

The Djelk Ranger Program: An Outsider's Perspective

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June 2005

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FOREWORD

In May 2003 Michelle Cochrane visited the Maningrida area for ten days, to study the Djelk Ranger program that is operating as an arm of the Bawinanga Aboriginal Corporation (BAC). This research trip was organised in the context of joint research on cooperative wildlife management and sustainable development options on Aboriginal land that Michelle and I were undertaking at that time. It was also intended as a professional development opportunity for Michelle, who had not previously visited Arnhem Land. Michelle was able to collaborate with several different groups of Rangers to visit several sustainable wildlife harvesting trial sites.

Publication of this report has been delayed a little, for not long after completing a draft Michelle moved to work on a secondment with the Aboriginal Rainforest Council in Cairns. Subsequently, Michelle resigned her post at CAEPR and is now working on a longer-term basis with the Aboriginal Rainforest Council. Importantly, while in Cairns, she has assisted in the development of the Wet Tropics Aboriginal Cultural and Natural Resource Management Plan released in April 2005.

Michelle's working paper presented here provides a snapshot of the Djelk Ranger Program at May 2003. While this is some two years ago, it is nevertheless an important record of the diversity of activity undertaken by the program. It should be noted that this research is part of long-term research that has been undertaken in the Maningrida region since 1979 and this particular report reflects a period when CAEPR was collaborating actively with the then ARC Key Centre for Tropical Wildlife Management (KCTWM) at Charles Darwin University, Darwin. In particular, at the same time Michelle and I had co-authored *CAEPR Discussion Paper No. 247 'Innovative institutional design for sustainable wildlife management in the Indigenous-owned savanna'*, which argued for an approach to sustainable natural and cultural resource use based on Indigenous control. This Working Paper supplements that Discussion Paper and provides additional information on the actual activities undertaken by the Djelk community rangers. While some activities documented here are no longer undertaken (e.g. BAC Safaris proved to be financially marginal and no longer operates) others have continued and expanded. Some updated information on the activities of the Djelk Ranger Program is contained in the annual report of the Bawinanga Aboriginal Corporation for the financial year 2003–04.

I commend this report to readers and would personally like to thank the Bawinanga Aboriginal Corporation and the Djelk Ranger Program for hosting Michelle and facilitating this research. I trust that this report will be a useful historical record of the program at one point in time as well as of value in policy discussions under the broad umbrella of the Northern Land Council's Caring for Country Strategy.

Professor Jon Altman
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June 2005

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ABSTRACT

This report is the result of a ten-day general conceptualisation research trip in May 2003 into an Indigenous community to study the Djelk Ranger program operating under the Bawinanga Aboriginal Corporation (BAC). During this visit I spent time with several different groups of Rangers and visited several sustainable wildlife harvesting sites which are described here.

The Djelk Ranger program established by the BAC is built on the extensive knowledge and skills that already exist within this Indigenous community. The success of the ventures mentioned in this report is built on a unique blend of formal legal institutional mechanisms and customary law and socio-cultural conventions. Cooperative community-based wildlife resource management and aquaculture has the potential to deliver sustainable and cost effective development benefits for Indigenous landowners. Greater recognition of the valuable land management and biodiversity conservation roles undertaken by Indigenous people in these circumstances would seem appropriate, and it would be desirable for these roles to be reflected in more formal and sustained income arrangements than the current CDEP project funding.

The opportunities for economic development in Indigenous communities, and some of the challenges that these communities face are demonstrated in the Djelk Ranger program initiative. The BAC is an impressive institution for its commitment to learning, communication, cultural integration, and economic development. There is clearly a need for such adaptive and flexible institutions to provide a bridge between cultures and protect the interests of remote Indigenous communities.

ACKNOWLEDGMENTS

I would like to thank BAC for their permission to undertake this research with the Djelk Rangers. My sincere thanks go to all the people associated with the BAC who took time out of their busy schedules to talk about their projects and associated work practices. The Rangers provided valuable insight into social, cultural, ecological and economic issues associated with integrating traditional knowledge into sustainable wildlife harvesting enterprises in a remote Aboriginal community. I would like to thank Jon Altman for financing my visit from his personal research funds and for facilitating this research visit to north central Arnhem Land and to the National Landcare Conference in Darwin. I would also like to thank Jon Altman, Jerry Schwab, Bill Fogarty and Geoff Buchanan for constructive comments on this report. Thanks also to Hilary Bek and Melissa Johns for editorial work, and John Hughes for layout and design.

ABBREVIATIONS

AERG	Applied Ecology Research Group
ANU	The Australian National University
AQIS	Australian Quarantine Inspection Service
ATSIC	Aboriginal and Torres Strait Islander Commission
BAC	Bawinanga Aboriginal Corporation
CAEPR	Centre for Aboriginal Economic Policy Research
CDEP	Community Development Employment Projects (scheme)
CDU	Charles Darwin University
CEC	Community Education Centre
CITES	Convention on International Trade of Endangered Species
DEWR	Department of Employment and Workplace Relations
DOLA	Department of Lands Administration
IPA	Indigenous Protected Area
IUCN	The World Conservation Union
JET	Job Employment Training
KCTWM	Key Centre for Tropical Wildlife Management
MAC	Maningrida Arts and Culture
PWCNT	Parks and Wildlife Commission Northern Territory
RIRDC	Rural Industries Research and Development Corporation
STEP	Structured Training and Employment Project

Michelle Cochrane was a Graduate Research Assistant at the Centre for Aboriginal Economic Policy Research, The Australian National University.

Fig. 1. Djelk Rangers logo



INTRODUCTION

The Bawinanga Aboriginal Corporation (BAC) has been at the forefront of an emerging form of collaborative wildlife management by Indigenous people. The BAC is located in Maningrida in north central Arnhem Land in the Northern Territory of Australia. This report describes both past and present land management programs undertaken by the Djelk Rangers, as well as other activities they are associated with through the BAC and the community as at May 2003.

The BAC was first established in 1979 as an outstation resource organisation incorporated under Commonwealth law (BAC 2001). Over the past 24 years, BAC has expanded into a large, complex organisation that assists Aboriginal landowners residing in small communities in the region. In this region there are currently approximately 800 people on 35 outstations. The BAC is the innovative coordinator of the successful Maningrida Arts and Culture (MAC) Centre and is part of a large Community Development Employment Project (CDEP) creating jobs and employment for approximately 520–550 people in the community.

The BAC is managed by an annually elected executive representing each of the outstation communities. The executive meets regularly to consider service delivery and planning issues and to formulate policy to be enacted by the organisation through the leadership of the Chief Executive Officer and senior managers (BAC 2001).

BAC's role as a service provider has diversified since the mid-1990s and the organisation has expanded into a significant regional economic development corporation, with a turnover of \$20 million (BAC 2001). This growth has seen sustainable land and resource management practices incorporated into the BAC's plans for future

economic development. Their economic independence and empowerment has been achieved by making practical use of the region's rich land and sea resources, developing sustainable commercial wildlife harvesting ventures and trialling aquaculture enterprises that are community operated and driven (Altman 2001; Altman & Cochrane 2003; Altman & Johnson 2000; BAC 2001).

The original Djelk Ranger program started in 1991 with a grant from the Community Employment Program for Aboriginal Natural and Cultural Resource Management. In 1995, under a feral pig eradication program in the Cadell region, the Aboriginal and Torres Strait Islander Commission (ATSIC) and Australian Quarantine Inspection Service (AQIS), paid community Rangers a bounty for pigs that were collected and sampled. Recognising that the Indigenous people's land and culture was their greatest asset, the BAC engaged a Ranger on secondment from the New South Wales National Parks and Wildlife Service to work with the men on buffalo and weed eradication. The program has continued to grow with funding support in 1998 from the Natural Heritage Trust for a program coordinator and ongoing in-kind support from BAC.

The BAC and the Djelk Rangers have focused on wildlife utilisation and management as a potential avenue for greater regional engagement with the market economy. This is achieved by providing an employment program that incorporates education, training and collaboration with researchers, is culturally and socially appropriate, and focuses on commercialisation of wildlife harvesting to provide environmental and economic outcomes and benefits for the community.

THE DJELK RANGER PROGRAM

The Rangers have a logo and a vision statement to express their objectives: 'Our people from the Bawinanga homelands will keep our land, law, culture, and people strong by using traditional and non-traditional ways to care for country' (see Fig. 1). Indigenous people in this region have utilised wildlife for generations. They now have the capacity to use this traditional knowledge to develop local enterprises that contribute to economic development, while maintaining and strengthening traditional/cultural ties to country.

The Djelk Ranger program is made up of both Men Rangers and Women Rangers. The Djelk Rangers undertake a variety of land and sea management activities to promote conservation while providing employment. The work complements the Rangers' Indigenous values, knowledge and skills, takes place on their traditional lands, and utilises contemporary land management approaches and tools. Collaboration in adaptation of ideas and values has become an increasingly important element in dealing with land management issues in the region such as restoration and rehabilitation of degraded land, identification and monitoring of feral pests and weeds, and fire management.

The Djelk Ranger program is overseen by a non-Indigenous coordinator, based in Darwin, under the umbrella of the BAC. The coordinator is responsible for the Ranger portion of the CDEP program, working with the CDEP coordinator and the Women's Ranger coordinator, managing approximately \$700,000 for top-up wages annually for the Rangers. The coordinator liaises with a variety of government agencies both at the State/Territory and the Commonwealth levels as well as non-government organisations such as the Northern Land Council and their Caring for Country Unit and several tertiary institutions which are involved in collaborative research with the Rangers. This includes determining permit conditions, applications and licences related to sustainable harvesting of wildlife, reporting to various government departments and authorities, and representing the BAC and the Rangers on committees related to Indigenous land management, such as Landcare and Coastcare. The current

Fig. 2. Ranger vehicle and boat

coordinator has obtained funding for a range of projects (the latest being funding for the Sea Ranger program), investigated the viability of proposed sustainable wildlife enterprises, written management plans and business plans for trials (e.g. crocodile egg hatchery, turtle harvesting, trepang aquaculture project), and investigated associated marketing opportunities. The position of coordinator is funded through the Natural Heritage Trust.

The Men's Ranger program is coordinated by the non-Indigenous CDEP coordinator. The Women's Ranger program is coordinated by a non-Indigenous woman. There are approximately 40 Rangers participating in the CDEP program. On an average working day between 12 and 20 people work on various projects. No prior experience is required to join the Ranger program. Achievement within the program is based on interest, active involvement and personal ability.

The Ranger program is divided into land-based Men Rangers (the 'freshwater mob') and the soon-to-be established Sea Rangers (the 'saltwater mob'). The Women Rangers program was established in 2002. A pilot program is underway for Junior Rangers, integrated into the school curriculum for Year 11 students at Maningrida Community Education Centre (CEC). The Ranger programs are linked into other CDEP based programs in the community. These include the Nursery, the Women's Centre, Aged Care and Disability Services, the Job Employment Training (JET) Centre and the local Maningrida School.

There are several languages spoken in the region. The Rangers employed at the time of this field work speak eight of these languages, representing a cross-section of the community. There also appears to be a balance between younger and older people involved in the program, with several senior Rangers in the men's team.

Infrastructure

The Men Rangers currently operate out of a shed in Maningrida, where the incubator facilities for the crocodile and turtle eggs are housed. The Women Rangers are based across the street, operating out of the CDEP nursery. New premises are currently under construction in town, which will provide offices and facilities for the Rangers and street access for the community to obtain permits. These facilities will include administration areas, storage areas for field equipment, lock-up facilities for fire arms and satellite phones, lockers and amenities for the Rangers, a lock-up area for the vehicles, and a fish cleaning area.

There are also facilities at the Djinkarr Ranger Station approximately 20 kilometres south of Maningrida at Djinkarr, or 'Messel's Lookout'. The Ranger Station is owned by the BAC and operated by the Djelk Rangers. A well equipped laboratory and field station with accommodation and shade house are available for researchers working on collaborative projects with the Djelk Ranger program, such as the long-necked turtle egg harvesting project. The Rangers currently own two troop carrier vehicles, which Men and Women Rangers can access (Fig. 2). However, lack of vehicles is a constraint on daily activities. With additional funding for the Sea Ranger program another vehicle and a boat should become available. The Rangers currently possess a four metre canoe and a 'tinny' (runabout boat and trailer) for water-related field work. There is access to the BAC helicopter for fire management purposes as required.

Education and training

The Djelk Rangers are involved in resource assessment and management as part of their training. The training assists with literacy and numeracy skills, as well as developing an awareness of the need for resource management planning.

The Men Rangers program is trialling a restructure of the work program. The CDEP coordinator works with the JET Centre in conjunction with the Faculty of Aboriginal and Torres Strait Islander Studies at Charles Darwin University (CDU) as part of the Structured Training and Employment Project (STEP) program. This provides the Rangers with skills for developing management plans, participatory planning and supervisory roles in the workplace. Training in planning skills is seen as a tool to bring traditional and scientific expertise together to facilitate the continued use of wildlife in the region in an ecologically and economically sustainable way.

This approach aims to improve capacity to:

- control decision making;
- identify and solve problems;
- recognise and encourage the use of Indigenous knowledge;
- identify issues that cannot be solved by Indigenous knowledge alone;
- negotiate collaborative assistance with these issues; and
- improve capacity to manage the land in an institutional environment.

Effective remote area literacy and numeracy training requires a unique approach to delivery of information and skills training. The BAC has appointed a training coordinator who works in conjunction with the JET Centre on

the CDEP programs. The courses are designed to assist in the transfer of cross-cultural information, lift levels of literacy and numeracy, and provide options to pursue other areas of interest and job opportunities in the future. The training programs aim to encourage a two-way learning environment with a mix of traditional and scientific ecological knowledge. Men and Women Rangers are studying Natural Resource Management Certificates levels I, II and IV. Each Certificate takes approximately two years to complete. Certificate I is a skill-based certificate; Certificate II involves a lot more reading and writing; Certificate IV in Administration focuses on planning and assessment. At the time of field work, six women and 16 men were enrolled in Certificate I; five men were enrolled in Certificate II and four were enrolled in Certificate IV. Women Rangers in the nursery have undertaken a Horticultural Certificate.

The courses involve two two-hour training sessions each week—one focusing on literacy, the other on numeracy—adapted to current work commitments. When I visited, they were starting a unit on Occupational Health and Safety as part of the Certificate course. There are core modules for each Certificate, chosen and based on local community priority issues identified by the Rangers, and addressed throughout the program. Identified issues include feral animals, weed eradication, fire control, and the commercial utilisation of plants and animals. An output from this program has been stories and reports about the Djelk Rangers' projects, which have been contributed to the local community paper, *Manayingkarirra Djúrrang*.

The Rangers are divided into working groups each week, with one person nominated as supervisor. This system enables each individual to experience the supervisor's role, with added responsibility on a more formal basis. Team leaders are assigned to a group each week to assist supervisors to coordinate the projects.

One difficulty in relation to education and training is regular attendance: it is challenging for the training supervisors to organise and plan activities in a consistent and constructive way when people do not attend on a regular basis. Sometimes absence is unavoidable due to ceremonial obligations or lack of transport. It is a difficult issue to resolve, although participating in training is now paid as part of work, and this has helped with attendance. The JET centre has achieved a balance of structure and flexibility in the programs, which creates a safe learning environment for adults and keeps communication lines open.

Currently only two men have a driver's license. Most Rangers have also completed a shooter's course and have a shooter's license. The Rangers participate in a range of courses throughout the wet season, including driving, firearm, chemical use and handling, first aid, and coxswain (boat handling) courses.

Pay

The Rangers are paid through the CDEP scheme, with pay 'topped up' from a Department of Employment and Workplace Relations (DEWR) allocation and income earned from program enterprises. Rangers are paid for up to 6.2 hours daily. At the time of field work (May 2003) supervisors were paid \$17.00 per hour; team leaders \$15.00 per hour; and workers \$13.75 per hour and \$11.75 per hour (a high-level pay and low-level 'the harder you work the higher you are paid'). Workers are paid the lower rate for sick pay/maternity leave/ceremonial duties and funerals. In the past, pay packets did not bring home much more than the unemployment benefits. This new system of payment initiated by the BAC Accountant in 2003 is more rewarding for both the Rangers and their families, and encourages people to participate in the program. There are still very few Indigenous people in Maningrida in salaried work. There is a strong sense that these Indigenous land managers should be recognised and paid for their management of the land, and that this should not be a cost-shifting exercise predicated on the CDEP Scheme.

External engagement

The Rangers attended the Indigenous Ranger Conference held at Kakadu in August/September 2002. The Women Rangers attended the 3rd Daluk (Women's) Land Management Conference, coordinated through the Northern Land Council and hosted by the Yugal Mangi Women Rangers at Wambunggu on the Limmen Bight River in May 2003, to participate in training sessions and planning workshops. Planning is underway for the 4th Daluk (Women's) Land Management Conference to be hosted by the Women Rangers in May 2004.

PLANT-RELATED PROJECTS

The activities performed by the Rangers vary seasonally (see Altman 1987). The Men Rangers are engaged in several plant-related projects including weed management and monitoring sustainable harvest of cycads, bombax and fruit.

Weed management

At the time of this field work, Rangers were focused on weed management. Rangers are educated in the identification of noxious weeds, and work with traditional landowners to locate infestations in a preventative approach to weed management.

The Rangers manage many weed species in the Maningrida region. These include:

- gamba grass (*Andropogon gayanus*), an introduced pasture species which spreads along roadsides, competes with native species, and dries out late in the dry season providing fuel for late hot fires which devastate the landscape;
- mission grass (*Pennisetum polystachion*), another introduced pasture species that spreads along road sides;
- Mosman River grass (*Cenchrus equinatus*) common name, candillo;
- hyptis (*Hyptis suaveolen*) common name, horehound, a small shrub that forms dense stands of bushes;
- giant spear grass (*Heteropogon triticeus*) which stays green late into the fire season and provides potential fuel for the late wild fires; and
- mimosa (*Mimosa pigra*) which forms dense thickets.

The Ranger teams spray weeds with backpack spraying units, hand-pull weeds and burn them before seed is set. There is experimental burning of weed-infested areas to see if the grasses regenerate.

Infestation of mimosa has been a particular challenge in one region. Mimosa produces a large number of seeds and spreads along the waterways, choking the native vegetation. Buffalo contribute to the spread of mimosa by trampling areas around billabongs, creating cleared sites for mimosa to establish, and water birds disperse propogules along the waterways. Work is underway to poison and isolate this area with approximately 17 kilometres of fencing. A nearby rainforest area is also being fenced to protect it from damage by feral animals. The Rangers contract out to other organisations in the community to control their weed invasions.

Fig. 3. Morinda fruit



Sustainable plant harvest

The Djelk Rangers are undertaking collaborative work on sustainable harvesting projects in relation to cycads, bombax, and morinda fruit.

In collaboration with the Key Centre for Tropical Wildlife Management (KCTWM) at CDU, the Djelk Rangers have been documenting the population and density levels of cycads (*Cycas arnhemica*). The Rangers obtained a permit from Parks and Wildlife Commission Northern Territory (PWCNT) to trial harvests of the cycads at the nursery, and collect data on the survival rates for a possible sustainable cycad harvest venture. The initial cycad transplantings had an 80 per cent success rate; there will be further investigation of marketing options for these plants. While harvest could provide a reasonable return, current regulatory requirements demand a monitoring regime which will be time consuming and could make the enterprise unviable. The extensive numbers of cycads growing in the Northern Territory is well documented (Griffiths et al. 2002).

A collaborative project with the KCTWM, BAC, MAC and the Centre for Aboriginal Economic Policy Research (CAEPR) has been underway to assess the harvest of *Bombax ceiba* for the production of sculpture. This species is a monsoonal rainforest deciduous tree that grows in wet fire-protected sites and grows to approximately 20 metres, with stems up to 100 centimetres in diameter. It coppices when cut, resulting in the production of new stems suitable for harvesting in less than 20 years. The Rangers have researchers from KCTWM in assessing regional populations and densities of flora, including Bombax. The Rangers have documented harvesting practices and rates to determine quantities used by artists, in order to analyse the implications for arts and craft production. The results show that, while Bombax is widely used in the Maningrida area and some patches need to be monitored

to avoid over-harvesting, in general the existing harvest rates for the arts industry are sustainable (Griffiths et al. 2002; Griffiths, Philips & Godjuwa 2003).

A *Morinda* (*Morinda citrifolia*) orchard of 1,000 trees was planted about two years ago near Djinkarr Ranger station and is being maintained by the Rangers. The trees are growing well and are already producing fruit. The fruit, commonly referred to as the 'stinky cheese fruit' due to its pungent smell, is reputed to have medicinal qualities (see Fig. 3). The BAC is investigating the marketing of the juice, also known as 'Noni juice', to health food and cosmetic companies. There is a high demand for the juice as an alternative medicine for several illnesses: it is said to contain phytonutrients such as xeronine (an alkaloid which activates enzymes) and selenium (an essential trace mineral). Once extracted, the juice sells for around \$100 per litre.

FERAL ANIMAL MANAGEMENT

The Djelk Rangers are involved in the management of feral pigs, cane toads and several ant species.

Every two to three years AQIS completes a Top End survey across the Northern Territory. Instead of sending out officers to take samples from the feral pigs (*Sus scrofa*), AQIS now provides equipment and trains Rangers to take blood and other samples and perform postmortems on both feral pigs and Asian water buffalo (*Bubalus bubalis*) for analysis. AQIS pays BAC a lump sum (\$1,200) for the Rangers to kill and sample 30 pigs, and work intermittently with Rangers on weeds and plant disease surveys.

The cane toad (*Bufo marinus*), locally known as the 'rubbish frog', reached the Maningrida region in 2000–01 and has spread throughout the wetlands. While no native species have become extinct because of the cane toad, scientists have advised the Northern Territory Government that animal populations may suffer severe reductions in numbers. The cane toads have the potential to affect 154 species, including the Northern Quoll (*Dasyurus hallucatus*), varanid lizards, elapid snakes, dingos, ghost bats, water birds, fresh water crocodiles, barramundi (eating eggs and spawn), and a range of small frogs (Van Dam, Walden & Begg 2000). There is considerable concern about the impact of cane toads on quoll numbers, as quolls compete for frogs.

The Djelk Rangers are concerned at the sudden decline in goanna sightings in the area. In 2002–03, field research was conducted to assess the impact of cane toads on the hunting and collection of bush tucker in the region (Altman, Griffiths & Whitehead 2003). The Djelk Rangers have been raising awareness within the community, by placing articles in the local paper, *Manayingkarirra Djurrang*, and educating outstation residents.

The Rangers also monitor outbreaks of a number of ant species that pose a potential threat to the Northern Territory. The ginger ant or tropical fire ant (*Solenopsis geminata*) can inflict a painful sting and is found in the Darwin area. The big-headed ant (*Pheidole mengacephala*) is an aggressive ant which forms enormous colonies. It can reduce the populations of other native insects, spiders and other invertebrates by between 40 and 85 per cent. It has been found in areas of Kakadu National Park, where a major eradication program was undertaken to remove this ant to avoid costly future control programs. The yellow crazy ant (*Anoplolepis gracilipes*) spits formic acid into the eyes of its victims and blinds them. Apart from the Christmas Islands where it is estimated that over 20 million crabs have been killed by the yellow crazy ant, the only other record of this ant in Australia is the Gove peninsula, approximately 200–300 kilometres north-east of Maningrida.

Fig. 4. Fire management activity



FIRE MANAGEMENT

The Rangers are promoting greater community involvement in bush fire management by educating the public about the best times of the year to burn. The Rangers liaise with the Bushfires Council of the Northern Territory which operates between Maningrida, Bulman and Gove, undertaking 'healthy' burning (early burning to stop late hot fires).

The Rangers inspect country which is no longer being burnt by traditional owners before planning any fire regimes for the area. In 2003 the BAC helicopter was used to monitor and evaluate sites, to back burn by dropping incendiary capsules into inaccessible areas to reduce fuel loads, and to monitor fires. Without regular burning these areas run the risk of late season wildfires that destroy the vegetation and put lives at risk. There is currently one fire truck based at Maningrida and two at Bulman.

The Rangers combine traditional ecological knowledge of country such as topography location of different vegetation types with contemporary scientific knowledge, satellite images and fire scar map tools from the Bushfires Council of the Northern Territory and Department of Lands Administration (DOLA), and record where areas have burnt. Different fire management techniques are used for different terrains. Early dry season roadside burning ensures sufficient firebreaks are in place. Preventative burning is carried out in the early part of the

Fig. 5. Turtle harvest



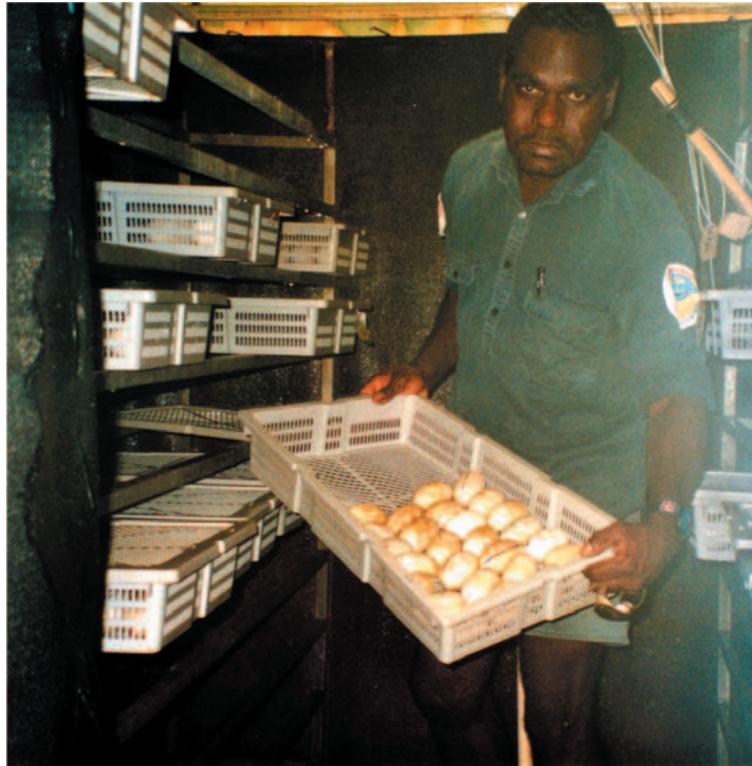
dry season when the weather is milder and fires are more likely to self extinguish (Fig. 4). When the fire season has finished, Rangers meet the elders on country with maps to assess achievements in each area and discuss future fire management strategies for their country. The DOLA maps have limitations as many of the fires around Maningrida are small and do not register on maps derived from satellite imagery; this underscores the value of local knowledge in fire management. By integrating traditional knowledge of the country with contemporary fire practice knowledge they are able to manage the natural resources and the landscape more effectively.

SUSTAINABLE HARVESTING ENTERPRISES

The Djelk Rangers are involved in enterprises involving the sustainable harvesting of long-necked turtle, crocodile eggs, goannas and native fish.

Turtle harvest and research

In 2000 the BAC and the Ranger program entered into a collaborative research program with KCTWM and the Applied Ecology Research Group (AERG) at the University of Canberra to investigate development of a northern long-necked turtle (*Chelodina rugosa*) egg harvesting enterprise. Data has been collected on turtle population structure and densities in the surrounding region. In 2003 further funding was received through the Australian Research Council to compare harvested turtle populations with populations which have no harvesting pressure, and develop models to assess how robust the populations are to harvesting. A computer model will be developed to predict the impact of heavy versus light harvesting. This will help establish how much harvesting can be tolerated

Fig. 6. Incubating crocodile eggs

by the turtle population and the extent to which the release of captive reared turtles can replenish harvested billabongs and contribute to the continued growth and survival of the turtle populations (AERG 2003).

The harvesting of northern long-necked turtles takes place in the dry season during April–June, to avoid their breeding season (the wet season). Both the Men and Women Rangers participate in this activity, sharing the use of a four metre Bayou canoe to set and check the traps in the six study sites (Fig. 5). The turtles are transported to the Djinkarr Ranger station, where a research student from the University of Canberra examines the turtles and tags them. The female turtles are x-rayed to determine how many eggs they contain.

The project hoped to recover 1,000 eggs in the 2003 season: 500 eggs to be incubated in Maningrida and 500 to be sent to Canberra for further testing. The turtles staying in Maningrida are given an injection of oxytocin to release their eggs, which are placed in the incubator until they hatch in approximately 90 days. Hatchlings are kept in water tanks for one month and fed on turtle pellets and shrimp, then sold to the pet trade for \$55 each. Income from hatchling sales goes back into the Djelk Ranger program to assist with further developments. The turtles are returned to the billabongs shortly after harvesting the eggs, and individual females are only harvested for eggs once each year. Some of the male turtles are passed on to the Rangers for bush tucker, a local delicacy, as allowed under their permit from PWCNT.

Most of the billabongs where harvests take place occur on traditional lands. The Rangers and the scientists liaise with traditional owners about the project's significance and potential benefits. Oral agreements about access and removal of turtles are established before any harvesting takes place. The decision of each traditional owner is

respected. Some traditional owners do not participate because they like to eat turtle, others for cultural reasons—both the turtle and crocodile are strong totems in this area. Some outstations participate in harvesting for the project, and a royalty of \$30 per harvested turtle is paid to the traditional owner.

Throughout the research the Rangers are being trained and instructed in field and experimental techniques. The ultimate aim of the project is to train the Rangers to monitor and evaluate the wildlife harvesting enterprises they manage and ultimately achieve sustainable cultural, social, and economic outcomes. In future the possibility of growing the turtles for a food enterprise will be explored.

Crocodile eggs

Crocodile (*Crocodylus porosus*) egg harvesting takes place along the Blyth, Caddell, Liverpool and Tomkinson Rivers in the wet season, starting around January each year. A helicopter is used to locate nests and flagging tape is dropped to allow Rangers to find the nests. Markers also indicate when eggs have been harvested from the nest. Crocodiles tend to come back and nest in the same place, so nest location is easier in subsequent seasons.

Each nest contains 40–60 eggs. Eggs are collected carefully and marked on the side facing up: if they are placed upside down the embryos can drown in the surrounding fluid. The Rangers check for opaque banding on the egg as this indicates that the egg is fertile. Eggs are transported back to the incubator in an esky, and kept at a constant 32° Celsius in a humid environment until they hatch. Incubation temperatures can determine the gender of the hatchlings with very high or low temperatures producing females, and temperatures of 32°–33°C producing males (Fig. 6). Crocodile farms prefer males, since they grow to a marketable size faster. The crocodile hatchlings are washed, placed in trays in the incubator facility, and eventually sent off to crocodile farms in the Northern Territory. Royalties are paid to the traditional landowner per egg collected and per hatchling sold.

While the Rangers have a permit to collect 2,500 eggs, they usually collect less than 2,000. At the time of this field work in 2003, nearly 400 eggs had been collected for the year, with 205 hatched, grown on, and sold. There was no known reason for the low numbers of crocodile eggs in 2003 by the end of May.

Goanna

The Djelk Rangers have a permit to trap and sell inland goannas (*Varanus sp.*) for the pet trade. There are four species in the area: a saltwater species, a freshwater species, an inland species and a rock species. There was considerable concern over the minimal goanna sightings in the region over the past 12 months, since the arrival of the cane toad.

Native fish

The Rangers are trialling the collection of freshwater threadfin rainbowfish (*Iriatherina wernerii*) from local billabongs in the dry season for the aquarium trade. The return is approximately \$2.50 per fish. Currently 70 per cent of the collected fish survive. The Rangers are improving the methods of transfer, with issues of water temperature and water quality (the water is quite acidic) to be refined.

Other wildlife harvesting possibilities

KCTWM has investigated the nesting biology and nesting success of the magpie goose (*Anseranas semipalmata*) and have found that the population fluctuates from year to year and reproductive activity is influenced by the amount of rainfall that occurs (Whitehead & Salfeld 2000). Preliminary KCTWM work on the proposed harvesting of the birds for a commercial enterprise estimated a cost of approximately \$19 per goose to produce a bird

for market, including the necessary hand plucking. It was estimated that, to make the venture worthwhile, the Rangers would need to sell the meat for \$60 a kilogram, and was therefore not considered a viable option.

The Rangers collect mud mussels in the dry season, also known as 'mangrove clams' (local Barrara name 'Umbombola'). It has been noted that the Rangers have a mangrove clam project underway where they are putting together oral histories from traditional owners on clam harvesting, Indigenous management and views relating to commercial utilisation. They have also documented a large number of sites for subsistence harvest rates, overall harvest rates and population ecology. A PhD student in aquaculture at CDU looking at reproduction also noted that the Northern Territory Government currently has a ban on all commercial shellfish harvesting (T. Griffiths, pers. comm.).

A feasibility study was undertaken by the KCTWM to examine the prospect of selling Kakadu plums (*Terminalia ferinandia*) to gourmet bushfood companies. The remote location and cost of transport, restrictive health regulations, seasonality of wild harvests, and competition with plantations situated closer to the market in Darwin collectively made the venture an economically unsustainable option.

OTHER MEN RANGER ACTIVITIES

Safari camp

The BAC has established a safari hunting and adventure camp near the Djinkarr Ranger station, where guests pay around \$1,000 per day to stay at top quality bungalows (of which there are four) and hunt. There is access to vast areas for hunting buffalo and pigs; access permission is negotiated with traditional owners before any hunting takes place. Several Rangers act as guides and help gut and cure the kill for trophies. While the enterprise has the additional benefit of assisting in the reduction of feral animal populations in the area, at this stage it is not commercially viable.

Fishing camp

At the time of field work, BAC was negotiating a takeover of the lease of the financially successful fishing camp. The BAC is planning to base a couple at the camp to administer the camp and possibly employ some of the Rangers. The fishing camp has provided significant royalties to the community through 'catch and release' recreational fishing tours using the BAC exclusive sports fishing license. While it may be possible to expand this into an eco-tourism package with bush tours and Indigenous cultural experiences, the current range of clients appear disinterested in any engagement with local Indigenous people.

Meals on Wheels bush food

The Rangers assist with the collection of local catfish, mullet, buffalo and wallaby, for the Aged Care Facility's Meals on Wheels program. The provision of this food is allowed if there is no on-selling for commercial gain. The Djelk Ranger coordinator hopes to purchase a sausage-making machine to better utilize the meat for the community. A community Aboriginal Coastal Fishing License allows the Rangers to catch and provide fish for the program as long as the fish are caught with recreational fishing gear. This program has until recently been run out of the Women's Centre: due to health regulations, however, it is currently contracted out to the local 'Hasty Tasty' fast food outlet until an upgrade of facilities is completed. The Rangers also supply food to local funerals as a sign of respect and to generate good will. The ultimate goal of the Rangers is to harvest bush tucker to sell to local stores.

FUTURE PROJECT PROPOSALS

Sea Rangers

The Djelk Rangers are planning to establish a program for Sea Rangers as part of their holistic resource management strategy, to be organised into a 'freshwater mob' and a 'saltwater mob'. The BAC has received an ongoing grant of \$60,000 from the Northern Territory Fisheries and Coastwatch to assist with wages and running costs, and possibly the purchase of a boat and another vehicle. The Rangers will engage in weekly coastal and estuary patrols. To assist in defining their roles and the area they will be monitoring, the Sea Rangers will engage in discussions with traditional owners for these sea country areas. This may encourage more traditional owners to join the Sea Rangers program in the future.

It is envisaged that the Sea Rangers will complete a coxswain course and enrol in a fisheries compliance course. Sea Rangers will enforce regulations under the Territory and Commonwealth fisheries legislation, the Aboriginal Lands Act, and the Sacred Sites Act, which dictate where commercial and recreational fishing boats can enter and fish. Fisheries law enforcement is difficult to maintain due to the vast areas of sea authorities have to cover. Sea Rangers would form an important link with fisheries authorities in maintaining future compliance to regulations and controls in the region.

Potential resource users are expected to obtain permission from traditional owners before entering these waters to fish. The Rangers would be able to assist in supporting this important part of valuing and respecting traditional rights and culture.

Aquaculture

The potential significant benefit of Indigenous aquaculture to many Indigenous communities has been acknowledged in the National Aquaculture Development Strategy Report (Lee & Nel 2001) by Agriculture Fisheries and Forestry—Australia (now Department of Agriculture, Fisheries and Forestry). The report identified various national and regional activities that are necessary for aquaculture development to succeed, and identified six categories of factors that need to be considered when forming a local strategy: industry development; physical factors of the environment; bio-technical factors; commercial and legal factors, including funding; education and training; and social and cultural factors. These factors will be considered as BAC plan an aquaculture pilot project.

Some of the aquaculture ideas currently under investigation include oyster farm trials (the original trial was destroyed by cyclone, a repeat trial is planned); sea sponge farming (sponges are relatively easy to propagate on ropes suspended in the sea); freshwater prawn cultivation (trials thus far have had low survival rates); a Saratoga aquaculture farm (found to be an unviable option); and a trepang hatchery (see below).

Trepang

The enterprise with the most promise is the trepang (sea cucumber) hatchery. The BAC is currently assessing the viability of a trepang hatchery and processing facility, to be operated by the Rangers. Under the current Northern Territory legislation, the Indigenous right to utilise this resource by customary means is provided under Section 53 of the *Fisheries Act*. The major constraint on the BAC's ability to acquire a license to commercially harvest trepang has been the financing of a license on the open market, suitable vessels and processing facilities. An added restriction has been the listing of trepang under Appendix 2 of the Convention on International Trade of Endangered Species (CITES), which prohibits wild harvest but not trepang aquaculture.

The trial venture will cost approximately \$1 million to establish. The Rangers will hatch trepang juveniles (a species known as Sandfish or *Holothuria scabra*) for cultivation and release them off the coast adjacent to Maningrida. Trepang takes approximately 18 months to reach harvestable size. Qualified divers would retrieve the trepang, which are then gutted, sun dried or frozen whole, and sold on to a processor. There is a well-developed market for dried trepang in Southeast Asia and China, where it fetches AUD\$65–\$100 per kilogram. This venture has huge potential earnings for the Djelk Rangers.

The Australian Government provided \$2.5 million in 2003–04 to implement the Action Agenda for the Australian Aquaculture Industry and establish an Indigenous Aquaculture Unit run by the Department of Agriculture, Fisheries and Forestry and ATSIC. The unit will promote aquaculture ventures in Indigenous communities and will aim to streamline State and Territory and Commonwealth aquaculture and environmental regulations, to reduce the barriers to entry of Indigenous people to the industry and promote investment. Access to such funding may assist the Djelk Rangers in developing aquaculture enterprises.

At the time of field work, there was extensive concern about illegal fishing taking place at the mouth of the Liverpool River. Professional fishermen access local waters to harvest barramundi, crabs and trepang, and take what traditional owners consider to be their customary resources from the sea and sea bed. The commercial licenses held by these professional fishermen have been issued by the Northern Territory Government which is not releasing more licenses in the near future. Therefore, for local Indigenous people to operate in the same way, they need to purchase a commercial license on the open market at a cost of \$250,000–\$500,000. These licenses need to be operated effectively and sustainably to profit in the long term. BAC is invaluable in bridging the gap between viable opportunity and future economic development.

WOMEN RANGERS

The BAC, keen to develop a role for women in the Djelk Ranger program, formed the Women Rangers program in June 2002 with funding for a coordinator from the Natural Heritage Trust. At the time of this field work the coordinator was Michelle Hatt. The Women Rangers are emerging as a robust and reliable team, consisting of between seven and nine women based at the nursery. The Women Rangers attend training at the JET Centre (see above) in the level 1 Land Management Certificate, a course concerned with land management practices. A Troop Carrier vehicle is available for women's business.

Women have a valued role in land management, with a good knowledge of harvesting bush fruit and seeds and the medicinal use of plants, and are skilled in the art of fishing. Through the Ranger program this role can be acknowledged and maintained, and provide an income. Women's ecological knowledge is maintained by participating in activities on country—certain Ranger activities can only be conducted by women, such as maintaining women's sacred sites and areas used for women's business. It is interesting to note that it is not seen as a culturally acceptable arrangement for the Women Rangers to work together with the men; the only time they work together is to attend firearm and boat training courses. Another cultural issue affecting the Aboriginal women worker's cohesion is that Aboriginal women should not supervise women who belong to other clan groups. Tension can also arise when older women ask younger women to complete a task and they don't respond. Despite these complications the women seem to be developing clearer authoritative positions in the workplace.

The Women Rangers program is flexible and supports the inclusion of young children in daily routines allowing Women Rangers to care for and breastfeed their children—this is particularly crucial since there are no childcare facilities for them to access. (While the Women's Centre has a childcare facility, this is only available to women who work at or attend the Centre.)

Fig. 7. The Nursery



As part of the Outstation health agenda, they assist in the supply of plants for the Outstation gardens, monitor weeds and collect rubbish at Outstations. They provide fresh fish caught from local billabongs and rivers to the Aged Care facility. Women Rangers also dig for bush tucker, such as yams and onions, and collect pandanus leaves for basket weaving and pandanus seeds for dyeing.

The Women Rangers are part of the team trapping northern long-necked turtles (see above). Aboriginal people generally see turtle harvesting as women's business; they have an intimate knowledge of the turtle behaviour and habitat and are very successful turtle trappers.

The Women Rangers have also been involved in collecting mud mussels ('mangrove clams') and mud crabs, collecting water lilies for sale, collecting Yam seed for a research project, and AQIS testing for fruit fly. Future plans include monitoring water quality in the area. Water Watch, a Northern Territory Government initiative, is supplying a water testing kit to help provide more comprehensive environmental information for the management of the surrounding wetland and river systems in the area.

Nursery

The Women Rangers work closely with the local CDEP nursery program. The Nursery is coordinated by two women as part of the CDEP scheme. The nursery has seven workers, all women, and occasionally a man with a disability assists in the projects. The nursery propagates a wide range of local Indigenous plants for landscaping and for sale (Fig. 7).

Fig. 8. Collected pandanus seeds and leaves



The Women Rangers work closely with the Nursery program, participating in regular seed and plant collection trips and working in the weeding program (Fig. 8). The plants are used in BAC projects and in community landscaping schemes, designed and implemented by the nursery. Information is being developed and documented on propagation techniques for all the plant species, both in Gurrgoni and English. Nursery staff are currently completing Certificate 1 in Horticulture at the JET Centre.

Examples of some of the projects completed by Nursery staff include the Health Clinic for the Northern Territory Health Department (\$20,000), the JET Centre (\$5,000), Batchelor College campus (\$4,000) Djomi sacred site regeneration (\$60,00), erosion gully revegetation (\$10,000), outstation vegetation projects funded by the BAC, and special consignments to Territory landscaping companies.

Current projects underway include the Barge landing landscaping (with a \$25,000 community grant from the Coastcare program via the Australian Government Envirofund), private landscaping around local homes, and providing *Morinda* seedlings for the *Morinda* plantation at Djinkarr. A fruit and vegetable garden is being established on adjacent land to supply fresh fruit and vegetables both to the Aged Care facility and the wider community. The BAC plans to encourage further participation of people with disabilities in this project. Experimental harvest and nursery trials of Cycads (*Cycas arnhemicus*) are being conducted in conjunction with the KCTWM and Rangers at the Nursery.

JUNIOR RANGERS

The Junior Ranger program links the local Maningrida CEC and its pupils directly with the Djelk Ranger program in a two way learning process: the Rangers develop their communication skills and the children learn to value and respect their Indigenous knowledge relating to natural resource management. At primary school level the children go on outings to the Ranger station and other facilities to learn about the Rangers' activities. The Rangers appear to be highly regarded in the school and the wider community, making a positive contribution to the community and the region by providing an opportunity for the students to develop awareness about future options in employment.

MANINGRIDA COMMUNITY EDUCATION CENTRE (CEC)

The Maningrida CEC offers primary and secondary education both in town and in the outstations, and teaches three languages: the local Maningrida language Ndjebbana, the Blythe River region language Bararra, and English. There is also a wet season education program run for children from outstations, which is conducted in various locations around the town.

As 2003 is the first year the school has offered a year 11 course, it is in the process of formally developing specific cultural and natural resource management modules for Year 11 students. Topics include management of feral animals and noxious weeds; soil degradation issues; how the permit systems operate; fire management; pollution control; and sustainable commercial enterprise development. The units will be lodged with the South Australian Board of Studies for formal consideration as part of the curriculum taught.

Several days each year are set aside for active involvement with the Rangers, with students participating in the daily activities and exploring the Rangers' current projects (e.g. turtle harvesting, Morinda plantation operation). A youth walk will be trialled in the near future—a two-day walk and camp through country to provide experience in living off country, thus linking literacy into learning about country and culture.

The school has a large body of documented local knowledge of plant and animal species, largely obtained from senior men who have since passed away. This material is available in various languages and in pictures and photographs.

INDIGENOUS PROTECTED AREA

The BAC has been exploring the option of declaring an Indigenous Protected Area (IPA), and has obtained funds for a scoping assessment. This option may impact on the future work of the Djelk Rangers.

The federal IPA program is one of the few sources of funding for natural resource management activities within Indigenous communities. Such funding can enable the community to productively manage the landscape, developing innovative cross-cultural approaches to natural and cultural resource management. A formal IPA becomes part of the National Reserve System and is not a National Park: it indicates a formalised agreement to actively manage an area. The Commonwealth enters into a contract, called a Financial Assistance Agreement, with an Indigenous community which requires ongoing conservation of biodiversity values. Money can then be

provided to the community to self assess whether an IPA would be a good option. The first stage requires the community to consult broadly with members of the community and other stakeholders, with assistance from land councils.

If the community is interested, the next stage is to develop a Plan of Management. This requires the community to critically assess land management activities they are already performing, or might want to perform, on the ground such as fire management, feral animal management, weed control, enterprise developments relating to the use of natural resources, and any other related activities. The community can do whatever it sees as important, providing it does not impact on biodiversity and heritage values. Funding can top up Rangers' wages on the CDEP program for conservation and land management activities. These decisions need to be incorporated into the Management Plan. The contract with the Commonwealth does not prevent the community seeking other funding for specific projects. Currently the Commonwealth is considering the development of Conservation Agreements under the *Environment Protection and Biodiversity Conservation Act*, to provide a longer-term basis for IPA project funding. For a plan to be acceptable, it needs to take into consideration The World Conservation Union (IUCN) categories. Australia's National Reserve System is based on these six broad categories, which are all compatible with Indigenous ownership and management of land. The Management Plan should refer to IUCN categories under the *Environment Protection and Biodiversity Conservation Act*.

An IPA Plan of Management is usually coordinated by a local Indigenous person. Traditional owners are encouraged to select a Steering/Advisory Committee to provide advice on employment, training, enterprise development and capacity building. Land councils may assist and the Caring for Country Unit (of the Northern Land Council) may provide expertise in planning and facilitating workshops.

It is interesting to note that in 2002 the Dhimurru Land Management Aboriginal Corporation took the IPA a step further and entered into an agreement with the Commonwealth Government and the Northern Territory Government under Section 73 of the *Parks and Wildlife Conservation Act* (Northern Territory). This Agreement provided Northern Territory Government support to the protection, conservation and sustainable management of Yolngu lands. It is the first agreement under which the Commonwealth, the Northern Territory Government and traditional owners work together to protect and conserve Aboriginal lands, allowing Dhimurru to set permit conditions, design camping areas, enforce 'no hunting' rules and make other regulations regarding their land. Dhimurru were required to set up an Advisory Committee, which consisted of two Dhimurru members, one PWCNT representative, one Commonwealth representative, and one Northern Land Council representative. Although communities could attempt to use similar provisions under Local Government by-laws, this approach has not been tested to date.

CONCLUSION

The Djelk Ranger program established by the BAC is built on the extensive knowledge and skills that already exist within this Indigenous community. The success of the ventures mentioned in this report is built on a unique blend of formal legal institutional mechanisms and customary law and socio-cultural conventions. This combination accommodates goals and aspirations of Indigenous people in this community, including the creation of meaningful and sustainable employment.

In pursuing these sustainable goals, alliances and partnerships have been developed with other Indigenous institutions, while the expertise of ecological and social scientists has been utilised in assessing the ecological sustainability and economic viability of each venture. Training and skills development has been promoted in the community partly through the exploration of economic development options, such as the expansion of wildlife harvesting from customary use to commercial use.

Cooperative community-based wildlife resource management and aquaculture has the potential to deliver sustainable and cost effective development benefits for Indigenous landowners. Greater recognition of the valuable land management and biodiversity conservation roles undertaken by Indigenous people in these circumstances would seem appropriate, and it is desirable for this to be reflected in more formal and sustained income arrangements than the current CDEP project funding. In addition, some of the significant difficulties experienced in these economic development efforts, which could be addressed by government, relate to current regulatory and licensing regimes of the Federal and State and Territory governments which stifle further constructive economic development in these communities.

The opportunities for economic development in Indigenous communities, and some of the challenges that these communities face are demonstrated in the Djelk Ranger program initiative. The BAC is an impressive institution for two-way learning, communication, cultural integration, and economic development. There is clearly a need for such adaptive and flexible institutions to provide a bridge between cultures and protect the interests of remote Indigenous communities.

REFERENCES

- Altman, J.C. 1987. *Hunter-Gatherers Today: An Aboriginal Economy in North Australia*, Australian Institute of Aboriginal Studies, Canberra.
- 2001. 'Exploring sustainable development options on Aboriginal land: The hybrid economy in the twenty-first century', *CAEPR Discussion Paper No. 226*, CAEPR, ANU, Canberra.
- and Cochrane, M.J. 2003. 'Sustainable development in the Indigenous-owned savanna: Innovative institutional design for cooperative wildlife management', *CAEPR Discussion Paper No. 247*, CAEPR, ANU, Canberra.
- and Johnson, V. 2000. 'CDEP in town and country Arnhem Land: Bawinanga Aboriginal Corporation', *CAEPR Discussion Paper No. 209*, CAEPR, ANU, Canberra.
- , Griffiths, T. and Whitehead, P.J. 2003. 'Invasion of the rubbish frogs', *Nature Australia*, Spring: 44–51.
- Applied Ecology Research Group (AERG) 2003. 'Aboriginal Harvest of Long-necked Turtles', *Issue 1*, AERG, University of Canberra, Canberra.
- Bawinanga Aboriginal Corporation (BAC) 2001. *Bawinanga Aboriginal Corporation Annual Report 2000–2001*, BAC, Maningrida.
- Griffiths A.D., Gorman, J., Whitehead, P. and Altman, J.C. 2002. 'Trial commercial harvests of native plants by Aboriginal communities in the Top End of the Northern Territory: Cycads and Bombax', in P. J. Whitehead, J. Gorman, A.D. Griffiths, G. Wightman, H. Massarella and J.C. Altman (eds), *Small Scale Commercial Plant Harvests by Indigenous Communities: A Report for the RIRDC/Land & Water Australia/ FWPRDC Joint Venture Agroforestry Program*, RIRDC Project No UNT-6A, Rural Industries Research and Development Corporation, Canberra.
- Griffiths, A.D., Philips, A. and Godjuwa, C. 2003. 'Harvest of *Bombax ceiba* for the Aboriginal arts industry, central Arnhem Land, Australia', *Biological Conservation*, 113 (2): 295–305.
- Lee, C.L. and Nel, S. 2001. *A National Aquaculture Development Strategy for Indigenous Communities in Australia Final Report*, Department of Agriculture, Fisheries and Forestry, Canberra.
- Van Dam, R.A., Walden, D. and Begg, G. 2000. *A Preliminary Risk Assessment of Cane Toads in Kakadu National Park*, Final Report to Parks North, Office of the Supervising Scientist, Darwin.
- Whitehead, P.J. and Salfeld, K. 2000. 'Nesting phenology of magpie geese (*Anseranas semipalmata*) in monsoonal northern Australia: responses to antecedent rainfall', *Journal of Zoology*, 251 (4): 495–508.