments both domestically and overseas to RDPIFR, at least two business days before the date needed. • Ensure applications for inspections on shipment dates are lodged with RDPIFR at least ten working days in advance. • Ensure that a CITES permit has been issued and that CITES permit numbers are available for overseas shipments of crocodile skins and products. • Ensure that permit applications to remove live crocodiles from farms are submitted to NRETAS at least ten working days before the desired transport date. • Ensure an application to renew the commercial permit to keep and trade for the farm is submitted to NRETAS before the current permit expires. |

| Stakeholder | Responsibilities |
|-------------|---|
| | <ul style="list-style-type: none">• Submit any application(s) to NRETAS to harvest wild eggs by 30 April each year.• Submit completed egg collection returns for the season to NRETAS by 31 January each year. |

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Appendix 3. Annual Milestone Matrix for 2010– 2014 Program

Milestone matrix for each objective in the Freshwater Crocodile 2010–2014 Management Program.

| Milestone | Program Reference | Action Officer | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|--------------------------------|---|-----------------|-----------------|-----------------|-----------------|-----------------|
| Objective 1. To facilitate the sustainable use of freshwater crocodiles | | | | | | | |
| Ensure all harvest permit applications minimise the possible negative impact on or conflict with tourism, social or cultural interests. | 4.1 Restrictions on harvesting | Director, Wildlife Use | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |
| Investigate and take appropriate action on all suspected local impacts on the population. | 4.1 Harvest ceilings | Director, Wildlife Use | Ongoing, review | Ongoing, review | Ongoing, review | Ongoing, review | Ongoing, review |
| Instigate adaptive management actions should there be any increase in threats to the freshwater crocodile and their habitat. | 4.1 Harvest ceilings | Director, Wildlife Use | Ongoing, review | Ongoing, review | Ongoing, review | Ongoing, review | Ongoing, review |
| Develop and implement a GIS database to assist with monitoring harvest effort and compliance. | 4.1 Harvest ceilings | Director, Wildlife Use | | | commence | | |
| Adjust harvest appropriately, based on monitoring results and in accordance with the provisions of this Management Program. | 4.1 Harvest ceilings | Director, Wildlife Use | January–March | January–March | January–March | January–March | January–March |
| Ensure that the annual commercial harvest of freshwater crocodiles does not exceed the approved ceiling for each category. | 4.2 Permits and compliance | Director, Wildlife Use | January–March | January–March | January–March | January–March | January–March |
| Assess applications and issue permits under the <i>TPWC Act</i> . | 4.2 Permits and compliance | Director, Conservation and Wildlife | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |
| Monitor and audit harvest applications, approvals and returns and investigate and resolve any discrepancies. | 4.2 Permits and compliance | Director, Wildlife Use | Ongoing, review | Ongoing, review | Ongoing, review | Ongoing, review | Ongoing, review |
| Ensure all permit applications have correct landholder approval. | 4.2 Permits and compliance | Senior Wildlife Ranger, Conservation and Wildlife | Ongoing, review | Ongoing, review | Ongoing, review | Ongoing, review | Ongoing, review |
| Ensure returns comply with permit conditions and are reported to NRETAS as per permit conditions. | 4.2 Permits and compliance | RDPIFR | Ongoing, review | Ongoing, review | Ongoing, review | Ongoing, review | Ongoing, review |
| Ensure compliance with the issue of skin tags and permits. | 4.2 Permits and compliance | RDPIFR | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |
| Conduct random checks on farm stock numbers as required. | 4.2 Permits and compliance | RDPIFR | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |

| Milestone | Program Reference | Action Officer | 2010 | 2011 | 2012 | 2013 | 2014 |
|--|-----------------------------------|---|-------------------|-------------------|-------------------|-------------------|-------------------|
| Review permit conditions annually and amend where necessary. | 4.2 Permits and compliance | Directors, Wildlife Use and Conservation and Wildlife | January–March | January–March | January–March | January–March | January–March |
| Ensure compliance with permit conditions is at or near 100% and that the addressing of permit breaches through warning letters, caution notices, infringement notices or prosecution is at or near 100%. | 4.2 Permits and compliance | Director, Conservation and Wildlife | annually | annually | annually | annually | annually |
| Review and analyse available data to describe changes to freshwater crocodile populations and their distribution and publish the outcomes as appropriate. | 4.3 Management-focused research | Director, Wildlife Use | commence | | | | |
| Objective 2. To promote community awareness and public safety. | | | | | | | |
| Issue permits to remove problem crocodiles as necessary and appropriate. | 4.4 Removal of problem crocodiles | Director, Conservation and Wildlife | Ongoing, as needs | Ongoing, as needs | Ongoing, as needs | Ongoing, as needs | Ongoing, as needs |
| Maintain the program to remove all crocodiles in designated swimming and 'no tolerance' management areas. | 4.4 Removal of problem crocodiles | Director, Conservation and Wildlife | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |
| NRETAS responds to reports of problem crocodiles and implements appropriate management measures. | 4.4 Removal of problem crocodiles | Director, Conservation and Wildlife | Ongoing as needs | Ongoing as needs | Ongoing as needs | Ongoing as needs | Ongoing as needs |
| Continue to conduct public awareness, safety and educational message campaigns through the media and on the NTG website. | 4.5 Community awareness | Director, Marketing and Communications | Ongoing, as needs | Ongoing, as needs | Ongoing, as needs | Ongoing, as needs | Ongoing, as needs |
| Objective 3. To ensure humane treatment of Freshwater Crocodiles. | | | | | | | |
| Ensure the requirements of the Code of Practice are a condition on all permits and that a copy of the Code is distributed to all new permit holders. | 4.6 Animal welfare | Director, Conservation and Wildlife | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |
| Ensure all successful permit applicants are competent to comply with animal welfare standards including the <i>Animal Welfare Act</i> and the Code of Practice. | 4.6 Animal welfare | Director, Conservation and Wildlife | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |
| Inspect farms regularly to ensure animal welfare standards are met. | 4.6 Animal welfare | RDPIFR | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |

| Milestone | Program Reference | Action Officer | 2010 | 2011 | 2012 | 2013 | 2014 |
|--|--------------------|-------------------------------------|------------------|------------------|------------------|------------------|------------------|
| Investigate and take appropriate action on any suspected breaches of the <i>Animal Welfare Act</i> or the Code of Practice. | 4.6 Animal welfare | Director, Conservation and Wildlife | Ongoing as needs | Ongoing as needs | Ongoing as needs | Ongoing as needs | Ongoing as needs |
| Objective 4. To monitor and report on the impact of the harvest of freshwater crocodiles. | | | | | | | |
| Continue the population survey program as stipulated in this Management Program. | 4.7 Monitoring | Director, Wildlife Use | commence | review | review | review | Review |
| Investigate any large scale declines in populations as appropriate. | 4.7 Monitoring | Director, Wildlife Use | Ongoing as needs | Ongoing as needs | Ongoing as needs | Ongoing as needs | Ongoing as needs |
| Analyse and assess the results of the survey program(s) and implement any resulting management recommendations. | 4.7 Monitoring | Director, Wildlife Use | October–December | October–December | October–December | October–December | October–December |
| Annually audit the progress of the Management Program against each of the performance indicators and adjust management practices as necessary. | 4.8 Reporting | Director, Wildlife Use | March | March | March | March | March |
| Submit bi-annual reports to the Australian Government. | 4.8 Reporting | Director, Wildlife Use | June | | June | | June |
| Review and update the Management program by 2014. | 4.8 Reporting | Director, Wildlife Use | | | | commence | complete |