# MANAGEMENT PROGRAM FOR THE SALTWATER CROCODILE *Crocodylus porosus* AND THE FRESHWATER CROCODILE *Crocodylus johnstoni* IN WESTERN AUSTRALIA, 1999 TO 2003

(Effective from 1 January 1999

until 31 December 2003)

**DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT**
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## 1. INTRODUCTION

The overall aim of this management program is to enhance the current and long-term conservation of crocodiles and their habitats in Western Australia, through management of crocodile farming and wild crocodile populations. This management program applies to the two crocodile species that occur in the wild in Western Australia:

| | |
|---|---|
| Class: | Reptilia |
| Order: | Crocodylia |
| Family: | Crocodylidae |
| Species: | *Crocodylus porosus* Schneider, 1801 (Saltwater Crocodile, Estuarine Crocodile) |
| | *Crocodylus johnstoni* Krefft, 1873 (Australian Freshwater Crocodile, Freshwater Crocodile, Johnston's River Crocodile). |

Under the *Conservation and Land Management Act 1984*, the Western Australian Department of Conservation and Land Management (CALM) is responsible for the management of various public lands and waters including conservation reserves, and also for the conservation and protection of fauna throughout the State. The latter responsibility is given effect largely through administration of the Western Australian *Wildlife Conservation Act 1950*. CALM is the management authority responsible for the conservation and management of crocodiles in Western Australia.

In October 1988 the Western Australian Government decided to permit the commercial farming of crocodiles, involving both captive breeding operations and also controlled harvesting from the wild under the approach known as 'ranching' ('ranching' is defined and elaborated upon in Appendix A). Export from Australia of products derived from crocodiles taken from the wild is permitted where the crocodiles are captive bred or taken in accordance with a management program approved under the Commonwealth *Wildlife Protection (Regulation of Exports and Imports) Act 1982*. This Commonwealth Act is also the Australian enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), to which Australia is a signatory. The Australian population of *C. porosus* is listed on Appendix II of CITES and international trade in the species is regulated in accordance with CITES requirements and the identification of products in trade. The Freshwater Crocodile C. *johnstoni* is also listed on Appendix II of CITES. The 'ranching' restriction applying to the Australian population of *C. porosus* was removed by CITES in 1994.

Because the Western Australian commercial crocodile farming industry intends to continue exporting products from crocodiles of both captive-bred and wild origin, this management program has been developed to meet the requirements of the Commonwealth legislation and CITES, as well as the requirements of the Western Australian Government. This program provides for the controlled harvesting of crocodiles for farming purposes, and for the regulation of farming operations and trade in crocodile products.

This management program describes the management approach that will continue to be taken for crocodiles in Western Australia from 1 January 1999 until 31 December 2003. It supersedes the management program for the Saltwater Crocodile and Freshwater Crocodile operating between 1996 and 1998. This program also covers the management of crocodiles and the regulation of crocodile products derived from animals taken under previous management programs for Western Australia, or from the wild prior to those programs.

## 2. AIMS OF CROCODILE MANAGEMENT IN WESTERN AUSTRALIA

CALM has adopted a comprehensive policy statement entitled 'Conservation and Management of Crocodiles'. That policy statement is reprinted in full as Appendix A to this management program. It contains background information, sets out objectives and policies, and lists strategies for the achievement of those objectives and policies.

In general terms, the main aims of the Western Australian crocodile management program are to:

(1) maintain viable wild populations of crocodiles and conserve the habitats on which they depend;

(2) facilitate the recovery of *C. porosus* populations which have been depleted by past hunting;

(3) provide for public safety by maintaining public awareness and removing "problem" crocodiles;

(4) provide for the commercial utilisation of crocodiles through controlled farming and harvesting.

## 3. BACKGROUND TO CROCODILE MANAGEMENT IN WESTERN AUSTRALIA

### 3.1 Distribution, Biology and Conservation Status of the Saltwater Crocodile

The Saltwater Crocodile, *C. porosus*, is distributed along the coastal regions of northern Australia and throughout south-east Asia. In Western Australia it is found from the Northern Territory border and west to the Broome area. In recent years the species has been found in the vicinity of Port Hedland in the Pilbara region (See Figure 1). In Western Australia, *C. porosus* primarily inhabits the tidal portions of coastal rivers.

It is not the purpose of this management program to provide a detailed account of the biology and ecology of *C. porosus*, as that information is available elsewhere. The extensive bibliography in the crocodile management program for the Northern Territory (Conservation Commission of the Northern Territory, 1989) gives an indication of the level of knowledge of the species in Australia at that time.

The first documented report on the status of *C. porosus* populations in Western Australia was that of Bustard (1970), who in 1969 conducted limited boat spotlight surveys in several areas. Bustard concluded that *C. porosus* "has been hunted to the verge of extinction" and recommended that the species be protected for ten years.

The first systematic surveys of *C. porosus* populations in Western Australia were conducted in 1977 (Messel *et al.* 1977) and 1978 (Burbidge and Messel 1979). These boat spotlight surveys covered the estuarine portions of major river systems across most of the range of *C. porosus* in Western Australia. The combined results yielded the estimates of the non-hatchling populations in the surveyed portions of each river system given in Table 1.

Extrapolating from the survey results to correct for unsurveyed areas, Burbidge and Messel (1979) estimated that there were about 2,000 non-hatchling *C. porosus* in the whole of Western Australia.

In 1986, most of the areas surveyed in 1977 and 1978 were resurveyed, as well as some additional areas (Messel *et al.* 1987), resulting in a Kimberley-wide population estimate of 2,500 non-hatchling *C. porosus*. The 1986 survey revealed a significant increase in the proportion of large crocodiles in the population, and showed that the largest populations were in the Cambridge Gulf, Prince Regent and Roe River systems.

Since 1986, no further large-scale population surveys covering most of the range of *C. porosus* in the Kimberley have been conducted. However, the *C. porosus* population in King Sound and Stokes Bay was surveyed for the first time in 1989, resulting in an estimated population of the order of 25 (G Webb Pty Ltd 1989a). The low density of *C. porosus* in the King Sound area reflects a generally poor environment at the extremity of the main part of the range of *C. porosus*.

**TABLE 1: *C. porosus* non-hatchling population estimates from 1977-1978 boat spotlight surveys (after Messel *et al.* 1977; Burbidge and Messel 1979).**

| River | Population Estimate | River | Population Estimate |
|---|---|---|---|
| Ord | 235-306(a) | Roe | 177-230 |
| Lawley | 44-57 | Prince Regent | 190-246 |
| Mitchell | 60-78 | Glenelg | 200-259 |
| Hunter | 51-67 | | |
| **Total** | (all surveyed rivers) | | **957-1,243** |

(a): this estimate was subsequently revised to 245-297 by Messel *et al.* 1987.

Associated with the Western Australian Government's 1988 decision to permit crocodile farming, the West Arm river systems in Cambridge Gulf (Figure 2) which had been surveyed in 1986 were resurveyed in 1989, 1990, 1992, 1993, 1994,1995, 1996 and 1997 (G Webb Pty Ltd 1989b, 1990 and 1992, Wildlife Management International, 1994b, 1995, 1996 and 1997). In 1992 the Ord River, which had been partly surveyed in 1978 and 1986, was fully surveyed for the first time (G Webb Pty Ltd 1992). This river was resurveyed again in 1993, 1994, 1995, 1996 and 1997 (Wildlife Management International 1994a, 1994b, 1995, 1996 and 1997). As a result of these surveys, WMI developed helicopter monitoring zones for the East Arm (Ord River) and West Arm areas of the Cambridge Gulf. After trial development and proofing, population estimates from 1994-on have been based on the results of the helicopter surveys of monitoring areas.

Monitoring areas for Saltwater Crocodiles comprise the following areas.

| **West Arm** | **East Arm** |
|---|---|
| Parrys Creek | Ord River (East Bank) 20-60 km |
| King River | Ord River (East Bank) 60-80 km |
| Pentecost river | |
| Durack River | |
| Forrest River | |
| Patrick River | |
| West Arm (East Bank) 0-40 km | |
| West Arm (East Bank) 40-62 km | |

The results of crocodile population monitoring surveys in the Cambridge Gulf river systems are summarised in Table 2. The Helicopter count indices for Cambridge Gulf are detailed in Table 3.

The results from the 1997 surveys show that the 1997 population estimate for the West Arm of Cambridge Gulf is similar to the estimate for 1989 and certainly within an acceptable range. In the East Arm the 1997 population is perhaps slightly higher than, but not significantly different from the original (1992) estimate.

**TABLE 2: Summary of *C. porosus* population surveys in the Cambridge Gulf system, east Kimberley, 1978 to 1997 (after Messel *et al.* 1987; G Webb Pty Ltd 1989b, 1990 and 1992, Wildlife Management International 1994a, 1994b, 1995, 1996 and 1997).**

| Surveyed portions | ESTIMATED POPULATION OF NON-HATCHLINGS MONTH/YEAR OF SURVEY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 7/78 | 7/86 | 10/89 | 9/90 | 7/92 | 7-8/93 | 7/94 | 7/95 | 7/96 | 7/97 |
| **East Arm & Ord River** | | | | | | | | | | |
| 98.8 km | 245-297 | 221-271 | ns | ns | 240 | 278 | | | | |
| additional 20 km | ns | 38(c) | ns | ns | 55 | 92 | | | | |
| additional 59.5 km | ns | ns | ns | ns | 84 | 40 | | | | |
| Total estimate | | | | | 379 | 410 | 400(d) | 422 (d) | 382 (d) | 422 (d) |
| **West Arm (a)** | ns | | | | | | | | | |
| West Arm (b) | ns | 187-233 | 256 | 202 | 198 | 152 | 99 (d) | 173(d) | 138 (d) | 160 (d) |
| **Cambridge Gulf, Total estimate.** | - | **494** | - | - | **577** | **562** | **495** | **595** | **520** | **582** |

ns: not surveyed.
(a) Includes West Arm, Parrys Ck, Sellers Ck, Forrest R, Patrick R, Durack R, Canal Ck, King R, Pentecost R (203 km).
(b) Includes all in (a) plus, West Arm side creek and Bulla Nulla Ck (215.2 km)
(c): count only, i.e. not a population estimate.
(d): estimate based on monitoring zones.

The Cambridge Gulf river systems have been the principal source of C. porosus for crocodile farms in Western Australia. The combined population estimates for the two survey areas give a total population in 1997 that is almost identical to the first combined estimate available (1992). These results demonstrate that Saltwater Crocodile populations are being conserved in the Cambridge Gulf through the operation of successive crocodile management programs.

A helicopter survey was conducted in the 1988/89 breeding season to locate *C. porosus* nests between Cambridge Gulf and the Prince Regent River (G Webb Pty Ltd 1989c). This survey provided for the first time an assessment of nesting levels in the Kimberley through a direct count of nests. The river systems in which nests were found, and the number of nests found, are listed in Table 4.

Details of Saltwater Crocodile population monitoring results for 1997 and previous years are provided in Appendix B.

As shown in Figure 3, average rainfall in the Kimberley peaks in the north-west, in the vicinity of the Roe River, at over 1200 mm per year, coinciding with the highest recorded number of nests (Table 4). In contrast, rainfall in the Cambridge Gulf area averages 600-800 mm per year.

**TABLE 3. Helicopter count indices for Saltwater Crocodiles in Cambridge Gulf (values for 1978-1990 were derived from spotlight count data, after Wildlife Management International, 1997).**

| Year | Ord River | West Arm |
|---|---|---|
| 1978 | 64 | - |
| 1986 | 67 | 44 |
| 1989 | - | 53 |
| 1990 | - | 43 |
| 1992 | 65 | 44 |
| 1993 | 72 | 34 |
| 1994 | 70 | 23 |
| 1995 | 74 | 40 |
| 1996 | 67 | 32 |
| 1997 | 74 | 37 |

**TABLE 4: *C. porosus* nesting survey results (after G Webb Pty Ltd 1989c).**

| Rivers | Nests recorded |
|---|---|
| **Cambridge Gulf Rivers** | |
| Ord River | 6 |
| King River | 8 |
| **Other Rivers** | |
| Drysdale River | 1 |
| Admiralty Gulf Creek | 1 |
| Roe River | 20 |
| Prince Regent River | 1 |
| **Total** | **37** |

The 1988/89 survey (G Webb Pty Ltd 1989c) confirmed previous conclusions (Messel *et al.* 1987; Burbidge 1987) that nesting habitat and levels are limited in Western Australia, particularly in comparison with prime areas in the Northern Territory. Further confirmation of this has been provided by subsequent surveys in various localities (unpublished data, CALM). Burbidge (1987) commented:

> *"The areas of the Kimberley inhabited by C. porosus differ markedly from most of the Northern Territory ... The Kimberley coastline and hinterland are chiefly composed of steep, rugged, ancient, deeply faulted sandstones. Access up many rivers is blocked to crocodiles by waterfalls and their associated gorges. There are few areas of floodplain and very few freshwater swamps; hence breeding habitat is scarce. It would appear, therefore, that the carrying capacity of the Kimberley river systems and the Kimberley as a whole is much less than that of the Northern Territory."*

In summary, *C. porosus* was extensively hunted for the skin trade in the 1950's and 1960's, and while the pre-harvest population size is unknown, the species apparently suffered a decline in numbers throughout its range in Western Australia. It is considered that the total population of *C. porosus* in Western Australia is now only of the order of a few thousand non-hatchlings. Nesting habitat is limited, with very few nests located during the surveys conducted to date. Nevertheless, from anecdotal information and limited surveys, *C. porosus* appears to be recovering from past hunting, and still occupies its historical range.

Saltwater Crocodiles were given legal protection under the *Wildlife Conservation Act 1950* on 24 April 1970, in response to the report by Bustard (1970). From the time of protection of the species until the establishment in 1989 of the Wyndham Crocodile Farm, the legal removal of *C. porosus* from the wild was restricted to the capture of limited numbers for the experimental crocodile farm at Kalumburu, and also for display at the Broome Crocodile Park, with the latter comprising mostly "problem" *C. porosus* (see Section 3.4). The Saltwater Crocodile *C. porosus* is formally declared to be "specially protected" under the *Wildlife Conservation Act 1950*. The legal effect of this declaration is that a higher penalty applies to illegal taking or possession than would otherwise be the case.

### 3.2 Distribution, Biology and Conservation Status of the Freshwater Crocodile

The Freshwater Crocodile, *C. johnstoni*, is distributed across the coast and hinterland of northern Australia. In Western Australia the species is found throughout the freshwater rivers and billabongs of the Kimberley (Figure 1). The area of most extensive habitat is considered to be the high rainfall north-west Kimberley, and the species also extends well inland along the two largest river basins, the Ord and the Fitzroy (Burbidge 1987).

It is not the purpose of this management program to provide a detailed account of the biology and ecology of *C. johnstoni* in Western Australia. As stated for *C. porosus* in Section 3.1, that information is available elsewhere.

Prior to 1989, there had only been very limited surveys of *C. johnstoni* populations in Western Australia. As a consequence of the 1988 decision by the Western Australian Government to allow crocodile farming, there has been a considerable increase in knowledge about Western Australian *C. johnstoni* populations. In 1989, boat spotlight surveys yielded non-hatchling population estimates of 25,000 in Lake Argyle and 7,500 in Lake Kununurra (G Webb Pty Ltd 1989d). The earlier construction of two dams on the Ord River impounded Lake Kununurra (in 1963) and the very large Lake Argyle (in 1972).

Also in 1989, boat spotlight and helicopter surveys yielded a population estimate of 13,000 non-hatchling *C. johnstoni* along 172 km of the Fitzroy River and in some of its tributaries and Seventeen Mile or Camballin Dam (G Webb Pty Ltd 1989a). Boat spotlight surveys in 1992 and 1993 yielded estimates of 2,100, and 2,900 *C. johnstoni* respectively in the Ord River downstream of the Diversion Dam which forms Lake Kununurra, all within 90 km of the dam (G Webb Pty Ltd 1992, Wildlife Management International 1994a). During 1994 a comparison of boat spotlight and helicopter counts was undertaken by Wildlife Management International in order to provide helicopter count indices for future population monitoring. Helicopter counts were repeated in 1995, giving the monitoring results displayed in Table 5.

There has not been a survey of the total Western Australian *C. johnstoni* population and therefore there is no scientific estimate of the total population size. Nevertheless the species is clearly

common in suitable habitat and would have a total population in the order of an integer x $10^4$, if not higher.
No intensive legal hunting of *C. johnstoni* ever took place in Western Australia but there was significant poaching in accessible habitat during the 1960's and early 1970's (Bustard 1970; Burbidge 1987).

**Table 5: Helicopter count indices for non hatchling C. Johnstoni in Cambridge Gulf and associated lakes (after Wildlife Management International, 1997)**

| Year | Ord River | L Kununurra | L Argyle | Total |
|---|---|---|---|---|
| 1988/89 | - | 218 | 2124 | - |
| 1992 | 217 | 194 | 857 | 1267 |
| 1993 | 266 | 142 | 1238 | 1646 |
| 1994 | 413 | 157 | 1621 | 2191 |
| 1995 | 478 | 329 | 1411 | 2218 |
| 1996 | 358 | 189 | 846 | 1393 |
| 1997 | 527 | 156 | 996 | 1679 |

*C. johnstoni* was given legal protection under the *Wildlife Conservation Act 1950* on 11 June 1958. The species is formally declared to be "specially protected" under the Wildlife Conservation Act, giving it the same level of protection as *C. porosus*.

Details of Freshwater Crocodile population monitoring results for 1997 and previous years are provided in Appendix C.

## 3.3 Past Harvesting of Wild Crocodiles

### *3.3.1 Aboriginal Harvests*

Crocodile meat and eggs have been used as a food source by Aboriginal people for some 20,000 to 40,000 years prior to European contact (McBryde 1979; Flood 1983). This use continues but for Western Australia the size and impact of the harvest are unknown. However, some Aboriginals are very skilled hunters, especially adept at locating nests of both species, and the impact of their harvesting, even though unknown, "should not be lightly dismissed" (Webb *et al.* 1987).

### *3.3.2 Hunting for the Skin Trade*

The number of *C. porosus* killed for trade prior to protection is unknown, but Webb *et al.* (1984) estimated that a total of between 270,000 and 330,000 *C. porosus* were killed in Australia from 1945 to 1972, with the upper estimate comprising 271,500 skins exported, 13,500 (5%) assumed killed and not retrieved, and 45,000 juveniles killed for the curio trade. Webb *et al.* (1984) estimated that 10% of the skin harvest was from Western Australia, and it therefore seems likely that some 25,000 *C. porosus* were harvested in Western Australia from 1946 until they were legally protected in April 1970. Webb *et al.* (1987) considered that the earlier estimate of the number of juveniles killed for the curio trade was probably an overestimate.

There are no published estimates of the numbers of *C. johnstoni* killed in Western Australia for the skin trade prior to 1970.

### *3.3.3 Drowning in Fishing Nets and Illegal Shooting*

Entanglement in fishing nets is known to be a cause of mortality for crocodiles in Australia, although firm data on the level of mortality and the effect of that mortality on crocodile populations are not available, as indicated by Webb *et al.* (1987) for the Northern Territory and Taplin (1987) for Queensland. For Western Australia, published references are limited to Messel *et al.* (1987) suggesting that commercial netting for barramundi in the 1978-84 period may have caused or contributed to a decline in *C. porosus* numbers in the Ord River system, while G. Webb Pty Ltd (1989a) reported that a single professional fisherman stated in 1989 that he had accidentally drowned 50 *C. porosus* in nets in the King Sound area over the previous three years. It is known from reports received by CALM that net entanglements and mortalities continue to occur, particularly with *C. johnstoni* in the Lake Argyle net fishery, where arrangements exist for reporting of incidental catches.

In addition, CALM receives reports that illegal shooting occurs from time to time. Such reports are investigated and action is taken where offenders can be identified.

It is difficult to assess the level of mortality resulting from drowning in fishing nets and illegal shooting. Using only records based on carcasses that have been located or on reports that have been reliably substantiated, CALM's District Wildlife Officer stationed in Kununurra recorded five *C. porosus* drownings (including two in the Cambridge Gulf West Arm river systems) and 17 *C. porosus* shot (including 13 in the Ord River and two in the West Arm river systems) between April 1989 and 30 June 1994. In contrast, CALM's District Wildlife Officer in Broome received only one substantiated report of a *C. porosus* being shot between October 1988 and the 30 June 1994.

## 3.4 Collecting and Harvesting for Crocodile Farms and Displays

### *3.4.1 Private Collections*

Two private collections of captive crocodiles were maintained for many years in Western Australia, however, records are incomplete with respect to the actual numbers obtained and held. One collection, on Cockatoo Island, is reputed to have commenced with the capture of one *C. porosus* in about 1960, and an unknown number of crocodiles of both species (mainly *C. porosus*) were held, until the last of them (one *C. porosus* and one *C. johnstoni*) were transferred to the Broome Crocodile Park in 1987.

Another collection, at Wyndham, dated back to 1956 and appears to have consisted of 10-20 crocodiles of both species (mainly *C. porosus*) in the 1960's and early 1970's, down to 10 *C. porosus* and two *C. johnstoni* in 1975, and then two *C. porosus* and one *C. johnstoni* from 1982. The last three crocodiles were transferred to the Fremantle Crocodile Park in 1989.

### *3.4.2 Kalumburu Crocodile Farm*

In 1973 Applied Ecology Pty Ltd was licensed to establish an experimental crocodile farm at the Kalumburu Mission. Applied Ecology Pty Ltd was a company established by the Commonwealth Government to research and develop natural resource based industries for the benefit of Aboriginal and Torres Strait Islander communities.

The farm never developed beyond a small scale, experimental operation. It faced difficulties due to lack of finance, a scarcity of *C. porosus* nests in the wild from which eggs and hatchlings could be

harvested and inadequate food supplies. After Applied Ecology Pty Ltd was disbanded in 1981, the farming operation was eventually discontinued by the Kalumburu Mission in 1983.

The history of the Kalumburu farm in relation to *C. porosus* stocks is summarised below:

(i) 10 crocodiles were taken from the wild in 1973/74, of which one was released in 1974 and four in 1976;

(ii) 118 hatchlings were successfully hatched from 207 eggs taken from the wild (67 from two nests in the Drysdale area (Laininge Creek) in 1975; 94 from two nests in the Drysdale area (Laininge Creek) in 1976; and 46 eggs from one nest in Admiralty Gulf in 1977);

(iii) 14 hatchlings were collected from one nest in Monger Creek in 1976;

(iv) following losses due largely to suspected disease and predation, 56 crocodiles remained alive early in 1978;

(v) following further losses, 11 of the remaining 13 animals were transferred to the Broome Crocodile Park in 1983, which was then being established (one of these died in transit);

(vi) the two remaining crocodiles, which had been considered too weak to be transported to Broome in 1983, survived and were released into the wild in 1988.

### *3.4.3 Broome, Wyndham and Fremantle Crocodile Farms, post 1983*

There were three licensed crocodile farms in Western Australia operating between 1983 and 1998:

- the Broome Crocodile Farm, which began acquiring crocodiles in 1983, opened to the public as a display park in 1985, and subsequently obtained Government approval, in August 1990, to become licensed as a farm;
- the Wyndham Crocodile Farm, which in January 1989 obtained Government approval for its establishment as a farm, and began acquiring crocodiles that year;
- the Fremantle Crocodile Farm, which began acquiring crocodiles in 1989, opened to the public as a display park in that year, and subsequently obtained Government approval, in August 1990, to become licensed as a farm.

The Fremantle Crocodile Farm closed in February 1998. Stock from this farm was either processed or transferred to the Wyndham Crocodile Farm.

Detailed information on the controls applying to the taking of crocodiles from the wild for farming purposes is given in Sections 4 and 5 of this management program. Stock acquisitions by the three farms have involved collections from the wild in Western Australia for breeding, ranching and 'problem' crocodile control purposes and also imports from licensed sources in the Northern Territory and Queensland. These acquisitions have been detailed in previous management programs, for both *C. porosus* and *C. johnstoni*. Collections of *C. porosus* from the wild in Western Australia are summarised according to their location of capture in Table 6, which shows that collections have been predominantly from the Cambridge Gulf system (see also Figure 2 and Section 4.3), with smaller numbers of 'problem' crocodiles taken from other locations (see Section 4.4).

It is noteworthy that despite the removal to farms of 258 non-hatchling C. porosus from the Cambridge Gulf river systems between the 1986 and 1997 surveys, as well as an egg/hatchling harvest in the King River and the losses through drowning and shooting referred to in Section 3.3.3, the populations in both the West Arm river systems and the East Arm/Ord River were about the same size (if not larger) in 1997 as they were in 1986 (see Table 2). This indicates resilience within the Cambridge Gulf population to recent harvest levels.

Table 7 gives details of all crocodiles processed in Western Australia under licence between 1 January 1991, when trial processing commenced, and 31 August 1995.

**TABLE 6: Collections of *C. porosus* from the wild in Western Australia, by location of capture (including "problem" animals and farm stock acquisition captures).**

| | Location of Capture | | | | |
|---|---|---|---|---|---|
| | Cambridge Gulf system | | | Elsewhere (King Sound) | Total |
| | East Arm/ Ord River | West Arm | Total | | |
| **Non-hatchlings** | | | | | |
| 1983 - 1985 | 8 | 0 | 8 | 6 | 14 |
| 1986 - 1988 | 6 | 0 | 6 | 7 | 13 |
| 1989 - 7/92 | 34 | 81 | 115 | 18 | 133 |
| 8/92 - 6/93 | 50 | 38 | 88 | 6 | 94 |
| 7/93 - 6/94 | 12 | 2 | 14 | 0 | 14 |
| 7/94 - 6/95 | 8 | 4 | 12 | 15 | 27 |
| 7/95 - 6/96 | 14 | 1 | 15 | 2 | 17 |
| 7/96 - 6/97 | 7 | 1 | 8 | 0 | 8 |
| **TOTAL** | **139** | **127** | **266** | **54** | **320** |
| **Viable eggs/hatchlings** | | | | | |
| 1983 - 1985 | 0 | 0 | 0 | 0 | 0 |
| 1986 - 1988 | 0 | 0 | 0 | 30 | 30 |
| 1989 - 1992 | 0 | 268(a) | 268 | 0 | 268 |
| 1993 | 0 | 0 | 0 | 0 | 0 |
| 1/94 – 6/95 | 0 | 6 | 6 | 0 | 6 |
| 1995/1996 | 0 | 19 | 19 | 0 | 19 |
| 1996/997 | 0 | 20 | 20 | 0 | 20 |
| 1997 | 0 | 20 | 20 | 0 | 20 |
| **TOTAL** | 0 | **333** | **333** | **30** | **363** |

(a): taken from the King River.

**TABLE 7: Crocodiles processed under licence in Western Australia 1991 to 30 June 1998**

| Year | *C. porosus* | *C. johnstoni* |
|---|---|---|
| 1991 | 70 | 11 |
| 1992 | 90 | 21 |
| 1993 | 89 | 167 |
| 1994 | 158 | 517 |
| 1995 | 426 | 60 |
| 1996 | 807 | 231 |
| 1997 | 191 | 173 |
| 1998* | 349 | 216 |
| **TOTAL** | **2180** | **1396** |

(Note * until 30 June 1998)

During 1994 a trial harvest of *C. johnstoni* from Lake Argyle was undertaken. A total of 83 *C. johnstoni* were taken during this trial. The trial was repeated in 1997, with a further 132 crocodiles harvested and processed.

Successful captive breeding of *C. porosus* has occurred on all three farms and *C. johnstoni* has been bred at the Broome and Wyndham farms. During 1994, 639 *C. porosus* were bred in captivity, with a further 746 in 1995.

There have also been authorised transfers of stock between the three farms in Western Australia. Total stock levels on the two operating farms as at 30 June 1998 are presented in Table 8.

### *3.4.4 Trial Direct Harvests of Freshwater Crocodiles from Lake Argyle.*

In 1994 and 1997 approval was given for the Wyndham Crocodile Farm to undertake trial direct harvests of freshwater crocodiles from Lake Argyle. This lake is an artificial impoundment created by the Argyle Dam on the upper Ord River. Surveys of Lake Argyle have demonstrated over the years that there is a very large population of Freshwater Crocodiles in the lake (see Section 3.2). The 1989 boat spotlight surveys yielded non-hatchling population estimates of 25,000 in Lake Argyle (G Webb Pty Ltd 1989d). While this figure may be a high estimate, subsequent boat spotlight and helicopter surveys (Table 6) have shown the artificial population in the lake to be very high, in the order of 10,000, or higher.

Given the high local population it was determined that a direct harvest of Freshwater crocodiles for meat may be commercially viable and would certainly be of no conservation risk to the species. Initial approval was given for a harvest of up to 100 Freshwater Crocodiles. In 1997 approval was given for a total trial harvest of up to 1,000 Freshwater Crocodiles (around 10% of the non-hatchling population). During 1997, a total of only 132 Freshwater Crocodiles were directly harvested for processing by Wyndham Crocodile Farm.

Provided future monitoring demonstrates a resilience in the Lake Argyle Freshwater Crocodile population to permitted harvests, future conservative direct harvests from Lake Argyle may be permitted.

**TABLE 8: Stock levels on Western Australia's two licensed crocodile farms as at 30 June 1998**

| Species and size-classes | Broome | Wyndham | TOTAL |
|---|---|---|---|
| *C. porosus* | | | |
| hatchlings (<0.4m) | 869 | 1051 | 1920 |
| juveniles (0.4 - 2.2m) | 3025 | 1700 | 4725 |
| adults (>2.2m) | 191 | 62 | 253 |
| **TOTAL** | **4085** | **2813** | **6898** |
| *C. johnstoni* | | | |
| hatchlings (<0.3m) | 0 | 0 | 0 |
| juveniles (0.3 - 1.5m) | 7 | 842 | 849 |
| adults (>1.5m) | 13 | 105 | 118 |
| **TOTAL** | **20** | **947** | **967** |

## 4. IMPLEMENTATION OF CROCODILE MANAGEMENT IN WESTERN AUSTRALIA

### 4.1 Introduction

As indicated in Section 2, CALM's policy statement on crocodiles (Appendix A) contains a detailed statement of objectives and policies, and lists strategies for achieving them. The four main aims of the Western Australian crocodile management program were identified in Section 2. The strategies for achieving those aims are listed below:

(1) *"Maintain viable wild populations of crocodiles and conserve the habitats on which they depend";*

and

(2) *"Facilitate the recovery of C. porosus populations which have been depleted by past hunting";*

are to be achieved through:

- the establishment and maintenance of a conservation reserve system where crocodiles and their habitats are totally protected;
- the legal protection of crocodiles throughout their natural range, with taking from the wild subject to licensing and restrictions on location and extent;
- ongoing monitoring of crocodile populations and harvests; and
- re-establishment or replenishment of wild populations from farm-raised stocks, if required.

(3) *"Provide for public safety by maintaining public awareness and removing "problem" crocodiles",*

is to be achieved through:

- a public education and awareness campaign designed to encourage public support for the conservation of crocodiles, while at the same time informing people of the potential dangers posed by *C. porosus*, and promoting safe behaviour in crocodile habitats; and
- problem crocodile control involving removal of crocodiles where they pose a public threat.

(4) *"Provide for the commercial utilisation of crocodiles through controlled farming and harvesting",*

is to be achieved through:

- captive breeding on licensed farms;
- regulated sustainable harvesting of animals from wild populations, under licence;
- regulation and supervision of farming and trade; and
- monitoring and assessment of harvested populations.

With respect to (4) above, and as indicated in the policy statement at Appendix A, a key element of CALM's approach in this management program is to build and maintain broad community support for the protection of crocodiles and their habitats, in part by providing for the harvesting of wild crocodiles and thus conferring commercial value on crocodiles and their habitats.

The range of procedures identified in this management program ensure the conservation of crocodiles and provide control over their taking, in conformity with the *Wildlife Conservation Act 1950*, the *Wildlife Protection (Regulation of Exports and Imports) Act 1982* and CITES. In particular, as required by the Wildlife Protection (Regulation of Exports and Imports) Regulations, these procedures ensure that the taking from the wild, under the management program, of crocodiles will not be detrimental to the survival of either crocodile species, that it will be carried out at minimal risk to the continuing role of the species in the ecosystems in which they occur and so as to maintain each species in a manner that is not likely to cause irreversible changes to, or long-term deleterious effects on, the species or their habitats.

## 4.2 The Conservation Reserve System

Conservation reserves provide secure areas where crocodiles and their habitats are totally protected. Existing Western Australian conservation reserves inhabited by crocodiles, or where the immediately adjacent waters are inhabited by crocodiles, are listed in Table 9 and shown in Figure 4.

The identification and declaration of conservation reserves is continuing. CALM has proposed a number of additional conservation reserves that include crocodile habitat (Burbidge *et al.* 1991, and Appendix A).

Other major land tenures in the Kimberley region include Aboriginal lands, pastoral leases and vacant Crown land. Much coastal and near-coastal land in the Kimberley is included in Aboriginal reserves, and in these areas land-use activities are not likely to be significantly detrimental to crocodile conservation.

**TABLE 9: Existing Western Australian conservation reserves where crocodiles occur**

| Conservation Reserve | Area (ha) | *C. porosus* | *C. johnstoni* |
|---|---|---|---|
| Prince Regent Nature Reserve | 634,952 | Present | Present |
| Geikie Gorge National Park and Conservation Park | 8,468 | Absent | Present |
| Drysdale River National Park | 448,264 | Absent | Present |
| Ord River Nature Reserve | 79,842 | Present | Present(*) |
| Parry Lagoons Nature Reserve | 36,111 | Present | Present |
| Purnululu (Bungle Bungle) NP/CP | 319,325 | Absent | Present |
| Windjana Gorge National Park | 2,134 | Absent | Present |
| Coulomb Point Nature Reserve | 28,676 | Present(*) | Absent |
| Brooking Gorge CP | 7,967 | Absent | Present |
| Tunnel Creek NP/Devonian Reef CP | 41,462 | Absent | Present |

(*): indicates that the species occasionally occurs in the reserve.

## 4.3 Crocodile Farming

### *4.3.1 Introduction*

Many more crocodile eggs are laid in the wild than survive to hatching and in turn few hatchlings survive to adulthood, as indicated in Table 10.

Egg and hatchling survivorship can be much greater in captivity, so that collection of a limited number of eggs and hatchlings for captive raising can produce a net increase in the total survivorship of crocodiles (wild and captive combined). In turn, farms can be required to return some stock to the wild after partial raising, should this be required for conservation. Commercial use of crocodiles in Western Australia is based on both captive breeding and harvesting animals from the wild.

**TABLE 10: Estimates of mortality rates in wild populations of *C. porosus* in Northern Territory tidal rivers and the McKinlay River (NT) population of *C. johnstoni* (from Webb 1989).**

| Period | Saltwater Crocodiles | | Freshwater Crocodiles | |
|---|---|---|---|---|
| | Unit | Cumulative | Unit | Cumulative |
| Eggs laid to hatchlings | 75% | 75.0% | 70% | 70.0% |
| Hatchlings to 1 year | 46% | 86.5% | 88% | 96.4% |
| 1 to 2 years | 70% | 96.0% | 15% | 96.9% |
| 2 to 3 years | 40% | 97.6% | 15% | 97.4% |
| 3 to 4 years | 44% | 98.6% | 15% | 97.7% |
| 4 to 5 years | 44% | 99.2% | 15% | 98.1% |

### *4.3.2 Wild Harvest Limits - General*

Harvest limits for both species, timing of harvests and areas from which crocodiles may be harvested will be determined by CALM. Harvest limits will be set taking into account:

- current trends in population size and structure;
- seasonal effects on breeding, recruitment and survivorship;
- management objectives for specific areas;
- proportion of the total habitat subject to harvesting;
- review of previous harvests; and
- review of research information.

Commercial harvesting will not be permitted from national parks or nature reserves (other than special crocodile conservation reserves) or areas of waterways immediately adjacent to national parks or nature reserves (such areas will be designated as non-harvest areas), however problem crocodiles may be removed from these areas according to CALM policy (see Appendix A) and provided to farms. Scientific research harvests from conservation reserve areas may also be permitted. Harvesting may be permitted from any conservation reserves established specifically for crocodile management purposes.

It has been a requirement since 1 July 1993 that all stock taken from the wild, other than eggs/ hatchlings, be marked individually by scute clipping. Wild harvest limits for both species will be set, based on the considerations detailed in the following sections.

### *4.3.3 Wild Harvest Limits - Saltwater Crocodiles*

a) Adults and Juveniles

The harvest of limited numbers of adult and juvenile *C. porosus* may be permitted for farming purposes. In addition, problem crocodiles removed from the wild according to this program and the policy detailed in Appendix A, may be provided to farms. Details of crocodiles captured and taken to farms are provided in Table 6.

CALM's approach to problem crocodiles is detailed in the policy statement at Appendix A. Whenever practical they will be caught alive and taken to crocodile farms. They may also be taken to crocodile display parks in Western Australia, should any such parks be established during the term of this management program. In those very rare situations where live capture and transport are impractical, problem crocodiles may be killed and, where practicable, products may be salvaged from such killed animals.

b) Eggs and Hatchlings

Harvests of eggs and hatchlings may be permitted. These harvests will be reduced or discontinued if monitoring indicates that they have an unacceptable impact on *C. porosus* populations.

As a condition of licence, CALM will reserve the right to require farms to make available a proportion of the eggs and hatchlings collected, after they have been raised to a specified length, to restock the harvested population, should monitoring indicate this to be warranted.

c) Harvest Areas

Harvest areas are determined in the light of information on the status of *C. porosus* populations.

While harvest areas will be subject to review in the light of information obtained during the term of this management program, *C. porosus* harvests will be concentrated in the Cambridge Gulf system (including the East Arm/Ord River system and the West Arm and its associated rivers). Within that general area, no adult harvest (apart from the removal of problem crocodiles) will be permitted from Nature Reserves, National Parks, Conservation Parks or other conservation reserves, except those that may be specially created for crocodile management (see Figure 2).

In addition small numbers of crocodiles, mostly problem crocodiles, may be taken from the King Sound region for farming purposes.

The rationale for this selection of harvest areas is that:

- the Cambridge Gulf System contains a large *C. porosus* population relative to other river systems in Western Australia (Messel *et al.* 1987), is accessible for harvest operations and population monitoring surveys, and is an area for which adequate baseline population data exist;
- in the remainder of the coastal Kimberley region:
  - the largest *C. porosus* populations are in existing and proposed conservation reserves;

- the *C. porosus* populations in other river systems where harvesting potentially could be permitted are generally not large enough to support regular harvests, particularly of eggs and hatchlings as nesting habitat and levels are very limited;
- much of the region is extremely rugged and access is difficult, thus harvesting and associated population monitoring would be very expensive;

- the King Sound region:
  - is at the extremity of the main part of the range of *C. porosus* in Western Australia;
  - appears to be marginal habitat supporting a relatively small *C. porosus* population and little or no breeding activity, and is considered to be of little importance in relation to the overall conservation status of *C. porosus* in Western Australia;
  - is accessible for harvest operations and population monitoring surveys;
  - is an area for which adequate baseline population data exist;
- most instances of problem *C. porosus* in Western Australia occur in the Cambridge Gulf system and the King Sound region, and harvesting in such areas assists in meeting the public safety objectives of this management program.

Should other areas in the Kimberley be identified for possible harvesting to supplement breeding stock for farms, these will be investigated and population estimation surveys will be conducted prior to any trial harvest. No subsequent harvests will be permitted from these areas unless post-harvest monitoring demonstrates that previous harvests have had no significant impact on local crocodile populations, or that local populations have fully recovered from any short-term harvest impacts.

### *4.3.4 Wild Harvest Limits - Freshwater Crocodiles*

a) Adults and Juveniles

The harvest of limited numbers of adult and juvenile *C. johnstoni* may be permitted for farming purposes.

b) Eggs and Hatchlings

Harvests of eggs and hatchlings may be permitted. These harvests will be reduced or discontinued if monitoring indicates that they have an unacceptable impact on *C. johnstoni* populations.

As a condition of licence, CALM will reserve the right to require farms to make available a proportion of the eggs and hatchlings collected, after they have been raised to a specified length, to restock the harvested population, should monitoring indicate this to be warranted.

c) Harvest Areas

Harvest areas will be determined in the light of information on the status of *C. johnstoni* populations.

The largest single *C. johnstoni* population is in Lake Argyle (see Figure 2). Surveys have shown that other areas (namely the Fitzroy River system and Lake Kununurra) also support abundant *C. johnstoni* populations that could be harvested. Nevertheless, it is likely that harvests will be concentrated in Lake Argyle, because it has a very large population and because such an approach will minimise the number of populations for which population monitoring will be required in

association with harvesting operations. Harvesting of other populations for which there is adequate information on abundance may be permitted.

### 4.4 Problem Crocodile Control

In keeping with the requirements for public safety and the policy statement at Appendix A, CALM will continue to implement a program of problem crocodile control. This will involve the removal of crocodiles as determined by CALM on a case by case basis. While all crocodiles taken from the vicinity of human populated areas provide some assistance in reducing the threat of crocodile attacks, specific action to remove crocodiles from high human use areas is required as an ongoing management control. It has been a requirement since 1 July 1993 that all problem crocodiles captured are marked individually by scute clipping. Problem crocodiles provided to farms may be used as breeding stock, or slaughtered.

### 4.5 Public Education and Awareness

CALM will continue to implement a program of public education and awareness directed towards both residents and tourists, with emphasis on the importance of, and reasons for, crocodile conservation, and on safety in areas inhabited by crocodiles. Strategies are detailed in the policy statement at Appendix A.

### 4.6 Other Conservation Measures

CALM will seek to identify whether there are areas where crocodile populations are being adversely affected by such factors as drowning in fishing nets or by introduced animals causing habitat damage. Remedial action will be pursued where necessary in consultation with the relevant authorities and land managers.

### 4.7. Harvesting of Crocodiles by Aboriginals

Provisions of the *Wildlife Conservation Act 1950* in relation to the taking of crocodiles by Aboriginals for food are detailed in the policy statement at Appendix A. Harvesting by Aboriginals for food will be provided for in accordance with the Act and Government policy.

## 5. REGULATION, SUPERVISION AND MONITORING OF CROCODILE FARMING AND TRADE

### 5.1 Introduction

In keeping with State, national and international requirements, crocodile collection, farming, processing and trade are regulated by a system of licences, keeping of records, submission of regular returns, and identification procedures (skin tagging and product marking or labelling) enforced under the *Wildlife Conservation Act 1950*.

The procedures outlined in Sections 5.2 to 5.5 are those that will be in place during the term of this management program. These procedures will, however, be subject to review and modified as required. The Commonwealth Government agency, which administers the *Wildlife Protection (Regulation of Exports and Imports) Act 1982*, will be advised of proposed changes.

## 5.2 Crocodile Farming

Persons farming crocodiles must be licensed under the *Wildlife Conservation Act 1950*. Licensed crocodile farmers must keep detailed records of stock levels (categorised as hatchlings, raising stock/juveniles and adults), additions, losses and breeding activity. Farmers are required to submit regular returns containing this information, on forms supplied by CALM. They are also required to maintain farms at an appropriate animal welfare and public safety standard and to permit access at any time for CALM staff to inspect farms and records.

## 5.3 Stocking of Farms

All collection of crocodiles from the wild is governed by licences to take fauna. These licences specify the locations and timing for collection, as well as numbers, sex and age/size classes to be collected. Collection operations are supervised by CALM staff or subject to CALM verification, as appropriate. Farm stock additions are recorded on the farms' regular stock reports for submission to CALM.

## 5.4 Processing and Tagging

Processing activities are licensed to provide control over the crocodiles processed and the products produced and to facilitate tracking of products through trade. Processing operations are controlled as follows:

(i) Approval is obtained from CALM for the maximum number of crocodiles to be slaughtered and processed.

(ii) CALM provides a quantity of non-reusable skin tags which comply with CITES requirements, equivalent to the number of crocodiles approved to be slaughtered and processed.

(iii) The skin tags are uniquely numbered, species specific and give the year of processing.

(iv) A skin tag is attached to the skin of the tail of each crocodile at slaughter, whether it is for export overseas or domestic use in Australia. The unique tag number is the basis for identification and record keeping for skin and flesh products from each crocodile.

(v) Records are taken of the sex, weight, age, length, date of slaughter and origin of each slaughtered crocodile and entered against the tag number on the record form provided by CALM.

(vi) Records of slaughtered stock and packaging of skins, meat and other products are submitted to CALM on a regular basis.

(vii) Export of crocodile products internationally is regulated by the Commonwealth Government.

### 5.5 Marking and Trade in Products

Crocodile flesh is sold packaged in a manner approved by CALM and traceable to skin tag numbers.

Skins sold as whole skins have the tags attached. Manufactured skin products are marked (labelled) in a manner approved by CALM to identify that they have been legally sourced from licensed farms. Other byproducts and parts and derivatives from slaughtered crocodiles, such as teeth and bones, are also accountable to farms through the system of record keeping and submission of returns.

Processors are required to keep records of sales of crocodile flesh and skins, identifying the source crocodile, purchaser and date of sale. Manufacturers of skin products must be licensed and are required to possess only skins and products obtained legitimately from a crocodile farming operation. Processors and manufacturers are required to account for and correlate the quantity of products manufactured with the number and source of crocodiles obtained.

The transfer of commercial consignments of crocodile flesh, skins and products to or from other Australian States and Territories is subject to approval and licensing by CALM. Non-commercial or 'personal effects' trade in manufactured crocodile products is subject to the use of a product marking (labelling) system approved by CALM.

The export of commercial quantities of crocodile products and parts out of Australia requires the approval of the Designated Authority under the *Wildlife Protection (Regulation of Exports and Imports) Act 1982*, in addition to a licence from CALM.

The Designated Authority will be kept informed of the labelling and packaging requirements for crocodile products approved by CALM, as required.

### 5.6 Regulation and Monitoring of Farming and Trade

The system of licence controls and required stock, production and trade records and reports provide bases for monitoring crocodile farming and trade. Data are obtained on collections from the wild, captive raising, captive breeding, slaughter, processing and trade in crocodile products. These data provide a means for detection of any discrepancies between the various reports lodged with CALM. In addition, field and farm inspections are undertaken by CALM officers to verify that records and returns are accurately documented. Trade transactions and the activities of manufacturers and crocodile product distributors will also be monitored by CALM.

Any discrepancies detected by the above methods will be investigated and acted upon as considered appropriate. In addition to the possibility of prosecution action, the *Wildlife Conservation Act 1950* provides for the cancellation of licences and for the variation of licence conditions.

## 6. POPULATION MONITORING AND ASSESSMENT

As the principal aim of this management program is to maintain viable populations of both crocodile species in the wild, the principal monitoring requirement is an ability to detect any serious decline in wild populations in sufficient time to effect remedial action. The monitoring program proposed will meet this objective and will also provide information on rates of change in population size and structure in harvest areas. This monitoring will therefore provide an objective basis for ongoing review of harvest levels and locations.

Harvested populations in the Cambridge Gulf area, as outlined in Section 4.3 will be quite restricted in relation to the overall distribution of the two species in the Kimberley region, and will be monitored annually by standard boat spotlight and/or helicopter surveys. Comparisons of boat spotlight and helicopter surveys in order to provide standard abundance indices were concluded in 1994 (Wildlife Management International 1994(b).

In addition, CALM will seek to ensure that the total Kimberley-wide *C. porosus* population (i.e. covering unharvested as well as harvested areas) is surveyed periodically. This is considered desirable regardless of commercial harvesting, but will be subject to the availability of resources because of the high costs involved.

Should monitoring indicate that the population management aims are not being met, the following management adjustments can be made:

- if surveys indicate that populations are declining in harvest areas, the age class structure of the harvest and/or the harvest limits can be altered or harvesting can be stopped;

- if population declines are detected in areas which have not been subject to harvesting, more intensive surveys and research programs can be conducted to determine the reasons for the decline;

- where necessary and appropriate, crocodiles raised from eggs or hatchlings taken from the wild can be reintroduced into specified locations.

Additional population monitoring on a localised scale is a key element of the problem crocodile control program. Specific surveys will be undertaken as required to assess the need for problem crocodile control.

## 7. RESEARCH

Considerable research has been conducted into the biology and status of *C. porosus* in northern Australia, particularly in the Northern Territory. Less research has been conducted on *C. johnstoni*.

This management program is based on the results of research and surveys. In particular there has been a considerable increase in knowledge about Western Australian crocodile populations through surveys conducted as a direct consequence of the Western Australian Government's 1988 decision to permit crocodile farming.

Additional information will be obtained through the operation of this management program and CALM will support and encourage further research directed towards crocodile conservation and management. The taking of limited numbers of crocodiles for scientific research may be permitted.

## 8. REPORTING ON THE MANAGEMENT PROGRAM

CALM will report periodically to the Commonwealth Government agency administering the *Wildlife Protection (Regulation of Exports and Imports) Act 1982* on the implementation of this management program, in compliance with CITES reporting requirements.

## 9. REVIEW OF THE MANAGEMENT PROGRAM

This management program will be reviewed as required by CALM in the light of the results of population monitoring, research and experience with implementation of the program. While this management program is intended to operate until 31 December 2003, changes may be warranted before then. In these circumstances CALM will liaise with the Commonwealth Government agency administering the *Wildlife Protection (Regulation of Exports and Imports) Act 1982*and others with an interest in, or affected by, such changes.

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TABLE B13. Numbers of *C. porosus* sighted during helicopter surveys of Cambridge Gulf in July 1996. SB= South bank, NB= North bank, etc. * indicate the monitoring zone.

| Area | Small (2-4') | Medium (4-7') | Large (7-11') | X-Large (>11') | Total | |
|---|---|---|---|---|---|---|
| Parrys Creek | - | 3 | 2 | 1 | 6 | * |
| King River | - | 4 | 3 | - | 7 | * |
| Pentecost River | - | - | - | 1 | 1 | * |
| Durack River | - | - | 2 | 1 | 3 | * |
| Forrest River | - | 1 | 1 | 2 | 4 | * |
| Patrick River | - | - | - | - | - | * |
| West Arm (EB 0-40 km) | - | 1 | 5 | 3 | 9 | * |
| West Arm (SB 40-62 km) | - | - | 1 | 1 | 2 | * |
| Ord River (EB 20-60 km) | - | 6 | 23 | 19 | 48 | * |
| Ord River (EB 60-80 km) | - | 1 | 9 | 9 | 19 | * |
| Ord River (EB 80-87.5 km) | - | 1 | - | 2 | 3 | |
| House Roof X'ing-Tararra Bar (EB) | - | - | 2 | 2 | 4 | |
| Ivanhoe X'ing-Bullock's X'ing (EB) | - | - | - | - | - | |
| Ivanhoe X'ing-Ford Beach (EB) | - | - | - | - | - | |
| Ford Beach-Diversion Dam (EB) | - | - | - | - | - | |
| Bullock's X'ing-Tarrara Bar (EB) | - | - | 1 | - | 1 | |
| House Roof X'ing-Tararra Bar (WB) | - | - | 2 | 6 | 8 | |
| Ivanhoe X'ing-Bullock's X'ing (WB) | - | - | 1 | - | 1 | |
| Ivanhoe X'ing-Ford Beach (WB) | - | - | - | - | - | |
| Ford Beach-Diversion Dam (WB) | - | - | - | - | - | |
| Bullock's X'ing-Tarrara Bar (WB) | - | - | - | 1 | 1 | |
| West Arm | - | 9 | 14 | 9 | 32 | |
| (%) | (0.0) | (28.1) | (43.8) | (28.1) | | |
| Ord River | - | 8 | 38 | 39 | 85 | |
| (%) | (0.0) | (9.4) | (44.7) | (45.9) | | |

FIGURE 1: NORTHERN WESTERN AUSTRALIA

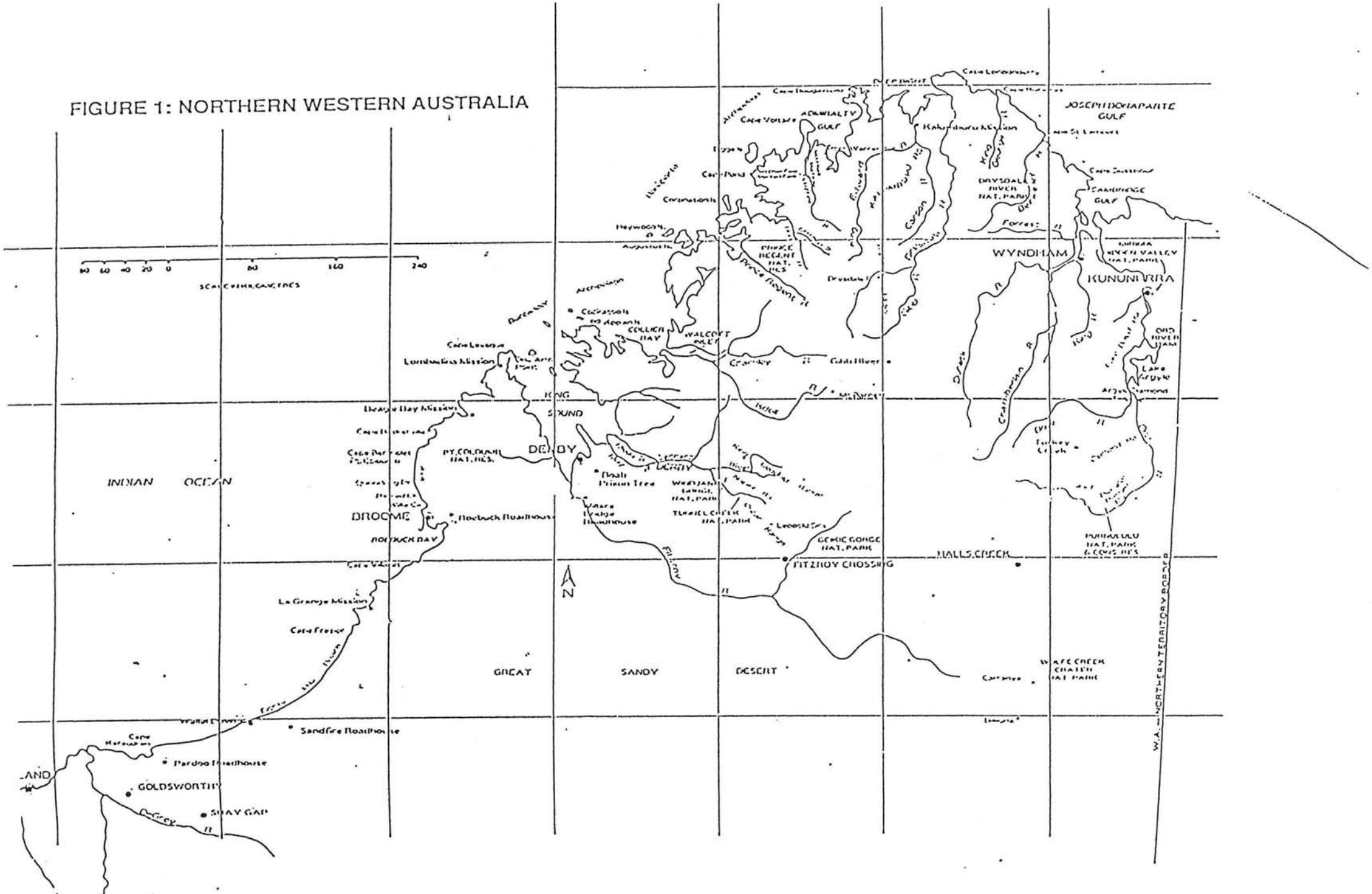
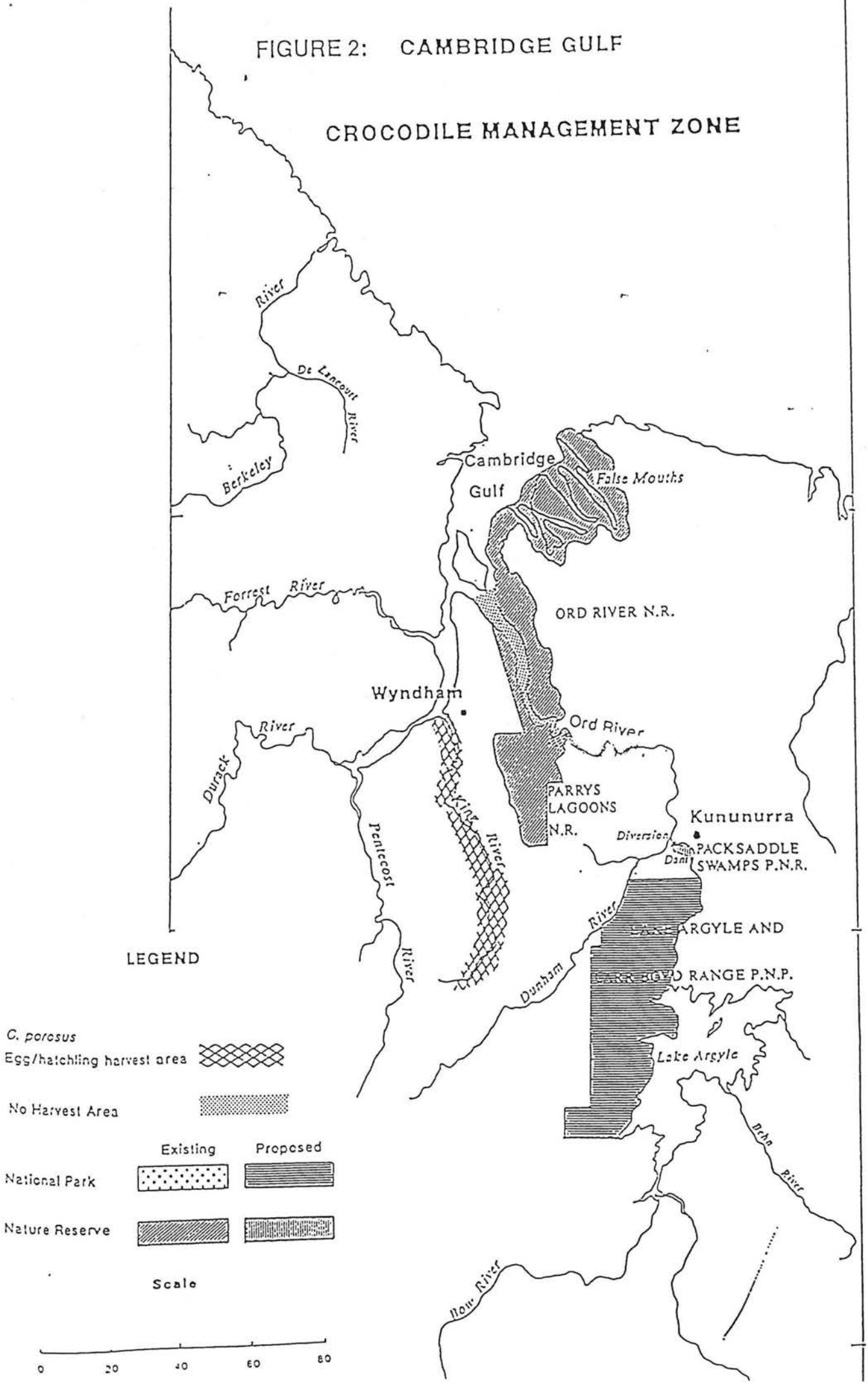
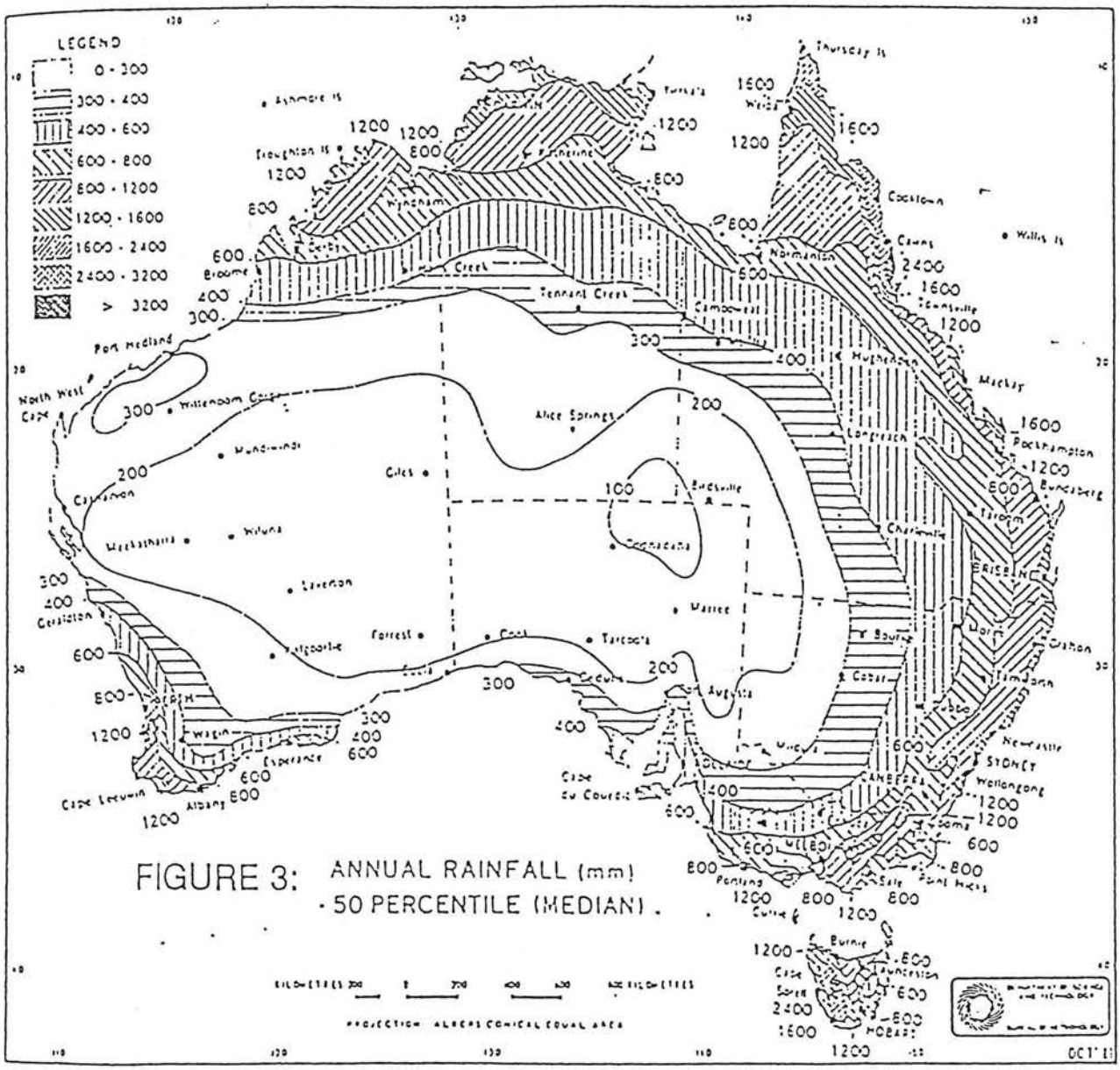


FIGURE 2: CAMBRIDGE GULF

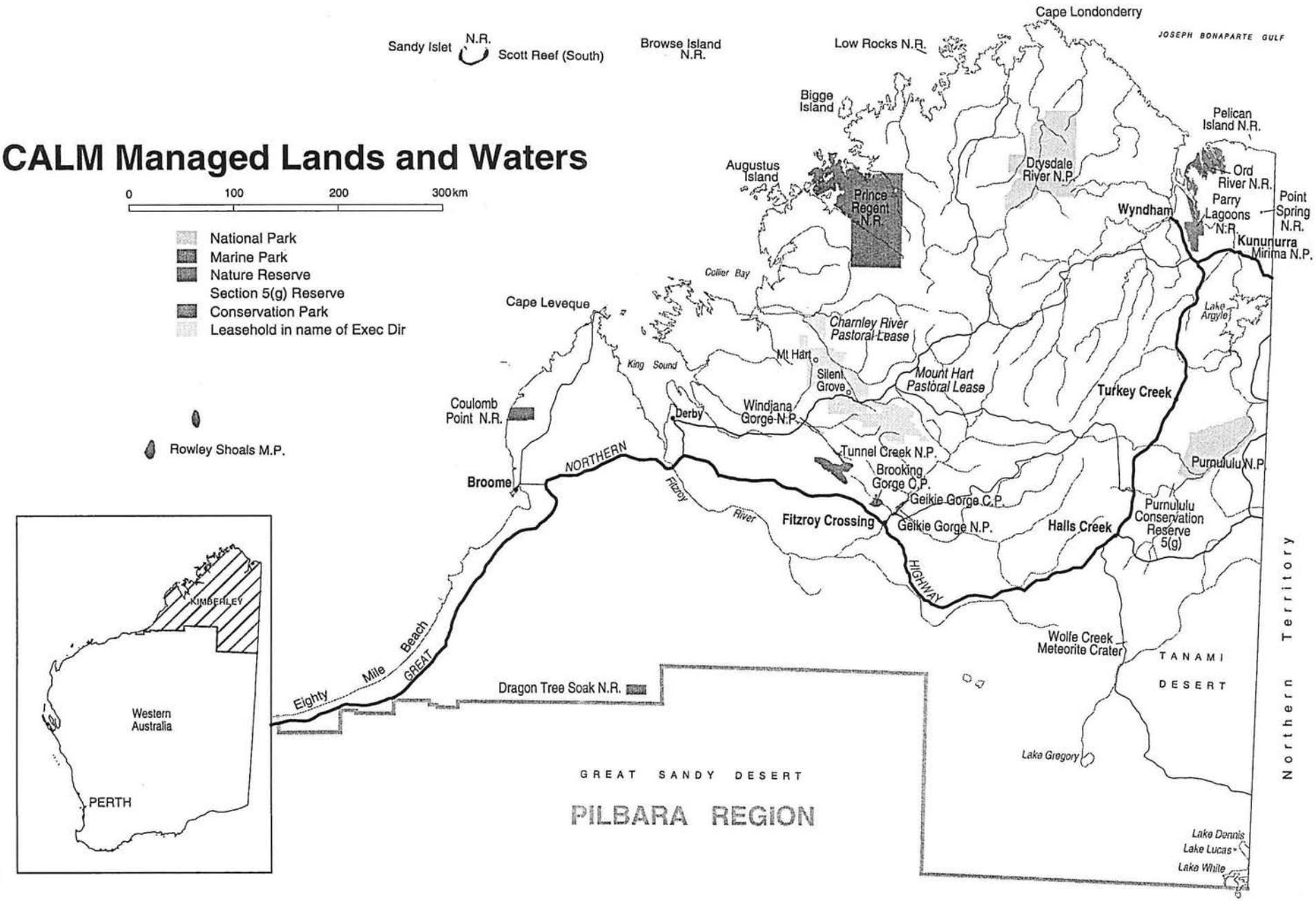
CROCODILE MANAGEMENT ZONE






(after Castles, I, 1988)

# CALM Managed Lands and Waters




Map 1

APPENDIX A

**Department of Conservation and Land Management**

**Policy Statement No. 24**

**'Conservation and Management of Crocodiles'**

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

POLICY STATEMENT NO. 24

# CONSERVATION AND MANAGEMENT OF CROCODILES

JUNE 1993

## 1. BACKGROUND

Both of the crocodile species which occur in Australia are found in the north of Western Australia. They are the Estuarine or Saltwater Crocodile *Crocodylus porosus* and the Freshwater or Johnston's River Crocodile *C. johnstoni*.

In Western Australia the Saltwater Crocodile is found from the Northern Territory border to the Broome area, and in recent years has been found in the vicinity of Port Hedland in the Pilbara region. It inhabits coastal rivers and swamps, often occurs in the open sea and around islands, and extends well inland via major rivers and floodplain billabongs into freshwater rivers, creeks and swamps. It is concentrated in the tidal portions of large rivers where mangroves are plentiful, however Saltwater Crocodiles may occur in any salt or fresh water within their known range. Furthermore, individuals have occasionally been recorded very long distances from areas in which they are normally found.

It has been estimated that approximately 25,000 Saltwater Crocodiles were harvested in Western Australia for the skin trade from 1946 until they were legally protected in April 1970. While the pre-harvest population size is unknown, the Saltwater Crocodile apparently suffered a decline in numbers throughout its range, including Western Australia, due to overharvesting. Surveys in 1977-78 resulted in the total Western Australian non-hatchling population being estimated to number about 2,000. The population was resurveyed in 1986 resulting in an estimated total population of 2,500 non-hatchlings. The proportion of large (>1.8m) Saltwater Crocodiles in the population increased from 20% in 1977-78 to 40% in 1986. Nesting habitat in Western Australia is limited in comparison with the Northern Territory.

Further surveys of Saltwater Crocodile populations and nesting activity in various parts of the Kimberley have been conducted in 1989 and subsequently, because of the commencement of crocodile farming in Western Australia.

Saltwater Crocodiles feed on crustaceans, fish, reptiles, birds and mammals, and are dangerous to humans. Courtship and mating begin in the late dry season, and nest construction and egg-laying (c.50 per nest) occur in the wet season. About 80% of mature females nest annually. The peak of hatching occurs around March in the Kimberley. Adult females typically remain close to the nest, and may actively defend it, throughout incubation (c. three months), and they excavate the nests when hatchlings begin calling from them. Subsequently creches are formed and the female may remain with the hatchlings for up to two months. Saltwater Crocodiles grow slowly, with males reaching maturity at about 3.4 metres total length and 16 years of age and females at about 2.3 metres and 12 years. They may live as long as about 70 years.

There is a high mortality of eggs due to flooding of nests, raiding of nests by predators, destruction of nests through trampling by introduced herbivores, and high temperatures. Furthermore, nesting habitat may be degraded by introduced herbivores. There is also a high mortality among hatchlings and sub-adults. The probability of a Saltwater Crocodile reaching adulthood has been estimated at less than 1%.

The Freshwater Crocodile is widespread in the Kimberley wherever there is suitable habitat. The area of most extensive habitat is considered to be the high rainfall north-west Kimberley, and it also extends well inland along the two largest river basins, the Ord and the Fitzroy. It generally inhabits the non-tidal freshwater reaches of rivers, and permanent lagoons and billabongs.

A market for Freshwater Crocodile skins was established in 1959 and commercial hunting followed, but the Freshwater Crocodile had been legally protected in Western Australia since 1958. Although no intensive legal hunting of Freshwater Crocodiles ever took place in Western Australia, there was significant poaching in accessible habitat during the 1960's and early 1970's, but populations in the north-west Kimberley were not affected by hunting because of the rugged, inaccessible nature of the country. There are no published estimates of the numbers killed in Western Australia for the skin trade.

Freshwater Crocodiles feed on fish, frogs, crustaceans, and small reptiles, birds and mammals. Nesting occurs towards the end of the dry season and about 13 eggs are laid, although clutch size varies, in sand or other friable substrates close to water. Incubation times vary between about 65 and 95 days, and there is a high mortality of eggs and hatchlings. Hatchlings congregate in creches, and adult females often remain with them. Females mature at about 12 years of age, and males at about 17 years.

There has not been a survey of the total Western Australian Freshwater Crocodile population, but it is considered to be common in suitable habitat. In particular, surveys conducted in 1989 because of the commencement of crocodile farming in Western Australia confirmed that it is abundant in Lake Argyle (population estimated at 25,000 non-hatchlings), Lake Kununurra (7,500) and in the Fitzroy River system (13,000 in 172km of the Fitzroy River and in some of its tributaries and Seventeen Mile or Camballin Dam). A 1992 survey yielded an estimate of more than 2,000 in the Ord River between the Diversion Dam and 90km downstream of the Dam.

Larger crocodiles of both species face threats from accidental drowning in fishing nets and illegal shooting.

Saltwater and Freshwater Crocodiles are protected under the Wildlife Conservation Act and may not be killed or taken from the wild, or kept in captivity, without a licence. Both are declared 'in need of special protection' pursuant to the Act.

Following the depletion of many crocodilian populations around the world as a result of uncontrolled hunting for the skin trade, international trade in their products was restricted through the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, an international treaty to which some 118 nations including Australia are now signatory) and through the domestic controls of various nations (e.g. the Australian Government banned exports in 1972). International trade in products of certain crocodilian species is now permitted subject to strict controls established under CITES.

Whether there can be "legal" (in terms of CITES) international trade varies according to the species or population of crocodilian concerned, i.e. whether it is on CITES Appendix I which essentially prohibits commercial trade unless specimens

are derived from animals bred in captivity, or Appendix II which permits commercial trade using animals taken from the wild, subject to controls. There has been considerable growth in the number of crocodile farms around the world, and in more recent years various ranching operations and trade in products derived from the culling of wild populations, for which quotas are set, have been sanctioned by CITES.

Ranching is defined as the rearing in a controlled environment of specimens taken from the wild, for the purposes of trade. In order to be eligible for CITES approval, the ranching scheme must be beneficial to the wild population and the products of it must be marked so that they may be distinguished from the products of other populations of the same species on Appendix I. In practice, ranching usually involves taking eggs or hatchlings from the wild and rearing them in captivity, resulting in both a higher level of survival than would normally occur in the wild, and a lesser impact on wild populations than would result from a harvest of adults or sub-adults. The Australian Saltwater Crocodile population was transferred from Appendix I to Appendix II of CITES in 1985 under a ranching scheme. The Freshwater Crocodile is listed on Appendix II of CITES under the family listing *Crocodylidae* spp.

In Australia crocodile farms have been established in the Northern Territory and Queensland for a number of years. Crocodile farming was also attempted in Western Australia in the 1970's but was not successful. In 1988, in response to interest being expressed in establishing a crocodile farming industry in Western Australia and following an analysis of data on crocodile populations in the State, the Western Australian Government decided to allow crocodile farming and three farms are now licensed. Products from crocodile farms include skins, meat and souvenir items. Farms can also operate as tourist attractions.

Export overseas of crocodile products must be in accordance with the Commonwealth Wildlife Protection (Regulation of Exports and Imports) Act 1982, which requires essentially that the products must be either from animals taken in accordance with a management program approved under the Act or from animals which are bred in captivity. The Regulations under that Act specify stringent requirements for approved management programs and breeding in captivity. The Northern Territory approach involves ranching and a management program approved by the Commonwealth Minister, whereas the Queensland approach is based on breeding in captivity.

A key element of the Department's approach is to build and maintain broad community support for the protection of wild crocodiles and their wetland habitats. To do this in the case of a dangerous animal such as the Saltwater Crocodile, one approach is to make it a valuable asset, both as a renewable resource and a tourist attraction. Through its adoption of the ranching approach the Northern Territory Government has deliberately sought to give wild Saltwater Crocodiles and their habitat commercial value by making them integral parts of crocodile farming and therefore enhancing their value to the community. The Western Australian Government has adopted the ranching approach to crocodile farming.

Because of the danger which Saltwater Crocodiles pose to humans, an active campaign of public education and awareness is essential. The need for such a campaign will increase because of the increasing human population inhabiting the Kimberley and increasing tourist visitation. The campaign needs to promote safe behaviour in crocodile habitat and to place the onus on people to behave responsibly. While Freshwater Crocodiles generally are not dangerous, there have been instances of injuries to people, and small children and pets may be at risk.

Zoning of Saltwater Crocodile habitat is also necessary. However, because of the Department's limited resources, the extent of Saltwater Crocodile habitat, the

relatively small number of towns and settlements involved, the consequent lack of need for widespread reduction or elimination of crocodiles and the desire to conserve Saltwater Crocodiles throughout as much of their range as possible, a policy of removal of all Saltwater Crocodiles will be pursued only in a few selected areas where effective control can be achieved. Provision will be made for the removal of "problem" crocodiles in other areas. However the Department will not use or promote the notion that any area within the range of the species can be guaranteed to be "crocodile-free", as this would create a false sense of security.

Section 23(1) of the Wildlife Conservation Act provides that Aboriginals may take fauna for food for themselves and their families, without needing a licence issued under the Act. This provision applies to Crown land or any other land, other than nature reserves, but where land is owned or occupied the consent of the owner or occupier is required. National parks and other lands managed by the Department are "occupied" lands for this purpose. However, by Wildlife Conservation Regulation 63, the operation of Section 23(1) of the Act has been indefinitely suspended in relation to crocodiles, because both species are declared to be in need of special protection. Therefore crocodiles may be taken legally only under licence. Crocodile eggs and meat are traditional foods for Aboriginal people.

Considerable research has been conducted into the biology and status of Saltwater Crocodiles in northern Australia, particularly in the Northern Territory. Less research has been conducted on Freshwater Crocodiles. There is a need for further research on crocodiles in Western Australia, with emphasis on population assessment and monitoring (i.e. distribution, abundance, recruitment and population structure), and management of crocodile populations and their interaction with human activities.

## 2. OBJECTIVE

To conserve crocodiles in the wild in Western Australia, while at the same time maintaining as high a level of public safety as possible, and to provide for the commercial farming of crocodiles.

## 3. POLICY

The Department will:

3.1 seek to maintain viable populations of crocodiles throughout appropriate areas of their natural range, and seek to maintain the estuarine and wetland habitats on which they depend;

3.2 seek to facilitate the recovery of Saltwater Crocodile populations which have been depleted by past harvesting, in appropriate areas;

3.3 seek to establish and maintain staff and resources in the Kimberley to implement this policy;

3.4 monitor crocodile distribution, abundance, recruitment and population structure;

3.5 monitor and act upon threats to crocodile populations;

3.6 maintain a high level of public awareness of crocodile conservation values, distribution, habits and dangers and educate people concerning safe behaviour in crocodile habitat;

3.7 within the limitations of staff and resources, react to the legitimate concerns of people about "problem" crocodiles;

3.8 establish and manage an adequate system of conservation reserves for crocodiles;

3.9 provide for the commercial farming of crocodiles in accordance with Government policy and subject to appropriate controls;

3.10 prohibit the commercial harvesting of wild crocodiles, other than as provided for in approved farming and ranching operations;

3.11 carry out, cause to be carried out or promote research on crocodiles as necessary.

## 4. STRATEGIES

To accomplish the Department's objective and policy, the following strategies will be implemented:

4.1 Subject to the provision of staff and resources by Government, the Department will seek to establish, equip, train and maintain staff in the Kimberley to implement Departmental policy and strategies.

4.2 The Department will seek to establish and manage a system of conservation reserves that protect adequate areas of crocodile habitat, including:

- Ord River Nature Reserve (including the False Mouths of the Ord), and the proposed marine nature reserve in the lower reaches of the Ord and waters adjacent to the False Mouths;
- Parry Lagoons Nature Reserve;
- proposed Packsaddle Swamps reserve;
- proposed Lake Argyle and Carr Boyd Range National Park;
- Drysdale River National Park;
- Prince Regent Nature Reserve and the proposed extension to it (proposed to become national park);
- proposed marine park in St George Basin;
- proposed marine park in Prince Frederick Harbour;
- proposed Walcott Inlet National Park and marine park;
- proposed Lawley River National Park and marine park;
- Purnululu (Bungle Bungle) National Park and conservation reserve;
- Geikie Gorge National Park;
- Windjana Gorge National Park;
- proposed Mt Hart National Park.

Details of most of these areas are provided in 'Nature Conservation Reserves in the Kimberley' (A.A. Burbidge, N.L. McKenzie and K.F. Kenneally. 1991. Department of CALM).

4.3 The Department will seek to identify priority areas for the application of specific conservation measures such as netting controls and protection of nesting habitat against damage by introduced animals.

4.4 Crocodiles will be completely protected on lands and waters managed by CALM, except in the case of problem crocodiles (see 4.7 below) and where permission is given either to Aboriginals to pursue traditional hunting activities or for the taking of crocodiles for scientific purposes. Crocodiles are also protected elsewhere and may be taken only with the appropriate licence.

4.5 Saltwater Crocodile habitat will be zoned as follows:

4.5.1 Crocodile Control Zones will be areas around selected centres of human population or activity. They will be areas where effective control is possible, taking into account the availability of staff and resources and the potential for reinvasion by Saltwater Crocodiles. The aim will be to remove all Saltwater Crocodiles, regardless of size, that enter the area. However a Crocodile Control Zone does not guarantee that an area is "crocodile-free" and therefore absolutely safe, but it seeks to significantly reduce the risk of attack.

The following areas will be zoned as Crocodile Control Zones:

- three areas in the Pilbara region:
  - Cape Keraudren to Point Poolingerina;
  - within 15km of Finucane Island and Port Hedland;
  - west and south-west of Cossack;
- Broome area, from Barred Creek (35km north of Broome) south to Fall Point (10km east of Broome) inclusive;
- Ord River, upstream of the Diversion Dam (i.e. including Lake Kununurra and Lake Argyle).

4.5.2 Crocodile Management Zones will be areas where Saltwater Crocodiles may be managed as a renewable resource through ranching. Crocodile Management Zones would normally include only private property or pastoral lease, but may be declared over Aboriginal reserves with the agreement of the relevant community. The Department will specify the numbers and age-classes which may be taken and the localities from which they may be taken.

A Crocodile Management Zone will be defined within the Cambridge Gulf and its associated river systems, but will not include existing or proposed conservation reserves.

4.5.3 Crocodile Protection Zones will be all areas not zoned as Crocodile Control Zones or Crocodile Management Zones and will include all national parks, nature reserves, marine parks and marine nature reserves.

4.6 Given that the objective in a Saltwater Crocodile Control Zone is the removal of any Saltwater Crocodile as soon as possible after its presence is known:

- within the limitations of staff and resources, CALM will investigate, as quickly as possible, reports of Saltwater Crocodiles in Crocodile Control Zones;

- whenever practical such animals will be caught alive and relocated to crocodile farms or crocodile parks (because of their homing tendencies, it is generally impractical to relocate these animals in the wild);

- however, because of the unacceptable risk to public safety in Crocodile Control Zones, CALM officers may destroy any Saltwater Crocodile in a Crocodile Control Zone whenever it is deemed necessary;

- whenever necessary, persons other than CALM officers may be authorised in writing to remove Saltwater Crocodiles from Crocodile Control Zones.

4.7 Within the limitations of staff and resources, the Department will implement and maintain an active program of removal of problem Saltwater Crocodiles. Problem animals are defined as animals within or near settled areas or areas of human use (e.g. for recreation) and which present a threat to humans, and animals which are attacking livestock. Decisions on problem animals will be made by the Department on a case by case basis, having regard to whether the risk associated with not removing the animal is acceptable so long as people behave in a responsible manner. Whenever practical such animals will be caught alive and relocated to crocodile farms or crocodile parks. In other cases they may be destroyed by CALM officers or by other persons authorised in writing by CALM. The decision to remove a problem animal will take account of where it occurs:

- in a Crocodile Control Zone all Saltwater Crocodiles are, by definition, problem animals and will be removed;

- in national parks and marine parks, where human use and recreation are provided for and encouraged, removal will normally be permitted only where human safety is endangered in areas of established recreational use;

- in nature reserves and marine nature reserves, which are declared primarily for nature conservation purposes, removal will be permitted only in very exceptional circumstances.

Within these criteria, particular emphasis will be given to problem Saltwater Crocodiles at Wyndham, Derby, Aboriginal settlements and popular recreational areas along the Ord and Fitzroy Rivers.

4.8 Any person (other than CALM officers) authorised to take problem Saltwater Crocodiles pursuant to 4.6 and 4.7 above will be required to do so in accordance with a Regulation 4 'Licence to Take Dangerous Fauna'. Wherever appropriate (e.g. where a licence is requested to cover short-term activities in a remote area), the licence conditions will require that scaring be attempted, rather than killing.

4.9 The Department will provide for the development and operation of a crocodile products industry in Western Australia in accordance with Government policy and the Wildlife Conservation Act, and based upon the following considerations:

- the Department will license operators in the industry to farm and process crocodiles and trade in their skins and other products;

- licensed operators will be subject to appropriate controls including the keeping of records, provision of returns, and tagging/marking of parts and products;

- farms will be encouraged to maximise captive breeding, in addition to which the ranching approach to crocodile farming will be adopted with respect to the harvesting of eggs and hatchlings from the wild, and harvesting of adult and juvenile crocodiles for farms may also be permitted;

- the ranching approach will be kept under review and the Department will recommend that it be discontinued if monitoring indicates that wild crocodile populations cannot sustain ongoing harvesting, particularly in the case of Saltwater Crocodiles given their relatively low population levels;

- all taking of crocodiles from the wild for farming will be subject to licences issued by the Department, stipulating numbers, age-classes and localities so that the conservation status of the two species is not jeopardized;

- overseas export of products will be in accordance with a crocodile management program approved by the Western Australian Minister responsible for the Wildlife Conservation Act and by the Commonwealth Minister responsible for the Wildlife Protection (Regulation of Exports and Imports) Act, and in accordance with CITES;

- once a management program is approved, all taking of crocodiles from the wild for farming will be in accordance with the management program;

- farms will be required to accept problem Saltwater Crocodiles as stipulated by the Department and subject to such conditions as the Department may impose with respect to use of the animals for breeding and their disposal, and subject to agreement with respect to payment of a fee or any costs incurred by the Department for capture and transport;

- it will be the responsibility of the industry to make a significant contribution to the costs of satisfying State, Commonwealth and CITES requirements (e.g. for ongoing monitoring) and appropriate licence fees and royalties will be imposed.

4.10 The Department will maintain an active, ongoing program of public education and awareness, directed towards both residents and tourists. Emphasis will be placed on the importance of and reasons for crocodile conservation. The Department will make use of a range of techniques and avenues which may include the following:

- literature (e.g. posters, brochures and drink coasters), videos (e.g. Northern Territory Conservation Commission documentary "Living with Crocodiles") and slide kits;

- media releases, feature articles, advertisements and announcements, directed towards Kimberley and State-wide media (newspapers, newsletters, tourism publications, radio and television), at appropriate intervals and particularly at the onset of the Saltwater Crocodile breeding season and the Kimberley tourism season;

- warning signs at sites frequented by people within Saltwater Crocodile habitat (e.g. boat ramps, river crossings, camping grounds) and sale of warning sign replicas as souvenirs;

- literature and signs at appropriate outlets (e.g. CALM offices, National Park Ranger stations, Shire and Police offices, crocodile farms and parks, tourist centres and information bays, roadhouses, tour operators, hotels and motels, fishing charters, air charters, airports and air ticket sales outlets);

- talks to school, service club, community and tour groups;

- displays at town and agricultural shows.

4.11 The Department will implement procedures for dealing with fatal and non-fatal attacks on humans, pets and livestock, and will maintain records of all attacks and other incidents.

4.12 The establishment of crocodile parks will not be encouraged in an area where there is already a farm that is open to the public. The distinction between a crocodile farm and crocodile park is that the former raises crocodiles for the skin and meat trade and may be open to the public, while the latter is a wildlife park specialising in the display of crocodiles to the public but it does not raise crocodiles for their commercial products.

4.13 The keeping of crocodiles in private or hobby collections is inappropriate (e.g. because of the potential dangers and animal welfare considerations) and no licences will be issued.

4.14 The Department will liaise with Commonwealth, State and Northern Territory wildlife authorities, local government and other relevant authorities and groups on appropriate matters including research and monitoring, commercial utilisation, enforcement and joint strategies for public information and education.

4.15 The Department will encourage the promotion of crocodiles in their natural habitat as a tourist attraction, provided that safe behaviour is observed.

Syd Shea
EXECUTIVE DIRECTOR

17 June 1993

Distribution:

Lists A,B,D,E and L