HISTORIES OF OLD AGES

Essays in honour of Rhys Jones

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PANDANUS BOOKS
Research School of Pacific and Asian Studies
THE AUSTRALIAN NATIONAL UNIVERSITY

In Search of the Traditional Australian Aboriginal Diet — Then and Now

Neville G. White
Biological Anthropology and Immunology Section
Department of Genetics
La Trobe University

THERE IS considerable interest in the subsistence behaviours and diets of early humans (e.g. Southgate 1991) for the reconstruction of prehistoric societies. Interest in these 'natural' diets (Southgate 1991:281) has also been stimulated by research on preventative diets for a number of chronic, or 'lifestyle', diseases prevalent in industrialised societies. As Eaton and Konner (1985:288) have argued, 'it is both intellectually satisfying and heuristically valuable to estimate the typical diet that human beings were adapted to consume during the long course of our evolution .... The diet of our remote ancestors may be a reference standard for modern human nutrition and a model for defense against certain "diseases of civilization." ' Research of this kind rests largely on ethnographic studies of recent and present-day hunting and foraging societies. Using 'subsistence data from fifty eight technologically primitive societies', Eaton and Konner (1985:287) claimed that the 'mean, median, and mode for recent foragers converge on a dietary ratio of 35% meat and 65 % vegetable foods'. While recognising that the 'paleolithic diet' was not fixed, they used these ratios to develop recommendations for the American diet.

In Australia there is also considerable interest in trying to reconstruct pre-contact diets not only to add insights into the processes of Aboriginal colonisation(s) and adaptations, but also to understand the causes of, and to develop preventative strategies for, nutrition-related diseases such as diabetes mellitus and cardiovascular disease. These diseases are a major cause of illness and death in Aboriginal communities across Australia. Here, too, we need to draw on the available ethnographic studies of traditional-oriented Aboriginal people. Without such information, we are forced back onto an interpretation of the sparse archaeological evidence.

Here I will summarise the observations and conclusions of some of the major studies of Australian Aboriginal subsistence. In addition to the published accounts of others, particularly those of Rhys Jones and his research colleague Betty Meehan for the Anbarra of central coastal Arnhem Land, I will draw upon observations which we have made over a period of almost 30 years in the remote Aboriginal community of Donydji, in northeastern Arnhem Land. Donydji is one of a number of Homeland Centres, or outstations, located in the lands of people known to anthropologists as the Yolngu (see e.g. White 1985, for background to both the community and the field research).

The overriding concern of our research over recent years has been to help the Yolngu people understand, and cope with their rapidly changing world. We believe that long term studies of subsistence, and an understanding of indigenous belief systems and food habits, are crucial for the interpretation of nutritional health in remote Australian Aboriginal communities such as Donydji (White 1985; White 1989; Polakiewicz et al. 1990). The value of such an approach became evident in 1985 during the initial phase of a long term study at Donydji to monitor the markers of nutritional status and the risk factors for diabetes mellitus and cardiovascular diseases (O'Dea et al. 1988). The considerable variation found among individuals in their

cholesterol concentrations, triglyceride levels and fatty acid profiles, could only be understood through long term research into food beliefs and habits. Nutritional anthropological studies also enable us to predict which individuals and groups in Aboriginal communities are at greatest risk from nutrition-related disorders, particularly as a consequence of dietary and lifestyle change.

What then do we know of the diets of Australian hunters and foragers? Does the Australian evidence support the generalisation by Eaton and Konner (1985:287) concerning the macro-nutrient profile of 'the paleolithic diet'?

"Everywhere [vegetable foods] were of the order of 70 or 80 percent of the total food supplies"

This assertion was made by Meggitt (1964:33) in one of the most widely quoted papers in Aboriginal studies: from the central desert through the semi-arid steppes, the sub-humid grasslands and humid forests to the northern coasts with areas of rainforest 'vegetable foods collected by women made by far the greatest contribution to the diet; everywhere these were of the order of 70 or 80 percent of the total food supplies.'

While it is unclear whether this figure refers to gross weight or available energy or some other measure, the claim has become dogma in many anthropological studies stimulating considerable research and debate (e.g. Hiatt 1967/8; Meehan 1982a). Meehan considers that the belief that 'Aborigines were Arcardian vegetarians and that the women were the main providers of the food' are myths 'derived partly from what is stated to have been the economy of pre-European Australian Aborigines which is unsupported by any quantitative facts' (cited in Jones 1980:136). What is the evidence for Meggitt's assertion, and is there a 'typical' Aboriginal diet? Certainly, the accounts of early observers indicate substantial regional differences. For example:

1. the food of Aborigines living near Cooper's Creek in the arid southern central region of Australia 'may be described as consisting of everything having life ... [although] ... it is principally of fish and seeds, which are pounded and then mixed with water, and either eaten raw or baked in ashes' (Smyth 1878, 2:302);
2. Curr (1886, 2:46), referring to the 'Dieyerie Tribe' of this same region, wrote that 'their food is principally vegetable, animals being very scarce, if we except rats and their species, and snakes and other reptiles, of which there is an unlimited number ... . In a dry season they mainly subsist on ardoo seeds of *Marsilea quadrifolia*, but in a good season they have an ample supply of seeds which they grind and pound and bake in the ashes. They gather also then plenty of plants, herbs and roots';
3. the 'Kurnai' of Gippsland, in southeastern temperate Australia, 'depend upon their success in hunting, or in gathering plants, roots, fruit and seeds for their daily support of food' (Fison and Howitt 1880:208). There were 'grassy forests and plains stocked with kangaroos and other marsupials; forest trees harbouring opossums, native bear [koalas], and iguana [goannas]; rivers and lakes swarming with fish and eels; birds were plentiful in number and variety' and, finally, 'various plants, bushes and trees [which] afforded edible roots, berries and seeds;
4. Dawson (1881:22), recorded the traditions, organisation and beliefs of the Aboriginal people living on the relatively rich soils of western Victoria. While not providing great detail of the subsistence of these people, he places emphasis on animal species, especially shellfish on the coast and the seasonal exploitation of eels, although 'of roots and vegetables they have plenty' (1881:19), adding that 'the southern portions of Australia are remarkably deficient in native fruits' (1881:22);
5. in their work among the 'native tribes of central Australia' Spencer and Gillen (1899:22) paid little attention to the diet of the people other than the rules governing food distribution and proscriptions. They did write, however, that 'perhaps the most standard vegetable diet of the native in this part of the Centre ... is the seed of a species of *Claytonia* which takes the place of the Nardoo (*Marsilea quadrifolia*) which is the staple article of food in the Barcoo district and other parts of the interior of Australia'; and

6. for the people of the Burdekin River region of north-central eastern Queensland, there were 'innumerable articles of food, fish, flesh and fowl' (Curr 1887, 3:27). Further south in mid-eastern Queensland, the 'food of the tribes is very various. Amongst other articles they have emu, kangaroo, wallaby, opposum, snakes and birds: but each season of the year has its particular article of food' (Curr 1887, 2:473). Similarly, the Aboriginal people living in the Halifax Bay area of tropical north Queensland had for food 'besides marsupial game, ...fish, roots and fruits of several kinds. From some of the roots they extract, before they can be eaten, certain poisonous qualities by more than one ingenious process' (1887, 2:427).

Reading these early accounts leaves us with the impression that vegetable food was more important in the arid and semi-arid regions of Australia. It should be noted, however, that at the time ethnographers first began studying the Aboriginal people of southeastern Australia, considerable disruption to traditional life had already occurred following the arrival of European settlers and their stock. This included the displacement of people from their favoured habitats and damage to traditional plant food resources by sheep and cattle; the impact of grazing on the grasslands with their traditional plant foods would have been both rapid and dramatic (N. Scarlett, pers. comm.).

Meggitt's assertion received support from Richard Gould (1982:77) who concluded that the diet of Western Desert Aborigines 'is primarily vegetarian, with the women providing about 95% of the total diet about 90% of the time, mainly in the form of edible plant staples.' This is despite fleshy foods always being preferred over vegetable foods (Gould 1969; F. Walsh pers. comm.). Gould (1969:18) had previously noted that 'for all their talk about this or that kangaroo they once killed, or the pros and cons of a particular spot for hunting, the men contribute relatively little to the subsistence of the group ... one consequence of the preponderance of vegetables over meat foods is a tendency towards an unbalanced diet. There is generally enough to eat, but generally the emphasis is on particular staples, one or two at a time.' It should be noted that here a 'staple' was 'any plant species which singly or in combination with another (all vegetables) accounted for at least 50% of the total diet during the period it was collected and consumed' (Gould 1969:258), whereas later it became 'any food that constituted at least 30% of the total diet by weight at the time it was collected' (Gould 1982:77).

Figure 1. A Wagilak woman collecting *Cycas media* nuts, *ngathu*, an important source of carbohydrate for inland Yolngu. The fresh nuts require intensive processing to remove toxic alkaloids. (N.G. White collection 1983, F33 no. 21.).

What of the situation in the tropical north of Australia? Hart's observations in 1928–29 among the Tiwi of Melville and Bathurst Islands, near Darwin, led him to declare that they 'ate pretty well especially in larger households' but despite terrestrial and marine animals being 'very plentiful', these 'were extras or dividends; the staple every day foods were the vegetable foods gathered day after day in apparently unending quantities by the women' (Hart *et al.* 1988:38). Shortly after this, Thomson, who was the first anthropologist to work with 'traditional' Yolngu people living on the east coast of Arnhem Land, also found that 'contrary to the general idea, the main food supply among Aborigines, except at certain restricted seasons of the year, is not animal but vegetable ... but a comparatively small number which constitute staple foods, are gathered in great bulk' (1949:21). These foods included cycad nuts, '2 or more species of yam' (*Dioscorea* spp.), and water lilies of several species. Little had changed three or four decades later for Yolngu people in the Donydji area (Figure 1). The same point was expressed in a remarkably similar way by W.B. Chaseling, the missionary who established the Yirrkala mission on the Gove Peninsula in 1934, who wrote (1957:42): 'contrary to popular belief, Aboriginal foods are mainly of vegetable origin ... .'

During 1966–67 Peterson conducted anthropological research among a group of Yolngu people living near the Arafura Swamp, in northeastern Arnhem Land. (A number of families in this group are, or were, living at Donydji.) At that time, as is still the case in some remote communities, these Yolngu relied heavily on wild foods for their survival. Peterson concluded that 'at least 60% of the food by bulk is provided by the women, and at certain times of the year this rises to 90% and included animal proteins as well as vegetable foods' (Peterson 1973:22). This was also my experience of the productivity of women in the Donydji area, although, as suggested by Peterson, there are considerable seasonal differences, ranging from about 80% of the food by weight gathered by women to less than 20% during the 'hungry time' at the height of the wet season (White 1985). (The contribution of store purchased carbohydrate foods also varied greatly by season and according to the availability of cash and transport). The men's contribution of meat from large game, although much more prized than vegetable foods and small fish, is less certain. The Donydji study showed that men were successful in their hunting quest a little over 50% of the time on average, while women returned to camp with food on 95% of foraging trips, although this figure has dropped as store foods have become more readily available. (It should be noted that in my experience men quite commonly captured small game and consumed it on site. This was rarely declared back at camp). Apart from a food craving by the individual or band, hunters can be motivated by a desire for recognition as a successful hunter as well as to satisfy kinship obligations, particularly towards actual or potential parents-in-law. It would seem then, that, contrary to the claim by Meehan that it is a myth that women were the main providers of the food, in much of Aboriginal Australia women were the regular providers of the bulk of food eaten by Aboriginal people, although it needs to be considered more carefully in terms of the macro-nutrients obtained over the seasonal cycle, as well as the energy expended in the food quest. As noted by Peterson (1974) this gross quantification ignores the relative nutritional value of the foods provided by the two sexes.

Most subsistence studies of Aboriginal people have been qualitative, relying on inventories of edible plant and animal species, some providing considerable detail of hunting and foraging techniques and food preparation (e.g. Roth 1901; Levitt 1981; Rose 1987). Table 1a summarises Rose's data from Groote Eylandt presented with the inland Yolngu data from Donydji, shown for comparison. Such qualitative studies can be misleading, since they provide no information on the relative contribution of each of these species and food categories to the diet and take no account of their nutritional importance.

Unfortunately, there have been few detailed quantitative studies of Aboriginal diets and none from the arid zone, at least for people who relied largely on hunting and foraging for their subsistence. McArthur (1960) is justifiably seen as a landmark study. It was the first to look at 'food consumption and dietary levels of groups of Aborigines living on naturally occurring foods.' This research was carried out in Arnhem Land during 1948, as part of the American-Australian Scientific Expedition. Table 2 summarises the bush foods consumed at four Arnhem Land localities visited by McArthur, together with an estimate of the mean daily consumption of major nutrients. The dietary variation, by food type, locality and season, is considerable.

The most detailed study of food intake in a traditional-oriented Aboriginal community was that of Meehan and Jones who, for a full year, lived with the Anbarra Gidjingali community of central coastal Arnhem Land (Meehan 1982a, 1982b; Jones 1980) (Figures 2 and 3). The results of their dietary study are summarised in Tables 3 and 4. Taken together with McArthur's observations (Table 5) they are at odds with Meggitt's generalisation. Over a 4 month period, the contribution of animal flesh (mainly shellfish collected by women, and fish) to the diet of about 30 Anbarra people was nearly 50% in terms of energy, and 80% (66% from marine food) as protein by weight. In 1972–73, vegetable foods contributed only to 31% of the total gross weight of all food available to the Anbarra (Table 3). It is also of interest here to note that a similar figure for the contribution of marine protein to the diet was obtained by Collier and Hobson (1987) who analysed human skeletal remains from southern coastal Queensland, using stable-isotype analysis. Jones and Bowler (1980:21), concluded that 'the basic fact that emerges from the studies we have of the Australian tropical savanna, is that they were substantial meat eaters as defined in the broadest sense.' This conclusion

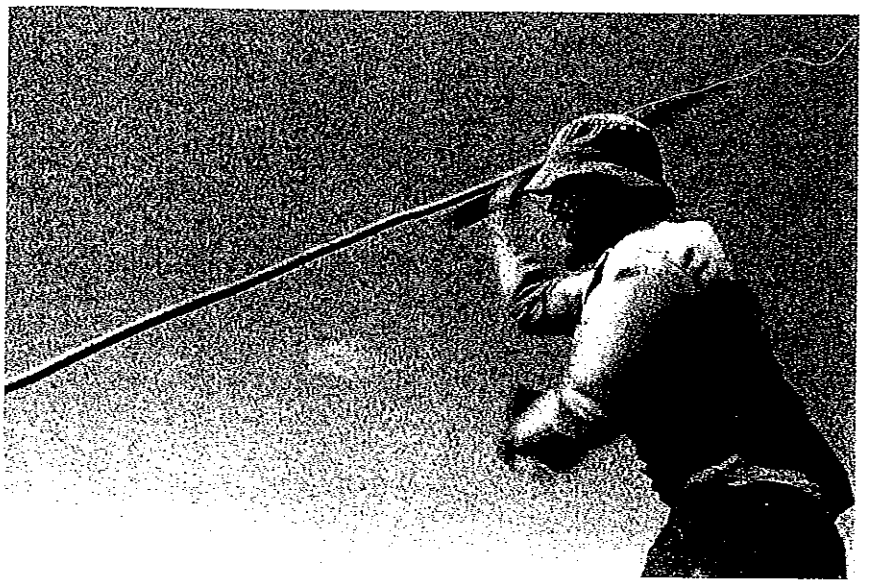

Figure 2. Man the hunter fails again. Rhys Jones attempting to spear fish off Gupanga beach in the late dry season of 1972. (Photograph: Meehan-Jones collection.).

Table 1a. Number of varieties of foodstuffs consumed by Aborigines of Groote Eylandt and the Donydji region, compared with the Dieri of the south central region of Australia (adapted from Rose, 1987).

	Groote Eylandt		Dieri		Donydji region	
	No. of varieties	% of total foodstuffs consumed	No. of varieties	% of total foodstuffs consumed	No. of varieties	% of total foodstuffs consumed
Land animals (incl reptiles)	15	5	40	33	37	14
Birds (land and sea)	76	25	55	45	73	27
Freshwater and marine animals and fish	97	31	3	2	31	11
Shellfish, crabs, etc.	39	13	2	2	3	1
Plants	82	26	22	18	130	47
Total	309	100	122	100	274	100

Table 1b. Details of Donydji region foodstuffs

	No. of varieties	No. actually observed being eaten	Varieties most commonly eaten
Land animals			
Reptiles	17	8	4
Mammals	20	12	4
+ Introduced	3	3	2
Birds	73	18	5
Freshwater Fish and Animals			
Fish	25	13	5
Tortoises	3	3	2
Snakes	3	2	1
Shellfish, crabs and custaceans	3	3	1
Honey	?4	?4	3
Plants			
Roots	46	18	9
Fruits	51	14	6
Seeds	9	7	3

Figure 3. Successful foragers, wet season 1973. Fortunately Betty Meehan did not have to rely on the hunting skills of Rhys Jones. Here she is seen collecting the bivalve *diyama* (*Tapes hiantina*) with Anbarra women on the shell fish beds located adjacent to a wet season coastal home base of Lalarr Gujirrapa. (Photograph: Meehan-Jones collection.).

Table 2. Summary of foods consumed at the four Arnhem Land locations visited by McArthur in 1948 (adapted from McArthur, 1960).

Foods (weight in pounds)	Hemple Bay 4 days; 13 people early May 1948	Bickerton Island 3 days; 15 people May 1948	Port Bradshaw 4 days; 20 people July-August 1948	Fish Creek 11 days; 9 people mid Oct. 1948
Vegetable foods				
Fruit	3		1	7
Roots, etc.	87	76.5	92.5	28
Honey		3.5		
Animal foods				
Fish	137	46.5	120	116.5
Turtle	75			
Turtle eggs			7.5	
Shellfish			33.5	
Crabs			4	
Reptiles			8	
Macropods			16	390
Offal	3.5	0.5	5	16.5
Total	305.5 lb	127 lb	287.5 lb	565.5 lb
% Vegetable	30	63	33	7.5

Mean Daily Consumption as Percentage of Recommended Dietary Allowances

Camp	Calories	Protein	Iron	Calcium	
Ascorbic acid					
Hemple Bay	116	444	80	128	394
Bickerton Island	74	172	135	41	234
Port Bradshaw	79	300	131	490	220
Fish Creek	104	544	33	355	47

Table 3. Contribution made by vegetable foods to the Anbarra diet (based on Meehan 1982a).

Vegetable food contribution	%
Gross weight (kg)	31
Weight protein (kg)	20
Energy equivalent (k'cal)	57

Table 4. Vegetable foods eaten by the Anbarra Community 1972–73 (based on Meehand 1982b)

	Percentage total food eaten
Traditional	
Gross wt (kg)	37.4%
Energy (k'cal)	10.9%
European	
Gross wt (kg)	62.6%
Energy (k'cal)	89.1%

Table 5. Relative gross weight of meats and vegetable foods hunted and gathered by some Arnhem Land groups (adapted from Jones 1980 based on Meehan 1975, 1977, and McArthur 1960).

Consumption/day	Anbarra Gidjingali			Hemple Bay (Groote Eylandt)	Port Bradshaw	Fish Creek
	1972–1973					
	Early Wet	Late Dry	Dry	May 1948 (Early Dry)	Dry 1948	October 1948 (Late Dry)
Consumption/day						
Animal flesh/head (kg)	0.61	0.61	0.75	1.60	0.91	1.77
Vegetable food/head (kg)	0.31	0.65	0.24	0.78	0.52	0.19
Protein/head(kg)						
(animal& vegetable)	0.14	0.16	0.17	0.23	0.15	0.30
k'cal/head	1620	2400	2090	2160	1380	2130

would seem to rest on the observations of the coastal Anbarra. For the Yolngu people living in the hinterland to the southeast, the contribution of fleshy foods to the diet in terms of bulk, was substantially less over most of the year, varying from about 25% by weight to about 70% in the wet season (White 1985). According to elderly Yolngu women, the wet season was a 'hungry' time since they were largely dependent on the hunting success of the men. Elsewhere, Jones (1980:136) postulated that 'perhaps only in the grassy areas of the central deserts could there have been a tendency for a vegetable based diet .... Certainly farther south in Tasmania the Aborigines ate proportionally even more meat than did the Arnhemlanders.' The importance of meat to the diet was also claimed for Tasmanians in the late Pleistocene (Cosgrove et al. 1990), although some of the dietary conclusions drawn from the archaeological evidence are contentious. The archaeological study of early diets is, after all, 'a little like navigating in the vicinity of an iceberg: more than four-fifths of what is of interest is not visible' (Isaac 1971:280).

Despite the undoubted quality of the field research of Meehan and Jones with the Anbarra, I do not think the available evidence such as that cited here, justifies Jones' (1980:136) generalisation that the Aboriginal people of the tropical savanna consumed a diet in which 'some two thirds of the gross weight of food was in the form of meat of all sorts, and that even in calorific terms possibly half of the food came from meat'. This is not to deny that for *some coastal communities* such as the Anbarra, the amount of animal flesh including the shellfish collected by women may indeed have formed the bulk of the diet for a good part of the seasonal cycle. Bernhard Schebeck (pers. comm.) draws attention to the use of words for vegetable foods, rather than those for meat or game, to mean food in the wider sense. For example, in Yolngu, *ngatha* ('vegetable foods') is used for food in general rather than *wayin* ('game'), or *dhaangguwarrakan* ('meat'). Similarly, *mai*, which means vegetable food in Yura from the Flinders Ranges, South Australia, is used there to mean food in general. I do not think this is a coincidence. In my experience, the amount of meat that people desire is not always matched by the amount that they actually eat. Similarly, the emphasis given to hunting, especially big

Figure 4. Clubbing an Agile Wallaby (*Macropus agilis*), *barranggal*, which had been wounded by spear during a late dry season *Wurrk*, or fire-assisted communal hunt. (N.G. White collection 1990, F9 no. 35.).

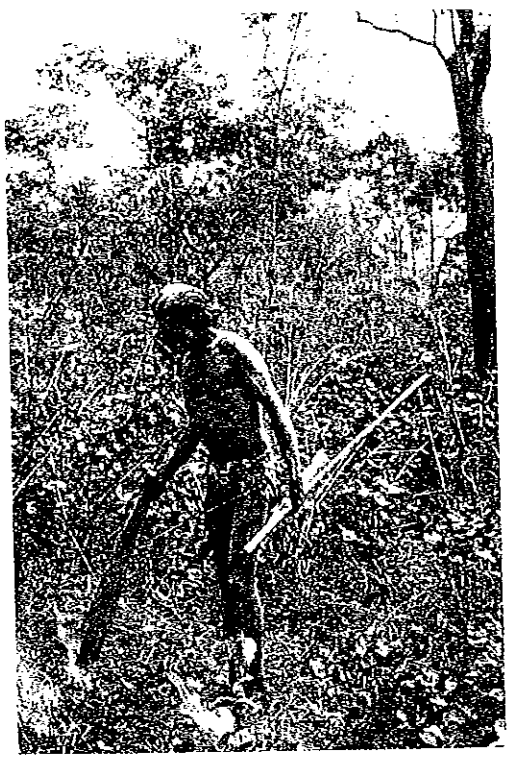

Figure 5. A Ritharrngu hunter at *Wurrk*: lighting a late dry season fire as part of a communal hunt, Mitchell Ranges, northeast Arnhem Land. (N.G. White collection 1981, 73620.).

game hunting, in general conversation among men, and the significance of kill sites in their personal histories give the impression of a society of meat eaters; however this is not confirmed by observation.

More recently, Cosgrove and Allen (this volume) provide a convincing case for regular (probably seasonal) targetting of Bennett's wallaby (*Macropus rufogriseus rufogriseus*) by hunters in southwest Tasmania between 35,000 BP and 14,000 BP, principally during the periods 24–23,000 BP and 16–14,000 BP. The evidence which they present for the selective use of body parts and the scenario of co-operative seasonal hunting is strikingly reminiscent of the late Dry Season hunting of agile wallabies (*Macropus agilis*) which I have observed in the Donydji region. Here groups of related Yolngu men use hunting fires, or *wurrk*, to drive these and other prey animals into river junctions, defiles or onto stony rises (Figures 4, 5 and 6). These hunting sites were deliberately preserved for late season fires, unlike other parts of the landscape which were subject to early, 'cool', patch burns. The macropods were carefully butchered, with certain portions eaten by the hunters on site, while other body parts were selectively distributed to their kin back at the base camp (White 1985). Cosgrove and Allen argue that their data point to substantial differences in the quantity and quality, and hence nutritional value, of wild flesh and plant foods over the seasonal cycle. This seems to have been characteristic of the diets of Aboriginal people throughout Australia in the past as it is in some parts of remote Australia today.

Although the studies of McArthur, as well as Meehan and Jones are exceptional, both in terms of the quality of the data and their implications for our understanding of traditionally based Aboriginal subsistence, there are some methodological limitations that need to be borne in mind when interpreting their results. For example, in McArthur's study:

1. there were sometimes problems obtaining satisfactory interpreters;
2. visited groups were those which could be reached by the transport available. All had access to store foods or were returning to their traditional lands after long periods on the missions or settlement. People were told not to eat store foods during the study periods, even though, in the case of Fish Creek, some of the people had gone to Oenpelli Mission to obtain flour and sugar 'because they were sick of meat';
3. all people living nearby gathered at the site that was chosen for the survey;
4. the composition of the groups differed; at Fish Creek there was a preponderance of males, all of whom were excellent hunters, while at Port Bradshaw there were 11 children;
5. the groups were studied over short periods (3–11 days) at different times of the seasonal cycle. The Fish Creek study took place in the late Dry Season (the worst time for vegetable foods) while

the people at Hemple Bay were visited in the early Dry (the best time for edible plants). Furthermore, the habitats in which the groups hunted and foraged were very different, and,

6. McArthur accompanied hunting and foraging groups where possible, but at other times she had to question people about what they had eaten. From this she was forced to 'simply allow' for foods eaten. My own field experience has shown that the dietary recall method is highly unreliable in this situation.

Figure 6. A party of *Ritharrngu* hunters in the Mitchell Ranges with a bustard (*Ardeotis australis*), *walpurrunggu*, speared during a late dry season *Wurrk*. (N.G. White collection 1981, 73618.).

The Anbarra people, who were the focus of Meehan's and Jones's study (1972–73), had access to store foods, especially flour and sugar. These 'European' foods accounted for about 60% of the gross weight of all the vegetable foods eaten, providing nearly 90% of the energy over the study period (Table 4). In addition, the hunting success of men may well have been substantially increased by the use of fence wire tips for fish spears and a 'few' 12-gauge shotguns.

REGIONAL DIFFERENCES IN THE TYPES OF PLANT FOODS EATEN

The ethnographic studies discussed above, a number of which are summarised for edible plant species in Table 6, highlight important differences in the types of vegetable foods consumed by Aboriginal people living in the arid and semi-arid parts of Australia, compared with those living in the northern tropical regions. As far as we can ascertain from the early accounts, the southeastern temperate region of the continent was similarly distinguishable from the more arid parts of the continent. There is an emphasis on roots on the coast, and seeds requiring pounding or grinding, in the interior. This form of plant processing 'has been around for about 30,000 years' according to Fullagar and Field (1997:306) from their research at Cuddie Springs in north-central NSW, although it may have been far more recent in the Western Desert region as the Aboriginal occupants 'focussed on the abundant seed species of the hummock grasslands' (Veth 1989:90).

Table 6. Comparison of edible plant species from Central and northern Australia (based on Cleland 1966, Cleland and Johnston 1939, Cleland and Tindale 1959, Crawford 1982, Gason in Smyth 1878, Levitt 1981, Meggit 1962, 1964, Rose 1987, Smyth 1878, Specht 1958, Veth and Walsh 1988, Worsley 1961 and White unpubl. for the Yolngu).

Locality (north coastal to central & southern Australia)	Total edible species/ "varieties" n (%)	Roots, Corms & Tubers n (%)	Fruits n (%)	Seeds & Nuts n (%)	Stems & Leaves n (%)	Miscellaneous [exudates, gum nectar, galls,honey] n (%)
"Coast"	152 (100)	41 (27)	68 (45)	12 (8)		31 (20)
Groote Eylandt	86 (100)	22 (26)	45 (52)	9 (11)	5 (6)	5 (6)
1. Donydji area	127 (100)	46 (36)	51 (40)	9 (7)	5 (4)	16 (13)
2. Yolngu pooled	183 (100)	65 (36)	85 (46)	11 (6)	5 (3)	17 (9)
Northern Qld	51 (100)	15 (29)	26 (51)	9 (18)		1 (2)
Northern Kimberely	101 (100)	48 (47.5)	36 (35.5)	13 (13)		4 (4)
"Inland"	91 (100)	10 (11)	32 (35)	34 (37)		15 (17)
Dieri	22 (100)	3 (14)	5 (23)	11 (50)	2 (9)	1 (4)
Western Desert (Martudjarra)	89 (100)	5 (6)	12 (14)	43 (48)		23 (26)
Arid South & Central Aust.	92 (100)	10 (11)	21 (23)	37 (40)	15 (16)	9 (10)

Golson (1971:205) noted that 'of 45 species used for seed in Central Australia, 14 are grasses and 19 are acacias [while] Arnhem Land has 40 species in 9 of the 10 genera of grasses that supplied seed food in Central Australia ... [but] not one is recorded as a food. [Similarly] Arnhem Land has 36 species of Acacia', (2 identical with Central Australian food species), but none was used as food. Golson also drew attention to the large number of food plants preponderantly from Malaysian genera, particularly near the northern coasts. These regional differences in the types of vegetable foods consumed have nutritional implications. Seeds, for example, are the most energy-rich and protein-rich plant foods, while, fruits are important sources of essential micronutrients, especially vitamin C and carotenoids (Southgate 1991; Brand Miller *et al* 1993). While tubers and some roots contain significant amounts of starch some contain toxic and/or unpalatable compounds that require treatment before they are consumed. This would suggest that more roots and tubers by weight are needed to satisfy energy and protein requirements than seeds and nuts. While the data on the composition of Aboriginal foods are informative, consideration must also be given to the spatial and seasonal availability of the different food types and species, as well as to the different costs in time and energy required in their collection and processing.

Variation in the quantity and quality of food resources throughout the year is a feature of the Aboriginal economy in both the arid and tropical zones (e.g. White 1985:fig. 3, for the inland Yolngu; Tonkinson 1991:fig 2.2, for the Mardu of the Western Desert). In the central arid region of the continent where rainfall is sporadic and localised, there is good evidence to suggest that drought and famine had a considerable impact on the Aboriginal people living in the area with, perhaps, '10% of the population perishing every two generations' (Kimber 1990:162). However, this does not appear to have been the case for other areas. While seasonality is particularly marked in the tropical woodlands and coastal areas of northern Australia, the resources are far more predictable in time and space than in the arid zones. Compared with parts of the arid interior of the continent, for much of the year food was considerably more abundant and more easily obtained, with the outlay of less time and effort, especially on the coast (McArthur 1960; White 1985). This apparent ease with which the material needs of Aboriginal people were satisfied was used by Sahlins (1972) in declaring that hunter-gatherers represent the 'original affluent society'. I say apparent, since there would, no doubt, have been occasions when greater time and effort were required to obtain sufficient food, and the existence of 'emergency' (or 'children's') foods suggests that the people of the Top-End did experience times of hardship. For instance, in the Donydji region, of the 253 plant and animal species said to be edible, only about 100 (40%) were actually observed being eaten in nearly two and a half years of fieldwork, with just 17% commonly eaten (Table 1b). That is, almost 60% of plant and animal species known to be edible appear to have sustained these Yolngu people only when their preferred foods were unavailable. For these inland Yolngu the 'hungry' times were the heavy Wet Season and the late Dry. A number of older women complained that they were often hungry during the rainy times because they had to rely on the men for their food (White 1985). On the coast there was less hardship since the Aboriginal people could collect shellfish and other marine resources (Meehan 1977a, 1977b, 1982a). These data also underline the range of choice available to the Aboriginal people in their food quest.

Apart from variation in diet by locality and by season, and indeed, day-to-day, there are considerable differences among individuals as a result of customary rules governing the distribution of food, particularly meat, fat and offal. These tend to favour older men at the expense of older women and children. In addition, food proscriptions ('taboos') applied at different times to varying degrees to all Aboriginal people during their lifetime (White 1985), although, with the possible exception of pregnant and lactating women, food taboos were probably of little nutritional significance.

ABORIGINAL VIEWS ON DIET AND HEALTH

We have noted elsewhere (Scarlett *et al*. 1982:166), that: 'sorcery and supernatural agents form an important, possibly the most important component of the Yolngu view of illness and death', although there

is a recognition of the relationship between physical cause and biological consequences in the area of health and well-being. Examples of the perceived link between diet and health drawn from the Donydji study include: coughs and 'lung complaints' attributed to being 'slack inside' as a consequence of a diet deficient in meat; diarrhoea said to be caused by vegetable food that is 'too dry'; cycad bread made from old nuts; yams (*Dioscorea* spp.) eaten at the wrong time of the year, and headaches resulting from 'dry' food or excessive exposure to the sun. A Ritharrngu-speaking Yolngu man living at Donydji explained to me that if you 'want to feel good (*djaal-ngamadhirri)* you should eat a mixed diet (*miil manabarn*), a diet of meat and vegetable foods'.

Peterson (1973:184), makes a similar point: the Yolngu people in the vicinity of the Arafura swamp 'place a high value on a mixed diet containing both meat and vegetable food. To eat such a mixed diet, that is to eat well, is *dakarait'yun*. [Whereas] a diet of vegetable without meat (*gulu'yun*) for more than a day or two' leads to complaints from the old people; 'they say they want something to "relieve their tongues" (*matayal*)'. If, on the other hand, the diet is entirely of meat, 'the people complain that their head becomes heavy (*bukumuktun*)'. (Zorc 1986 offers for *dakarait'yun* the word *dhaakardatjun* 'eat vegetarian in contrast to meat; eaten for variety'; and for *gulu'yun* he offers *gurlurl'yun* 'vegetarian'. Schebeck (pers. comm.), suggests *matayal* derives from *matha yalyun* 'tongue to cool down'.) Recently, in pursuing the meaning of these terms with a middle-aged Ritharrngu man, great emphasis was again given to eating both vegetables and meat in order to have a healthy or 'happy' diet (Fieldnote book 1/1, March 2000). This is illustrated by his use of *dhaakardatjun*: *"nhakana wayin luki - ngatha gaana; ngaathili wayin ... ga gapu";* literally, 'like eating meat - vegetable food separately, first meat ... and water'. That is, for a satisfying diet you need meat, vegetables and water. Another Ritharrngu man indicated that people get sick of eating *ngatha* ('vegetable food'), that is, they feel nauseous (*munyanggun*), and crave other foods, especially meat or fish, with fat. When asked to give the meaning of *gurlurl'yun* , the first man replied "then "*yalukmirri ngay*" then ('he hungry') ... too much bush tucker - *gugu* (wild honey) and *ngatha* (vegetable food) makes him sick". Here the meaning also seems to be that you would become unwell if you ate only vegetables and honey without meat. In both cases meat is emphasised. My experience of Yolngu living in small bush camps suggests a continual cycle of food 'crises', at least as perceived by the people — almost always men — based on food cravings. Here is the imperative for a mixed diet over the course of days and weeks if not meal to meal; this in turn leads to the shifting of camp, that is, to 'nomadism'. In other words, moving from place to place is not simply dictated by seasonal and other environmental constraints, it is also driven by a desire for variety in the diet.

Similarly, Meehan (1982:115) describes how the Anbarra:

> "prefer a diet that contains ample quantities of all the different food categories. If forced to eat white meat for too many days, they complain ... and want red meat. If they have lots of flour, yams or spike nuts they say how much they wish for ... any kind of white or red animal flesh. ... . Sometimes they crave for [vegetable foods] especially during the wet season when traditional and European forms are in short supply and they eat fish and crabs constantly. On a more subtle level, people sometimes say they want to have shellfish because its flesh is 'wet' ...; they are tired of eating flesh that is 'dry' (i.e. usually fish and vegetable substance)."

This emphasis on a variety of food stuffs in the diet makes physiological sense. Effective food strategies in selecting a mixture of plant and animal foods would ensure, for instance, that the biological quality of the dietary protein would be satisfactory and also enhance the supply of inorganic nutrients which would be only marginally adequate from plant foods alone (Southgate 1991:287). To satisfy energy requirements, the most effective food selection in terms of amounts eaten requires a proportion of animal foods, especially those that contain fat. 'These have several advantages; firstly, in the amounts required; secondly, as sources of substantial amounts of protein of high biological value, free from natural toxicants; thirdly, as sources of essential inorganic nutrients; fourthly, as sources of the B-vitamins, especially B12 and, very importantly, as

a source of vitamin A and the other fat-soluble vitamins'. Meat and fish would also 'provide long-chain polyunsaturated fatty acids of the n-3 series' (Southgate 1991:287).

PERSPECTIVES ON FAT

'Every drop [of fat] was treasured' (Smyth 1878, 2:306)

Fat, in particular, is a much sought after food which is differentially incorporated into the diets of men and women, and among the young and old, according to customary rules of sharing and avoidance (Figure 7). This reflects the place of fat in the indigenous belief system which finds expression in the language. Schebeck (pers. comm.) noted that in the Yolngu dialects of the Gove area, *djana'-mirri*, literally 'having fat', is used to mean also 'beautiful' or 'cute'. For example, somebody may be said to be *djana'mirri buku*, that is, to have a nice/beautiful face.

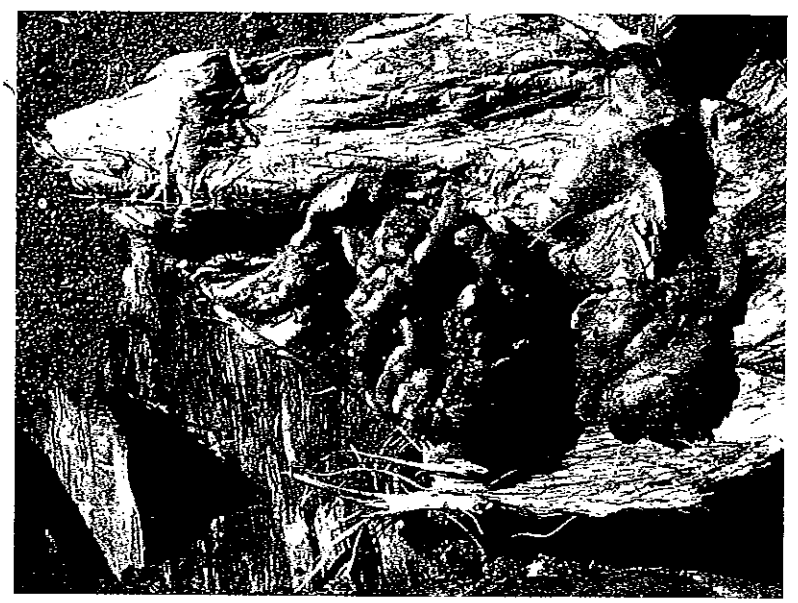

Figure 7. 'Every drop of fat was treasured.' An unwrapped bundle of golden emu fat (*Wurrparn djukurr*), which was distributed by the hunter to selected kin at Donydji, according to custom. (N.G. White collection 1983, F25 no. 3.)

'To the Yolngu [then,] fat is more than a rich source of energy; it can be endowed by '*marr*' or spiritual power - sometimes a positive force associated with happiness, strength, health and fertility. At other times, for certain people, it can have a dangerous dimension (Thomson 1975). In Yolngu religious art, animal fats are said to have properties of shininess and brightness (Morphy 1989)' (White 1990:225). Jones and White (1988:83) linked the concept of *marr* to the highly regarded stone spear heads (*ngambi*) from the Ngilipitji quarry in northeastern Arnhem Land: 'Thomson (1975) [drew attention to the] need to distribute in small bark bundles, the fat (*djukurr*) from certain species said to be endowed with *marr* "lest the owner" become contaminated by the spiritual power which had accumulated. It is interesting to speculate that the special *djukurr* [the shiny, grey-pink quartzite] from deep within the stone of Ngilipitji was regarded in the same way'.

The cultural value accorded animal fats by Aboriginal people throughout Australia has been noted by a number of researchers, including Meehan (1982b), for the Anbarra, and Devitt (1990), for the people of the Sandover River region of Central Australia, who writes (1990:226) that, like the Yolngu, 'their view is grounded in traditionally-derived notions linking animal fat with high-quality food, abundance and well-being - associations [that] are complex, multidimensional and often symbolic'. Contemporary dietary practices reflect the continuing influence of the high value associated with fat. A consequence of this is the incorporation of new and different fats into the diet.

In terms of nutrition, especially energy requirements, it was noted above that the selection of food providing fat had substantial advantages in reducing the amount of plant foods to be gathered. Furthermore, satiety is 'strongly influenced by the fat content of a meal, and thus a learned association of fatty foods in delaying the need to seek more foods is possible' (Rogers and Blundell 1990, cited in Southgate 1991:285).

The desire for fat may be *one* of the contributing factors to the increasing obesity in Aboriginal communities undergoing transition from a substantial dependence on hunting and foraging to a westernised lifestyle, with fatty foods accessible year round. I say may be, because at Donydji, where store-purchased foods are now consumed on a more regular basis and in increasing amounts, introduced fatty foods such as tinned meat do not figure prominently in the diet. Priorities are given to refined carbohydrates such as white flour and bread, sugar and sweet beverages. There has, however, been an increase in recent years in the number of introduced wild cattle and buffalo being captured, largely because of greater access to guns and off-road vehicles. In these feral animals there is a larger amount of depot fat than in most native animals, although the saturated fat component is less than in their domesticated state. In my experience, while these people, and especially the men, have access to more captured fat, they still prefer the fat from native animals such as wallabies, kangaroos and emus. All of these species have a substantially lower fat content and a higher proportion of polyunsaturated fatty acids than do introduced animals (Naughton *et al.* 1986).

CHANGING DIETS

The changes to subsistence behaviour and diet that have taken place throughout Aboriginal Australia following European colonisation, have occurred in a particularly dramatic way over recent years in the more remote communities of Central Australia and Arnhem Land. O'Connell and Hawkes (1984:509), working with the Alyawara (ca. 250 km northeast of Alice Springs) in 1974–75, observed that over a 260 day study period 'even the most active collectors went out only once or twice a week, and their take represented no more than 5% of their total diet'. The situation for the Mardu people of the Western Desert is the same, according to Fiona Walsh (pers. comm.). In addition, she noted that only ca. 40% of plant foods and less than 30% of animal species that were said to have been used at the time of European contact, were being used today. The changing role of women in the food economy, was also noted by Altman (1987), who lived with an outstation community of Gunwinggu in Central Arnhem Land. There, 46% of total kilocalories and 81% of total protein came from bush foods, with almost 90% of both contributed by males through hunting and fishing. The situation is similar in the Homeland Centre of Donydji. Access to off-road motor vehicles has led not only to a higher intake of meat and fat, but has also resulted in a growing dependence on store foods (White 1985).

As a consequence of these dietary and lifestyle changes, particularly the shift towards refined carbohydrates and fats, and a decrease in physical activity, there has been for many indigenous communities, an increase in lifestyle-related disorders, such as obesity, NIDDM (Non-Insulin Dependent, or type 2, Diabetes Mellitus), cardiovascular disease and nutritional deficiencies. There is now strong evidence that at least 'some of the major chronic diseases of Industrialised society are related to the typical Western diet' (Eaton and Konner 1985:288)

T.R. Guyula, is a health worker from Gapuwiyak near Donydji. He was raised in seasonal bush camps in the Arafura Swamp area, and when in his Homeland Centre still depends to a considerable extent on the bush and its resources for subsistence. TRG expressed his concerns about the impact of dietary and lifestyle changes on the health of his community in the following way. (This is part of his 'story' which was recorded on audio-cassette and given to me at Donydji on June 2, 1993.):

> '... Bush food made people feel good and look well. ... Now things are changing, now people go to shops and eat food that's got a lot of sugar in it — lots of greasy food. In the large settlements where there are shops people have lots of sores and are getting fat because they're using a lot of shop food. ... My father said that before the balanda [white people] came to this country, people looked healthy because they didn't have a shop and they only ate bush foods. Now that the white people have come the people are changing their bodies. ... Now some people are diabetics which is no good. That's the story I want to tell. ... We've got to start teaching our culture to those Yolngu; teaching

> people how to live off the land once again. We need programmes to learn more from older people like my family at Mirrngadja and Donydji. It will be good for diabetics to eat bush food without fat and grease and sugar. We've got to teach the kids the ways of the old people: show them how to be healthy like our mothers, fathers, grandmothers and grandfathers. They've got to be taught not to eat too much shop food. ... I'm always happy to be back with my family eating bush food and getting exercise when I'm hunting. With this life they don't get any diabetic sickness and that's really good. I'd like to learn more about diet and sugar sickness. ... I've got to learn more from her [his mother] and we've got to talk more about how things are changing — look at what happened before and what's happening now, what was good for our body in the past and what's causing sickness today. ...'

NIDDM and cardiovascular disease are not yet problems for the Donydji community although according to O'Dea et al. (1988:177), 'their fasting insulin and triglyceride levels were inappropriately high for their very low body mass index and fasting glucose levels. The mild elevation of triglycerides and fasting insulin levels is consistent with insulin resistance and suggests that these Aborigines (in common with other Aborigines) may become susceptible to obesity and diabetes if they urbanised further.' The risks of these lifestyle diseases is greater in Aboriginal women than for women of European descent because of their android pattern of fat distribution (Rutishauser and MacKay 1986; Jones and White 1994). Such population-specific differences in fat patterning may, in part, be the result of biological adaptation to climate. 'If women with a central distribution of fat are more efficient at laying down and metabolising their fat deposits, then such a pattern in Aboriginal women living in tropical environments may well have conferred an advantage in thermoregulation, metabolic efficiency and reproduction. It may also help account for the rapid increase in adiposity that occurs in Australian Aboriginal people when they adopt a Westernised diet and sedentary lifestyle' (Jones and White 1994:222).

While on the subject of the biology of Aboriginal people, it must be noted that there are substantial genetic differences within and between Aboriginal populations (e.g. White 1997). Strong divisions exist at the population genetic level between groups living in northern parts of Australia and the people of the arid centre of Australia. Given the duration of Aboriginal occupation of this country, and the important differences in the nutritional environment across Australia, it would be surprising if genetically determined dietary adaptations had not evolved at the regional level. However, despite the very different selective regimes, the susceptibility to NIDDM of Aboriginal people of full descent across the different environments appears to be similar. A closer inspection of the dietary data and subsistence behaviour available for Aboriginal Australia appears to challenge the feast and famine hypothesis proposed for NIDDM (Neel 1963) in populations such as indigenous Australians. The impact of famine, rather than food shortages, was almost certainly greatest on those populations living in the arid central parts of the continent, being far less common, if it occurred at all, in the tropical coastal regions of Australia which were colonised earlier than Central Australia, perhaps by some thousands of years. It is generally accepted that the ancestors of Aboriginal Australians came from southeast Asia, having presumably adapted to tropical lowland and coastal environments where cycles of feast and famine would have been infrequent or less pronounced than in drier inland areas. Despite their different evolutionary histories, Aboriginal people in all regions of Australia who have adopted a 'western' lifestyle exhibit similar levels of NIDDM. The metabolic characteristics predisposing Aboriginal people to this form of diabetes 'may have been important to survival in the traditional lifestyle by favouring efficient fat deposition - the 'thrifty gene' - on a diet in which the carbohydrate content was seasonally variable' (O'Dea and Spargo 1982:498). An alternative hypothesis (Brand Miller and Colagiuri 1994), sees insulin resistance as an adaptation to diets high in protein and low in available carbohydrate, that is, foods with a low glycaemic index, such as wild plants which contain carbohydrate in a form which is slowly digested and absorbed.

CONCLUSION

Detailed quantitative accounts of the diets of traditionally orientated Aboriginal people are few, and none is available for groups residing in the arid central parts of Australia. The information that we do have for Australia as a whole, based as it is on impressionistic accounts of early European settlers and ethnographers, and on recent descriptions by anthropologists, many of whom spent considerable time with the Aboriginal people, suggest that there was no typical Australian hunter-gatherer diet. Important regional differences existed in the types of food available to the Aboriginal people. The seeds of grasses and Acacia formed a substantial part of the diet of desert Aborigines, while roots and fruits (at least the number of fruit-bearing species) contributed far more to the food intake away from the arid zone, especially in the northern coastal regions. The extent to which vegetable foods dominate the diets of Aboriginal people is debatable, although it does seem clear that animal flesh contributed far more to the diet of tropical groups than was asserted by Meggitt (1964). This was particularly so on the coast, where shellfish, most of which were collected by women, and fish, formed a major part of the diet. Apart from regional differences in diet, there were very considerable seasonal differences in the quality and quantity of food consumed in all regions, as well as differences among individuals according to gender, age and status. Such dietary variation recorded among hunting and foraging populations in Australia and beyond, calls into question the notion of a (or the) traditional diet, and the value of an average, mean or mode as used by Eaton and Konner (1985) to generalise pre-industrial or 'paleolithic' diets as a basis for current dietary recommendations.

Obviously, an adequate diet can be obtained in many different ways. Southgate (1991:281), in his discussion of the 'natural' diet of humans, believes that 'this characteristic of extreme fluctuations in the amounts and types of foods available for consumption is an important one ... and that the control of appetite and the choice of food evolved under conditions of alternating abundance and scarcity ...'. Introduced foods will have influenced the choice and amounts of wild foods that are hunted and gathered as it will have altered the appetite to varying degrees. For instance, at Donydji the introduction of sugar, almost invariably consumed as very sweet, black tea, is said by the Yolngu to quickly satiate their hunger and make them happy.

Throughout Aboriginal Australia today, dramatic dietary and lifestyle changes have occurred and are still occurring. In remote, traditionally-orientated communities it is the contribution of the women to subsistence that has changed most of all, with wild vegetable foods no longer providing the quantity and quality of nourishment that they did in the past. In the place of these foraged resources are the refined carbohydrate, salt and saturated fat of purchased food. An awareness of food beliefs and habits is crucial, not only for an understanding of Aboriginal diet and nutritional status both in the past and today, but also for the provision of effective health management programs for Aboriginal communities. Gould (1969), commenting on the lack of dietary information for desert Aboriginal groups, acknowledged that the time has probably passed when anthropologists can hope to carry out the kind of empirical quantitative studies of Aboriginal subsistence which have been carried out in other parts of the world, most notably among the Kalahari San. To quote from Gould (1969:273): 'It will be the sad task of historians of anthropology to ask how it was that anthropologists in Australia [with a few exceptions] failed to get this kind of information before it was too late. Anthropologists should use every means at their disposal to salvage whatever information can be gained about Aboriginal subsistence'. Rhys Jones and Betty Meehan are prominent among these exceptions, having contributed substantially to our knowledge of the subsistence behaviour and diet of Aboriginal hunters and foragers, particularly those living in tropical northern Australia.

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