# Darwin Archaeology:

## Aboriginal, Asian and European Heritage

## of

## Australia's Top End

*Edited by*

Patricia Bourke, Sally Brockwell
and Clayton Fredericksen

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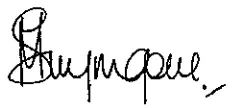
## VOLUME CONTENTS

## FOREWORD

It gives me great pleasure as the Minister for the Environment and Heritage to introduce this volume of selected papers.

Modern Darwin is a culturally rich and diverse place. In so many ways this multiculturalism is a direct reflection of the diverse and sometimes traumatic history of the "Top End". It is a history that has created a unique place with a unique way of life and one which all Territorians have come to appreciate and should be proud.

The articles in this volume span Aboriginal occupation from the mid-Holocene, the early days of European and Chinese settlement in the late 1800s through to the Second World War. These articles also reflect the dynamism of the cultures who came to live in tropical Australia and forge an existence, and in turn the integral role each played in contributing to the history of the "Top End".



Ms Marion Scrymgour MLA
Minister for the Environment and Heritage
Northern Territory Government



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# Settlement patterns on the lower Adelaide River in the Mid to Late Holocene

**Sally Brockwell***

## INTRODUCTION

This paper describes several aspects of archaeological fieldwork on a series of earth mounds on the western margins of the Adelaide River floodplains. Earth mounds are a common archaeological feature of the northern Australian coastal plains. They tend to be oval or circular in shape. They range from an average of 39 m in length (R=11-80 m), 32 m in breadth (R=4-40 m) and 0.8 m in height (R=0.1-1.3 m) (Brockwell 2001). They are usually found at the junction of a number of resource zones, close to areas that are flooded seasonally. This location has given rise to the conclusion that they have been chosen to provide well-drained camping sites above wet ground (Baker 1981; Burns 1999; Brockwell 1989; Cribb 1986; Schrire 1968; Meehan 1988, 1991; Peterson 1973). There are ethnographic observations that they may have been constructed deliberately. For example, Meehan (1988:2) and Peterson (1973:177) recorded that, in central Arnhem Land, Aboriginal people built up mounds through using them repeatedly as earth ovens.

Research has demonstrated that the Adelaide River earth mounds were occupied over a period of 4000 years, during which time the floodplains evolved from estuarine conditions, through a transition phase to the freshwater environment that exists today. This paper addresses the consequences of these changes for the human population of the Adelaide River and investigates strategies that were adopted to deal with these changes.

## THE STUDY AREA

The lower Adelaide River flows through the coastal plains of northern Australia, which lie in a sub-tropical savanna environment 12° south of the Equator. The study area is located 60 km south-east of Darwin and covers some 2000 km$^2$ (Figure 1).

The climate of northern Australia is characterised by high temperatures and two major seasons, the dry season from May to October and the wet season from November to April. This marked seasonality has a dramatic impact on hydrological regimes, and consequently on vegetation and animal communities. It had a strong influence on hunter-gatherer mobility and settlement patterns, and the activities of the Aboriginal people who live in the Adelaide River region today continue to be regulated by seasonal changes.

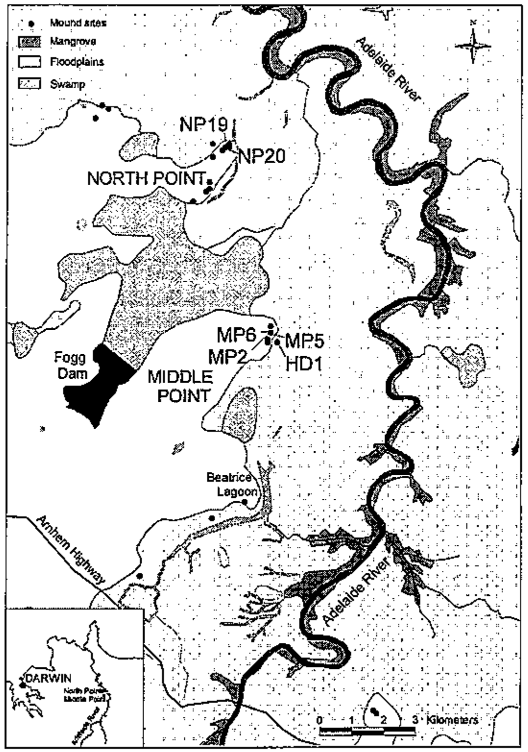


*Figure 1. Location of Sites in the Study Area.*

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## Geomorphology

During the post-Pleistocene sea level rise, down-cut river valleys on the coastal plains of northern Australia were flooded. When the sea level stabilised, mangroves invaded rapidly leading the coastal plains into what has been described as the 'Big Swamp Phase' from about 7000 to 4500 years BP (Woodroffe *et al.* 1985). Subsequent siltation and coastal progradation reduced the extent of tidal influence and mangroves retreated towards the coast and the edges of the rivers and the creeks. During this phase, known as the 'Transition Phase' (from c. 5000 to 3000 years BP, depending on the river system), there existed a landscape of great variability made up of a mosaic of freshwater and estuarine ecosystems. From 4000-1500 years BP large productive freshwater wetlands formed on the floodplains of the major rivers of the north (Chappell 1988; Clark *et al.* 1992; Woodroffe and Mulrennan 1993). This sequence is illustrated in Figure 2. Since European contact some 150 years ago, the freshwater floodplains have been much degraded by the introduction of feral animals and exotic weeds, and modern late dry season fire regimes, which have led to changes in vegetation and the drying up of swamps (Brockwell 2001:55-57).

In the study area, shells from a chenier ridge believed to have marked the shoreline at the time of localized sea level stabilization towards the end of the Big Swamp Phase have been dated to 4990±330 years BP (Woodroffe and Mulrennan 1991:90, 91). This earliest known Holocene shoreline is the most landward of the chenier ridges and marks the boundary between the estuarine and coastal plains (Woodroffe *et al.* 1993). This ridge lies just north of North Point, and shows that the study area was once adjacent to the sea.

Geomorphological studies for the region have focussed on the duration and extent of the Big Swamp Phase, rather than the later establishment of freshwater conditions on the floodplains. Archaeological dating of the lower Adelaide River earth mounds may shed light on environmental changes post the Big Swamp Phase and has the potential to expand the palaeo-environmental data.

## Productivity

The initiation of extensive mangrove forests, and later freshwater floodplains, made the Adelaide River floodplains a rich resource base for its prehistoric inhabitants. On a world scale, estuarine systems have a mean productivity rate of 1500 g per metre square per year, while freshwater wetlands produce 3000 g per $m^2$ per year. In contrast, savanna grasslands produce only 900g per metre square per year; and woodland/shrublands 700 g per metre square per year (Finlayson *et al.* 1988; Head 1987:450-51).

## ARCHAEOLOGICAL INVESTIGATIONS OF EARTH MOUNDS

Surveys have located a variety of sites in the study area. The majority of sites are earth mounds situated on the floodplain margins. Other site types include artefact scatters and quarried rock outcrops (Brockwell 1996; Schrire 1968; Smith 1981).

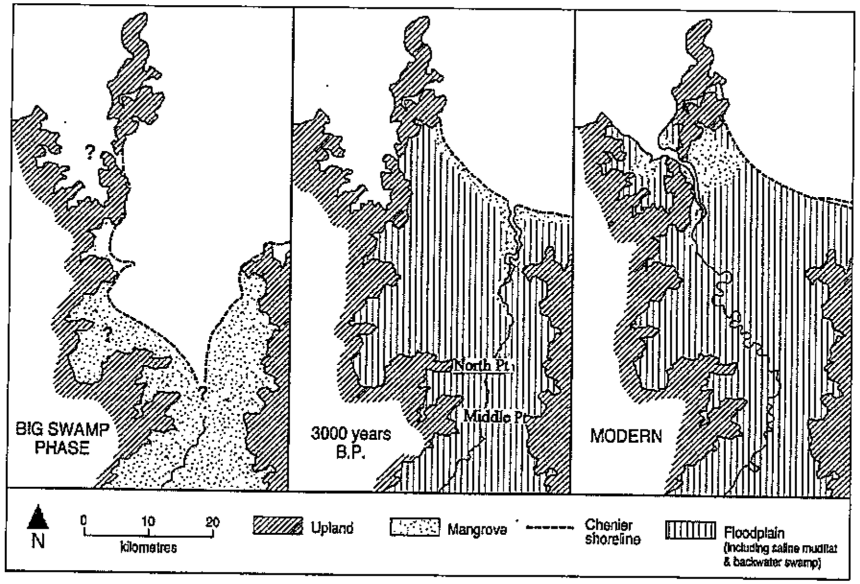


*Figure 2. Holocene Geomorphic Sequence on the Adelaide River.*





The earth mounds are concentrated in two main areas, both on headlands jutting into the floodplains, Middle Point and North Point (Figure 1). Altogether 30 earth mounds have been recorded. These range from 30 m to 80 m in diameter and from 25 cm to 1.4 m high and tend to occur in clusters. They are all located in the pandanus scrub that lines the floodplain margins (Brockwell 1996).

As a result of the initial survey, three earth mound sites on Middle Point (MP2, MP5 and MP6) and two mounds on North Point (NP19 and NP20) were selected for excavation. A collection from an earth mound (HD1) at Middle Point, excavated by Carmel Schrire in 1968, was also analysed (Brockwell 2001).

The excavations yielded numerous stone artefacts and two sites contained large quantities of well-preserved bone, including macropods, birds, reptiles and fish. There was estuarine shell located in the lower levels of the HD1 excavation, but little shell recovered from the other mounds. As the base of the cultural deposit was positioned above the base of the mounds, all the sites investigated appeared to be situated on low-level rises.

Stone artefacts recovered from the mounds were made from a variety of local and non-local raw materials. They consisted mainly of flakes, including bipolar, retouched, edge rejuvenation flakes, and utilised flakes. Recognizable tool types included unifacial and bifacial points, ground sandstone pieces, ground ochre pieces, ground volcanic flakes (which may be the result of sharpening or using edge ground axes), and cores, including bipolar cores.

The faunal analysis revealed both floodplain (fish and turtles) and open savanna species (goannas, wallabies, possums and bandicoots). There was a marked variation in species between the top and bottom of the deposits. The upper layers were dominated by large quantities of turtle shell, which gradually decreased with depth and were replaced by increasing quantities of fish bone. Quantities of the mangrove shell *Geloina* sp. were also present in the lower levels of HD1.

The turtle remains are mainly carapace fragments that have been identified as long-necked turtle (*Chelodina rugosa*). This is a freshwater species that typically inhabits swamps, billabongs and waterholes across the northern Australia (Cogger 1992). Today they occur commonly on the floodplains of the Adelaide River.

## Chronology

Dates for the geomorphological samples were quoted as conventional radiocarbon ages. The shell dates were uncorrected for the ocean reservoir effect because a number of known older samples yielded dates less than the correction factor of -450 years for marine shells in northern Australia (Woodroffe *et al.* 1993:260). Likewise, a number of regional archaeological studies relevant to this study have also used uncorrected and uncalibrated radiocarbon determinations. As the geomorphological dates were crucial to the interpretation of the archaeology and I wished to place the Adelaide River study in a regional perspective, I have used uncorrected and uncalibrated radiocarbon determinations to avoid confusion.

Twelve radiocarbon determinations were obtained from the Middle Point and North Point mound sites. All fall within the period of the mid-late Holocene period. They indicate that the western floodplain margins of the Adelaide River have been occupied from at least 4000 years ago until the recent past. The mound sites thus have the potential to chart cultural responses to a period that witnessed rapid environmental change.

## ENVIRONMENTAL PHASES AND ARCHAEOLOGICAL MODELS

For the purposes of comparative analysis, I assigned the cultural assemblages of the Adelaide River to the environmental phases, based on the archaeological dates (Table 1). These phases are the Big Swamp Phase (>3900 years BP), the Transition Phase (3900-2000 years BP), the Early Freshwater Phase (2000-630 years BP), the Late Freshwater Phase (630-150 years BP) and the Contact Phase (150 years BP until Modern). These divisions cannot be considered absolute, as the dating of each of the phases is not precise and in some cases dates overlap, but it does provide a basic framework for the interpretation of the cultural data.

**Table 1. Chronological Phases of the Adelaide River Sites**

| Phase | Site | Spit no. | Date (years BP) |
|---|---|---|---|
| CONTACT | NP20 | 1 | Modern |
| LATE FRESHWATER | MP2 | 1-4 | <350 |
| | MP2 | 5-7 | <460 |
| | MP5 | 1-10 | <630 |
| | MP6 | 1-4 | <430 |
| | NP19 | 1-3 | ? |
| EARLY FRESHWATER | MP2 | 8-13 | 460-2000 |
| | MP5 | 11-15 | 630-? |
| | MP6 | 5-11 | 430-1430 |
| | MP6 | 12 | >1430 |
| | HD1 | 1-2 | <2000 |
| TRANSITION | MP2 | 14-16 | >2000 |
| | HD1 | 3-9 | 2000-3900 |
| BIG SWAMP | HD1 | 10-11 | 3900-4100 |

The separation of the Freshwater Phase into Early and Late Phases is artificial. It was done because recent dates were available from most of the sites and the division makes it possible to ask more qualified questions of data spanning a 2000-year period. For example, Hiscock (1997, 1999, see this volume) and Bourke (2000, see this volume) have suggested an environmental change, from open beaches to closed mangroves, occurred in the Darwin Harbour region post 1000 years BP. This event may have had consequences for the Adelaide River residents. The division of the Freshwater Phase into Early and Late phases means that I was able to address this question. The Contact Phase at the end of the sequence is a cultural rather than an environmental construction and may well be encompassed by the Late Freshwater Phase, but it remains valid nonetheless because of the obvious impacts of European contact on the environment.

Predictive models regarding mobility and settlement patterns were developed for each phase of the environmental framework. The Big Swamp and Freshwater Phases were periods of high biomass productivity on the floodplains. It was expected that this situation would result in regional populations focussing the majority of their settlement and subsistence efforts on the swamps, which would lead to reduced residential mobility. Conversely, the Transition and Contact Phases were periods of reduced or variable productivity on the floodplains. It was therefore expected that, in these phases, the swamps would no longer be the major focus of settlement and exploitation and the population would become more mobile.

These models were tested by the lithic and faunal analyses. The lithic analysis addressed questions of residential mobility through the comparison between phases, of artefact discard rates, extent of reduction, average size of artefacts and bipolar production. The faunal analysis examined subsistence strategies over time through a study of resource use and seasonality.

## Stone Artefact Analysis

It was assumed that the archaeological indicators of reduced residential mobility in the Big Swamp and Freshwater Phases would be increased discard of lithic raw materials, increase in modification accompanied by a subsequent reduction in the size of flakes, and a higher rate of bipolar flake production. The theory under-pinning these assumptions is that, in periods of low mobility, a population has less opportunity to obtain non-local lithic raw materials, and therefore will concentrate on local raw materials and conserve those materials that are available through increased modification (cf. Byrne 1980; Jeske 1989; Lurie 1989). Similarly, bipolar production was expected to increase in periods of low residential mobility, as it is a method of economically producing flakes (cf. Hiscock 1996; Jeske 1992; Parry and Kelly 1987).

Conversely, it was expected that the scenario of increased residential mobility during the Transition and Contact Phases would be expressed archaeologically as a decreased discard rate of stone, decreased modification with an accompanying increase in size, and a lower rate of bipolar production.

The chronological comparison of discard rates, degrees of modification and average weights of raw materials followed the patterns mostly as predicted, with some variation in the Freshwater and Contact Phases. Bipolar production was low in all phases. This latter result is consistent with the model for periods of predicted high residential mobility (the Transition and Contact Phases), but not for periods of low residential mobility (the Big Swamp and Freshwater Phases).

Unfortunately, because only 6mm sieve finds were available from HD1, and there was no basal date for MP2, the overall discard rates of flaked stone artefacts could not be calculated for the Big Swamp and Transition Phases. The figures for the Freshwater and Contact Phases (based on 6mm and 3mm finds) show that the discard rate of non-local raw materials remained steady through the Early and Freshwater Phases and then declined in the Contact Phase (Figure 3). This distribution is consistent with that predicted by the model, based on the assumption that the sites were occupied less frequently when the productivity of the floodplains decreased in the Contact Phase. The discard rate of local raw materials increased in the Late Freshwater Phase, which does not affect the model, but increased again in the Contact Phase, which was not as predicted (Figure 3).

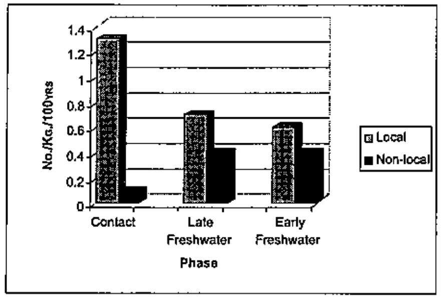


*Figure 3. Discard Rate of Flaked Raw Materials.*

The rate of modification of local flaked raw materials increased between the Big Swamp and Transition Phases. However, these figures should be treated cautiously, as the sample from the Big Swamp is small. The modification rate then remained relatively steady in subsequent phases (Figure 4). Neither result complies with the model, which predicted increased modification of local raw materials during periods of high productivity on the floodplains (ie. the Big Swamp and Freshwater Phases) and decreased

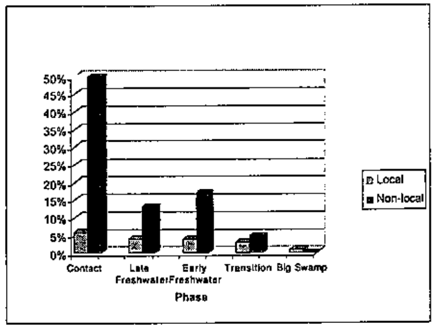


*Figure 4. Percentage Modification of Flaked Raw Materials by Phase.*

modification during periods of low productivity (ie. the Transition and Contact Phases). However, modification of non-local raw materials increased from the Transition to the Early Freshwater Phase and decreased only slightly in the Late Freshwater Phase. These results are consistent with the model. The results from the Contact Phase do not agree with the model as rates of modification of local and non-local materials all increased, which is inconsistent with the prediction for less frequent occupation of the sites.

The average weight of local flaked raw materials decreased from the Transition into the Freshwater Phases, which is consistent with predictions (Figure 5). However, it subsequently decreased in the Contact Phase, which is not consistent. The average weight of non-local raw materials increased from the Transition into the Freshwater Phases, which was also not as predicted. However, the increase in average weight of non-local raw materials in the Contact Phase conforms to the model of less frequent use of sites during a phase of lower resource productivity.

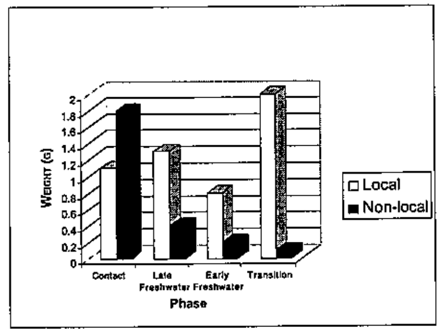


*Figure 5. Average Weight of Flaked Raw Materials.*

The results suggest that the model of settlement for the Adelaide River during the Freshwater and Contact Phases needs to be revised. The fact that there was no increase in modification of local raw materials during the Freshwater Phases suggests that periods of frequent site use and low residential mobility lead to conservation of non-local raw materials, rather than increased use of local stone. Alternatively, the results could suggest that there were no periods of low residential mobility and that mobility remained high throughout the Freshwater Phases.

The increase in the average weight of both local and non-local raw materials in the Late Freshwater Phase may emphasise the argument that there was some shift in site use, perhaps increased residential mobility post 630 years BP. The low-level of bipolar production also suggests that settlement was more mobile at the Adelaide River floodplain sites than appears to be the case at other comparable floodplain sites on the South Alligator River (cf. Hiscock 1996). However, increased modification of non-local flaked raw materials during the Freshwater Phases also suggests that there were at least some periods of reduced residential mobility. This result may be due to the fact that the sites were occupied seasonally, rather than on a year-round basis. Questions of seasonality will be addressed in the summary of the faunal analysis below.

The stone artefact discard rates from the Contact Phase suggest that there was an increased reliance on local stone in this period. At the same time, the modification of non-local stone increased substantially, which suggests a lack of access to raw material sources. Both patterns are consistent with reduced residential mobility, which does not seem likely during a period of decreased productivity on the floodplains. An alternative explanation is the disruption to local settlement and exchange patterns due to the impact of European contact and the introduction of exotic species.

## Faunal Distributions and Foraging Strategies

The archaeological evidence provides information on how the Aboriginal inhabitants were exploiting the environment over time. Mammals, birds, turtle, fish and estuarine shellfish remains in the Adelaide River sites are all attributed to human introduction. Rodents, reptiles, snakes and land snails were excluded from the faunal analysis because, although it is highly likely that they formed part of the Aboriginal diet, equally they may have been introduced naturally into the sites and their status as cultural material is ambiguous. The domination of turtle and fish remains across all the environmental phases in the mounds attests to the fact that foraging strategies at the earth mound sites were focussed on the floodplains in all its various incarnations throughout the mid to late Holocene period.

It was predicted that the emphasis of exploitation in the Big Swamp Phase would be on the floodplains. This was confirmed by the dominance of estuarine taxa in the faunal assemblages of this phase. There was some minor exploitation of mammals from the woodlands, as well as birds, although whether the latter were floodplain or woodland species is uncertain. It was predicted that there would be some freshwater fauna from transitory lagoons located in the open woodlands and some rainforest fauna. However, the proportion of both was statistically insignificant. It was also predicted that there would be some exploitation of the littoral zone, as the sea was located relatively close to the sites during this phase. There was however no evidence of marine species in the faunal assemblages. Perhaps the inhabitants did not exploit the sea on a regular basis because it lay outside their territory, or sites containing marine species are located elsewhere, possibly buried by the build-up of mud on the floodplains. Overall, the proportion of cultural species was substantially higher for the Big Swamp Phase than for the other phases (Figure 6). This result may be due to the weight of estuarine shell as opposed to the weight of other faunal taxa. However, even if estuarine shell is excluded from the sample, the distribution rate still remains nearly as high as that in the Late Freshwater Phase. Perhaps because estuarine resources were available all year-round in the Big Swamp Phase, continual rather than seasonal residence could be maintained in the Big Swamp Phase. Whatever the explanation, the evidence is consistent with predictions that, as there was high biomass productivity on the floodplains during this phase, the mound sites were used frequently.

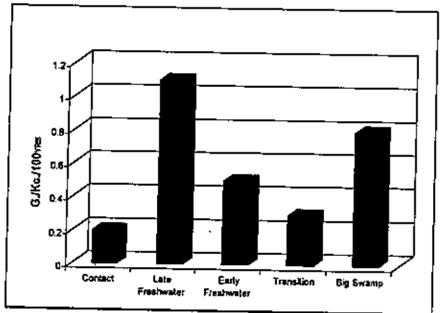


*Figure 6. Distribution of Faunal Remains by Phase.*

It was predicted that, as floodplain resources became unpredictable in the Transition Phase, foraging strategies would diversify and woodland resources would become more important. It was expected that the remains of freshwater, woodland and rainforest species would increase, while estuarine and littoral remains would decrease. The results suggest that, although there was an increase in the proportion of mammals in the Transition Phase, floodplain species remained the focus of foraging strategies at the sites (Figure 7). The introduction of turtle and a continuing, though reduced, presence of estuarine fish and shellfish reflect foraging in a mosaic environment of freshwater and estuarine zones that were extant on the floodplains during the Transition Phase. Littoral remains were absent as expected. Overall, the proportion of faunal remains dropped to 20% of the Big Swamp rate. This pattern is consistent with predictions that, although there was high species diversity on the floodplains during this phase, the unpredictable nature of the resource base meant that the floodplain sites were no longer used as frequently.

In both the Early and Late Freshwater Phases, it was predicted that the emphasis of foraging activities would be on freshwater floodplain resources. The large proportion of turtle and fish remains, and the small proportion of woodland fauna present in the sites during these phases suggests that this was the case (Figure 7). The low proportion of bird remains is puzzling as it was expected that, with the establishment of freshwater wetlands, waterbirds would become an important resource. A possible explanation for this absence is seasonal occupation of the sites, which is discussed below.

In the Early Freshwater Phase, the overall distribution rate of fauna increased. The proportion of turtle increased, woodland mammal decreased, estuarine shellfish dropped out and littoral species were absent (Figures 6 and 7). These patterns are consistent with the model. Estuarine fish were still present but proportionately lower. This is not inconsistent with the model as the species involved were mainly catfish and barramundi, which can also flourish in freshwater conditions.

In the Late Freshwater Phase, the proportion of woodland fauna recovered in the remains was low and estuarine shellfish and marine species remained absent (Figure 7). These results are consistent with predictions. The proportion of turtle increased, while that of estuarine fish decreased. These results suggest that there was a change in foraging strategies in the Late Freshwater Phase, as distinct from patterns in the Early Freshwater Phase. This may be due to an increase in productivity on the floodplains due to environmental change and/or more frequent exploitation of the freshwater wetlands. Compared with the Transition and Early Freshwater Phases, the overall proportion of faunal remains increased in the Late Freshwater Phase (Figure 6), which does suggest an increase in the frequency of site use. However it was still not as high as the proportion of fauna in the Big Swamp Phase. This outcome may be because, like the Early Freshwater Phase, residence at the floodplains in the Late Freshwater Phase was seasonal rather than year-round.

In the Contact Phase, the overall proportion of fauna decreased (Figure 6), as the model predicted, because of the downturn in productivity of the floodplains and less frequent use of sites. Marine taxa were absent, as predicted. Woodland taxa were also absent, which was an unexpected as, following contact and the consequent





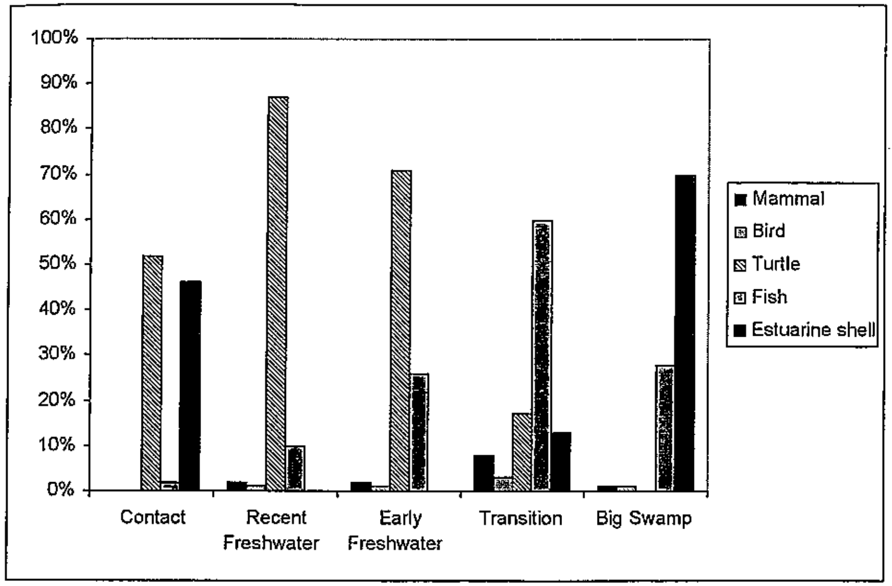


*Figure 7. Distribution of Faunal Remains by Species.*

degradation of the freshwater floodplains, the model predicted a change in foraging activities away from the floodplains. Foraging was still floodplains-based, however. The proportion of freshwater turtle decreased, but there was an unexpectedly high proportion of the mangrove shellfish remains (*Geloina* sp.) present (Figure 7). Thus the change was not away from the floodplains as predicted, but a shift in exploitation focus to richer estuarine areas further away from the mound sites.

## Seasonality

It was assumed that, in the Big Swamp Phase, seasonality was not a major factor affecting foraging strategies and settlement patterns, as estuarine resources were available year-round. Seasonality, however, would have been important in the Transition Phase when freshwater resources began to appear on the floodplains. The seasonality of freshwater resources on the floodplains would have become even more influential, in terms of foraging and settlement strategies, in the Freshwater Phases when behavioural patterns became strongly regulated by the annual cycle of wet and dry.

The magpie goose (*Anseranus semipalmata*) feeds on grasses on the high floodplains during the early dry season, then moves to see out the late dry season at permanent lagoons and backwater swamps where it nests in the wet season. The dusky rat (*R. colletti*) hides in cracks in the high floodplain in the early to mid-dry season and then moves to the backwater swamps in the late dry and onto high ground in the wet season. The water python (*Liasis fuscus*) that hunts the dusky rat follows its prey in its seasonal movements. It returns to its breeding grounds located near to the sites in the middle of the dry season but disperses widely across the floodplains in the wet. The barramundi (*Lates calcarifer*) and the catfish (*Arius* sp.) return to the river to spawn in the wet season. Freshwater turtle (*Chelodina rugosa*) aestivate during the dry season, making them easy prey for Aboriginal people who hunt them by poking the mud with digging sticks. They are a popular food and their eggs are also eaten (Goodfellow 1993:48; Meehan 1982:147).

Some tentative conclusions can be drawn about seasonal site occupation from the annual cycle and the faunal remains from the Freshwater Phases. The earth mound sites on the Adelaide River are located adjacent to the high floodplains, which tends to rule out occupation of the sites from the mid to late dry season. By mid-dry season, the high floodplains have dried out. By late dry season, the transitory lagoons on the floodplains have also dried up and fauna has retreated to permanent water elsewhere on the floodplains. The availability of fresh drinking water would also have affected settlement patterns at this time. From the middle of the dry season onwards, people would have been forced to seek water away from the floodplains.

The location of the sites also suggests that wet season occupation of the mounds was unlikely. There appears to be no strategic advantage in occupying these sites while the resources of the floodplains were flooded and widely dispersed. Nesting magpie geese and their eggs, which were available in the late wet season, occupied the backwater swamps rather than the high floodplains adjacent to the sites. The lack of bird remains or eggshell in the mounds suggests that geese did not form part of the foraging strategies employed at the sites.

This leaves the early dry season for occupation of the sites. Turtle, catfish and barramundi would have been widely available at this time, when there was still water on the high floodplains and the transitory lagoons were full. The archaeological evidence supports this conclusion, as most of the remains from the Freshwater Phases are of turtle and fish (Figure 7). Although geese would have occupied the floodplains adjacent to the sites in the early dry season, they would have been widely dispersed while the floodplains were still inundated, and would not have been easy prey. Again the lack of bird remains from the Freshwater Phases infers that the earth mound were not used as processing sites for waterbirds and that such sites must have been located elsewhere, perhaps adjacent to the backwater swamps.

## CONCLUSIONS

I will now return to the original questions; what were the consequences of the environmental changes on the floodplains for the human population of the Adelaide River and what strategies did they adopt to deal with the changes?

Prior to sea level rise, the down-cut Adelaide River valley probably supported small bands of hunter-gatherers exploiting riverine and savanna resources. The establishment of estuarine conditions on the floodplains c. 7000 years BP provided the resource base for a larger population to occupy the region, with the earth mounds being formed by at least 4000 years BP. By 3900 years BP, with further siltation cutting off the tidal influence, the mangroves began retreating seawards and estuarine resources became limited to the river margins. This was a period during which there was a mosaic of estuarine and freshwater zones. The resource base was probably changeable and unpredictable during this period and subsistence efforts were probably diversified and included more emphasis on exploitation of the open woodlands. The data support this argument in that there appears to be a period of resource depletion on the floodplains, indicated by a diminution of remains of floodplain species in the mounds during the Transition Phase, and a slight increase in the remains of woodland fauna. This was also a time when the coastline was actively prograding, and there was perhaps some movement of people to the coast to exploit marine resources.

The faunal remains and the $C^{14}$ results indicate that the Freshwater Phase began c. 2000 years BP on the Adelaide River. Multiple sites were established along the margins of the floodplains at Middle Point. Freshwater was available from lagoons on the floodplains adjacent to the mound sites. The discard rate of non-local lithic raw materials increased and stone was used more intensively. The overall proportion of faunal remains increased in the sites. It was concluded that the highly productive resource base meant that residence once more became less mobile. However, as the freshwater floodplains were seasonally productive, settlement remained seasonally mobile. The late dry season was the most productive time on the floodplains, as resources became increasingly concentrated on contracting water sources. In the wet season when floodplain resources were flooded or dispersed, people relocated to other areas, perhaps to the coast.

In the Contact Phase, the discard rate of stone and proportion of faunal remains decreased. This probably reflects the gradual abandonment of the sites from c. 1860 onwards. Although freshwater conditions persist to this day, the floodplains have become less productive due to the impact of feral animals, the invasion of exotic weed species and man-made earthworks on the western side of the river. Historically, the region became depopulated through the effects of introduced diseases and the drift of the population towards non-Aboriginal settlements. Today, the custodians still reside locally but hunt and fish elsewhere on the floodplains, as the lagoons next to the Adelaide River earth mounds have silted up and can no longer be used as they were in the past.

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# Coastal cowboys: The development of speculative models of molluscan midden matter in the Darwin region

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## INTRODUCTION

The 1990s was an exploratory period in the archaeological investigations of the Darwin region. Like explorations in many other Australian regions, the imperatives of formative archaeological enquiries around Darwin were the pursuit of basic questions about the archaeological record, the methods suitable for exploring it and of course understandings of the prehistoric past. Issues that were emphasised by archaeologists working in this region included: Establishing the anthropogenic character of materials, developing methods to discover and investigate archaeological sites, establishing a chronological framework for the region, characterising the variation through time and space in human behaviour, and comprehending the environmental context of behavioural differences (see Bourke 2000; Brockwell 1996, 2001; Burns 1994, 1999; Hiscock 1997, 1999; Hiscock and Kershaw 1992; Hiscock and Hughes 2001).

These kinds of questions are often the initial ones examined by archaeologists in unknown regions, and in the 1990s archaeologists exploring the Darwin region were substantially occupied with these endeavours. As this volume reveals, the success of this preliminary research has been impressive. This paper reviews these speculative investigations through the lens of one archaeological site, a shell mound at Bayview Haven on the western margins of Darwin city. Analyses presented here demonstrate that within this mound there was substantial variation in the composition of the molluscan assemblage, variation that may reflect not only patterns of prehistoric foraging and food discard but also analytical decisions of sample location, sample size and recovery method. The magnitude and sources of variation must be clarified if ancient foraging is to be interpreted. Establishing appropriate methods for investigating midden variability has been and remains one of the characteristics of the initial, or "cowboy", phase of archaeological enquiry in the area around Darwin.

### Bayview Haven 3

Bayview Haven 3 was a mound of shell situated south of Tiger Brennan Drive on a promontory of land jutting out into Francis Bay on the eastern margin of Darwin Harbour.

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This promontory is a steep sided ridge rising to more than 20m above sea level. The ridge overlooks Sadgroves Creek, and at its base was surrounded by a broad fringe of mangroves. The ridge was covered by open woodland, although parts of the area had been cleared over the last fifty years. This landscape was substantially modified in developing a housing estate. The shell mound was recorded and excavated in the early 1990s, as part of the archaeological assessment and salvage preceding that urban development. It has now been destroyed.

This shell mound was of a form quite common in the region, but positioned in an atypical location. The mound was approximately 10-12 m in diameter and had a 50 cm deposit of shell material. Comparable dimensions are available for a large number of shell mounds in the greater Darwin area, and the descriptive statistics for mound length (13.0 m $\pm$ 11.1 m, N=120) and mound width (8.8 m $\pm$ 6.0 m, N=120) display typical values very similar to the dimensions of Bayview Haven 3. Mound thickness in the region is also extremely variable, ranging from 20 cm to 4 metres, although very thick mounds are uncommon. The 50 cm depth of Bayview Haven 3 also represents a size common within the Darwin region. The size of Bayview Haven 3 is therefore an average one for the region.

Faunal composition of Bayview Haven 3 is also broadly typical of many shell mounds in the Darwin region (see Burns 1999; Hiscock 1997, 1999; Hiscock and Hughes 2001). Although a small number of middens have been found to be dominated by other kinds of molluscs, the vast majority are dominated by the bivalve *Anadara granosa*. These middens often contain several other species of mollusc, but *Anadara* occurs in overwhelming numbers. This pattern is repeated at Bayview Haven 3.

Even the disturbance that has occurred to Bayview Haven 3 reflects processes that can be observed more widely in the region. When first recorded in 1992 (Hiscock 1992) the mound did not take the usual domed or flat topped, circular shape (see Figure 1). Instead, a vaguely horseshoe shape structure was visible, created by a large rectangular, parallel-sided depression exactly three metres wide positioned on the western side of the mound. The depression was approximately 20 cm deep relative to the