

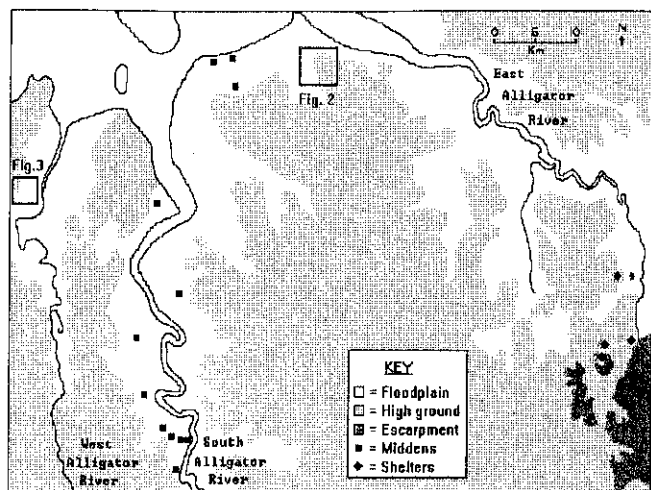
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## MIDDEN VARIABILITY IN THE COASTAL PORTION OF THE KAKADU REGION

Peter Hiscock and Fiona Mowat

Shell middens in the Kakadu wetlands have not hitherto been described outside rockshelters. Along the eastern margins of the floodplains rockshelter sites such as Ngarradj Warde Djobkeng (Allen and Barton nd), Nawamoyrn, Paribari and Malangangerr (Schrire 1982) have been well studied by archaeologists (Fig. 1). Throughout the vast wetlands to the north and west of

these sites there are no comprehensive reports on middens. Woodroffe et al. (1988) have investigated the age and geomorphic context of middens along the South Alligator River, but there has been no detailed, quantified description of the archaeological components of those sites. Researchers from the Northern Territory University are currently undertaking an extensive



**Figure 1** The Kakadu region showing locations of previously recorded sites named in the text. (■ = middens recorded by Woodroffe et al. [1988]; ◆ = rockshelters excavated by Schrire and Allen).

survey of sites in the Kakadu wetlands and a picture of a rich and diverse archaeological record is emerging. This paper provides an initial record of the complex archaeological patterns on the wetlands by focusing on examples of dramatic inter-site variation in midden composition. The purpose of the paper is to document the diversity of middens which exist in the Kakadu region.

Two small areas of the wetlands are described; a section of the Cairncurry Plain, and a section of the floodplain at West Alligator Head (Fig. 1). In each of these areas there are three shell middens located short distances apart. Both areas consist of near horizontal plains several kilometres across, butting up against undulating lateritic surfaces formed around outcrops of granite and sandstone. In both areas the sites studied are located on the seasonally inundated plains, but are in close proximity to the higher land surfaces. These floodplains have formed since approximately 6500 years BP, as sediment accumulated in mangrove communities throughout the area now occupied by estuarine plains (Woodroffe et al. 1988:98). Although there are many other middens in the region these have been selected to highlight the variation that occurs over small distances.

No excavations were carried out, as the objective of the study was to measure inter-site faunal variability. Variation in midden composition between sites has been quantified by counting shells on the surface of sample squares. Faunal composition in the sample squares was observed to be representative of the surrounding portions of the midden. Where species composition appeared uniform a single 1 m<sup>2</sup> square was recorded, but when intra-site variations were evident we recorded

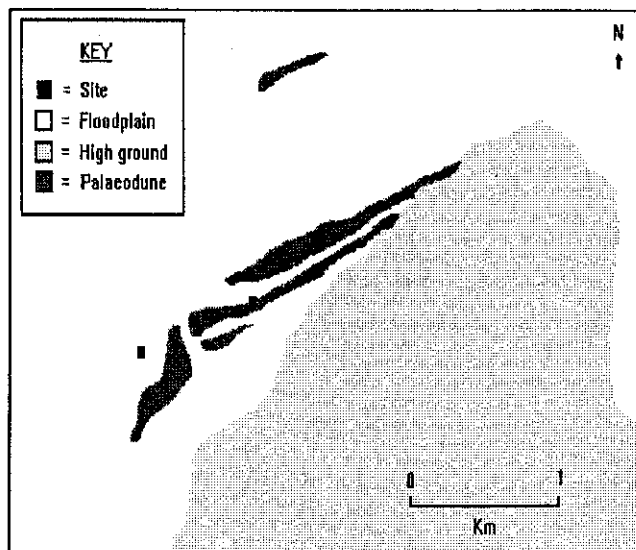
multiple samples. These methods were adopted in the expectation that precisely quantified small samples would be preferable to the gross measures of abundance provided by other studies in the region (e.g. Woodroffe et al. 1988). All counts are transformed into MNI (Minimum Number of Individuals) estimates for presentation.

### Case Study 1: Cairncurry Plain

The Cairncurry Plain stretches along the coast between the South and East Alligator Rivers. The area of interest is located at the junction of the Cairncurry Plain and the peninsula north of Killuppa Spring. In addition to the grass-covered black soil floodplain, there are a number of prominent landscape features, including relict beach ridges and sea-cliffs from the mid-Holocene period prior to coastal progradation and formation of the coastal floodplain. The three middens which are the subject of this study are located 400 m north of the lateritic peninsula, in proximity to a relict beach ridge system (Fig. 2).

Positioned on the northern flank of a relict sandy beach ridge, site 5473 P 0708 consists of a subsurface midden, recently exposed by goanna activity. Dense scatters of marine shells are dominated by *Anadara*. At least two species of *Terebralia* are present; *T. palustris* and *T. semistriata*. Other genera that occur in small numbers include *Nerita*, *Cerithidea*, *Telescopium* and *Chicoreus*.

Further west on the same palaeo-beach ridge there is a second midden, 5473 P 0710. Adjacent to this site the ridge is breached by a 40 m stretch of black soil that probably represents a mid-Holocene erosional event. This site is extremely similar to 5473 P 0708 in that it consists of subsurface middens, recently exposed by goanna activity. In the spoil heaps at the entrance of



**Figure 2** Location of sites on the Cairncurry Plain.

Family	Genus	Palaeoridge		Black soil	
		5473 P 0708	5473 P 0710	5473 P 0709	5473 P 0709
<b>GASTROPODS</b>					
Potamididae	<i>Telescopium</i>	1 (1.3%)	1 (2.8%)	3 (7.1%)	
	<i>Terebralia</i>	1 (1.3%)	5 (13.9%)	10 (23.8%)	
	<i>Cerithidea</i>	1 (1.3%)	1 (2.8%)	1 (2.4%)	
Neritidae	<i>Nerita</i>	3 (4.0%)	1 (2.8%)	0	
Muricidae	<i>Chicoreus</i>	1 (1.3%)	0	0	
<b>BIVALVES</b>					
Arcidae	<i>Anadara</i>	68 (89.5%)	28 (77.8%)	28 (66.7%)	
<b>Total MNI</b>		<b>75</b>	<b>36</b>	<b>42</b>	

**Table 1** Midden composition in sites on the Cairncurry Plain. Numbers are MNI in sample squares (1 m x 1 m).

goanna burrows are dense scatters of marine shells. MNI counts reveal that *Anadara* is again the dominant shell genus, and again there are small numbers of *Nerita*, *Cerithidea*, *Telescopium* and *Terebralia*. A higher proportion of *Terebralia* in comparison to *Anadara* is the main difference to shell composition at site 5473 P 0708 (see Table 1).

The third midden, 5473 P 0709, is a low shell mound positioned on the black soil plain approximately 80 m from the northwestern flank of the sandy beach ridge. The mound is approximately 180 m<sup>2</sup>, has a maximum depth of 40 cm, and is composed of densely packed shells. While still predominantly *Anadara* the midden composition of the mound differs from that of the two nearby palaeo-beach ridge middens (5473 P 0708 and 5473 P 0710) in having less *Anadara* and more *Telescopium* and *Terebralia*.

The variation between these three middens can be characterised in terms of a single trend; the westward increases in Potamididae. Between the most eastern and western of the sites there is a decrease in Arcidae by some 23%, and an increase in Potamididae by a similar order of magnitude (29.4%). The increase in Potamididae takes place not only at the expense of *Anadara*, but also *Nerita* and *Chicoreus*, which decline and disappear towards the west. Although the MNI data presented in Table 1 are derived from small samples, a cursory examination of each site revealed that the sample squares were representative, and that the trend is not simply a sampling phenomenon.

There are several plausible explanations for this small scale variation between sites. It may be that the sites are contemporary and compositional differences reflect varying access from the sites to silt flats surrounding mangroves, where *Anadara* is most frequent, and the mangroves proper, where Potamididae are abundant. If this is the case then the selection of shellfish by prehistoric foragers must have been extremely sensitive to the distance to the shellfish resource.

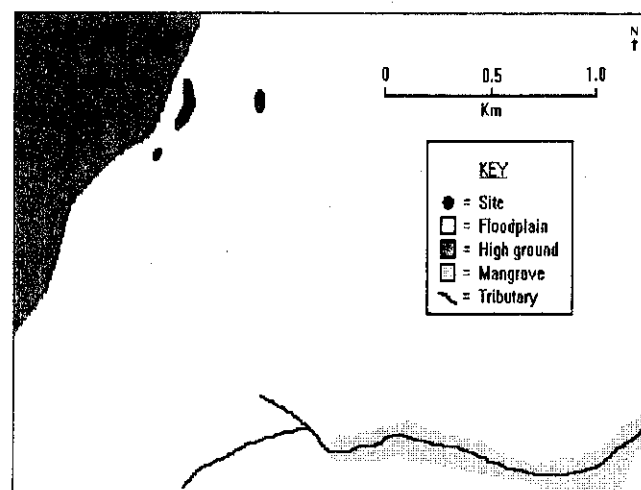
Alternatively, the differences between the two

palaeo-beach ridge middens (708, 710) and the shell mound (709) may reflect environmental change associated with shoreline progradation and the consequent proliferation of mangrove communities at this locality. In this scenario the middens on the palaeo-beach ridge probably date to the mid-Holocene, before the coastal plain had formed, whereas the shell mound, situated on the plain, would be more recent. This proposition will be tested by radiocarbon dating of the middens and local investigations of palaeoenvironments.

### Case Study 2: West Alligator Head

All three of the sites we describe from West Alligator Head are shell mounds situated on the black soil plains relatively close to the eastern margin of the high ground and looking towards the West Alligator River, some 3 km distance (Fig. 3). These sites are located 9 km from the mouth of the river (Fig. 1). Two of these mounds support a moderate cover of low shrubs and trees, including clumps of *Pandanus*. The surrounding black soil plain supports a cover of grass.

The shell mounds are located within a short



**Figure 3** Location of sites at West Alligator Head.

Family	Genus	5373 P 0711	5373 P 0712	5373 P 0713
<b>GASTROPODS</b>				
Potamididae	<i>Telescopium</i>	4 (2.0%)	8 (14.3%)	5 (18.5%)
	<i>Terebralia</i>	6 (3.0%)	17 (30.4%)	7 (25.9%)
	<i>Cerithidea</i>	1 (0.5%)	0	0
Neritidae	<i>Nerita</i>	1 (0.5%)	1 (1.8%)	0
Melongenidae	<i>Volegalea</i>	2 (1.0%)	2 (3.6%)	1 (3.7%)
Muricidae	<i>Chicoreus</i>	1 (0.5%)	2 (3.6%)	0
<b>BIVALVES</b>				
Arcidae	<i>Anadara</i>	26 (13.0%)	0	7 (25.9%)
	<i>Barbatia</i>	2 (1.0%)	0	0
Veneridae	<i>Marcia</i>	143 (71.0%)	4 (7.1%)	6 (22.2%)
	<i>Circe</i>	15 (7.5%)	22 (39.3%)	0
Ostreidae	<i>Crassostrea</i>	0	0	1 (3.7%)
Total MNI		201	56	27

**Table 2** Midden composition at West Alligator Head. Numbers are MNI in sample squares.

distance of each other, forming a cluster of sites (Fig. 3). One of the outstanding features of this shell mound cluster is the distinct variation in the faunal material between mounds.

The largest of the mounds, 5373 P 0711, is positioned on the black soil plain approximately 50 m east of the vegetation-covered higher ground. A cover of low shrubs and trees, including a large fig and clumps of *Pandanus*, is found on the mound crest. The mound is about 200 m long by 30 m wide and has an approximate height of 1.4 m above the floodplain at its southern end. The mound is elongated and its microtopography suggests that it was formed by the joining of several smaller mounds. Indeed there is minor variation in faunal content along the mound, consistent with this proposition.

Our sample of shells was drawn from the northern and southern ends of the site. MNI calculations derived from these samples are presented in Table 2. Four bivalve genera (*Anadara*, *Barbatia*, *Marcia*, *Circe*) were found, with *Marcia* being numerically dominant. Gastropods were poorly represented, with specimens of the genera *Telescopium*, *Terebralia*, *Cerithidea*, *Nerita*, *Volegalea* and *Chicoreus* being found in very low numbers. Although not present in the recorded squares, specimens were noted elsewhere on the mound that belong to the genus *Syrinx*. In total, gastropods make up less than 10% of MNI in the site, a figure that contrasts with the nearby mounds.

Site 5373 P0712 is a shell mound positioned on the black soil plain approximately 300 m east of the vegetation-covered higher ground. The mound is about 75 m long and 35 m wide, and has an approximate height of 0.8 m above the floodplain. Gastropods and bivalves occur in roughly equal numbers. Gastropods are represented by *Telescopium*, *Terebralia*, *Nerita*,

*Volegalea* and *Chicoreus*. Bivalves are represented by only *Marcia* and *Circe*. The most common genera are *Circe* and *Terebralia*.

The third and smallest shell mound, 5373 P 0713 is positioned on the black soil plain only 30 m east of the vegetation-covered higher ground. This roughly circular shell mound, 40 m x 30 m in area, has an approximate height of 0.4 m. Three bivalve genera are present (*Anadara*, *Marcia* and *Crassostrea*). Gastropods were represented by *Telescopium*, *Terebralia*, and *Volegalea*. No single genus is dominant, there being broadly equal amounts of *Anadara*, *Terebralia*, *Telescopium*, and *Marcia*.

Comparison of faunal composition from these mounds does not reveal the similarity that might be expected at sites in such close proximity to one another. The noticeable differences in faunal assemblages can be summarised as follows:

1. The largest of the three sites, 5373 P 0711, contains the greatest number of genera. Since this site also has the largest sample, there may be a sample-size factor involved, and further information would be required before variation in richness can be interpreted (cf. Grayson 1984:132).
2. Evenness of specimen distribution between genera appears to be inversely proportional to site size, with the smallest site (713) having much of the assemblage split between four genera while at the largest site (711) most specimens belong to one genus.
3. There are presence/absence differences among the three sites that field inspections reveal are real and not an artefact of sampling. For example, the absence of *Circe* at 5373 P0713 or *Anadara* at 5373 P0712 when they are significant components of the other two sites points to qualitative differences in

the nature of the assemblage.

4. There are major shifts in the proportions of genera, reflected in the fact that the most abundant genus is different in each site: *Marcia* in 711, *Circe* in 712, and *Anadara/Terebralia* in 713.

In comparison to 711, which is dominated by the family Veneridae, the variation in assemblages can be portrayed as a shift to Potamididae at 712, and to Potamididae and Arcidae at 713. However, this characterisation overlooks the sizeable variation in genera that make up the family groups at each site, and it is perhaps inappropriate to treat 711 as a standard for comparison. Consequently, it may be better to simply describe the three shell mounds as varying in the relative frequency of Veneridae, Arcidae and Potamididae.

The most plausible explanation for this variation in species composition is that the mounds were formed at different times under different landscape regimes. Likely changes to the environment would have taken the form of changes in the extent and location of the mangrove forest and such changes in environmental conditions would have affected the species of shellfish available for exploitation by the people using these sites. Most of the shellfish species present in the West Alligator sites are found in intertidal mangrove muds, and any changes in the mangrove swamps would have been reflected in the shellfish fauna available for exploitation. Since all of the geomorphological investigations in Kakadu have taken place on the South Alligator River (cf. Woodroffe et al. 1988; Hope et al. 1985) the timing and nature of landscape changes at the mouth of the West Alligator River are currently ill-defined. In an attempt to identify shifts in river position or coastal form a cursory examination of aerial photography was made. Unlike the nearby Point Stuart area (Baker 1981; Clarke et al. 1979) the aerial photographs show no obvious evidence of shoreline progradation, such as beach ridges.

Despite the lack of information on environmental change, the suggestion that these mounds differ in age is reinforced by variations in the fragmentation and preservation of shells. The details of these taphonomic characteristics will be the subject of a future paper, which will suggest that site 5373 P 0711 is the older of the mounds (possibly mid-Holocene) and that site 5373 P 0712 is probably late Holocene in age. If the mounds form a chronological sequence in this way then the variation between the sites may reflect ecological change. This chronological explanation will only be upheld if radiometric dating reveals that the mounds are of different antiquity. Should the sites turn out to be contemporary, other explanations must be sought.

	Cairncurry Plain	West Alligator Head
Average richness	5	7.7
Range of richness	4 - 6	6 - 10
Number of sites	3	3
Average sample at site (MNI)	51	95

Table 3 Regional differences in shellfish species richness.

### Regional variation

The description of midden variability provided above has focused on differences within each of the areas selected as case studies. However, there is even greater variation in faunal assemblages between the sub-regions that make up the Kakadu wetlands. One measure of the contrasts between sites on the Cairncurry Plain and those at West Alligator Head is the diversity of shell species. Table 3 summarises regional difference in species richness. Available data appears to indicate greater richness at West Alligator Head, but since the sample sizes are also greater in that area the differences in richness could be methodological (cf. Grayson 1984). Further field observation is required before this aspect of variation is interpreted.

As a means of illustrating the inter-site variation in genera found between these middens a comparison was made of the three most abundant families represented in the sites; the bivalve families Arcidae (containing the genera *Anadara* and *Barbatia*) and Veneridae (containing the genera *Marcia* and *Circe*), and the gastropod family Potamididae (containing the genera *Terebralia*, *Telescopium* and *Cerithidea*). Other species were excluded from this analysis. There are several inferences we would make in light of the patterns presented in Figure 4. Firstly, the middens at West Alligator Head display greater intra-regional variation than those on the Cairncurry Plain. Secondly, while

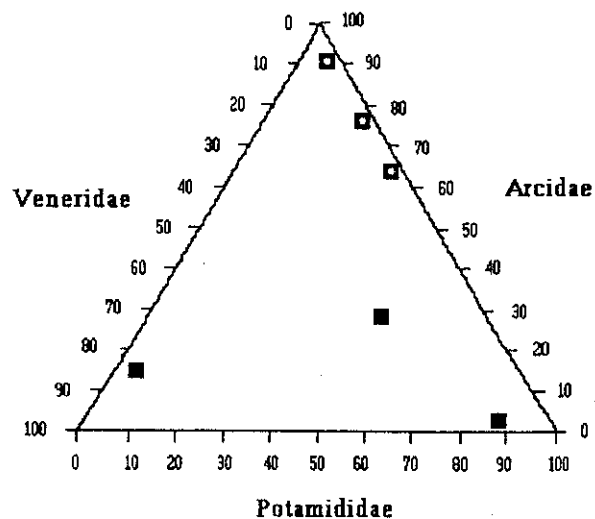


Figure 4 Midden composition.

assemblages vary in one direction on the Cairncurry Plain, change in Potamididae frequency, the variation at West Alligator Head is more complex. Thirdly, middens in the two regions are quantitatively different, with no overlap in relative species composition. In combination these points emphasise the high degree of midden variability that exists within at least the coastal portion of the Kakadu wetlands. This variability can also be documented by contrasting the site descriptions given above with those provided by Woodroffe et al. (1988) for an area located between the Cairncurry Plain and West Alligator Head.

**Discussion**

The archaeological pattern described here displays some similarities with the observations of Woodroffe et al. (1988). Shell midden composition along the tidal reaches of the South Alligator River is described in qualitative terms by Woodroffe et al. (1988:97), and Table 4 summarises their information. Four classes of site were defined by Woodroffe et al. (1988:96) as follows:

1. **Coastal middens**, which were observed on chenier ridges on the coastal plain at the mouth of the river.
2. **Surface mounds**, consisting of shell, bone and sediment in low mounds up to 20 m in diameter. These sites were located on the estuarine plain more than 10 km from the coast.
3. **Palaeochannel middens**, which were positioned on landscape features associated with defunct river channels.
4. **Surface scatters** of small numbers of shells. These sites were located in various contexts.

Of these four categories only coastal middens are positioned within 5 km to 10 km of the coast in broadly similar landscape contexts to the sites described in this

paper. It is noteworthy that these coastal middens have far greater faunal richness ( $\bar{x} = 7.0$ ) than the other site categories (surface mounds  $\bar{x} = 2.5$ ; palaeochannel middens  $\bar{x} = 2.67$ ; surface scatters  $\bar{x} = 1.77$ ). This richness value for the coastal plain at the mouth of the South Alligator River is comparable to the diversity of shells the authors observed on the Cairncurry Plain and at the West Alligator Head (see above).

However, in many other respects the patterns described by Woodroffe et al. (1988) differ from observations of the authors in areas to the east and west of the South Alligator River. Several points of difference can be identified:

1. All the coastal middens recorded by Woodroffe et al. (1988) were positioned on the crests of chenier ridges, whereas the sites described above are found either on relict beach ridges or on the black clay of the floodplain.
2. All the coastal middens reported by Woodroffe et al. (1988) were dominated by *Anadara*. While this is also the case for the Cairncurry Plain sites, it is not so at West Alligator Head. Not only are none of the middens on the West Alligator dominated by *Anadara*, site 5373 P 0712 contains no specimens of that genus.
3. Species such as *Cerithidea* that were consistently absent in sites at the mouth of the South Alligator River recorded by Woodroffe et al. (1988) are present in middens on both the Cairncurry Plain and West Alligator Head.
4. Conversely, the coastal middens at the mouth of the South Alligator River contain genera not represented in middens described here.

To these differences in gross site position and species presence/absence we could probably add a range

Genera	Coastal midden	Surface mound	Palaeochannel mounds	Surface scatters
<i>Anadara</i>	x	--	--	--
<i>Turritella</i>	x	--	--	--
<i>Naquetia</i> #	x	--	--	--
<i>Mactra</i>	x	--	--	--
<i>Ellobium</i>	x	--	--	--
<i>Nerita</i>	x	x	--	--
<i>Telescopium</i>	x	--	x	x
<i>Terebralia</i>	x	--	x	x
<i>Polymesoda</i>	x	--	x	--
<i>Cerithidea</i>	--	x	x	x
<i>Volegalea</i>	--	--	x	--
<i>Meretrix</i>	--	x	x	--
Dominant genera	<i>Anadara</i>	<i>Cerithidea</i> <i>Meretrix</i>	?	<i>Telescopium</i>
Sites	A, B, C	G, H, J, N	F, K, L, M	D, E, P?

**Table 4** Midden composition along the South Alligator River (data from Woodroffe et al. 1988:97). # *Naquetia* is a synonym of *Chicoreus*.

of quantitative variations in composition and context, if only MNI/NISP (Number of Identified Specimens) data were available. We take these differences between the observations of Woodroffe et al. (1988) and those of our own, as further evidence of the extreme variability in shell middens, within and between regions in the Kakadu wetlands.

### Conclusions

The focus of this paper has been on the high degree of variability in midden composition in the coastal portion of the Kakadu region. In itself this diversity deserves documentation and explanation. Furthermore, given the massive environmental changes that have taken place to form the wetlands since the mid-Holocene, knowledge of midden diversity will contribute to a general understanding of prehistoric landscape use in the area. In this regard we have built on the initial work of Woodroffe et al. (1988) by describing an even greater variety of midden contents and site locations. Further investigation using faunal assemblages with larger sample sizes, radiocarbon dating of midden sites, and local geomorphic studies should resolve some of the questions raised here and develop a picture of the subsistence-settlement systems that were in operation along the Kakadu coast.

Recognition of the extreme diversity in midden form has implications for previous studies of Kakadu, which have tended to treat 'plateau' and 'plain' as internally homogeneous archaeological and environmental units. Schrire's (1982) work, focused as it was on the differences between the lowlands and the plateau, tended to undervalue the differences she found within each region. An equivalent tendency is found in Jones' (1985:293) broad synthesis since his characterisation of the Alligator Rivers wetlands is based on a study of the freshwater section of the South Alligator River. Similarly, in an innovative synthesis of late Holocene prehistory on the coastal plains Allen and Barton (nd:104-5) argue, on the basis of rockshelters along the East Alligator River together with the unquantified data of Woodroffe et al. (1985) and middens from the region to the west of Kakadu, that throughout the coastal lowlands there is a chronological change in shellfish procurement away from *Cerithidea* in the last 3000 years. While this may well have been the case in the east, the small amounts of *Cerithidea* in all of the middens described here, including those hypothesised to be more than 3000 years old, suggests that such temporal trends may be localised rather than universal within the wetlands. Current environmental diversity within the wetlands lead to an expectation of variation in past environments and human economies within the wetlands.

We therefore conclude that whilst the archaeology along the East and South Alligator Rivers, in areas

relatively near the Arnhem Land escarpment are well described (cf. Schrire 1982; Jones 1985; Allen and Barton nd), other portions of the wetlands, such as the West Alligator River and the plains between the mouths of the Alligator Rivers, are largely unknown. This paper has demonstrated the existence of diverse and intriguing variations in middens at the extreme northern margins of the Kakadu wetlands, and future syntheses of the region will need to incorporate this information into pictures of the prehistoric human exploitation of the floodplains.

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