CHAPTER 8

Conclusion

8.1 Towards revised models of Pleistocene subsistence

Since the earliest known examples of Homo sapiens sapiens were recovered at Lake Mungo in western NSW the Pleistocene prehistory of the Murray Darling basin has become in a real sense the prehistory of our own species. For this reason the evidence for subsistence behaviour and adaptation of Pleistocene Aboriginals must be carefully considered. I have interpreted the currently accepted model of Pleistocene adaptation to the environments of western NSW as one which suggests that there was an unbroken tradition of food procurement strategies, ultimately devised from the purported coast foraging strategy of Aboroginal forebears. This model, which presents a static picture of Aboriginal culture, is questioned.

When models of Pleistocene and recent foraging strategies in the Murray Darling river tract are critically examined, it becomes clear that they are based not on ethnohistory, nor on the systematic appraisal of contents of archaeological deposits but in fact on theoretical consideration of the optimal foraging range of human populations, given what is known about the distribution of food and water. The essential problem with this approach is that these models are generalised, while water resources vary through time and space. Models which are premised on the availability of water should also admit the possibility of variability. The static model of human adaptation to western NSW environments cannot be accepted, and models of Pleistocene human adaptation which are currently widely cited require re-evaluation. Jones' conclusion that there were no great Pleistocene adaptations in Australia for example, requires rigorous investigation (1973:281).

Although generalized environmental models are of some value, an approach which examines the upper limits of possible adaptations

through investigation of the available water and food resources, has several advantages, notably the advantages of obtaining information about the environment from sources which are independent of the evidence contained in archaeological occupation deposits. In this way archaeological information can be contrasted with theoretical optimal subsistence patterns (Cook 1972).

Recent investigations of Aboriginal subsistence strategies and adaptations in the Murray Darling basin have in fact tended to be confined to limited areas where environmental variables, particularly water resources, can be more fully understood (Wickham 1983; Jacobs in prep; Balme in prep), thus, implicitly rejecting the hypothesis that Aboriginal subsistence strategies were static.

Similarly, a regional approach has been adopted in this study of a single lake basin on the Murray river. The Lake Victoria basin is comparatively well watered, and the area of the flood tract which is well endowed with lakes, swamps and other diverse habitats capable of providing which could have provided a subsistence base for comparatively large numbers of Aboriginals.

The investigation of susbistence and adaptation in the Lake Victoria basin began by examining all evidence for subsistence strategies and for food and water availability for the recent past, to gain insights into the range of subsistence possibilities. Ethnohistoric records were of little direct aid in determining the details of subsistence. They consistently indicated the importance of fish and aquatic birds in the district, and suggested that plant foods, particularly typha roots were important, but in the main ethnohistoric records concentrated on the more spectacular aspects of Aboriginal life - such as devious methods of trapping ducks and fish, descriptions of armed confrontations, and so on. There were no records of the activities of small groups, and very few detailed descriptions of the activities of Aboriginals who were foraging under 'normal' conditions. However, if we assume that

ethnohistoric estimates of the population were roughly correct, and that the river was the principal source of sustenance - which would seem reasonable in view of the numbers of people who were recorded, then we may assume that variations in the resources of the river was an important limiting factor in determining subsistence strategies, and that failure of flood pulses to innundate the river tract would lead to a decline in available resources. Investigation of the records of Murray river discharge of the past 50 years has suggested that flood failure would occur at least once in a human generation, and possibly twice. If resources of the river tract failed, as they would in paired years of failure, a population of the size recorded in 1854 would be thrown back on the resources of the hinterland.

In the country to the north, south and west of Lake Victoria there are no rockholes to store water, and ground water is very saline. Exploitation of the hinterland is restricted by water availability to areas around ephemeral pools and areas where water bearing plants could supply moisture, and to areas within reach of remaining pools in the trunk river systems. Thus, it is likely that distant hinterland areas were exploited by small groups which could subsist on limited water supplies. It is likely that in times of drought the hinterland would have been more intensively utilized. The ecotone between riverain and hinterland was probably regularly exploited for seed and fruit resources. In addition to this pattern of exploitation, it is likely that a more intense use was made of the ecotone during periods of riverain failure. This is suggested because in times of river droughts the normally sparsely distributed and ephemeral resources of the ecotone would have been supplemented by large game, who would have been dependent on the remaining sources of drinking water. At time of riverain drought it is also likely that humans would fully exploit normally inaccessible resources of the remaining pools - large fish, turtles and crustacea - and, if the dry episode was protracted, it is likely that there would be an increased exploitation of low ranked foods, such as shellfish. Exploitation of the ecotone zone might have even

supported large groups during times of drought, if the products of ecotone hunting, collecting and fishing were combined.

The ecotone is a very important zone as far as archaeological investigation is concerned, for it is in this area that most of the evidence for Pleistocene subsistence strategies is preserved (Fig 5.1). If subsistence shifts did take place in the past 30,000 years, then they will be documented in the ecotone zone. Thus the nature of the ecotone resource systems and the changing relations between ecotone and riverain are very important in interpreting the archaeological record.

The currently available evidence from Lake Victoria indicates that combined exploitation of resources of riverain and hinterland was a frequent occurrence. This is documented by the presence of large shell middens up to 50 km from the nearest shellfish source. It is not yet possible to determine if these middens were continually formed through the history of occupation, or if midden formation was episodic and related to drought, or if middens were formed in response to cultural factors.

Excavation of portions of two ecotone middens has shown that they are rich potential sources of evidence for exploitation of animal foods, and that traces of cultural activities may be located by small scale excavation and recovery techniques. The further investigation of ecotone midden deposits lies outside the scope of the current work which has aimed at establishing the basic nature of resource distribution in the riverain and ecotone in the Pleistocene. In further research the contents of middens may be used to test the hypothesis that intensified use of the ecotone was made during intervals of riverain failure.

The main points to emerge from the theoretical consideration of the possible range of exploitation strategies of the recent past are:

(i) although occupation deposits in the riverain are more likely to document change, they are much less likely to survive

(ii) occupation deposits which survive in the ecotone or the distant hinterland are more likely to document specific types of foraging

(iii) it is premature to dismiss the possibility that changes have occurred in subsistence, and it is possible that evidence for change might be deduced from examining the nature of the ecotone and changes in the zones where occupation deposits have survived.

It is concluded that currently, most information has come from ecotone sites, and thus, the nature of the ecotone as an environment of the recent past and the Pleistocene is worthy of further consideration.

8.2 Environmental change in the riverain and the ecotone in the Lake Victoria basin

Evidence for the Lake Victoria environment of the Pleistocene has been sought in the records of change in river flood and in hinterland precipitation effectiveness which are contained in sediments and soils of the basin and in the fossil animal remains which have been recovered from these sediments and soils. The sedimentary record of this area contains an interrupted record of variation in local conditions from the mid Pleistocene until the terminal Pleistocene. This evidence suggests that river discharge and riverain topography have varied, and that there were major swings from locally wet to locally arid through the last 128,000 years. Wet intervals saw a relative expansion of diverse riverain habitats (associated with high freshwater tables). Diversity is suggested by the presence of a suite of fauna, including arboreal species, and some species whose modern counterparts only inhabit forested areas. It is believed likely that larger animal species

expanded into the Lake Victoria area during times of high river discharge and high local effective precipitation, and probably became locally extinct during arid phases.

At the time the first human occupation of the Lake Mungo area is recorded, the Lake Victoria area supported a suite of large animals. This, as well as the evidence of soil formation, indicated a high effective precipitation, and a diverse and stable groundcover. Humans at Lake Mungo 200 km to the north east inhabited the Willandra Lakes during the tail end of this favourable 'lacustral' period. However, the Lake Mungo area was probably never analagous to the Darling flood tract. It is likely that larger animals less tolerant of drought had either never colonised the Lake Mungo environment, or had become locally extinct prior to human occupation.

As the Willandra Lakes dried, Lake Victoria continued to fill with water, although the region wide changes in atmospheric circulation began to affect the Murray basin, because increased windstrengths caused increased wave action, and initiated the formation of a sandy dune on the eastern side of the lake basin. There is no evidence available for human occupation of the Lake Victoria basin as early as 30,000 BP.

The earliest evidence for human presence at Lake Victoria comes from three shell middens deposits on the northern and eastern sides of the lake. These middens are dated between 18,2000 BP and 17,650 BP. In the lake basin at this time there was a brief period when the erodible sands of the lunette were stable enough for a soil to form. This suggests an increase in effective precipitation in the hinterland and locally in the river basin; and lower wave action and sand supply in the lake shore area, implying a diminuition in strong dune building summer winds. This interpretation is supported by the presence of fossil remains of large grazing and browsing animals in the soil which marks this pause in lunette construction. The environment in which human populations would have lived c 17,500 BP would have been one in which the river tract was regularly supplied with

water, and the hinterland was well vegetated, and ephemeral pools took longer to evaporate than they do at present. If this was the case, a wide area of the hinterland would have been accessible to exploitation. Vegetation cover was diverse enough to support animals including the large browser Diprotodon optatum, the large grazer Procoptodon, Sthenurine kangaroos, and other macropods 30% larger than similar modern species.

Little is known of the adaptive strategies of the earliest human inhabitants of Lake Victoria. It is suggested that plentiful occupation deposits and numerous hearths which are found to the north and west of the lunette might contain some indication of the prey species, size and activities of Pleistocene groups. It is not beyond the bounds of possibility that the earliest Pleistocene inhabitants of the Murray flood tract were exploiting large faunal species. If this proves to be the case, then additional questions relating to the nature of the Aboriginal post Pleistocene adaptations will be raised; cf Hawkes and O'Connell's argument that the adoption of broad spectrum foraging often followed the loss of large game species, and that the loss of large game species may be associated with socio economic changes in group size, and seasonal population distribution (1982). In view of the fact that the larger species are dependent on water, it is certain that the frequency of contact between humans and larger animals would have increased during droughts. In the droughts of the Pleistocene it is thus probable that ecotone foraging strategies would have encompassed the exploitation of large animals. This means that the remains of these activities should be preserved in Pleistocene sediments.

In the period after 17,500 BP the human environment at Lake Victoria experienced marked changes. The moblization of sediments in dunefields to the east and north indicate that the hinterland area were now experiencing desiccation and devegetation. The final drying of lake basins in the Willandra system to the north and east, indicate that the Murray river must have been receiving a decreased input of water, and that

riverain habitats in these areas were rapidly contracting. As regional fresh water tables lowered, ground water salinity must have increased. Lake basins which were formerly sources of sustenance for humans would have become desert and the overall carrying capacity of the hinterland must have been severely decreased.

In the Gill's Gully area of the Lake Victoria lunette between 8 and 10 metres of sand from the lake shore and the stoss face of the lunette accumulated over the remnants of the soil of c 17.500 BP. The accession of sand indicates that at this time the lake basin probably continued to fill - although the lake shore may have been bare and devegetated. After 16,000 BP there is evidence for a period of c 1,000 years when the lake floor was exposed repeatedly to drying winds, which transported aggregates of clay and silt up the dune face to coat the sands of the crest and the lee slopes of the lunette. At this time, flood pulses failed to fill the lake basin for years at a time. It is likely that between 16,000 and 15,000 BP flood pulses travelling down the Murray were weak, and that the river remained low. Low river levels at the present time allow saline aquifers to discharge into the trunk river, and so it is possible that flood failure was associated with rising salinity levels in the remaining pools of the trunk river. Lake Victoria sediments of this time provide the most recent evidence for the survival of large grazing and browsing species, including the Diprotodon, Macropus cooperi, the giant ancestor of the wallaroo, Macropus robustus and Macropus ferragus, a giant relative of the grey kangaroo. It is likely that loss of riverain habitats contributed to the decline of these species, and that human predation increased the prospects of local extinction. It has been suggested from areas elsewhere that human occupation might have caused changes in vegetation, which could lead to increased rates of sediment build up. In the area of Lake Victoria, consideration of the possible range of vegetation and the susceptibility of this vegetation to human modification by fire, has led to the conclusion that the major changes in sedimentation observed in this period are more

economically explained in terms of natural changes, including a higher incidence of frost, and decreased precipitation effectiveness.

The period between 16,000 BP and 15,000 BP was also one which was apparently marked by aridity and cold strong winds in the hinterland. The human resource base must have been diminished by repeated riverain failure, further decreased by the lack of water sources in the hinterland.

Some evidence for human subsistence during the thousand year drought period has been preserved in sediments of the lunette. Because the lunette is actually part of the ecotone zone, the surviving information should not be interpreted as being typical of the full range of Pleistocene exploitation strategies.

A survey of 1 sq km of the lunette was designed to investigate the evidence for change. A midden deposit dating to the beginning of the period of droughts after 16,170 BP was partially excavated, utilizing techniques designed to recover evidence for small particles of bone, and of plant remains. This midden, Gill's Gully 2, contained the remains of a brief occupation by a large group of people, who were exploiting a diverse range of hinterland fauna, and also the resources of the lake, including shellfish, procured from the muddy lake floor, yabbies and fish. No plant remains were recovered from in situ deposits, Preservation of hearths, bones and shell was excellent. In the survey area there were no other middens at the same stratigraphic horizon, which could imply that exploitation of the ecotone was not a regular activity at c 16,000 BP.

Similarly, no midden deposits were located in sediments bracketed by dates of 16,170 BP and 15,750 BP. These sediments include laminar beds of fine sediments deflated from the lake floor, with some sand rich lenses.

This interval marks the most severe period of river failure, and yet contains little evidence for the intensified use of ecotone resources, which is curious, and requires further investigation.

The strata which post date 15,750 BP, are, in contrast, rich in in situ shell midden deposits. These deposits of Silt A, a light grey fine sediment, may be traced over a wide area of the lunette crest, and preliminary investigation of cliffed sections indicates that the increased frequency of shell midden deposits in this horizon is not confined to the Gill's Gully survey area.

The area of this sediment which was excavated suggests that, in contrast with the small midden deposit at Gill's Gully 2, the midden deposits in Silt A are small lenses, which implies that they were deposited by small groups, who were returning to the same area at frequent intervals to supplement shell fish from the lake with small mammals of the lunette. The small lenses of shell are very common both in and on top of Silt A.

In the Gill's Gully area there is definite evidence for a variation in the rate of formation of midden deposits from 16,170 BP to 14,900 BP. If future investigations demonstrate that this phenomenon was more widespread, we might have evidence for a definite intensification of ecotone resources in the last phases of the most recent Pleistocene arid phase, that is an intensification of exploitation of shellfish subsequent to the last recorded occurrence of large game, and at some time after the period of the most intensive droughts in the history of human occupation in the Murray basin.

The sedimentary record of climatic and paleohydrologic change in the lake basin cuts off soon after c 14,900 BP because this is the latest date at which surviving lunette crest sediments were deposited. Sandy sediments deposited after 14,900 BP probably were deflated into lee dunes of loose sand by the strong winds passing over the lunette crest. In any case no in situ midden deposits have survived in these sands overlying Silt A. There is little chance of using stratigraphic dating to

ascertain the age of shell middens or other occupation deposits in the period after 14,500 BP. Research into change after 14,500 BP must therefore rely on datable materials in midden deposits.

8.3 Directions of future research in the central Murray valley

Information sources for the environmental prehistory of the Lake Victoria area of the central Murray valley are summarised in Table 8.1. This table shows that information presently available comes from two time slices, the Pleistocene period of lunette formation, and the recent past, between 1829 and 1983.

Table 8.1 Information sources for the prehistory of the Lake Victoria basin

Time	Environment	Human activity
17,500 BP to 14,000 BP	Sediment, ancient soils, landforms, channel forms, palynology, fossil faunas including those in occupation deposits	Distribution and content of dated archaeological deposits at Lake Victoria and elsewhere in western NSW
	Aboriginal occupation deposits	
700 BP	Sediment	Shell midden deposits
1829 to 1900 AD	Written records of pastoralists, early explorers, government officials, and missionaries	Occupation deposits, written records of explorers, travellers, overlanders and missionaries
Recent past to 1938 AD	Observations of the landscape by local observers, (past 200 years) and environmental scientists (past 50 years)	Analogous studies of human behaviours in similar environments elsewhere

There are still many grey areas, and many areas in which analogies between sources of information need to be explored. Paleohydrologic evidence for change may be further documented in

the paleochannels and terraces of the riverain, and it is likely that further exploration of the river tract will reveal occupation traces which may be related to the ethnohistory of the recent past.

Theoretical consideration of the range of possible subsistence strategies suggests that the next step in investigating the Pleistocene prehistory of the Murray basin will be to determine more about the distribution and content of occupation deposits in the ecotone zone through time, particularly to compare ecotone occupation deposits of the Pleistocene and the Holocene, to determine if (i) there were any major adaptive shifts, and (ii) to compare subsistence patterns in the hinterland more than 20 km from water with those in the ecotone, and (iii) to investigate the prehistory of the riverain tract, particularly the high level alluvium, with particular stress on the hearth sites which might contain evidence for exploitation of large mammals.

Within the river tract, the possibility of developing sedentism requires further investigation. Sedentism within the river tract would necessitate some mechanism which would enable comparatively large populations to maintain adequate food reserves during summer low flow, and 'paired drought years' without recourse to ecotone foraging. The most interesting possibility in this respect would be the development of artificial methods of supplying water to reservoirs, to maintain fish and bird populations. Water diversion schemes were apparently known in areas to the south east of the Murray, (Lourandos 1980) so the conceptual structure of irrigation may have been available to Murray flood tract inhabitants, although there is no evidence that such techniques were ever employed in the Murray flood plain.

8.4 General conclusions

This regional study of Lake Victoria lunette has established that humans in the Lake Victoria area in the Pleistocene would

have inhabited a landscape with no modern parallels. Models developed to describe subsistence strategies in the Pleistocene areas of western NSW further to the north and east have little relevance to range of Pleistocene foraging strategies which could have been possible at Lake Victoria, for example. It has now been established that humans and larger mammalian species were dependent on bodies of standing water, it is likely that human/megafaunal contacts would have been frequent, and that they would have increased during droughts. It is thus likely that humans contributed to the local extinction of megafaunal species.

Evidence for human predation on larger animals will not be found in shell midden deposits, but it is possible that such evidence will be located in the Pleistocene sediments of the high level alluvium of the Murray flood tract to the east of Lake Victoria. Human predation on larger species at Lake Victoria might have contribute to local extinction of these species, but it does not explain the failure of large species to survive in refuge zones in better watered areas where they had apparently survived much more severe intervals of drought in the mid and late Pleistocene. Extinction in better watered areas may be explicable in terms of the types of changes which humans could have cause in the natural landscapes of refuge zones. In this way humans may have contributed to the continent wide extinction of megafaunal species during the late Pleistocene

The initial effects on human presence in the landscape of the Pleistocene lake basin are not yet well understood, however, increased frequency of burning would have exercised little effect on the natural landscapes of areas which were not vegetated by flammable species. In areas vegetated by eucalypts it is possible that humans could have effectively opened up the vegetation, and, by creating a mosiac of habitats in various stages of recovery from fire, promote species diversity. It is considered unlikely that burning of any kind could have contributed to the devegetation and sediment mobilization of the late Pleistocene, when natural factors such as drought, frost

and insect attack or disease are all more likely explanations for late Pleistocene landscape change.

Pleistocene human occupation deposits are principally known from the ecotone zone between riverain and hinterland, and are mainly shell midden sites. Shell middens were probably formed with increased frequency during periods of low water, and it is possible that the formation of these deposits can be related to times when the river resources were low. In the area of lunette investigated, one midden deposit was found in sediments older than 17,000 BP, one large midden deposit was located in the sands deposited between 17,000 and 16,000 BP, one small midden was found in sediments deposited between 16,000 and 14,900 BP. Sediments older than 15,000 BP appear to be rich in in situ middens, suggesting a variation in the rate of midden formation. This variation cannot be explained by preservation of shell and bone, which was excellent in middens of all ages, it may be partly explicable in terms of visibility in the cliffed exposures of sediment horizons - however in this portion of the lunette there seems to have been a real difference in rates of midden formation. Further investigation of lunette strata and midden frequency in strata is required to establish if this variation is real, or if it is a factor of the small area of lunette surveyed (approximately 1/14th of the total). In addition to the higher frequency of midden deposits, there was an apparent variation in midden size. The midden deposit of 16,000 BP covers an area of approximately 30 x 50 metres at the same stratigraphic horizon, and was apparently formed by a large group in a single event. In contrast, shell middens in sediments older than 14,900 BP are small deposits, indicating repeated visits to the lunette crest by people who discarded shells in small patches.

This may be interpreted variously as intensified utilization of the part of the ecotone between lake and riverain in times of drought, or an increase in the exploitation of low ranked game, or as an increase in total population in the flood tract, or a change in socio cultural behaviour. If the first explanation is

adopted it is difficult to explain why there was no corresponding increase in midden frequency in sediments documenting droughts prior to 15,000 BP. In the other cases, additional information on the size, age and contents of midden deposits in areas outside the lunette is required to complete the picture of late Pleistocene Aboriginal subsistence, and to determine what variations in foraging strategy occurred through time as the environment changed.